

# METROPOLITAN COAL LONGWALLS 301-303

## EXTRACTION PLAN



## MAIN TEXT



**METROPOLITAN COAL**

# **METROPOLITAN COAL**

## **LONGWALLS 301-303**



### **EXTRACTION PLAN**

#### **Revision Status Register**

<b>Section/Page/ Annexure</b>	<b>Revision Number</b>	<b>Amendment/Addition</b>	<b>Distribution</b>	<b>DP&amp;E Approval Date</b>
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**November 2016**

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<b>Mine</b>	Metropolitan Coal
<b>Project Approval</b>	Project Approval 08_0149
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<b>Date</b>	16 November 2016
<b>Document Reference Number</b>	EP-R01-A
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<b>Date of Signatures</b>	16 November 2016

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Appendix D	Heritage Management Plan
Appendix E	Built Features Management Plan
Appendix F	Public Safety Management Plan
Appendix G	Subsidence Monitoring Program
Appendix H	Coal Resource Recovery Plan
Appendix I	Subsidence Report

## 1 OVERVIEW OF THE EXTRACTION PLAN

Metropolitan Coal is wholly owned by Peabody Energy Australia Pty Ltd (Peabody), and is located adjacent to the township of Helensburgh and approximately 30 kilometres (km) north of Wollongong in New South Wales (NSW) (Figure 1). Metropolitan Coal is located within Consolidated Coal Lease (CCL) 703, Mining Lease (ML) 1610 and ML 1702. Metropolitan Coal is one of the earliest established and longest continually running coal mining operations in Australia, with a history dating back to the 1880s.

Metropolitan Coal was granted approval for the Metropolitan Coal Project (the Project) by the Minister for Planning under section 75J of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act) on 22 June 2009. A copy of the Project Approval is available on the Peabody website (<http://www.peabodyenergy.com>). The Project comprises the continuation, upgrade and extension of underground coal mining operations and surface facilities at Metropolitan Coal.

The Project involves the extraction of coal by longwall mining methods from the Bulli Seam. The potential environmental consequences of the Project were assessed in the *Metropolitan Coal Project Environmental Assessment* (the Project EA) (Helensburgh Coal Pty Ltd [HCPL], 2008) and the *Metropolitan Coal Project Preferred Project Report* (the Preferred Project Report) (HCPL, 2009).

The underground mining longwall layout is shown on Figure 1. Following the anticipated completion of Longwall 27 in 2017, Longwalls 301, 302 and 303 (herein referred to as Longwalls 301-303) define the next mining sub-domain within the Project underground mining area (Figures 1 and 2).

### 1.1 PURPOSE AND SCOPE

This Extraction Plan outlines the proposed management, mitigation, monitoring and reporting of potential subsidence impacts and environmental consequences in the Project underground mining area during the secondary extraction of Longwalls 301-303 at Metropolitan Coal.

This Extraction Plan has been prepared in consideration of the NSW Department of Planning and Environment (DP&E) and NSW Division of Resources and Energy (DRE) (2015) *Guidelines for the Preparation of Extraction Plans*.

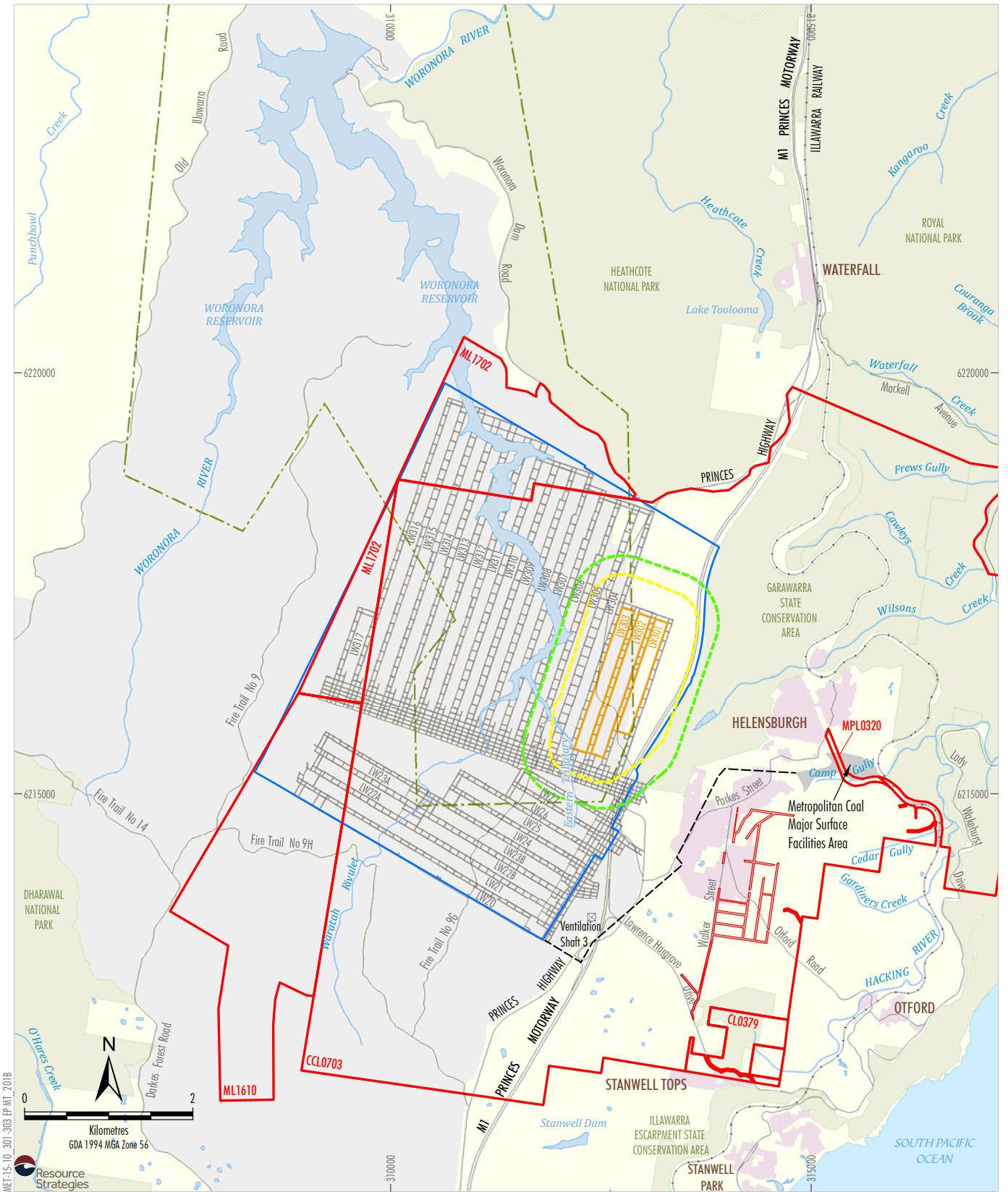
This Extraction Plan includes post-mining monitoring and management of potential subsidence impacts and environmental consequences, subject to the two previously approved Metropolitan Coal Extraction Plans for Longwalls 20-22 and Longwalls 23-27. That is, the Metropolitan Coal Longwalls 20-22 and Longwalls 23-27 Extraction Plans will be superseded by this Extraction Plan following the completion of Longwall 27 consistent with the recommended approach in the DP&E and DRE (2015) *Guidelines for the Preparation of Extraction Plans*.

