WAMBO COAL PTY LIMITED

SOUTH BATES UNDERGROUND MINE

EXTRACTION PLAN
LONGWALLS 11 TO 16

APPENDIX A
WATER MANAGEMENT PLAN

Peabody ENERGY

WAMBO COAL PTY LIMITED
SOUTH BATES UNDERGROUND MINE

WATER MANAGEMENT PLAN
LONGWALLS 11 - 16

PREPARED BY
WAMBO COAL PTY LIMITED

JANUARY 2017
Project No. WAM-09-15
Document No. 00805546

DOCUMENT CONTROL

Document No.	WMP LW11-16
Title	Water Management Plan for South Bates Underground Mine Longwalls 11 to 16
General Description	Management of potential subsidence effects, subsidence impacts and environmental consequences on surface water resources, groundwater resources and flooding for the mining of Longwalls 11 to 16 at the South Bates Underground Mine
Key Support Documents	Wambo Coal Surface Water Monitoring Program Wambo Coal Groundwater Monitoring Program Wambo Coal Surface and Groundwater Response Plan

Revisions

Rev No	Date	Description	By	Checked
A	October 2015	Final for Submission	WCPL and Resource Strategies	-
B	December 2015	Revised to Address DPI Water Comments	WCPL and Resource Strategies	S. Peart
C	January 2016	Incorporation of Addendum	WCPL and Resource Strategies	S. Peart
D	December 2016	Revised to include Longwalls 14 to 16	WCPL and Resource Strategies	S. Peart
E	January 2017	Final for Submission	WCPL and Resource Strategies	P. Jaeger

The nominated Coordinator for this document is	Environment and Community Manager

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1 INTRODUCTION

The Wambo Coal Mine is an open cut and underground coal mining operation located approximately 15 kilometres (km) west of Singleton, near the village of Warkworth, New South Wales (NSW) (**Figure 1**). The Wambo Coal Mine is owned and operated by Wambo Coal Pty Limited (WCPL), a subsidiary of Peabody Energy Australia Pty Limited.

The South Bates Underground Mine is a component of the approved Wambo Coal Mine. The South Bates Underground Mine commenced in Longwall 11 in February 2016 and involves extraction of coal by longwall mining methods from the Whybrow Seam and Wambo Seam within Coal Lease (CL) 397 and Mining Lease (ML) 1594 (**Figure 2**).

The potential environmental impacts of the existing Wambo Coal Mine (including the approved South Bates [Whybrow Seam] Underground Mine) were assessed in the *Wambo Development Project Environmental Impact Statement* (the Wambo Development Project EIS) (WCPL, 2003). Development Consent DA 305-7-2003 for the Wambo Coal Mine was granted on 4 February 2004 by the then NSW Minister for Urban Affairs and Planning under Part 4 of the NSW *Environmental Planning and Assessment Act, 1979*.

An application to modify the Development Consent (DA 305-7-2003 MOD 15) was lodged in July 2015 to allow an extension to the South Bates Underground Mine to include three additional longwalls (Longwalls 14 to 16) in the Wambo Seam and was approved on 10 November 2015. The application was accompanied by the *South Bates (Wambo Seam) Underground Mine Modification Environmental Assessment* (WCPL, 2015).

An Extraction Plan for Longwalls 11 to 13 was approved by the NSW Department of Planning and Environment (DP&E) on 9 February 2016. The approved Extraction Plan for Longwalls 11 to 13 has been revised to include Longwalls 14 to 16 within the South Bates Underground Mine for a consolidated Extraction Plan for Longwalls 11 to 16.

This Water Management Plan (WMP) has been updated from the previous revision (Revision C) to incorporate Longwalls 14 to 16 in the Wambo Seam.

1.1 PURPOSE AND SCOPE

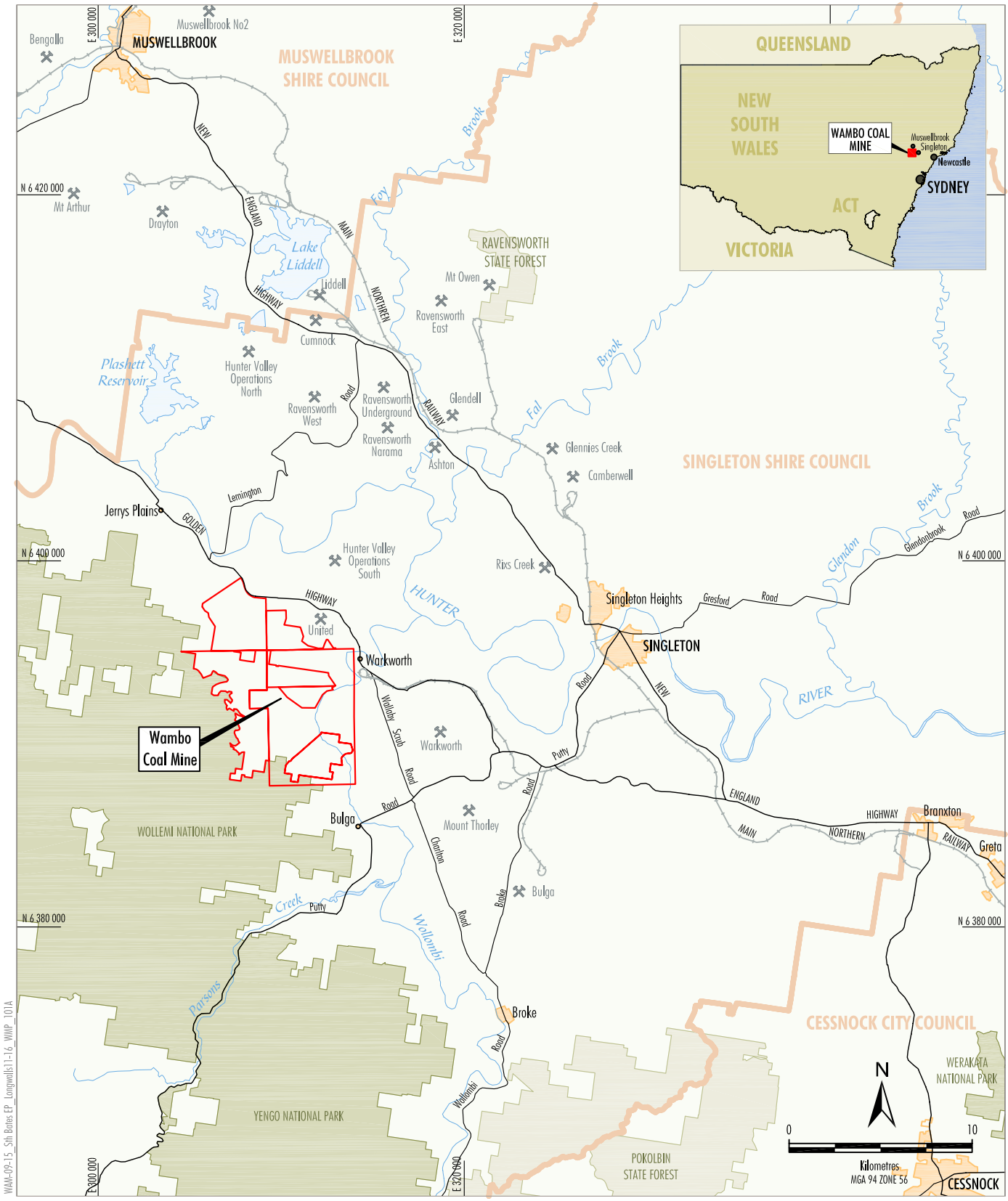
Purpose: This WMP for Longwalls 11 to 16 outlines the management of potential environmental consequences of the proposed secondary workings described in the Extraction Plan on water resources.

Scope: This WMP covers surface water resources, groundwater resources and flooding within the Longwalls 11 to 16 Application Area (**Figure 2**).

This WMP has been prepared in accordance with Condition 22C(h) of Schedule 4 of the Development Consent (DA 305-7-2003) as a component of the South Bates Underground Mine Longwalls 11 to 16 Extraction Plan.

Management plan requirements applicable to the preparation of this WMP, and where each of these requirements is addressed within this WMP, are summarised in **Table 1**.

This WMP has been prepared by WCPL, with assistance from Resource Strategies. The WMP draws on the conclusions of reports by Alluvium (2016) and HydroSimulations (2017) that form part of the Extraction Plan. The appointment of the team of suitably qualified and experienced experts (which includes representatives from WCPL, HydroSimulations, Alluvium and Resource Strategies) has been endorsed by the Secretary of the DP&E.



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LEGEND

- Mining and Coal Lease Boundary
- Local Government Boundary
- Mining Operation

Source: Geoscience Australia (2009)

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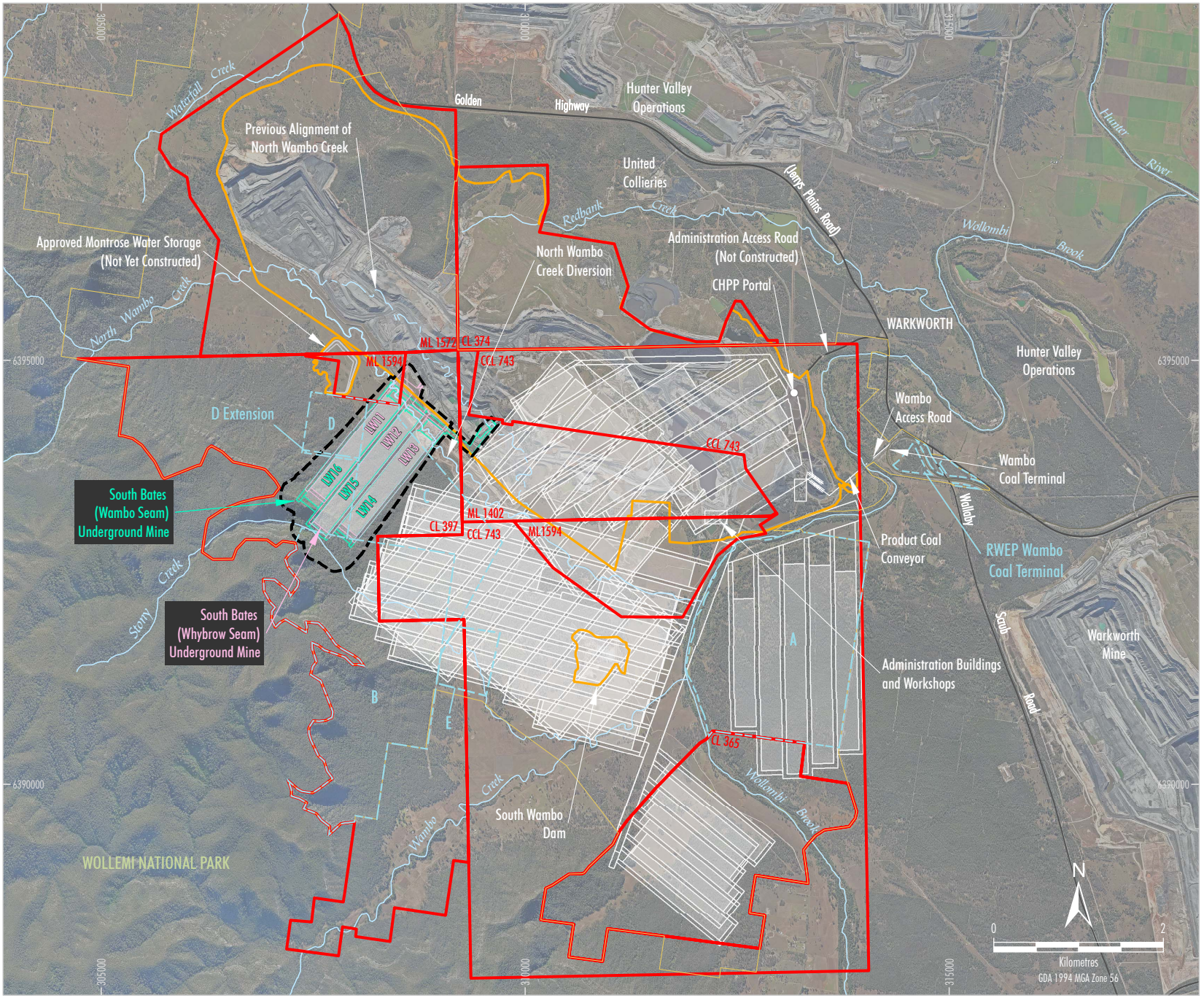
Regional Location

Figure 1



LEGEND

- WCPL Owned Land
- Mining and Coal Lease Boundary
- Existing/Approved Surface Development Area
- South Bates (Whybrow Seam) Underground Mine
- South Bates (Wambo Seam) Underground Mine
- Other Approved Underground Development
- Remnant Woodland Enhancement Program (RWEP) Area
- Extraction Plan Application Area

Source: Department of Lands (July 2009); WCPL (2016); WCPL Orthophoto (July 2016)

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WAMBO COAL MINE

Approved Wambo Coal Mine Layout

Figure 2

Table 1
Water Management Plan Requirements

Development Consent (DA 305-7-2003) Condition	WMP Section
Condition 22C(h) of Schedule 4	
22C. The Applicant must prepare and implement an Extraction Plan for the second workings within each seam to be mined to the satisfaction of the Secretary. Each Extraction Plan must:	
...	
(h) include a:	
• *Water Management Plan, which has been prepared in consultation with EPA and DPI-Water, which provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on surface water resources, groundwater resources and flooding, and which includes:*	Management of potential impacts and/or environmental consequences on water are addressed in **Section 5**. Performance measures and performance indicators relevant to water are presented in **Section 2** and **Section 6** respectively.
– *surface and groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse impacts on water resources or water quality;*	Addressed in **Table 2**.
– *a program to monitor and report groundwater inflows to underground workings; and*	Addressed in **Table 2**.
– *a program to manage and monitor impacts on groundwater bores on privately-owned land;*	Addressed in **Table 2**.
...	
Condition 22D of Schedule 4	
22D. The Applicant must ensure that the management plans required under condition 22C(h) above include:	
(a) an assessment of the potential environmental consequences of the Extraction Plan, incorporating any relevant information that has been obtained since this consent;	Addressed in **Section 3**.
(b) a detailed description of the measures that would be implemented to remediate predicted impacts; and	Addressed in **Table 2**.
(c) a contingency plan that expressly provides for adaptive management.	Addressed in **Section 7**.

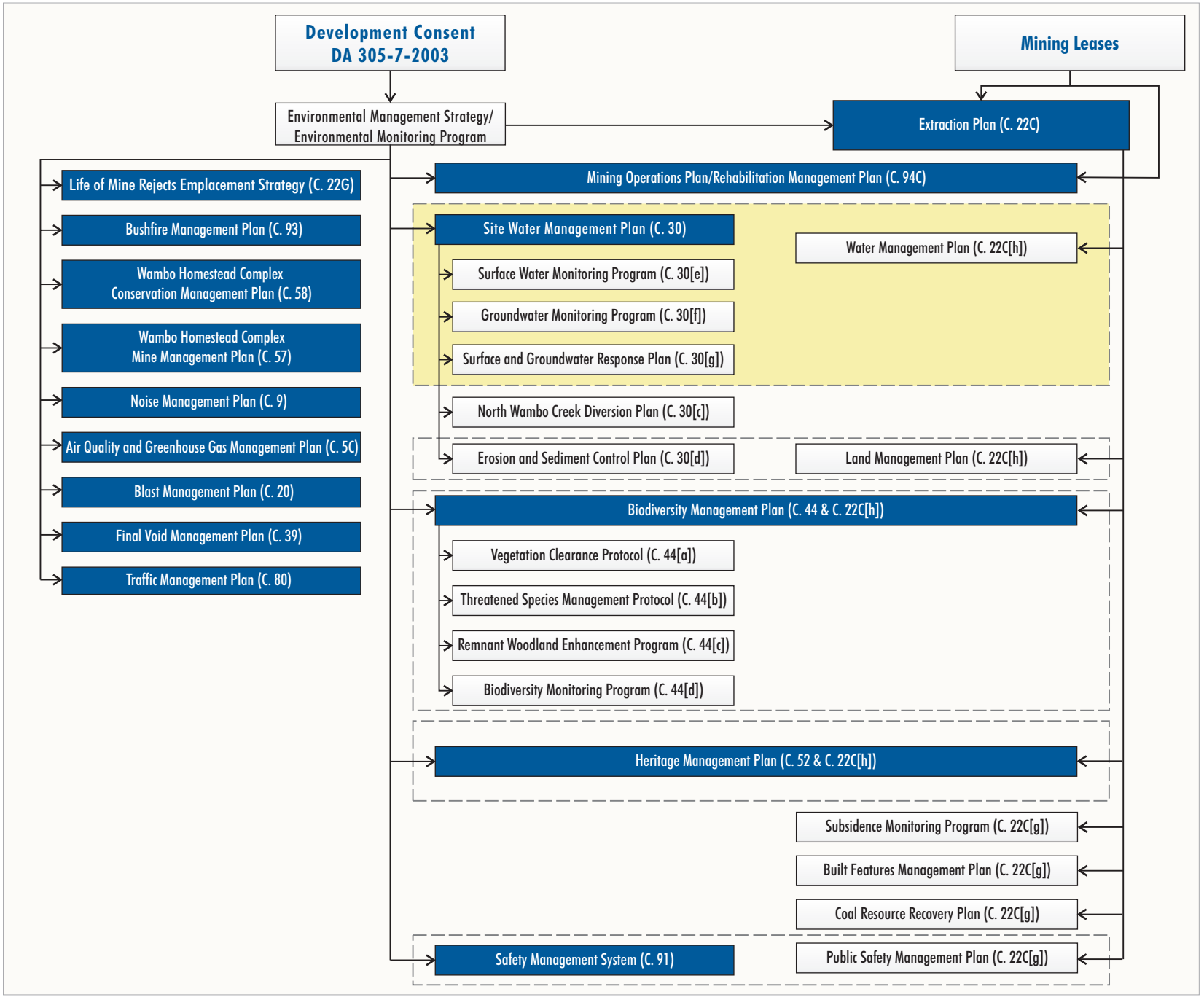
1.2 STRUCTURE OF THE WATER MANAGEMENT PLAN

This WMP forms part of WCPL's Environmental Management System for the Wambo Coal Mine. The relationship of this WMP to the Wambo Coal Mine Environmental Management System is shown on **Figure 3**.

To avoid duplication of existing Environmental Management Plans, this WMP references components of the existing WCPL Site Water Management Plan, including the:

- Surface Water Monitoring Program (SWMP);
- Groundwater Monitoring Program (GWMP); and
- Surface and Groundwater Response Plan (SGWRP).

The SWMP has been revised in support of this Extraction Plan, and a draft of the revised SWMP is included in **Attachment 2**.



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Wambo Coal Mine
Environmental Management System

Figure 3

The sections of the SWMP, GWMP and SGWRP relevant to the WMP are summarised in **Table 2**, with the monitoring site locations shown in **Figure 4**. The SWMP, GWMP and SGWRP are included as **Attachments 2 to 4**, respectively.

If the SWMP, GWMP or SGWRP are revised separately in accordance with the Development Consent (DA 305-7-2003) as part of the consultation process with relevant agencies, **Attachments 2 to 4** of this WMP will be updated accordingly.

Table 2
Supporting Documents – Reference Summary

WMP Component	Existing Program/Plan Reference	Section Description
Description of the existing environment[1]	GWMP Section 2 – Existing Groundwater Conditions and Baseline Data	Section 2 of the GWMP includes an overview of the hydrogeology in proximity to the Wambo Coal Mine.
	SWMP Section 2 – Existing Surface Water Conditions and Baseline Data	Section 2 of the SWMP includes an overview of the hydrological features in proximity to the Wambo Coal Mine.
Surface water monitoring	SWMP Section 4.1.1 – Surface Water Quality	Water sampling is undertaken at sites along Wollombi Brook, North Wambo Creek, the North Wambo Creek Diversion, Wambo Creek (also known as South Wambo Creek), and Stony Creek. The location of these sites is presented in **Figure 4**. Parameters monitored include pH, electrical conductivity (EC) and total suspended solids (TSS). Sampling is only undertaken during flow periods to ensure that increased solute concentration (caused by evaporation) does not cause incorrect sample results.
	SWMP Section 4.1.2 – Mine Water Quality	A number of monitoring sites relevant to mine water are sampled as described in Table 13 of the SWMP. Mine water storage dams including Eagles Nest Dam, West Cut Dam, Chitter Dam and Gordon Below Franklin Dam are sampled monthly for pH, EC and TSS.
	SWMP Section 4.1.3 – Surface Water Flows	WCPL monitors flow in North Wambo Creek, the North Wambo Creek Diversion, Wambo Creek and Stony Creek using continuous flow monitoring stations. Surface water flow monitoring data for Wollombi Brook is sourced from Department of Primary Industries - Water (DPI Water) operated flow gauging stations, located at Warkworth (FM10) and Bulga (FM11) (**Figure 4**).
	SWMP Section 4.1.5 – Riparian Vegetation and Creek Bed Stability	A program to monitor for potential subsidence impacts to fluvial geomorphology commenced in October 2006. The program aims to distinguish natural erosion from mine subsidence associated instability, through pre-mining and post-mining survey mapping in North Wambo Creek, the North Wambo Creek Diversion, Wambo Creek and Stony Creek and annual transect monitoring of riparian vegetation.
	SWMP Section 4.1.7 – Diversion and Subsidence Monitoring Program	This new section of the SWMP provides a consolidated description of the monitoring methodology proposed to be used for the North Wambo Creek Diversion.

Table 2 (Continued)
Supporting Documents – Reference Summary

WMP Component	Existing Program/Plan Reference	Section Description
Groundwater monitoring	GWMP Section 4 – Groundwater Monitoring Program	Section 4 of the GWMP summarises the Wambo groundwater monitoring program including the monitoring network, measured parameters and monitoring frequency.
	GWMP Section 4.1 – Monitoring Network, Parameters and Frequency	The Wambo groundwater monitoring network is presented in **Figure 4**. Groundwater monitoring sites are regularly monitored for water level, pH and EC. The GWMP takes into account the existing site groundwater data, both from WCPL and the neighbouring United Colliery, as well as the historical and current mining operations.
	GWMP Section 4.1.5 – Inflows to Underground Workings	Dewatering volumes and underground water levels will be recorded on a daily basis during pumping. This data will be incorporated into the site water balance on an annual basis to allow calculation of groundwater inflows including loss of groundwater from alluvium and to verify whether WCPL holds sufficient groundwater licence entitlements.
Surface water impact assessment criteria	SWMP Section 3 – Surface Water Impact Assessment Criteria	Section 3 of the SWMP summarises the surface water impact assessment criteria adopted for Wollombi Brook, North Wambo Creek, Wambo Creek, Stony Creek and Waterfall Creek. If monitoring data exceed these criteria an investigation is undertaken to identify any adverse impacts on water resources or water quality.
	SWMP Section 4.4 – Data Review and Investigation	Section 4.4 of the SWMP outlines the procedure for review of data collected as part of the SWMP, as well as the investigation and response protocol implemented if water quality monitoring data are found to exceed the water quality criteria (i.e. if the trigger levels are exceeded).
Groundwater impact assessment criteria	GWMP Section 3 – Groundwater Triggers	Trigger levels have been developed for groundwater quantity and quality. Shallow bore trigger levels are listed in Table 9 of the GWMP.
	GWMP Section 4.4 – Data Review and Investigation	Section 4.4 of the GWMP outlines the procedure for review of data collected as part of the GWMP, as well as the investigation and response protocol implemented if water quality monitoring data are found to exceed the water quality criteria (i.e. if the trigger levels are exceeded).
Program to manage and monitor impacts on groundwater bores on privately-owned land	SGWRP Section 2.3 – Impacts on Groundwater	Section 2.3 of the SGWRP details the investigation undertaken in the event that a trigger level is exceeded or a complaint is received in relation to loss of groundwater supply. If the investigation identifies groundwater impacts attributable to WCPL activities, appropriate measures will be developed in consultation with relevant agencies and any affected adjacent landowners.
	SGWRP Section 2.12 – Unforseen Impacts	This section details the general response procedure initiated in the event that an unforseen surface or groundwater impact is detected.

Table 2 (Continued)
Supporting Documents – Reference Summary

WMP Component	Existing Program/Plan Reference	Section Description
Responsibilities[1]	SWMP Section 7 – Responsibilities	This section summarises the SWMP responsibilities and timing of SWMP tasks.
	GWMP Section 7 – Responsibilities	This section summarises the GWMP responsibilities and timing of GWMP tasks.
	SGWRP Section 5 – Responsibilities	This section summarises the SGWRP responsibilities and timing of SGWRP tasks.

[1] Not a specific requirement of this WMP under Condition 22C(h) of Schedule 4 of the Development Consent (DA 305-7-2003).

An overview of the main text sections and attachments of this WMP is presented below:

Section 1 Provides an introduction to the WMP, including the purpose and scope of the WMP and the context of the WMP in relation to WCPL's Environmental Management System for the Wambo Coal Mine.

Section 2 Describes the performance measures relevant to water.

Section 3 Summarises the predicted subsidence impacts and environmental consequences resulting from the extraction of Longwalls 11 to 16.

Section 4 Provides a summary of the monitoring that will be undertaken of the North Wambo Creek Diversion and Stony Creek in relation to Longwalls 11 to 16.

Section 5 Describes the management measures that will be implemented for the North Wambo Creek Diversion and Stony Creek.

Section 6 Describes how monitoring data will be used to assess the extraction of Longwalls 11 to 16 against the relevant performance indicators and performance measures.

Section 7 Provides a Contingency Plan to manage any unpredicted impacts and their consequences.

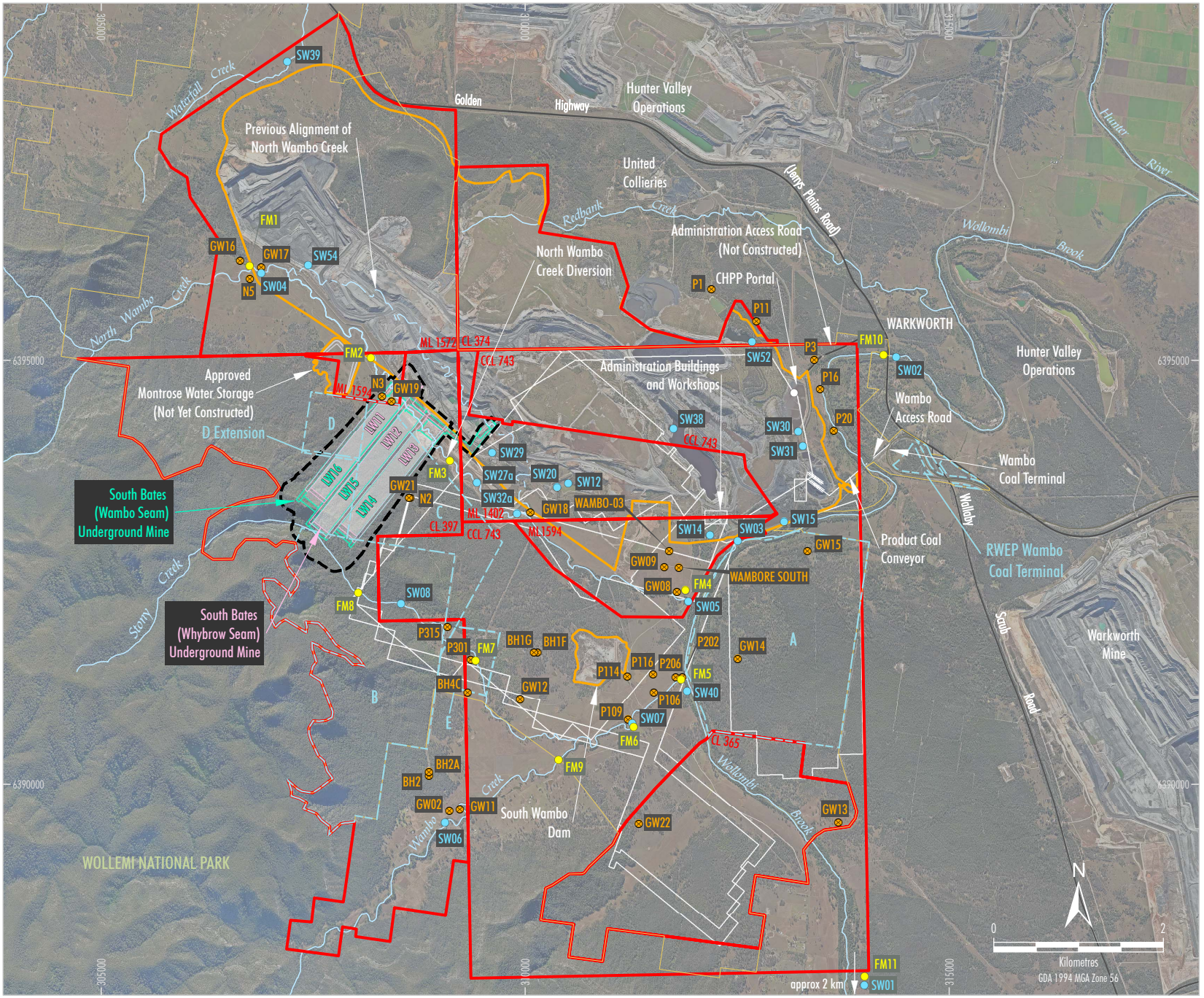
Section 8 Lists the documents referred to in **Sections 1 to 7** of this WMP.

Attachment 1 Provides a Trigger Action Response Plan (TARP) for this WMP which is a simple and transparent snapshot of the monitoring of environmental performance and where required the implementation of management and/or contingency measures.

Attachment 2 Provides a copy of the existing SWMP.

Attachment 3 Provides a copy of the existing GWMP.

Attachment 4 Provides a copy of the existing SGWRP.



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Locations of Surface Water and Groundwater Monitoring Sites

Figure 4

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2 PERFORMANCE MEASURE

This WMP has been developed to manage the potential environmental consequences of the proposed secondary workings described in the Extraction Plan on surface water resources, groundwater resources and flooding in accordance with Condition 22C(h) of Schedule 4 of the Development Consent (DA 305-7-2003).

In accordance with Condition 22 of Schedule 4 of the Development Consent (DA 305-7-2003), WCPL must ensure that there is no exceedance of the subsidence impact performance measures listed in Tables 14A and 14B of Schedule 4 of the Development Consent (DA 305-7-2003). The performance measure specified in Table 14A of Schedule 4 of the Development Consent (DA 305-7-2003) relevant to water is listed in **Table 3**.

Table 3
Water Performance Measure

Feature	Subsidence Impact Performance Measure
Wollombi Brook	Negligible subsidence impacts[1] to Wollombi Brook. Negligible environmental consequences[2] to Wollombi Brook. Controlled release of excess site water only in accordance with EPL requirements.

Source: Table 14A of Schedule 4 of the Development Consent (DA 305-7-2003).

[1] A subsidence impact is defined by the Development Consent (DA 305-7-2003) as "*physical changes to the ground and its surface caused by subsidence effects, including tensile and shear cracking of the rock mass, localised buckling of strata caused by valley closure and upsidence and surface depressions or troughs*".

[2] An environmental consequence is defined by the Development Consent (DA 305-7-2003) as "*The environmental consequences of subsidence impacts, including: damage to infrastructure, buildings and residential dwellings; loss of surface flows to the subsurface; loss of standing pools; adverse water quality impacts; development of iron bacterial mats; cliff falls; rock falls; damage to Aboriginal heritage sites; impacts on aquatic ecology; ponding*".

Section 6 provides a summary of the analysis of monitoring data that will be undertaken to assess the impact of Longwalls 11 to 16 against the performance measure.

3 PREDICTED SUBSIDENCE IMPACTS AND ENVIRONMENTAL CONSEQUENCES

3.1 SURFACE WATER

3.1.1 Background

Wambo is situated adjacent to Wollombi Brook, south-west of its confluence with the Hunter River (**Figures 1 and 2**). Wollombi Brook drains an area of approximately 1,950 square kilometres and joins the Hunter River some 5 km north-east of the Wambo Coal Mine. The Wollombi Brook sub-catchment is bound by the Myall Range to the south-east, Doyles Range to the west, the Hunter Range to the south-west and Broken Back Range to the north-east (Hunter Catchment Management Trust, 2002).

The majority of lands within WCPL mining tenements drain via Wambo Creek, Stony Creek, North Wambo Creek and Redbank Creek to Wollombi Brook, while Waterfall Creek drains directly to the Hunter River (**Figure 2**).

A section of North Wambo Creek has been diverted to avoid the Wambo Open Cut (**Figure 2**). The North Wambo Creek Diversion was constructed in accordance with the approved North Wambo Creek Diversion Plan (WCPL, 2007).

3.1.2 Potential Subsidence Impacts and Environmental Consequences

Approved Subsidence Impacts and Environmental Consequences

The approved subsidence impacts and environmental consequences relating to surface water are described in the Wambo Development Project EIS, the *Wambo Seam Underground Mine Modification Statement of Environmental Effects* (North Wambo SEE) (WCPL, 2005) and the *South Bates (Wambo Seam) Underground Mine Modification Environmental Assessment* (WCPL, 2015). As part of the Wambo Development Project EIS, Gilbert & Associates prepared a surface water assessment for the Wambo Coal Mine in 2003 (Gilbert & Associates, 2003). Advisian (2015) prepared a surface water assessment in support of the South Bates (Wambo Seam) Underground Mine Modification,

Wollombi Brook

Section 4.2.3 of the Wambo Development Project EIS stated:

> *Mining of the longwall panels in the vicinity of Wollombi Brook would be constrained to an angle of 26.5 degrees from the vertical to "Protected Land" (i.e. within 40 m of Wollombi Brook as defined by the Rivers and Foreshore Improvement Act, 1948).*

Longwalls 11 to 16 are consistent with this commitment as the Application Area is approximately 3.8 km from Wollombi Brook.

Stony Creek

In regard to potential environmental consequences on Stony Creek, Section 4.2.3 of the Wambo Development Project EIS stated:

> *Extraction of the western most portions of the Whybrow Seam longwall panels would result in subsidence of Stony Creek (Figure 4-2). Potential impacts in this area include bank and headward erosion...*

Further, the *South Bates (Wambo Seam) Underground Mine Modification Subsidence Assessment* (Mine Subsidence Engineering Consultants [MSEC], 2015) stated:

> *Mining can potentially result in increased levels of ponding in locations where the mining induced tilts oppose and are greater than the natural stream gradients that exist before mining.*
>
> *...Cracking in the beds of the streams would only be visible at the surface where the depths of the surface soils are shallow, or where the bedrock is exposed.*
>
> *Some sections of Stony Creek and the upper reaches of ephemeral drainage lines have exposed bedrock which has formed into small cascades with isolated pools. Fracturing of the exposed bedrock could result in spalling or dislodgement of rocks.*

North Wambo Creek Diversion

In regard to the North Wambo Creek Diversion (referred to as the "water control structure" in the Wambo Development Project EIS), Section 4.2.3 of the Wambo Development Project EIS stated:

> *…As this portion of the water control system would be constructed following the extraction of the Whybrow Seam longwall panels a majority of the predicted subsidence in this area would already have occurred. Due to the shallow depth of the Whybrow Seam in this area (approximately 60 m to 80 m) subsidence is predicted to be variable resulting in a hump and hollow effect along the channel alignment…*

An application to modify the Development Consent (DA 305-7-2003 MOD 2) was lodged in January 2005 to modify the timing and orientation of the North Wambo Underground Mine. The modification was approved on 4 May 2005 and resulted in the construction of the North Wambo Creek Diversion prior to the commencement of mining at the South Bates Underground Mine.

Advisian (2015) concluded the following regarding potential impacts on the North Wambo Creek Diversion from Longwall 11 to 16:

> *Subsidence is predicted to have the greatest impact on North Wambo Creek Diversion which following mining in the Whybrow Seam:*
>
> - *Small areas where the channel gradient is predicted to increase by up to 6.1%. Erosion/scour protection will be provided in these areas;*
> - *Ponding in the three subsidence troughs with the ponds ranging from 200 m to 250 m long and up to 40 m wide. Depth of ponding is predicted to be 1.3 m to 1.4 m. No works are proposed to reduce the depth or extent of ponding;*
> - *Cracking of the surface soil and underlying rock is predicted. This will be remediated by washing fine sediment into the underlying rock and filling surface soil cracks.*
>
> *Additional impacts resulting from mining in the Wambo Seam are predicted to be minor and should be managed using the same techniques employed once subsidence has occurred as a result of mining in the Whybrow Seam.*

Other Ephemeral Drainage Lines

There were no specific subsidence effect predictions provided for ephemeral drainage lines in the Wambo Development Project EIS (WCPL, 2003).

Ephemeral drainage lines are located directly across the extents of Longwalls 11 to 16. MSEC (2015) concluded the drainage lines could therefore experience the full range of predicted subsidence movements.

Overview of Revised Predicted Subsidence Effects and Impacts

This WMP has been informed by revised predictions of subsidence effects and impacts prepared by MSEC (2017) based on the final mine layout presented in the Extraction Plan and incorporating recent subsidence monitoring results.

Wollombi Brook

As summarised in **Table 3**, the Development Consent (DA 305-7-2003) includes a performance measure specific to Wollombi Brook.

Wollombi Brook lies 3.8 km east of the extent of Longwalls 11 to 16 and is outside of Wollombi Brook "Protected Land"[1]. Wollombi Brook is not expected to experience any measurable tilts, curvatures or strains. Notwithstanding, performance indicators have been developed for Wollombi Brook and are detailed in **Section 6**.

[1] Wollombi Brook "Protected Land" is defined as land within 40 m of Wollombi Brook in accordance with the now repealed *Rivers and Foreshore Improvement Act, 1948* (replaced by provisions relating to "controlled activity approvals" within the NSW *Water Management Act, 2000)*.

Stony Creek

The predicted subsidence effects and impacts on Stony Creek have reduced compared to previous assessments as a result of shortening the commencing ends of Longwalls 13 and 14.

MSEC (2017) predicts the extraction of Longwalls 11 to 16 would result in maximum vertical subsidence for Stony Creek of 150 millimetres, maximum tilt of 1 millimetre per metre (mm/m) and maximum conventional tensile and compressive strains of less than approximately 0.01 mm/m. Compressive strains in the order of 5 mm/m could occur along the section of Stony Creek located immediately adjacent to the longwalls due to the valley related movements (MSEC, 2017).

The predicted post-mining grades along Stony Creek are similar to the natural grades, therefore MSEC (2017) expects no adverse changes in the levels of ponding or scouring along Stony Creek as a result of Longwalls 11 to 16.

Consistent with approved potential impacts, some minor cracking in the bed of Stony Creek may occur and would only be visible at the surface where the depths of the surface soils are shallow, or where the bedrock is exposed. Fracturing of exposed bedrock could result in spalling or dislodgement of rocks (MSEC, 2017).

Other Ephemeral Drainage Lines

Ephemeral drainage lines are located directly across the extents of Longwalls 11 to 16 and are expected to experience the full range of predicted subsidence movements consistent with previous subsidence impact predictions. This includes localised increased ponding and surface cracking.

North Wambo Creek Diversion

MSEC (2017) predicts the extraction of Longwalls 11 to 16 would result in maximum vertical subsidence to the North Wambo Creek Diversion of about 2 m, maximum tilt of 80 mm/m, and hogging and sagging curvature greater than 3.0 km^{-1}. This is consistent with previous subsidence effect predictions.

Potential subsidence impacts to the North Wambo Creek Diversion include (MSEC, 2017):

- Surface cracking and heaving similar to the impacts observed due to the mining of Longwall 11. The largest surface cracks occurred near the bend in the alignment above Longwall 11 and were typically in the order of 25 to 50 mm, with isolated locations up to 100 mm in width. The compression heaving in this location was typically up to 200 mm in height. Elsewhere, the surface cracking in the base of the creek diversion was typically less than 50 mm in width and the compressive heaving was typically less than 50 mm in height.
- Changes in grade along the North Wambo Creek Diversion.
- Creation of topographical depressions along the North Wambo Creek Diversion directly above the Whybrow Seam longwalls (Longwalls 11 to 13) and immediately adjacent to the Wambo Seam longwalls (Longwalls 14 to 16). These depressions along the creek diversion are estimated to be up to 1.4 m deep and up to 250 m long.
- Potential for increased connectivity between the workings and the North Wambo Creek Diversion (noting that an increase in water make in the workings was not observed during the extraction of Longwall 11 beneath the Diversion).

Overview of Revised Predicted Environmental Consequences

An assessment of potential subsidence effects and impacts on the North Wambo Creek Diversion, Stony Creek and ephemeral drainage lines was prepared by MSEC (2017) as part of the Extraction Plan. Alluvium (2016) has prepared an assessment of environmental consequences on surface water as a result of Longwalls 11 to 16 (Surface Water Technical Report) in consideration of the subsidence effects predicted by MSEC (2017).

Consistent with subsidence impact predictions, there are no expected environmental consequences for Wollombi Brook.

Ephemeral Drainage Lines

Surficial and subsurface erosion responses can be expected where cracks occur as a result of Longwalls 11 to 16 in colluvial and alluvial sediments (Alluvium, 2016). The sediments across this terrain above Longwalls 11 to 16 can be dispersive, which makes them prone to changes in rates of erosion (Alluvium, 2016).

Alluvium (2016) considers the areas of greatest risk would be where cracks open in erodible sediments with an orientation downslope or where local ponding occurs in the same location as cracking.

The geometry of flow paths towards North Wambo Creek Diversion would also change as a result of Longwalls 11 to 16 (Alluvium, 2016). The changes in flow paths have been identified by Alluvium (2016) based on the software CatchmentSIM using the predicted subsidence digital terrain model (DTM).

Without appropriate mitigation measures, the changes in flow paths may result in increases in erosion and scour of the south-western batter of the North Wambo Creek Diversion. Mitigation measures to manage this risk are summarised in Section 5 and described in detail in Alluvium (2016).

North Wambo Creek Diversion

Potential environmental consequences to the North Wambo Creek Diversion above the Longwalls 11 to 16 Application Area identified by Alluvium (2016) include:

- potential for surficial and subsurface erosion responses as a result of unremediated subsidence cracking;
- potential for increased bed and bank erosion upstream of Longwalls 11 and 16 in response to the steepening of the channel longitudinal profile;
- erosion of the elevated section of channel bed that would form over the pillar between Longwalls 11 and 12;
- potential for an increase in suspended sediments from increased bed and bank erosion and erosion from overland flow entry;
- an increase of in-channel storage compared to the existing channel that would have minimal impacts on flows in North Wambo Creek; and
- changes in baseflow conditions due to the effects of underground mining.

Alluvium (2016) considers that management measures can be put in place to reduce the risk of an increase in suspended sediments in the North Wambo Creek Diversion to negligible. These measures have been incorporated into Section 5.

WCPL proposes to maintain the predicted in-channel ponding as works to allow free drainage of the pools would require significant disturbance of the North Wambo Creek Diversion.

HydroSimulations (2017) estimates that increased leakage from the North Wambo Creek Diversion to the underground workings could conservatively be up to 12.5 megalitres per day (ML/day) prior to remediation during periods of flow (reducing significantly following remediation). In addition, no increase in groundwater inflows to the workings following rainfall events has been observed as part of the experience from Longwall 11 to date.

Management and remediation measures to mitigate the risk of scour and leakage associated with Longwalls 11 to 16 are outlined in **Section 5**.

3.2 GROUNDWATER

3.2.1 Background

The hydrogeological regime of the Wambo Coal Mine area comprises two main systems (Australasian Groundwater and Environmental Consultants [AGE], 2003):

- a Quaternary alluvial aquifer system of channel fill deposits associated with Wollombi Brook, North Wambo Creek, Wambo Creek and Stony Creek; and
- underlying Permian strata of hydrogeologically "tight" and hence very low yielding to essentially dry sandstone and lesser siltstone and low to moderately permeable coal seams which are the prime water bearing strata within the Permian sequence.

The alluvial flow in North Wambo Creek has been altered by historical and existing mining operations including the removal of alluvium across the full width of the channel with consequent desaturation of the adjacent upstream and downstream alluvium.

As described in **Section 3.1.1**, a section of North Wambo Creek has been diverted to avoid the Wambo Open Cut (**Figure 2**). The North Wambo Creek Diversion (**Figure 2**) was constructed in accordance with the approved North Wambo Creek Diversion Plan (WCPL, 2007).

Historical and ongoing open cut and underground mining within the Wambo Coal Mine area (including adjoining mining operations) has created significant groundwater sinks and this has generated a regional zone of depressurisation within the Permian coal measures.

3.2.2 Potential Subsidence Impacts and Environmental Consequences

Approved Subsidence Impacts and Environmental Consequences

The approved subsidence impacts and environmental consequences relating to groundwater are described in the Wambo Development Project EIS, the North Wambo SEE and the *South Bates (Wambo Seam) Underground Mine Modification Environmental Assessment* (WCPL, 2015). As part of the Wambo Development Project EIS, AGE prepared a groundwater assessment for Wambo (AGE, 2003). A more contemporary numerical model was developed to support the South Bates (Wambo Seam) Underground Mine Modification (HydroSimulations, 2015) to assess the potential cumulative impacts of Wambo and surrounding mining operations on groundwater resources.

Alluvial Aquifers

In regard to potential environmental consequences on alluvial aquifers, Section 4.7.1 of the Wambo Development Project EIS stated:

> *The subsidence would result in a lowering of the base of the North Wambo Creek alluvium which may also affect the groundwater leakage rates. Bores set in the alluvium between the southern extent of the open cut and the confluence of Wollombi Brook may be impacted by a declining water level and yield. These bores are owned by WCPL. It is expected that with the implementation of appropriate mitigation measures (see below) there would be no impacts on groundwater bores or wells along Wollombi Brook (Appendix F).*
>
> *Project underground mine areas are distant to the Hunter River and the Project open cut, although expanding to the north-west towards the Hunter River, would not intersect the alluvium. The Project would therefore not impact groundwater users along the Hunter River (Appendix F).*
>
> *Impact on groundwater quality due to the Project would be limited to the coal seams and Permian aquifers. As a result no water quality impact is expected on the local alluvial groundwater system (Appendix F).*

HydroSimulations (2015) concluded the following as part of the *South Bates (Wambo Seam) Underground Mine Modification Environmental Assessment*:

> *Due to the cumulative impacts of approved mining, shallow drawdowns in alluvium and regolith from the commencement of the South Bates Underground Mine are expected to reach about 10 m at the north-eastern end of the mine layout. This is partially due to fracturing to land surface but primarily due to adjacent open cut mining. Negligible drawdown is anticipated at the south-western end of the mine layout in the vicinity of Stony Creek. The incremental drawdown due to the Modification, as shown on Figure 37, is not discernible, being less than 0.01 m.*

Permian Aquifers

In regard to potential environmental consequences on Permian aquifers, Section 4.7.2 of the Wambo Development Project EIS stated:

> *The available data indicates that substantial dewatering of the coal seams in the Wambo Coal Mine area has already taken place and that the Project would result in further dewatering of the Permian aquifers and lowering of groundwater levels, particularly in the Permian strata around the Project underground workings.*
>
> *...*
>
> *The assessment undertaken for the Project has shown that the potential impacts of the mining on water quality would be limited to the coal seams and Permian strata (Appendix F). Due to the poor quality of the water, it is considered that the resource is of limited benefit and as a result, any loss through mining activities would not be detrimental to the area.*

HydroSimulations (2015) concluded the following as part of the *South Bates (Wambo Seam) Underground Mine Modification Environmental Assessment*:

> *The approved South Bates Underground Mine will cause depressurisation of the Permian strata. The upper Permian coal measures within the mine footprint are predicted to be essentially dewatered during mining of the target Whybrow Seam. Outside the mine footprint, the main impact from the approved South Bates Underground Mine on potentiometric pressures within Permian strata would occur to the immediate north-west. Impacts to the north, north-east, east and south would be minimal due to the influence of neighbouring open cut and underground mines. In addition, propagation of impacts is constrained to the north-east by the finite distance from the mine to seam subcrop.*

Overview of Predicted Environmental Consequences

A groundwater assessment review, supported by numerical modelling, was prepared by HydroSimulations (2017) as part of the Extraction Plan for Longwalls 11 to 16.

The groundwater assessment review considered the cumulative impacts on groundwater, as the drawdown caused by Longwalls 11 to 16 is difficult to assess in isolation due to groundwater responses being affected significantly by adjacent open cut and longwall mining (HydroSimulations, 2017).

Following a review of monitoring data, HydroSimulations (2017) concluded revision of the potential cumulative environmental consequences for groundwater is not required. Of note to Longwalls 11 to 16, HydroSimulations (2017) concluded:

- Shallow drawdowns in alluvium and regolith from the commencement to the completion of Longwalls 11 to 16 are expected to reach approximately 10 m at the north-eastern end of the longwalls, in the vicinity of the North Wambo Creek Diversion.
- Shallow groundwater associated with the North Wambo Creek Diversion is expected to experience freshwater recharge at a rate higher than occurred pre-mining.
- Negligible drawdown is anticipated over the western half of Longwalls 11 to 16 and in the vicinity of Stony Creek.
- There are no private registered bores that would be likely to be affected by 2 m drawdown or more if Longwalls 11 to 16 were to occur in isolation.

4 MONITORING

Surface water and groundwater monitoring will be undertaken in accordance with the programs outlined in the SWMP and GWMP (**Section 1.2**). Specific monitoring for Longwalls 11 to 16 is outlined in **Table 4**.

The SWMP has been revised to incorporate a diversion and subsidence monitoring program that incorporates the following:

- monitoring of the Index of Diversion Condition (IDC);
- Landscape Function Analysis (LFA) monitoring;
- riparian vegetation assessment;
- aerial photography analysis;
- analysis of long and cross-section surveys for comparison with previous years and design;
- analysis of flow event information; and
- reviews of the geomorphic condition of the North Wambo Creek Diversion and an assessment of the efficacy of subsidence management or rehabilitation works and maintenance requirements.

Table 4
Water Management Plan Monitoring Program Overview

Monitoring Component	Parameter	Timing/Frequency	Responsibility
Pre-Mining			
Bed and bank stability monitoring of North Wambo Creek Diversion and Stony Creek.	In accordance with the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Monitoring of surface water quality and flow monitoring sites (SW04, SW27a, SW08, FM2, FM3).	In accordance with the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Monitoring of groundwater sites (GW21, N2, N3).	In accordance with the GWMP.	In accordance with the GWMP.	Environment and Community Manager
During Mining			
Longwalls 11 to 16 subsidence monitoring lines as described in the Subsidence Monitoring Program.	Monitoring parameters include: • subsidence; • tilt; • tensile strain; • compressive strain; and • absolute horizontal translation.	Monitoring during secondary extraction of Longwalls 11 to 16 in accordance with the Subsidence Monitoring Program.	Mine Surveyor
Diversion and subsidence monitoring program.	As outlined in the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Visual inspection of the North Wambo Creek Diversion.	Surface cracks. Surface ponding.	Daily inspections when extraction is occurring directly beneath North Wambo Creek Diversion.	Environment and Community Manager
Visual inspection of drainage line flow paths.	Evidence of erosion or channelisation.	Following a rainfall event of greater than 40 mm in 24 hours.[1]	Environment and Community Manager
Bed and bank stability monitoring of Stony Creek.	In accordance with the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Monitoring of surface water quality and flow monitoring sites (SW04, SW27a, SW08, FM2, FM3).	In accordance with the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Monitoring of groundwater sites (GW21, N2, N3).	In accordance with the GWMP.	In accordance with the GWMP.	Environment and Community Manager
Inflows to underground workings.	Dewatering volumes and underground water levels in accordance with the GWMP.	Recorded on a daily basis during pumping.	Environment and Community Manager

Table 4 (Continued)
Water Management Plan Monitoring Program Overview

Monitoring Component	Parameter	Timing/Frequency	Responsibility
Post-Mining			
Diversion and subsidence monitoring program	As outlined in the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Visual inspection of surface areas which required remediation.	Stabilisation of erosion and groundcover.	Monthly inspections until monitoring confirms stabilisation of erosion and groundcover is >60%.	Environment and Community Manager
Visual inspection of drainage line flow paths.	Evidence of erosion or channelisation.	Following a rainfall event of greater than 40 mm in 24 hours up to 6 months following completion of mining.[1]	Environment and Community Manager
Bed and bank stability monitoring of Stony Creek.	In accordance with the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Monitoring of surface water quality and flow monitoring sites (SW04, SW27a, SW08, FM2, FM3).	In accordance with the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Monitoring of groundwater sites (GW21, N2, N3).	In accordance with the GWMP.	In accordance with the GWMP.	Environment and Community Manager

[1] Inspection to occur once access is practically available following the rainfall event. Inspections would not occur for subsequent rainfall events within 7 days of previous inspection.

5 MANAGEMENT MEASURES

Management measures to remediate impacts on water resources resulting from the extraction of Longwalls 11 to 16 will be undertaken in accordance with **Table 5**, the SGWRP and the measures proposed in **Section 6**.

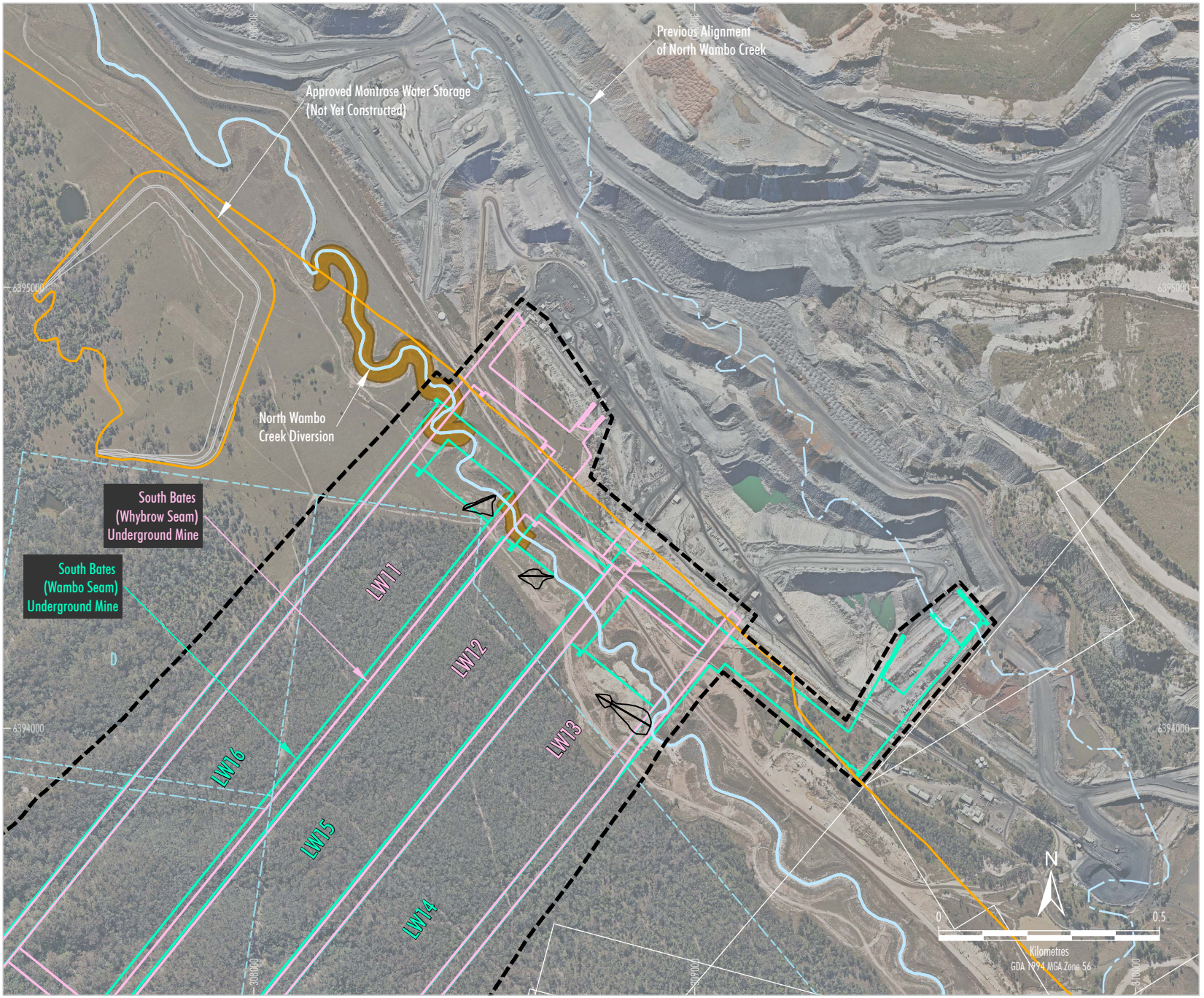
Table 5
Water Management Plan Key Management Measures

Management Measure	Timing/Frequency	Responsibility
Pre-Mining		
Stockpile sufficient materials and make equipment and necessary resources available for: • sealing any surface cracks (particularly in areas that are predicted to be ponded); and • installation of scour protection works.	Prior to commencement of secondary extraction of Longwalls 11 to 16.	Environment and Community Manager

Table 5 (Continued)
Water Management Plan Key Management Measures

Management Measure	Timing/Frequency	Responsibility
During Mining		
Remediation of all visible surface cracks in the North Wambo Creek Diversion low flow channel as soon as practicable. Cracks would be infilled with alluvial/colluvial material that may be blended with bentonite to achieve a level of seal consistent with the surrounding host material.	As soon as practicable following observation (nominally within two weeks).	Environment and Community Manager
Remediation of surface cracks[1] in areas outside the North Wambo Creek Diversion low flow channel where practicable using conventional earthmoving equipment (e.g. a backhoe) including: • infilling of surface cracks with soil or other suitable materials; or • locally re-grading and re-compacting the surface.	When required during secondary extraction of Longwalls 11 to 16.	Environment and Community Manager
Review of areas that may be vulnerable to scour along the North Wambo Creek Diversion (as shown on **Figure 5**) and installation of appropriate scour protection (e.g. vegetation planting, placement of woody debris, localised rock armouring).	To be installed in 2017.	Environment and Community Manager
Construction of new batter chutes to manage concentrated overland flow entry to the North Wambo Creek Diversion (see conceptual locations on **Figure 5**).	To be constructed in 2017.	Environment and Community Manager
Stabilisation of any areas of surface cracking or erosion using erosion protection measures (e.g. vegetation planting).	When required during secondary extraction of Longwalls 11 to 16.	Environment and Community Manager
Review of remediation measures and implementation of additional measures if required, in accordance with the TARP (**Attachment 1**).	Ongoing during mining.	Environment and Community Manager
Post-Mining		
Review of remediation measures and implementation of additional measures if required, in accordance with the TARP (**Attachment 1**).	Following completion of secondary extraction of Longwalls 11 to 16.	Environment and Community Manager
Post-subsidence assessment of impacts to Stony Creek and drainage lines and implementation of any minor remedial works.	Following completion of secondary extraction of Longwalls 11 to 16.	Environment and Community Manager

[1] Minor cracks that develop are not expected to require remediation as geomorphologic processes will result in natural filling of these cracks over time.



LEGEND

- Existing/Approved Surface Development Area
- South Bates (Whybrow Seam) Underground Mine
- South Bates (Wambo Seam) Underground Mine
- Other Approved Underground Development
- Remnant Woodland Enhancement Program (RWEP) Area
- Extraction Plan Application Area
- Conceptual Location of Batter Chute
- Extent of Area that may require Stabilisation Measures

Source: Department of Lands (July 2009); WCPL (2016); WCPL Orthophoto (July 2016); Alluvium (2016)

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WAMBO COAL MINE

Aerial Photograph of North Wambo Creek Diversion

Figure 5

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6 ASSESSMENT OF PERFORMANCE INDICATORS AND MEASURES

In accordance with Condition 22C(d) of Schedule 4 of the Development Consent (DA 305-7-2003), performance indicators have been developed for the performance measure listed in **Table 3**. The proposed performance indicators are summarised in **Table 6**.

Monitoring conducted to inform the assessment of the extraction of Longwalls 11 to 16 against the performance indicators for the performance measure relating to Wollombi Brook includes:

- monitoring in accordance with the SWMP; and
- monitoring in accordance with the GWMP.

Table 6
Water Performance Measure and Performance Indicators

Performance Measure	Performance Indicator(s)
Negligible subsidence impacts[1] to Wollombi Brook. Negligible environmental consequences[2] to Wollombi Brook.	• The performance indicators will be considered to have been exceeded if the **surface water quality in Wollombi Brook exceeds the surface water quality criteria in the SWMP**. • The performance indicators will be considered to have been exceeded if the **groundwater levels in alluvial bores exceed the groundwater level criteria in the GWMP**. • The performance indicators will be considered to have been exceeded if the **groundwater quality in alluvial bores exceeds the groundwater quality criteria in the GWMP**. • The performance indicators will be considered to have been exceeded if **zero flow is recorded at the Warkworth gauging station (FM10) and measurable flow is recorded at the Bulga gauging station (FM11)**.

[1] A subsidence impact is defined by the Development Consent (DA 305-7-2003) as "*physical changes to the ground and its surface caused by subsidence effects, including tensile and shear cracking of the rock mass, localised buckling of strata caused by valley closure and upsidence and surface depressions or troughs*".

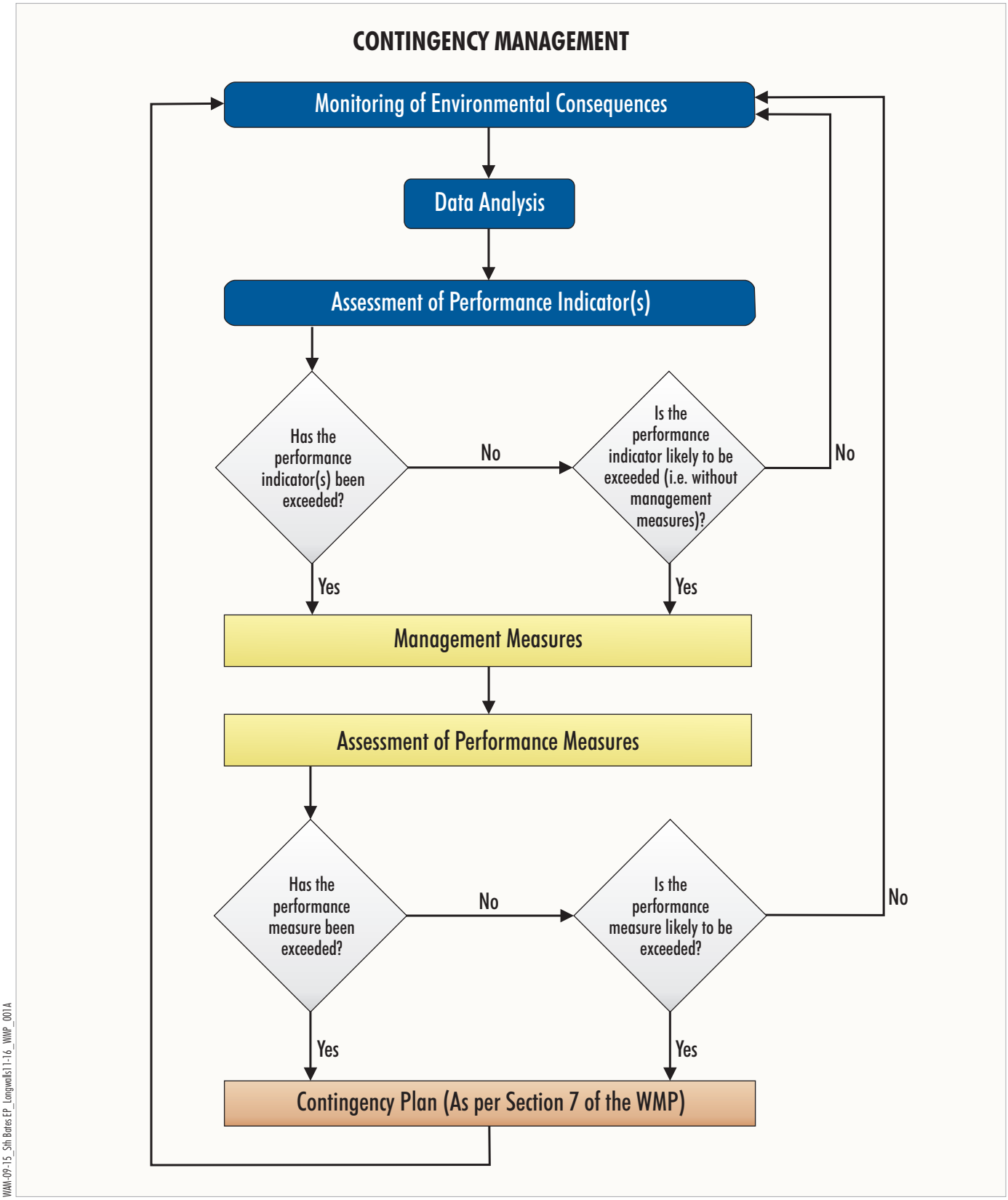
[2] An environmental consequence is defined by the Development Consent (DA 305-7-2003) as "*The environmental consequences of subsidence impacts, including: damage to infrastructure, buildings and residential dwellings; loss of surface flows to the subsurface; loss of standing pools; adverse water quality impacts; development of iron bacterial mats; cliff falls; rock falls; damage to Aboriginal heritage sites; impacts on aquatic ecology; ponding*".

Monitoring results will be used to assess the extraction of Longwalls 11 to 16 against the performance indicators and performance measure as detailed in **Table 7**. The monitoring process and subsequent assessment of performance indicators and measures is outlined in **Figure 6**.

If data analysis indicates a performance indicator has been exceeded or is likely to be exceeded, an assessment will be made against the performance measure. If the performance measure is considered to have been exceeded, the Contingency Plan will be implemented (**Section 7**). If data analysis indicates that the performance measure has not been exceeded, WCPL will continue to monitor.

Table 7
Monitoring of Environmental Consequences against Performance Indicators and Measures

Performance Measure	Monitoring of Environmental Consequence			Data Analysis to Assess against Performance Indicator(s)	Performance Indicator	Assessment of Performance Indicator	Assessment of Performance Measure	Potential Relevant Management and Contingency Measure
	Site	Parameter	Frequency					
Negligible impact to Wollombi Brook.	• Surface water quality monitoring sites listed in Table 13 of the SWMP. • FM10. • FM11.	• pH. • EC. • Surface water flow.	• Monthly/Rainfall event. • Continuous.	• Analysis of surface water quality monitoring data in accordance with the SWMP.	• The surface water quality in the Wollombi Brook does not exceed the surface water quality criteria listed in Table 11 of the SWMP.	• The performance indicators will be considered to have been exceeded if the surface water quality in Wollombi Brook exceeds the surface water quality criteria listed in Table 11 of the SWMP. • If data analysis indicates the performance indicators have been exceeded, an assessment will be made against the performance measure (**Figure 6**).	• A preliminary investigation will be conducted to determine the likely cause of the performance indicator exceedance. No further hydrological and/or hydrogeological analysis will be conducted where: – the exceedance is not a result of underground extraction (e.g. climatic variations); or – the exceedance is of the groundwater level criteria or groundwater quality criteria and the exceedance is isolated to one or more alluvial bores that are not located in proximity to Wollombi Brook. • The performance measure is exceeded if subsidence, groundwater and surface water monitoring data and hydrological and/or hydrogeological analysis indicate subsidence from development of Longwalls 11 to 16 has resulted in: – a greater than negligible change in Wollombi Brook surface water flow (e.g. stream baseflow); or – a greater than negligible change in Wollombi Brook water quality. • The above analysis will include consideration of streamflow gauging sites FM10 and FM11 listed in the SWMP (i.e. DPI Water Gauging Stations Wollombi Brook at Bulga and Wollombi Brook at Warkworth). • The above analysis will be peer reviewed by a specialist approved by the DP&E. • The results of the above analysis will be reported to the DP&E, NSW Environment Protection Authority (EPA) and DPI Water. • If the performance measure has been exceeded, the Contingency Plan will be implemented (**Section 7**).	• Implementation of stream flow loss remediation techniques (e.g. injection grouting or installation of a geomembrane). • Provision of offsets (i.e. retirement of an equivalent volume of water licence). • Implementation of erosion and sediment control measures and stabilisation techniques. • Additional monitoring (e.g. increase in monitoring frequency). • Consideration of changes to longwall extraction geometry in consultation with relevant regulatory authorities.
	• Groundwater monitoring sites listed in Table 12 of the GWMP. • FM10. • FM11.	• Water level. • Surface water flow.	• Every two months or as specified in Table 12 of the GWMP. • Continuous.	• Analysis of groundwater level monitoring data in accordance with the GWMP.	• The groundwater levels in alluvial bores do not exceed the groundwater level criteria listed in Table 9 of the GWMP.	• The performance indicators will be considered to have been exceeded if the groundwater levels in alluvial bores exceed the groundwater level criteria listed in Table 9 of the GWMP. • If data analysis indicates the performance indicators have been exceeded, an assessment will be made against the performance measure (**Figure 6**).		
	• Groundwater monitoring sites listed in Table 12 of the GWMP. • FM10. • FM11.	• pH. • EC. • Surface water flow.	• Every two months or as specified in Table 12 of the GWMP. • Continuous.	• Analysis of groundwater quality monitoring data in accordance with the GWMP.	• The groundwater quality in alluvial bores does not exceed the groundwater quality criteria listed in Table 10 of the GWMP.	• The performance indicators will be considered to have been exceeded if the groundwater quality in alluvial bores exceeds the groundwater quality criteria listed in Table 10 of the GWMP. • If data analysis indicates the performance indicators have been exceeded, an assessment will be made against the performance measure (**Figure 6**).		
	• FM10. • FM11.	• Surface water flow.	• Continuous.	• Review of data monthly or following 20 mm of rainfall.	• Measureable flow is recorded at the Warkworth gauging station (FM10) when there is measurable flow recorded at the Bulga gauging station (FM11).	• The performance indicators will be considered to have been exceeded if zero flow is recorded at the Warkworth gauging station (FM10) and measurable flow is recorded at the Bulga gauging station (FM11). • If data analysis indicates the performance indicators have been exceeded, an assessment will be made against the performance measure (**Figure 6**).		



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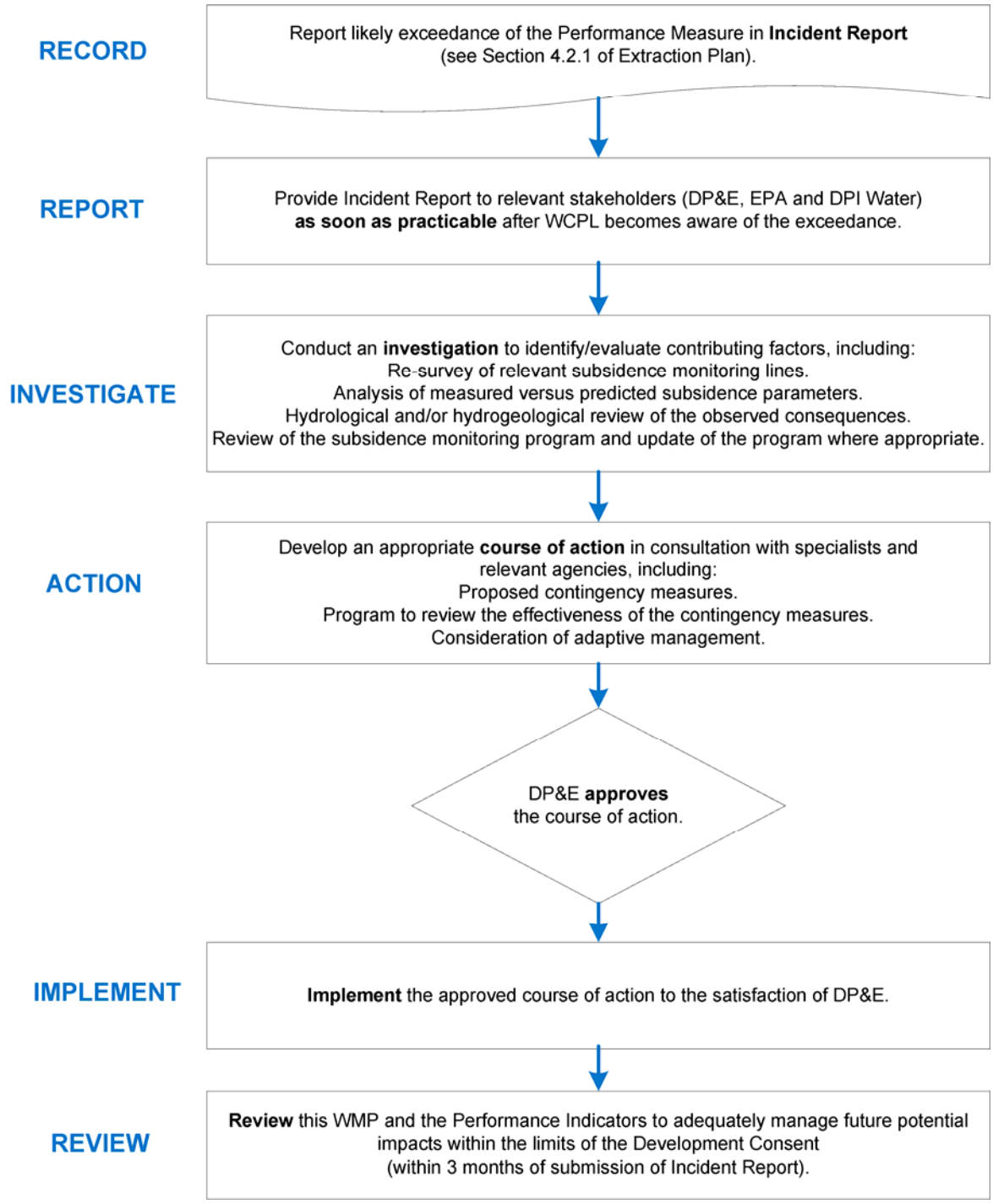
Monitoring of Environmental Consequences against Performance Indicators and Measures

Figure 6

7 CONTINGENCY PLAN

In the event the Wollombi Brook performance measure summarised in **Table 6** is considered to have been exceeded or is likely to be exceeded, in accordance with the schematic presented in **Figure 6**, WCPL will implement the following Contingency Plan:



The framework for the various components of the WMP are summarised in the WMP TARP which is included as **Attachment 1**. The WMP TARP illustrates how the various predicted subsidence impacts, monitoring components, performance measures and responsibilities are structured, and the framework for management and contingency actions.

8 REFERENCES

Advisian (2015) *South Bates (Wambo Seam) Underground Mine Modification Surface Water Assessment.* Report prepared for Wambo Coal Pty Limited.

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ATTACHMENT 1

WATER MANAGEMENT PLAN
TRIGGER ACTION RESPONSE PLAN

Table A1-1
Water Management Plan Trigger Action Response Plan

Condition	Normal	Level 1	Level 2
	Normal Conditions	**Management Measures**	**Restoration/Contingency Phase**
Trigger	• No visible cracks along North Wambo Creek Diversion. • Dewatering volumes and underground water levels at normal conditions and not significantly influenced by climatic conditions. • Predicted impacts on other surface water and groundwater as described in **Section 3**.	• Cracks observed along North Wambo Creek Diversion. • Dewatering volumes and underground water levels are elevated and responding significantly to climatic conditions. • Impacts requiring remediation observed on Stony Creek or other ephemeral drainage lines/overland flow paths. • Groundwater or surface water impacts greater than expected.	• Functionality of North Wambo Creek Diversion materially affected. • Dewatering volumes and underground water levels continue to respond significantly to climatic conditions following remediation. • The Wollombi Brook performance measure has been exceeded, or is likely to be exceeded.
Action	• Conduct monitoring, consistent with **Tables 4 and 7**, the GWMP, SWMP and the Subsidence Monitoring Program (Appendix H of the Extraction Plan). • Assess the environmental consequences of the subsidence in accordance with **Section 6** and the SGWRP. • Assess the need for management measures in accordance with **Section 5** and the SGWRP.	• Implement management measures, as required, in accordance with **Section 5** and the SGWRP.[1] • Continue monitoring, consistent with **Tables 4 and 7**, the GWMP, SWMP and the Subsidence Monitoring Program (Appendix H of the Extraction Plan).	• Implement Contingency Plan described in **Section 7**. • Develop action plan for additional measures, including consideration of: – additional scour protection, crack remediation and/or stabilisation; and/or – isolation sealing of the diversion cutting, for example through injection grouting or installation of low permeability material.
Frequency	• Frequency consistent with **Table 5**, the GWMP, SWMP and SGWRP.	• As required, in accordance with **Section 6** and the SGWRP.	• As required, in accordance with **Section 7**.
Position of Decision Making	• Environment and Community Manager.	• Environment and Community Manager.	• General Manager. • Implementation of additional management measures will be undertaken in consultation with DRE and DPI Water.

1 With regard to the specific circumstances of the subsidence impact [e.g. the location, nature and extent of the impact] and the assessment of environmental consequences, in accordance with **Sections 5 and 6** and the SGWRP.

Note: GWMP refers to the Wambo Coal Groundwater Monitoring Program.
SWMP refers to the Wambo Coal Surface Water Monitoring Program.
SGWRP refers to the Wambo Coal Surface Water Groundwater Response Plan.
DRE refers to the Division of Resources and Energy.
DPI Water refers to the Water division in the Department of Primary Industries.

ATTACHMENT 2

WAMBO COAL PTY LIMITED
SURFACE WATER MONITORING PROGRAM

WAMBO COAL
SURFACE WATER MONITORING PROGRAM

Document No. WA-ENV-MNP-509.2
December 2016

Document Control

Document No.	WA-ENV-MNP-509.2
Title	Surface Water Monitoring Program
General Description	Surface Water Monitoring at WCPL
Document Owner	Environment & Community Manager

Revisions

Rev No	Date	Description	By	Checked	Signature
0	August 2005	Original Draft	Resource Strategies	JT/TS	
1	August 2005	Revised Draft	Resource Strategies	JT/TS	
2	August 2007	Management Plan Consolidation	Hansen Bailey	SW	
3	October 2008	Management Plan Consolidation	WCPL	SB	
4	November 2009	Consent Modification	WCPL	SB	
5	March 2012	Audit Findings/Rail Loop DA Mod	WCPL	LC	
6	September 2014	Revision 6	WCPL	TF	
7	April 2015	Addressing DP&E Comment	WCPL	TF	
8	September 2015	New management plan format and revision	WCPL/Palaris	SP	
9	October 2015	Revised following receipt of comments from DP&E on Rev 8	WCPL/Palaris	SP	
10	December 2016	Revised to incorporate LW11-16	WCPL		

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LIST OF APPENDICES

1.0 Introduction

1.1 Background

The Wambo Coal Mine (the Mine) is situated approximately 15 kilometres west of Singleton, near the village of Warkworth, New South Wales (Figure 1). Wambo is owned and operated by Wambo Coal Pty Limited (WCPL), a subsidiary of Peabody Energy Australia Pty Limited.

A range of open cut and underground mine operations have been conducted at WCPL since mining operations commenced in 1969. Mining under the current Development Consent (DA 305-7-2003) commenced in 2004 and permits both open cut, underground operations and associated activities to be conducted.

The approved run-of-mine (ROM) coal production rate is 14.7 million tonnes per annum and all product coal is transported from WCPL by rail. A summary of the approved Wambo Coal Mine is provided in Table 1.

Table 1: Summary of the Approved Wambo Coal Mine

Component	Approved Wambo Coal Mine[1]
Life of Mine	28 years (from the date of the commencement of Development Consent [DA305-7-2003]). 1st March 2032
Open Cut Mining	Open cut mining at a rate of up to 8 Mtpa of ROM coal from the Whybrow, Redbank Creek, Wambo and Whynot Seams
	An estimated total open cut ROM coal reserve of 98 Mt
	Open cut mining operations under current approved MOP
Underground Mining	Underground mining of up to 9.75 Mtpa of ROM coal from the Whybrow, Wambo, Woodlands Hill and Arrowfield Seams. Underground ROM coal reserves are estimated at 143.3 Mt.
Subsidence commitments and management.	The subsidence performance measures listed in Conditions 22 and 22A of the Development Consent (DA305-7-2003).
ROM Coal Production Rate	Up to 14.7 Mtpa of ROM coal
Total ROM Coal Mined	241.3 Mt
Waste Rock Management	Waste rock deposited in open cut voids and in waste rock emplacements adjacent open cut operations
Total Waste Rock	640 million bank cubic metres (Mbcm)
Coal Washing	Coal handling and preparation plant (CHPP) capable of processing approximately 1,800 tonnes per hour (tph)
Product Coal	Production of up to 11.3 Mtpa of thermal coal predominantly for export
CHPP Reject Management	Coarse rejects and tailings would be incorporated, encapsulated and/or capped within open cut voids in accordance with existing Wambo management practices
Total CHPP Rejects	Approximately 36.6 Mt of coarse rejects and approximately 22.4 Mt of tailings
Water Supply	Make-up water demand to be met from runoff recovered from tailings storage areas, operational areas, dewatering, licensed extraction from Wollombi Brook and Hunter River
Mining Tenements	Coal Lease (CL) 365, CL374, CL397, Consolidated Coal Lease (CCL) 743, Mining Lease (ML) 1402, ML1572, ML1594, Authorisation (A) 444, Exploration Licence (EL) 7211.

Note: [1] Development Consent DA305-7-2003 (as modified December 2016)

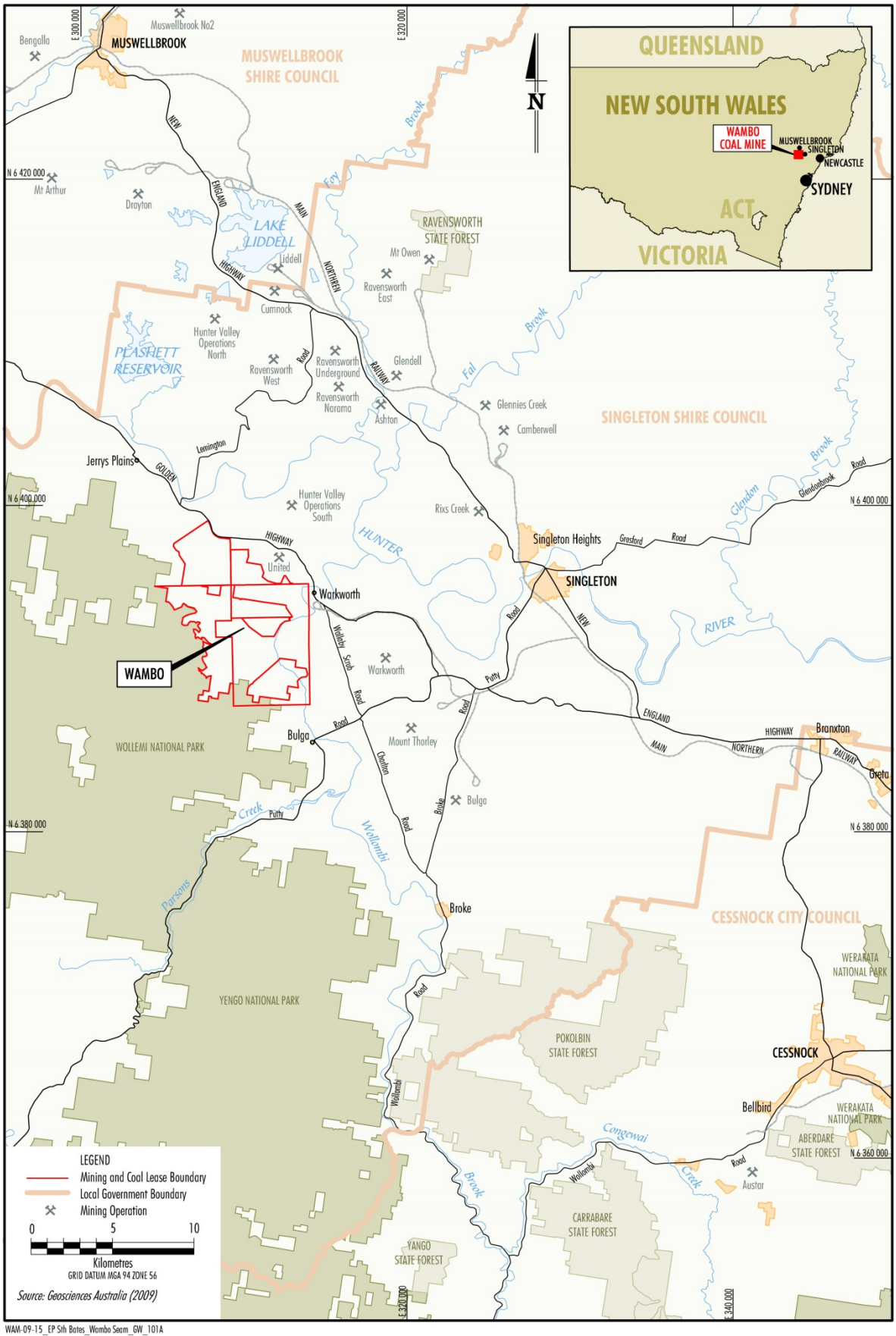


Figure 1: Wambo Coal Regional Location

In accordance with Schedule 4, Condition 30 of DA305-7-2003, WCPL are required to prepare a Site Water Management Plan (SWMP). This Surface Water Monitoring Program (SWMP) is a component of the WCPL Site Water Management Plan. Figure 2 shows the components of the WCPL Site Water Management Plan. This SWMP should be read in conjunction with the other components of the WCPL Site Water Management Plan, in particular the Surface and Ground Water Response Plan (SGWRP).

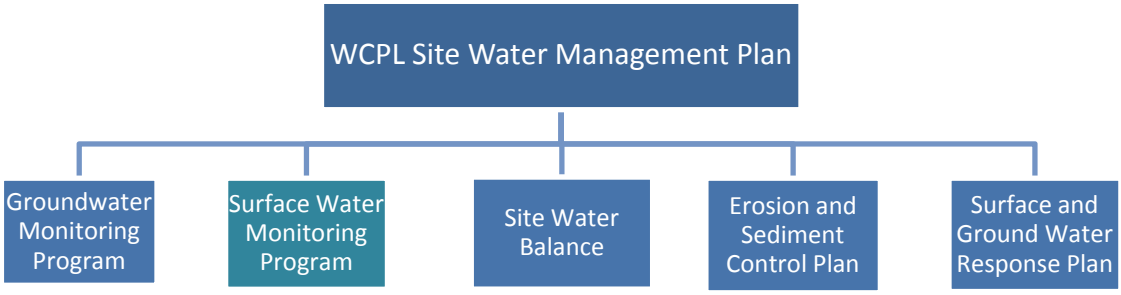


Figure 2: WCPL Site Water Management Plan

In accordance with WCPL's continuous improvement and review processes and Conditions 4 & 6, Schedule 6 of DA305-7-2003, a review of the SWMP has been undertaken to ensure that surface water monitoring at the Mine continues to be undertaken in a manner that ensures compliance and that surface water impacts from the Mine are minimised where possible.

1.2 Purpose

This SWMP has been developed to address the relevant requirements of relevant consent conditions and regulatory requirements. The SWMP also addresses the relevant conditions of WCPL mining leases and Environmental Protection Licence (EPL). In accordance with Condition 33, Schedule 4 of DA305-7-2003, WCPL have prepared this SWMP to provide:

- Detailed baseline data on surface water flows and quality in the Wollombi Brook, and North Wambo, South Wambo, and Stony Creeks;
- Surface water impact assessment criteria;
- A program to monitor surface water flows and quality in the Wollombi Brook; and North Wambo, South Wambo, and Stony Creeks;
- A program to monitor bank and bed stability in North Wambo, South Wambo, and Stony Creeks;
- A program to monitor the quantity and quality of the vegetation in the riparian zones adjacent to North Wambo, South Wambo, and Stony Creeks; and
- A program to monitor the effectiveness of the Erosion and Sediment Control Plan.

1.3 Scope

This SWMP applies to all surface water monitoring activities undertaken within WCPL's mining authorisations and approved mining areas (Figure 3). This SWMP has been prepared to allow for the collection and interpretation of surface water data such that WCPL can implement appropriate measures to manage potential impacts to surface water during the operation of the Mine. This SWMP forms part of WCPL's Environmental Management System (EMS).

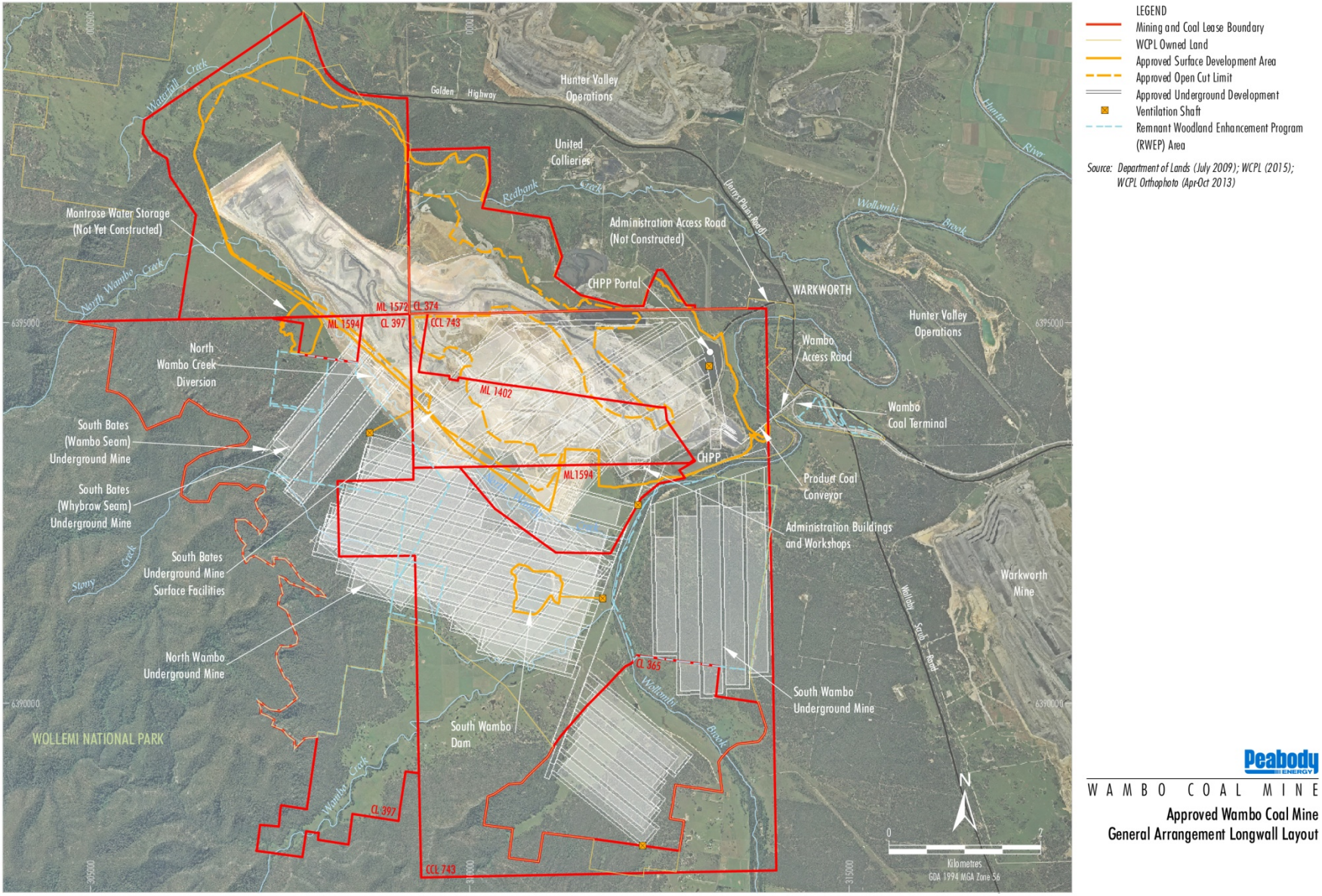


Figure 3: Approved Wambo Coal Mine Layout

Peabody ENERGY

WAMBO COAL MINE

Approved Wambo Coal Mine
General Arrangement Longwall Layout

1.4 Statutory Requirements

This SWMP has been prepared to address the relevant Development Approval (DA) consent conditions within DA305-7-2003 and DA177-8-2004 (Table 2). Additional monitoring requirements are included in Table 3.

The SWMP has also been prepared to address the requirements of WCPL's Environment Protection Licence (EPL) 529 (Section 1.4.2).

1.4.1 Environmental Planning & Assessment Act 1979

WCPL received Development Consent (DA305-7-2003) in accordance with the *Environmental Planning & Assessment Act 1979* (EP&A Act) from the NSW Department of Planning and Environment (DP&E), formerly NSW Department of Planning, on 4 February 2004. Conditions within DA305-7-2003 relevant to surface water monitoring at the Mine are summarised in Table 2.

WCPL received Development Consent (DA177-8-2004) in accordance with the EP&A Act from the NSW DP&E on 16 December 2004. Conditions within DA177-8-2004 relevant to surface water monitoring at the Mine are summarised in Table 2.

In April 2008, the North Wambo Creek Diversion Plan was approved subject to the additional requirements shown in Table 3.

Table 2: Development Consent Requirements for the Surface Water Monitoring Program

Schedule	Condition	Requirements	SWMP Section
DA305-7-2003			
4	29	The applicant shall: (a) measure: The volume of water discharged from the site; … Dam and water structure storage levels; …. (b) monitor the quality of the surface water: Discharged from the licenced discharge point/s at the development; and Upstream and downstream of the development. (c) monitor flows in the Wollombi Brook, and North Wambo, South Wambo, and Stony Creeks; (d) monitor the volume and quality of water inflows from each separate source to the underground and open cut workings… to the satisfaction of the EPA, NOW and the Secretary.	 **Section 4.1.7** **Section 4.1.2** **Section 4.1.1** **Section 4.1.3** **Section 4.1.9**
4	30	Before carrying out any development, the Applicant shall prepare a Site Water Management Plan for the development in consultation with DRE and NOW, and to the satisfaction of the Secretary. This plan must include: … (d) a Surface Water Monitoring Program; *By the end of October 2009, the Applicant shall revise the Site Water Management Plan in consultation with DII, DECCW, and NOW, and to the satisfaction of the Director-General.**	**This SWMP**

Schedule	Condition	Requirements	SWMP Section
4	33	The Surface Water Monitoring Program shall include: (a) detailed baseline data on surface water flows and quality in the Wollombi Brook, and North Wambo, South Wambo, and Stony Creeks;	**Section 2.0**
		(b) surface water impact assessment criteria;	**Section 3.0**
		(c) a program to monitor surface water flows and quality in the Wollombi Brook; and North Wambo, South Wambo, and Stony Creeks;	**Sections 4.1.1 and 4.1.3**
		(d) a program to monitor bank and bed stability in North Wambo, South Wambo, and Stony Creeks;	**Section 4.1.5**
		(e) a program to monitor the quantity and quality of the vegetation in the riparian zones adjacent to North Wambo, South Wambo, and Stony Creeks; and.	**Section 4.1.5**
		(f) a program to monitor the effectiveness of the Erosion and Sediment Control Plan	**Section 4.1.4**
6	3	**Adaptive Management** The Applicant must assess and manage project-related risks to ensure that there are no exceedances of the criteria and/or performance measures in schedule 4. Any exceedance of these criteria and/or performance measures constitutes a breach of this consent and may be subject to penalty or offence provisions under the EP&A Act or EP&A Regulation. Where any exceedance of these criteria and/or performance measures has occurred, the Applicant must, at the earliest opportunity: (a) take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur; (b) consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measures or other course of action; and (c) implement remediation measures as directed by the Secretary, to the satisfaction of the Secretary.	**Refer SGWRP**
6	4	**Management Plan Requirements** The Applicant shall ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include: (a) detailed baseline data;	**Section 2.0**
		(b) a description of: - the relevant statutory requirements (including any relevant consent, licence or lease conditions);	**Section 1.4**
		- any relevant limits or performance measures/criteria;	**Section 3.0**
		- the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;	**Section 3.4**
		(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/ criteria;	**Section 4.0**
		(d) a program to monitor and report on the:	**Sections**

Schedule	Condition	Requirements	SWMP Section
		- impacts and environmental performance of the Wambo Mining Complex; - effectiveness of any management measures (see c above); (e) a contingency plan to manage any unpredicted impacts and their consequences; (f) a program to investigate and implement ways to improve the environmental performance of the Wambo Mining Complex over time; (g) a protocol for managing and reporting any: - incidents; - complaints; - non-compliances with statutory requirements; and - exceedances of the impact assessment criteria and/or performance criteria; and (h) a protocol for periodic review of the plan.	**4.0 and 6.0** **Refer SGWRP Section 6.2** **Section 0** **Section 5.0** **Refer SGWRP** **Refer SGWRP** **Section 6.1**
DA177-8-2004			
4	17	Before carrying out any development, the Applicant shall prepare and implement a Soil and Water Management Plan for the development, to the satisfaction of the Director-General. This plan must include: … (b) details of the dirty water management system to be implemented for the development including measures to prevent contamination from diesel and oil spills; (c) a Surface Water Monitoring Program; and (d) a strategy for decommissioning the water management structures on the site."	**This SWMP** **Section 2.2.5** **Section 4.0** **Section 2.2.6**

* In September 2009, DP&E granted WCPL an extension to the submission date to 30/4/2010 to allow for DII and EPA review and comment.

Table 3: Additional Surface Water Monitoring Program Requirements

Regulator	Requirements	SWMP Section
DP&E	1. The SWMP must be updated to include at least two additional surface monitoring sites within the area of the North Wambo Creek Diversion footprint to replace those to be discontinued in the old North Wambo Creek footprint i.e. SW27 & SW32 have been replaced by SW41, SW47 and SW48. 2. The company must comply with the requirements of the Department of Water and Energy (DWE) and the Department of Primary Industries (DPI) as outlined in the attached letters to the company ….	**Sections 2.2.2 and 4.1** **See below**
DPI Water (formerly NSW Office of Water (NOW)/ Department of Water and Energy (DWE))	DWE grants approval to the detailed design plans for the constructed diversion channel, subject to the following; Monitoring of discharge flows, and calculation of bankfull discharge capacities and velocities along the channel shall occur at the first discharge event along the diversion channel, and then thereafter as directed by the DWE; Comparative performance with agreed reaches upstream and downstream of the diversion shall occur, together with agreed stable reaches of control catchments, as approved by DWE; Reporting on performance of the diversion channel shall occur annually (in AEMR).	**Section 4.1.6** **Section 4.1.6** **Section 6.2**

1.4.2 Protection of the Environment Operations Act 1997

The EPA issued EPL 529 on 27 September 2000 under the *Protection of the Environment Operations Act 1997 (*POEO Act). The EPL permits activities that may impact on surface and ground water to occur across the site, subject to the EPL conditions. In consultation with the EPA, the EPL will be modified (as required) to reflect any relevant modified development consent conditions.

Under EPL 529 and the Hunter River Salinity Trading Scheme (HRSTS), WCPL are required to monitor discharges from a designated licenced discharge point. Section 3.1 provides further information on discharge requirements under the HRSTS.

1.4.3 Water Management Act 2000

The *Water Management Act 2000* (WM Act) is intended to ensure that water resources are conserved and properly managed for sustainable use benefitting both present and future generations. It is also intended to provide formal means for the protection and enhancement of the environmental qualities of waterways and their in-stream uses as well as to provide for protection of catchment conditions.

An amendment to the WM Act (section 60I) came into effect on 1 March 2013. This amendment provides that it is *an offence for a person without an access licence to take, remove or divert water from a water source, or relocate water from one part of an aquifer to another part of an aquifer, in the course of carrying out a mining activity.* Various activities are captured by the provisions of the amendment including mining, mineral exploration and petroleum exploration.

The area covered by this SWMP is located within the Water Sharing Plan (WSP) area for the Hunter Unregulated and Alluvial Water Sources (HUA WSP), which commenced in August 2009 and regulates the interception and extraction of surface water and alluvium within the defined WSP area.

1.4.4 Hunter Unregulated and Alluvial Water Sources Sharing Plan

The HUA WSP includes the unregulated rivers and creeks and alluvial groundwater within the Hunter region and is categorised into four extraction management units (EMUs) and further broken down into water sources. The area covered by the WSP includes 39 surface water and alluvial groundwater sources.

Wambo is located predominantly within the Lower Wollombi Brook water source. WCPL currently holds two WALs within the Lower Wollombi Brook water source of the HUA WSP (WAL No. 23897 and 718).

1.5 Stakeholder Consultation

In accordance with Condition 30, Schedule 4 of DA 305-7-2003, this revision of the SWMP (Revision 9) has been undertaken in consultation with NSW Department of Resources and Energy (DRE) and DPI Water (formerly NOW), prior to submitting to the Secretary of the DP&E for approval.

This review of the SWMP (Revision 9) includes:

- Updating the format and layout of the SWMP, consistent with WCPL's current document management procedures and templates;

- Updating the plan consistent with the revised Groundwater Monitoring Program (Revision 10);
- Including additional information to ensure the SWMP addresses Condition 4, Schedule 6 of DA305-7-2003; and
- Addressing comments received from DPI Water and DP&E on the SWMP (Revisions 7 and 8).

Correspondence in relation to the SWMP is attached as Appendix B.

2.0 Existing Surface Water Conditions and Baseline Data

2.1 Description of Surface Waters – Existing Environment

2.1.1 Landforms and Watercourses

Wambo is located in the Upper Hunter Valley where the landform is characterised by gently sloping floodplains of the Hunter River and its tributaries and the undulating foothills, ridges and escarpments of the Mount Royal Range and Great Dividing Range (Heritage Computing, 2012). Elevations in the vicinity of Wambo range from approximately 60 metres (m) Australian Height Datum (AHD) at Wollombi Brook to approximately 650 m AHD at Mount Wambo within the Wollemi National Park to the west of Wambo.

The mine site is within the lower Wollombi Brook catchment near its confluence with the Hunter River. Wollombi Brook drains an area of approximately 1,950 km^2 (Gilbert and Associates, 2003) and joins the Hunter River some 5 km north- east of Wambo (**Figure 3**).

The majority of land within the WCPL's Mining Lease boundaries has surface drainage over the site area flowing to Wollombi Brook via a series of generally easterly flowing creeks including South and North Wambo Creek, Stony Creek, Waterfall Creek and Redbank Creek. South Wambo Creek and its main tributary Stony Creek rise in the Wollemi National Park escarpment south of the mine and drain the southern and south-western parts of the mining lease area. Waterfall Creek drains the north end of the mining lease area. Relatively smaller parts of the northern side of the site drain to Redbank Creek in the United Collieries lease area (Figure 3).

North Wambo Creek, which also has its headwaters in the Wollemi escarpment, drains the central parts of the mining lease. A section of North Wambo Creek has been diverted to avoid the Wambo open cut (Figure 3). The North Wambo Creek Diversion was constructed in accordance with the approved North Wambo Creek Diversion Plan (WCPL, 2007b).

The rail line also crosses numerous small ephemeral creek systems including Longford Creek and Doctors Creek, which discharge into the Hunter River. Table 4 provides the catchment areas of the creeks within WCPL Mining Lease Boundaries and in the vicinity of the WCPL rail line and Wambo rail loop.

Table 4: Catchment Areas of Local Creeks

Creek	Catchment Area (km^2)
North Wambo Creek	48.5
South Wambo Creek	43.2
Stony Creek	11.2
Redbank Creek	12.3
Waterfall Creek	5.5
Longford Creek	0.89*
Doctors Creek	1.58*

* *Source: Gilbert and Associates (2003) and Mackie Environmental Research (MER) (2002).*
*Note: * Mining operations from the Warkworth Mine will reduce the catchment size of these systems. The figure provided is the estimated catchment size.*

2.1.2 Climate and Rainfall

The area experiences a dry temperate to sub-tropical climate with hot humid summers and cool drier winters. The annual average rainfall is some 650 mm. Further information on rainfall, including a Cumulative Rainfall Departure (CRD) curve for the area, is included in the GWMP.

2.1.3 Geology

Wambo is located in the Hunter Coalfield, which occupies the north-eastern portion of the Sydney Basin. The area covered by the SWMP is underlain by the Permian Singleton Coal Measures as well as Quaternary alluvial sediments along watercourses. This is underlain by the Permian Maitland Group which consists of siltstone, sandstone and conglomerate.

Approximate boundaries of quaternary alluvial sediments in the vicinity of Wambo are shown in Figure 4 and have been derived from the Hunter Coalfields Regional Geology 1:100,000 map (NSW Department of Mineral Resources, Edition 2 1993).

A transient electromagnetic (TEM) survey (Groundwater Imaging, 2012) was carried out to investigate the extent and thickness of alluvium along the lower reaches of (South) Wambo and North Wambo Creek. The extent of alluvial sediments determined from that study is also presented on Figure 4.

Further information on the geology of the area is included in the GWMP.

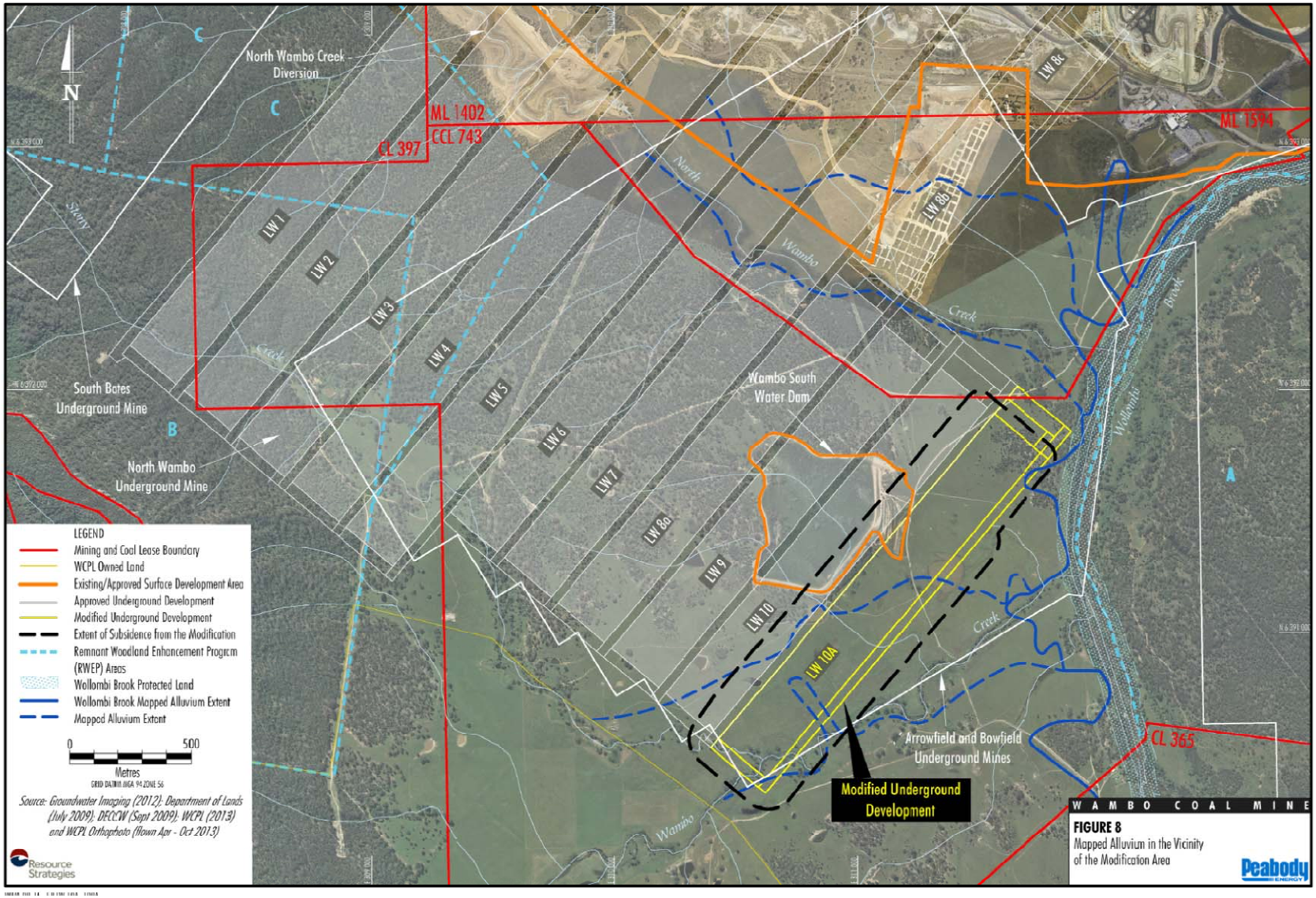


Figure 4: Location of Alluvium in Lower Reaches of Creeks

2.2 Existing Monitoring and Management

2.2.1 Mining History

Substantial coal mining activity has occurred historically and is continuing currently in the vicinity of Wambo, by a number of companies, with development across several coal seams. Coal is extracted by means of both underground and open cut mining methods. Coal mines neighbouring Wambo include United Colliery to the north and east of Wambo, Mt Thorley Warkworth to the south-east, and a number of open cut and underground mines to the north and east within the Hunter Valley Operations (Figure 3).

Open cut mining at Wambo commenced in 1969. During the 1970's1970s development consents were issued for a range of open cut and underground mining operations. The Whybrow, Redbank Creek, Wambo and Whynot Seams have primarily been mined by open cut methods at the Mine. The Wambo Seam was also mined for a short period in the Wambo No. 1 Underground Mine however was abandoned due to hydrological issues (Australian Groundwater Consultants Pty Ltd (AGC), 1989). The Whybrow Seam was also mined from the Ridge Underground in this early period.

The Wollemi Underground Mine commenced production in 1997 and was placed under care and maintenance in October 2002 after the available longwall reserves were exhausted. Open cut operations were suspended between March 1999 and August 2001. Following the closure of the Wollemi Underground Mine in October 2002, open cut operations were expanded to maintain an overall production rate of 3 Mtpa of product coal.

Development of the North Wambo Underground Mine commenced in November 2005, with longwall operations commencing in October 2007. Underground mining has occurred both above and below the Wambo Seam currently being mined by WCPL in the NWU Mine.at North Wambo Underground Mine. The North Wambo Underground Mine is due for completion in 2016. The adjacent United Colliery mined the lower Arrowfield Seam until 2010 (United Underground Mine).

2.2.2 Surface Water Monitoring Network

Surface water monitoring data has been collected at Wambo since 2003. Monitoring locations have been established along a number of watercourses to monitor both water quality and flow, as summarised in Table 5. Monitoring of mine water storages is also undertaken for management purposes. Monitoring locations are shown on Figure 5.