The objectives of this Extraction Plan are to:

- provide detailed plans of Longwalls 301-303;
- outline potential subsidence effects, subsidence impacts and environmental consequences of Longwalls 301-303;
- describe the measures that will be implemented to manage, mitigate and remediate potential subsidence impacts and environmental consequences during the mining of Longwalls 301-303;
- detail the monitoring of subsidence effects, subsidence impacts and environmental consequences during the mining of Longwalls 301-303; and
- provide a contingency plan for subsidence impacts and environmental consequences in relation to the Project's subsidence impact performance measures.

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- LEGEND**
- Mining Lease Boundary
  - Woronora Special Area
  - Railway
  - Project Underground Mining Area  
Longwalls 20-27 and 301-317
  - Longwalls 301 - 303 Secondary Extraction
  - 35° Angle of Draw and/or Predicted  
20 mm Subsidence Contour
  - 600 m from Secondary Extraction of  
Longwalls 301-303
  - Woronora Notification Area
  - Existing Underground Access Drive (Main Drift)

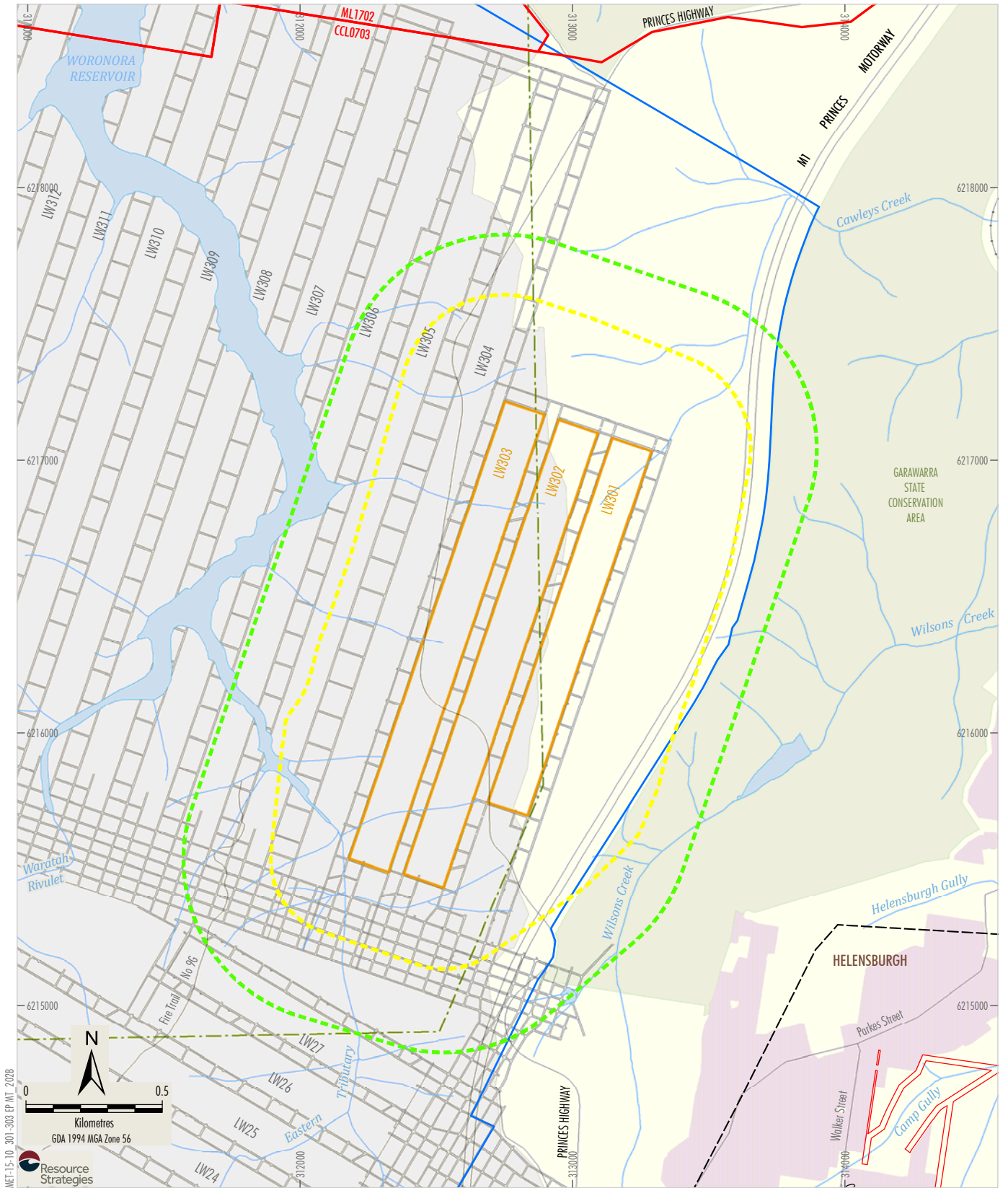
Source: Land and Property Information (2015); Department of Industry (2015); Metropolitan Coal (2016); MSEC (2016)