Table 5: Surface Water Monitoring Locations

Site ID	Easting	Northing	Site Description
Surface Water Quality			
SW01	314429	6385707	Wollombi Brook - Upstream
SW02	314376	6395037	Wollombi Brook - Downstream
SW03	312509	6392866	Wollombi Brook - Pump-Out
SW04	306887	6396024	North Wambo Creek - Upstream
SW05	311927	6392157	North Wambo Creek – Downstream
SW06	309056	6389550	South Wambo Creek - Upstream
SW07	311263	6390718	South Wambo Creek – Junction with Stony Creek
SW08	308536	6392133	Stony Creek
SW12	310510	6393550	West Cut Dam
SW14	312179	6392939	Box Cut Dam (Admin)
SW15	313055	6393097	Eagles Nest Dam – Licenced Discharge Dam (EPA ID No. 4)
SW20	310378	6393501	West Cut Holding Dam
SW27a	309431	6393558	North Wambo Creek – Middle-Lower

Site ID	Easting	Northing	Site Description
SW29	309612	6393908	SW29
SW30	313220	6394160	Chitter Dam
SW31	313276	6393987	Gordon Below Franklin Dam
SW32a	309905	6393191	North Wambo Creek – Pump
SW38	311750	6394190	Homestead Open Cut
SW39	307194	6398519	Waterfall Creek
SW40	311910	6391093	Wollombi Brook – Upstream of Wambo Creek
SW52	312677	6395220	C11 Void
Stream Flow			
FM1	306752	6396115	North Wambo Creek - upstream of diversion
FM2	308181	6395028	North Wambo Creek – middle of diversion
FM3	309114	6393813	North Wambo Creek – diversion
FM4	311890	6392288	North Wambo Creek - downstream near confluence of Wollombi Brook
FM10	314228	6395064	Wollombi Brook - downstream from Wambo Coal at Warkworth*
FM11	314323	6385825	Wollombi Brook - upstream from Wambo Coal at the Bulga Village*
FM12	307611	6392832	Stony Creek Upstream
FM13	309530	6391043	Stony Creek Downstream
FM14	307730	6392246	Stony Creek Tributary
FM15	TBC#	TBC#	South Wambo Creek
FM16	TBC#	TBC#	South Wambo Creek

* *Data sourced from DWE Gauging Stations on Wollombi Brook at Bulga [GS21004] and Warkworth [GS210028]*
#Survey pending
^ Coordinates unavailable

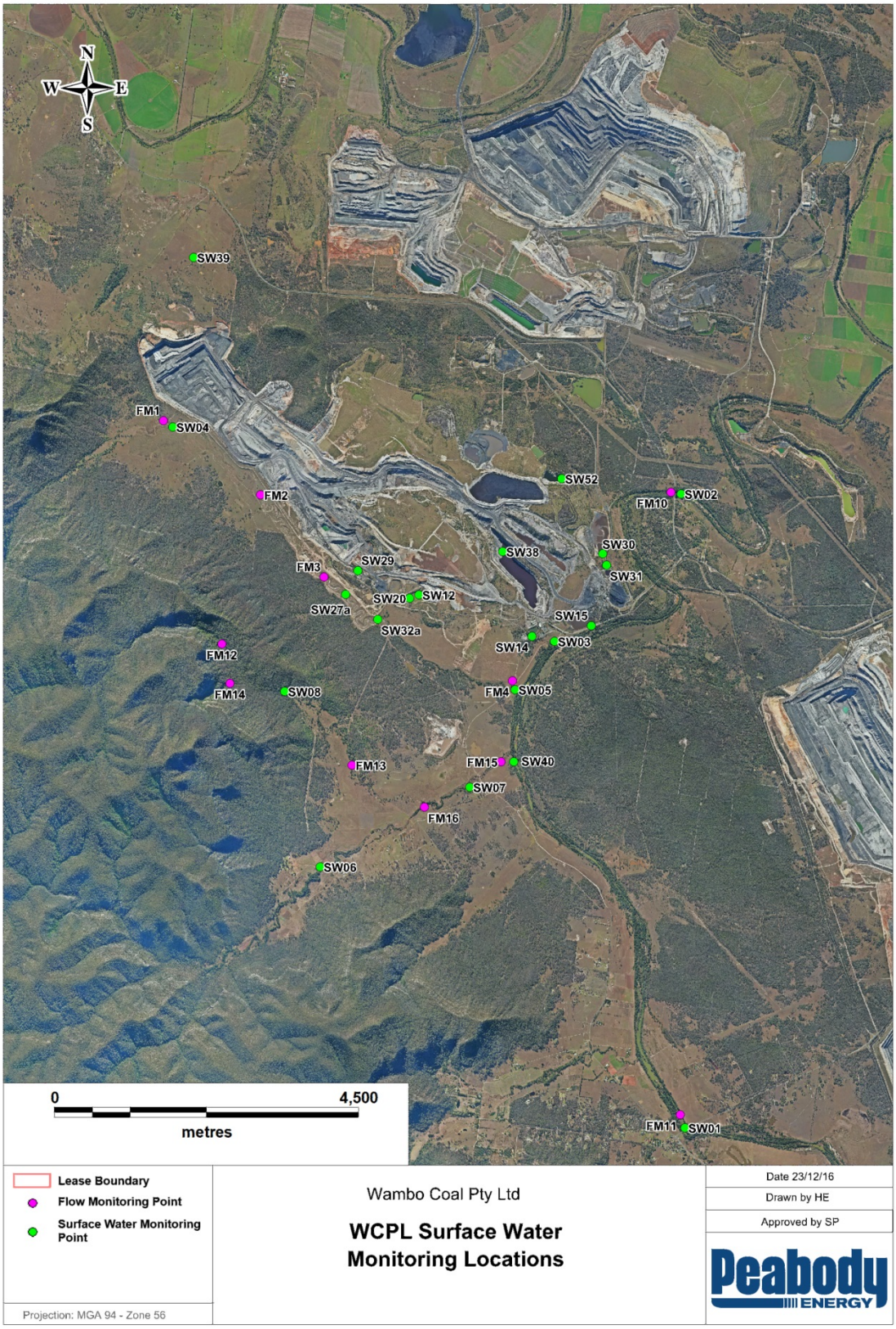


Figure 5: Wambo Surface Water Monitoring Locations

2.2.2.1 Historical Flow Monitoring Locations

From January 2004 until June 2007 WCPL monitored stream flow at four locations on South Wambo Creek (sites V1 and V2) and Stony Creeks (sites V7 and V8). Automatic data loggers recorded flow at hourly intervals. No flows were observed at sites V1, V2 and V7 between January 2004 and June 2007. The single flow record for site V8 is provided in Section 2.2.3.2 (Table 8).

Three V-notch weirs, established by United Collieries (United), have recorded flow along North Wambo Creek since mid-2002. A summary of flow records from United weir sites 1 and 2, for the period June 2002 to October 2003, is provided in Section 2.2.3.2 (Table 8).

Flow monitoring at Weir 3 (since December 2001) has generally shown the creek to be dry, except following significant rainfall. The highest flow recorded at Weir 3 was 0.1 L/sec in late May 2002 (Geoterra, 2005).

2.2.3 Review of Existing Data

2.2.3.1 Surface Water Quality

A summary of surface water quality monitoring results for July 2003 to May 2015 is presented in Table 6.

Table 6: Surface Water Quality Ranges – Local Watercourses

Sites	Count	Sampling Period	pH			EC (uS/cm)			TDS (mg/L)			TSS (mg/L)		
			Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
SW01 - Wollombi Brook Up	135	Jul 03 - May 15	6.45	8.80	7.62	160	1,969	736	60	1,157	405	1	128	11
SW02 - Wollombi Brook Down	137	Jul 03 - May 15	6.77	9.00	7.75	152	5,290	1,307	25	3,238	720	1	308	15
SW03 - Wollombi Brook Pump Out	142	Jul 03 - May 15	6.64	9.10	7.64	106	5,240	1,420	3	2,924	717	1	1630	76
SW04 - North Wambo Creek Up	4	Jul 03 - May 15	7.3	8.71	8.03	256	563	362	157	2,712	855	5	154	47
SW05 - North Wambo Creek Down	137	Jul 03 - May 15	6.94	8.96	7.67	111	3,200	1,729	135	2,162	1,008	1	1110	50
SW06 - South Wambo Creek	78	Jul 03 - May 15	6.30	9.10	7.40	156	970	506	28	440	265	1	286	18
SW07 - South Wambo/Stony Creeks	41	Jul 03 - May 15	6.60	9.10	7.61	159	971	565	145	520	312	1	331	26
SW08 - Stony Creek	26	Jul 03 - May 15	6.20	8.44	7.19	186	479	342	58	276	186	1	15	4
SW27a - North Wambo Creek Middle Lower	46	Jul 03 - May 15	7.00	9.00	7.95	52	3,360	973	262	4,900	977	1	5440	524
SW32a - North Wambo Creek Pump	39	Jul 03 - May 15	7.40	9.20	8.12	220	6,970	936	378	4,400	792	1	4190	479
SW39 - Waterfall Creek	39	Jul 07 - May 15	6.60	8.60	7.60	92	1,268	316	82	958	466	8	1922	361
SW40 - Wollombi Brook Upstream of South Wambo Creek	97	Nov 05 - Dec 09	6.40	8.80	7.64	66	1,147	612	80	730	342	1	179	17

2.2.3.2 Stream Flow

WCPL operate eight continuous flow gauging stations, which are located along North Wambo Creek, Stony Creek and South Wambo Creek (Figure 5 and Table 5).The ephemeral nature of these creeks has resulted in extended no-flow periods. These gauging stations replaced the previous V-notch weir flow measurement points, which were destroyed during the June 2007 flood event.

Additionally, surface water flow monitoring data for Wollombi Brook is sourced from NOW operated flow gauging stations, located at Warkworth (FM10) and Bulga (FM11). A summary of the stream flow data is provided in Table 7.

Table 7: Stream Flow Monitoring Data Summary

Site	Period of Record	Flow Days	Max (M/L Day)	Mean per Flow Day (ML/Day)	% of results with no Data Available
FM1	21/10/2008 to 01/12/2009	31	264.81	0.77	NA
	02/12/2009 to 30/06/2012	No flow data available			
	01/07/2012 to 30/06/2013	NA	1.296	0.086	16.7%
	01/07/2013 to 31/01/2014	NA	NA	NA	85.7%
	01/02/2014 to 19/08/2014	No flow data available			
FM2	12/04/2009 to 01/12/2009	6.5	0.05	NA	NA
	02/12/2009 to 30/06/2012	No flow data available			
	01/07/2012 to 30/06/2013	9	0.39	<0.09	66.7%
	01/07/2013 to 31/01/2014	NA	18.1	0.69	0.0%
	01/02/2014 to 19/08/2014	42	22.59	1.57	Negligible
FM4	21/10/2008 to 01/12/2009	391	237.14	1.36	NA
	02/12/2009 to 30/06/2012	No flow data available			
	01/07/2012 to 30/06/2013	21	200.8	86.8	58.3%
	01/07/2013 to 31/01/2014	0	0	0	14.3%
	01/02/2014 to 19/08/2014	6	291.28	59.07	Negligible

Note: Insufficient data available for FM12 – FM16

The flow monitoring data shows that Wollombi Brook is perennial and has a persistent baseflow which maintains flows between rainfall events. In comparison site drainages are ephemeral and typically only flow in response to intense rainfall events. Flow monitoring data has been used to characterise the flow regime of the monitored watercourses.

Figure 6 shows the flow duration curves for Wollombi Brook at the NOW gauging stations at Warkworth and Bulga (GS 210004 and GS 210028) which have been derived from flow recorded between 2003 and 2014. It is apparent that the distribution of flows in Wollombi Brook upstream and downstream of Wambo has generally been similar but with an increased frequency of low flows at the downstream station.

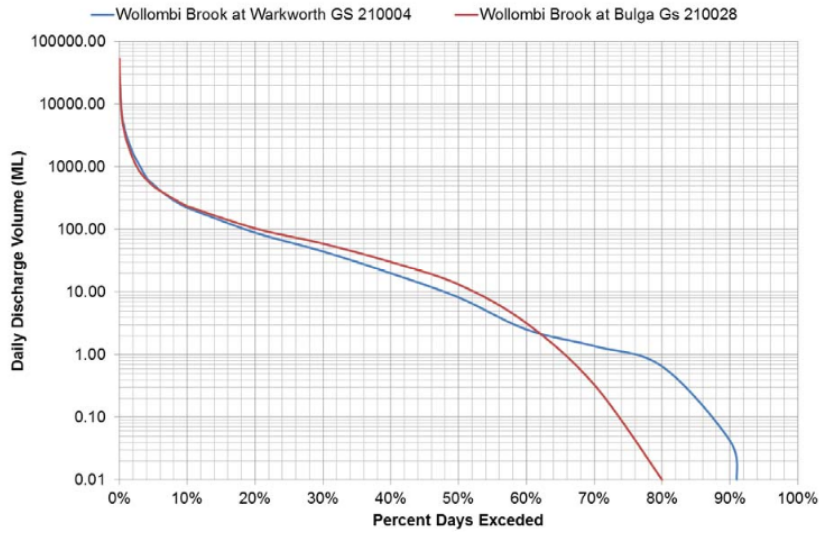


Figure 6: Flow Duration Curves Wollombi Brook Upstream and Downstream of the Mine

The available flow monitoring data for *North Wambo Creek* show that these creeks are all ephemeral and typically only flow in response to intense rainfall. This can be seen in Figure 7 and Figure 8, which show showing monitored (non-zero) daily flow data and concurrent daily rainfall measured at the Wambo climate station.

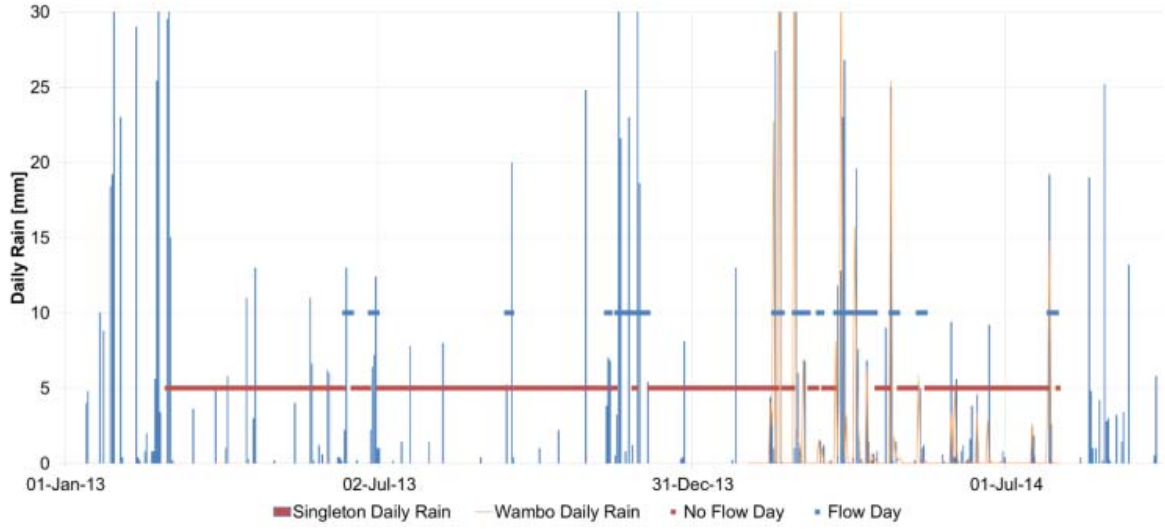


Figure 7: Recorded Daily Rainfall and Flow/No Flow Days – North Wambo Creek at FM2

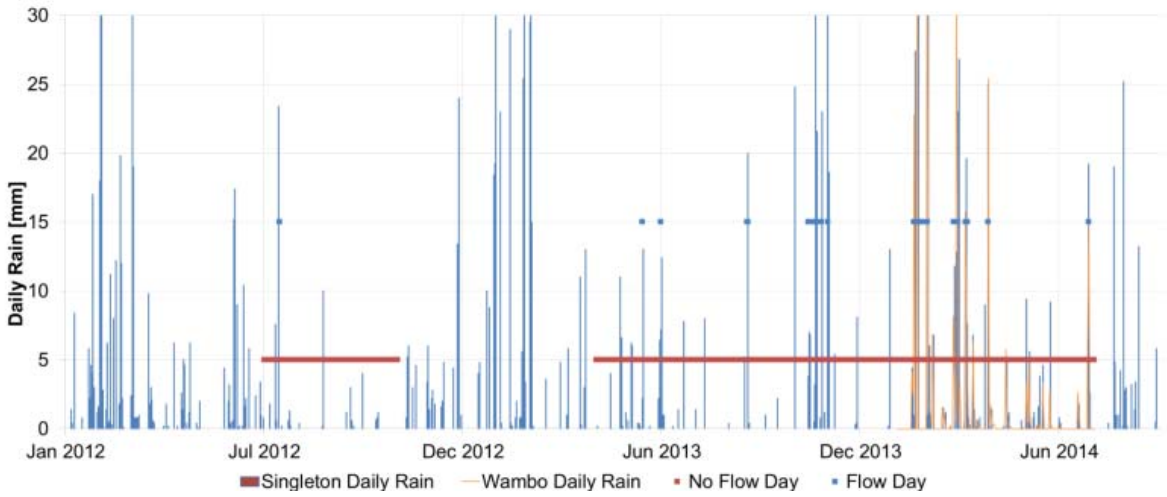


Figure 8: Recorded Daily Rainfall and Flow/No Flow Days – North Wambo Creek at FM4

Historical data for monitoring Site V8 and the two United sites (Weir 1 and Weir 2) is provided in Table 8.

Table 8: Stream Flow Summary for Historical Monitoring Sites

Site	Period of Record	Flow Days	Max (L/s Day)	Minimum (L/s)	Mean (L/s)
V8	29 Jun 2005 - 10 Aug 2005	43	216.1	0.0	17.7
Weir 1	14 Jun 2002 – 1 Oct 2003	NA	9.3	0.0	1.5
Weir 2	14 Jun 2002 – 1 Oct 2003	NA	120.0	0.0	0.9

2.2.4 Site Water Balance

A site water balance is undertaken annually to document the management of water at Wambo in accordance with Schedule 4, Condition 25 of DA 305-7-2003. Summary results are reported in the Annual Review report which is available on the Peabody Energy Australia website (http://www.peabodyenergy.com/content/398/Australia-Mining).

2.2.5 Management of the Locomotive Provisioning Facility

The 2012 modification to the Wambo Rail Spur Consent (DA 177-8-2004) allowed for the construction of a Locomotive Provisioning Facility adjacent to the WCPL rail loop. The facility includes storage and handling facilities for 100,000L diesel, 2,000L oil, sand and water. Due to the environmental risk associated with storage of hydrocarbons, the following management measures will be implemented during the operation of the facility to minimise the potential for contamination of land, or water in Wollombi Brook:

2.2.5.1 Hydrocarbon Storage and Handling

The diesel storage tank is a double skinned self bunded diesel storage tank with a capacity of approximately 100,000L (Transtank T108E) with an extended pumping bay. The tank has a capacity of 108,000L and a safe fill of 95,000L. The oil tank is integrated into the double bunded storage structure.

The refilling facility incorporates several spill prevention features including a security card to activate the pump, a refill nozzle that must be connected to the fuel tank to flow, an operator dead man switch and a cut-off valve in the event of a ruptured pipe. The refuelling hose connects to the locomotive fuel tank using a Banlaw nozzle eliminating accidental spills. Oil will be pumped via a low pressure pipeline into the locomotives via two retractable hose and trigger nozzles. These retractable hose reels will be located above spill containment grates adjacent to the rail track.

2.2.5.2 Facility Site

The design and location of the tank is designed to be compliant with AS 1940-2004 The storage and handling of flammable and combustible liquids. Spill containment kits are kept within a lockable onsite storage container.

All pumps and external equipment are locked, and a two metre high chain wire perimeter fence with lockable gate has been installed around the outside of the facility to deter unauthorised access, theft and vandalism.

Drip and spill control grates located at the two refill points and a bunded concrete area for tanker refilling are connected to a SPEL Puraceptor™ oily water management system.

2.2.5.3 Water Treatment System

The SPEL Puraceptor™ oily water management system is a full retention separator that treats flows from the three refill areas and is sized to contain more than the anticipated maximum oil and diesel spillage enabling it to be fully operational at all times. The system has a working capacity (the volume of water held before treated water discharges from the outflow) of 2050L with a treatment rate of up to 4L/s, and a spill capacity of a further 1,000L. With the small catchment area for the system (approximately 30m^2), the system is capable of treating the equivalent of over 2,000mm of rainfall per hour.

The unit has an alarm signal that notifies management (via SMS) in the event of a spillage that is in excess of 10% of the spill capacity (i.e. 100L) or when progressive spillage reaches this capacity. No visible oil and grease is permitted to leave the site. Visible oil and grease in water is considered equivalent to a criterion of 10mg/L. Treated water from the system has levels of 5mg/L or less.

2.2.5.4 Management Procedures

All personnel involved in the use of hydrocarbons on the site are trained in the appropriate use of facility and emergency response measures. Monthly inspections, servicing and maintenance of the station, in addition to visual inspections by locomotive drivers during refuelling, are undertaken.

Absorbent spill control matting located between the tracks in the refuel area (absorbs approximately 12L/m^2) will be replaced every 18 months or as required.

2.2.6 Decommissioning of Water Management Structures

It is anticipated that the post-mining area would consist of safe and stable landform features, revegetated to a mixture of woodland and pasture areas, consistent with the open cut Mining Operation Plan (MOP). It is expected that the majority of internal and external mine water management dams will be decommissioned and completely rehabilitated in accordance with the MOP. However a number of key sediment control structures are likely to remain.

If the Locomotive Provisioning Facility is retained until the end of Mine Life, the structures associated with the facility will be decommissioned simultaneously with the adjacent rail load out infrastructure. If decommissioning is required before the removal of the rail load out then all above-ground infrastructure will be removed, a contamination assessment completed, and the site rehabilitated to the match the landuse in the immediate surrounding area.

3.0 Surface Water Impact Assessment Criteria

Surface water impact assessment criteria have been established for the following possible project related impacts:

- Reduction in flow due to catchment excision and loss of baseflow; and
- Degradation of surface water quality.

Data from Wambo's surface water monitoring program will be compared against the established criteria. Details of the monitoring program are included in Section 4.0. Reporting requirements for this SWMP are detailed in Section 6.0.

A review of the data against the criteria will determine if the surface water impact investigation procedure or Trigger Action Response Plan (TARP) in the SGWRP should be initiated. The SGWRP provides a protocol for the investigation, notification, and mitigation of identified exceedances of these assessment criteria.

3.1 Discharge Criteria

Mine water at Wambo is discharged through the EPL 529 licensed discharge point, located at Eagles Nest Dam (Figure 5). Water quality discharge limits are drawn from DA 305-7-2003, EPL 529 and the HRSTS, as presented in Table 9.

Table 9: Discharge Limits and Requirements

Conditions		Source
Discharge Limits	No more than 250 ML/day will be discharged from the licensed discharge point/s.	Schedule 4, Condition 24 of DA 305- 7-2003 and Condition L3.3 of EPL 529
	Discharges from any licensed discharge point must comply with the following limits: 6.5 ≤ pH ≤ 9.5; and NFR* ≤ 120 mg/L for non-filterable residues (NFR).	
Discharge Requirements	Notification from NOW of discharge opportunity must be received.	HRSTS Guidelines
	Flow of water in Wollombi Brook at the NOW Bulga Gauging Station (FM11) needs to be more than 500ML/day.	
	pH will to be measured continuously throughout the discharge with an inline instrument.	
	Conductivity (EC) will to be measured continuously in µS/cm throughout the discharge with an instrument designed to measure between 0 and 10,000µS/cm.	
	TSS will be measured once a day during discharge. A representative sample will be collected every day and sent to the lab for analysis.	

**Equivalent to TSS*

3.2 Stream Flow Impact Assessment Criteria

Wollombi Brook is perennial and the impact assessment criterion for Wollombi Brook has been set to zero flow at the Warkworth gauging station.

Flow impact assessment criteria for the local mine site ephemeral creeks are based on the unexpected absence of flow in climatic situations when flows would be expected. The impact assessment criteria would be met if there was no flow recorded at the flow monitoring site either on the day or the day after the recorded rainfall was equal to or greater than the nominated amount. The resulting runoff generating rainfall values are given in Table 10.

Table 10: Surface Water Flow Impact Assessment Condition

Watercourse and flow monitoring site	Daily rainfall when flow commenced on 80% of recorded occasions
Stony Creek – FM7	20mm
South Wambo Creek – FM5	20mm
North Wambo Creek – FM4	20mm

3.3 Surface Water Quality Impact Assessment Criteria

The impact assessment criteria for surface water quality are summarised in Table 11. Where actual site specific water quality monitoring data is available (Section 2.2.3) the criteria have been set based on the 20th and 80th percentile for the available dataset. Where insufficient data is available, WCPL has adopted the applicable ANZECC default guidelines values for slightly to moderately disturbed ecosystems or the water quality objectives for the Hunter River.

The high variability in TSS concentrations poses some difficulty in the selection of appropriate assessment criteria. Given the correlation between TSS and flow, separate impact assessment criteria have been set for 'low' and 'high' flow conditions. In this context the term low flow covers recessionary flows and flows generated by small to moderate flow events up to a 1 in 1 year average recurrence interval. The term high flow covers the rising stage of flow events and medium to large flow events e.g. 1 in 20 year average recurrence interval and larger.

Table 11: Surface Water Quality Impact Criteria

Sampling Site	Parameter	Lower Limit	Upper Limit
SW02 – Wollombi Brook	pH	7.4	8.1
	EC (µS/cm)	599	1947
	TSS (mg/L)	17 (low flow) – 308 (high flow)[1]	
SW05 – North Wambo Creek	pH	7.3	7.9
	EC (µS/cm)	1155	2246
	TSS (mg/L)	53 (low flow) – 1,110 (high flow)[1]	
SW07 – Wambo Creek	pH	7.4	7.9
	EC (µS/cm)	360	724
	TSS (mg/L)	29 (low flow) – 331 (high flow)[1]	
SW08 – Stony Creek[5]	pH	6.8	7.4
	EC (µS/cm)	288	416
	TSS (mg/L)	5 (low flow) – 15 (high flow)[1]	
SW39 Waterfall Creek	pH	7.3	7.8
	EC (µS/cm)	159	429
	TSS (mg/L)	582 (low flow) – 1,922 (high flow)[1]	

Notes:
[1] Low flow conditions based on 80th percentile of recorded concentrations and high flow criteria on maximum recorded concentrations (**Table 6**)

3.4 Performance Indicators

The performance indicators in Table 12 will be used to assess the performance of the Mine against the predicted impacts.

Table 12: Performance Indicators

Performance Indicator	Number
Number of complaints received relating to surface water	Nil
Number of non-compliances relating to surface water	Nil
Number of exceedances of surface water impact assessment criteria[1]	Nil
Number of reportable environmental incidents relating to surface water	Nil

Note:

An exceedance occurs when water quality results exceed the 80th Percentile Trigger Value after three consecutive sampling events (refer to SGWRP for TARP)

WCPL will report on progress against these performance indicators in the Annual Review (Section 6.2). In the event that a complaint is received relating to surface water, it will be handled in accordance with the complaints management protocol (Section 5.0). Contingency plans for unpredicted surface water impacts are discussed in the SGWRP.

4.0 Surface Water Monitoring Program

The purpose of this SWMP is to monitor and manage surface water quality and levels to detect potential impacts on surrounding catchment users and to ensure that relevant legislative and policy requirements are met. Monitoring locations, parameters, frequency and methodology of monitoring are outlined in this section.

Data collected will:

- Be used in the continued development of surface water investigation triggers (Section 3.0); and
- Provide input to annual reviews of surface water monitoring data (Section 6.2).

4.1 Monitoring Network, Parameters and Frequency

Ongoing surface water monitoring requirements at Wambo are as follows:

- Monitoring of water quality at 28 sites including Wollombi Brook, North Wambo, South Wambo, and Stony Creeks (Section 4.1.1);
- Monitoring of mine water quality in three mine water storage dams and one sediment pond (Section 4.1.2);
- Monitoring of flow in the North Wambo Creek, Stony Creek and South Wambo Creek (Section 4.1.3);
- Monitoring of water quality to assess the effectiveness of erosion and sediment control measures (Section 4.1.4);
- Monitoring of riparian vegetation and creek bed stability (Section 4.1.5);
- Monitoring discharge flows through the North Wambo Creek diversion; (Section 4.1.6);
- Monitoring of subsidence impacts on the North Wambo Creek diversion (Section 4.1.7);
- Monitoring of licenced discharges under EPL 529 and the HRSTS (Section4.1.8) and
- Monitoring of inflows into the underground and open cut workings (Section 4.1.9).

These monitoring requirements are summarised in Table 13. Monitoring locations are shown on Figure 5 (Section 2.2.2).

Water quality trigger values have been developed for a number of creeks and waterways. The results of monitoring of these creeks and waterways will be compared against the triggers in Section 3.0. Results of monitoring at the licenced discharge point will be compared against the criteria detailed in EPL 529 (Section 3.1). All required reporting will be undertaken in accordance with Section 6.0.

Mine water monitoring is undertaken for operational management purposes only. This data is not reported publicly.

Table 13: Surface Water Monitoring Program

Site Ref	Parameter[1]	Frequency[2]	Purpose
Creeks & Waterways			
SW01	pH, EC, TSS	Monthly/Rainfall Event	Monitoring water quality of Wollombi Brook, upstream of Wambo Coal Operations
SW02	pH, EC, TSS	Monthly/Rainfall Event	Monitoring water quality of Wollombi Brook, downstream of Wambo Coal Operations
SW03	pH, EC, TSS	Monthly/Rainfall Event	Monitoring water quality of Wollombi Brook, downstream of junction with North Wambo Creek and at Wambo Coal intake pump.
SW04	pH, EC, TSS	Monthly/Rainfall Event	Monitoring water quality of North Wambo Creek upstream of North Wambo Creek Diversion
SW05	pH, EC, TSS	Monthly/Rainfall Event	Monitoring water quality of North Wambo Creek downstream of Wambo Coal Operations
SW06	pH, EC, TSS	Monthly/Rainfall Event	Monitoring water quality of South Wambo Creek upstream of Wambo Coal former operations
SW07	pH, EC, TSS	Monthly/Rainfall Event	Monitoring water quality of South Wambo Creek downstream of Wambo Coal former operations and junction with Stony Creek
SW08	pH, EC, TSS	Monthly/Rainfall Event	Monitoring water quality of Stony Creek
SW27a	pH, EC, TSS	Monthly/Rainfall Event	Monitoring water quality at North Wambo Creek (middle of diversion)
SW32a	pH, EC, TSS	Monthly/Rainfall Event	Monitoring water quality at North Wambo Creek Pump
SW39	pH, EC, TSS	Monthly/Rainfall Event	Monitoring water quality of Waterfall Creek
SW40	pH, EC, TSS	Monthly/Rainfall Event	Monitoring water quality of Wollombi Brook, upstream of junction with South Wambo Creek
Licensed Discharge Point			
SW15	pH, EC	Monthly Continuous during discharge[3]	Monitoring water quality of Eagles Nest Dam – licensed discharge dam licensed under HRSTS and EPL 529 (EPA ID No. 4)
	TSS	Monthly Daily during discharge[4]	
	Discharge Volume	Continuous[5]	Monitoring discharge from the licenced discharge point
Mine Water			
SW12	pH, EC	Monthly	Monitoring water quality of West Cut Dam
SW14	pH, EC,	Monthly	Monitoring water quality of Box Cut Dam (Admin)
SW20	pH, EC	Monthly	Monitoring water quality of West Cut Holding Dam
SW29	pH, EC	Monthly	Monitoring water quality
SW30	pH, EC	Monthly	Monitoring water quality of Chitter Dam
SW31	pH, EC	Monthly	Monitoring water quality of Gordon Below Franklin Dam
SW38	pH, EC	Monthly	Monitoring water quality of Homestead Open Cut
SW52	pH, EC	Monthly	Monitoring water quality of C11 Void

Site Ref	Parameter[1]	Frequency[2]	Purpose
Flow Monitoring			
FM1	Flow	Continuous	Monitoring of flow in North Wambo Creek - upstream of diversion
FM2	Flow	Continuous	Monitoring of flow in North Wambo Creek – middle of diversion
FM3	Flow	Continuous	Monitoring of flow in North Wambo Creek
FM4	Flow	Continuous	Monitoring of flow in North Wambo Creek - downstream near confluence of Wollombi Brook
FM10	Flow	Continuous	Monitoring of flow in Wollombi Brook - downstream from Wambo Coal at Warkworth*
FM11	Flow	Continuous	Monitoring of flow in Wollombi Brook - upstream from Wambo Coal at the Bulga Village*
FM12	Flow	Continuous	Stony Creek Upstream
FM13	Flow	Continuous	Stony Creek Downstream
FM14	Flow	Continuous	Stony Creek Tributary
FM15	Flow	Continuous	South Wambo Creek
FM16	Flow	Continuous	South Wambo Creek

Notes:

[1] *Sampling of the creek water systems will only be undertaken during periods of flow*

[2] *Rainfall event – Following >20 mm rainfall on a 24 hour calendar day. Actual timing of rainfall event based monitoring to be dependent on site accessibility and flow*

[3] *pH to be sampled using in-line instrument, EC to be sampled using a probe designed to measure the range 0-10,000 µS/cm (in accordance with EPL 529 Condition M2.3)*

[4] *Grab sample*

[5] *Volume to be measured using in line instrumentation (in accordance with EPL 529 Condition M7.1))*

4.1.1 Surface Water Quality

Sampling is undertaken at 28 sites, including Wollombi Brook, North Wambo, South Wambo, and Stony Creeks. Monitoring site locations are shown in Figure 5 and provided in Table 13. Surface water quality monitoring is undertaken on a monthly basis and/or following a significant rainfall event (20 mm within 24 hours, midnight to midnight), with a new rainfall event considered to have commenced if there has not been a rainfall event in the previous 48 hours. Sampling is only undertaken during flow periods to ensure that increased solute concentration (caused by evaporation) does not cause incorrect sample results.

Water quality monitoring sites are generally located upstream and downstream of WCPL's operations, to distinguish mining impacts from natural water quality fluctuations. Redbank Creek is not monitored by WCPL, as downstream creek flow is used by United Collieries for operational purposes. Monitoring in Waterfall Creek (SW39 on Figure 5) commenced in July 2007 to enable the collection of sufficient baseline data prior to the commencement of any potential mining within that catchment.

4.1.2 Mine Water Quality

A number of mine water storage dams and pits are sampled monthly for water pH and EC (Table 13). Data from this monitoring is used for operational purposes and is reported internally as required.

4.1.3 Surface Water Flows

WCPL monitors flow in the North Wambo Creek, Stony Creek and South Wambo Creek using continuous flow monitoring stations. Surface water flow monitoring data for Wollombi Brook is sourced from NOW operated flow gauging stations, located at Warkworth (FM10) and Bulga (FM11).

The ephemeral nature of these creeks often results in extended no-flow periods. Available data from this monitoring is reported in the Annual Review (Section 6.2).

4.1.4 Erosion and Sediment Control

As well as collecting background water quality data and identifying potential mining impacts, surface water quality monitoring sites are strategically located so as to enable the effectiveness of erosion and sediment control measures (implemented in accordance with the WCPL Erosion and Sediment Control Plan (ESCP)) to be assessed. Inspection, maintenance and management of erosion and sediment control structures is undertaken in accordance with the requirements of the ESCP.

4.1.5 Riparian Vegetation and Creek Bed Stability

Localised bed and bank instability is a natural phenomenon in alluvial creeks, which contributes to the dynamic geomorphology of fluvial systems. Creek beds are also susceptible to subsidence induced erosion, due to the variable depth of subsidence associated with underground longwall mining.

The Baseline Riparian Vegetation and Bed Bank Stability Monitoring Program commenced in October 2006 to monitor for potential subsidence impacts. The program aims to distinguish

natural erosion from mine subsidence associated instability, through pre-mining and post-mining survey of North Wambo Creek, South Wambo Creek and Stony Creeks.

A program to monitor riparian vegetation corridors along North Wambo, South Wambo and Stony Creeks has also been implemented. Details of both programs are presented in the WCPL Flora and Fauna Management Plan (FFMP) and North Wambo Creek Diversion Rehabilitation Plan (for North Wambo Creek only)

4.1.6 Monitoring of Discharge Flows in the North Wambo Creek Diversion

Monitoring and reporting of discharge flows in the North Wambo Creek Diversion (NWCD) will be undertaken in accordance with NOW requirements. These requirements include the:

- Calculation of bankfull discharge flow capacities and velocities for the first discharge event following NWCD completion, and thereafter as directed by the NOW;
- Assessment of diversion stability performance, compared with selected stable reaches of North Wambo Creek and other control catchments, as approved by NOW; and
- Reporting of NWCD monitoring data in the Annual Review (Section 6.2).

4.1.7 Diversion and Subsidence Monitoring Program

Operational Monitoring

An operational monitoring program for the NWCD will be implemented from 2017.

The program will provide an assessment of the condition and condition trajectory of North Wambo Creek and the NWCD above the underground mining areas and adjacent upstream and downstream reaches. The outcomes of the monitoring program will inform recommendations to manage any identified issues with the condition of the NWCD, in particular management issues that may affect downstream receiving waters or WCPL infrastructure.

The first round of collection of monitoring data in 2017 will form the baseline for future monitoring.

The operational monitoring requirements are summarised in Table 14. Monitoring locations are shown on Figure 9.

The results of the operational monitoring program and the geomorphic condition of the NWCD will be reviewed annually. This review will include an assessment of the efficacy of subsidence management or rehabilitation works and maintenance requirements.

Construction/Rehabilitation Monitoring

Monitoring will be undertaken during and immediately after construction of mitigation or rehabilitation works along the NWCD to confirm that works have been undertaken to specification and/or meet design intent.

The following records will be maintained following the implementation of mitigation or rehabilitation works:

- Descriptions of the design activities completed.
- Photographs of the works taken during construction and immediately after the work is finished. Where possible photographs should be taken from fixed photo points, with details such as date, time and weather conditions noted.
- Aerial photography within 12 months after works are completed to accurately display the extent of change and provide a baseline reference for changes that may occur in the future.

Relinquishment Monitoring

If the operational monitoring program indicates the operation of the NWCD is operating in dynamic equilibrium at or before mine closure, a relinquishment monitoring program would be developed.

With the implementation of planned remediation works, it is anticipated this will not be required as the diversion should have been operating for a minimum of 10 years and had flow events of sufficient frequency and magnitude to test the performance of the diversion and its response to subsidence.

Table 14: Diversion and Subsidence Monitoring Program – Operational Monitoring

Component	Locations	Parameters	Frequency
• Index of Diversion Condition (IDC)	• Upstream reach (U1 – U4). • NWCD Stage 2 (Div1 – Div5). • NWCD Stage 3 (Div 6 – Div11). • Above completed North Wambo Underground (WS1 – WS6). • Downstream reach (D1 – D2).	• Geomorphic Index* – based on: width of high flow channel, active channel and low flow channel; bank condition; piping of banks; bed condition; spoil piles; recovery; and in-stream structures. • Riparian Index* – based on: width of riparian zone; structural intactness; regeneration; and longitudinal continuity. • Six photos at each monitoring point: • Upstream, cross-stream, downstream and away from stream – with the monitoring peg in the lower centre of the frame (where possible). • In-channel bed upstream and downstream – from the centre of the creek bed (or as near as possible).	• Annually. #
• Landscape Function Analysis (LFA)	• NWCD Stage 2 (17R, 19 R, 21R, 23R). • NWCD Stage 3 (28R, 27R, 26R, 25R).	• Landscape Organisation Index (LOI) (as outlined in the Biodiversity Management Plan). • Soil Surface Assessment (as outlined in the Biodiversity Management Plan).	• Annually.
• Riparian Vegetation	• Same as IDC monitoring points.	• Vegetation structure and extent.	• Annually. #
	• North Wambo Creek (8A, 9A, 10A, 11A, 12A, 13A, 14A, 15A).	• Rapid Appraisal of Riparian Condition (RARC) index (as outlined in the Biodiversity Management Plan).	• Annually.
• Aerial Photography	• Full reach of NWCD and North Wambo Creek downstream.	• Changes to channel form compared to previous aerial photographs.	• Annually. #

Component	Locations	Parameters	Frequency
• Long And Cross-Section Surveys	• Extracted from LiDAR or aerial photogrammetry survey data captured over NWCD and North Wambo Creek downstream.	• Changes to channel form compared to previous surveys.	• Annually. #
• Surface Water Quality Data	• As per Section 4.1.1.	• As per Section 4.1.1.	• As per Section 4.1.1.
• Flow Event Data	• As per Section 4.1.3.	• As per Section 4.1.3.	• As per Section 4.1.3.

* Based on ID&A Pty Ltd (2001).
# Frequency may be reduced following the completion of subsidence from the South Bates Underground Mine.

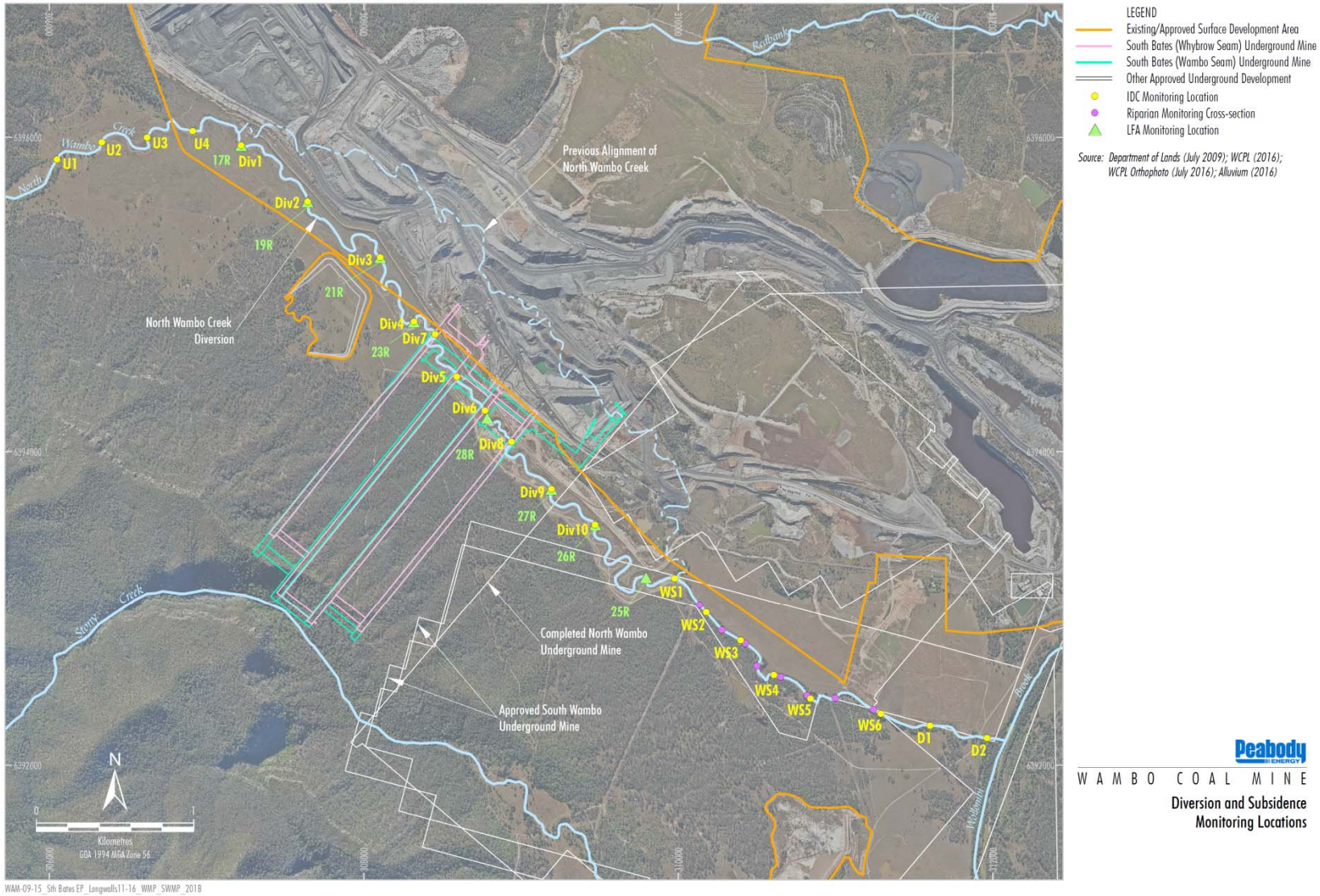


Figure 9: Diversion and Subsidence Monitoring Locations

4.1.8 Monitoring of Licensed Discharges under EPL 529 and the HRSTS

Wambo are required to monitor water quality and volume for licensed discharges at monitoring location SW15 (EPL ID No. 4) in accordance with the licensed discharge limits and requirements detailed in Table 9 and relevant monitoring conditions of EPL 529 and the HRSTS.

4.1.9 Monitoring of Flows into Underground and Open Cut Workings

Wambo monitor the volume of water reporting to the North Wambo underground at two locations; the tailgate (TG) 1 pumpout into the old portal and the pumpout into Homestead Pit. These two sites are also monitored for pH and EC on a monthly basis.

A visual assessment of flows to the open cut workings is undertaken by site personnel during regular site inspections. These flows are not quantified however if it is noted that there is a notable increase in seepage to the open cut pit then the response plan in the SGWRP is followed.

Data from this monitoring is used for operational purposes and is reported internally as required.

4.2 Methodology

Surface water quality sampling and analysis is conducted in accordance with Approved Methods for Sampling and Analysis of Water Pollutants in New South Wales (DEC, 2004); Australian Standard/New Zealand Standard (AS/NZS) 5667:1998 Parts 1, 4 and 6; and the requirements of the HRSTS.

4.3 Data Management Procedures

Validated data from the monitoring program will be entered into a digital database by an Environmental Advisor. This renders the data in a form suitable for analysis.

WCPL will record the following details for all surface water monitoring samples:

- The date(s) on which the sample was taken;
- The point at which the sample was taken; and
- The name of the person who collected the sample.

In the event of an apparently anomalous result, WCPL will conduct a re-test as soon as is practicable to do so.

4.4 Data Review and Investigation

Upon receipt of monitoring results, the following review processes will be undertaken:

- Data will be compared to the impact assessment criteria where applicable (Section 3.0).
- If result(s) do not meet impact assessment criteria a response procedure will be initiated in accordance with the SGWRP.

WCPL will undertake an annual review of monitoring data and compare the results to the surface water impact assessment criteria detailed in Section 3.0. Results of the review will be included in the Annual Review (Section 6.2).

When monitoring results exceed the impact assessment criteria or the annual review identifies surface water impacts, an investigation appropriate for the situation will be launched to determine the cause. The investigation will include comparison of monitoring results, meteorological patterns, mining activities and changes to land use. Further details outlining these response procedures are outlined in the SGWRP.

5.0 Community Complaint Response

All surface water related community complaints received by WCPL will be recorded within the Community Complaints Register. The E&C Manager will investigate the complaint, which will include, where possible, contacting the complainant within 24 hours to discuss the complaint. A review of the effectiveness of the corrective or preventative actions will be conducted within a month of the complaint and the relevant work procedures updated if required.

Preliminary investigations will commence as soon as practicable upon receipt of a complaint to establish if WCPL is responsible. All efforts will be made to determine the likely causes contributing to the complainants concerns.

WCPL will attempt to address the complainants concerns such that a mutually acceptable outcome is achieved. However, if required, the Independent Dispute Resolution Process would be referred to (Appendix A).

Details of all community complaints will be included in the Monthly Environment Monitoring Report. WCPL will retain a copy of the Community Complaints Register for at least four years. The E&C Manager will ensure the latest Community Complaints Register is posted on the WCPL website.

6.0 Review and Reporting

6.1 Review

The performance of the surface water monitoring program outlined in the SWMP is to be reviewed annually by the E&C Manager. A complete review of the SWMP will occur:

- Every two years;
- When there are changes to consent or licence conditions relating to surface water monitoring;
- Prior to new underground mining areas being developed;
- Following significant surface water related incidents at WCPL;
- Following continual exceedance of the impact assessment criteria;
- Following an independent environmental audit which requires SWMP review; or
- If there is a relevant change in technology, practice or legislation.

The revised SWMP will be re-submitted to the Secretary for approval as required by Condition 30, Schedule 4 of DA305-7-2003.

6.2 Annual Review

Prior to the end of March each year, WCPL will review the environmental performance of the Mine and submit an Annual Review report to the DP&E. This report will:

- Describe the development (including any rehabilitation) that was carried out in the past year, and the development that is proposed to be carried out over the next year;
- Include a comprehensive review of the monitoring results and complaints records of the Project over the past year, which includes a comparison of these results against the:
    - Relevant statutory requirements, limits or performance measures/criteria
    - Monitoring results of previous years; and
    - Relevant predictions in the EA;
- Identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
- Identify any trends in the monitoring data over the life of the Project;
- Identify any discrepancies between the predicted and actual impacts of the Project, and analyse the potential cause of any significant discrepancies; and
- Describe what measures will be implemented over the next year to improve the environmental performance of the Project.

Reporting on the performance of the North Wambo Creek diversion channel will also be included in the Annual Review, in accordance with NOW requirements (Table 3).

6.3 EPL 529 Annual Return

WCPL will prepare and submit an Annual Return comprising a certified Statement of Compliance and a signed Monitoring and Complaints Summary to the EPA at the end of each EPL reporting period.

The Annual Return for the reporting period will be supplied to the EPA by registered post not later than 60 days after the end of each reporting period. WCPL will retain a copy of the Annual Return for a period of at least four years after the Annual Return was due to be supplied to the EPA.

6.4 Website Updates

A comprehensive summary of the surface water monitoring results will be made publicly available at WCPL website:

http://www.peabodyenergy.com/content/404/australia-mining/new-south-wales/wambo-mine)

Information on the website will be updated regularly as required by DA305-7-2003.

WCPL will also ensure that any information relevant to surface water monitoring is uploaded to the website (and kept up to date). This includes:

- Current statutory approvals;
- Approved strategies, plans or programs required under the DA305-7-2003;
- A community complaints register;
- Minutes of Community Consultative Committee (CCC) meetings;
- Annual Reviews;
- A copy of any Independent Audits and WCPL's response to any recommendations in any audit; and
- Any other matter required by the Secretary.

6.5 Reportable Environmental Incidents

All reportable incidents will be reported via the EPA's Environmental Line on **131 555** by the E&C Manager in accordance with WCPL's Pollution Incident Response Management Plan (PIRMP).
In accordance with the PIRMP, WCPL must notify all relevant authorities of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident in accordance with the requirements of *Part 5.7* of the *POEO Act.*
For all other incidents that do not cause threatening material harm to the environment associated with the Project, WCPL will notify the Secretary and any other relevant agencies as soon as practicable after WCPL becomes aware of the incident.
Within 7 days of the date of the incident, WCPL will provide the Secretary and any relevant agencies with a detailed report on the incident to include:

- The cause, time and duration of the event;
- Where possible the type, volume and concentration of every pollutant discharged as a result of the event;
- The name, address and business hours telephone number of employees or agents of the licensee who witnessed the event;

- The name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;
- Action taken by the licensee in relation to the event, including any follow-up contact with any complainants;
- Implement remediation measures as directed by the Secretary, to the satisfaction of the Secretary;
- Details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and
- Any other relevant matters.

7.0 RESPONSIBILITIES

Table 15 below summarises responsibilities documented in the SWMP. Responsibilities may be delegated as required.

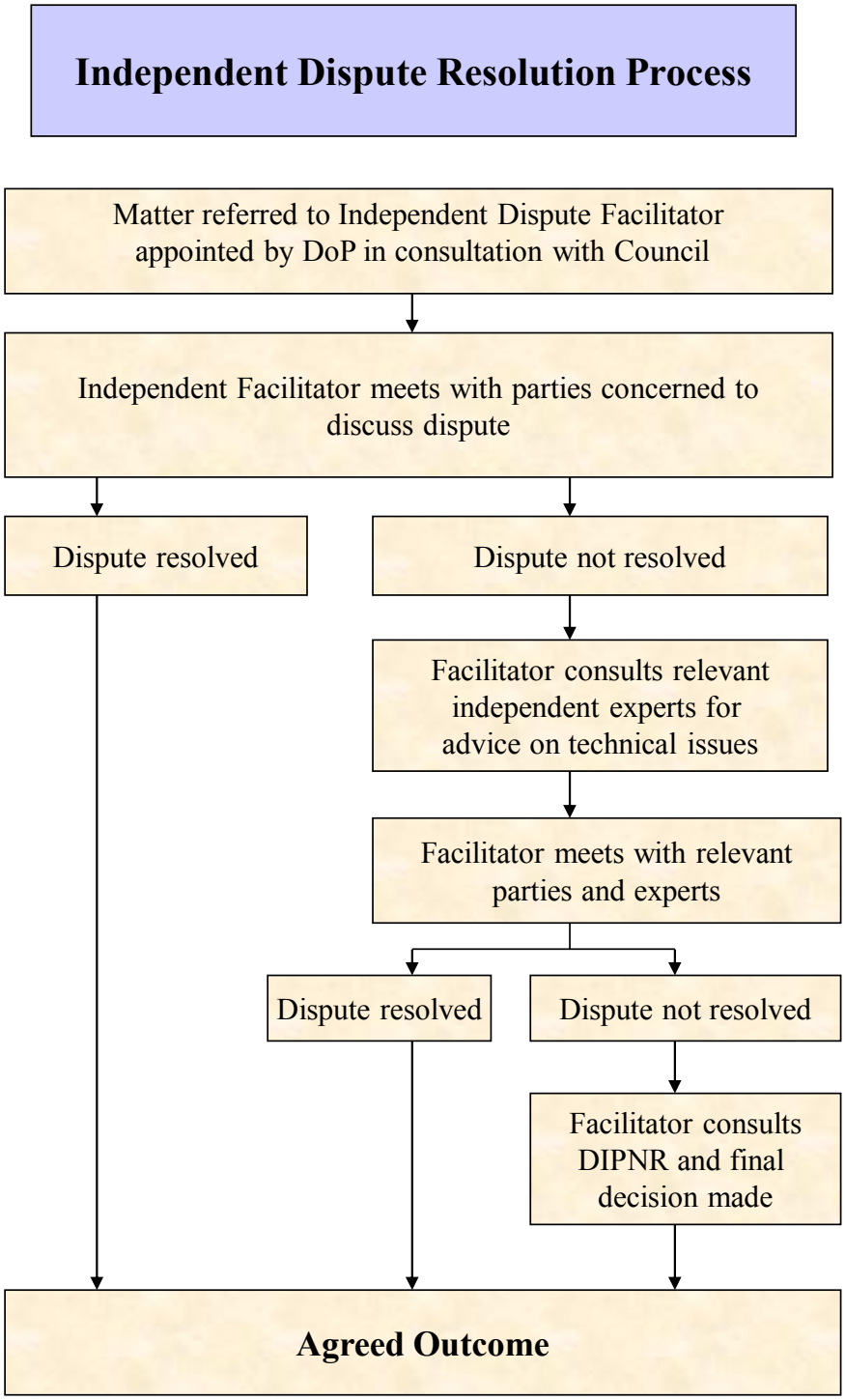
Table 15: Surface Water Monitoring Program Responsibilities

No	Task	Responsibility	Timing
1	Ensure surface water monitoring is undertaken in accordance with Section 4.0.	Environmental Advisor	As required
2	Assess surface water monitoring data against relevant criteria listed in Section 3.0	Environmental Advisor	As required
3	Review SWMP in accordance with Section 6.0.	Environmental Advisor	Annually
4	Undertake internal surface water reporting.	Environmental Advisor	Monthly/Quarterly
5	Notify government departments if an incident occurs in accordance with Section 0	E&C Manager	As required
6	Submit updated SWMP to DP&E.	E&C Manager	As required
7	Surface water related complaints to be responded to in accordance with Section 5.0	E&C Manager	As required
8	Annual Review to include surface water monitoring results, complaints, mitigation measures undertaken and a review of the monitoring undertaken	E&C Manager	Annually
9	Regulator review to be undertaken of the SWMP	E&C Manager	As required
10	Prepare investigation reports and implementation of corrective actions in accordance with Section 0	E&C Manager	As required

8.0 References

- Development Consent (DA305-7-2003)
- Development Consent (DA177-8-2004)
- Wambo Development Project Environmental Impact Statement (EIS), July 2003
- Resource Strategies Pty Ltd (2003) Wambo Coal Mine Project Environmental Impact Statement. Report prepared for Wambo Coal Pty Ltd
- Wambo Environment Protection Licence (529)
- Water Management Act 2000
- Environmental Planning and Assessment Act 1979
- Hunter Unregulated and Alluvial Water Sources Water Sharing Plan
- Glen, R.A. and Beckett, J. (1993) Newcastle Coalfields Regional Geology 1:100,000 map, (Second Edition), NSW Department of Mineral Resources, Sydney.
- Groundwater Imaging Pty Ltd (2012) A Transient Electromagnetic Investigation of the Extent of the Wollombi Brook Alluvium at the Wambo Coal Mine Site.
- HLA-Envirosciences Pty Ltd (1999) Effect of Longwall Panel 9 Mining on Surface and Groundwater – Homestead Underground Mine Warkworth NSW.
- Worley Parsons (2014) OPSIM Water Balance Model Initial Investigations – January 2014.
- Australian and New Zealand Environment and Conservation Council (ANZECC) (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Canberra.
- Department of Urban Affairs and Planning (DUAP) (1997) Upper Hunter Cumulative Impact Study and Action Strategy.
- Geoterra (2005) United Collieries Pty Ltd Surface and Groundwater Monitoring to December 31 2004.
- Gilbert and Associates (2005) Wambo Development Project Surface Water Impact Assessment.
- Hunter Catchment Management Trust (2003) Wollombi Brook Catchment. Fact Sheet. http://hcmt.org.au/factsheets/sub_catchments/wollombi_brook.htm
- Mackie Environmental Research (MER) (2002), Extension of Warkworth Coal Mine Assessment of Environmental Impacts Surface & Groundwater Management Studies, on behalf of Warkworth Mining Limited.
- Resource Strategies (2003) Wambo Development Project Aquatic Assessment.
- Resource Strategies (2003) Wambo Development Project Environmental Impact Statement.
- Strata Engineering (2005) Subsidence Impact Assessment for First Workings Development Associated with LW 1 at the Proposed Wambo Seam Punch Mine.
- WCPL (2008) North Wambo Creek Subsidence Response Strategy
- Wells Environmental Services (2011) Modification of DA 177-8-2004, Environmental Assessment, Locomotive Refuelling Station - Wambo Coal Rail Loop
- ID&A Pty Ltd (2001) Monitoring & Evaluation Program for Bowen Basin River Diversions. Australian Coal Association Research Program (ACARP) Project C9068.

APPENDIX A
INDEPENDENT DISPUTE RESOLUTION PROCESS


Independent Dispute Resolution Process
Matter referred to Independent Dispute Facilitator appointed by DoP in consultation with Council
Independent Facilitator meets with parties concerned to discuss dispute
Dispute resolved
Dispute not resolved
Facilitator consults relevant independent experts for advice on technical issues
Facilitator meets with relevant parties and experts
Dispute resolved
Dispute not resolved
Facilitator consults DIPNR and final decision made
Agreed Outcome

APPENDIX B
CORRESPONDENCE WITH REGULATORY AGENCIES

NSW GOVERNMENT | Planning & Environment

Contact: Scott Brooks
Phone: 6575 3401
Fax: 6575 3415
Email: scott.brooks@planning.nsw.gov.au
Our ref: 305-7-2003

The General Manager
Wambo Mine
PMB 1
SINGLETON NSW 2330

Attention: Steve Peart

Dear Steve

Wambo Coal – Approval of Water Management Plan

Thank you for forwarding the Wambo Water Management Plan and all its parts as required under project approval DA 305-7-2003 for the Department's consideration.

The Water Management Plan is required by Condition 30 Schedule 4 and the following 5 components of the Plan were reviewed:

- Site Water Balance (30)
- Erosion and Sediment Control Plan (32)
- Surface Water Monitoring Program (33)
- Ground Water Monitoring Program (34)
- Surface and Ground Water Response Plan (35).

The Department has reviewed these plans, and is satisfied that they generally address the requirements set out in the relevant conditions of the project approval. Consequently, I would like to advise you that the Secretary has approved the plans.

These plans come into force on the 30th November 2015 and remains in force until replaced by any future updated approved Plans.

I am aware that DPI Water are expected to comment on the Extraction Plan for the South Bates U/G (Wybrow seam) LW 11-13. Should this comment require significant changes to any component of the Water Management Plan, I ask if these changes could be made and the plans resubmitted for review and approval.

Could you please forward finalised copies of the above plan (preferably in PDF format with a copy of this approval letter appended) for the Department's records by the end of November 2015.

If you require further information or clarification in this matter please contact Scott Brooks on 6575 3401 or by email to scott.brooks@planning.nsw.gov.au.

Yours sincerely

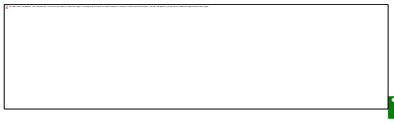
Scott Brooks
Investigations (Lead), Compliance
27-11-2015
As Nominee for the Secretary, Planning & Environment

From: Scott.Brooks@planning.nsw.gov.au [mailto:Scott.Brooks@planning.nsw.gov.au]
Sent: Wednesday, 21 October 2015 1:22 PM
To: Peart, Steven D
Subject: RE: 3 of 3

Steve,
I had no comment on the EE&SC Plan

Scott

Scott Brooks
Investigations (lead), Compliance
Planning Services, Resources Assessments
Planning & Environment
Suite 14, Level 1, 1 Civic Av
PO Box 3145
Singleton NSW 2330
http://www.planning.nsw.gov.au
E: scott.brooks@planning.nsw.gov.au
P: 02 6575 3401 | | **Office:** 6575 3405
M: 0419 970924 **F:** 02 6575 3415



Please consider the environment before deciding to print this e-mail.

From: Peart, Steven D [mailto:SPeart@peabodyenergy.com]
Sent: Wednesday, 21 October 2015 12:50 PM
To: Scott Brooks
Subject: RE: 3 of 3

Cheers Scott

The only other one was the Erosion and Sediment Control Plan if you had any comments on it.

Thanks again

Steven Peart
Manager: Environment & Community

Wambo Coal Pty Ltd
Peabody Energy Australia
PMB 1, Singleton NSW 2330
Phone: +61 (0)2 6570 2209
Fax: +61 (0)2 6570 2290
Mob: +61 (0)448 082 987
Email: speart@peabodyenergy.com
www.peabodyenergy.com.au
Please consider the environment before printing this email.

From: Scott.Brooks@planning.nsw.gov.au [mailto:Scott.Brooks@planning.nsw.gov.au]
Sent: Wednesday, 21 October 2015 11:46 AM
To: Peart, Steven D
Subject: RE: Wambo Coal_WMP's 1 of 3

Steve,
Comments on the 3 water management plans.

Please note we will need some type of water balance, and the info for the evaporation sprays if you want to use them.

Scott

Scott Brooks
Investigations (lead), Compliance
Planning Services, Resources Assessments
Planning & Environment
Suite 14, Level 1, 1 Civic Av
PO Box 3145
Singleton NSW 2330
http://www.planning.nsw.gov.au
E: scott.brooks@planning.nsw.gov.au
P: 02 6575 3401 | | **Office:** 6575 3405
M: 0419 970924 **F:** 02 6575 3415

Plan	Section	DP&E Comment
Surface and Ground Water Response Plan (WA-ENV-MNP-509.4) Version 8	2.7 North Wambo Creek Diversion Performance Criteria	Given the problems with the NWCD this section should refer to other management plans of have a section referring to erosion and the potential for sediment generation and loss from the system.
Surface Water Monitoring Program (WA-ENV-MNP-509.2) Version 8	1.4.1 Environmental Planning & Assessment Act 1979 (Table 3)	(NOW) Currently called DPI Water
	2.2.3.2 Stream Flow (Table 7)	(No flow data available) Is this because the SWC never runs?
	4.1 Monitoring Network, Parameters and Frequency	(Mine water monitoring is undertaken for operational management purposes only. This data is not reported publicly). This would appear to conflict with Schedule 6 Condition 12 requiring the publishing of monitoring results.
	4.1.5 Riparian Vegetation and Creek Bed Stability	The NWCD has its own rehab management plan. This management plan should refer to it and it may need to be updated.
	4.1.6 Monitoring of Discharge Flows in the North Wambo Creek Diversion	What did NOW ask for. This should be included.
	6.1 Review	(Review every two years) Usually 3 years
Groundwater Monitoring Program (WA-ENV-MNP-509.1) Version 9	2.2.3.1 Alluvial Water Sources	(Investigation into increase in EC) This will need to be reported in the AEMR
	3.1.3 Permian Monitoring Locations	Need to discuss why we monitor if the results cannot result in action.
	3.2 Trigger Values for Groundwater Quality	(Bi-monthly monitoring) This will need to be defined. Twice a month or every 2 months
	4.1.6 Chitter Dam and Wambo South Water Dam Monitoring Program	Need some comment here if the dam will be recommissioned if it is found to be leaking.

Plan	Section	DP&E Comment
	6.1 Review	(Review every two years) Review is normally every 3 years.

From: Joanna Webster [mailto:jwebster@ResourceStrategies.com.au]
Sent: Wednesday, 17 June 2015 1:05 PM
To: Jessie Evans; Brendan Liew
Cc: Joshua Hunt; Howard Reed; Alexander, Micheal G; Peart, Steven D
Subject: RE: Wambo 10A Extraction Plan - NOW comments
Importance: High

Hi Jessie/Brendan,

On behalf of Wambo Coal, please find attached a response to the recommendations made by NSW Office of Water.

Also attached is a revised Groundwater Monitoring Program that has been updated to address the recommendations made by the Office of Water.

Please consider Attachment 3 of the Water Management Plan for North Wambo Underground Mine Longwalls 8 to 10A Extraction Plan to be replaced by the attached revised Groundwater Monitoring Program.

Please don't hesitate to call if you would like to discuss.

Regards

Joanna Webster
Senior Environmental Manager
e jwebster@resourcestrategies.com.au
m 0414 664 532

Resource Strategies Pty Ltd
Suite 2 Level 3, 24 McDougall Street
PO Box 1842
Milton Qld 4064
t 07 3367 0055 f 07 3367 0053
www.resourcestrategies.com.au

From: Jessie Evans [mailto:Jessie.Giblett@planning.nsw.gov.au]
Sent: Thursday, 4 June 2015 8:42 AM
To: Joanna Webster
Cc: Joshua Hunt; Howard Reed; Brendan Liew
Subject: RE: Wambo 10A Extraction Plan - NOW comments

Hi Joanna,

The Department has received comments from NOW in regards to the Wambo LW 8-10A Extraction Plan. I have attached these for your careful consideration and response. NOW has raised a number of issues, and in particular has concerns regarding the Groundwater Management Plan.

Could you please provide a response to NOWs concerns at your earliest possible convenience.

Thanks
Jessie

North Wambo Underground Mine Extraction Plan Longwalls 8 to 10A
Response to NSW Office of Water Comments (Dated 3 June 2015)

NOW Recommendation	Response
Groundwater Management It is recommended with respect to the exceedance of groundwater level triggers: • WCPL must investigate the drivers for declining water levels (rather than omitting bores from the monitoring program when bores go dry). Notification to the Office of Water is required as part of the response procedure within 3 months of such an event.	Five bores are proposed to be removed from the groundwater monitoring program (GW14, GW18, GW19, P5 and P6). Only two samples (August 2011 and December 2011) have been obtained from GW14 since its installation in 2011 (these samples may have been associated with groundwater levels stabilising following drilling). This bore is located to the east of Wollombi Brook and is far removed from mining activities associated with the Wambo Coal Mine. Only one sample (August 2010) has been obtained from GW18. GW19 has been consistently dry since installation and no valid samples have been obtained from this bore. GW18 and GW19 are located immediately downstream and upstream of the North Wambo Creek Diversion, respectively. The alluvial flow in North Wambo Creek has been altered by the historical and existing mining operations including the removal of alluvium across the full width of the channel with consequent desaturation of the adjacent upstream and downstream alluvium associated with the approved and constructed North Wambo Creek Diversion. Bores P5 and P6 have been covered by the approved Wambo Coal Mine waste rock emplacement. WCPL considers removal of these five bores from the groundwater monitoring program is justified as outlined above. Trigger levels are not proposed for a further four bores along North Wambo Creek (GW08, GW09, GW16 and GW17). WCPL has initiated an investigation for bores GW08 and GW09 as outlined further below. Trigger levels will not be developed for these bores until this investigation is complete. GW16 and GW17 are located upstream of the North Wambo Creek Diversion and in close proximity to the approved open cut. There are no groundwater users located in the vicinity of North Wambo Creek upstream of the North Wambo Creek Diversion. Therefore, a trigger level for these two bores is not considered warranted.

NOW Recommendation	Response
• Where the driver for declining shallow bore water levels exceeding trigger levels can not be linked to the prevailing climatic influence or miscellaneous sampling error, additional groundwater modelling is required to re-assess if there is a change in the predicted take of water from the Lower Wollombi Brook Water Source from mining related activities. As part of WCPL's response procedure, a report summarising the assessment is to be submitted to the Office of Water.	WCPL has initiated an investigation into the monitored declining water levels in GW08 and GW09. As described in Section 6.1.3 of the revised GWMP, a preliminary investigation report will be provided to the DP&E and NOW by 30 September 2015. This report will include preliminary conclusions regarding the potential licensing implications and a process and timetable for any further investigation work (including potential additional numerical hydrogeological modelling work).
• Where the updated modelled aquifer interference take of water from the Lower Wollombi Brook Water Source (encapsulating Wambo and North Wambo Creek) exceeds the estimates as predicted in WPCL's Groundwater Impact Assessment by 100% or more, WCPL must re-evaluate the associated ecological impacts and any influence on a low flow cease to pump criteria specified in the relevant WSP. The reference value triggering this response procedure must be clearly documented in the GWMP.	As described in Section 6.1.3 of the revised GWMP, Where the investigation for GW08 and GW09 indicates a revised predicted take from alluvial water sources that exceeds the previous estimates by more than 100%, WCPL would consider other potential associated impacts (e.g. on ecology) and any influence on a low flow cease to pump criteria specified in the HUA WSP.
• The trigger levels in Table 11 of the GWMP outlines a minimum and maximum depth to water level. These values, plus any new bores added to the list, and the bores proposed to be dropped, must be presented in Australian Height Datum.	Table 11 of the GWMP has been revised to include trigger levels presented in Australian Height Datum.
<u>It is recommended with respect to the exceedance of groundwater quality triggers</u> • Appropriate water quality baseline data has not been captured and presented in way that can be used for before and after impact. Salinity data for a number of bores has fluctuated considerably which is not consistent with a more stable groundwater environment. The use of major ion analysis and QA/QC procedures should be reviewed to inform if the salinity measurements reported are accurate and if so the drivers to cause such variability in the results.	The GWMP has been revised to include annual comprehensive analysis of major ions standpipe bores. A description of data management procedures has been included in Section 5.3.2.
• Due to the concerns with the potential for cross aquifer interconnection, water quality performance measures are essential to the impact assessment. Water quality performance measures should be defined and added to the GWMP.	The GWMP has been revised to include groundwater quality trigger levels in Section 5.4.
<u>It is recommended with respect to the exceedance of predicted mine inflows</u> • There is a discrepancy between the GWMP which outlines a monthly measurement and annual assessment of mine inflows, whilst the 'Subsidence Response Strategy' indicates metering of weekly dewatered volumes. It should be consistently reported weekly, in the GWMP as this will improve the understanding of inflow and assist with groundwater management and the triggers for exceedance.	Section 5.2.5 of the GWMP has been updated to clarify that dewatering values are recorded internally on a daily basis (during active pumping). As outlined in the North Wambo Creek Subsidence Response Strategy, these values are reviewed weekly for any indication that pumping rates are higher than normal (which would trigger an investigation). Dewatering values are also reviewed annually (as outlined in the GWMP) to determine the inflows from groundwater sources and to verify whether WCPL holds sufficient groundwater licence entitlements.

NOW Recommendation	Response
• Where the annual assessment for mine inflows exceeds the peak estimate as predicted in WCPL's Groundwater Impact Assessment by 50% or more, WCPL shall: – investigate if there is a change in the predicted take of water from the Lower Wollombi Brook Water Source from mining related activities; – where there is an increased take from the Lower Wollombi Brook Water Source, investigate any influence on a low flow cease to pump criteria specified in the relevant WSP. – define the mine inflow volume value triggering this response procedure within the GWMP. – As part of WCPL's response procedure, a report summarising the assessment is to be submitted to the Office of Water.	Section 5.2.5 of the GWMP has been updated to include the recommended response procedure. The mine inflow volume that would response procedure has been defined in the GWMP (563 ML/annum, which is 50% more than the peak estimate predicted by HydroSimulations (2014) [375 ML/annum] for the North Wambo Underground Mine).
• WCPL must notify the Office of Water as soon as practicable on become aware of any take of water in excess of its licensed entitlement	Section 5.2.5 of the GWMP has been updated to include this statement.
It is recommended with respect to monitoring leakage from dams • The closest bore to South Dam is Piezometer 114 representative of Wambo Creek alluvium. South Dam contains produced water from the mine and P114 shows a sharp rise in salinity to a level on par with water in the dam. This indicates probable leakage occurring from the dam that warrants further investigation. However, as the proponent proposes not to utilise water quality as a performance measures, no direct response is proposed. Significant leakage to the nearby alluvial aquifer could risk a change in the beneficial use of the aquifer. Trigger levels with regard to salinity must be set to investigate and determine if remediation is required.	WCPL has initiated an investigation into the monitored increasing salinity levels in P114. Wambo South Water Dam is currently not in use for the period of secondary extraction for Longwall 9, Longwall 10 and Longwall 10A at the North Wambo Underground Mine. Wambo South Water Dam has been drained as far as practical since January 2015. Therefore, any possible leakage mechanism that may have impacted bore P114 may no longer be present.
A report summarising any special assessment for the above recommendations should be provided within 6 months.	As described in Section 6.1.4 of the revised GWMP, a preliminary investigation report will be provided to the DP&E and NOW by 30 November 2015.
Surface Water Management • The Office of Water recommends the proponent and the Department of Planning and Environment develop a consultation process with affected landholders to address existing and potential degradation which occurs as a result of mining subsidence. This should focus on incorporating natural processes for channel recovery particularly using large timber controls to maintain bed level (bed sills), bank toe protection (timber bank revetment) and creation of scour pools by using 'forced' controls such as engineered log jams as an adjunct to revegetation of both banks of both watercourses.	All land above the North Wambo Underground Mine is owned by WCPL. Therefore there are no other affected landholders associated with the North Wambo Underground Mine Extraction Plan for Longwalls 8 to 10A. Advisian (2015) concluded it is unlikely Wambo Creek and Stony Creek would experience adverse impacts from the North Wambo Underground Mine, and mitigation measures are unlikely to be required. In the unlikely event that any mitigation measures are required, these would be developed in consultation with the Department of Planning and Environment and the NSW Office of Water, and would aim to incorporate natural processes for channel recovery.

ATTACHMENT 3

WAMBO COAL PTY LIMITED
GROUNDWATER MONITORING PROGRAM

WAMBO COAL
GROUNDWATER MONITORING PROGRAM

Document No. WA-ENV-MNP-509.1
October 2015

Document Control

Document No.	WA-ENV-MNP-509.1
Title	Groundwater Monitoring Program
General Description	Groundwater Monitoring at WCPL
Document Owner	Environment & Community Manager

Revisions

Rev No	Date	Description	By	Checked	Signature
0	August 2005	Original Draft	AGE	JT/TS	
1	August 2005	Revision 1	AGE	JT/TS	
2	March 2006	Revision 2	WCPL	JT	
3	June 2007	Revision 3	WCPL	SW	
4	July 2008	Revision 4	WCPL	RP	
5	January 2010	Revision 5	WCPL	SB	
6	September 2014	Revision 6	GHD/WCPL	TF	
7	April 2015	Revision 7	WCPL	TF	
8	June 2015	Revision 8	WCPL	PJ/SB	
9	September 2015	New management plan format and revision	WCPL/Palaris	SP	
10	October 2015	Revised following receipt of comments from DP&E on Rev 9	WCPL/Palaris	SP	

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Tables

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LIST OF APPENDICES

1.0 Introduction

1.1 Background

The Wambo Coal Mine (the Mine) is situated approximately 15 kilometres west of Singleton, near the village of Warkworth, New South Wales (**Figure 1**). Wambo is owned and operated by Wambo Coal Pty Limited (WCPL), a subsidiary of Peabody Energy Australia Pty Limited.

A range of open cut and underground mine operations have been conducted at WCPL since mining operations commenced in 1969. Mining under the current Development Consent (DA 305-7-2003) commenced in 2004 and permits both open cut, underground operations and associated activities to be conducted.

The approved run-of-mine (ROM) coal production rate is 14.7 million tonnes per annum and all product coal is transported from WCPL by rail. A summary of the approved Wambo Coal Mine is provided in **Table 1**.

Table 1: Summary of the Approved Wambo Coal Mine

Component	Approved Wambo Coal Mine[1]
Life of Mine	21 years (from the date of the commencement of Development Consent [DA305-7-2003]). 1st March 2025
Open Cut Mining	Open cut mining at a rate of up to 8 Mtpa of ROM coal from the Whybrow, Redbank Creek, Wambo and Whynot Seams
	An estimated total open cut ROM coal reserve of 98 Mt
	Open cut mining operations under current approved MOP
Underground Mining	Underground mining of up to 7.5 Mtpa of ROM coal from the Whybrow, Wambo, Arrowfield and Bowfield Seams. Underground ROM coal reserves are estimated at 109.3 Mt.
Subsidence commitments and management.	The subsidence performance measures listed in Conditions 22 and 22A of the Development Consent (DA305-7-2003).
ROM Coal Production Rate	Up to 14.7 Mtpa of ROM coal
Total ROM Coal Mined	207.3 Mt
Waste Rock Management	Waste rock deposited in open cut voids and in waste rock emplacements adjacent open cut operations
Total Waste Rock	640 million bank cubic metres (Mbcm)
Coal Washing	Coal handling and preparation plant (CHPP) capable of processing approximately 1,800 tonnes per hour (tph)
Product Coal	Production of up to 11.3 Mtpa of thermal coal predominantly for export
CHPP Reject Management	Coarse rejects and tailings would be incorporated, encapsulated and/or capped within open cut voids in accordance with existing Wambo management practices
Total CHPP Rejects	Approximately 28.2 Mt of coarse rejects and approximately 18.6 Mt of tailings
Water Supply	Make-up water demand to be met from runoff recovered from tailings storage areas, operational areas, dewatering, licensed extraction from Wollombi Brook and Hunter River
Mining Tenements	Coal Lease (CL) 365, CL374, CL397, Consolidated Coal Lease (CCL) 743, Mining Lease (ML) 1402, ML1572, ML1594, Authorisation (A) 444, Exploration Licence (EL) 7211.

Note: [1] Development Consent DA305-7-2003 (as modified April 2015)

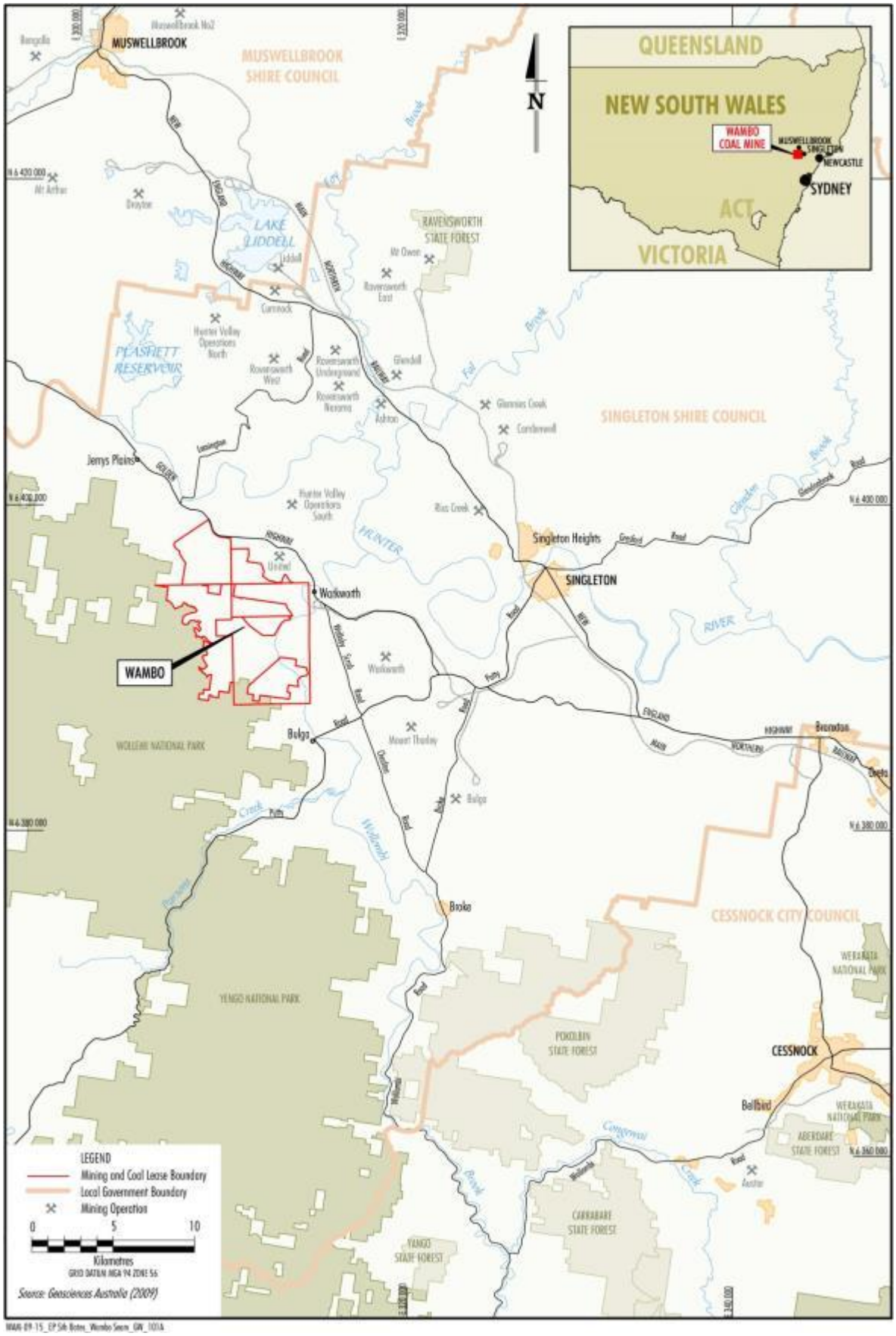

Figure 1: Wambo Coal Regional Location

In accordance with Schedule 4, Condition 30 of DA305-7-2003, WCPL are required to prepare a Site Water Management Plan (SWMP). This Groundwater Monitoring Program (GWMP) is a component of the WCPL Site Water Management Plan. **Figure 2** shows the components of the WCPL Site Water Management Plan. This GWMP should be read in conjunction with the other components of the WCPL Site Water Management Plan, in particular the Surface and Ground Water Response Plan (SGWRP).

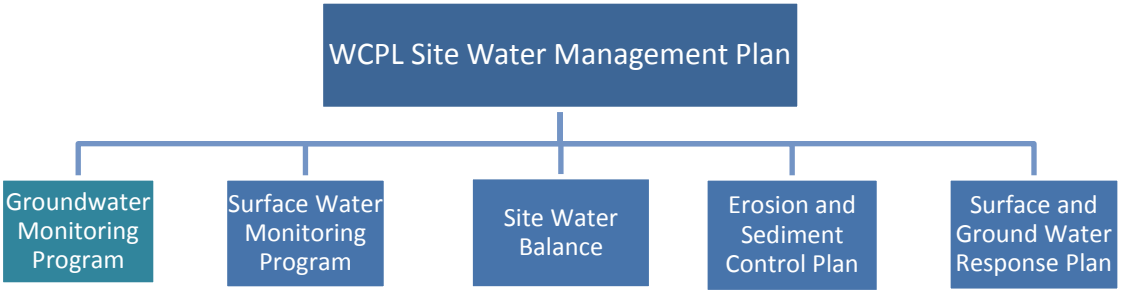

Figure 2: WCPL Site Water Management Plan

In accordance with WCPL's continuous improvement and review processes and Conditions 4 & 6, Schedule 6 of DA305-7-2003, a review of the GWMP has been undertaken to ensure that groundwater monitoring at the Mine continues to be undertaken in a manner that ensures compliance and that groundwater impacts from the Mine are minimised where possible.

1.2 Purpose

This GWMP has been developed to address the relevant requirements of DA305-7-2003. In accordance with Condition 34, Schedule 4 of DA305-7-2003, WCPL have prepared this GWMP to provide:

- Detailed baseline data on groundwater levels and quality, based on statistical analysis, to benchmark the pre-mining natural variation in groundwater levels and quality;
- Groundwater impact assessment criteria;
- A comprehensive and detailed program to monitor the volume and quality of groundwater seeping into the open cut and underground mining workings;
- A detailed program to monitor regional groundwater levels and quality in the alluvial and overburden aquifers; and
- A program to investigate and monitor potential water loss from the Chitter Dump Dam and South Wambo Dam (also known as Wambo South Water Dam), and Montrose East Dam (not yet constructed), including potential migration of stored water toward Wollombi Brook.

The GWMP has also been prepared in accordance with Schedule 6, Condition 4 of DA305-7-2003. In addition this GWMP addresses the relevant requirements of bore licences 20BL173032, 20BL173033, 20BL173034 and 20BL173035 issued under the *Water Act 1912*. There are no conditions relevant to groundwater monitoring in DA177-8-2004 or WCPL's Environment Protection Licence (EPL) 529.

1.3 Scope

This GWMP applies to all groundwater monitoring activities undertaken within WCPL's mining authorisations and approved mining areas (**Figure 3**) as well as regional groundwater bores. This GWMP has been prepared to monitor groundwater impacts from the Mine on local groundwater systems. This GWMP forms part of WCPL's Environmental Management System (EMS).

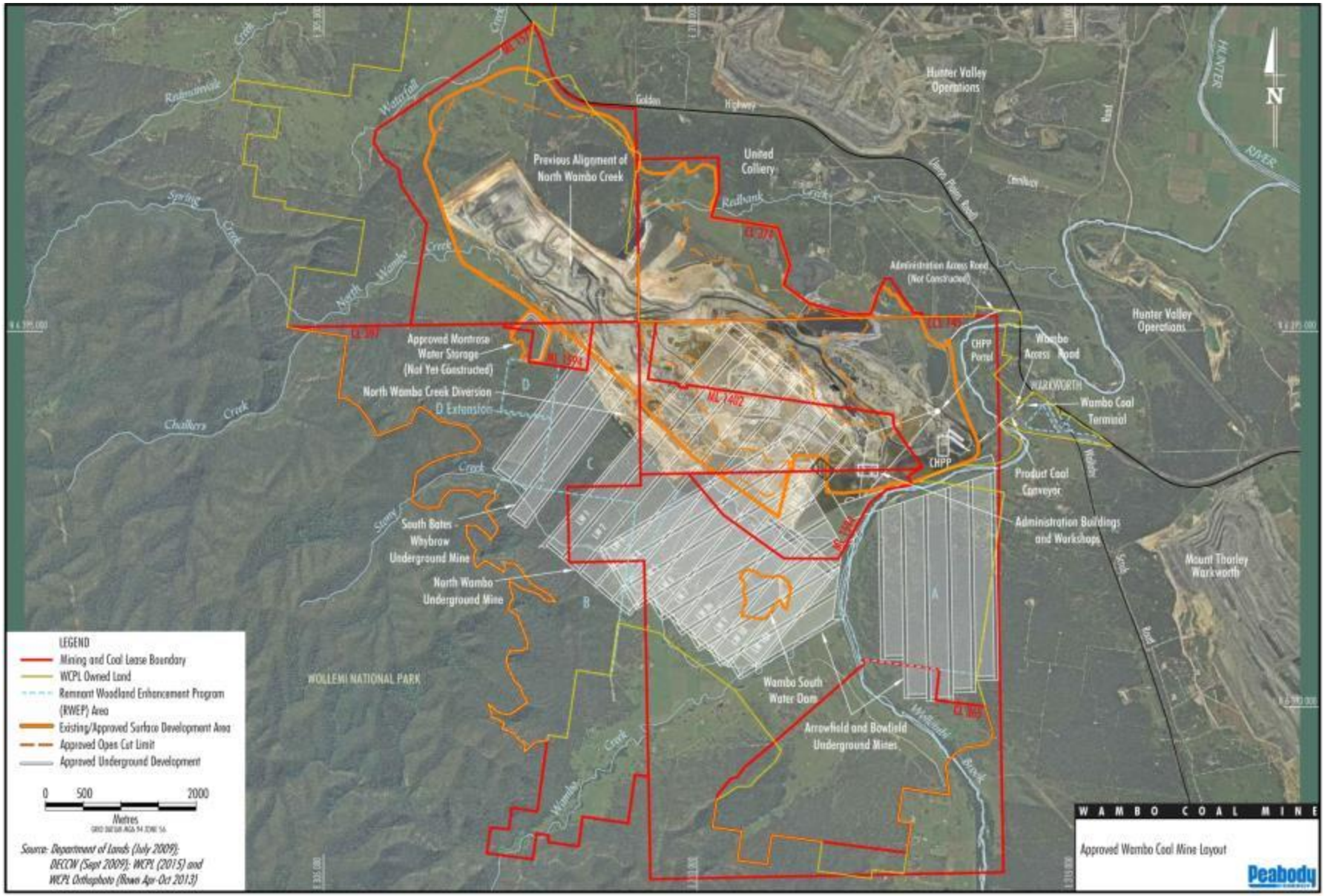

Figure 3: Approved Wambo Coal Mine Layout

1.4 Statutory Requirements

This GWMP has been prepared to fulfil the requirements of DA305-7-2003 and bore licences 20BL173032, 20BL173033, 20BL173034 and 20BL173035 (**Table 2** and **Table 3**). There are no conditions relevant to groundwater monitoring or management in DA177-8-2004 or WCPL's EPL 529.

1.4.1 Environmental Planning & Assessment Act 1979

WCPL received Development Consent (DA305-7-2003) in accordance with the *Environmental Planning & Assessment Act 1979* (EP&A Act) from the NSW Department of Planning and Environment (DP&E), formerly NSW Department of Planning, on 4 February 2004. Conditions within DA305-7-2003 relevant to groundwater monitoring at the Mine are summarised in **Table 2**.

Table 2: DA305-7-2003 Requirements for the Groundwater Monitoring Program

Schedule	Condition	DA 305-7-2003	GWMP Section
4	29	The applicant shall: … (e) monitor regional ground water levels and quality in the alluvial and overburden aquifers during the development and at least 10 years after mining; and	**Section 4.1.1**
		(f) periodically assess groundwater pressure response in the coal measures; to the satisfaction of the EPA, NOW and the Secretary.	**Section 4.4**
4	30	Before carrying out any development, the Applicant shall prepare a Site Water Management Plan for the development in consultation with DRE and NOW, and to the satisfaction of the Secretary. This plan must include: … (f) a Ground Water Monitoring Program;	**This GWMP**
4	34	The Ground Water Monitoring Program shall include: (a) detailed baseline data on ground water levels and quality, based on statistical analysis, to benchmark the pre-mining natural variation in groundwater levels and quality;	**Section 2.0**
		(b) ground water impact assessment criteria;	**Section 3.0**
		(c) a comprehensive and detailed program to monitor the volume and quality of ground water seeping into the open cut and underground mining workings;	**Sections 4.1.4 and 4.1.5**
		(d) a detailed program to monitor regional ground water levels and quality in the alluvial and overburden aquifers; and	**Section 4.1.1**
		(e) a program to investigate and monitor potential water loss from the Chitter Dump Dam and South Wambo Dam, and Montrose East Dam, including potential migration of stored water toward Wollombi Brook.	**Section 4.1.6**
6	3	**Adaptive Management** The Applicant must assess and manage project-related risks to ensure that there are no exceedances of the criteria and/or performance measures in schedule 4. Any exceedance of these criteria and/or performance measures constitutes a breach of this consent and may be subject to penalty or offence provisions under the EP&A Act or EP&A Regulation. Where any exceedance of these criteria and/or performance measures has occurred, the Applicant must, at the earliest opportunity: (a) take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur; (b) consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measures or other course of action; and (c) implement remediation measures as directed by the Secretary, to the satisfaction of the Secretary.	**Refer SGWRP**

Schedule	Condition	DA 305-7-2003	GWMP Section
6	4	**Management Plan Requirements** The Applicant shall ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:	
		(a) detailed baseline data;	**Section 2.0**
		(b) a description of: - the relevant statutory requirements (including any relevant consent, licence or lease conditions);	**Section 1.4**
		- any relevant limits or performance measures/criteria;	**Section 3.0**
		- the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;	**Section 3.3**
		(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/ criteria;	**Section 4.0**
		(d) a program to monitor and report on the: - impacts and environmental performance of the Wambo Mining Complex;	**Sections 4.0 and 6.0**
		- effectiveness of any management measures (see c above);	
		(e) a contingency plan to manage any unpredicted impacts and their consequences;	**Refer SGWRP**
		(f) a program to investigate and implement ways to improve the environmental performance of the Wambo Mining Complex over time;	**Section 6.2**
		(g) a protocol for managing and reporting any: - incidents;	**Section 6.5**
		- complaints;	**Section 5.0**
		- non-compliances with statutory requirements; and	**Refer SGWRP**
		- exceedances of the impact assessment criteria and/or performance criteria; and	**Refer SGWRP**
		(h) a protocol for periodic review of the plan.	**Section 6.1**

1.4.2 Water Act 1912

The *Water Act 1912* governs access, trading and allocation of licences associated with both surface and underground water for water sources where a Water Sharing Plan (WSP) has not commenced. The elements to which the *Water Act 1912* applies include extraction of water from a river, extraction of water from underground sources, aquifer interference and capture of surface runoff in dams.

At this point in time, the *Water Act 1912* applies to groundwater interference, bore installation and extraction of groundwater within the Permian formations within the GWMP area. WCPL currently has a number of licences under the *Water Act 1912* shown in **Table 3**.

Table 3: WCPL Entitlement and Licences

Licence No.	Description	Facility	Valid To	Extraction Limit
Licences under the Water Management Act 2000				
WAL 23897	Well No. 2	Well	Perpetuity	70 ML/year
WAL 718	Hunter River Pump	Pump	Perpetuity	1,000 ML/year
Licences under the Water Act 1912				
20BL132753	Old Well No. 1	Well	29/07/2018	243ML/year
20BL166910	Dewatering (Bore No. 1)	Bore	21/05/2017	450ML/year
20BL168017	Dewatering (Bore No. 2)	Bore	21/05/2017	750ML/year
20BL167738[1]	Dewatering Bore	Bore	11/09/2015	57ML/year
20BL168643	Dewatering Bore	Bore	7/08/2018	40ML/year
20BL172061[2]	Dewatering (BoreNo.2a)	Bore	22/03/2014	750ML/year
20BL172156	Dewatering	Excavation	3/05/2019	98ML/year
20BL173032	Dewatering Bore	Bore	30/11/2016	450ML/year
20BL173033	Dewatering Bore	Bore	30/11/2016	450ML/year
20BL173034	Dewatering Bore	Bore	30/11/2016	450ML/year
20BL173035	Dewatering Bore	Bore	30/11/2016	450ML/year
20BL173040	Dewatering Bore	Bore	21/05/2017	750 ML/year
20BL173844	Dewatering Bore	Bore	04/09/2019	9 ML/year
20BL166438	Well - Stock	Bore	Perpetuity	5ML/year
20BL168997	Piezometer	Test Bore	Perpetuity	Groundwater monitoring
20BL168998	Piezometer	Test Bore	Perpetuity	Groundwater monitoring
20BL168999	Piezometer	Test Bore	Perpetuity	Groundwater monitoring
20BL169000	Piezometer	Test Bore	Perpetuity	Groundwater monitoring
20BL170638	Piezometer	Test Bore	Perpetuity	Groundwater monitoring
20BL166906	Spearpoints	Irrigation	Perpetuity	19ML/year
20BL172237	GW14, GW18, GW21	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL172238	GW12	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL172240	GW15	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL172242	GW16, GW17	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL172244	GW20	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL172255	GW22	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL172256	GW13	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL172257	GW19	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL172332	Piezometer	Test Bore	Perpetuity	Groundwater monitoring
20BL173290	Bore	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL173291	Bore	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL173292	Bore	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL173293	Bore	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL009818	Bore	Stock	Perpetuity	Stock
20BL009819	Bore	Stock	Perpetuity	Stock
20BL009820	Bore	Stock	Perpetuity	Stock
20BL009821	Bore	Stock	Perpetuity	Stock
20BL143779	Bore	Stock/Domestic	Perpetuity	Stock/Domestic

[1] *Note: Application for renewal of 20BL167738 has been submitted to DPI Water*

[2] *Note: Application for renewal of 20BL172061 has been submitted to DPI Water*

1.4.3 Water Management Act 2000

The *Water Management Act 2000* (WM Act) is intended to ensure that water resources are conserved and properly managed for sustainable use benefitting both present and future generations. It is also intended to provide formal means for the protection and enhancement of the environmental qualities of waterways and their in-stream uses as well as to provide for protection of catchment conditions.

An amendment to the WM Act (section 60I) came into effect on 1 March 2013. This amendment provides that it is *an offence for a person without an access licence to take, remove or divert water from a water source, or relocate water from one part of an aquifer to another part of an aquifer, in the course of carrying out a mining activity.* Various activities are captured by the provisions of the amendment including mining, mineral exploration and petroleum exploration.

The area covered by this GWMP is located within the Water Sharing Plan (WSP) area for the Hunter Unregulated and Alluvial Water Sources (HUA WSP), which commenced in August 2009 and regulates the interception and extraction of surface water and alluvium within the defined WSP area. Any interference and extraction of alluvial groundwater throughout the GWMP area generally requires a water access licence (WAL) under the WM Act.

A WSP for the North Coast Fractured and Porous Rock Groundwater Sources (NFPR WSP) is currently under development by the NSW Department of Primary Industries Water (DPI Water), formerly the NSW Office of Water (NOW), and due to commence in 2015 (**Section 1.4.5**). Once the WSP commences, existing licences under the *Water Act 1912* will be converted to WALs and water supply works and use approvals under the WM Act.

1.4.4 Hunter Unregulated and Alluvial Water Sources Sharing Plan

The HUA WSP includes the unregulated rivers and creeks and alluvial groundwater within the Hunter region and is categorised into four extraction management units (EMUs) and further broken down into water sources. The area covered by the WSP includes 39 surface water and alluvial groundwater sources.

Wambo is located predominantly within the Lower Wollombi Brook water source. At the commencement of the WSP in August 2009, the groundwater (alluvial) entitlement within the Lower Wollombi Brook water source was 5,071 megalitres per year (ML/year) shared between 38 licences. WCPL currently holds one WAL within the Lower Wollombi Brook water source of the HUA WSP as shown in **Table 3**.

1.4.5 Draft North Coast Fractured and Porous Rock Groundwater Sources

The NFPR WSP is currently under development and is due to commence in 2015. The water extraction entitlement for each groundwater source has not yet been determined, however it is expected to be based on existing groundwater extraction licences under the *Water Act 1912* and the Long Term Average Annual Extraction Limit (LTAAEL).

It is expected that the NFPR WSP will provide rules for each groundwater source, which may include:

- Access rules;
- Rules for managing water allocation accounts;
- Rules for granting and amending water supply works approvals;

- Rules for the use of water supply works approvals;
- Limits to the availability of water; and
- Trading rules.

1.4.6 Policies

1.4.6.1 NSW Aquifer Interference Policy

The NSW Aquifer Interference Policy (AIP) was finalised in September 2012 and clarifies the water licensing and approval requirements for aquifer interference activities in NSW, including the taking of water from an aquifer in the course of carrying out mining. Many aspects of this Policy will be given legal effect in the future through an Aquifer Interference Regulation. Stage 1 of the Aquifer Interference Regulation commenced on 30 June 2011.

This Policy outlines the water licensing requirements under the *Water Act 1912* and WM Act:

A water licence is required whether water is taken for consumptive use or whether it is taken incidentally by the aquifer interference activity (such as groundwater filling a void) even where that water is not being used consumptively as part of the activity's operation.

Under the WM Act, a water licence gives its holder a share of the total entitlement available for extraction from the groundwater source. The WAL must hold sufficient share component and water allocation to account for the take of water from the relevant water source at all times.

Sufficient access licences must be held to account for all water taken from a groundwater or surface water source as a result of an aquifer interference activity, both for the life of the activity and after the activity has ceased. Many mining operations continue to take water from groundwater sources after operations have ceased. This take of water continues until an aquifer system reaches equilibrium and must be licensed.

The AIP requires that potential impacts on groundwater sources, including their users and Groundwater Dependent Ecosystems (GDEs), be assessed against minimal impact considerations, outlined in Table 1 of the Policy. If the predicted impacts are less than the Level 1 minimal impact considerations, then these impacts will be considered as acceptable.

The Level 1 minimal impact considerations for less productive groundwater sources are relevant to the groundwater sources at Wambo and are as follows:

- **Water table**: less than or equal to 10% cumulative variation in the water table, allowing for typical climatic 'post-water sharing plan' variations, 40 m from any high priority groundwater dependent ecosystem or high priority culturally significant site listed in the schedule of the relevant WSP. A maximum of a 2 m decline cumulatively at any water supply work unless make good provisions should apply.
- **Water pressure**: a cumulative pressure head decline of not more than 40% of the 'post-water sharing plan' pressure head above the base of the water source to a maximum of a 2 m decline at any water supply work.
- **Water quality**: any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity. For alluvial water sources, there should be no increase of more than 1% per activity in the long-

term average salinity in a highly connected surface water source at the nearest point to the activity.

1.4.6.2 NSW State Groundwater Policy

The objective of the NSW State Groundwater Policy Framework Document (NSW Government 1997) is to manage the State's groundwater resources so that they can sustain environmental, social and economic uses for the people of NSW. NSW groundwater policy has three component parts:

- NSW Groundwater Quantity Protection Policy.
- NSW Groundwater Quality Protection Policy.
- NSW Groundwater Dependent Ecosystems Policy.

The principles of the NSW Groundwater Quantity Protection Policy include:

- Maintain total groundwater use within the sustainable yield of the aquifer from which it is withdrawn;
- Groundwater extraction shall be managed to prevent unacceptable local impacts; and
- All groundwater extraction for water supply is to be licensed. Transfers of licensed entitlements may be allowed depending on the physical constraints of the groundwater system.

The criteria and management plan developed as part of this document will seek to follow the principles of this policy.

The objective of the NSW Groundwater Quality Protection Policy is the ecologically sustainable management of the State's groundwater resources so as to:

- Slow and halt, or reverse any degradation in groundwater resources;
- Direct potentially polluting activities to the most appropriate local geological setting so as to minimise the risk to groundwater;
- Establish a methodology for reviewing new developments with respect to their potential impact on water resources that will provide protection to the resource commensurate with both the threat that the development poses and the value of the resource; and
- Establish triggers for the use of more advanced groundwater protection tools such as groundwater vulnerability maps or groundwater protection zones.

Groundwater triggers will be developed as part of this management plan where they will seek to follow the objectives of this policy.

The NSW Groundwater Dependent Ecosystem Policy was designed to protect ecosystems which rely on groundwater for survival so that, wherever possible, the ecological processes and biodiversity of these dependent ecosystems are maintained or restored for the benefit of present and future generations.

1.4.7 Guidelines

1.4.7.1 Draft Groundwater Monitoring Guidelines

The former NSW Department of Infrastructure, Planning and Natural Resources (DIPNR) developed the 'Draft Groundwater Monitoring Guidelines for Mine Sites within the Hunter Region' in September 2003. This draft guideline is still used by DPI Water as the benchmark for groundwater monitoring programs at mine sites within the Hunter Region.

1.5 Stakeholder Consultation

Several applications to modify DA 305-7-2003 were sought and approved by the DP&E in June and August 2009, for the construction of the Chitter Dam and Wambo South Water Dam respectively. To address additional consent requirements resulting from the recent approved modifications, a review of the GWMP was completed in May 2015.

In accordance with Condition 30, Schedule 4 of DA 305-7-2003, this revision of the GWMP (Revision 10) has been undertaken in consultation with NSW Department of Resources and Energy (DRE) and DPI Water, prior to submitting to the Secretary of the DP&E for approval.

This review of the GWMP (Revision 10) includes:

- Updating the format and layout of the GWMP, consistent with WCPL's current document management procedures and templates;
- Including additional information to ensure the GWMP addresses Condition 4, Schedule 6 of DA305-7-2003; and
- Addressing comments received from DPI Water and DP&E on the GWMP (Revisions 8 and 9).

Correspondence in relation to the GWMP is attached as **Appendix B**.

2.0 Existing Groundwater Conditions and Baseline Data

2.1 Description of Groundwaters – Existing Environment

2.1.1 Landforms and Watercourses

Wambo is located in the Upper Hunter Valley where the landform is characterised by gently sloping floodplains of the Hunter River and its tributaries and the undulating foothills, ridges and escarpments of the Mount Royal Range and Great Dividing Range (Heritage Computing, 2012).

Elevations in the vicinity of Wambo range from approximately 60 metres (m) Australian Height Datum (AHD) at Wollombi Brook to approximately 650 m AHD at Mount Wambo within the Wollemi National Park to the west of Wambo.

Watercourses in the vicinity of Wambo Mine include Wollombi Brook, North Wambo Creek, South Wambo Creek, Stony Creek, Wollombi Brook, Longford Creek and Doctors Creek. These creeks are tributaries of the Hunter River. North Wambo Creek has been diverted in accordance with the approved modification to its development consent (DA305-7-2003 MOD 5). The locations of these watercourses are shown in **Figure 3 (Section 2.1.4).**

2.1.2 Rainfall

A continuous daily rainfall dataset was obtained as SILO Patched Point Data from the Queensland Climate Change Centre of Excellence (QCCCE), which is based on historical data from a particular Bureau of Meteorology (BOM) station with missing data 'patched' in from interpolations from nearby stations. SILO data was obtained for the BOM Jerry's Plains Post Office Station (station number 61086). Daily rainfall records from January 1901 to September 2014 were utilised.

Key statistics for the rainfall dataset are as follows:

- Minimum annual rainfall – 316.3 mm in 1957.
- Average annual rainfall – 648.5 mm.
- Median annual rainfall – 658.6 mm.
- Maximum annual rainfall – 1191.2 mm in 1950.

Monthly rainfall averages ranged from 36.9 mm in August to 76.2 mm in January.

The SILO dataset was also used to generate a Cumulative Rainfall Departure (CRD) curve. CRD is the monthly accumulation of the difference between the observed monthly rainfall and long term average monthly rainfall.

The CRD over the period 1901 to 2014 is shown in **Figure 4**. Any increase in the CRD reflects above average rainfall while a decrease in CRD reflects below average rainfall. The CRD curve only deviates from zero due to atypical (above and below average) rainfall.

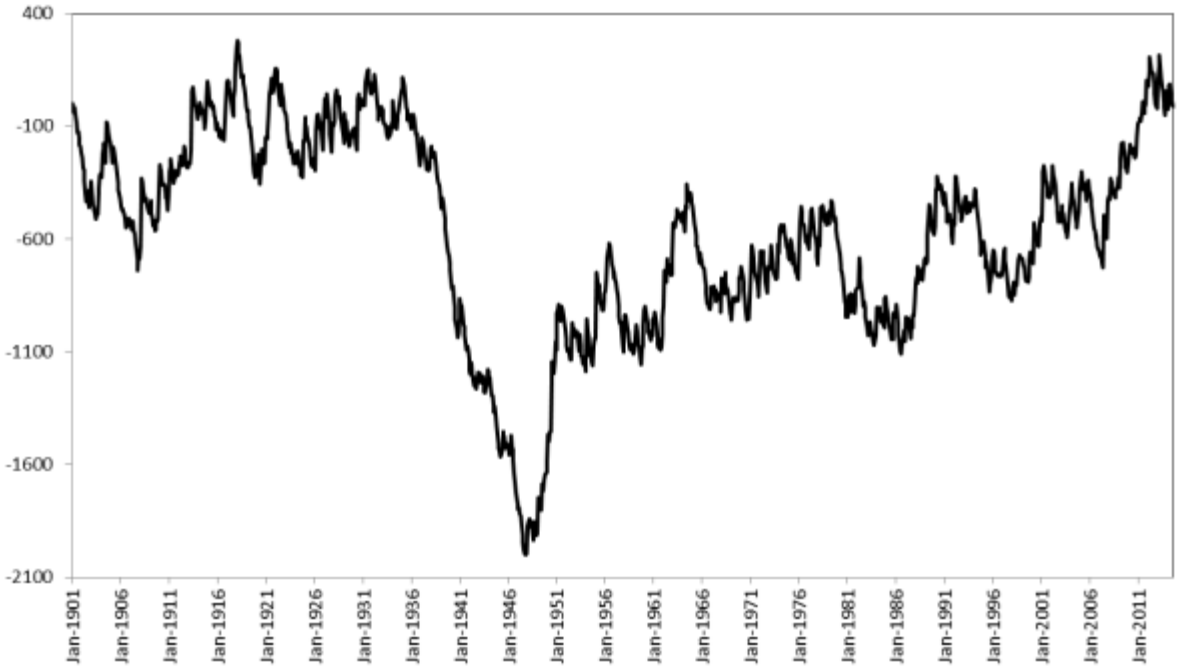

Figure 4: CRD Curve for Jerry's Plains Post Office (1901-2014)

2.1.3 Geology

Wambo is located in the Hunter Coalfield, which occupies the north-eastern portion of the Sydney Basin. The area covered by the GWMP is underlain by the Permian Singleton Coal Measures as well as Quaternary alluvial sediments along watercourses. This is underlain by the Permian Maitland Group which consists of siltstone, sandstone and conglomerate.

The stratigraphy at Wambo is summarised in **Table 4**. This information has been sourced from the Newcastle Coalfields Regional Geology 1:100,000 map (NSW Department of Mineral Resources, Edition 2 1993). The target coal seams at Wambo are all within the Jerry's Plains Subgroup of the Wittingham Coal Measures.

Table 4: Stratigraphic Sequence

Period	Supergroup	Group	Subgroup	Lithology
Quaternary				Alluvium
Permian	Singleton Supergroup	Newcastle Coal Measures (Wollombi Coal Measures)	Glen Gallic Subgroup	
			Doyle's Creek Subgroup	
			Horseshoe Creek Subgroup	
			Apple Tree Flat Subgroup	
			Watts Sandstone	Medium to coarse-grained sandstone
		Wittingham Coal Measures	Denman Formation	Sandstone siltstone laminite
			Jerry's Plains Subgroup	Whybrow Seam Redbank Creek Seam Wambo Seam Whynot Seam Blakefield Seam Woodlands Hill Seam Arrowfield Seam Bowfield Seam
			Archerfield Sandstone	Well sorted quartz lithic sandstone
			Vane Subgroup	
			Saltwater Creek Formation	Sandstone, siltstone, minor coaly bands

Approximate boundaries of quaternary alluvial sediments in the vicinity of Wambo are shown in Figure 5 **(Section 2.1.4)** and have been derived from the Hunter Coalfields Regional Geology 1:100,000 map (NSW Department of Mineral Resources, Edition 2 1993). The coal measures are overlain by the Triassic Narrabeen Group. The Narrabeen Group outcrops to the south and west of Wambo but is not present within the mining lease area (Heritage Computing, 2012).

A transient electromagnetic (TEM) survey (Groundwater Imaging, 2012) was carried out to investigate the extent and thickness of alluvium along the lower reaches of (South) Wambo and North Wambo Creek. The extent of alluvial sediments determined from that study is also presented on **Figure 5.**

2.1.4 Hydrogeology

The hydrogeological regime of the Wambo area and surrounds comprises two main systems (HydroSimulations, 2014):

- Quaternary alluvial aquifer system of channel fill deposits associated with Wollombi Brook, North Wambo Creek, Wambo Creek and Stony Creek.
- Underlying Permian strata consisting of:
  - hydrogeologically “tight” and hence very low yielding to essentially dry sandstone and lesser siltstone; and
  - low to moderately permeable coal seams, which are the prime water-bearing strata within the Permian measures.