**Peabody**  
ENERGY

METROPOLITAN COAL

Project Longwalls 20 - 27 and  
Longwalls 301 - 317 Layout

**Figure 1**



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- LEGEND**
- Mining Lease Boundary
  - Woronora Special Area
  - Railway
  - Project Underground Mining Area  
Longwalls 20-27 and 301-317
  - Longwalls 301 - 303 Secondary Extraction
  - 35° Angle of Draw and/or Predicted  
20 mm Subsidence Contour
  - 600 m from Secondary Extraction of  
Longwalls 301-303
  - Woronora Notification Area
  - Existing Underground Access Drive (Main Drift)

Source: Land and Property Information (2015); Department of Industry (2015); Metropolitan Coal (2016); MSEC (2016)



METROPOLITAN COAL  
Longwalls 301 - 303 Layout

**Figure 2**

Longwalls 301-303 are located to the north of Longwalls 20-27 at Metropolitan Coal (Figure 1). The Extraction Plan area for Longwalls 301-303, based on a 35 degree (°) angle of draw and/or predicted 20 millimetre (mm) subsidence contour, is shown on Figures 1 and 2. Pending the approval of this Extraction Plan from the Secretary of the DP&E, secondary extraction of Longwall 301 is scheduled to commence in April 2017.

This Extraction Plan has been prepared by Metropolitan Coal, with assistance from Mine Subsidence Engineering Consultants (MSEC), HydroSimulations, Hydro Engineering & Consulting, FloraSearch, Cenwest Environmental Services, Niche Environment and Heritage, and Resource Strategies. The appointment of the team of suitably qualified and experienced persons was endorsed by the Secretary of the DP&E in June 2016.

This Extraction Plan forms part of Metropolitan Coal's Environmental Management Strategy. The relationship of this Extraction Plan to the Metropolitan Coal Environmental Management Structure is shown on Figure 3.

### 1.1.1 Statutory Requirements

This Extraction Plan has been prepared in accordance with the conditions of the Project Approval (08\_0149) and in consideration of the DP&E and DRE (2015) *Guidelines for the Preparation of Extraction Plans*.

The statutory requirements relevant to this Extraction Plan are summarised below.

#### **Project Approval (08\_0149)**

This Extraction Plan has been prepared in accordance with Conditions 6 and 7, Schedule 3 of the Project Approval. The requirements of Conditions 6 and 7, Schedule 3 of the Project Approval are summarised in Table 1, along with the relevant section of this Extraction Plan in which the requirements are addressed.

Further detail on the requirements of the Project Approval is provided in Attachment 1.

**Table 1  
Extraction Plan Requirements**

<b>Project Approval (08_0149) Condition</b>	<b>Extraction Plan Reference</b>
<b>Condition 6, Schedule 3</b>	
6. The Proponent shall prepare and implement an Extraction Plan for all second workings in the mining area to the satisfaction of the Director-General <sup>[1]</sup> . This plan must:	This document
(a) be prepared by a team of suitably qualified experts whose appointment has been endorsed by the Director-General;	Section 1.1 and Attachment 2
(b) be approved by the Director-General before the Proponent is allowed to carry out the second workings covered by the Extraction Plan;	Section 1.1
(c) include a detailed plan for the second workings, which has been prepared to the satisfaction of DRE, and provides for adaptive management (from Longwall 23 onwards);	Section 1.3 and Appendix H
(d) include detailed plans of any associated surface construction works;	Section 3 and Appendix G

**Table 1 (Continued)**  
**Extraction Plan Requirements**

Project Approval (08_0149) Condition	Extraction Plan Reference
<b>Condition 6, Schedule 3 (Continued)</b>	
(e) include the following to the satisfaction of DRE: <ul style="list-style-type: none"> <li>• a coal resource recovery plan that demonstrates effective recovery of the available resource;</li> <li>• revised predictions of the conventional and non-conventional subsidence effects and subsidence impacts of the extraction plan, incorporating any relevant information that has been obtained since this approval; and</li> <li>• a Subsidence Monitoring Program to: <ul style="list-style-type: none"> <li>- validate the subsidence predictions; and</li> <li>- analyse the relationship between the subsidence effects and subsidence impacts of the Extraction Plan and any ensuing environmental consequences;</li> </ul> </li> </ul>	Appendix H  Appendix I  Appendix G
(f) include a: <ul style="list-style-type: none"> <li>• Water Management Plan, which has been prepared in consultation with OEH, SCA<sup>[2]</sup> and NOW<sup>[3]</sup>, to manage the environmental consequences of the Extraction Plan on watercourses (including the Woronora Reservoir), aquifers and catchment yield;</li> <li>• Biodiversity Management Plan, which has been prepared in consultation with OEH and DRE (Fisheries)<sup>[4]</sup>, to manage the potential environmental consequences of the Extraction Plan on aquatic and terrestrial flora and fauna, with a specific focus on swamps;</li> <li>• Land Management Plan, which has been prepared in consultation with SCA<sup>[2]</sup>, to manage the potential environmental consequences of the Extraction Plan on cliffs, overhangs, steep slopes and land in general;</li> <li>• Heritage Management Plan, which has been prepared in consultation with OEH and the relevant Aboriginal groups, to manage the potential environmental consequences of the Extraction Plan on heritage sites or values;</li> <li>• Built Features Management Plan, which has been prepared in consultation with the owner of the relevant feature, to manage the potential environmental consequences of the Extraction Plan on any built features; and</li> </ul>	Appendix A  Appendix C  Appendix B  Appendix D  Appendix E
(g) include a Public Safety Management Plan, which has been prepared in consultation with DRE (for any mining within the DSC notification area), to ensure public safety in the mining area.	Appendix F
<p><i>Note: In accordance with condition 12 of schedule 2, the preparation and implementation of Extraction Plans for second workings may be staged, with each plan covering a defined area of second workings. In addition, these plans are only required to contain management plans that are relevant to the specific second workings that are being carried out.</i></p>	

**Table 1 (Continued)**  
**Extraction Plan Requirements**

Project Approval (08_0149) Condition	Extraction Plan Reference
<p><b>Condition 7, Schedule 3</b></p> <p>7. In addition to standard requirements for management plans (see condition 2 of schedule 7), the Proponent shall ensure that the management plans required under condition 6(f) above include:</p> <p>(a) a program to collect sufficient baseline data for future Extraction Plans;</p> <p>(b) a revised assessment of the potential environmental consequences of the Extraction Plan, incorporating any relevant information that has been obtained since this approval;</p> <p>(c) a detailed description of the measures that would be implemented to remediate predicted impacts; and</p> <p>(d) a contingency plan that expressly provides for adaptive management.</p>	<p>Appendices A to E, Attachment 3</p> <p>Appendices A to F, Appendix I</p> <p>Appendices A to F, Section 3</p> <p>Appendices A to F, Section 4.1</p>

<sup>1</sup> The Director-General of the DP&E is now the Secretary of the DP&E.

<sup>2</sup> The Sydney Catchment Authority (SCA) is now WaterNSW.

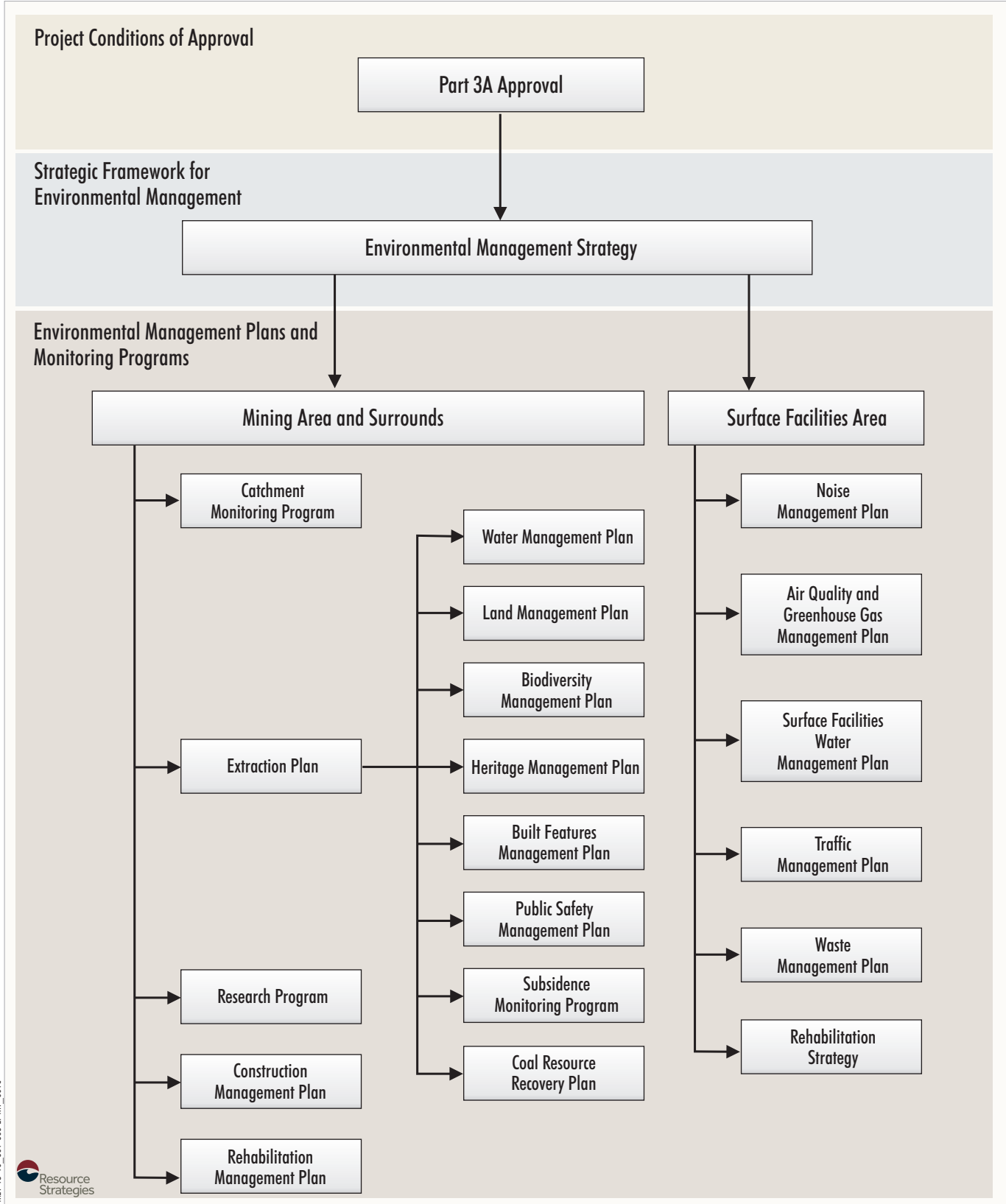
<sup>3</sup> The NSW Office of Water (NOW) is now the Department of Primary Industries – Water (DPI-Water).