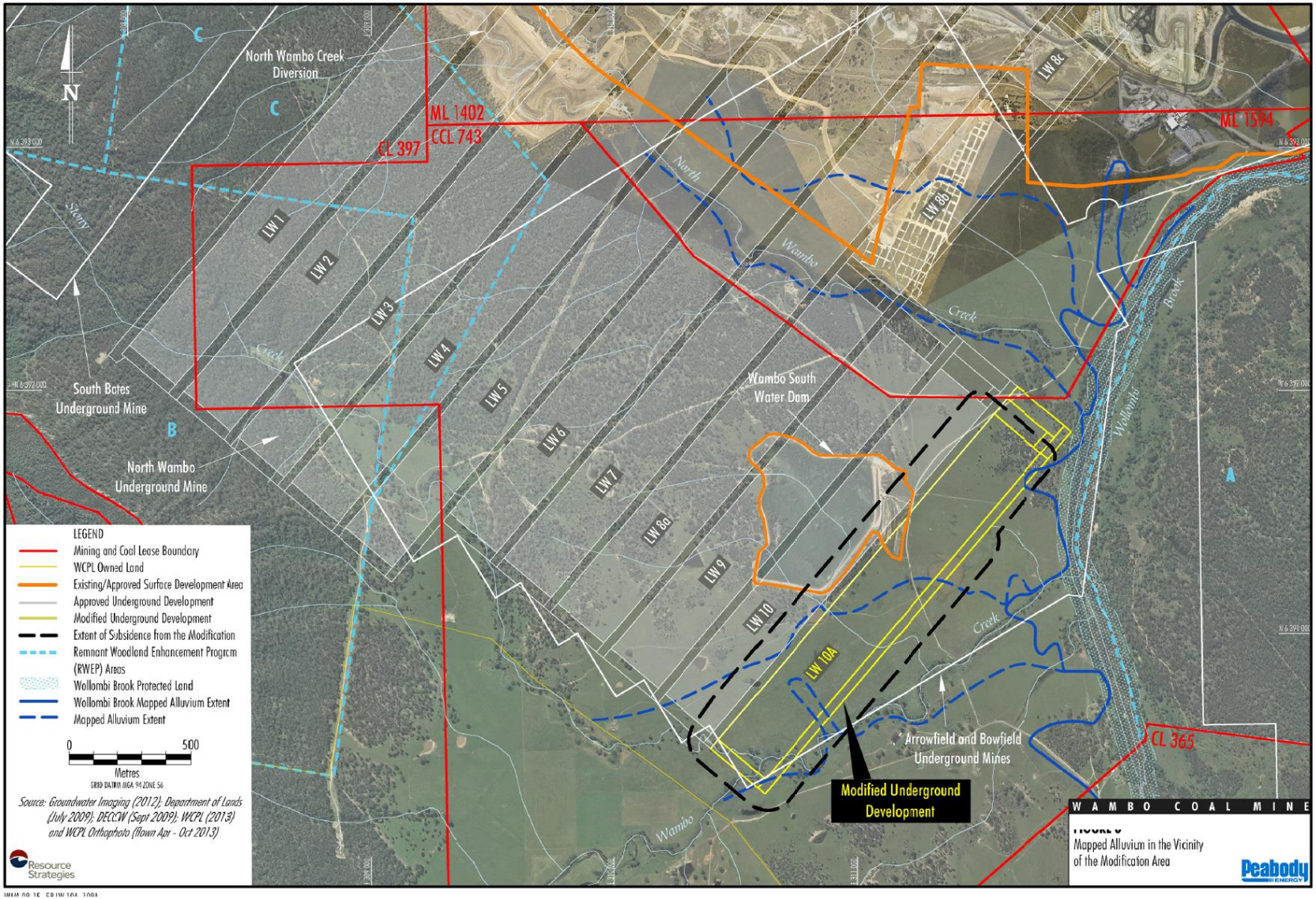

Figure 5: Location of Alluvium in Lower Reaches of Creeks

2.1.4.1 Alluvial Water Sources

The alluvium in the vicinity of the GWMP area forms an unconfined shallow aquifer. The alluvium within the Wambo area is generally less than 15 m thick (Heritage Computing, 2012). Previous studies indicate that the alluvium of Wambo Creek is 4 to 7 m deep and is discontinuous, probably due to bedrock highs (HLA-Envirosciences, 1999). The alluvium of North Wambo Creek near its confluence with Wollombi Brook was found to vary between 7 and 19 m (GHD, 2007). The extent of alluvium interpreted from the TEM study is typically of a thinner (laterally) alluvial body along both the lower reaches of (South) Wambo and North Wambo Creeks than is mapped in the publicly available mapping (HydroSimulations, 2014).

A section of North Wambo Creek has been diverted to avoid the Wambo Open Cut. The alluvial flow in North Wambo Creek has been altered by the historical and existing mining operations including the removal of alluvium across the full width of the channel with consequent desaturation of the adjacent upstream and downstream alluvium.

Based on a review of groundwater quality and the results of the search of the NSW Bore Database (**Section 2.1.5.1**) the typical yield of the alluvial aquifer is likely to be less than 5 litres per second (L/s) and the salinity varies from low to very high. Based on this information the environmental value of the alluvial groundwater is considered to be 'primary industry' (specifically stock watering) and potentially irrigation.

2.1.4.2 Permian Groundwater Sources

The fractured and porous groundwater sources within the Permian strata consist of both the coal seams and the interburden layers. It is predicted that pre-mining piezometric head in the Permian groundwater sources closely resembled topographic levels. Previous and ongoing open cut and underground mining within the Wambo area and adjoining mining operations has resulted in a regional zone of depressurisation within the Permian coal measures (HydroSimulations, 2014).

The permeability of the Permian rock units is generally low and decreases with depth. This is due to a decrease in weathering and tightening of joints between rock units as depth increases. The coal seams generally have higher permeability than the interburden layers. Overall, the Permian groundwater sources are low yielding and brackish to saline.

2.1.5 Groundwater Receptors

2.1.5.1 NSW Bore Database Search

A search of the NSW Bore Database was undertaken to identify registered bores within a 5 km radius of Wambo. The search identified 72 bores, with the majority (44) registered as monitoring/test bores and located within WCPL tenement boundaries (namely ML 1402, CL 743 and ML 1594). There were 10 bores identified as mining/dewatering bores and 3 bores were of unknown use. The remainder are registered for irrigation, domestic and/or stock use (15).

Bore details are outlined in **Table 5** and approximate bore locations are shown in **Figure 6.**

Table 5: Results of NSW Bore Database Search

Figure 6 Ref.	Bore No.	Licence No.	Location		Use	Depth (m)	SWL (bgl)	Salinity (ppm)	Yield (L/s)	Aquifer
			mE	mN						
1	GW080963	20BL170103	315994	6397210	Monitoring	84	60		5	Gravel Clay
2	GW047240	20CA209896	316826.7	6397095	Irrigation	12.7				
3	GW200621	20BL168887	312857	6395909	Monitoring	37	24.89	5695		
4	GW200622	20BL168887	312901	6395806	Monitoring	30	29.95	4050		
5	GW200943	20BL167947	312332	6395760	Test	30	27			
6	GW200942	20BL167947	312325	6395750	Test	37	32			
7	GW200623	20BL168887	312982.1	6395319	Monitoring	31	13.84	11500		
8	GW080516	20BL168883	312898.8	6394954	Test	15	7.11	950		Sandy Clay
9	GW060750	20BL132130	314309.8	6394923	Domestic	24.4	7.8		1.25	
10	GW080952	-	314643	6394905	Unknown	1.6	1.59			Sandy Clay / Gravel / Clay
11	GW080951	-	314619	6394878	Unknown	3.1	3.14			
12	GW079060	-	314595.5	6394852	Unknown	14.6				
13	GW079059	20BL153300	314595.5	6394852	Monitoring	0		5147		
14	GW080513	20BL168880	312345	6394818	Test	10	7.53			
15	GW080515	20BL168882	313418	6394794	Monitoring	8.1	5.7	8690		
16	GW080517	20BL168884	313572.7	6394742	Monitoring	15	7.24	3600		
17	GW200835	20BL172256	308424	6394517	Monitoring	11				
18	GW005327	20BL009540	314682.9	6394498	Stock	10.4	6.1	Excellent	0.13	
19	GW200616	20BL168886	313473.4	6394446	Monitoring	8.5	5.68	8360		
20	GW080514	20BL168881	310973	6394353	Monitoring	55	42.7	6300		Coarse Sand
21	GW200615	20BL168886	313434	6394246	Monitoring	11.5	7.49	7160		
22	GW080518	20BL168885	313585.8	6394232	Monitoring	10.8	6.95	53000		
23	GW080519	20BL168885	313622.4	6394161	Test	10.5	7.42	6490		
24	GW200620	20BL168888	310489.4	6394097	Monitoring	49	39.09	4700		
25	GW200617	20BL168888	309987.4	6393974	Monitoring	9	4.75	710		
26	GW079780	-	309588.9	6393932	Monitoring	0				
27	GW037184	-	309685	6393911	Test	21				
28	GW038579	-	309737.7	6393882	Test	20.9				
29	GW060328	-	314205.2	6393534	Mining	10	7			
30	GW060327	-	314180.8	6393442	Mining	9.8	6.7	0-500		
31	GW200829	20BL172237	308641	6393376	Monitoring	36				
32	GW200625	20BL168940	310901	6393375	Mining	270				
33	GW060326	-	314104.3	6393348	Mining	9.8	6.7			

Figure 6 Ref.	Bore No.	Licence No.	Location		Use	Depth (m)	SWL (bgl)	Salinity (ppm)	Yield (L/s)	Aquifer
			mE	mN						
34	GW200828	20BL172237	310061	6393206	Monitoring	11.5				
35	GW060364	-	311636.3	6392808	Mining	5.1				
36	GW043676	-	311479.9	6392805	Test	10.6				
37	GW200830	20BL172240	313335	6392745	Monitoring	16.8				
38	GW037999	-	311481.6	6392713	Irrigation	13.7				
39	GW060365	-	311690.8	6392686	Irrigation	6.6				
40	GW200624	20BL168939	310165.9	6392650	Dewatering	260	6			
41	GW060366	-	311195.9	6392646	Irrigation	5.2				
42	GW038000	-	311457.3	6392620	Irrigation	9.4				
43	GW037998	-	311589.4	6392530	Irrigation	10.9				
44	GW043675	-	311432.9	6392527	Test	8.5				
45	GW043674	-	311302.6	6392525	Test	8.2				
46	GW060329	-	311903.5	6392474	Mining	6.4				
47	GW043673	-	311486.3	6392467	Test	9.4				
48	GW060363	20BL132753	311697.8	6392317	Mining	6.3				
49	GW200361	20BL170638	311832.9	6392209	Test	0	3.12			
50	GW060330	-	311726.7	6392163	Mining	6.2	3.8	0-500		
51	GW200827	20BL172237	312505	6391469	Monitoring	9				
52	GW017462	20BL008224	315339.2	6391460	Farming	0				
53	GW200634	20BL168999	311470	6391252	Monitoring	20		13000		
54	GW200635	20BL168999	311659	6391236	Monitoring	20		23300		
55	GW200638	20BL168999	311452	6391103	Monitoring	20	5.18			
56	GW200637	20BL168999	311662	6391094	Monitoring	15	8.45	17900		
57	GW200636	20BL168999	311749	6391078	Monitoring	20		4790		
58	GW200641	20BL168999	311761	6390921	Monitoring	20	7.01	1210		
59	GW200640	20BL168999	311638	6390920	Monitoring	50		1210		Coarse Sand
60	GW200639	20BL168999	311455	6390889	Monitoring	20				
61	GW065117	-	311153.9	6390735	Irrigation	6				
62	GW200642	20BL168999	311696	6390688	Monitoring	20	15.12	6230		
63	GW200643	20BL168999	311454	6390685	Monitoring	15				
64	GW066606	-	311207.2	6390674	Domestic	2.5				
65	GW078574	20BL167170	309174.3	6390605	Farming	12				
66	GW078055	-	310104.9	6390490	Test	198.5		1660	3-May	
67	GW080502	20BL168017	308897	6390160	Mining	250	105			Coarse Sand

Figure 6 Ref.	Bore No.	Licence No.	Location		Use	Depth (m)	SWL (bgl)	Salinity (ppm)	Yield (L/s)	Aquifer
			mE	mN						
68	GW078577	20WA208559	309968.7	6389973	Domestic	10				
69	GW078576	20BL167172	309763.7	6389784	Farming	7				Gravel, Shale Grey Siltstone, Sandstone Conglomerate
70	GW078575	20BL167171	309504.8	6389687	Farming	12				
71	GW200834	20BL172257	313695	6389546	Monitoring	15				Shale, coal, fractured, with fragments of quartz
72	GW200833	20BL172255	311340	6389530	Monitoring	54				Fractured Shale, Coal

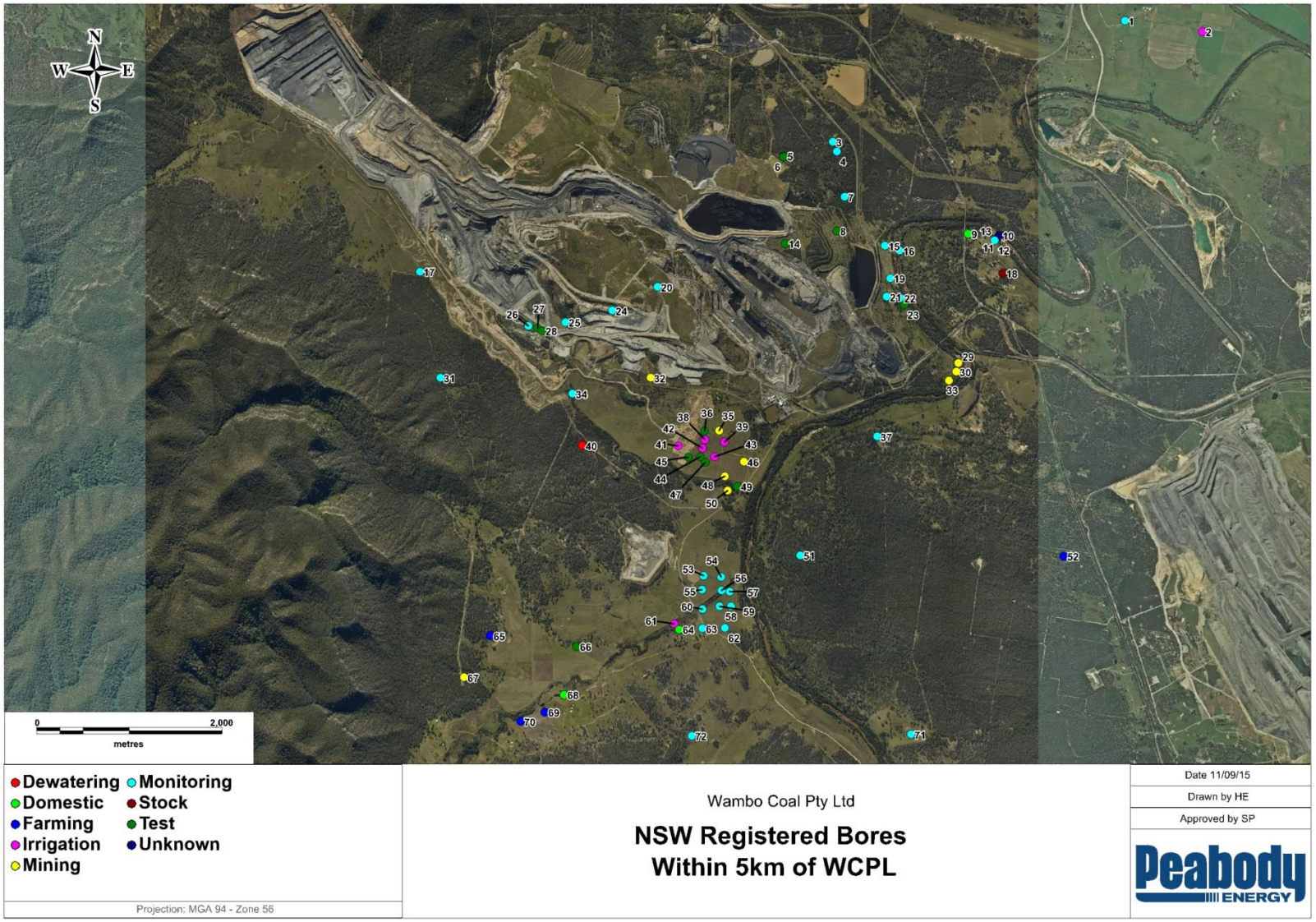

Figure 6: NSW Bore Database Search Results

2.1.5.2 Groundwater Dependent Ecosystems

The potential vegetation GDEs within the vicinity of Wambo have been mapped by BOM in the Groundwater Dependant Ecosystem Atlas. They include ecosystems that rely on the surface presence of groundwater and ecosystems that rely on the subsurface presence of groundwater.

Ecosystems that potentially rely on the surface presence of groundwater include various vegetation types include:

- Grey Box-Red Gum-Grey Ironbark.
- White Box-Ironbark-Red Gum.
- Hunter Roughbarked Apple-Red Gum.
- Roughbarked Apple-Forest Oak.
- Grey Gum - Grey Myrtle.
- Yellow Bloodwood-Stringybark.
- Yellow Bloodwood-Narrowleaved Apple.
- Blackbutt-Sydney Peppermint-Smoothbarked Apple.
- Grey Gum-Scribbly Gum.
- Grey Gum-Stringybark-Apple.
- Turpentine-Oak-Myrtle.

The Wollombi Brook and the Hunter River were also identified in the search of the Groundwater Dependant Ecosystem Atlas as being GDEs. It is considered that all or parts of these communities are potentially GDEs. The mapped locations of potential GDEs generally correspond with the surrounding watercourses, the neighbouring national park or the Remnant Woodlands Enhancement Program (RWEP) areas.

2.2 Existing Monitoring and Management

2.2.1 Mining History

Substantial coal mining activity has occurred historically and is continuing currently in the vicinity of Wambo, by a number of companies, with development across several coal seams. Coal is extracted by means of both underground and open cut mining methods. Coal mines neighbouring Wambo include United Colliery to the north and east of Wambo, Mt Thorley Warkworth to the south-east, and a number of open cut and underground mines to the north and east within the Hunter Valley Operations (**Figure 3**).

Open cut mining at Wambo commenced in 1969. During the 1970's1970s development consents were issued for a range of open cut and underground mining operations. The Whybrow, Redbank Creek, Wambo and Whynot Seams have primarily been mined by open cut methods at the WCPL Coal Mine. The Wambo Seam was also mined for a short period in the Wambo No. 1 Underground Mine however was abandoned due to hydrological issues (Australian Groundwater Consultants Pty Ltd (AGC), 1989). The Whybrow Seam was also mined from the Ridge Underground in this early period.

The Wollemi Underground Mine commenced production in 1997 and was placed under care and maintenance in October 2002 after the available longwall reserves were exhausted. Open cut operations were suspended between March 1999 and August 2001. Following the closure of the Wollemi Underground Mine in October 2002, open cut operations were expanded to maintain an overall production rate of 3 Mtpa of product coal.

Development of the North Wambo Underground Mine commenced in November 2005, with longwall operations commencing in October 2007. Underground mining has occurred both above and below the Wambo Seam currently being mined by WCPL in the NWU Mine.at North Wambo Underground Mine. The North Wambo Underground Mine is due for completion in 2016. The adjacent United Colliery mined the lower Arrowfield Seam until 2010 (United Underground Mine).

2.2.2 Groundwater Monitoring Network

Groundwater monitoring data has been collected at Wambo since 1994. The groundwater monitoring network currently consists of standpipe monitoring bores installed in the alluvial groundwater sources and the Permian groundwater sources. The bores are generally monitored bi-monthly for groundwater levels and quality (pH and electrical conductivity [EC]), although there are some bores that contain a water level logger that continuously monitors groundwater levels.

Four vibrating wire piezometers have also been installed to monitor water levels in the Permian measures. These piezometers are downloaded on a quarterly basis.

An additional four bores have hydrostatic level transducers fitted to monitor water levels in real time. This data is monitored by the SCADA system and any rise in level outside normal levels is communicated via alarm emails sent to distribution lists of appropriate personnel.

Wambo have also been monitoring standing water levels and quality in a number of private bores since 2005.

The groundwater monitoring network includes a number of bores that are part of the United Colliery's monitoring network.

Details of the groundwater bores at Wambo are summarised in **Table 6** and locations are shown in **Figure 7**.

Table 6: Groundwater Monitoring Bore Details

Bore	Lithology	Easting	Northing
Wambo Monitoring Network			
P106	Wambo Creek Alluvium	311518	6391084
P109	Wambo Creek Alluvium & Underlying Interburden	311215	6390768
P114	Wambo Creek Alluvium	311205	6391288
P116	Wambo Creek Alluvium	311057	6391293
P202	Whybrow Interburden	311852	6391288
P206	Whybrow Interburden	311772	6391293
P301	Whybrow Interburden	309360	6391467
P315	Stony Creek Alluvium/Regolith	309091	6391852
GW02[1]	Wambo Creek Alluvium	309109	6389680
GW08	North Wambo Creek Alluvium	311793	6392268
GW09	North Wambo Creek Alluvium	311644	6392565
GW11[1]	Wambo Creek Alluvium	309228	6389699
GW12	Stony Creek Alluvium / Whybrow Interburden	309841	6391056
GW13	Wollombi Brook Alluvium	313810	6388990
GW14[2]	Regolith	312478	6391358
GW15	Wollombi Brook Alluvium	313164	6392807
GW16	North Wambo Creek Alluvium	306641	6396034
GW17	North Wambo Creek Alluvium	306895	6396048
GW18[2]	North Wambo Creek Alluvium	310061	6393206
GW19[2]	Alluvium/Whybrow Interburden	308550	6394648
GW20[3]	North Wambo Creek Alluvium, Whybrow Seam, Redbank Seam, Wambo Seam	305762	6397717
GW21	Whybrow Coal Interburden	308454	6393439
GW22	Whybrow Coal Interburden	310548	6389505
N2[3]	Permian Overburden, Whybrow Seam, Redbank Creek Seam, Wambo Seam	308663	6393376
N3[3]	Permian Overburden, Whybrow Seam, Redbank Creek Seam, Wambo Seam	308315	6394575

Bore	Lithology	Easting	Northing
N5[3]	Permian Overburden, Whybrow Seam, Redbank Creek Seam, Wambo Seam	306755	6395960
BH2A[4]	Whybrow Seam	308870	6390138
BH2[4]	Whybrow Seam	308871	6390095
BH4C[4]	Whybrow Seam	309319	6391070
BH1F	Whybrow Seam	310144	6391552
BH1G	Whybrow Seam	310104	6391551
WAMBORE SOUTH	Wambo Seam	311815	6392555
WAMBO-03[4]	Wambo Seam	311699	6392752
United Colliery Monitoring Network			
P1	Coal Measure Overburden	312198.64	6395839.7
P3	Blakefield Seam	313411.79	6395006.3
P11	Blakefield Seam	312727.99	6395461.9
P16	Wollombi Brook Alluvium	313479.53	6394654.9
P20	Wollombi Brook Alluvium	313638.76	6394166.4

Note:

1. Private Bores
2. GW14 has been dry since December 2011. GW18 has been dry since October 2010 and GW19 has been dry since monitoring began in 2009.
3. Contains a Vibrating Wire Piezometer (VWP).
4. Contains hydrostatic level transducers (monitored by SCADA system)
5. A number of alluvial bores are also screened within the underlying interburden.

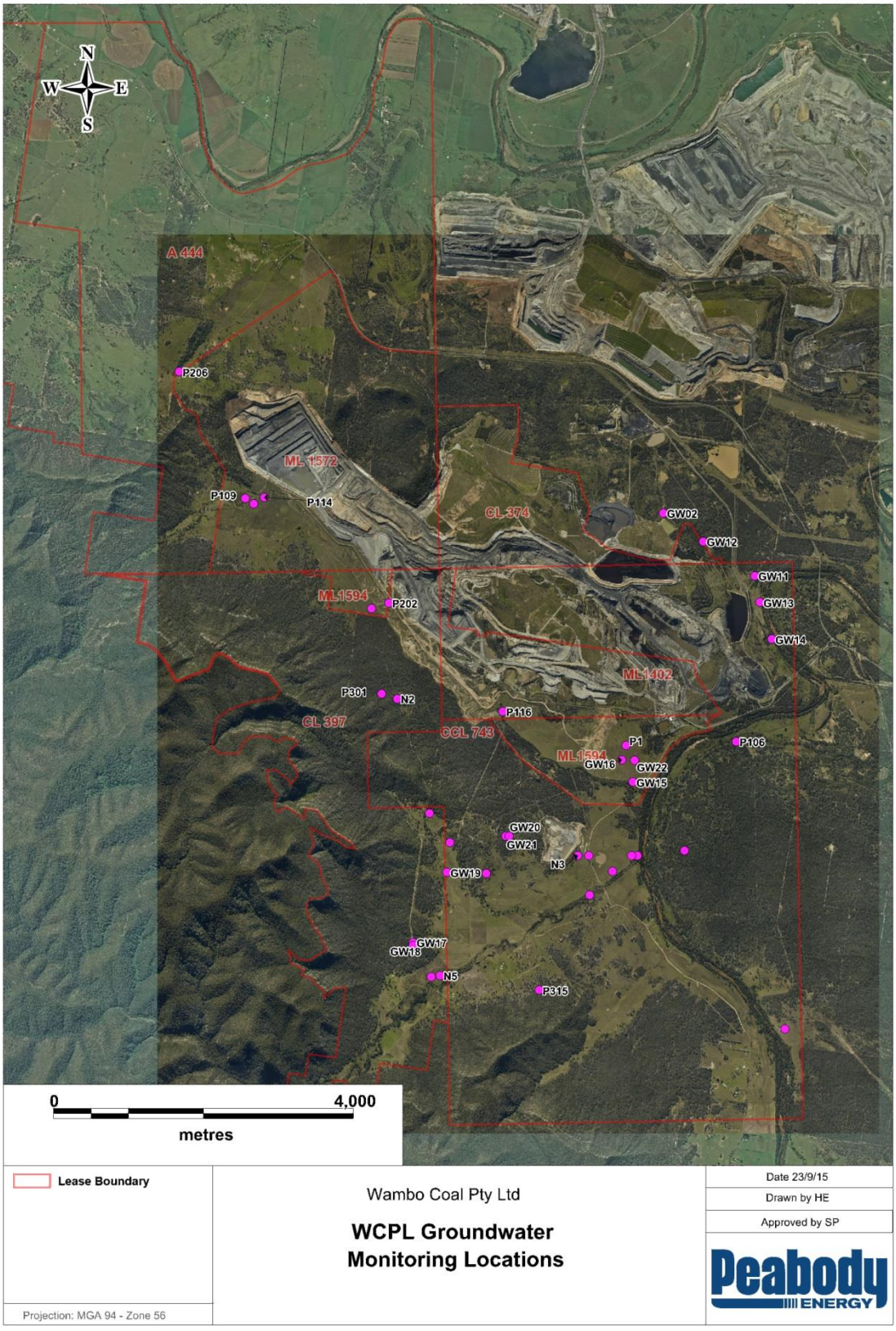

Figure 7: Wambo Groundwater Monitoring Bore Locations

2.2.3 Review of Existing Data

2.2.3.1 Alluvial Water Sources

Most groundwater levels at Wambo have been recorded manually and the limit of reading of the measuring tape is considered to be 10 mm. Therefore, groundwater monitoring is unlikely to detect changes in groundwater level of less than 10 mm at a particular bore from one monthly monitoring round to the next.

A HARTT (Hydrograph Analysis: Rainfall and Time Trends) analysis has been undertaken for each alluvial dataset (up to June 2014) to establish the relationship between groundwater levels and rainfall and detect underlying trends in groundwater level that are independent of rainfall. The HARTT statistical output for each alluvial hydrograph is given in **Table 7**. The analysis also includes the bores that are screened across alluvium and interburden.

Table 7: HARTT Analysis Results for Shallow Monitoring Bores

Bore	R^2	Rainfall Coeff. *a* (m/mm)	P rain	Time Coeff. *b* (m/month)	P time	*c* (m)
P106	0.400	0.006	0.000	-0.005	0.365	54.751
P109	0.587	0.003	0.000	-0.002	0.446	58.690
P114	0.734	0.003	0.000	-0.004	0.005	57.173
P116	0.541	0.000	0.483	0.015	0.000	52.859
P202	0.254	0.001	0.273	0.010	0.001	52.021
P206	0.802	0.003	0.001	0.031	0.000	40.476
P301	0.149	0.000	0.950	-0.015	0.013	77.220
P315	0.313	0.005	0.002	-0.003	0.671	89.304
GW02	0.411	0.005	0.000	-0.012	0.000	79.447
GW08	0.643	0.000	0.273	-0.015	0.000	56.869
GW09	0.811	0.000	0.241	-0.024	0.000	64.339
GW11	0.601	0.003	0.000	0.005	0.111	75.982
GW12	0.765	0.010	0.004	-0.169	0.000	82.760
GW13	0.354	0.012	0.002	-0.113	0.010	65.201
GW15	0.360	0.002	0.006	-0.005	0.307	51.836
GW16	0.701	0.011	0.000	-0.064	0.000	108.256
GW17	0.660	0.011	0.000	-0.050	0.001	102.559
GW18	0.988	0.020	0.014	-0.581	0.006	78.010
P16	0.367	0.001	0.000	-0.008	0.000	53.445
P20	0.388	0.002	0.000	-0.017	0.000	55.512

The R^2 value of the HARTT regression line gives a measure of the quality of fit of the non-linear regression line to the observed hydrograph. This value was greater than 50% for 12 of the 22 alluvial hydrographs analysed, indicating that over half of the hydrographs can be reasonably modelled by the HARTT variables (CRD and linear time trends) alone. A lower R^2 value indicates that the bore is situated at a location where the hydrograph cannot be adequately modelled by the HARTT variables and that other factors are affecting groundwater levels.

The p-value for the rainfall variable *a* is less than 0.05 for 17 of 22 bores, indicating that there is a significant relationship between groundwater level and CRD at most alluvial monitoring locations. The rainfall coefficient suggests that alluvial groundwater levels generally respond by 1 – 10 mm per mm of CRD (or atypical rainfall).

The p-value for the time variable *b* is less than 0.05 for the datasets of 17 of the 22 alluvial bores at Wambo, indicating statistically significant linear time trends (independent of rainfall) in groundwater levels at these locations. Where the p-value is greater than 0.05, time trends are statistically insignificant and the time coefficient *b* cannot be relied upon to describe historical trends or predict future groundwater levels.

Of the 17 bores displaying statistically significant time trends, only three indicated an increasing trend. As shown in **Figure 7** these three bores (P116, P202 and P206) are all located near the confluence of Wambo Creek and Wollombi Brook. Bores P202 and P206 are screened within the Whybrow Seam interburden. It is considered that recovering water levels within the underlying previously mined Homestead workings and/or seepage from the Wambo South Water Dam may be attributable to these increasing trends.

The decreasing trends in groundwater levels at a number of the alluvial bores may be attributable to mining related activities. The decreasing trend in groundwater levels in GW18 is most likely due to the approved impacts associated with the Wambo open cut operations and the diversion of North Wambo Creek. The decreasing trends in groundwater levels within North Wambo Creek alluvium at bores GW16 and GW17 are most likely attributable to the open cut operations at Wambo. Decreasing trends in lower North Wambo Creek alluvium at GW08 and GW09 may be attributable to upstream impacts as well as underlying secondary extraction within the United Colliery mine, recent dewatering operations in the historic Wambo No.1 bord and pillar workings and/or North Wambo Underground Mine. An investigation has commenced and is outlined in **Section 4.4**.

Minor decreasing downward trends in groundwater at bores P16, P20 and GW13 within Wollombi Brook alluvium are less likely to be attributable to mining operations. The HARTT regression for these bores has a lower R^2 value which suggests that other recharge or discharge mechanisms may be affecting these locations.

Dewatering of the old Homestead Underground Mine via dewatering bores 2 and 2A may be responsible for the slight decreasing trend in groundwater levels within Wambo Creek alluvium at GW02. It is noted however that there is no statistically significant trend at adjacent bore GW11.

Significant decreasing trends in groundwater levels at GW12 and P301 (screened in Whybrow seam interburden) are likely related to mining within the North Wambo Underground Mine and/or dewatering of the old Homestead workings. HydroSimulations (2014) predicted cumulative drawdowns greater than 40 m in the Whybrow Seam overburden in the vicinity of these bores.

Time series plots of groundwater pH and EC reported at alluvial monitoring bores at Wambo have been prepared and are shown in GHD (2014). Based on a visual assessment of the time series plots, EC appears to be increasing at many bores for the period prior to June 2007 while there appears to be a falling trend in EC at most monitoring locations post 2007. This may be attributable to increased rainfall from 2007.

There are a number of bores where EC has recently increased and this is potentially attributable to reduced rainfall and/or interaction with mine water from the Homestead workings or seepage from Wambo South Water Dam. Between February 2011 and June 2014 at monitoring bore P114, EC has increased from below 1,000 microSiemens per centimetre (µS/cm) to almost 7,000 µS/cm. This bore is located to the west of Wambo South Water Dam. Between July 2011 and October 2013 average EC in the Wambo South Water Dam was 7350 µS/cm (WorleyParsons 2014). This indicates the increase in EC may be due to seepage from this water storage, which has now been drained. An investigation has

commenced and is outlined in **Section 4.4**. Results from this investigation will be reported in the Annual Review (**Section 6.2**).

The variation in EC over the same time period at neighbouring alluvial bore P116 indicates a much smaller increase in EC that is within the range reported prior to construction of the Wambo South Water Dam, while EC at alluvial bore P106 and Whybrow Seam interburden bore P206 has been steady over the same time period. At Whybrow Seam interburden bore P202 groundwater EC has increased from 3,490 µS/cm in October 2011 to 6,610 µS/cm in June 2014.

pH is consistently between 6 and 8 at the majority of alluvial monitoring locations.

A statistical summary of alluvial groundwater levels and quality is shown in **Table 8**, including the maximum, minimum, median and 10th and 90th percentiles. This table includes the bores screened within both alluvium and underlying interburden. Wambo are currently collecting baseline data for GW18 and will develop appropriate criteria for this bore when sufficient data is available.

Table 8: Bore Groundwater Level and Quantity

Bore	pH					Conductivity (µS/cm)					Depth to Groundwater (mBTOC[1])				
	Min	Max	Median	10th	90th	Min	Max	Median	10th	90th	Min	Max	Median	10th	90th
P106	6.2	8.6	6.9	6.7	7.9	391	1072	593	454	941	4.7	15.1	9.3	6.6	10.7
P109	6.2	8.7	6.8	6.5	7.6	431	1164	616	525	694	4.3	9.0	6.1	4.6	6.7
P114	6.3	8.7	7.1	6.5	7.8	509	7180	611	550	6141	5.2	8.1	6.7	5.4	7.6
P116	6.1	8.0	7.1	6.6	7.5	454	6570	1710	673	5972	4.2	8.3	6.3	4.8	7.3
P202	6.4	7.9	7.3	6.7	7.7	2650	10520	4687	3552	8172	3.3	8.7	8.8	7.8	9.6
P206	6.8	8.6	7.6	7.3	8.1	213	2672	2410	2160	2630	12.9	22.8	18.8	16.1	21.6
P301	5.8	7.6	6.6	6.1	7.2	461	9270	6430	2420	9199	7.2	19.9	13.2	11.1	15.5
P315	3.7	7.7	6.4	6.0	7.4	257	758	405	298	552	3.8	9.4	7.6	4.4	9.1
GW02	6.3	8.4	7.0	6.7	7.4	439	908	588	481	715	4.7	9.5	6.8	5.8	8.5
GW08	5.7	8.4	7.1	6.8	7.7	1371	2248	1864	1749	1972	2.8	5.9	3.4	3.0	5.1
GW09	6.5	8.8	7.7	7.2	8.4	287	1937	1140	420	1800	2.5	7.1	3.7	3.0	6.3
GW11	6.6	8.2	7.1	6.8	7.5	372	691	529	433	592	3.7	7.6	4.8	4.0	6.5
GW13	6.8	7.3	7.0	6.9	7.1	575	4820	3630	3240	4370	4.8	12.9	5.1	4.8	5.4
GW15	6.3	7.5	6.9	6.7	7.2	521	879	627	599	730	10.0	11.4	10.9	10.4	11.1
GW16	7.1	8.1	7.5	7.3	7.8	294	889	666	454	823	4.3	9.7	7.2	4.9	8.9
GW17	6.9	7.6	7.1	7.0	7.3	4610	5480	5160	4812	5304	6.9	11.8	10.9	8.3	11.5
P16	5.1	8.1	7.4	7.0	7.7	6700	12100	9545	7697	10832	6.3	8.2	7.4	7.1	7.8
P20	5.5	8.1	7.3	7.0	7.6	6500	12390	9515	8504	10625	5.4	8.1	7.8	7.1	8.2

1. mBTOC = metres below top of casing

2.2.3.2 Permian Groundwater Sources

According to Ferdowsian et al. (2001), the HARTT method is generally limited to the analysis of relatively shallow groundwater from unconfined aquifers. Therefore, a visual assessment of hydrographs from deeper bores was undertaken to identify existing responses of Permian groundwater sources to mining at Wambo. Hydrographs for deeper monitoring bores at Wambo are shown in GHD (2014).

The Permian strata monitored are the Blakefield Seam and the Whybrow Interburden. The monitoring data for these aquifers indicate that generally there is a decreasing trend in groundwater levels in the deeper strata.

Groundwater bore P3 in the Blakefield Seam experienced a steady drop in groundwater level from the commencement of monitoring in December 2005 to August 2009. Groundwater bore P11 also in the Blakefield Seam appears to have experienced a gradual decline in groundwater levels. Groundwater levels have stabilised since September 2010 and any variation since this time is possibly attributable to natural variation in groundwater levels.

Groundwater levels at bore GW21 in the Whybrow Seam have been slightly decreasing since August 2011. Groundwater levels at bore GW22 in the Whybrow seam interburden have been relatively stable since monitoring commenced with no clear depressurisation evident.

Available Permian data indicates that post 2007, EC has been very stable with little variation. pH is reasonably constant with minimum and maximum recorded values ranging between 5.9 and 8 at all locations.

2.2.4 Site Water Balance

A site water balance is undertaken annually to document the management of water at Wambo in accordance with Schedule 4, Condition 25 of DA 305-7-2003. Summary results are reported in the Annual Review report which is available on the Peabody Energy Australia website (http://www.peabodyenergy.com/content/398/Australia-Mining).

2.2.5 Hydrogeological Model

A hydrogeological model has been developed for Wambo and is detailed in HydroSimulations (2014).

The hydrogeological model predicts the lateral zone of impact of depressurisation of aquifers due to current and future mining activity. In addition the hydrogeological model predicts groundwater inflows into the underground workings over the life of the mine.

Periodic re-calibration of the model will be undertaken based on observed piezometric heads and groundwater inflow data.

2.2.6 Groundwater Users

HydroSimulations (2014) predicted that no privately owned registered bores in alluvium or regolith would incur more than 0.5 m incremental drawdown due to the North Wambo Underground and no bores would experience more than 2 m cumulative drawdown.

Limited information is available on three privately owned bores in the vicinity of Wambo (**Figure 6**). Depending on the extraction depth and nature of bores, these bores may experience more than 2 m cumulative drawdown as a result of the approved Wambo operations.

3.0 Groundwater Triggers

Groundwater triggers for both groundwater levels and quality have been developed using statistical analysis of the baseline data (**Section 2.2.3**) and data acquired to 2014, and the predicted effects presented in the EIS and subsequent EAs.

The trigger values are not assessment criteria but are used to initiate investigations into the groundwater levels or groundwater quality as reported by the monitoring program. Details of the monitoring program are included in **Section 4.0**. Reporting requirements for this GWMP are detailed in **Section 6.0**.

Triggers will be used to determine if the groundwater impact investigation procedure or Trigger Action Response Plan (TARP) in the SGWRP should be initiated. The SGWRP provides a protocol for the investigation, notification, and mitigation of identified exceedances of these assessment criteria.

3.1 Trigger Values for Groundwater Levels

3.1.1 Alluvial Monitoring Locations

Statistical analysis of groundwater levels in shallow bores has been undertaken in **Section 2.2.3.1**. The results of this analysis indicate that shallow groundwater levels are highly responsive to rainfall.

Trigger values have been adopted for shallow bores where predicted impacts are less than 2 metres. The trigger values adopted are equivalent to the 10th and 90th percentiles of recorded depths to groundwater in the historical dataset (**Table 8**). Groundwater level trigger values are shown in **Table 9**.

Table 9: Shallow Bores Water Level Trigger Values

Bore	Depth to Groundwater (mBTOC[4])	
	Minimum (10th percentile)	Maximum (90th percentile)
P106	6.6	10.7
P109	4.6	6.7
P114	5.4	7.6
P116	4.8	7.3
P202	7.8	9.6
P206	16.1	21.6
P301[1]	NA	NA
P315	4.4	9.1
GW02	5.8	8.5
GW08[2]	NA	NA
GW09[2]	NA	NA
GW11	4.0	6.5
GW12	9.9	12.9
GW13	4.8	5.4
GW15	10.4	11.1
GW16[3]	NA	NA
GW17[3]	NA	NA

Bore	Depth to Groundwater (mBTOC[4])	
	Minimum (10th percentile)	Maximum (90th percentile)
P16	7.1	7.8
P20	7.1	8.2

1. P301 is predicted to go dry by HydroSimulations (2014)
2. Specific trigger levels for GW08 and GW09 have not been established however if GW08 and GW09 do not recover within 12 months of the cessation of dewatering pumping, WCPL may consider installing replacement bores that allow monitoring of the alluvium and underlying Interburden material (for more information see **Section 4.4.1**)
3. GW16 and GW17 are located upstream of the North Wambo Creek Diversion and in close proximity to the approved open cut. There are no groundwater users located in the vicinity of North Wambo Creek upstream of the North Wambo Creek Diversion. Therefore, a trigger level for these two bores is not considered warranted. Monitoring data will be reviewed annually at these bores.
4. mBTOC = metres below top of casing

3.1.2 Chitter Dam and Wambo South Water Dam Monitoring Locations

As outlined in **Section 4.1.6**, WCPL is required to monitor impacts from the Chitter Dam and Wambo South Water Dam.

WCPL will monitor groundwater levels in bores P16 and P20 (Chitter Dam) and P114, P116 and P202 (South Wambo Water Dam) against the trigger levels in **Table 9**. Trigger values for groundwater levels for P114, P116 and P202 have been determined to be minimum and maximum groundwater levels prior to construction of Wambo South Water Dam (pre August 2009) as shown in **Table 9.** It is noted that the Wambo South Water Dam is currently not in use (**Section 3.1.2**).

3.1.3 Permian Monitoring Locations

Given the lack of licensed water supply bores within the coal measures and generally poor water quality (EIS, 2003), no specific management measures are proposed. However groundwater levels and quality are monitored to assist in validation of the groundwater model and review general groundwater behaviour.

Therefore, groundwater level trigger values have not been established for Permian groundwater bores, since it is predicted by HydroSimulations (2014) that levels will fall below pre-mining levels. Hydrographs within these sources will be reviewed annually in combination with a review of subsidence parameters.

Further investigations within these sources are triggered if:

- An adjacent landholder complains about declining groundwater levels in their bore; or
- Higher than predicted inflows are recorded; or
- The groundwater drawdown is greater than predicted.

Groundwater monitoring data from the Permian monitoring bores will be assessed and reviewed as part of the Annual Review (**Section 6.2**). Data will also be used to validate the groundwater model.

3.2 Trigger Values for Groundwater Quality

There is considerable variability in groundwater pH and EC in both alluvial and Permian groundwater sources. In addition the beneficial use category of Permian groundwater and alluvial groundwater along North Wambo and Wambo Creek is limited due to the high EC.

A water quality trigger for EC has been proposed based on the 90th percentile value observed in these bores (refer to statistical summary in **Table 8**). Although ANZECC and ARMCANZ (2000) recommend 80th percentile values as being suitable for trigger values, a trigger would be initiated 20% of the time due to natural causes. Therefore for the trigger to be a meaningful indicator of a possible mining effect, an investigation will not be triggered unless the 90th percentile value is exceeded on three consecutive bi-monthly (i.e. every 2 months) monitoring events (**Table 10**).

As described in **Section 2.2.3.1**, pH is consistently between 6 and 8 at the majority of alluvial monitoring locations. The 10th and 90th percentile values have been adopted as minimum and maximum exceedance values, where an investigation will not be triggered unless the value is exceeded on two consecutive bi-monthly monitoring events (**Table 10**).

Bores P16 and P20 provide suitable indicators near the Chitter Dam. Bores P116, P202 and P206 provide suitable indicators near the South Wambo Water Dam.

Table 10: Shallow Bores Water Quality Trigger Values

Bore	Conductivity (µS/cm)	pH	
	Maximum (Three Consecutive Bi-Monthly Exceedances)	Minimum (Two Consecutive Bi-Monthly Exceedances)	Maximum (Two Consecutive Bi-Monthly Exceedances)
P106	941	6.7	7.9
P114	6141	6.5	7.8
P116	5972	6.6	7.5
P202	8172	6.7	7.7
P206	2630	7.3	8.1
P301[1]	NA	NA	NA
P315	552	6.0	7.4
GW02	715	6.7	7.4
GW11	592	6.8	7.5
GW13	4370	6.9	7.1
GW15	730	6.7	7.2
GW16	NA	NA	NA
GW17	NA	NA	NA
P16	10832	7.0	7.7
P20	10625	7.0	7.6

1. P301 is predicted to go dry by HydroSimulations (2014)
2. GW16 and GW17 are located upstream of the North Wambo Creek Diversion and in close proximity to the approved open cut. There are no groundwater users located in the vicinity of North Wambo Creek upstream of the North Wambo Creek Diversion. Therefore, a trigger level for these two bores is not considered warranted. Monitoring data will be reviewed annually at these bores.

3.3 Performance Indicators

Specific performance indicators have been developed for the subsidence impact performance measures relating groundwater in Section 3.1.3 of the Extraction Plan for North Wambo Underground Mine Longwalls LW 8 to LW10A (Extraction Plan). For further details of the monitoring conducted to inform the assessment of the extraction of Longwalls 8 to 10A against these performance indicators, refer to Section 3.8 of the Extraction Plan.

The performance indications outlined in the Extraction Plan specific for groundwater are outlined in **Table 11.** The performance indications outlined in **Table 11** will also be used to assess the performance of the Mine against the predicted impacts.

Table 11: Performance Indicators

Performance Indicator
The performance indicators will be considered to have been exceeded if Wambo receive complaints from groundwater users
The performance indicators will be considered to have been exceeded if monitoring data suggests significant divergences away from the modelled groundwater.
The performance indicators will be considered to have been exceeded if pumping of water from the North Wambo Underground Mine roadways requires regular pumping at rates higher than normal.
The performance indicators will be considered to have been exceeded if the groundwater levels in alluvial bores exceed the groundwater level criteria listed in **Table 9** of the GWMP
The performance indicators will be considered to have been exceeded if the groundwater quality in alluvial bores exceeds the groundwater quality criteria listed in **Table 10** of the GWMP

WCPL will report on progress against these performance indicators in the Annual Review (**Section 6.2**). In the event that a complaint is received relating to groundwater, it will be handled in accordance with the complaints management protocol (**Section 5.0**). Contingency plans for unpredicted groundwater impacts are discussed in the Extraction Plan and the SGWRP.

4.0 Groundwater Monitoring Program

The purpose of this GWMP is to monitor and manage groundwater quality and levels to detect potential impacts on surrounding groundwater users, assess the performance of the Mine against the performance indicators and to ensure that relevant legislative and policy requirements are met. Monitoring locations, parameters, frequency and methodology of monitoring are outlined in this section.

Data collected will:

- Enable verification and refinement (where necessary) of the hydrogeological model developed for Wambo;
- Be used in the continued development of groundwater investigation triggers (**Section 3.0**); and
- Provide input to annual reviews of groundwater monitoring data (**Section 4.4**).

4.1 Monitoring Network, Parameters and Frequency

Ongoing groundwater monitoring requirements at Wambo are as follows:

- Groundwater monitoring bores to monitor groundwater sources above and in close proximity to mine workings;
- Monitoring of potential groundwater leakage from Wollombi Brook and associated alluvial aquifers;
- Monitoring of groundwater inflows to underground and open cut mining operations; and
- Monitor for potential water loss from the Chitter Dam and Wambo South Water Dam, including potential migration of sub-surface water toward Wollombi Brook.

4.1.1 Groundwater Monitoring Bores

Wambo's groundwater monitoring network comprises of purpose constructed monitoring bores (also referred to as piezometers) and water supply bores. The GWMP includes the monitoring of water levels and water quality. **Table 12** provides a summary of WCPL's proposed groundwater monitoring program. Bore locations are described in **Table 6** and shown on **Figure 7 (Section 2.2.2)**.

Table 12: Groundwater Monitoring Program

Monitoring Locations	Parameters Monitored	Lithology Monitored	Monitoring Frequency*
P1, P3, P11	• Depth to water. • EC. • pH. • Temperature.	Alluvium	Bi-monthly [from December 2005]
P16, P20	• Depth to water. • EC. • pH. • Temperature.	Alluvium	Bi-monthly [from December 2005]

Monitoring Locations	Parameters Monitored	Lithology Monitored	Monitoring Frequency*
	• TDS, Na, K, Mg, Ca, Cl, HCO_3, $CaCO_3$, SO_4 and metals (Cu, Zn, Fe, Al, Ni, Mn, Ba, Pb, As, Se).		Annually [from July 2015]
P106, P109, P114, P116	• Depth to water. • EC. • pH. • Temperature.	Alluvium	Bi-monthly [from July 2003]
	• TDS, Na, K, Mg, Ca, Cl, HCO_3, $CaCO_3$, SO_4 and metals (Cu, Zn, Fe, Al, Ni, Mn, Ba, Pb, As, Se).		Annually [from July 2015]
P202, P206	• Depth to water. • EC. • pH. • Temperature.	Shallow Permian, Overburden	Bi-monthly [from July 2003]
	• TDS, Na, K, Mg, Ca, Cl, HCO_3, $CaCO_3$, SO_4 and metals (Cu, Zn, Fe, Al, Ni, Mn, Ba, Pb, As, Se).		Annually [from July 2015]
P301, P315	• Depth to water. • EC. • pH. • Temperature.	Alluvium, Shallow Permian. Overburden	Bi-monthly [from March 2004]
GW02^, GW08, GW09, GW11^	• Depth to water. • EC. • pH. • Temperature.	Alluvium	Bi-monthly [from July 2005]
	• TDS, Na, K, Mg, Ca, Cl, HCO_3, $CaCO_3$, SO_4 and metals (Cu, Zn, Fe, Al, Ni, Mn, Ba, Pb, As, Se).		Annually [from July 2015]
GW12, GW13, GW15, GW16, GW17, GW21, GW22	• Depth to water. • EC. • pH. • Temperature.	Alluvium, Shallow Permian. Overburden	Bi-monthly [from December 2009]
	• TDS, Na, K, Mg, Ca, Cl, HCO_3, $CaCO_3$, SO_4 and metals (Cu, Zn, Fe, Al, Ni, Mn, Ba, Pb, As, Se).		Annually [from July 2015]
GW20, N2, N3, N5	• Groundwater Pressure.	Alluvium, Permian Overburden, Whybrow Seam, Redbank Seam, Wambo Seam	Continuous (downloaded quarterly)
BH2, BH2A, BH4C, Wambo-03	• Depth to Water	Whybrow Seam, Wambo Seam	Continuous (real time)
BH1G, BH1E, Wambore South	• Depth to Water	Whybrow Seam, Wambo Seam	Monthly

Notes: ^ Private Bores
* Bi-monthly = every 2 months

The overall objectives of the GWMP are to establish baseline groundwater quality and water level data and implement a program of data collection that can be utilised to assess potential impacts of mining activities on the area's groundwater resources. From a hydrogeological perspective, the Wambo region is relatively complex. This is due to the various areas of alluvium, proximity to Wollemi National Park and number of historical and current mining developments.

A key component of the GWMP is the establishment of an effective network of long-term monitoring sites that will enable any impacts on groundwater to be readily identified. Particular areas of alluvium that will require monitoring are those associated with Wollombi Brook, Wambo Creek (also known as South Wambo Creek), North Wambo Creek and Stony Creek. Significant underground mining has already been undertaken above a large portion of the proposed underground mining areas and it is possible that depressurisation in such areas may extend above the historical workings.

The GWMP takes into account the existing site groundwater data, both from WCPL and the neighbouring United Colliery, as well as the historical and current mining operations. Furthermore, it incorporates the recommendations of an independent review of WCPL's GWMP in 2008 and the results of the 2008 Geophysical Report for the upper section North WCPL Creek.

Additional monitoring bores may be required in the future as open cut and underground mining is undertaken in new areas. Any additional monitoring locations should target alluvial groundwater and areas where depth of cover above the seam is lowest. Any additional monitoring bores should be installed so that at least two years of monitoring data is collected prior to undermining. All new monitoring bores are to be constructed in accordance with the Minimum Construction Requirements for Water Bores in Australia (NUDLC, 2011).

4.1.2 Decommissioning of Bores

Decommissioning of monitoring bores will be undertaken in accordance with NUDLC (2011) requirements. In most cases, this will involve:

- Removal of above ground casing and monuments.
- Injection of a cement bentonite grout from the base of the bore to the surface with a tremie pipe.

4.1.3 Monitoring Parameters and Frequency

Bi-monthly monitoring of groundwater levels, pH and EC will be undertaken at all standpipe bores in the groundwater monitoring program. Comprehensive analysis of major ions will occur at each standpipe bore annually.

4.1.4 Inflows to Open Cut Pits

As reported in the Site Water Balance (WorleyParsons, 2014), Wambo open cut pits receive inflows from:

- Bates North open cut pit via the old creek alluvial material whenever the adjacent creek flows.

- Seepage into Bates South open cut pit from the Homestead Pits water storage. The Homestead Pits water storage receives underground dewatering.

Metering of daily dewatered volumes from each of the Wambo open cut pits will be undertaken. These dewatered volumes will be incorporated into the site water balance on an annual basis to determine the inflows from groundwater sources, including alluvial aquifers, and to verify whether WCPL holds sufficient groundwater licence entitlements.

4.1.5 Inflows to Underground Workings

The active North Wambo Underground Mine, the Wollemi Drift and the old Homestead underground workings are currently dewatered.

Dewatering volumes and underground water levels will be recorded on a daily basis during pumping. This data will be incorporated into the site water balance on an annual basis to allow calculation of groundwater inflows including loss of groundwater from alluvium and to verify whether WCPL holds sufficient groundwater licence entitlements.

Where the annual assessment for mine inflows to the North Wambo Underground Mine exceeds the peak estimate predicted by HydroSimulations (2014) (375 ML/year) by 50% or more (that is more than 563 ML/year), WCPL will:

- Investigate if there is a change in the predicted take of water from the Lower Wollombi Brook Water Source from mining related activities;
- Where there is an increased take from the Lower Wollombi Brook Water Source, investigate any influence on a low flow cease to pump criteria specified in the HUA WSP;
- Define the mine inflow volume value triggering this response procedure; and
- Submit a report summarising the assessment to DPI Water.

WCPL must notify DPI Water as soon as practicable on becoming aware of any take of water in excess of its licensed entitlement.

4.1.6 Chitter Dam and Wambo South Water Dam Monitoring Program

In accordance with Consent Condition 34(e), Schedule 4 of DA305-7-2003, WCPL has expanded the GWMP to investigate and monitor potential water loss from the Chitter Dam and Wambo South Water Dam, including potential migration of sub-surface water toward Wollombi Brook.

To detect potential sub-surface water loss from the two dams, WCPL will monitor existing groundwater monitoring bores P16, P20, P114, P116 and P202 and surface water quality of both dams. Water quality analysis will include annual analysis of major cations (sodium, potassium, magnesium and calcium) and major anions (chloride, sulphate and alkalinity) in addition to bi-monthly monitoring of pH and EC. Water chemistry and water levels will be analysed to identify evidence of connection between dams and the shallow bores.

It is noted that Wambo South Water Dam is currently not in use for the period of secondary extraction for Longwall 9, Longwall 10 and Longwall 10A at the North Wambo Underground Mine. Wambo South Water Dam has been drained as far as practical since January 2015.

Wambo South Water Dam can only be recommissioned after secondary extraction has been completed following receipt of relevant approvals from the NSW Dams Safety Committee.