<sup>4</sup> DRE (Fisheries) is now the Department of Primary Industries – Fishing (DPI-Fishing).

### **Licences, Permits and Leases**

In addition to the Project Approval, all activities at or in association with Metropolitan Coal will be undertaken in accordance with the following licences, permits and leases which have been issued or are pending.

- The conditions of mining leases issued by the DRE, within the NSW Department of Industry, Skills and Regional Development (NSW Department of Industry) under the NSW *Mining Act, 1992* (e.g. CCL 703, ML 1610, ML 1702, Coal Lease [CL] 379 and Mining Purpose Lease [MPL] 320).
- The *Metropolitan Coal Mining Operations Plan 1 October 2012 to 30 September 2019* approved by the DRE.
- The conditions of Environment Protection Licence (EPL) No. 767 issued by the NSW Environment Protection Authority (EPA) under the NSW *Protection of the Environment Operations Act, 1997*. Revision of the EPL will be required prior to the commencement of Metropolitan Coal activities that differ from those currently licensed.
- The prescribed conditions of specific surface access leases within CCL 703 for the installation of surface facilities as required.
- Water Access Licences (WALs) issued by the NSW Department of Primary Industries – Water (DPI-Water) under the NSW *Water Management Act, 2000*, including WAL 36475 under the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011* and WAL 25410 under the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011*.
- Mining and workplace health and safety related approvals granted by the NSW Department of Industry and WorkCover NSW.
- Supplementary approvals obtained from WaterNSW (previously the Sydney Catchment Authority [SCA]) for surface activities within the Woronora Special Area (e.g. fire road maintenance activities).



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Figure 3

## 1.2 STRUCTURE OF THE EXTRACTION PLAN

This Extraction Plan comprises a main text component (with Attachments) and supporting management plans and studies, which include Appendices A through to I. An overview of the Extraction Plan main text sections and Attachments is presented below:

- Section 1 Provides an overview of the Extraction Plan, including: a description of the purpose and scope of the Extraction Plan and a summary of the mine plan and design, subsidence predictions, subsidence impact performance measures and subsidence management approach.
- Section 2 Describes the process of development of the Extraction Plan, including: the conduct of risk assessments, the review of relevant information obtained since Project Approval, the update and review of predicted subsidence effects and potential subsidence impacts and environmental consequences, and a summary of consultation conducted with key stakeholders.
- Section 3 Describes the measures that will be implemented to manage, mitigate, remediate and monitor potential subsidence impacts and environmental consequences on natural and built features.
- Section 4 Outlines the key elements of plan implementation, including reporting, regular review and key responsibilities.
- Section 5 Lists the references cited in Sections 1 to 4 of this Extraction Plan.
- Attachment 1 Outlines the relevant requirements under the Project Approval, and provides the relevant section of this Extraction Plan where the requirements are addressed.
- Attachment 2 Provides evidence of Metropolitan Coal's consultation process for the Extraction Plan.
- Attachment 3 Provides details of a program to collect baseline data for the next Extraction Plan (i.e. Longwall 304 on).
- Attachment 4 Provides a key contact register for the Extraction Plan.

Appendices A to H contain component management and monitoring plans of the Extraction Plan, and Appendix I contains the MSEC (2016) *Metropolitan Mine – Longwalls 301 to 303 Subsidence Predictions and Impact Assessments for the Natural and Built Features in Support of the Extraction Plan*. Appendices A to I are listed below:

- Appendix A Longwalls 301-303 Water Management Plan (WMP).
- Appendix B Longwalls 301-303 Land Management Plan (LMP).
- Appendix C Longwalls 301-303 Biodiversity Management Plan (BMP).
- Appendix D Longwalls 301-303 Heritage Management Plan (HMP).
- Appendix E Longwalls 301-303 Built Features Management Plan (BFMP).
- Appendix F Longwalls 301-303 Public Safety Management Plan (PSMP).
- Appendix G Longwalls 301-303 Subsidence Monitoring Program (SMP).
- Appendix H Longwalls 301-303 Coal Resource Recovery Plan (CRRP).
- Appendix I Subsidence Report.

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The following graphical plans have been prepared in accordance with the DP&E and DRE (2015) *Guidelines for the Preparation of Extraction Plans*:

Plan 1	Existing, Proposed and Future Workings.
Plan 2	Longwalls 301-303 Surface Features.
Plan 3	Geological and Seam Data.
Plan 5	Mining Titles and Land Ownership.
Plan 6	Geological Section and Geotechnical Logs.
Plan 7	Subsidence Monitoring Locations.

Plans 1, 2, 3, 5 and 6 are provided in Attachment 1 of the Longwalls 301-303 CRRP (Appendix H of the Extraction Plan).

As there are currently no existing and/or planned future workings in seams above and/or below the proposed workings, Plan 4 (referred to in the DP&E and DRE [2015] *Guidelines for the Preparation of Extraction Plans*) has not been prepared.

Plan 7 is provided in Attachment 1 of the Longwalls 301-303 SMP (Appendix G of the Extraction Plan).

### 1.3 MINE PLANNING AND DESIGN

#### 1.3.1 Geology and Stratigraphy

Metropolitan Coal is located within the Southern Coalfield, within the southern part of the Sydney Basin, which is infilled with sedimentary rocks of Permian age (<270 million years ago) and of Triassic age (<225 million years ago) (HCPL, 2008).

Three formally named coal seams of the Illawarra Coal Measures are present in the Southern Coalfield, namely the Bulli, Balgownie and Wongawilli Seams (HCPL, 2008).

Immediately overlying the Bulli Coal unit of the Illawarra Coal Measures are sandstones and claystones of the Narrabeen Group. The Narrabeen Group contains the Newport Formation (sometimes referred to as the Gosford Formation), the Bald Hill Claystone (also referred to as Chocolate Shale), the Bulgo Sandstone, the Stanwell Park Claystone/Shale, the Scarborough Sandstone, the Wombarra Shale and the Coal Cliff Sandstone.

At the top of the sequence in the area of interest is the Hawkesbury Sandstone (HCPL, 2008).

The major geological features at seam level are shown on Plan 3 in Attachment 1 of Appendix H. The nearest longwall is located approximately 500 m from the Metropolitan Fault. The Metropolitan Fault has a north-west to south-east strike and dips to the north-east. The Powell Fault has been projected into the 35° angle of draw and/or 20 mm subsidence contour area, but not above Longwalls 301-303. Most of the faults have been identified at seam level.

#### 1.3.2 Mining Geometry

During the NSW Government's assessment phase of the Project EA (HCPL, 2008), and in recognition of concerns raised by key stakeholders during the formal Planning Assessment Commission (PAC) assessment process, Metropolitan Coal (previously HCPL) considered it appropriate to reduce the proposed extent of the original Project longwall mining area (i.e. Longwalls 20-44).

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The Project Approval granted by the Minister for Planning in June 2009 included a layout for Longwalls 301 to 317 referred to as the Preferred Project Layout (as described in the Preferred Project Report [HCPL, 2009]). Longwalls 302 and 303 based on the Preferred Project Layout comprised 163 metres (m) panel widths (void) with 45 m pillars (solid) beyond 500 m from the Woronora Reservoir, and 138 m panel widths (void) with 70 m pillars (solid) within 500 m of the Woronora Reservoir.

Following further mine planning investigations, Metropolitan Coal identified that significant operational efficiencies and consequently a significant economic benefit would be achieved by rotating the first workings of Longwalls 301-317 to be square with the 300 Mains (a rotation of approximately six degrees). The Secretary of the DP&E approved the revised first workings in accordance with Condition 5, Schedule 3 of the Project Approval in April 2015.

In May 2016, Metropolitan Coal requested the approval of the Secretary of the DP&E to further amend the first workings layout for Longwalls 301-303. The proposed changes to the first workings layout for Longwalls 301-303 were as follows:

- Longwall 301 – reduce the panel void length from 1,680 m to 1,428 m, with no change to the tailgate pillar dimensions.
- Longwall 302 – reduce the panel void length from 2,637 m to 1,954 m, with a reduction in the tailgate pillar width by 25 m for approximately 608 m of the panel length.
- Longwall 303 – reduce the panel void length from 2,760 m to 2,122 m, with a reduction in the tailgate pillar width by 25 m for approximately 728 m of the panel length.

The commencing (i.e. northern) ends of Longwalls 301 to 303 were proposed to be shortened based on geological considerations. The finishing end of Longwall 301 was determined in consultation with the Roads and Maritime Services based on the presence of Bridge 2 (M1 Princes Motorway), which is located approximately 330 m to the south-east of the end of Longwall 301 and which is sensitive to small differential movements. The changes to the first workings layout for Longwalls 301-303 described above were approved by the Secretary of the DP&E in June 2016.

During the preparation of this Extraction Plan, Metropolitan Coal further shortened the commencing ends of Longwalls 302 and 303 to reduce subsidence impacts to the Garrawarra Centre Complex, such that they have the same alignment with the commencing end of Longwall 301. The panel void length of Longwall 302 was reduced from 1,954 m to 1,775 m, and the panel void length of Longwall 303 was reduced from 2,122 m to 1,788 m.

The proposed layout of Longwalls 301-303 is shown on Figure 2 in this document and on Plan 1 in Attachment 1 of Appendix H. A summary of the longwall dimensions for Longwalls 301-303 is provided in Table 2. The longwall layout includes 163 m panel widths (void) with 45 m pillars (solid).

**Table 2**  
**Summary of Longwall Dimensions for Longwalls 301-303**

Longwall	Longwall Length (m)	Total Void Width (m)	Tailgate Chain Pillar Width (m)
LW301	1,428	163	0
LW302	1,775	163	45
LW303	1,788	163	45

Figure 2 in this document and Plan 1 in Attachment 1 of Appendix H shows existing Metropolitan Coal longwalls located within 500 m of Longwalls 301-303, as well as future longwalls (i.e. Longwall 304 on).