If, once the dam is recommissioned, the monitoring data from groundwater monitoring bores P16, P20, P114, P116 and P202 indicates that the dam is potentially leaking, WCPL will:

- Notify the relevant authorities, including the NSW Dams Safety Committee;
- Drain the dam as far as practical;
- Engage a suitably qualified person to undertake a technical assessment of the dam to determine the source and nature of the leak and develop an action plan to address the issue; and
- Investigate the risk of potential impact on water quality in Wollombi Brook, including undertaking necessary water quality testing as required.

4.2 Methodology

As specified in DIPNR (2003), groundwater monitoring will be undertaken in general accordance with 'A Practical Guide for Groundwater Sampling' (Jiwan & Gates, 1992), although it is recommended that low flow sampling techniques be used for purging and sampling (rather than bailers or submersible pumps) to minimise aquifer disturbance and reduce the volume of groundwater extracted during sampling.

In general, the groundwater monitoring methodology will include the following:

- Gauging of groundwater levels prior to purging.
- Purging of monitoring bores using a low flow peristaltic pump. To limit the disturbance of possible sediments in the base of each bore, the sample tubing at each bore should be lowered to approximately the middle of the screened interval for purging and sample collection.
- Measurement of groundwater field parameters (pH, EC) using a calibrated water quality meter and a flow cell during purging. pH and EC readings should be recorded in the field once they have stabilised.
- If groundwater samples are to be collected, they are to be transferred into suitably preserved laboratory supplied sample containers once field parameters have stabilised.
- All sample containers are to be clearly labelled with sample number, sample location, sample depth and sample date. The sample containers are to be transferred to a chilled esky for sample preservation prior to and during shipment to the testing laboratory. A Chain-of-Custody (CoC) form should be forwarded with the samples to the testing laboratory.
- Decontamination of all non-dedicated sampling equipment between monitoring locations.

4.3 Data Management Procedures

Validated data from the monitoring program will be entered into a digital database by an Environmental Advisor. This renders the data in a form suitable for analysis.

WCPL will record the following details for all groundwater monitoring samples:

- The date(s) on which the sample was taken;
- The point at which the sample was taken; and
- The name of the person who collected the sample.

In the event of an apparently anomalous result, WCPL will conduct a re-test as soon as is practicable to do so.

4.4 Data Review and Investigation

Upon receipt of monitoring results, the following review processes will be undertaken:

- Data will be compared to the specific trigger values where applicable (**Section 3.0**).
- If result(s) do not meet specified trigger values the response procedure will be initiated in accordance with the SGWRP.

WCPL will undertake an annual review of monitoring data to compare groundwater levels and quality to trigger levels. Recorded groundwater levels will also be compared to rainfall to identify trends. Modelled groundwater levels will be compared to monitored data and model re-calibration will be undertaken if necessary.

The annual review of data will also assess for lines of evidence for the seepage of mine water from the Chitter Dam and Wambo South Water Dam towards Wollombi Brook. Results of the review will be included in the Annual Review (**Section 6.2**).

When monitoring results exceed specified trigger values or the annual review identifies groundwater impacts, an investigation appropriate for the situation will be launched to determine the cause. The investigation will include comparison of monitoring results, meteorological patterns, mining activities and changes to land use.

Further details outlining the response procedures for exceedance of trigger values are outlined in SGWRP.

4.4.1 Investigation of Levels in GW08 and GW09

An investigation into the declining water levels in bores GW08 and GW09 has been undertaken to further investigate potential impacts on the North Wambo Creek alluvium in the vicinity of these bores and potential licensing implications (HydroSimulations, 2015a).

The investigation concluded that the drawdown at GW08 and GW09 is due to pumping of water from (dewatering of) the old mine workings. The numerical model which was updated by HydroSimulations in 2015 to assess the South Bates underground operations (HydroSimulations, 2015b) was not optimised at the location of GW08 and GW09, despite being well-calibrated elsewhere.

HydroSimulations (2015a) recommended that the numerical model be updated and calibrated to better replicate shallow groundwater effects in the area around GW08 and GW09, as part of the next groundwater assessment at the mine.

The status of the two bores will also be reassessed as part of the next monitoring review. If GW08 and GW09 do not recover within 12 months of the cessation of dewatering pumping, WCPL may consider installing replacement bores that allow monitoring of the alluvium and underlying Interburden material (HydroSimulations, 2015a).

A preliminary investigation report has been provided to the DP&E and DPI Water.

4.4.2 Investigation of Water Quality in P114

An investigation into the increased EC in shallow bore P114 has been initiated to further investigate the potential for impacts on this bore as a result of possible leakage from Wambo South Water Dam and potential remediation/mitigation measures.

As described in **Section 4.1.6**, Wambo South Water Dam is currently not in use for the period of secondary extraction for Longwall 9, Longwall 10 and Longwall 10A at the North Wambo Underground Mine. Wambo South Water Dam has been drained as far as practical since January 2015. Therefore, any possible leakage mechanism that may have impacted bore P114 may no longer be present.

WCPL will undertake quarterly water quality major ion analysis in P114 and P202 during the period of the investigation.

A preliminary investigation report will be provided to the DP&E and DPI Water by **30 November 2015** outlining the following:

- Detailed statistical review of monitoring data collected prior to and during the investigation period, including the results of water quality major ion analysis.
- Preliminary conclusions regarding the cause(s) of the observed increase in salinity and the potential risks to downstream receptors.
- Options for contingency and remedial measures.
- Process and timetable for any further investigation work.

It is noted Wambo South Water Dam can only be recommissioned after secondary extraction has been completed following receipt of relevant approvals from the NSW Dams Safety Committee.

5.0 Community Complaint Response

All groundwater related community complaints received by WCPL will be recorded within the Community Complaints Register. The E&C Manager will investigate the complaint, which will include, where possible, contacting the complainant within 24 hours to discuss the complaint. A review of the effectiveness of the corrective or preventative actions will be conducted within a month of the complaint and the relevant work procedures updated if required.

Preliminary investigations will commence as soon as practicable upon receipt of a complaint to establish if WCPL is responsible. All efforts will be made to determine the likely causes contributing to the complainants concerns.

WCPL will attempt to address the complainants concerns such that a mutually acceptable outcome is achieved. However, if required, the Independent Dispute Resolution Process would be referred to (**Appendix A**).

Details of all community complaints will be included in the Monthly Environment Monitoring Report. WCPL will retain a copy of the Community Complaints Register for at least four years. The E&C Manager will ensure the latest Community Complaints Register is posted on the WCPL website.

6.0 Review and Reporting

6.1 Review

The performance of the groundwater monitoring program outlined in the GWMP is to be reviewed annually by the E&C Manager. A complete review of the GWMP will occur:

- Every two years;
- When there are changes to consent or licence conditions relating to groundwater monitoring;
- Prior to new underground mining areas being developed;
- Following significant groundwater related incidents at WCPL;
- Following continual exceedance of trigger values;
- Following an independent environmental audit which requires GWMP review; or
- If there is a relevant change in technology, practice or legislation.

The revised GWMP will be re-submitted to the Secretary for approval as required by Condition 30, Schedule 4 of DA305-7-2003.

6.2 Annual Review

Prior to the end of March each year, WCPL will review the environmental performance of the Mine and submit an Annual Review report to the DP&E. This report will:

- Describe the development (including any rehabilitation) that was carried out in the past year, and the development that is proposed to be carried out over the next year;
- Include a comprehensive review of the monitoring results and complaints records of the Project over the past year, which includes a comparison of these results against the:
    - Relevant statutory requirements, limits or performance measures/criteria
    - Monitoring results of previous years; and
    - Relevant predictions in the EA;
- Identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
- Identify any trends in the monitoring data over the life of the Project;
- Identify any discrepancies between the predicted and actual impacts of the Project, and analyse the potential cause of any significant discrepancies; and
- Describe what measures will be implemented over the next year to improve the environmental performance of the Project.

6.3 Bore 20BL132753 Annual Compliance Report

It is a requirement of the licence for bore 20BL132753 that an Annual Compliance Report be submitted to DPI Water. As specified by the bore licence the Annual Compliance Report must:

- Assess compliance with the licence;
- Provide a summary of new bores or pits constructed during that year;
- Provide statistics for the monitoring data collated for each bore for the past water year;
- Summarise contingency events that impacted on groundwater during the last water year, including actions taken to remedy the situation and extra monitoring results; and
- Any recommendations for improvements for the new water year.

6.4 Website Updates

A comprehensive summary of the groundwater monitoring results will be made publicly available at WCPL website:

http://www.peabodyenergy.com/content/404/australia-mining/new-south-wales/wambo-mine)

Information on the website will be updated regularly as required by DA305-7-2003.

WCPL will also ensure that any information relevant to groundwater monitoring is uploaded to the website (and kept up to date). This includes:

- Current statutory approvals;
- Approved strategies, plans or programs required under the DA305-7-2003;
- A community complaints register;
- Minutes of Community Consultative Committee (CCC) meetings;
- Annual Reviews;
- A copy of any Independent Audits and WCPL's response to any recommendations in any audit; and
- Any other matter required by the Secretary.

6.5 Reportable Environmental Incidents

All reportable incidents will be reported via the EPA's Environmental Line on **131 555** by the E&C Manager in accordance with WCPL's Pollution Incident Response Management Plan (PIRMP).

In accordance with the PIRMP, WCPL must notify all relevant authorities of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident in accordance with the requirements of *Part 5.7* of the *POEO Act.*

For all other incidents that do not cause threatening material harm to the environment associated with the Project, WCPL will notify the Secretary and any other relevant agencies

as soon as practicable after WCPL becomes aware of the incident. This includes exceedance of the trigger levels defined in **Section 3.0.**

Within 7 days of the date of the incident, WCPL will provide the Secretary and any relevant agencies with a detailed report on the incident to include:

- The cause, time and duration of the event;
- Where possible the type, volume and concentration of every pollutant discharged as a result of the event;
- The name, address and business hours telephone number of employees or agents of the licensee who witnessed the event;
- The name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;
- Action taken by the licensee in relation to the event, including any follow-up contact with any complainants;
- Implement remediation measures as directed by the Secretary, to the satisfaction of the Secretary;
- Details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and
- Any other relevant matters.

7.0 RESPONSIBILITIES

Table 13 below summarises responsibilities documented in the GWMP. Responsibilities may be delegated as required.

Table 13: Groundwater Monitoring Program Responsibilities

No	Task	Responsibility	Timing
1	Ensure groundwater monitoring is undertaken in accordance with **Section 4.0**.	Environmental Advisor	Bimonthly
2	Assess groundwater monitoring data against relevant trigger levels listed in **Section 3.0**	Environmental Advisor	As required
3	Review GWMP in accordance with **Section 6.0**.	Environmental Advisor	Annually
4	Undertake internal bi-monthly groundwater reporting.	Environmental Advisor	Bimonthly
5	Notify government departments if an incident occurs in accordance with **Section 6.5**	E&C Manager	As required
6	Submit updated GWMP to DP&E.	E&C Manager	As required
7	Groundwater related complaints to be responded to in accordance with **Section 5.0**	E&C Manager	As required
8	Annual Review to include groundwater monitoring results, complaints, mitigation measures undertaken and a review of the monitoring undertaken	E&C Manager	Annually
9	Regulator review to be undertaken of the GWMP	E&C Manager	As required
10	Prepare investigation reports and implementation of corrective actions in accordance with **Section 6.5**	E&C Manager	As required

8.0 References

- Development Consent (DA305-7-2003)
- Development Consent (DA177-8-2004)
- Wambo Development Project Environmental Impact Statement (EIS), July 2003
- Resource Strategies Pty Ltd (2003) Wambo Coal Mine Project Environmental Impact Statement. Report prepared for Wambo Coal Pty Ltd
- Wambo Environment Protection Licence (529)
- Bore licences 20BL173032, 20BL173033, 20BL173034 and 20BL173035
- Water Management Act 2000
- Water Act 1912
- Environmental Planning and Assessment Act 1979
- Hunter Unregulated and Alluvial Water Sources Water Sharing Plan
- North Coast Fractured and Porous Rock Groundwater Sources Water Sharing Plan
- NSW Aquifer Interference Policy
- Aquifer Interference Regulation 2011
- NSW State Groundwater Policy Framework Document 1997
- Bureau of Meteorology (2014) Atlas of Groundwater Dependent Ecosystems.
- DIPNR (2003) Groundwater Monitoring Guidelines for Mine Sites within the Hunter Region. Draft Report, Former NSW Department of Infrastructure, Planning and Natural Resources.
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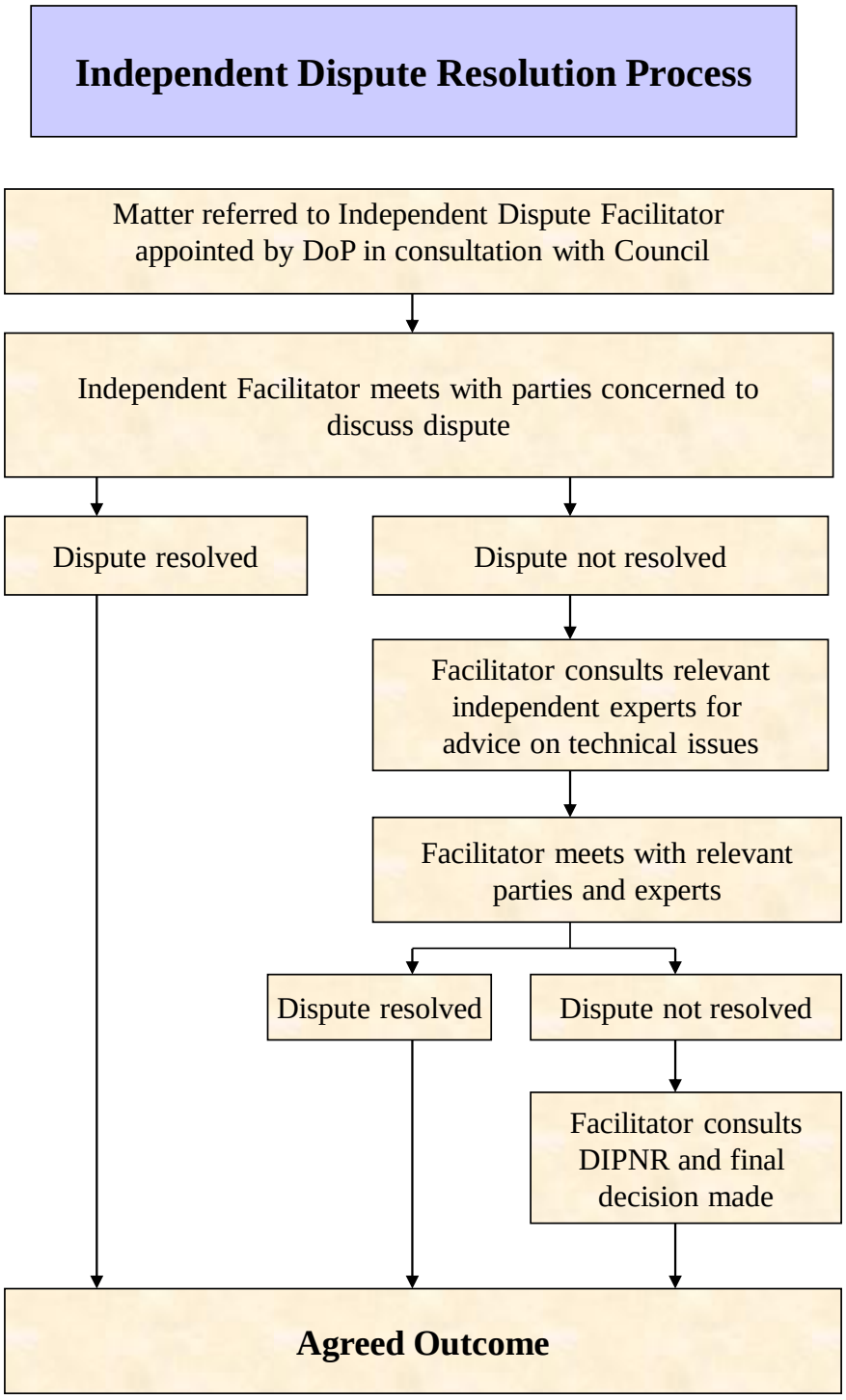
- NUDLC (2011) Minimum Construction Requirements for Water Bores in Australia. National Uniform Drillers Licensing Committee, 3rd Edition.
- Worley Parsons (2014) OPSIM Water Balance Model Initial Investigations – January 2014.

APPENDIX A
INDEPENDENT DISPUTE RESOLUTION PROCESS


Independent Dispute Resolution Process
Matter referred to Independent Dispute Facilitator appointed by DoP in consultation with Council
Independent Facilitator meets with parties concerned to discuss dispute
Dispute resolved
Dispute not resolved
Facilitator consults relevant independent experts for advice on technical issues
Facilitator meets with relevant parties and experts
Dispute resolved
Dispute not resolved
Facilitator consults DIPNR and final decision made
Agreed Outcome

APPENDIX B
CORRESPONDENCE WITH REGULATORY AGENCIES

NSW GOVERNMENT | Planning & Environment

Contact: Scott Brooks
Phone: 6575 3401
Fax: 6575 3415
Email: scott.brooks@planning.nsw.gov.au
Our ref: 305-7-2003

The General Manager
Wambo Mine
PMB 1
SINGLETON NSW 2330

Attention: Steve Peart

Dear Steve

Wambo Coal – Approval of Water Management Plan

Thank you for forwarding the Wambo Water Management Plan and all its parts as required under project approval DA 305-7-2003 for the Department's consideration.

The Water Management Plan is required by Condition 30 Schedule 4 and the following 5 components of the Plan were reviewed:

Site Water Balance (30)
Erosion and Sediment Control Plan (32)
Surface Water Monitoring Program (33)
Ground Water Monitoring Program (34)
Surface and Ground Water Response Plan (35).

The Department has reviewed these plans, and is satisfied that they generally address the requirements set out in the relevant conditions of the project approval. Consequently, I would like to advise you that the Secretary has approved the plans.

These plans come into force on the 30th November 2015 and remains in force until replaced by any future updated approved Plans.

I am aware that DPI Water are expected to comment on the Extraction Plan for the South Bates U/G (Wybrow seam) LW 11-13. Should this comment require significant changes to any component of the Water Management Plan, I ask if these changes could be made and the plans resubmitted for review and approval.

Could you please forward finalised copies of the above plan (preferably in PDF format with a copy of this approval letter appended) for the Department's records by the end of November 2015.

If you require further information or clarification in this matter please contact Scott Brooks on 6575 3401 or by email to scott.brooks@planning.nsw.gov.au.

Yours sincerely

Scott Brooks
Investigations (Lead), Compliance
27 - 11 - 2015
As Nominee for the Secretary, Planning & Environment

From: Scott.Brooks@planning.nsw.gov.au [mailto:Scott.Brooks@planning.nsw.gov.au]
Sent: Wednesday, 21 October 2015 1:22 PM
To: Peart, Steven D
Subject: RE: 3 of 3

Steve,
I had no comment on the EE&SC Plan

Scott

Scott Brooks
Investigations (lead), Compliance
Planning Services, Resources Assessments
Planning & Environment
Suite 14, Level 1, 1 Civic Av
PO Box 3145
Singleton NSW 2330
http://www.planning.nsw.gov.au
E: scott.brooks@planning.nsw.gov.au
P: 02 6575 3401 | | **Office:** 6575 3405
M: 0419 970924 **F:** 02 6575 3415

Please consider the environment before deciding to print this e-mail.

From: Peart, Steven D [mailto:SPeart@peabodyenergy.com]
Sent: Wednesday, 21 October 2015 12:50 PM
To: Scott Brooks
Subject: RE: 3 of 3

Cheers Scott

The only other one was the Erosion and Sediment Control Plan if you had any comments on it.

Thanks again

Steven Peart
Manager: Environment & Community

Wambo Coal Pty Ltd
Peabody Energy Australia
PMB 1, Singleton NSW 2330
Phone: +61 (0)2 6570 2209
Fax: +61 (0)2 6570 2290
Mob: +61 (0)448 082 987
Email: speart@peabodyenergy.com
www.peabodyenergy.com.au
Please consider the environment before printing this email.

From: Scott.Brooks@planning.nsw.gov.au [mailto:Scott.Brooks@planning.nsw.gov.au]
Sent: Wednesday, 21 October 2015 11:46 AM
To: Peart, Steven D
Subject: RE: Wambo Coal_WMP's 1 of 3

Steve,
Comments on the 3 water management plans.

Please note we will need some type of water balance, and the info for the evaporation sprays if you want to use them.

Scott

Scott Brooks
Investigations (lead), Compliance
Planning Services, Resources Assessments
Planning & Environment
Suite 14, Level 1, 1 Civic Av
PO Box 3145
Singleton NSW 2330
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P: 02 6575 3401 | | **Office:** 6575 3405
M: 0419 970924 **F:** 02 6575 3415

Plan	Section	DP&E Comment
Surface and Ground Water Response Plan (WA-ENV-MNP-509.4) Version 8	2.7 North Wambo Creek Diversion Performance Criteria	Given the problems with the NWCD this section should refer to other management plans of have a section referring to erosion and the potential for sediment generation and loss from the system.
Surface Water Monitoring Program (WA-ENV-MNP-509.2) Version 8	1.4.1 Environmental Planning & Assessment Act 1979 (Table 3)	(NOW) Currently called DPI Water
	2.2.3.2 Stream Flow (Table 7)	(No flow data available) Is this because the SWC never runs?
	4.1 Monitoring Network, Parameters and Frequency	(Mine water monitoring is undertaken for operational management purposes only. This data is not reported publicly). This would appear to conflict with Schedule 6 Condition 12 requiring the publishing of monitoring results.
	4.1.5 Riparian Vegetation and Creek Bed Stability	The NWCD has its own rehab management plan. This management plan should refer to it and it may need to be updated.
	4.1.6 Monitoring of Discharge Flows in the North Wambo Creek Diversion	What did NOW ask for. This should be included.
	6.1 Review	(Review every two years) Usually 3 years
Groundwater Monitoring Program (WA-ENV-MNP-509.1) Version 9	2.2.3.1 Alluvial Water Sources	(Investigation into increase in EC) This will need to be reported in the AEMR
	3.1.3 Permian Monitoring	Need to discuss why we monitor if the

Plan	Section	DP&E Comment
	Locations	results cannot result in action.
	3.2 Trigger Values for Groundwater Quality	(Bi-monthly monitoring) This will need to be defined. Twice a month or every 2 months
	4.1.6 Chitter Dam and Wambo South Water Dam Monitoring Program	Need some comment here if the dam will be recommissioned if it is found to be leaking.
	6.1 Review	(Review every two years) Review is normally every 3 years.

From: Joanna Webster [mailto:jwebster@ResourceStrategies.com.au]
Sent: Wednesday, 17 June 2015 1:05 PM
To: Jessie Evans; Brendan Liew
Cc: Joshua Hunt; Howard Reed; Alexander, Micheal G; Peart, Steven D
Subject: RE: Wambo 10A Extraction Plan - NOW comments
Importance: High

Hi Jessie/Brendan,

On behalf of Wambo Coal, please find attached a response to the recommendations made by NSW Office of Water.

Also attached is a revised Groundwater Monitoring Program that has been updated to address the recommendations made by the Office of Water.

Please consider Attachment 3 of the Water Management Plan for North Wambo Underground Mine Longwalls 8 to 10A Extraction Plan to be replaced by the attached revised Groundwater Monitoring Program.

Please don't hesitate to call if you would like to discuss.

Regards

Joanna Webster
Senior Environmental Manager
e jwebster@resourcestrategies.com.au
m 0414 664 532

Resource Strategies Pty Ltd
Suite 2 Level 3, 24 McDougall Street
PO Box 1842
Milton Qld 4064
t 07 3367 0055 f 07 3367 0053
www.resourcestrategies.com.au

From: Jessie Evans [mailto:Jessie.Giblett@planning.nsw.gov.au]
Sent: Thursday, 4 June 2015 8:42 AM
To: Joanna Webster
Cc: Joshua Hunt; Howard Reed; Brendan Liew
Subject: RE: Wambo 10A Extraction Plan - NOW comments

Hi Joanna,

The Department has received comments from NOW in regards to the Wambo LW 8-10A Extraction Plan. I have attached these for your careful consideration and response. NOW has raised a number of issues, and in particular has concerns regarding the Groundwater Management Plan.

Could you please provide a response to NOWs concerns at your earliest possible convenience.

Thanks
Jessie

North Wambo Underground Mine Extraction Plan Longwalls 8 to 10A
Response to NSW Office of Water Comments (Dated 3 June 2015)

NOW Recommendation	Response
Groundwater Management It is recommended with respect to the exceedance of groundwater level triggers: • WCPL must investigate the drivers for declining water levels (rather than omitting bores from the monitoring program when bores go dry). Notification to the Office of Water is required as part of the response procedure within 3 months of such an event.	Five bores are proposed to be removed from the groundwater monitoring program (GW14, GW18, GW19, P5 and P6). Only two samples (August 2011 and December 2011) have been obtained from GW14 since its installation in 2011 (these samples may have been associated with groundwater levels stabilising following drilling). This bore is located to the east of Wollombi Brook and is far removed from mining activities associated with the Wambo Coal Mine. Only one sample (August 2010) has been obtained from GW18. GW19 has been consistently dry since installation and no valid samples have been obtained from this bore. GW18 and GW19 are located immediately downstream and upstream of the North Wambo Creek Diversion, respectively. The alluvial flow in North Wambo Creek has been altered by the historical and existing mining operations including the removal of alluvium across the full width of the channel with consequent desaturation of the adjacent upstream and downstream alluvium associated with the approved and constructed North Wambo Creek Diversion. Bores P5 and P6 have been covered by the approved Wambo Coal Mine waste rock emplacement. WCPL considers removal of these five bores from the groundwater monitoring program is justified as outlined above. Trigger levels are not proposed for a further four bores along North Wambo Creek (GW08, GW09, GW16 and GW17). WCPL has initiated an investigation for bores GW08 and GW09 as outlined further below. Trigger levels will not be developed for these bores until this investigation is complete. GW16 and GW17 are located upstream of the North Wambo Creek Diversion and in close proximity to the approved open cut. There are no groundwater users located in the vicinity of North Wambo Creek upstream of the North Wambo Creek Diversion. Therefore, a trigger level for these two bores is not considered warranted.

NOW Recommendation	Response
• Where the driver for declining shallow bore water levels exceeding trigger levels can not be linked to the prevailing climatic influence or miscellaneous sampling error, additional groundwater modelling is required to re-assess if there is a change in the predicted take of water from the Lower Wollombi Brook Water Source from mining related activities. As part of WCPL's response procedure, a report summarising the assessment is to be submitted to the Office of Water.	WCPL has initiated an investigation into the monitored declining water levels in GW08 and GW09. As described in Section 6.1.3 of the revised GWMP, a preliminary investigation report will be provided to the DP&E and NOW by 30 September 2015. This report will include preliminary conclusions regarding the potential licensing implications and a process and timetable for any further investigation work (including potential additional numerical hydrogeological modelling work).
• Where the updated modelled aquifer interference take of water from the Lower Wollombi Brook Water Source (encapsulating Wambo and North Wambo Creek) exceeds the estimates as predicted in WPCL's Groundwater Impact Assessment by 100% or more, WCPL must re-evaluate the associated ecological impacts and any influence on a low flow cease to pump criteria specified in the relevant WSP. The reference value triggering this response procedure must be clearly documented in the GWMP.	As described in Section 6.1.3 of the revised GWMP, Where the investigation for GW08 and GW09 indicates a revised predicted take from alluvial water sources that exceeds the previous estimates by more than 100%, WCPL would consider other potential associated impacts (e.g. on ecology) and any influence on a low flow cease to pump criteria specified in the HUA WSP.
• The trigger levels in Table 11 of the GWMP outlines a minimum and maximum depth to water level. These values, plus any new bores added to the list, and the bores proposed to be dropped, must be presented in Australian Height Datum.	Table 11 of the GWMP has been revised to include trigger levels presented in Australian Height Datum.
<u>It is recommended with respect to the exceedance of groundwater quality triggers</u> • Appropriate water quality baseline data has not been captured and presented in way that can be used for before and after impact. Salinity data for a number of bores has fluctuated considerably which is not consistent with a more stable groundwater environment. The use of major ion analysis and QA/QC procedures should be reviewed to inform if the salinity measurements reported are accurate and if so the drivers to cause such variability in the results.	The GWMP has been revised to include annual comprehensive analysis of major ions standpipe bores. A description of data management procedures has been included in Section 5.3.2.
• Due to the concerns with the potential for cross aquifer interconnection, water quality performance measures are essential to the impact assessment. Water quality performance measures should be defined and added to the GWMP.	The GWMP has been revised to include groundwater quality trigger levels in Section 5.4.
<u>It is recommended with respect to the exceedance of predicted mine inflows</u> • There is a discrepancy between the GWMP which outlines a monthly measurement and annual assessment of mine inflows, whilst the 'Subsidence Response Strategy' indicates metering of weekly dewatered volumes. It should be consistently reported weekly, in the GWMP as this will improve the understanding of inflow and assist with groundwater management and the triggers for exceedance.	Section 5.2.5 of the GWMP has been updated to clarify that dewatering values are recorded internally on a daily basis (during active pumping). As outlined in the North Wambo Creek Subsidence Response Strategy, these values are reviewed weekly for any indication that pumping rates are higher than normal (which would trigger an investigation). Dewatering values are also reviewed annually (as outlined in the GWMP) to determine the inflows from groundwater sources and to verify whether WCPL holds sufficient groundwater licence entitlements.

NOW Recommendation	Response
• Where the annual assessment for mine inflows exceeds the peak estimate as predicted in WCPL's Groundwater Impact Assessment by 50% or more, WCPL shall: – investigate if there is a change in the predicted take of water from the Lower Wollombi Brook Water Source from mining related activities; – where there is an increased take from the Lower Wollombi Brook Water Source, investigate any influence on a low flow cease to pump criteria specified in the relevant WSP. – define the mine inflow volume value triggering this response procedure within the GWMP. – As part of WCPL's response procedure, a report summarising the assessment is to be submitted to the Office of Water.	Section 5.2.5 of the GWMP has been updated to include the recommended response procedure. The mine inflow volume that would response procedure has been defined in the GWMP (563 ML/annum, which is 50% more than the peak estimate predicted by HydroSimulations (2014) [375 ML/annum] for the North Wambo Underground Mine).
• WCPL must notify the Office of Water as soon as practicable on become aware of any take of water in excess of its licensed entitlement	Section 5.2.5 of the GWMP has been updated to include this statement.
It is recommended with respect to monitoring leakage from dams • The closest bore to South Dam is Piezometer 114 representative of Wambo Creek alluvium. South Dam contains produced water from the mine and P114 shows a sharp rise in salinity to a level on par with water in the dam. This indicates probable leakage occurring from the dam that warrants further investigation. However, as the proponent proposes not to utilise water quality as a performance measures, no direct response is proposed. Significant leakage to the nearby alluvial aquifer could risk a change in the beneficial use of the aquifer. Trigger levels with regard to salinity must be set to investigate and determine if remediation is required.	WCPL has initiated an investigation into the monitored increasing salinity levels in P114. Wambo South Water Dam is currently not in use for the period of secondary extraction for Longwall 9, Longwall 10 and Longwall 10A at the North Wambo Underground Mine. Wambo South Water Dam has been drained as far as practical since January 2015. Therefore, any possible leakage mechanism that may have impacted bore P114 may no longer be present.
A report summarising any special assessment for the above recommendations should be provided within 6 months.	As described in Section 6.1.4 of the revised GWMP, a preliminary investigation report will be provided to the DP&E and NOW by 30 November 2015.
Surface Water Management • The Office of Water recommends the proponent and the Department of Planning and Environment develop a consultation process with affected landholders to address existing and potential degradation which occurs as a result of mining subsidence. This should focus on incorporating natural processes for channel recovery particularly using large timber controls to maintain bed level (bed sills), bank toe protection (timber bank revetment) and creation of scour pools by using 'forced' controls such as engineered log jams as an adjunct to revegetation of both banks of both watercourses.	All land above the North Wambo Underground Mine is owned by WCPL. Therefore there are no other affected landholders associated with the North Wambo Underground Mine Extraction Plan for Longwalls 8 to 10A. Advisian (2015) concluded it is unlikely Wambo Creek and Stony Creek would experience adverse impacts from the North Wambo Underground Mine, and mitigation measures are unlikely to be required. In the unlikely event that any mitigation measures are required, these would be developed in consultation with the Department of Planning and Environment and the NSW Office of Water, and would aim to incorporate natural processes for channel recovery.

ATTACHMENT 4

WAMBO COAL PTY LIMITED
SURFACE AND GROUNDWATER RESPONSE PLAN

WAMBO COAL
SURFACE AND GROUND WATER RESPONSE PLAN

Document No. WA-ENV-MNP-509.4
May 2016

Document Control

Document No.	WA-ENV-MNP-509.4
Title	Surface and Ground Water Response Plan
General Description	Responses to potential surface and ground water impacts at WCPL
Document Owner	Environment & Community Manager

Revisions

Rev No	Date	Description	By	Checked	Signature
0	October 2005	Original Draft	RS	JT	
1	October 2005	Revision 1	RS	JT	
2	November 2007	Revision 2	RS	JT	
3	March 2008	Revision 3	WCPL	JT	
4	October 2009	Revision 4	RS	SW	
5	February 2012	Revision 5	WCPL	SB	
6	September 2014	Revision 6	GHD / WCPL	TF	
7	April 2015	Revision 7	WCPL	TF	
8	September 2015	New management plan format and revision	WCPL/Palaris	SP	
9	October 2015	Revised following receipt of comments from DP&E on Rev 8	WCPL/Palaris	SP	
10	May 2016	Revised following receipt of comments from DPI Water on Rev 8	WCPL	SP	

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LIST OF APPENDICES

1.0 Introduction

1.1 Background

The Wambo Coal Mine (the Mine) is situated approximately 15 kilometres west of Singleton, near the village of Warkworth, New South Wales (**Figure 1**). Wambo is owned and operated by Wambo Coal Pty Limited (WCPL), a subsidiary of Peabody Energy Australia Pty Limited.

A range of open cut and underground mine operations have been conducted at WCPL since mining operations commenced in 1969. Mining under the current Development Consent (DA 305-7-2003) commenced in 2004 and permits both open cut, underground operations and associated activities to be conducted.

The approved run-of-mine (ROM) coal production rate is 14.7 million tonnes per annum and all product coal is transported from WCPL by rail. A summary of the approved Wambo Coal Mine is provided in **Table 1**.

Table 1: Summary of the Approved Wambo Coal Mine

Component	Approved Wambo Coal Mine[1]
Life of Mine	21 years (from the date of the commencement of Development Consent [DA305-7-2003]). 1st March 2025
Open Cut Mining	Open cut mining at a rate of up to 8 Mtpa of ROM coal from the Whybrow, Redbank Creek, Wambo and Whynot Seams
	An estimated total open cut ROM coal reserve of 98 Mt
	Open cut mining operations under current approved MOP
Underground Mining	Underground mining of up to 7.5 Mtpa of ROM coal from the Whybrow, Wambo, Arrowfield and Bowfield Seams. Underground ROM coal reserves are estimated at 114.9 Mt.
Subsidence commitments and management.	The subsidence performance measures listed in Conditions 22 and 22A of the Development Consent (DA305-7-2003).
ROM Coal Production Rate	Up to 14.7 Mtpa of ROM coal
Total ROM Coal Mined	212.9 Mt
Waste Rock Management	Waste rock deposited in open cut voids and in waste rock emplacements adjacent open cut operations
Total Waste Rock	640 million bank cubic metres (Mbcm)
Coal Washing	Coal handling and preparation plant (CHPP) capable of processing approximately 1,800 tonnes per hour (tph)
Product Coal	Production of up to 11.3 Mtpa of thermal coal predominantly for export
CHPP Reject Management	Coarse rejects and tailings would be incorporated, encapsulated and/or capped within open cut voids in accordance with existing Wambo management practices
Total CHPP Rejects	Approximately 29.3 Mt of coarse rejects and approximately 19.4 Mt of tailings
Water Supply	Make-up water demand to be met from runoff recovered from tailings storage areas, operational areas, dewatering, licensed extraction from Wollombi Brook and Hunter River
Mining Tenements	Coal Lease (CL) 365, CL374, CL397, Consolidated Coal Lease (CCL) 743, Mining Lease (ML) 1402, ML1572, ML1594, Authorisation (A) 444, Exploration Licence (EL) 7211.

Note: [1] Development Consent DA305-7-2003 (as modified November 2015)

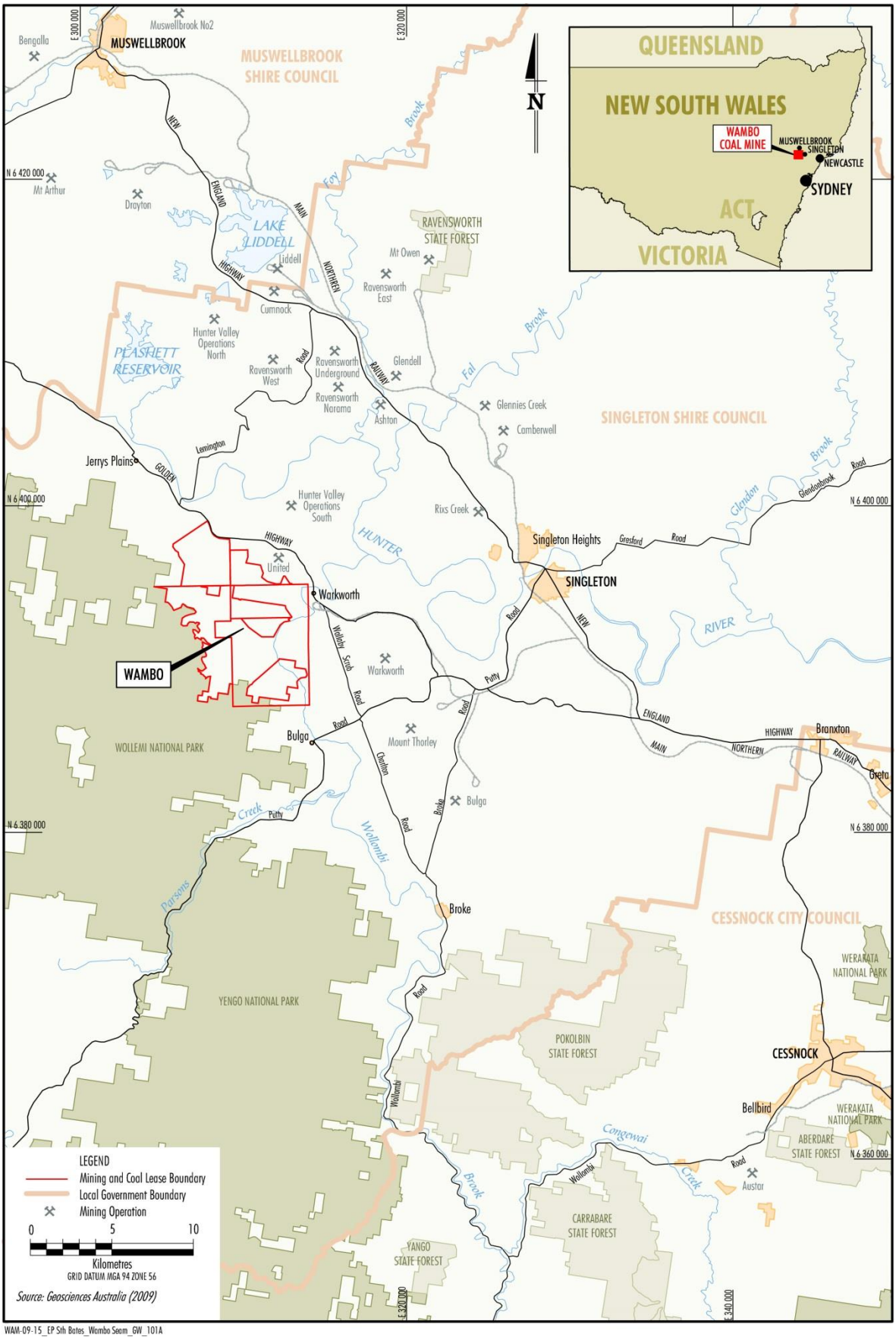


Figure 1: Wambo Coal Regional Location

In accordance with Schedule 4, Condition 30 of DA305-7-2003, WCPL are required to prepare a Site Water Management Plan (WMP). This Surface and Ground Water Response Plan (SGWRP) is a component of the WCPL Site Water Management Plan. **Figure 2** shows the components of the WCPL Site Water Management Plan. This SGWRP should be read in conjunction with the other components of the WCPL Site Water Management Plan.

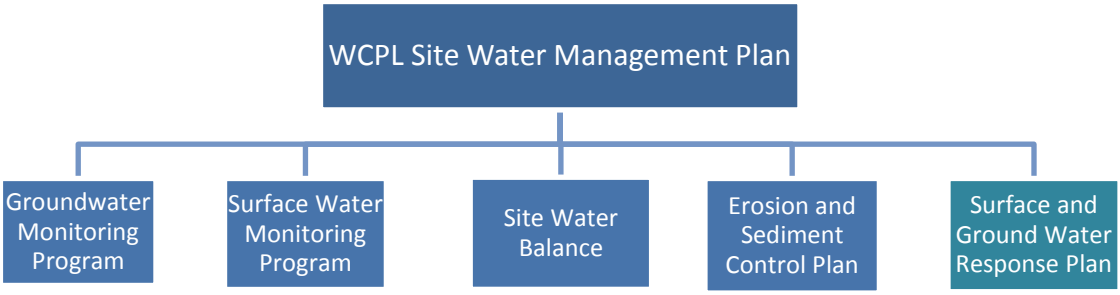


Figure 2: WCPL Site Water Management Plan

In accordance with WCPL's continuous improvement and review processes and Conditions 4 & 6, Schedule 6 of DA305-7-2003, a review of the SGWRP has been undertaken to ensure that surface and ground water impacts from the Mine are minimised, where possible, and that appropriate procedures are in place to respond to any unplanned impacts.

1.2 Purpose

This SGWRP has been developed to address the relevant requirements of relevant consent conditions and regulatory requirements. The SGWRP also addresses the relevant conditions of WCPL mining leases and Environmental Protection Licence (EPL). In accordance with Condition 35, Schedule 4 of DA305-7-2003, WCPL have prepared this SGWRP to provide:

- Measures to mitigate any adverse impacts on existing water supply bores or wells, including trigger levels for the provision of suitable compensatory water supplies (**Section 2.3**);
- Measures to mitigate the loss of surface water flows in the surface water streams or channel on the site (**Section 2.4**);
- Measures to mitigate the long term direct hydraulic connection between the backfilled open cut and the North Wambo Creek alluvium if the potential for any downstream adverse impact is detected (**Section 2.6**);
- Measures to address the decrease in through-flow rates caused by the development within the Wollombi Brook alluvium downstream of the open cut (**Section 2.4**);
- Measures to address any reduction in the stability or ecological quality of the North Wambo Creek Diversion below the established performance criteria (**Section 2.7**);
- Measures to minimise and/or offset potential groundwater leakage from Wollombi Brook and associated alluvial aquifers (**Section 2.8**);
- Measures to mitigate adverse impacts on groundwater dependent ecosystems or riparian vegetation and offset any impacts above the predicted impacts (**Section 2.9**);

- Trigger levels for the relinquishment of water extraction rights to compensate for surface and groundwater losses from streams, channels or alluvial to open cut and underground mining workings (**Section 2.11**);
- Procedures that would be followed if an unforseen impacts are detected during the development (**Section 2.12**); and
- Response times for undertaking the above measures.

1.3 Scope

This SGWRP applies to all surface and ground water monitoring/management activities undertaken within WCPL's mining authorisations and approved mining areas (**Figure 3**). This SGWRP outlines the response procedure that will be initiated if surface or ground water monitoring results exceed designated trigger levels. This SGWRP forms part of WCPL's Environmental Management System (EMS).

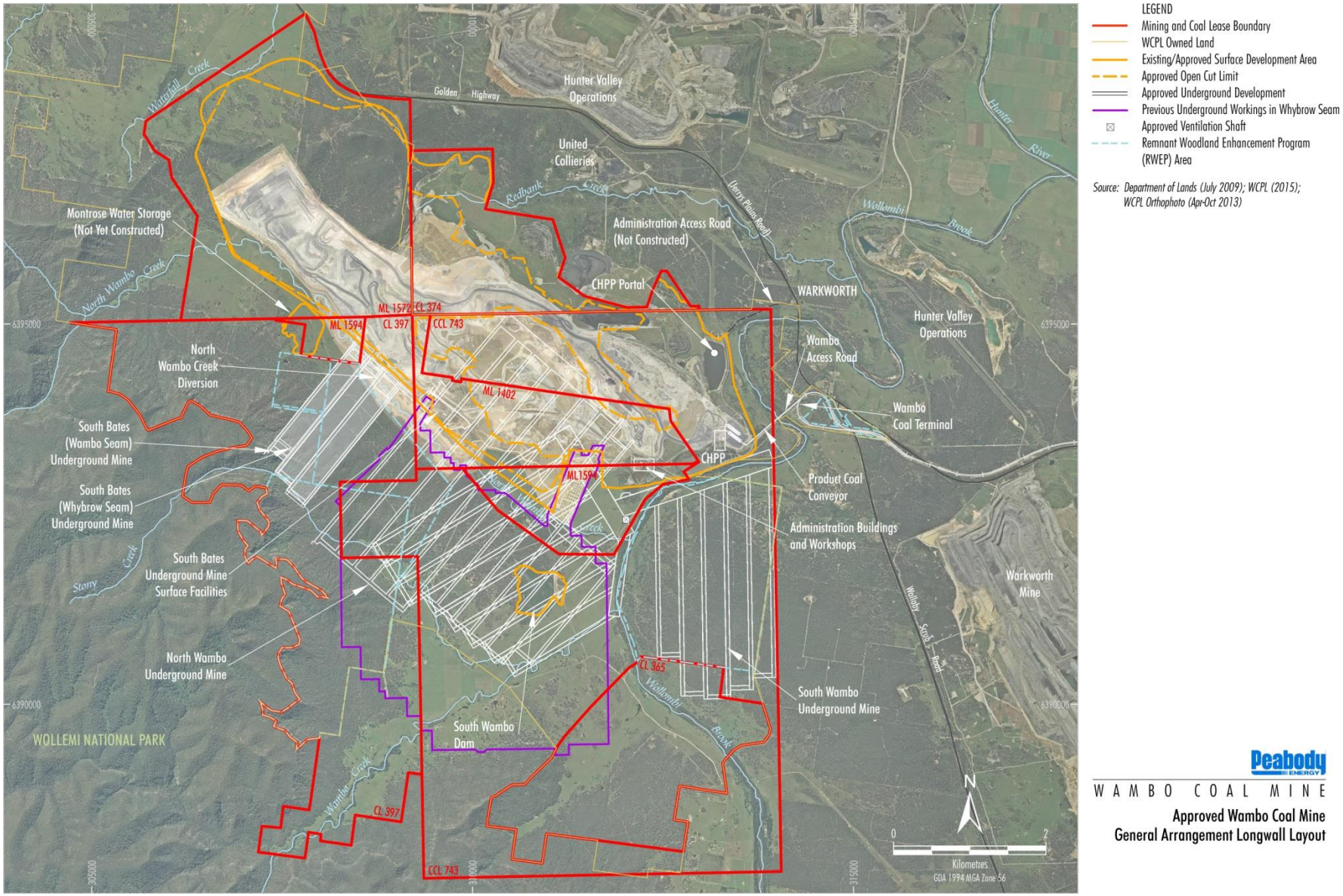


Figure 3: Approved Wambo Coal Mine Layout

1.4 Statutory Requirements

This SGWRP has been prepared to address the relevant Development Approval (DA) consent conditions within DA305-7-2003 (**Table 2**).

1.4.1 Environmental Planning & Assessment Act 1979

WCPL received Development Consent (DA305-7-2003) in accordance with the *Environmental Planning & Assessment Act 1979* (EP&A Act) from the NSW Department of Planning and Environment (DP&E), formerly NSW Department of Planning, on 4 February 2004. Conditions within DA305-7-2003 relevant to the SGWRP are summarised in **Table 2**.

Table 2: DA305-7-2003 Requirements for the Surface and Ground Water Response Plan

Schedule	Condition	Requirements	SGWRP Section
4	30	Before carrying out any development, the Applicant shall prepare a Site Water Management Plan for the development in consultation with DRE and NOW, and to the satisfaction of the Secretary. This plan must include: … (g) a Surface and Ground Water Response Plan; *By the end of October 2009, the Applicant shall revise the Site Water Management Plan in consultation with DII, DECCW, and NOW, and to the satisfaction of the Director-General.**	**This SGWRP**
4	35	The Surface and Ground Water Response Plan shall include:	
		(a) measures to mitigate any adverse impacts on existing water supply bores or wells, including trigger levels for the provision of suitable compensatory water supplies;	**Section 2.3**
		(b) measures to mitigate the loss of surface water flows in the surface water streams or channel on the site;	**Section 2.4**
		(d) measures to mitigate the long term direct hydraulic connection between the backfilled open cut and the North Wambo Creek alluvium if the potential for any downstream adverse impact is detected;	**Section 2.6**
		(e) measures to address the decrease in through-flow rates caused by the development within the Wollombi Brook alluvium downstream of the open cut;	**Section 2.4**
		(f) measures to address any reduction in the stability or ecological quality of the North Wambo Creek Diversion below the established performance criteria;	**Section 2.7**
		(g) measures to minimise and/or offset potential groundwater leakage from Wollombi Brook and associated alluvial aquifers;	**Section 2.8**
		(h) measures to mitigate adverse impacts on groundwater dependent ecosystems or riparian vegetation and offset any impacts above the predicted impacts;	**Section 2.9**
		(i) trigger levels for the relinquishment of water extraction rights to compensate for surface and groundwater losses from streams, channels or alluvial to open cut and underground mining workings;	**Section 2.11**
		(j) the procedures that would be followed if an unforseen impacts are detected during the development; and	**Section 2.12**
		(k) Response times for undertaking the above measures	**Included in relevant sections**
6	3	**Adaptive Management** The Applicant must assess and manage project-related risks to ensure that there are no exceedances of the criteria and/or performance measures in schedule 4.	**Section 2.1**

Schedule	Condition	Requirements	SGWRP Section
		Any exceedance of these criteria and/or performance measures constitutes a breach of this consent and may be subject to penalty or offence provisions under the EP&A Act or EP&A Regulation. Where any exceedance of these criteria and/or performance measures has occurred, the Applicant must, at the earliest opportunity: (a) take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur; (b) consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measures or other course of action; and (c) implement remediation measures as directed by the Secretary, to the satisfaction of the Secretary.	
6	4	**Management Plan Requirements** The Applicant shall ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include: (a) detailed baseline data; (b) a description of: - the relevant statutory requirements (including any relevant consent, licence or lease conditions); - any relevant limits or performance measures/criteria; - the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures; (c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/ criteria; (d) a program to monitor and report on the: - impacts and environmental performance of the Wambo Mining Complex; - effectiveness of any management measures (see c above); (e) a contingency plan to manage any unpredicted impacts and their consequences; (f) a program to investigate and implement ways to improve the environmental performance of the Wambo Mining Complex over time; (g) a protocol for managing and reporting any: - incidents; - complaints; - non-compliances with statutory requirements; and - exceedances of the impact assessment criteria and/or performance criteria; and (h) a protocol for periodic review of the plan.	**N/A to SGWRP** **Section 1.4** **Refer SWMP & GWMP** **Refer SWMP & GWMP** **Section 2.0** **Section 4.0** **Section 2.12** **Section 4.2** **Section 4.4** **Section 3.0** **Section 2.1** **Section 2.1** **Section 4.1**

* In September 2009, DP&E granted WCPL an extension to the submission date to 30/4/2010 to allow for DII and EPA review and comment.

1.5 Stakeholder Consultation

In accordance with Condition 30, Schedule 4 of DA 305-7-2003, this revision of the SGWRP (Revision 10) has been undertaken in consultation with NSW Department of Resources and Energy (DRE) and the NSW Department of Primary Industries Water (DPI Water, formerly the NSW Office of Water (NOW)), prior to submitting to the Secretary of the DP&E for approval.

This review of the SGWRP (Revision 10) includes:

- Updates to the description of the approved operations to incorporate the approval of MOD 15 of DA305-7-2003; and
- Addressing comments received from DPI Water on the SGWRP (Revision 8).

Correspondence in relation to the SGWRP is attached as **Appendix B**.

2.0 Surface and Ground Water Response Plan

2.1 Adaptive Management

Potential surface and groundwater impacts are detailed in the Wambo Development Project Environmental Impact Statement (EIS) (Wambo Coal, 2003) and in the North Wambo Underground Mine Modification Environmental Assessment (Resource Strategies, 2012).

WCPL's Site Water Management Plan has been developed to manage and monitor water-related risks associated with the Wambo Coal Mine, to ensure there are no exceedances of the criteria and/or performance measures detailed in the relevant development consents and licences. If an exceedance of these criteria and/or performance measures occurs, WCPL will, at the earliest opportunity:

- 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 DP&E describing those options and any preferred remediation measures or other course of action; and
- Implement remediation measures as directed by the Secretary,

to the satisfaction of the Secretary.

2.2 Incident Management

An incident is defined as "a set of circumstances that:

- Causes or threatens to cause material harm to the environment; and/or
- Breaches or exceeds the limits or performance measures/criteria in the development consent"

Incident reporting will be undertaken in accordance with **Section 4.4**.

2.3 Impacts on Groundwater

A network of bores and piezometers is monitored to quantify any effect of the open cut and underground workings on the local groundwater system (refer to GWMP).

Groundwater depth and quality (pH and EC) trigger levels are specified in the GWMP. Following the receipt of groundwater monitoring results a data review will be undertaken. In the event that a trigger level is exceeded, or a complaint is received in relation to loss of groundwater supply, an investigation will be undertaken as soon as possible. The investigation will include a detailed review of monitoring data trends and climatic information along with operational activities and surrounding land uses, to determine if the impact on groundwater is a result of Wambo's activities.

If the investigation identifies actual groundwater impacts and attributes those impacts to Wambo's activities, WCPL will implement the adaptive management process in **Section 2.1**. Appropriate remediation measures will be developed and implemented in consultation with relevant government agencies and affected landowners, as required.

Measures may include:

- Modification to the groundwater monitoring program;
- Review of the water balance modelling for relevant underground / open cut mining activities;
- Review of mine plan and/or methodology; or
- Implementation of mitigation measures, especially where use of groundwater resources are interrupted.

The outcomes of this process will be reported in the Annual Review (**Section 4.2**). If an incident is deemed to have occurred (**Section 2.2**) WCPL will notify and report to DP&E and any other relevant government departments in accordance with **Section 4.4**.

2.3.1 TARP for Impacts on Private Bores

WCPL has developed a Trigger Action Response Plan (TARP) that must be implemented in the event that:

- A complaint is received from a private bore holder in relation to decreasing levels in a private bore; or
- Groundwater monitoring of private bores (including GW02 or GW11) identifies a decreasing trend approaching 2 metres below the modelled statistical trends.

This TARP is summarised in **Table 3**.