### 1.3.3 Mining Method

The extraction of Longwalls 301-303 will occur from north to south. Longwalls 301-303 will be extracted using retreating longwall mining methods for secondary extraction of panels with a 163 m void width. The longwall panels will be formed by driving two sets of gate roads (the tailgate and maingate roads). Each gate road requires two roadways (headings) to be driven parallel to each other. The two roadways will be used for ventilation purposes, with one of the roadways utilised as a transport road and the other roadway used to convey the coal that will be mined back to the main conveyors. Construction of development main headings and gateroads are mined using continuous miners.

The dimensions of the headings will be approximately 5.2 m wide and 3.2 m in height. The headings are connected approximately every 120 m by driving a cut-through from one heading to another which forms pillars of coal along the length of the gate road. The tailgate and maingate roads are separated by the 158 m wide longwall panel (measured between roadway centrelines). The maingate roads and tailgate roads are then linked together by driving an installation road and bleeder road at the top end of the longwall panels. Run-of-mine (ROM) coal will be conveyed by the maingate conveyor to the main conveyor which will carry coal to the surface of the mine.

### 1.3.4 Mining Parameters

The Extraction Plan area and proposed mine plan is shown on Figure 2 and key dimensions are summarised in Table 3.

**Table 3**  
**Key Mining Parameters**

Parameter	LW301	LW302	LW303
ROM Coal Extracted (Mt)	Approx. 3.345		
Gate Road Width (m)	5.2		
Gate Road Height (m)	3.2		
Maingate (MG) Chain Pillar Width (m)	45		
Tailgate (TG) Chain Pillar Width (m)	-	45	45
Longwall Void Width (m) (ribline of goaf edge)	163		
Longwall Void Length (m)	1,428	1,775	1,788
Seam Thickness (m)	2.7 – 2.9		
Extraction Height (m)	Up to 3.2		
Depth of Cover (m)	395 – 555		

LW = longwall.

Mt = million tonnes.

### 1.3.5 Mining Schedule

Metropolitan Coal operates seven days a week, 24 hours a day on a rotating shift basis. The extraction of Longwalls 1 to 26 is complete, with extraction of Longwall 27 underway.

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The proposed sequence of mining for Longwalls 301-303 and anticipated start and completion dates are summarised in Table 4.

**Table 4**  
**Provisional Extraction Schedule**

Longwall	Estimated Start Date	Estimated Duration	Estimated Completion Date
Longwall 301	April 2017	6 months	September 2017
Longwall 302	November 2017	7 months	May 2018
Longwall 303	June 2018	7 months	December 2018

### 1.3.6 Previous and Future Mining

Mining at Metropolitan Coal commenced in the 1880's after the Bulli Seam was identified during exploration in 1884. Prior to the commencement of longwall mining in 1995, bord and pillar underground mining methods were primary employed.

Previous longwall mining areas at Metropolitan Coal are located to the south of Longwalls 301-303 and include Longwalls 1-18 and Longwalls 20-27. Extraction of Longwalls 1-18 commenced in 1995, and was completed in 2009. Extraction of Longwalls 20-27 commenced in 2010 and will be completed in early 2017. The location of historic and previous mining at Metropolitan Coal is shown in the Longwalls 301-303 CRRP (Appendix H).

Longwalls 301-303 form the first block of longwalls within the 300 longwall series. The layout for Longwalls 301-303 (i.e. 163 m panel widths [void] and 45 m pillars [solid]) will be trialled to build on the experience and dataset obtained from Longwalls 20-27. The outcomes of the trial will be used to inform the potential for a similar mine layout to be applied to the next Extraction Plan (i.e. Longwall 304 onwards). The current layout of Longwalls 304-317 is shown on Figure 1 in this document, and on Plan 1 in Attachment 1 of Appendix H.

Currently there are no plans for mining other coal seams (i.e. other than the Bulli Seam) at Metropolitan Coal.

## 1.4 SUBSIDENCE PREDICTIONS

Revised predictions of subsidence effects for Longwalls 301-303 were developed by MSEC (2016) (Appendix I). The process for the development of these predictions is described in Section 2.3.1.

### ***Predicted Conventional Subsidence Movements***

MSEC (2016) provides a detailed description of the development of mine subsidence and the method used to predict the mine subsidence movements resulting from the extraction of the longwalls. The report includes the maximum predicted conventional subsidence parameters for the longwalls including:

- Incremental Subsidence Parameters, which are the predicted subsidence parameters due to the extraction of a single longwall.
- Total Subsidence Parameters, which include the accumulated subsidence parameters after the completion of each longwall within a series of longwalls.

The maximum predicted incremental and total subsidence, tilt and curvatures for Longwalls 301-303 are summarised in Table 5. Figures 4, 5 and 6 provide the predicted total subsidence contours after the extraction of Longwalls 301, 302 and 303, respectively.

**Table 5**  
**Maximum Predicted Subsidence, Tilt and Curvature for Longwalls 301-303**

Subsidence Parameter	Longwalls 301-303	
	Incremental Subsidence Predictions	Total Subsidence Predictions
Maximum Subsidence (m)	0.65	0.9
Maximum Tilt (mm/m)	5.5	5.5
Maximum Hogging Curvature ( $\text{km}^{-1}$ )	0.08	0.07
Maximum Sagging Curvature ( $\text{km}^{-1}$ )	0.10	0.15

Source: after MSEC (2016) (Appendix I).

mm/m = millimetre per metre.

$\text{km}^{-1}$  = 1/kilometres.

The predictions of conventional subsidence parameters do not include the valley related upsidence and closure movements, or the effects of faults and other geological structures.