Table 3: TARP for Impacts on Private Bores

TARP Code	Level 1 Response Management Measures	Level 2 Response Contingency Phase
Trigger	•Groundwater monitoring of Private Bores including GW02 and GW11 (where access granted) for standing water levels, identifies a decreasing trend approaching 2m below the modelled statistical trends.	•Groundwater monitoring of Private Bores (where access granted) for standing water levels, identifies a decreasing trend greater than 2m below modelled statistical trends for three consecutive sampling events. •Wambo receives a community complaint in relation decreasing water levels in a Private Bore.
Action	•Maintain monitoring of Private Bores to identify if decreasing trends has stabilised and displays signs of increasing trends. •Review recent rainfall data to identify potential correlation between decreasing water level trends and extended dry periods. •If decreasing trends are maintained and eventually exceed 2m below modelled statistical trends then go to Level 2 Response.	•Initiate consultation with the affected Landowner /s of the Private Bore to commence preliminary investigations on receipt of complaint. •Maintain monitoring of Private Bores to identify if decreasing trends has stabilised and displays signs of increasing trends. •Review recent rainfall data to identify potential correlation between decreasing water level trends and extended dry periods. •If decreasing trends are maintained and remain 2m below statistical trends for three consecutive monitoring events, initiate consultation with affected owner of Private Bore. •Undertake preliminary investigation and engage groundwater specialist with a review of relevant groundwater monitoring results in conjunction with site activities being undertaken at the time, baseline groundwater monitoring results, groundwater results at nearby locations, the prevailing and preceding meteorological conditions and changes to the landuse/ activities being undertaken in the contributing

TARP Code	Level 1 Response Management Measures	Level 2 Response Contingency Phase
		hydrogeological regime. Notify DP&E and DPI water of contingency response.
Plan		•If preliminary or subsequent investigations indicate that compensatory water supplies are to be initiated, as a direct result from Wambo's operations, then Wambo will commence consultation with the affected Landowners to establish an agreed suitable compensatory supply of water, until further monitoring can establish these are no longer required. •Review and update the WMP and resubmit to DP&E.

2.4 Impacts on Surface Water

Surface water is monitored at over twenty locations across Wambo, including flow monitoring and water quality. Monitoring of mine water storage dams is also undertaken on a monthly basis. WCPL has developed a number of triggers for water quality and flow (refer Section 3.0 of the SWMP). Licensed discharges from site must also meet the Discharge Criteria specified in EPL 529.

As detailed in Wambo's 2003 EIS, the potential surface water impacts include:

- Connective cracking between North Wambo Creek and the underground workings;
- Reduction in water quality due to increased sedimentation; and
- Reduction of contributing catchments to North Wambo Creek, Waterfall Creek and Redbank Creek due to open cut mining.

Connective cracking was identified in the EIS as the highest risk to surface water flows. However, there has been no evidence of connecting cracking following the subsiding of North Wambo Creek by Longwall panels 1 and 2. In 2008, prior to Longwall 1, a specific North Wambo Creek Subsidence Response Strategy (NWCDSRS) was prepared in consultation with DRE, EPA and DP&E. Wambo will continue to monitor in accordance with the NWCSRS (**Appendix C**).

If routine monitoring (in accordance with SWMP) identifies evidence of potential surface water impacts, an investigation will be undertaken as soon as possible. The investigation will include a detailed review of relevant monitoring data trends and climatic information along with operational activities, to determine if the impact on surface water is a result of Wambo's activities.

If the investigation identifies actual surface water impacts and attributes those impacts to Wambo's activities, WCPL will implement the adaptive management process in **Section 2.1**. Appropriate remediation measures will be developed and implemented in consultation with relevant government agencies and affected landowners, as required.

The outcomes of this process will be reported in the Annual Review (**Section 4.2**). If an incident is deemed to have occurred (**Section 2.2**) WCPL will notify and report to DP&E and any other relevant government departments in accordance with **Section 4.4.**

The loss of catchment area due to open cut mining will have a temporary impact until rehabilitation has been completed and the catchment area is progressively reinstated. This

impact has been predicted and assessed in the 2003 EIS and no additional responses are proposed.

2.4.1 TARP for Impacts on Surface Water Flows

WCPL has developed a TARP that must be implemented in the event that:

- After rainfall exceeding 20mm in 24hr, visual observations during flow events within either North Wambo Creek, South Wambo Creek or Stony Creek, identifies a potential variance in flow rates between upstream and downstream flow monitoring stations; or
- The initial calculated theoretical flow rates identifies a potential loss of flow between upstream and downstream flow monitoring stations within either North Wambo Creek, South Wambo Creek or Stony Creek.

This TARP is summarised in **Table 4.**

Table 4: TARP for Impacts on Surface Water Flows

TARP Code	Level 1 Response Management Measures	Level 2 Response Contingency Phase
Trigger	•After rainfall exceeding 20mm in 24hr, visual observations during flow events within either North Wambo Creek, South Wambo Creek or Stony Creek, identifies a potential variance in flow rates between upstream and downstream flow monitoring stations.	•The initial calculated theoretical flow rates identifies a potential loss of flow between upstream and downstream flow monitoring stations within either North Wambo Creek, South Wambo Creek or Stony Creek.
Action	•Confirm actual flow event by observing creek flows at upstream and downstream locations. •Download flow monitoring data from flow monitoring stations at the completion of the flow event. •Check flow monitoring equipment for functionality; •Review recent climatic conditions and rainfall data recorded from meteorological station. •Calculate theoretical flow rates from flow monitoring stations to compare upstream and downstream flow rates. •If the initial calculation of the theoretical flow rates identifies a potential loss of flow when comparing the upstream and downstream flow rates, then go to Level 2 Response.	•Maintain surface flow monitoring to identify if creek flow rates have returned to statistical trends. •Undertake preliminary investigation, including: -Engaging a suitable qualified hydrologist to confirm if a loss of the calculated theoretical flow rates between upstream and downstream flow monitoring stations has occurred; -Review location of rainfall event/s that may have contributed to creek flow variability within the creek catchment; -Check flow monitoring equipment for functionality; -Review pumping volumes from the North Wambo Underground/South Bates Underground to examine pumping trends; and -Review pumping volumes from the old Homestead workings to examine pumping trends. -Provide pumping volumes from underground workings to groundwater specialists for review.
Plan		•If confirmation of a flow loss which is greater than modelled has occurred Wambo will notify the relevant government agencies and in consultation develop appropriate measures to mitigate the loss of surface water flows in the surface water streams (e.g. stream remediation techniques). •Review and update the WMP and resubmit to DP&E

2.4.2 TARP for Impacts on Surface Water Quality

WCPL has developed a TARP that must be implemented in the event that:

- Surface water monitoring of Wollombi Brook, North Wambo Creek, South Wambo Creek, Stoney Creek or Waterfall Creek for pH, EC and TSS, identifies water quality results exceeding the 80th Percentile Trigger Value, as identified in the SWMP, after two consecutive sampling events.

This TARP is summarised in **Table 5.**

Table 5: TARP for Impacts on Surface Water Quality

TARP Code	Level 1 Response Management Measures	Level 2 Response Contingency Phase
Trigger	•Surface water monitoring of Wollombi Brook, North Wambo Creek, South Wambo Creek, Stoney Creek or Waterfall Creek for pH, EC and TSS, identifies water quality results exceeding the 80th Percentile Trigger Value, as identified in the SWMP, after two consecutive sampling events.	•Surface water monitoring of Wollombi Brook, North Wambo Creek, South Wambo Creek, Stoney Creek or Waterfall Creek for pH, EC and TSS, identifies water quality results exceeding the 80th Percentile Trigger Value, as identified in the SWMP, after three consecutive sampling events.
Action	•Increase monitoring of surface water site(s) to fortnightly to identify if water quality results are trending back to long term averages as identified in the SWMP. •If any water quality exceeds the 80th Percentile Trigger Value (three consecutive samples), then go to Level 2 Response.	•Maintain monitoring of surface water sites to identify if water quality results are trending back to long term averages as identified in the SWMP. •Undertake preliminary investigation, including: -Determine contributing factors including meteorological conditions, if an incident has potentially occurred, review location of operational activities etc. -Where appropriate, engage a suitable qualified aquatic ecologist or similar to investigate the aquatic environment; -Increase monitoring frequency where relevant; and -Develop corrective/preventative actions based on the outcomes of the investigation and/or additional monitoring.
Plan		•If confirmation of a results above confirms impacts to water quality have occurred as a direct result from Wambo's operations, Wambo will notify the relevant government agencies and in consultation develop appropriate remedial measures. •Review and update the WMP and resubmit to DP&E.

2.4.3 TARP for Breach of EPL 529 Limits

WCPL has developed a TARP that must be implemented in the event that:

- Monitoring at the Licenced Discharge Point (LDP) confirms pH, EC, TSS or discharge volumes are approaching or have exceeded discharge limits as identified in the SWMP and EPL 529; and/or
- There is potential evidence of an unauthorised discharge or an uunauthorised discharge event has occurred; or
- Wambo has failed to monitor at the LDP as identified in the SWMP and EPL 529.

This TARP is summarised in **Table 6.**

Table 6: TARP for Breach of EPL 529 Limits

TARP Code	Level 1 Response Management Measures	Level 2 Response Contingency Phase
Trigger	•Monitoring at Licence Discharge Point (LDP) confirms pH, EC, TSS or discharge volumes are approaching discharge limits as identified in the SWMP and EPL 529; and/or •Potential evidence of an unauthorised discharge	•A Level 2 Response has been triggered if: -Exceedance of EPL 529 pollution concentration limits; -Unauthorised discharge event has occurred; -Exceedance of EPL 529 discharge volume limit; or -Failure to monitor at LDP as identified in the SWMP and EPL 529.
Action	•Maintain monitoring at LDP to confirm pH, EC, TSS remain within discharge limits. •Prepare to cease discharging: -If water quality values for pH, EC and TSS continue to trend towards an exceedence of their respective discharge water quality criteria; and -If daily discharge volumes continue to trend towards an exceedence of the daily discharge water volume criteria. •If there is an exceedence of the pH, EC, TSS criteria and/or discharge volume limit then go to Level 2 Response. •If there is evidence of an unauthorised discharge go to Level 2 Response.	•If monitoring at Licence Discharge Point (LDP) confirms any of the Level 2 Responses have been triggered, Wambo will: -Cease discharge; -Initiate Pollution Incident Response Management Plan (PIRMP); -Initiate an investigation to determine contributing factors including meteorological conditions, if an incident has potentially occurred, review location of operational activities , equipment failure etc; -Provide report within seven days to the EPA and DP&E and other relevant government agencies; -Increase monitoring frequency where relevant; -Develop corrective/preventative actions based on the outcomes of the investigation and/or additional monitoring; and -Undertake additional monitoring (stream health monitoring, etc.) if necessary.
Plan		•Implement appropriate contingency and remedial measures, including follow-up monitoring, auditing and advice from relevant government agencies. •Communicate results of investigation and subsequent contingency and remedial measures to relevant government agencies. •Review and update the WMP and resubmit to DP&E.

2.5 Direct Hydraulic Connection between Open Cut and Alluvium

If scheduled monitoring detects a long-term direct hydraulic connection between the backfilled open cut and the North Wambo Creek alluvium, with the potential to cause an associated downstream adverse impact, then an investigation will be undertaken to determine the nature and extent of the impact.

If the investigation identifies downstream adverse impacts and attributes those impacts to Wambo's activities, WCPL will implement the adaptive management process in **Section 2.1**. Appropriate management measures will be developed and implemented in consultation with relevant government agencies and may include the relinquishment of an equivalent portion of water access licences as a direct offset for potential groundwater inflows into the Mine (HydroSimulations, 2014) (i.e. in addition to licences already held to account for water take).

The outcomes of this process will be reported in the Annual Review (**Section 4.2**). If an incident is deemed to have occurred (**Section 2.2**) WCPL will notify and report to DP&E and any other relevant government departments in accordance with **Section 4.4.**

2.6 Impacts on North Wambo Creek Alluvium

WCPL has developed a TARP that must be implemented in the event that:

- Groundwater monitoring of standing water levels in bores GW08 and GW09 and GW016 and GW017 within the North Wambo Creek alluvium, identifies a decreasing trend or exceeds the standing water trigger levels, beyond natural fluctuations and predicted modelled impacts; and/or
- Monitoring of aquatic ecosystems in accordance with the Flora and Fauna Management Plan (FFMP) identifies a potential or actual decline in aquatic health, beyond natural fluctuations; and/or
- Monitoring of Land Function Analysis (LFA) of riparian areas in accordance with the FFMP identifies a potential or actual decline in creek stability, beyond natural fluctuations; and/or
- Visual observations and/or pumping rates from Montrose Pit confirm alluvium inflows into the open cut have increased above normal seepage rates.

This TARP is summarised in **Table 7.**

Table 7: TARP for Impacts on North Wambo Creek Alluvium

TARP Code	Level 1 Response Management Measures	Level 2 Response Contingency Phase
Trigger	•Groundwater monitoring of standing water levels in bores GW08 and GW09 and GW016 and GW017 within the North Wambo Creek alluvium, identifies a decreasing trend, beyond natural fluctuations and predicted modelled impacts; and/or •Monitoring of aquatic ecosystems in accordance with the Flora and Fauna Management Plan (FFMP) identifies a potential decline in aquatic health, beyond natural fluctuations; and/or •Monitoring of Land Function Analysis (LFA) of riparian areas in accordance with the FFMP identifies a potential decline in creek stability, beyond natural fluctuations; and/or •Visual observations and/or pumping rates from Montrose Pit confirm alluvium inflows into the open cut have not increased above normal seepage rates.	•Groundwater monitoring of standing water levels in bores GW08 and GW09 and GW016 and GW017 within the North Wambo Creek alluvium, exceed the standing water trigger values as provided in the GWMP, beyond natural fluctuations, for more than three consecutive monitoring events and/or •Monitoring of aquatic ecosystems in accordance with the Flora and Fauna Management Plan (FFMP) identifies a decline in aquatic health in consecutive monitoring events, beyond natural fluctuations; and/or •Monitoring of Land Function Analysis (LFA) of riparian areas in accordance with the FFMP identifies a decline in creek stability in consecutive monitoring events, beyond natural fluctuations. •Visual observations confirm alluvium inflows into the open cut have increased significantly above normal seepage rates.
Action	•Maintain monitoring of bores within the North Wambo Creek alluvium, for standing water levels, to identify if decreasing trends has stabilised and displays signs of increasing trends. •Maintain visual monitoring to confirm alluvium inflows into the open cut have ceased or have returned to normal seepage rates. •Review recent rainfall data to identify potential correlation between decreasing water level trends and	•Maintain monitoring of GW08, GW09, GW16 and GW17 within the North Wambo Creek alluvium, for standing water levels to identify if decreasing trends has stabilised and displays signs of increasing trends. •Continue annual LFA and aquatic ecosystems monitoring to determine if decline trends have stabilised and displaying signs of improving trends in consecutive monitoring periods. •Continue visual monitoring and/or pumping rates in the Montrose Pit to confirm alluvium inflows into the open cut have ceased or have returned to normal seepage rates. •If decreasing standing water level trends are maintained and/or LFA and aquatic ecosystems are in decline and/or a

TARP Code	Level 1 Response Management Measures	Level 2 Response Contingency Phase
	extended dry periods. •Continue annual LFA and aquatic ecosystems monitoring to determine if decline trends have stabilised and displaying signs of improving trends in consecutive monitoring periods. •If standing water levels exceed standing water trigger values (consecutively) as provided in the GWMP, then go to Level 2 Response. •If consecutive LFA and aquatic ecosystems monitoring events determine continue decline trends and displaying no signs of improving trends, then go to Level 2 Response. •If visual observations and/or pumping rates from Montrose Pit confirm alluvium inflows into the open cut increased above normal seepage rates, then go to Level 2 Response.	significant increase of alluvium flows into the open cut has been identified, Wambo will undertake preliminary investigation, including: -An investigation and engage groundwater specialist to review relevant groundwater monitoring results in conjunction with site activities being undertaken at the time, baseline groundwater monitoring results, groundwater results at nearby locations, the prevailing and preceding meteorological conditions and changes to the landuse/ activities being undertaken in the contributing hydrogeological regime; -Review the site water balance and groundwater model; -An investigation and engage ecologist to review LFA and aquatic monitoring results in conjunction with site activities being undertaken at the time, the prevailing and preceding meteorological conditions and changes to the landuse/ activities being undertaken. -Develop corrective/preventative actions based on the outcomes of the investigation.
Plan		•If confirmation of a results above and investigations confirms impacts to alluvium are greater than modelled, Wambo will notify the relevant government agencies and in consultation develop appropriate remedial measures. •Develop corrective/preventative actions based on the outcomes of the investigation for example: -Backfilling to seal the affected highwall areas with suitable material selected from the open cut; -Secure additional water licences to account for the estimated future inflows (if applicable). •Review and update the WMP and resubmit to DP&E.

2.7 North Wambo Creek Diversion Performance Criteria

WCPL manages the North Wambo Creek Diversion in accordance with the North Wambo Creek Diversion Rehabilitation Plan. Management controls have been designed and implemented to minimise erosion and the potential for sediment generation and loss from the system however there is still a risk that erosion and sediment generation may impact on North Wambo Creek water quality. Management controls are discussed in detail in WCPL's Erosion and Sediment Control Plan and the North Wambo Creek Diversion Rehabilitation Plan.

WCPL has developed a TARP that must be implemented in the event that:

- Surface water monitoring of North Wambo Creek, for pH, EC and TSS, identifies water quality results exceeding the 80th Percentile Trigger Value, as identified in the SWMP after two consecutive sampling events; and/or
- Monitoring of Land Function Analysis (LFA) of riparian areas in accordance with the FFMP identifies a potential decline in creek stability, beyond natural fluctuations.

This TARP is summarised in **Table 8.**

Table 8: TARP for North Wambo Creek Diversion Performance

TARP Code	Level 1 Response Management Measures	Level 2 Response Contingency Phase
Trigger	•Surface water monitoring of North Wambo Creek, for pH, EC and TSS, identifies water quality results exceeding the 80th Percentile Trigger Value, as identified in the SWMP after two consecutive sampling events; and/or •Monitoring of Land Function Analysis (LFA) of riparian areas in accordance with the FFMP identifies a potential decline in creek stability, beyond natural fluctuations.	•Surface water monitoring of North Wambo Creek for pH, EC and TSS, identifies water quality result exceeding the 80th Percentile Trigger Value, after three consecutive sampling events. •Monitoring of Land Function Analysis (LFA) of riparian areas in accordance with the FFMP identifies a decline in creek stability in consecutive monitoring events, beyond natural fluctuations.
Action	•Review recent rainfall data to identify potential correlation between decreasing water level trends and extended dry periods. •Continue annual LFA and aquatic ecosystems monitoring to determine if decline trends have stabilised and displaying signs of improving trends in consecutive monitoring periods. •Maintain monitoring of surface water sites to identify if water quality results are trending back to long term averages as identified in the SWMP. •If consecutive LFA and aquatic ecosystems monitoring events determine continue decline trends and displaying no signs of improving trends, then go to Level 2 Response. •If any water quality exceeds the 80th Percentile Trigger Value (three consecutive periods), then go to Level 2 Response.	•Continue annual LFA and aquatic ecosystems monitoring to determine if decline trends have stabilised and displaying signs of improving trends in consecutive monitoring periods. •Wambo will undertake preliminary investigation, including: -As above for Surface Water Quality -An investigation and engage ecologist specialist to review LFA monitoring results in conjunction with site activities being undertaken at the time, the prevailing and preceding meteorological conditions and changes to the landuse/ activities being undertaken.
Plan		•If confirmation of a results and investigations from above confirms impacts, Wambo will notify the relevant government agencies and in consultation develop appropriate remedial measures if required. •Review and update the WMP and resubmit to DP&E.

2.8 Groundwater Leakage from Wollombi Brook

WCPL has developed a TARP that must be implemented in the event that:

- Groundwater monitoring of standing water levels in bores P106, P109, P114, P116 within the Wambo Creek alluvium and GW13 and GW15 within the Wollombi Creek alluvium, identifies a decreasing trend, beyond natural fluctuations and predicted modelled impacts; and/or
- Groundwater monitoring of standing water levels in bores GW08 and GW09 and GW016 and GW017 within the North Wambo Creek alluvium, exceed the standing water trigger values as provided in the GWMP, beyond natural fluctuations, for more than three consecutive monitoring events.

This TARP is summarised in **Table 9.**

Table 9: TARP for Wollombi Brook and Wambo Creek Alluvium

TARP Code	Level 1 Response Management Measures	Level 2 Response Contingency Phase
Trigger	•Groundwater monitoring of standing water levels in bores P106, P109, P114, P116 within the Wambo Creek alluvium and GW13 and GW15 within the Wollombi Creek alluvium, identifies a decreasing trend, beyond natural fluctuations and predicted modelled impacts	•Groundwater monitoring of standing water levels in bores GW08 and GW09 and GW016 and GW017 within the North Wambo Creek alluvium, exceed the standing water trigger values as provided in the GWMP, beyond natural fluctuations, for more than three consecutive monitoring events.
Action	•Maintain monitoring of bores within the Wollombi and Wambo Creek alluvium, for standing water levels, to identify if decreasing trends has stabilised and displays signs of increasing trends. •If standing water levels exceed standing water trigger values as provided in the GWMP, then go to Level 2 Response.	•Maintain monitoring of P106, P109, P114, P116 within the Wambo Creek alluvium and GW13 and GW15 within the Wollombi Creek alluvium, for standing water levels to identify if decreasing trends have stabilised and displays signs of increasing trends. •If decreasing standing water level trends are maintained and/or a significant increase of alluvium flows into the open cut, Wambo will undertake preliminary investigation, including: -An investigation and engage groundwater specialist to review relevant groundwater monitoring results in conjunction with site activities being undertaken at the time, baseline groundwater monitoring results, groundwater results at nearby locations, the prevailing and preceding meteorological conditions and changes to the landuse/ activities being undertaken in the contributing hydrogeological regime. -Review the site water balance and groundwater model; -Develop corrective/preventative actions based on the outcomes of the investigation.
Plan		•If confirmation of a results and investigations from above confirms impacts to alluvium are greater than modelled, Wambo will notify the relevant government agencies and in consultation develop appropriate remedial measures. •Develop corrective/preventative actions based on the outcomes of the investigation for example: -Secure additional water licences to account for the estimated future inflows (if applicable). -Measures to offset the potential groundwater leakages. •Review and update the WMP and resubmit to DP&E.

2.9 Impacts on Groundwater Dependent Ecosystems or Riparian Vegetation

An aquatic ecosystems monitoring program has been developed to detect any potential changes in aquatic biology in accordance with the FFMP within North Wambo Creek, Wambo Creek and Stoney Creek and the North Wambo Creek Diversion.

Annual channel stability surveys are also undertaken to monitor the quantity and quality of riparian vegetation along North Wambo Creek and North Wambo Creek Diversion to determine the need for any maintenance and/or contingency measures. This program and the development of stream health triggers (for water quality, stability and alluvium) are discussed above and within the FFMP and SWMP.

In the event that deterioration is identified in groundwater dependent ecosystems during stream health monitoring or annual channel stability surveys, the processes outlined above will be implemented.

2.10 Exceedance of Licensed Extraction Limit

As part of annual reporting and data review WCPL is required to compare annual extractions from alluvium water sources to WCPL's licenced extraction volume under the Water Management Act 2000 (WM Act). If extraction from alluvial water sources exceeds the licenced volume, consultation will be entered into with the relevant government authorities to develop ameliorative measures. Where the take exceeds the estimates by 100% or more, WCPL will re-evaluate associated ecological impacts and any influence on any low flow cease to pump criteria specified in a relevant Water Sharing Plan.

Additional information regarding the WM Act is available in the GWMP. WCPL will ensure there are sufficient licenced volumes under the WM Act to account for the predicted extraction of water from alluvial water sources for the upcoming water year.

2.11 Trigger Levels for the Relinquishment of Water Extraction Limits

Trigger values for the relinquishment of water extraction rights to compensate for post mining closure (end of the approved mine life) for surface and groundwater losses from streams, channels or alluvials to the open cut and underground mine workings will be refined and further developed as an outcome of future groundwater models and as the mine progresses towards closure.

The outcomes of future groundwater modelling to determine post mining trigger values for the relinquishment of water extraction rights will be provided in subsequent reviews of this SGWRP and resubmitted to DP&E.

2.12 Unforeseen Impacts

In the event that any unforseen surface or ground water impacts are detected, the following general response procedure will be initiated:

- Check and validate the data/information which indicates an unforeseen impact;
- Notify DP&E, EPA and other relevant agencies immediately after becoming aware of the impact;
- In the event of an apparently anomalous monitoring result, conduct a resample/retest where possible;
- Review the unforeseen impact, including consideration of:
    - Any relevant monitoring data; and
    - Current mine activities and land management practices in the relevant catchment, including other mining activities;
- Commission an investigation by an appropriate specialist into the unforeseen impact;
- Provide a preliminary investigation report to DP&E, EPA and relevant agencies within 7 days of identifying the unforeseen impact;
- Implement appropriate contingency/remedial measures;
- Implement additional monitoring to measure the effectiveness of the mitigation measures, where necessary;
- Communicate results of investigation and subsequent contingency and remedial measures to government agencies as required; and
- Review and update the WMP and resubmit to DP&E.

3.0 Community Complaint Response

All water related community complaints received by WCPL will be recorded within the Community Complaints Register. The E&C Manager will investigate the complaint, which will include, where possible, contacting the complainant within 24 hours to discuss the complaint. A review of the effectiveness of the corrective or preventative actions will be conducted within a month of the complaint and the relevant work procedures updated if required.

Preliminary investigations will commence as soon as practicable upon receipt of a complaint to establish if WCPL is responsible. All efforts will be made to determine the likely causes contributing to the complainants concerns.

WCPL will attempt to address the complainants concerns such that a mutually acceptable outcome is achieved. However, if required, the Independent Dispute Resolution Process would be referred to (**Appendix A**).

Details of all community complaints will be included in the Monthly Environment Monitoring Report. WCPL will retain a copy of the Community Complaints Register for at least four years. The E&C Manager will ensure the latest Community Complaints Register is posted on the WCPL website.

4.0 Review and Reporting

4.1 Review

The SGWRP is to be reviewed annually by the E&C Manager. A complete review of the SGWRP will occur:

- Every two years;
- When there are changes to consent or licence conditions relating to the SGWRP;
- Prior to new underground mining areas being developed;
- Following significant water related incidents at WCPL;
- Following continual exceedance of the impact assessment criteria;
- Following an independent environmental audit which requires SGWRP review; or
- If there is a relevant change in technology, practice or legislation.

The revised SGWRP will be re-submitted to the Secretary for approval as required by Condition 30, Schedule 4 of DA305-7-2003.

4.2 Annual Review

Prior to the end of March each year, WCPL will review the environmental performance of the Mine and submit an Annual Review report to the DP&E. This report will:

- Describe the development (including any rehabilitation) that was carried out in the past year, and the development that is proposed to be carried out over the next year;
- Include a comprehensive review of the monitoring results and complaints records of the Project over the past year, which includes a comparison of these results against the:
    - Relevant statutory requirements, limits or performance measures/criteria
    - Monitoring results of previous years; and
    - Relevant predictions in the EA;
- Identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
- Identify any trends in the monitoring data over the life of the Project;
- Identify any discrepancies between the predicted and actual impacts of the Project, and analyse the potential cause of any significant discrepancies; and
- Describe what measures will be implemented over the next year to improve the environmental performance of the Project.

4.3 Website Updates

A comprehensive summary of surface and ground water monitoring results will be made publicly available at WCPL website:

http://www.peabodyenergy.com/content/404/australia-mining/new-south-wales/wambo-mine)

Information on the website will be updated regularly as required by DA305-7-2003.

WCPL will also ensure that any information relevant to the SGWRP is uploaded to the website (and kept up to date). This includes:

- Current statutory approvals;
- Approved strategies, plans or programs required under the DA305-7-2003;
- A community complaints register;
- Minutes of Community Consultative Committee (CCC) meetings;
- Annual Reviews;
- A copy of any Independent Audits and WCPL's response to any recommendations in any audit; and
- Any other matter required by the Secretary.

4.4 Reportable Environmental Incidents

All reportable incidents will be reported via the EPA's Environmental Line on **131 555** by the E&C Manager in accordance with WCPL's Pollution Incident Response Management Plan (PIRMP).

In accordance with the PIRMP, WCPL must notify all relevant authorities of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident in accordance with the requirements of *Part 5.7* of the *POEO Act.*

For all other incidents that do not cause threatening material harm to the environment associated with the Project, WCPL will notify the Secretary and any other relevant agencies as soon as practicable after WCPL becomes aware of the incident.

Within 7 days of the date of the incident, WCPL will provide the Secretary and any relevant agencies with a detailed report on the incident to include:

- The cause, time and duration of the event;
- Where possible the type, volume and concentration of every pollutant discharged as a result of the event;
- The name, address and business hours telephone number of employees or agents of the licensee who witnessed the event;
- The name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;
- Action taken by the licensee in relation to the event, including any follow-up contact with any complainants;
- Implement remediation measures as directed by the Secretary, to the satisfaction of the Secretary;
- Details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event

5.0 RESPONSIBILITIES

Table 10 below summarises responsibilities documented in the SGWRP. Responsibilities may be delegated as required.

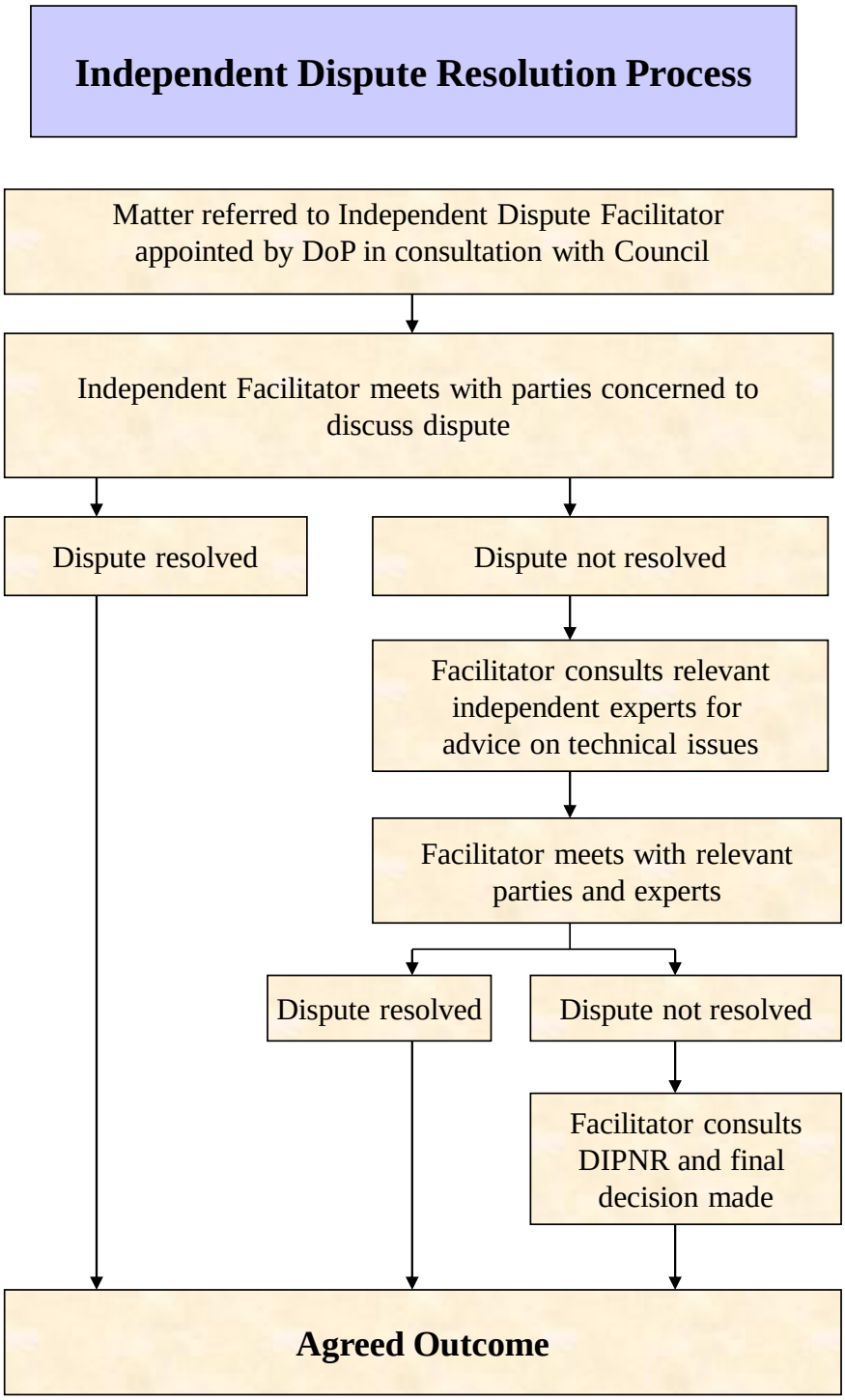
Table 10: Surface and Ground Water Response Plan Responsibilities

No	Task	Responsibility	Timing
1	Identify triggers and initiate appropriate response in accordance with the SGWRP	E&C Manager	As required
2	Implementation of mitigation measures in accordance with the relevant response process.	E&C Manager	As required
3	Review SGWRP in accordance with **Section 4.0**.	E&C Manager	As specified in **Section 4.0**.
4	Notify government departments if an incident occurs in accordance with **Section 4.4**	E&C Manager	As required
5	Submit updated SGWRP to DP&E.	E&C Manager	As required
6	Water related complaints to be responded to in accordance with **Section 3.0**	E&C Manager	As required
7	Annual Review to include water monitoring results, complaints, mitigation measures undertaken and a review of the monitoring undertaken	E&C Manager	Annually
8	Regulator review to be undertaken of the SGWRP	E&C Manager	As required
9	Prepare investigation reports and implementation of corrective actions in accordance with **Section 4.4**	E&C Manager	As required

6.0 REFERENCES

- Development Consent (DA305-7-2003)
- Development Consent (DA177-8-2004)
- Wambo Development Project Environmental Impact Statement (EIS), July 2003
- Resource Strategies Pty Ltd (2003) Wambo Coal Mine Project Environmental Impact Statement. Report prepared for Wambo Coal Pty Ltd
- Wambo Environment Protection Licence (529)
- Environmental Planning and Assessment Act 1979
- Australasian Groundwater and Environmental Consultants (AGE) (2003) Wambo Development Project Groundwater Impact Assessment.
- Gilbert & Associates (2006) Wambo Coal Mine Hydrological Assessment of Staged Diversion and Temporary Pipeline – North Wambo Creek.
- HydroSimulations (2014) North Wambo Underground Mine Longwall 10A Modification Groundwater Assessment
- Resource Strategies (2012) North Wambo Underground Mine Modification Environmental Assessment.
- SP Solutions (2006) Review of North Wambo Underground SMP Proposed Controls – North Wambo Creek.
- Wambo Coal (2003) Wambo Development Project Environmental Impact Statement.
- Wambo Coal (2006) Wambo Coal Mine Modification Statement of Environmental Effects.
- Wambo Coal (2007) Wambo Coal North Wambo Creek Diversion Plan.

APPENDIX A
INDEPENDENT DISPUTE RESOLUTION PROCESS


Independent Dispute Resolution Process
Matter referred to Independent Dispute Facilitator appointed by DoP in consultation with Council
Independent Facilitator meets with parties concerned to discuss dispute
Dispute resolved
Dispute not resolved
Facilitator consults relevant independent experts for advice on technical issues
Facilitator meets with relevant parties and experts
Dispute resolved
Dispute not resolved
Facilitator consults DIPNR and final decision made
Agreed Outcome

APPENDIX B
CORRESPONDENCE WITH REGULATORY AGENCIES

Planning & Environment

Contact: Scott Brooks
Phone: 6575 3401
Fax: 6575 3415
Email: scott.brooks@planning.nsw.gov.au
Our ref: 305-7-2003

The General Manager
Wambo Mine
PMB 1
SINGLETON NSW 2330

Attention: Steve Peart

Dear Steve

Wambo Coal – Approval of Water Management Plan

Thank you for forwarding the Wambo Water Management Plan and all its parts as required under project approval DA 305-7-2003 for the Department's consideration.

The Water Management Plan is required by Condition 30 Schedule 4 and the following 5 components of the Plan were reviewed:

- Site Water Balance (30)
- Erosion and Sediment Control Plan (32)
- Surface Water Monitoring Program (33)
- Ground Water Monitoring Program (34)
- Surface and Ground Water Response Plan (35).

The Department has reviewed these plans, and is satisfied that they generally address the requirements set out in the relevant conditions of the project approval. Consequently, I would like to advise you that the Secretary has approved the plans.

These plans come into force on the 30th November 2015 and remains in force until replaced by any future updated approved Plans.

I am aware that DPI Water are expected to comment on the Extraction Plan for the South Bates U/G (Wybrow seam) LW 11-13. Should this comment require significant changes to any component of the Water Management Plan, I ask if these changes could be made and the plans resubmitted for review and approval.

Could you please forward finalised copies of the above plan (preferably in PDF format with a copy of this approval letter appended) for the Department's records by the end of November 2015.

If you require further information or clarification in this matter please contact Scott Brooks on 6575 3401 or by email to scott.brooks@planning.nsw.gov.au.

Yours sincerely

Scott Brooks
Investigations (Lead), Compliance
27 - 11 - 2015
As Nominee for the Secretary, Planning & Environment

From: Scott.Brooks@planning.nsw.gov.au [mailto:Scott.Brooks@planning.nsw.gov.au]
Sent: Wednesday, 21 October 2015 1:22 PM
To: Peart, Steven D
Subject: RE: 3 of 3

Steve,
I had no comment on the EE&SC Plan

Scott

Scott Brooks
Investigations (lead), Compliance
Planning Services, Resources Assessments
Planning & Environment
Suite 14, Level 1, 1 Civic Av
PO Box 3145
Singleton NSW 2330
http://www.planning.nsw.gov.au
E: scott.brooks@planning.nsw.gov.au
P: 02 6575 3401 | | **Office:** 6575 3405
M: 0419 970924 **F:** 02 6575 3415

Please consider the environment before deciding to print this e-mail.

From: Peart, Steven D [mailto:SPeart@peabodyenergy.com]
Sent: Wednesday, 21 October 2015 12:50 PM
To: Scott Brooks
Subject: RE: 3 of 3

Cheers Scott

The only other one was the Erosion and Sediment Control Plan if you had any comments on it.

Thanks again

Steven Peart
Manager: Environment & Community

Wambo Coal Pty Ltd
Peabody Energy Australia
PMB 1, Singleton NSW 2330
Phone: +61 (0)2 6570 2209
Fax: +61 (0)2 6570 2290
Mob: +61 (0)448 082 987
Email: speart@peabodyenergy.com
www.peabodyenergy.com.au
Please consider the environment before printing this email.

From: Scott.Brooks@planning.nsw.gov.au [mailto:Scott.Brooks@planning.nsw.gov.au]
Sent: Wednesday, 21 October 2015 11:46 AM
To: Peart, Steven D
Subject: RE: Wambo Coal_WMP's 1 of 3

Steve,
Comments on the 3 water management plans.

Please note we will need some type of water balance, and the info for the evaporation sprays if you want to use them.

Scott

Scott Brooks
Investigations (lead), Compliance
Planning Services, Resources Assessments
Planning & Environment
Suite 14, Level 1, 1 Civic Av
PO Box 3145
Singleton NSW 2330
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M: 0419 970924 **F:** 02 6575 3415

Plan	Section	DP&E Comment
Surface and Ground Water Response Plan (WA-ENV-MNP-509.4) Version 8	2.7 North Wambo Creek Diversion Performance Criteria	Given the problems with the NWCD this section should refer to other management plans of have a section referring to erosion and the potential for sediment generation and loss from the system.
Surface Water Monitoring Program (WA-ENV-MNP-509.2) Version 8	1.4.1 Environmental Planning & Assessment Act 1979 (Table 3)	(NOW) Currently called DPI Water
	2.2.3.2 Stream Flow (Table 7)	(No flow data available) Is this because the SWC never runs?
	4.1 Monitoring Network, Parameters and Frequency	(Mine water monitoring is undertaken for operational management purposes only. This data is not reported publicly). This would appear to conflict with Schedule 6 Condition 12 requiring the publishing of monitoring results.
	4.1.5 Riparian Vegetation and Creek Bed Stability	The NWCD has its own rehab management plan. This management plan should refer to it and it may need to be updated.
	4.1.6 Monitoring of Discharge Flows in the North Wambo Creek Diversion	What did NOW ask for. This should be included.

Plan	Section	DP&E Comment
	6.1 Review	(Review every two years) Usually 3 years
Groundwater Monitoring Program (WA-ENV-MNP-509.1) Version 9	2.2.3.1 Alluvial Water Sources	(Investigation into increase in EC) This will need to be reported in the AEMR
	3.1.3 Permian Monitoring Locations	Need to discuss why we monitor if the results cannot result in action.
	3.2 Trigger Values for Groundwater Quality	(Bi-monthly monitoring) This will need to be defined. Twice a month or every 2 months
	4.1.6 Chitter Dam and Wambo South Water Dam Monitoring Program	Need some comment here if the dam will be recommissioned if it is found to be leaking.
	6.1 Review	(Review every two years) Review is normally every 3 years.

From: Joanna Webster [mailto:jwebster@ResourceStrategies.com.au]
Sent: Wednesday, 17 June 2015 1:05 PM
To: Jessie Evans; Brendan Liew
Cc: Joshua Hunt; Howard Reed; Alexander, Micheal G; Peart, Steven D
Subject: RE: Wambo 10A Extraction Plan - NOW comments
Importance: High

Hi Jessie/Brendan,

On behalf of Wambo Coal, please find attached a response to the recommendations made by NSW Office of Water.

Also attached is a revised Groundwater Monitoring Program that has been updated to address the recommendations made by the Office of Water.

Please consider Attachment 3 of the Water Management Plan for North Wambo Underground Mine Longwalls 8 to 10A Extraction Plan to be replaced by the attached revised Groundwater Monitoring Program.

Please don't hesitate to call if you would like to discuss.

Regards

Joanna Webster
Senior Environmental Manager
e jwebster@resourcestrategies.com.au
m 0414 664 532

Resource Strategies Pty Ltd
Suite 2 Level 3, 24 McDougall Street
PO Box 1842
Milton Qld 4064
t 07 3367 0055 f 07 3367 0053
www.resourcestrategies.com.au

From: Jessie Evans [mailto:Jessie.Giblett@planning.nsw.gov.au]
Sent: Thursday, 4 June 2015 8:42 AM
To: Joanna Webster
Cc: Joshua Hunt; Howard Reed; Brendan Liew
Subject: RE: Wambo 10A Extraction Plan - NOW comments

Hi Joanna,

The Department has received comments from NOW in regards to the Wambo LW 8-10A Extraction Plan. I have attached these for your careful consideration and response. NOW has raised a number of issues, and in particular has concerns regarding the Groundwater Management Plan.

Could you please provide a response to NOWs concerns at your earliest possible convenience.

Thanks
Jessie

North Wambo Underground Mine Extraction Plan Longwalls 8 to 10A
Response to NSW Office of Water Comments (Dated 3 June 2015)

NOW Recommendation	Response
Groundwater Management It is recommended with respect to the exceedance of groundwater level triggers: • WCPL must investigate the drivers for declining water levels (rather than omitting bores from the monitoring program when bores go dry). Notification to the Office of Water is required as part of the response procedure within 3 months of such an event.	Five bores are proposed to be removed from the groundwater monitoring program (GW14, GW18, GW19, P5 and P6). Only two samples (August 2011 and December 2011) have been obtained from GW14 since its installation in 2011 (these samples may have been associated with groundwater levels stabilising following drilling). This bore is located to the east of Wollombi Brook and is far removed from mining activities associated with the Wambo Coal Mine. Only one sample (August 2010) has been obtained from GW18. GW19 has been consistently dry since installation and no valid samples have been obtained from this bore. GW18 and GW19 are located immediately downstream and upstream of the North Wambo Creek Diversion, respectively. The alluvial flow in North Wambo Creek has been altered by the historical and existing mining operations including the removal of alluvium across the full width of the channel with consequent desaturation of the adjacent upstream and downstream alluvium associated with the approved and constructed North Wambo Creek Diversion. Bores P5 and P6 have been covered by the approved Wambo Coal Mine waste rock emplacement. WCPL considers removal of these five bores from the groundwater monitoring program is justified as outlined above. Trigger levels are not proposed for a further four bores along North Wambo Creek (GW08, GW09, GW16 and GW17). WCPL has initiated an investigation for bores GW08 and GW09 as outlined further below. Trigger levels will not be developed for these bores until this investigation is complete. GW16 and GW17 are located upstream of the North Wambo Creek Diversion and in close proximity to the approved open cut. There are no groundwater users located in the vicinity of North Wambo Creek upstream of the North Wambo Creek Diversion. Therefore, a trigger level for these two bores is not considered warranted.

NOW Recommendation	Response
• Where the driver for declining shallow bore water levels exceeding trigger levels can not be linked to the prevailing climatic influence or miscellaneous sampling error, additional groundwater modelling is required to re-assess if there is a change in the predicted take of water from the Lower Wollombi Brook Water Source from mining related activities. As part of WCPL's response procedure, a report summarising the assessment is to be submitted to the Office of Water.	WCPL has initiated an investigation into the monitored declining water levels in GW08 and GW09. As described in Section 6.1.3 of the revised GWMP, a preliminary investigation report will be provided to the DP&E and NOW by 30 September 2015. This report will include preliminary conclusions regarding the potential licensing implications and a process and timetable for any further investigation work (including potential additional numerical hydrogeological modelling work).
• Where the updated modelled aquifer interference take of water from the Lower Wollombi Brook Water Source (encapsulating Wambo and North Wambo Creek) exceeds the estimates as predicted in WPCL's Groundwater Impact Assessment by 100% or more, WCPL must re-evaluate the associated ecological impacts and any influence on a low flow cease to pump criteria specified in the relevant WSP. The reference value triggering this response procedure must be clearly documented in the GWMP.	As described in Section 6.1.3 of the revised GWMP, Where the investigation for GW08 and GW09 indicates a revised predicted take from alluvial water sources that exceeds the previous estimates by more than 100%, WCPL would consider other potential associated impacts (e.g. on ecology) and any influence on a low flow cease to pump criteria specified in the HUA WSP.
• The trigger levels in Table 11 of the GWMP outlines a minimum and maximum depth to water level. These values, plus any new bores added to the list, and the bores proposed to be dropped, must be presented in Australian Height Datum.	Table 11 of the GWMP has been revised to include trigger levels presented in Australian Height Datum.
<u>It is recommended with respect to the exceedance of groundwater quality triggers</u> • Appropriate water quality baseline data has not been captured and presented in way that can be used for before and after impact. Salinity data for a number of bores has fluctuated considerably which is not consistent with a more stable groundwater environment. The use of major ion analysis and QA/QC procedures should be reviewed to inform if the salinity measurements reported are accurate and if so the drivers to cause such variability in the results.	The GWMP has been revised to include annual comprehensive analysis of major ions standpipe bores. A description of data management procedures has been included in Section 5.3.2.
• Due to the concerns with the potential for cross aquifer interconnection, water quality performance measures are essential to the impact assessment. Water quality performance measures should be defined and added to the GWMP.	The GWMP has been revised to include groundwater quality trigger levels in Section 5.4.
<u>It is recommended with respect to the exceedance of predicted mine inflows</u> • There is a discrepancy between the GWMP which outlines a monthly measurement and annual assessment of mine inflows, whilst the 'Subsidence Response Strategy' indicates metering of weekly dewatered volumes. It should be consistently reported weekly, in the GWMP as this will improve the understanding of inflow and assist with groundwater management and the triggers for exceedance.	Section 5.2.5 of the GWMP has been updated to clarify that dewatering values are recorded internally on a daily basis (during active pumping). As outlined in the North Wambo Creek Subsidence Response Strategy, these values are reviewed weekly for any indication that pumping rates are higher than normal (which would trigger an investigation). Dewatering values are also reviewed annually (as outlined in the GWMP) to determine the inflows from groundwater sources and to verify whether WCPL holds sufficient groundwater licence entitlements.

NOW Recommendation	Response
• Where the annual assessment for mine inflows exceeds the peak estimate as predicted in WCPL's Groundwater Impact Assessment by 50% or more, WCPL shall: – investigate if there is a change in the predicted take of water from the Lower Wollombi Brook Water Source from mining related activities; – where there is an increased take from the Lower Wollombi Brook Water Source, investigate any influence on a low flow cease to pump criteria specified in the relevant WSP. – define the mine inflow volume value triggering this response procedure within the GWMP. – As part of WCPL's response procedure, a report summarising the assessment is to be submitted to the Office of Water.	Section 5.2.5 of the GWMP has been updated to include the recommended response procedure. The mine inflow volume that would response procedure has been defined in the GWMP (563 ML/annum, which is 50% more than the peak estimate predicted by HydroSimulations (2014) [375 ML/annum] for the North Wambo Underground Mine).
• WCPL must notify the Office of Water as soon as practicable on become aware of any take of water in excess of its licensed entitlement	Section 5.2.5 of the GWMP has been updated to include this statement.
It is recommended with respect to monitoring leakage from dams • The closest bore to South Dam is Piezometer 114 representative of Wambo Creek alluvium. South Dam contains produced water from the mine and P114 shows a sharp rise in salinity to a level on par with water in the dam. This indicates probable leakage occurring from the dam that warrants further investigation. However, as the proponent proposes not to utilise water quality as a performance measures, no direct response is proposed. Significant leakage to the nearby alluvial aquifer could risk a change in the beneficial use of the aquifer. Trigger levels with regard to salinity must be set to investigate and determine if remediation is required.	WCPL has initiated an investigation into the monitored increasing salinity levels in P114. Wambo South Water Dam is currently not in use for the period of secondary extraction for Longwall 9, Longwall 10 and Longwall 10A at the North Wambo Underground Mine. Wambo South Water Dam has been drained as far as practical since January 2015. Therefore, any possible leakage mechanism that may have impacted bore P114 may no longer be present.
A report summarising any special assessment for the above recommendations should be provided within 6 months.	As described in Section 6.1.4 of the revised GWMP, a preliminary investigation report will be provided to the DP&E and NOW by 30 November 2015.
Surface Water Management • The Office of Water recommends the proponent and the Department of Planning and Environment develop a consultation process with affected landholders to address existing and potential degradation which occurs as a result of mining subsidence. This should focus on incorporating natural processes for channel recovery particularly using large timber controls to maintain bed level (bed sills), bank toe protection (timber bank revetment) and creation of scour pools by using 'forced' controls such as engineered log jams as an adjunct to revegetation of both banks of both watercourses.	All land above the North Wambo Underground Mine is owned by WCPL. Therefore there are no other affected landholders associated with the North Wambo Underground Mine Extraction Plan for Longwalls 8 to 10A. Advisian (2015) concluded it is unlikely Wambo Creek and Stony Creek would experience adverse impacts from the North Wambo Underground Mine, and mitigation measures are unlikely to be required. In the unlikely event that any mitigation measures are required, these would be developed in consultation with the Department of Planning and Environment and the NSW Office of Water, and would aim to incorporate natural processes for channel recovery.

Department of Primary Industries
Water

Hamish Aiken
Team Leader, Resource Assessments
Department of Planning & Environment
GPO Box 39
SYDNEY NSW 2001

By email: Hamish.aiken@planning.nsw.gov.au

Contact Brendan Mee
Phone 02 4904 2524
Email Brendan.mee@dpi.nsw.gov.au

Our ref V15/3875#28

Dear Hamish

Response to Wambo South Bates (Whybrow Seam) Underground Mine Extraction Plan Long-walls 11-13 (DA305-7-2003) [Our Ref: V15/3875#28 & ER20556]

The Department of Primary Industries (DPI) Water has reviewed the Extraction Plan for Longwalls 11 to 13 for the Wambo South Bates (Whybrow Seam) Underground Mine. DPI Water has provided the following key comments as well as detailed comments in Attachment A. Attachment B includes more detailed groundwater comments.

Key comments

- DPI Water requires clarification on the maximum predicted take of surface and alluvial groundwater associated with Longwalls 11-13 (including predictions pre and post mitigation measures) and how this may impact on baseflow to Wollombi Brook.
- DPI Water requires clarification on current water entitlements held by the mine and where additional entitlement may be required. On receipt of further information regarding volume of water take and entitlements held, DPI Water can provide further advice on licensing requirements.
- There is significant uncertainty as to the reliance on sediment infilling for crack remediation. DPI water requires further analysis on the proposed remediation measures with reference to the updated volumetric information to be provided on maximum predicted take of water.
- Recent monitoring and investigations as well as details within the Groundwater Assessment Report (HC2015/36) indicate that there is greater hydraulic connection in the North Wambo Creek and connected alluvial aquifer systems and potentially greater impacts than those predicted. It is recommended that an appropriate timeframe be set where the groundwater conceptualisation and numerical models are updated to acknowledge the increased hydraulic connection and provide a more accurate estimate of the take of water.

If you require further information please contact Brendan Mee, Water Regulation Officer, Newcastle on (02) 4904 2524.

Yours sincerely

Tim Baker
A/Manager, Strategic Stakeholder Liaison
6 November 2015

ATTACHMENT A

Wambo South Bates (Whybrow Seam) Underground Extraction Plan Long-walls 11-13 NSW Department of Primary Industries, Water Detailed comments

General

The South Bates (Whybrow Seam) Underground Mine is a component of the Wambo Coal Mine with approval granted in 2004 under Part 4 of the *Environmental Planning and Assessment Act,* 1979. The Extraction Plan has been developed by Wambo Coal Pty Limited (WCPL) to satisfy condition 22C of the development consent DA 305-7-2003. In particular, the Extraction Plan outlines the potential subsidence impacts and environmental consequences associated with Longwalls 11 to 13. It incorporates updated modelling and revised predictions of impacts and proposes triggers and performance indicators to ensure that the performance measures outlined in the consent are not exceeded. The key relevant performance measure for DPI Water is “negligible impact on Wollombi Brook”.

Surface water

Advisian undertook an assessment of potential environmental consequences on North Wambo Creek, Stony Creek and minor watercourses associated with Longwalls 11 to 13, which include:

- Increased ponding as a result of differential subsidence;
- Increased erosion as a result of increased bed gradients; and
- Cracking of creek beds as a result of tensile strains, leading to loss of flow.

Advisian predicts impacts on North Wambo Creek including:

- in-channel ponding up to 1.4 m deep and up to 250 m long;
- potential for increased scour (and associated suspended solids) prior to the implementation of scour protection works; and
- potential for increased leakage from the North Wambo Creek Diversion prior to crack remediation works.

Advisian predicts impacts on Stony Creek and other ephemeral streams to include visible cracking in the beds where depths of the surface soils are shallow or where bedrock is exposed and potential diversion of surface flows.

Leakage of surface and alluvial groundwater from North Wambo Creek

DPI Water requires further information on what the predicted maximum take of surface and alluvial groundwater associated with Longwalls 11-13 is (including predictions pre and post mitigation measures).

HydroSimulations estimates that increased leakage from the North Wambo Creek Diversion to the underground workings would be approximately 12.5 megalitres per day (ML/day) prior to remediation during periods of flow. Advisian notes that flows in excess of 10 ML/day can be expected on approximately 22 days per year, comprising events of 2 to 3 days duration. This may result in a loss of water from North Wambo Creek of up to 275ML/year.

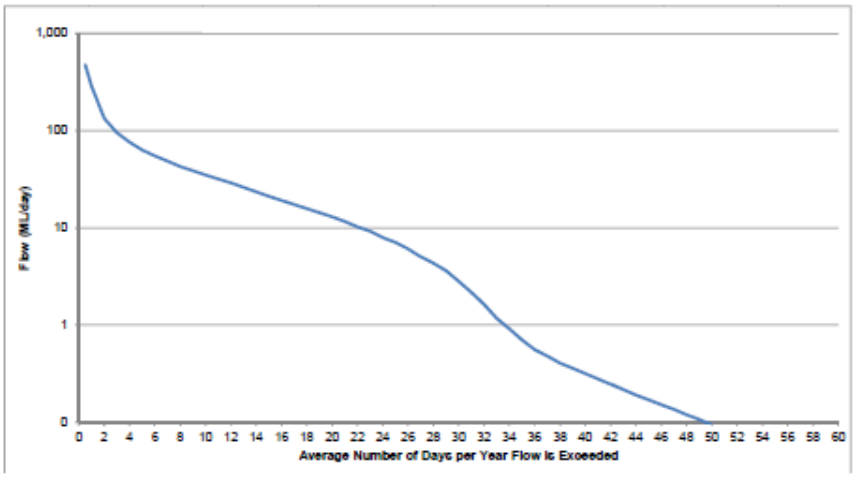


Figure 2.8: Flow Duration Graph for North Wambo Creek Diversion

Whilst WCPL proposes remediation of some surface cracks (minor cracks are not to be remediated) where practicable and when they are detected through infilling with soil, there is likely to be significant loss of surface water where cracks are not detected or prior to any remediation that does occur. This is likely to lead to a loss of baseflow to Wollombi Brook and potentially result in more than negligible impact to Wollombi Brook. Further information and analysis is required on the proportion of baseflow that will be lost to Wollombi Brook and the associated impacts with this loss of baseflow. Should there be impacts on baseflow to Wollombi Brook, further management measures may be required. This may include grouting of subsidence cracks, as opposed to infilling with soil as proposed and also treatment of smaller cracks as opposed to leaving these to natural processes (it is noted that WCPL assert that natural filling of minor cracking usually occurs within 6 to 12 months, by which time significant surface water loss may have occurred). Further remediation of the North Wambo Creek diversion may also be required, involving isolation sealing of bed and banks of the diversion cutting to reduce and minimise connective drainage from the engineered diversion into the longwall goaves.

Surface and alluvial groundwater is managed under the Hunter Unregulated and Alluvial Water Sharing Plan (WSP) within the Lower Wollombi Brook Water Source. WCPL does not outline how any loss of surface or alluvial groundwater from the Wollombi Brook Water Source will be accounted for. All loss of water must be accounted for through appropriate licences, as outlined in the consent. DPI Water notes that WCPL hold a water access licence of 350 units for surface water within the Lower Wollombi Brook Water Source (WAL18437), which may be used to account for the loss of surface water as a result of the mine, however it appears from recent Annual Environmental Management Reports that a significant proportion of the share component of this access licence is utilised each year for operational purposes. WCPL also hold an aquifer access licence of 70 units for alluvial groundwater within the Lower Wollombi Brook Water Source (WAL23897). WCPL may need to obtain further entitlement to fully account for the loss of surface water prior to commencement of operations. Discussion of this should be outlined in the Extraction Plan or associated water management plans. Following receipt of detailed information regarding the predicted take of water, DPI Water can provide further advice on licensing requirements as required.

Geomorphological impacts and ponding of surface water

Advisian predicts in-channel ponding up to 1.4 m deep and up to 250 m long. WCPL proposes to maintain the predicted in-channel ponding, as works to allow free drainage of the pools would require significant disturbance of the North Wambo Creek Diversion (regrading over a length of approximately 1.5 km downstream). As the channel to North Wambo Creek is rock cut, and has the potential for inclusion of large woody debris and other geomorphic elements to increase channel variability, the deformation which is predicted to result from mining-induced subsidence does not

impose a risk to the stability of the channel. Advisian notes that extended ponding which is likely to result from the subsidence profile is a beneficial outcome to North Wambo Creek, and will, in the medium to long term, infill with sediments to form a sand bedded stream. This presumes that remediation of the extended fracturing network will be successful, and effective sediment trapping will not flush out during following flow events. DPI Water supports the approach to allow ponding within the North Wambo Creek Diversion, however any loss of surface flow to Wollombi Brook associated with ponding will need to be appropriately accounted for. DPI Water also recommends incorporation of sediment trapping mechanisms such as use of large woody debris structures, including bar apex jams and bed sills within the North Wambo Creek Diversion.

Surface water flow monitoring

The consent requires monitoring of the volume and quality of water inflows from each separate source to the mine workings. Flow monitoring site FM2 is located immediately upstream of longwalls 11-13, however the nearest surface water flow monitoring site on North Wambo Creek downstream of longwalls 11-13 appears to be at the confluence to Wollombi Brook. This is a significant distance downstream of the likely impacts and DPI Water recommends WCPL investigate options to install a flow monitoring site immediately downstream of the predicted area of subsidence in order to monitor accurately the surface water losses as a result of longwalls 11-13 and separate these losses from other sources. Flow monitoring site FM3 is referenced in some documentation provided (including Table 4 of the Water Management Plan (WMP)) in the area downstream of longwalls 11-13, however it appears this site is no longer in existence. Flow monitoring in this area would provide a more accurate indication of surface water losses allowing better mitigation of the impacts as well as more precise accounting of surface water through water licences.

Surface water performance indicators

Performance indicators outlined in Table 6 of the WMP for “negligible impact” to Wollombi Brook include surface water quality, groundwater quality and groundwater level parameters, but do not include surface water flow volumes. There is the potential for considerable loss of surface water to Wollombi Brook as a result of subsidence and this should be a performance indicator to ensure negligible impact to Wollombi Brook. It is noted that surface water flow is listed as a monitoring parameter and in the assessment of performance measures within Table 7 of the WMP, however it should be listed separately as a performance indicator within Table 6.

The impact assessment criterion for Wollombi Brook for surface flow has been set to zero flow at the Warkworth gauging station. There may be considerable loss of surface water flow to Wollombi Brook from North Wambo Creek as a result of the proposal, which may cause more than a negligible impact on Wollombi Brook prior to Wollombi Brook ceasing flow. It is recommended WCPL provide further analysis on the impact of loss of baseflow to Wollombi Brook and associated impacts and whether the impact assessment criterion for Wollombi Brook requires review in order to ensure there is not a greater than negligible impact on Wollombi Brook.

Existing licences and site water balance

WCPL outlines the existing water licences and approvals held in Table 3 of the Groundwater Monitoring Program (GWMP). This table does not accurately show the licences and entitlement held by WCPL. It does not show the water source from which water is taken and does not describe when extraction limits are shared between multiple licences. For example:

- The following licences are linked to 20PT910607 (450 ML) - 20BL166910, 20BL173032, 20BL173033, 20BL173034 and 20BL173035. Therefore the total cumulative water abstracted from all bores in any 12 month period commencing 1 July must not exceed 450 ML.

- The following licences are linked to 20PT910929 (750 ML) - 20BL173040, 20BL168017 and 20BL172061. Therefore the total cumulative water abstracted from all bores in any 12 month period commencing 1 July must not exceed 750 ML.
- 20BL166906 previously had an entitlement of 19 ML however this licence has been cancelled.

The table implies that WCPL holds a total of 4971 ML entitlement under the *Water Act 1912*, however Wambo actually hold 1647 ML under the *Water Act 1912*.

Licences held by WCPL under the *Water Act* 1912 are currently being reviewed by DPI Water and WCPL to ensure a consolidated and clear outline of the entitlement held.

In reference to access licences held under the WMA 2000 Table 3 within the GWMP does not show a complete list. Access licences held by WCPL are shown below:

WAL	Licence	Holder	Shares	Water Source	Category
718	20AL200631	Wambo Coal Pty Limited	1000	Hunter Regulated River Water Source	Regulated River (High Security)
8599	20AL201457	Wambo Coal Pty Limited	6	Hunter Regulated River Water Source	Regulated River (High Security)
8600	20AL201458	Wambo Coal Pty Limited	868	Hunter Regulated River Water Source	Regulated River (General Security)
8604	20AL203044	Wambo Coal Pty Limited	240	Hunter Regulated River Water Source	Supplementary Water
18437	20AL208641	Wambo Mining Corporation Pty Limited	350	Lower Wollombi Brook water Source	Unregulated River
23897	20AL211371	Wambo Coal Pty Limited	70	Lower Wollombi Brook water Source	Aquifer

It is recommended that the proponent provide clarification regarding which licences relate to the operation of Wambo mine and which are used to account for passive water take. This should be outlined in an updated table that includes the maximum predicted take of water from surface water, alluvial groundwater and Permian groundwater pre and post remediation and the associated licences nominated to account for this take. A comprehensive site water balance for the mine should also be provided. The current site water balance referred to in the Extraction Plan and shown within a table in the Annual Environmental Management Report is insufficient to clearly outline the detailed water accounting circumstances of the mine.

Licensing and relinquishment of water rights

WCPL outline an approach of relinquishment of existing water extraction rights equivalent in volume to the loss of water in the North Wambo Creek system to compensate for water loss.

All loss of surface water, alluvial groundwater and permian groundwater as a result of the proposal needs to be quantified accurately and accounted for through appropriate licences during operation of the mine and prior to the take of water. Wambo needs to show that it is able to obtain relevant licences to account for this water and must nominate a licence with an appropriate volume.

Groundwater dependent ecosystems

The consent requires that measures are taken to mitigate adverse impacts on groundwater dependent ecosystems or riparian vegetation and offset any impacts above those predicted. The Extraction Plan and associated water management plans do not provide an analysis of impacts on GDEs or riparian vegetation associated with longwalls 11-13 or measures to mitigate any impacts. This should be detailed within the Water Management Plan provided.

Additional specific comments in relation to plans

Extraction Plan

- The management measures for the North Wambo Creek Diversion in the table on page iii and in Table 10 on page 29 of the Extraction Plan should include Implementation of the Surface

and Groundwater Response Plan (this has only been included as a management measure for Stony Creek).

- Remediation of surface cracks, as outlined in the management measures of Table 10 should include a timeframe for remediation (i.e. as soon as cracks are detected).
- Performance indicators in Table 11 should include a performance indicator for surface water flow, rather than just surface water quality.
- Table 11 refers to retirement of an equivalent volume of water licence as a contingency measure. All loss of surface flow needs to be accounted for through appropriate licences during operation of the mine and prior to the take of water. Wambo needs to show that it is able to obtain relevant licences to account for the maximum predicted take of water and must nominate a licence with an appropriate volume.
- Table 12 refers to remediation of surface cracks "where practicable". DPI Water requires further discussion of the definition of "where practicable". WCPL asserts that natural filling of minor cracks is likely to take 6 to 12 months. DPI Water recommends minor cracks be actively remediated to ensure minimal loss of surface water. DPI Water also recommends that grouting be implemented as a management measure in the initial remediation of surface cracks.
- Rehabilitation of surface cracks outlined in section 3.7 on page 48 should be reviewed and consistent with the advice above.

Water Management Plan

- Table 4 refers to surface water flow monitoring at flow monitoring sites FM2 and FM3. FM3 is not shown on other figures within the WMP and clarification is required regarding its use.
- Remediation of surface cracks outlined in Table 5 should be reviewed and consistent with the advice above. Timing of remediation should be outlined (i.e. as soon as cracks are detected).
- Performance indicators in Table 6 should include a specific indicator for surface water flow, consistent with the advice above.
- Table 7 – greater analysis of the impact of loss of surface flow on Wollombi Brook is required, consistent with the advice above. This should be reflected in more specific detail in Table 7. For example, assessment of performance indicators does not include a surface flow parameter. Assessment of performance measures includes a "greater than negligible change in Wollombi Brook surface water flow (e.g. stream baseflow)", however WCPL does not outline what a greater than negligible change in Wollombi Brook baseflow constitutes, only that the impact assessment criterion is set at zero flow at Warkworth gauge. Incorporation of triggers related to 20mm rainfall leading to flow needs to be incorporated.
- WMP – Trigger Action Response Plan (Table A1-1, pA1-1) – Level 1 Management Measures does not include a trigger should predicted impacts on surface and groundwater outlined in Section 3, or any performance indicators, be exceeded.

Surface Water Monitoring Program

- Section 1.4.4 states that WCPL currently holds two water access licences (WAL) within the Wollombi Brook water source (WAL No. 23897 and 718), however WAL 718 is within the Hunter Regulated River Water Source. Please see table above with details of current WALs.
- Table 7 shows a number of gauges for which there is no flow data available with no discussion, as well as NA marked on some flow days despite there being flow.
- Section 2.2.4 refers to a site water balance, however only "summary results" within the Annual Review reports are provided. A comprehensive site water balance is required.
- Performance indicators listed in section 3.4 list "number of exceedances of surface water impact assessment criteria" and Wambo notes that an exceedance occurs when water quality results exceed the 80th percentile trigger value after three consecutive sampling events. This performance indicator should also include exceedance of the stream flow impact assessment criteria. It is also recommended that water quality monitoring frequency be increased to weekly following any detection of an exceedance as per the below comment on the Surface and Groundwater Response Plan.

Surface and Groundwater Response Plan

- Table 3, p 10 – The triggers and responses for impacts on private bores need review. In relation to trigger levels for impacts on private bores, WCPL has not provided information supporting the adoption of a groundwater level trigger of 2 m below modelled statistical trends. It is unclear whether the depth and standing water level of privately held bores would allow for extraction for licensed and basic rights purposes if groundwater level declined to this level. No action occurs until three consecutive monitoring rounds show a decline at this level, potentially resulting in a significant period for private bore owners without water. The TARP does not provide for notification of any government agency until the WMP is updated in accordance with a groundwater investigation. It is recommended relevant agencies be notified of trigger exceedances as part of regular reporting requirements. Additionally compensation for privately held bores is only considered after a groundwater investigation has categorically proven that the groundwater level decline is directly related to mining. This may result in impacted landholders being without access to water for a considerable length of time prior to receiving any assistance with water supply. Furthermore, compensatory water supplies are only proposed to be provided until there are "signs of increasing water levels", however this may not equate to groundwater levels being at a consistent and sufficient level to allow private users to be able to extract.
- Table 4, p 12 – should monitoring indicate a loss of flow within watercourses and the flow trigger is exceeded, the only actions included in the TARP are related to further monitoring, rather than any mitigation measures to prevent further surface water loss. Remediation measures outlined in the WMP should be implemented if flow triggers are exceeded and this should be included in this table.
- Table 5, p 13 – This table outlines that should surface water monitoring detect an exceedance of water quality trigger values on two consecutive sampling events, then the action is to continue monitoring as usual (the trigger does not actually trigger any further actions). It is only if a third exceedance is detected that actions are implemented. Given sampling is conducted monthly, this could result in a period of up to three months where water quality is exceeding performance measures before any action was taken, which could result in significant impacts to the environment and other water users. It is recommended that after detection of an exceedance during one sampling event, the frequency of monitoring is increased to weekly and that contingency actions then be implemented following two further exceedances. Sampling could return to monthly once sampling indicates that parameters are within trigger levels.
- Page 15, first paragraph - refers to relinquishment of an equivalent volume of water licence as a contingency measure. All loss of surface flow needs to be accounted for through appropriate licences during operation of the mine and prior to the take of water.

End Attachment A

Wambo South Bates (Whybrow Seam) Underground Extraction Plan Long-walls 11-13 NSW Department of Primary Industries, Water detailed groundwater comments

A number of recommendations were provided for the previous Extraction Plan review covering long-walls 8-10A in the adjacent North Wambo Underground. There is an overlap in the Extraction Plan and Water Management Plan between the previous review for long-walls 8-10A and this review of the Extraction Plan for long-walls 11-13. The recommendations (blue text) were made due to concerns regarding declining alluvial groundwater levels, fluctuating salinity data and issues raised during the EIS assessment. They included the following:

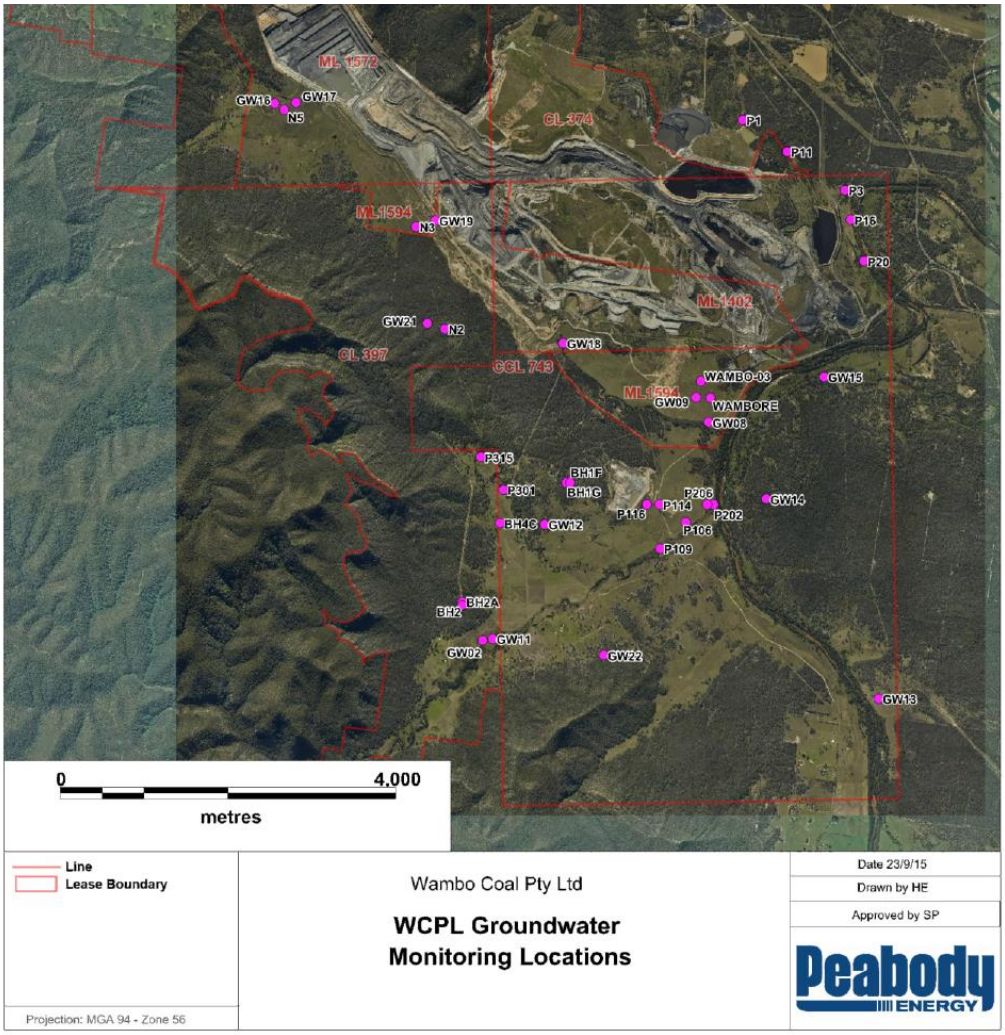
- WCPL must investigate the drivers for declining water levels (rather than omitting bores from the monitoring program when bores go dry). Notification to NOW is required as part of the response procedure within 3 months of the event.

The proponent responded with their justification for the removal of the 5 bores. GW14 being removed due it's distance from Wambo Coal Mine GW18 and 19 due desaturation of alluvium associated with creek diversion. P5 and P6 covered in waste rock emplacement.

The following table and figure below extracted from the GWMP presents the proponents proposed monitoring bores for assessing the impacts of the mine. It is noted that with the removal of the 5 bores as outlined, there is no longer bores in North Wambo Creek alluvium for trigger an assessment of impact. It is recommended that the monitoring program be revised to address the loss of bores from the North Wambo Creek alluvium.

Table 9: Shallow Bores Water Level Trigger Values

Bore	Depth to Groundwater (mBTOC[4])	
	Minimum (20th percentile)	Maximum (80th percentile)
P106	7.6	10.4
P109	5	6.5
P114	5.7	7.1
P116	5.1	7.2
P202	8.2	9.5
P206	16.9	21.3
P301[1]	NA	NA
P315	5.1	8.6
GW02	5.9	7.6
GW08[2]	NA	NA
GW09[2]	NA	NA
GW11	3.1	4.5
GW13	4.1	5.8
GW15	10.1	12.8
GW16[3]	NA	NA
GW17[3]	NA	NA
P16	5.4	8.6
P20	8.9	11.4



The proponent has also provided a supplementary report (ref: HC2015/39) looking at the drivers for declining water levels for alluvial bores in North Wambo Creek where it is concluded:

(i) That the decline in alluvial levels is attributed to one or more mining activities at the site.

(ii) The 2015 numerical model, although well-calibrated with respect to other bore hydrographs on site, under-predicts the drawdown at GW08 and GW09. This is most likely because the extent of fracturing and enhanced permeability related to the old Wambo mine workings is more extensive (both laterally and vertically) than is represented in the model

(iii) The sudden and sustained drawdown at GW08 and GW09 corresponds in time to the start of dewatering of the old Wambo mine workings.

Whilst DPI Water had raised such concerns with the numerical model having conceptualised a highly constrained vertical hydraulic conductivity and restricting the North Wambo Ck and Wambo Ck as drain cells, it was acknowledged that the independent review undertaken by Hugh Middlemis concluded that the groundwater model satisfied the Australian Groundwater Modelling Guideline (Barnett et al., 2012) requirements.

The supplementary assessment presents that the vertical connection is indeed more significant than modelled. Such findings when combined with the fact that both North Wambo Ck and Wambo Ck were modelled as drain cells (does not allow these watercourses to recharge the underlying groundwater system) and the proponent has negated any response measures to monitoring North Wambo Ck alluvium, leads the reader to conclude that the take of water from the Wollombi Brook Water Source is likely to be significantly under estimated. Further commentary on this is also provided in the next point.

- Where the driver for declining shallow bore water levels exceeding trigger levels is not linked to the prevailing climatic influence or miscellaneous sampling error, additional groundwater modelling is required to re-asses if there is a change in the predicted take of water from the Lower Wollombi Brook Water Source from mining related activities.

To address this concern the proponent has advised as follows:

"*This data analysis, based on currently available records, has shown that there are no predicted material impacts from longwall mining beyond what was foreseen for the cumulative impacts described in the North Wambo Underground Mine Modification Groundwater Assessment (HC, 2012) and the South Bates (Wambo Seam) Underground Mine Modification – Groundwater Assessment (HS, 2015). Therefore revision of the potential environmental consequences of Longwalls 11 to 13 is not required*". Note the HS 2015 report noted above reports a maximum take of 16 ML/yr from the Lower Wollombi Brook Water Source.

There are a number of points stated in the Groundwater Assessment Report (HC2015/36) that lead the reader to conclude that the take of water from Wollombi Brook Water Source being greater than presented.

(i) Shallow depth of mining. The depth of above Longwalls 11 to 13 in the Whybrow Seam is 54 m to 470 m. The depth of cover above the Whybrow Seam at the North Wambo Creek diversion is approximately 64 m to 80 m and there would be an enhanced hydraulic connection between the seam and the surface in this location.

(ii) Associated with previous undermining of Wambo creek and cracking, the highest inflow reported by Klenowski was approximately 16 ML/day (190 L/s), and the reported inflow to the Homestead Mine was approximately 17 ML/day (200 L/s). For North Wambo Creek diversion above the South Bates Underground Mine, using a reach of 250m (above one longwall), a channel width of 5m, and a conservative K of 10 m/day, the estimated inflow would be approximately 12.5 ML/day.

(iii) In the model, the diversion has been simulated as an ephemeral drain and the scenario of occasional high flows is not examined as part of the numerical model.

The Groundwater Management Plan outlines that the alluvial flow in North Wambo Creek has been altered from mining operations such that there is desaturation of the adjacent alluvium upstream and downstream of the North Wambo Creek Diversion.

The proponent holds a licence for 70 units within the Lower Wollombi Brook Water Source. It is unknown if the 70 units is adequate to offset the mine's combined direct and indirect take of water from this Water Source. The proponent's conclusion that 'no further revision of the consequences is required', is not supported.

It is recommended that an appropriate timeframe be set where the groundwater conceptualisation and numerical model be updated to acknowledge the increased hydraulic connection taking place along North Wambo Creek, South Wambo Creek and the connected alluvial aquifer systems and in addition to identify a more accurate estimate for the licensable take of water from North Wambo Creek, South Wambo Creek, these be modelled as river cells rather than drain cells.

- Where the updated modelled aquifer interference take of water from the Lower Wollombi Brook Water Source (encapsulating Wambo and North Wambo Creek) exceeds the estimates as predicted in WPCL's Groundwater Impact Assessment by 100% or more, WCPL must re-evaluate the associated ecological impacts and any influence on a low flow cease to pump criteria specified in the relevant WSP. The reference value triggering this response procedure must be clearly documented in the GWMP.

Comments from previous issue apply.

- The trigger levels in Table 11 of the GWMP outlines a minimum and maximum depth to water level. These values, plus any new bores added to the list, and the bores proposed to be dropped, must be presented in Australian Height Datum.

The proponent indicated in their response (see image clip below) that levels were revised to AHD.

• The trigger levels in Table 11 of the GWMP outlines a minimum and maximum depth to water level. These values, plus any new bores added to the list, and the bores proposed to be dropped, must be presented in Australian Height Datum.	Table 11 of the GWMP has been revised to include trigger levels presented in Australian Height Datum.

The groundwater triggers are actually presented as Table 9 within the Groundwater Management Plan and have not been referenced to AHD as required. Given the proponent's statements that the alluvial groundwater levels within Wambo Creek alluvium will not be impacted from LW 10A due to the inferred low hydraulic connection between the alluvium and mine workings (both historical and proposed), and the cumulative subsidence from multi seam monitoring will occur, the trigger levels must be presented in AHD and not depth below surface. This increased permeability and subsidence from multi seam mining has potential ramifications for the long term recovery and for flux of saline water from the Permian strata to the alluvium and thus needs to monitored in AHD levels. In addition, it is recommended that P114 and P116 of the Wambo Ck alluvial trigger bores within the subsided area be nested or paired with deeper interburden bores. This is required to assess the direction of flow between Permian and alluvial aquifers within subsided area during the post mining monitoring period. Presently there is only two interburden bores (P202 and P206) outside the subsidence area. Monitoring within North Wambo Creek alluvium needs to be added to the list of trigger bores.

- Appropriate water quality baseline data has not been captured and presented in way that can be used for before and after impact. Salinity data for a number of bores has fluctuated considerably which is not consistent with a more stable groundwater environment. The use of major ion analysis and QA/QC procedures should be reviewed to inform if the salinity measurements reported are accurate and if so the drivers to cause such variability in the results.

The proponent has responded outlining bi-monthly monitoring of groundwater levels, pH and EC will be undertaken at all standpipe bores in the groundwater monitoring program. Comprehensive analysis of major ions will occur at each standpipe bore annually. An overview of the guideline document for groundwater sampling is provided but no actual review or commentary on the robustness of the water quality data collected.

The inclusion of major ions is supported, however it is recommended that the frequency be increased to 6 monthly for the first two years, then annually.

- Due to the concerns with the potential for cross aquifer interconnection, water quality performance measures are essential to the impact assessment. Water quality performance measures should be defined and added to the GWMP.

The proponent has responded outlining bi-monthly monitoring of groundwater levels, pH and EC will be undertaken at all standpipe bores in the groundwater monitoring program. Comprehensive analysis of major ions will occur at each standpipe bore annually.

The inclusion of major ions is supported, however it is recommended that the frequency be increased to 6 monthly for the first two years, then annually.

- There is a discrepancy between the GWMP which outlines a monthly measurement and annual assessment of mine inflows, whilst the 'Subsidence Response Strategy' indicates metering of weekly dewatered volumes. It should be consistently reported weekly, in the

GWMP as this will improve the understanding of inflow and assist with groundwater management and the triggers for exceedance.

The proponent has advised the records of mine inflow are recorded internally daily basis when pumping, values reviewed weekly to see if pumping rates are higher than normal, reported annually against the licence.

The response is acknowledged and accepted.

- Where the annual assessment for mine inflows exceeds the peak estimate as predicted in WCPL's Groundwater Impact Assessment by 50% or more, WCPL shall:

  (i) investigate if there is a change in the predicted take of water from the Lower Wollombi Brook Water Source from mining related activities;

  (ii) where there is an increased take from the Lower Wollombi Brook Water Source, investigate any influence on a low flow cease to pump criteria specified in the relevant WSP.

  (iii) define the mine inflow volume value triggering this response procedure within the GWMP.

  (iv) As part of WCPL's response procedure, a report summarising the assessment is to be submitted to NOW.

The proponent advises the GWMP has been updated to include these recommendations.

The response is acknowledged and accepted.

- The closest bore to South Dam is Piezometer 114 representative of Wambo Creek alluvium. South Dam contains produced water from the mine and P114 shows a sharp rise in salinity to a level on par with water in the dam. This indicates probable leakage occurring from the dam that should warrant further investigation. However, as the proponent proposes not to utilise water quality as a performance measures, no direct response is proposed. Significant leakage to the near by alluvial aquifer could risk a change in the beneficial use of the aquifer. This is a potential conflict with the Objects of the WMA (2000). Trigger levels with regard to salinity should be set to investigate and determine if remediation is required.

The proponent advises "An investigation into the increased EC in shallow bore P114 has been initiated to further investigate the potential for impacts on this bore as a result of possible leakage from Wambo South Water Dam and potential remediation/mitigation measures. As described in Section 4.1.6, Wambo South Water Dam is currently not in use for the period of secondary extraction for Longwall 9, Longwall 10 and Longwall 10A at the North Wambo Underground Mine. Wambo South Water Dam has been drained as far as practical, since January 2015."

DPI Water can't provide comment until the report is submitted.

In respect the Rehabilitation Plan, without a better understanding of the implications for water take and the connectivity issue, it is difficult to comment on the rehabilitation option of simply allowing natural fill and surface grading to remedy the cracking to be created in Wambo Creek. At this stage based on the commentary above, it would be viewed as being insufficient and not commensurate with the risk

End Attachment B

Department of Primary Industries

OUT15/3875

Mr Hamish Aiken
Resource Assessments
NSW Department of Planning and Environment
GPO Box 39
SYDNEY NSW 2001

Hamish.Aiken@planning.nsw.gov.au

Dear Mr Aiken,

Response to updated Extraction Plan and Water Management Plan – Wambo South Bates (Whybrow Seam) Underground Mine Extraction Plan Long-walls 11-13 (DA305-7-2003)

Reference is made to the revised Extraction Plan and Water Management Plans for the Wambo South Bates (Whybrow Seam) Underground Mine Extraction Plan Long-walls 11-13 dated December 2015 and the response to DPI Water comments. DPI Water provides the following further comments.

Water Licensing

Wambo Coal Pty Ltd (WCPL) notes in its response that it is in the process of conducting a licensing review to confirm that it holds appropriate licences prior to the commencement of South Bates Underground Mine. DPI Water requests that WCPL liaise with DPI Water to ensure that sufficient entitlement is held and licences are nominated to account for the predicted take of water prior to commencement. As previously requested, WCPL must provide an updated table that includes the maximum predicted take of water from surface water, alluvial groundwater and Permian groundwater pre and post remediation and the specific licences nominated to account for this take. This should be incorporated into the Water Management Plan.

Groundwater

DPI Water made a number of comments regarding revision of the monitoring program, including concerns regarding the loss of bores and triggers in the North Wambo Creek alluvium. WCPL responded that the following statement had been included in the groundwater management plan: "*Specific trigger levels for GW08 and GW09 have not been established however if GW08 and GW09 do not recover within 12 months of the cessation of dewatering pumping, WCPL may consider installing replacement bores that allow monitoring of the alluvium and underlying interburden material…*". It is recommended that this issue be discussed in a meeting

between DPI Water and the proponent to ensure that DPI Water concerns regarding monitoring are resolved.

DPI Water recommended that an appropriate timeframe be set where the groundwater conceptualisation and numerical models are updated to acknowledge the increased hydraulic connection and provide a more accurate estimate of the take of water. WCPL responded that whilst the vertical hydraulic conductivity above the previous bord and pillar workings in the Wambo Seam is higher than previously adopted, there is no evidence to support any lateral extension of higher connectivity away from the workings. DPI Water recommends that this issue be further discussed and resolved in the meeting proposed above with the proponent.

DPI Water still has some concerns regarding groundwater monitoring and management, as outlined above. It is recommended these concerns be resolved at a subsequent meeting; however, it is not considered that the issues should delay the commencement of work.

For further information contact Brendan Mee, Water Regulation Officer, (Newcastle Office) on (02) 4904 2524 or at brendan.mee@water.nsw.gov.au.

Yours sincerely

Brendan Fletcher
A/Manager, Planning Policy & Assessment Advice
17/01/2016

APPENDIX C
NORTH WAMBO CREEK SUBSIDENCE RESPONSE STRATEGY

WAMBO COAL
NORTH WAMBO CREEK DIVERSION SUBSIDENCE RESPONSE STRATEGY – SBU MINE

Document No. WA-ENV-MNP-509.7
May 2016

Document Control

Document No.	WA-ENV-MNP-509.7
Title	North Wambo Creek Diversion Subsidence Response Strategy – SBU Mine
General Description	Responses to potential subsidence impacts on North Wambo Creek Diversion
Document Owner	Environment & Community Manager

Revisions

Rev No	Date	Description	By	Checked	Signature
1	May 2016	Updated for SBU LW11-LW13	WCPL	SP	

CONTENTS

Tables

Figures

LIST OF ATTACHMENTS

Attachment A *Water Management Plan – South Bates (Whybrow Seam) Underground Mine Longwalls 11-13*

1.0 Introduction

1.1 Background

The Wambo Coal Mine (the Mine) is situated approximately 15 kilometres west of Singleton, near the village of Warkworth, New South Wales (**Figure 1**). The Mine is owned and operated by Wambo Coal Pty Limited (WCPL), a subsidiary of Peabody Energy Australia Pty Limited.

The South Bates (Whybrow Seam) Underground Mine is a component of the approved Wambo Coal Mine. The South Bates (Whybrow Seam) Underground Mine commenced in February 2016 and involves extraction of coal by longwall mining methods from the Whybrow Seam within Coal Lease (CL) 397 and Mining Lease (ML) 1594 (**Figure 2**).

The potential environmental impacts of the existing Wambo Coal Mine (including the approved South Bates [Whybrow Seam] Underground Mine) were assessed in the Wambo Development Project Environmental Impact Statement (the Wambo Development Project EIS) (WCPL, 2003). Development Consent DA 305-7-2003 for the Wambo Coal Mine was granted on 4 February 2004 by the then NSW Minister for Urban Affairs and Planning under Part 4 of the *NSW Environmental Planning and Assessment Act, 1979*.

Underground mining at North Wambo Underground Mine commenced in 2005 was completed in early 2016 with the completion of Longwall 8b. Underground mining operations moved to South Bates (Whybrow Seam) Underground Mine with the commencement of Longwalls 11 to 13 (approved as part of the Development Consent DA 305-7-2003).

The SBU Mine has an approved Extraction Plan for LW11 to LW13 (the Extraction Plan) that outlines the proposed management, mitigation, monitoring and reporting of potential subsidence impacts and environmental consequences from the secondary extraction of Longwalls 11 to 13 at the South Bates (Whybrow Seam) Underground Mine.

1.2 Overview of Predicted Impacts - North Wambo Creek Diversion

Potential environmental consequences to the North Wambo Creek Diversion (NWCD)[1] above the Longwalls 11 to 13 from the Extraction Plan, include:

- In-channel ponding up to 1.4 metres (m) deep and up to 250 m long;
- Potential for increased scour (and associated suspended solids) prior to the implementation of scour protection works; and
- Potential for increased leakage from the North Wambo Creek Diversion prior to crack remediation works.

[1] North Wambo Creek has now been completely diverted around the active Bates South Open Cut Pit. The creek diversion is located adjacent to the finishing (i.e. north-eastern) ends of the proposed South Bates (Wambo Seam) Underground Mine Longwalls 14 to 16 (WMLW14 to WMLW16) and is partially located above the three longwalls in the Whybrow Seam, now referred to as WYLW11 to WYLW13 at the South Bates (Whybrow Seam) Underground Mine.

WCPL proposes to maintain the predicted in-channel ponding as works to allow free drainage of the pools would require significant disturbance of the North Wambo Creek Diversion (regrading over a length of approximately 1.5 km downstream) (Advisian, 2015).

HydroSimulations (2015) estimates that increased leakage from the North Wambo Creek Diversion to the underground workings could be in the order of approximately 12.5 megalitres per day (ML/day) prior to remediation during periods of flow. Advisian notes that flows in excess of 10 ML/day can be expected on approximately 22 days per year, comprising events of 2 to 3 days duration.

Management and remediation measures to mitigate the risk of scour and leakage associated with Longwalls 11 to 13 (**Section 2**).

1.3 Purpose

The purpose of this revised North Wambo Creek Subsidence Response Strategy (NWCSRS) is to provide monitoring and management response strategies as a result of subsidence impacts on the NWCD (**Figure 3**) from the subsequent underground mining operations at SBU for LW11 to LW13.

1.4 Scope

The NWCSRS applies to all WCPL employees, contractors and sub-contractors, undertaking activities within the vicinity of North Wambo Creek Diversion, within WCPL's mining authorisations and approved mining areas. The North Wambo Creek Diversion is located adjacent to the proposed LW11 to LW13 is shown in Error! Reference source not found..

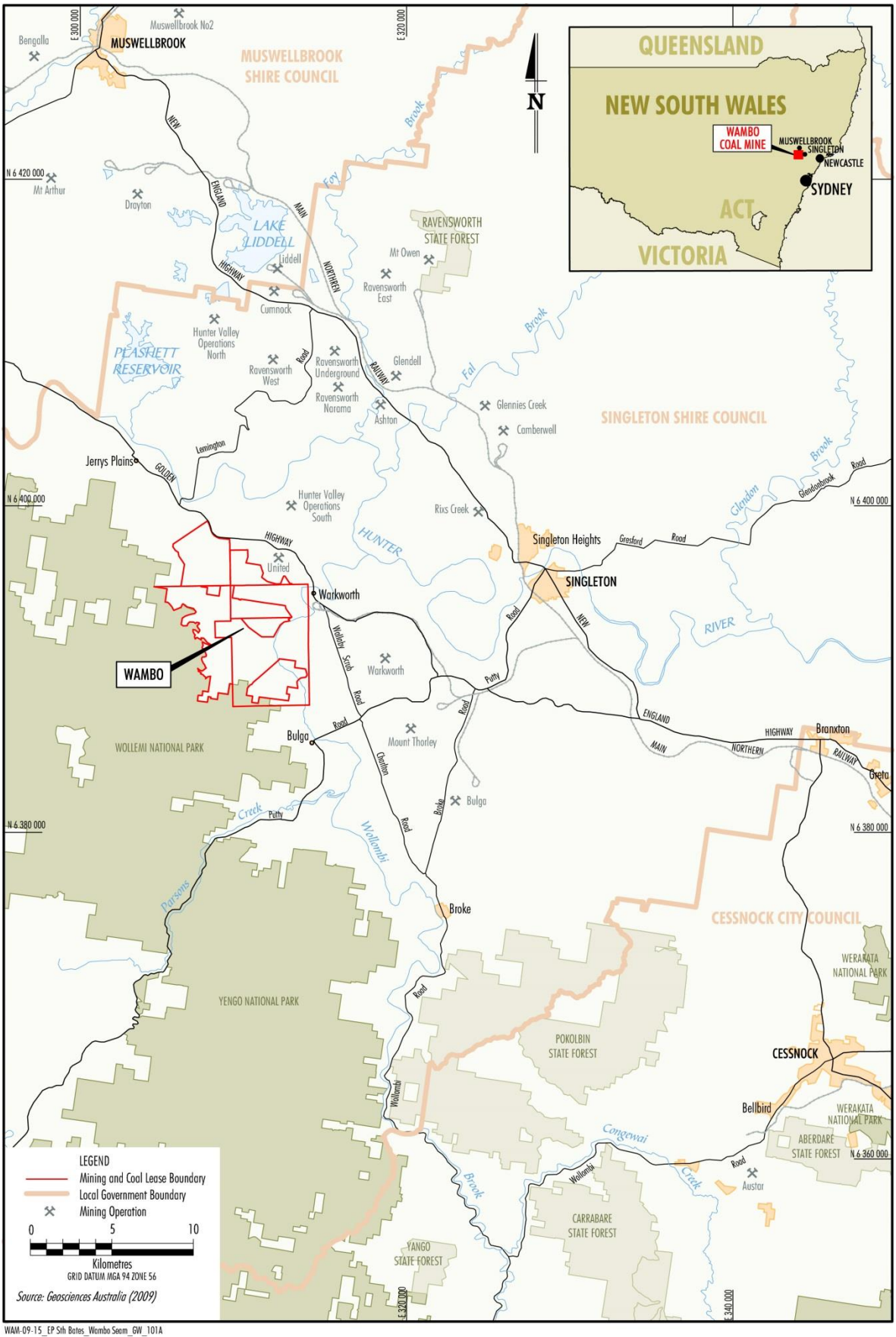


Figure 1: Wambo Coal Regional Location

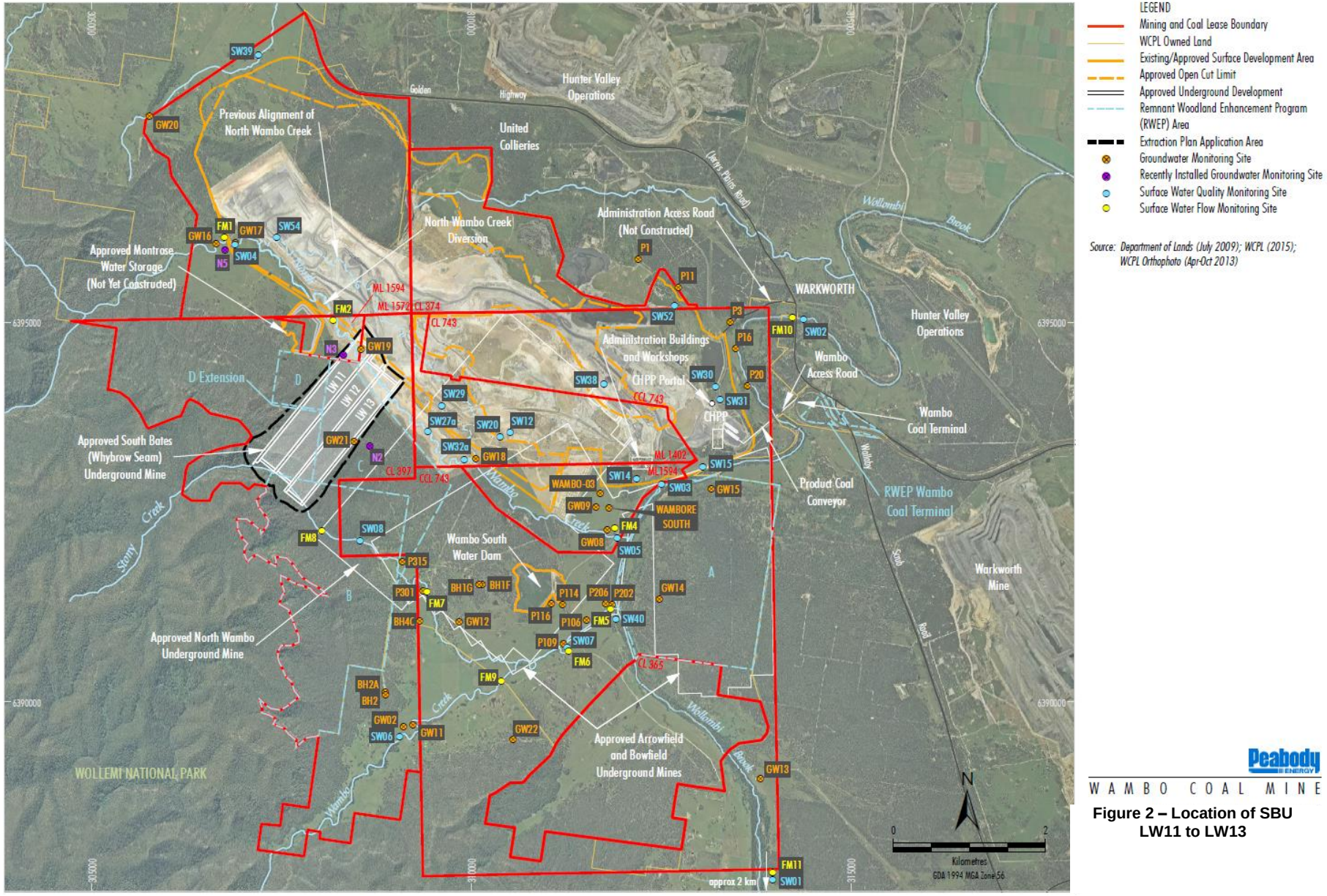


Figure 2 – Location of SBU LW11 to LW13

WAMBO COAL MINE

Figure 3 – Location of SBU LW11 to LW13 and section of the NWCD

2.0 Management Strategies

2.1 Monitoring

The monitoring strategies to identify the proposed impacts within the NWCD as described in **Section 1** (from the Extraction) are detailed and summarised in **Table 1**.

Table 1 Monitoring Program for NWCD

Monitoring Component	Parameter	Timing/Frequency	Responsibility
Pre-Mining			
Longitudinal survey along North Wambo Creek Diversion above Longwalls 11 to 13.	Detailed photographic geomorphic record. Review of 3 dimensional surface level maps. Identification of any areas of potential instability.	Prior to commencement of secondary extraction within 100 m of the North Wambo Creek Diversion.	Environment and Community Manager
Bed and bank stability monitoring of Stony Creek.	In accordance with the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Monitoring of surface water quality and flow monitoring sites (SW04, SW27a, SW08, FM2, FM3).	In accordance with the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Monitoring of groundwater monitoring sites (GW21, N2, N3).	In accordance with the GWMP.	In accordance with the GWMP.	Environment and Community Manager
During Mining			
Longwalls 11 to 13 subsidence monitoring lines as described in the Subsidence Monitoring Program.	Monitoring parameters include: • subsidence; • tilt; • tensile strain; • compressive strain; and • absolute horizontal translation.	Monitoring during secondary extraction of Longwalls 11 to 13 in accordance with the Subsidence Monitoring Program.	Mine Surveyor
Visual inspection of the North Wambo Creek Diversion.	Surface cracks. Surface ponding.	Daily inspections when extraction is occurring directly beneath North Wambo Creek Diversion.	Environment and Community Manager
Bed and bank stability monitoring of Stony Creek.	In accordance with the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Monitoring of surface water quality and flow monitoring sites (SW04, SW27a, SW08, FM2, FM3).	In accordance with the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Monitoring of groundwater sites (GW21, N2, N3).	In accordance with the GWMP.	In accordance with the GWMP.	Environment and Community Manager
Inflows to underground workings.	Dewatering volumes and underground water levels in accordance with the GWMP.	Recorded on a daily basis during pumping.	Environment and Community Manager

Table 1 Monitoring Program for NWCD (cont..)

Monitoring Component	Parameter	Timing/Frequency	Responsibility
Post-Mining			
Longitudinal survey along North Wambo Creek Diversion above Longwalls 11 to 13.	Detailed photographic geomorphic record. Review of 3 dimensional surface level maps. Identification of any areas of potential instability.	Following completion of secondary extraction of Longwalls 11 to 13.	Environment and Community Manager
Visual inspection of surface areas which required remediation.	Stabilisation of erosion and groundcover.	Monthly inspections until monitoring confirms stabilisation of erosion and groundcover is >60%.	Environment and Community Manager
Bed and bank stability monitoring of Stony Creek.	In accordance with the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Monitoring of surface water quality and flow monitoring sites (SW04, SW27a, SW08, FM2, FM3).	In accordance with the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Monitoring of groundwater sites (GW21, N2, N3).	In accordance with the GWMP.	In accordance with the GWMP.	Environment and Community Manager

2.2 Management Responses

The management response strategies to address the proposed impacts within the NWCD as described in **Section 1** (from the Extraction Plan) are detailed and summarised in **Table 2**.

Table 2 Management Response Strategies for NWCD

Management Measure	Timing/Frequency	Responsibility
Pre-Mining		
Stockpile sufficient materials and make equipment and necessary resources available for: • sealing any surface cracks (particularly in areas that are predicted to be ponded); and • installation of scour protection works (estimated to be over approximately 1.2 hectares).	Prior to commencement of secondary extraction of Longwalls 11 to 13.	Environment and Community Manager
During Mining		
Remediation of surface cracks[1] where practicable using conventional earthmoving equipment (e.g. a backhoe) including: • infilling of surface cracks with soil or other suitable materials; or • locally re-grading and re-compacting the surface.	When required during secondary extraction of Longwalls 11 to 13.	Environment and Community Manager

Table 2 Management Response Strategies for NWCD (cont..)

Management Measure	Timing/Frequency	Responsibility
Installation of scour protection works (localised rock armouring and placement of woody debris) in areas that may be vulnerable to scour (i.e. immediately downstream of the tailgates of Longwalls 11 to 13 as shown on **Figure 3**).	When required during secondary extraction of Longwalls 11 to 13 (likely to be following each longwall).	Environment and Community Manager
Stabilisation of any areas of surface cracking or erosion using erosion protection measures (e.g. vegetation planting).	When required during secondary extraction of Longwalls 11 to 13.	Environment and Community Manager
Placement of fill on the western floodplain area to maintain drainage towards the diversion channel.	When required during secondary extraction of Longwalls 11 to 13 (likely to be following each longwall).	Environment and Community Manager
Batter stabilisation and revegetation of low flow channel if required in areas where pools form.	When required during secondary extraction of Longwalls 11 to 13 (likely to be following each longwall).	Environment and Community Manager
Review of remediation measures and implementation of additional measures if required, in accordance with the TARP (**Attachment 1**).	Ongoing during mining.	Environment and Community Manager
Post-Mining		
Review of remediation measures and implementation of additional measures if required, in accordance with the TARP (**Attachment 1**).	Following completion of secondary extraction of Longwalls 11 to 13.	Environment and Community Manager
Post-subsidence assessment of impacts to Stony Creek and drainage lines and implementation of any minor remedial works.	Following completion of secondary extraction of Longwalls 11 to 13.	Environment and Community Manager

Notes: [1]

- Minor cracks that develop are not expected to require remediation as geomorphic processes will result in natural filling of these cracks over time;
- Remediate surface cracks as required by the MOP i.e.:
  - No subsidence surface cracks remaining that present a risk to the environment, safety and the final land use objectives; and/or
  - Remediation of surface cracks >50 mm.
- Remediation of surface cracks, where practicable using conventional earthmoving equipment (e.g. a backhoe) including:
  - Infilling of surface cracks with soil or other suitable materials; and
  - Locally re-grading and re-compacting the surface.
- Ensure sufficient stockpiles of suitable material (i.e. sandy-silt and/or alluvium material that has been confirmed by soil specialist) have been either placed or identified within the vicinity of the NCWD prior to longwall within the NWCD;
- Ensure equipment and necessary resources available for remediation prior to longwall within the NWCD;
- Whilst the methods of remediation would not be expected to change, infilling the larger surface cracking with cohesive materials and by regrading and re-compacting the surface soils; and
- WCPL will consider the addition of bentonite to the alluvial material used in crack remediation in the low flow channel (i.e. where the bedrock is exposed) based on geotechnical advice. The addition of bentonite could be beneficial due to its ultra fine particle size, expansive and sealing properties and could assist with the natural process of capturing fines. If required, a percentage of bentonite will be blended with the alluvial material where required to supplement its fines content to achieve a level of seal consistent with the surrounding host material.

2.3 NWCD Trigger Action Response Plan

A trigger action response plan (TARP) (**Table 3**) from the Extraction Plan has been developed if additional remediation measures and responses are required. **NOTE:** This TARP must be read in conjunction with the approved *Water Management Plan – South Bates (Whybrow Seam) Underground Mine Longwalls 11-13* (**Appendix 1**).

Table 3 NWCD Trigger Action Response Plan

Condition	Normal	Level 1	Level 2
	Normal Conditions	**Management Measures**	**Restoration/Contingency Phase**
Trigger	• No visible cracks along North Wambo Creek Diversion. • Dewatering volumes and underground water levels at normal conditions and not significantly influenced by climatic conditions. • Predicted impacts on other surface water and groundwater as described in **Section 3**.	• Cracks observed along North Wambo Creek Diversion. • Dewatering volumes and underground water levels are elevated and responding significantly to climatic conditions. • Impacts requiring remediation observed on Stony Creek or other ephemeral drainage lines.	• Functionality of North Wambo Creek Diversion materially affected. • Dewatering volumes and underground water levels continue to respond significantly to climatic conditions following remediation. • The Wollombi Brook performance measure has been exceeded, or is likely to be exceeded.
Action	• Conduct monitoring, consistent with **Tables 4 and 7**, the GWMP, SWMP and the Subsidence Monitoring Program (Appendix H of the Extraction Plan). • Assess the environmental consequences of the subsidence in accordance with **Section 6** and the SGWRP. • Assess the need for management measures in accordance with **Section 5** and the SGWRP.	• Implement management measures, as required, in accordance with **Section 5** and the SGWRP.[1] • Continue monitoring, consistent with **Tables 4 and 7**, the GWMP, SWMP and the Subsidence Monitoring Program (Appendix H of the Extraction Plan).	• Implement Contingency Plan described in **Section 7**. • Develop action plan for additional measures, including consideration of: - additional scour protection, crack remediation and/or stabilisation; and/or - injection grouting or installation of low permeability material.
Frequency	• Frequency consistent with **Table 5**, the GWMP, SWMP and SGWRP.	• As required, in accordance with **Section 6** and the SGWRP.	• As required, in accordance with **Section 7**.
Position of Decision Making	• Environment and Community Manager.	• Environment and Community Manager.	• General Manager. • Implementation of additional management measures will be undertaken in consultation with DRE and DPI Water.

1 With regard to the specific circumstances of the subsidence impact [e.g. the location, nature and extent of the impact] and the assessment of environmental consequences, in accordance with **Sections 5 and 6** and the SGWRP.

Note: GWMP refers to the Wambo Coal Groundwater Monitoring Program.
SWMP refers to the Wambo Coal Surface Water Monitoring Program.
SGWRP refers to the Wambo Coal Surface Water Groundwater Response Plan.
DRE refers to the Division of Resources and Energy.
DPI Water refers to the Office of Water in the Department of Primary Industries.

3.0 Monitoring and Reporting

3.1 Monitoring

Detailed longitudinal geomorphological surveys should be conducted along creek reaches affected by subsidence. The surveys should include a photographic record with location co-ordinates, with any areas of potential instability noted. Monitoring (as outlined in **Table 1**) should be undertaken:

- Prior to subsidence;
- During subsidence;
- Post subsidence; and
- Following the completion of any restoration or remediation works.

3.2 Reporting

All reporting requirements will be in accordance with Section 4.2 of the Extraction Plan. The reporting requirements include:

- Incident Reporting;
- Subsidence Management Status Report;
- Six Monthly Report; and
- Annual Review.

The Annual Review (AR) will include:

- Summary of subsidence effects monitoring and a comparison to predicted subsidence effects; and
- Summary of all environmental and subsidence monitoring results and a comparison of actual impacts with predicted subsidence impacts and the subsidence impact performance measures.

4.0 Audit/Review

The NWCSRS will be reviewed by the Environmental and Community Manager:

- On an annual basis;
- When there are changes to consent or licence conditions relating to aspects of this NWCSRS;
- In response to an Independent Environmental Audit conducted in accordance with Consent Condition 7, Schedule 6 of DA 305-7-2003;
- Following an incident at SBU in relation to water; or
- In response to a relevant change in technology or legislation.

5.0 Responsibilities

Table 4 below summarises responsibilities documented in the NWCSRS. Responsibilities may be delegated as required.

Table 4: NWCSRS Responsibilities

No	Task	Responsibility	Timing
1	Subsidence monitoring as identified in **Section 2** of this Strategy.	Environmental and Community Specialist	As required
2	Implementation of mitigation strategies and monitoring measures in accordance with this Strategy and in consultation with relevant agencies.	Environment and Community Manager and Underground Manager	As required
3	Ensure that all process and procedures under this Strategy and all other relevant management plans in relation to this Strategy are followed.	Environment and Community Manager	As required
4	Ensure that all relevant personnel have reviewed the Strategy and any amendments.	Environment and Community Manager	As required
5	Ensure Strategy is implemented across all relevant personnel.	Environment and Community Manager	As required

6.0 References

- *Gilbert & Associates (2003) Wambo Development Project – Surface Water Assessment.*
- *SP Solutions (2006) Review of North Wambo Underground SMP Proposed Controls - North Wambo Creek.*
- *SCT Operations Pty Ltd (2015) Assessment of Inflow Potential Associated with Mining Under the North Wambo Creek Diversion.*
- *WCPL (2006) Wambo Coal Mine Modification Statement of Environmental Effects.*
- *WCPL (2015) South Bates (Wambo Seam) Underground Mine Modification Environmental Impact Statement.*
- *Resource Strategies (October 2015) Extraction Plan – South Bates (Whybrow Seam) Underground Mine Longwalls 11 to 13; and*
- *Water Management Plan – South Bates (Whybrow Seam) Underground Mine Longwalls 11-13*