#### ***Non-Conventional Ground Movements***


MSEC (2016) (Appendix I) considers it likely that non-conventional ground movements will occur due to near surface geological conditions, steep topography and valley related movements, which are often accompanied by elevated tilts and curvatures. The potential subsidence impacts from non-conventional subsidence movements are described for natural and built features in Appendix I.

In most cases, it is not possible to predict the exact locations or magnitudes of the non-conventional anomalous movements due to near surface geological conditions. For this reason, the strain predictions provided in Appendix I are based on a statistical analysis of measured strains in the Southern Coalfield, including both conventional and non-conventional anomalous strains.

#### ***Predicted Far-Field Movements***

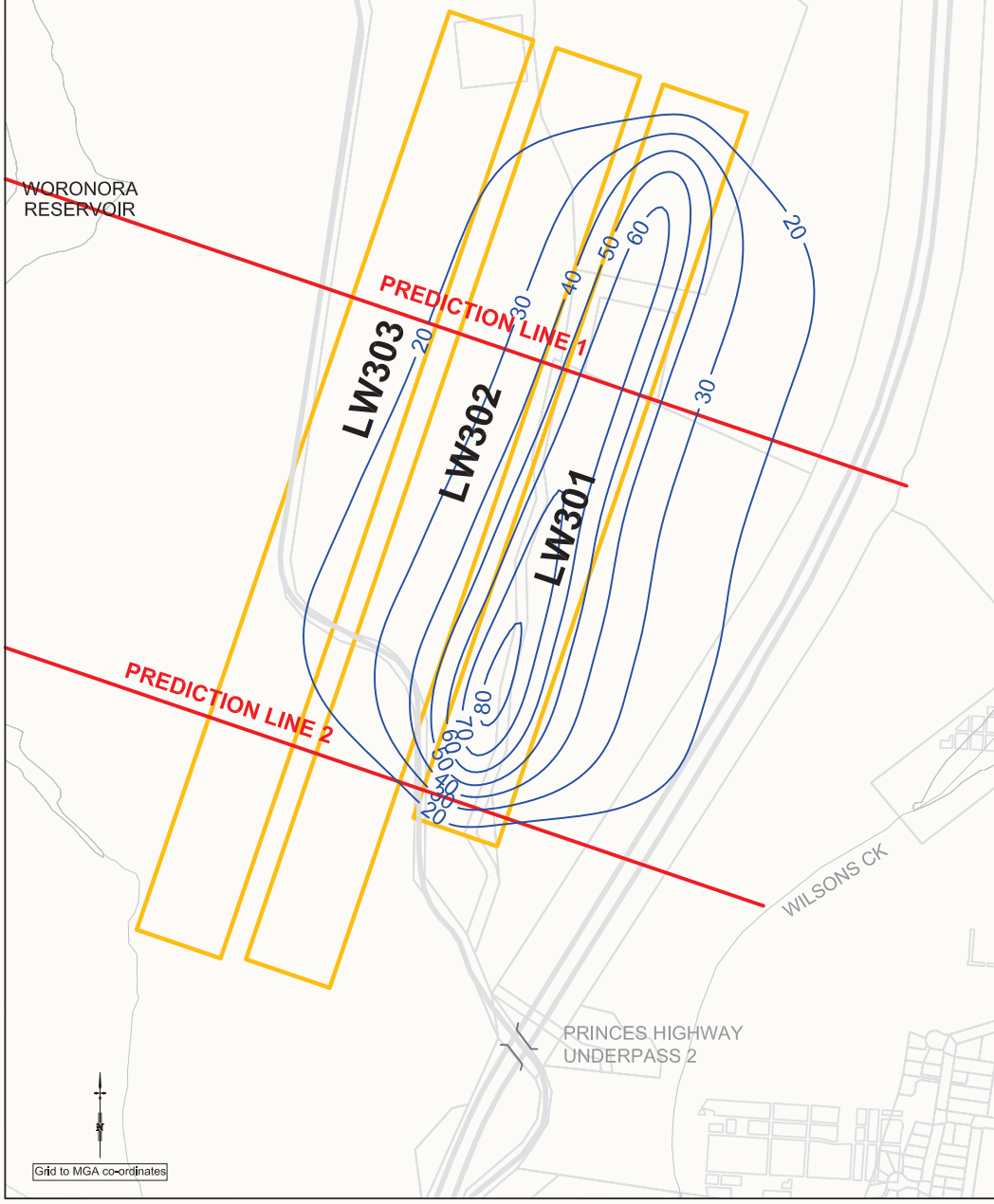
Based on an empirical model for the Southern Coalfield, MSEC (2016) (Appendix I) concluded that the predicted far-field horizontal movements resulting from the extraction of Longwalls 301-303 are very small and could only be detected by precise surveys. While the impacts of far-field horizontal movements on natural and built features within the vicinity of Longwalls 301-303 are not expected to be significant, there are structures which are sensitive to small differential movements, including transmission towers and road bridges to the east of Longwalls 301-303 (Appendix I). The Longwalls 301-303 BFMP (Appendix E) has been developed to manage the potential impact of far-field movements on sensitive infrastructure.


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**METROPOLITAN COLLIERY**  
 LONGWALLS 301 TO 303  
 PREDICTED SUBSIDENCE CONTOURS DUE TO  
 LONGWALL 301

DATE: 27 Oct 2016	SCALE: 1:10000	DRAWING No: MSEC846-11	Rev No A
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PREDICTED SUBSIDENCE CONTOURS ARE IN MILLIMETRES (mm)

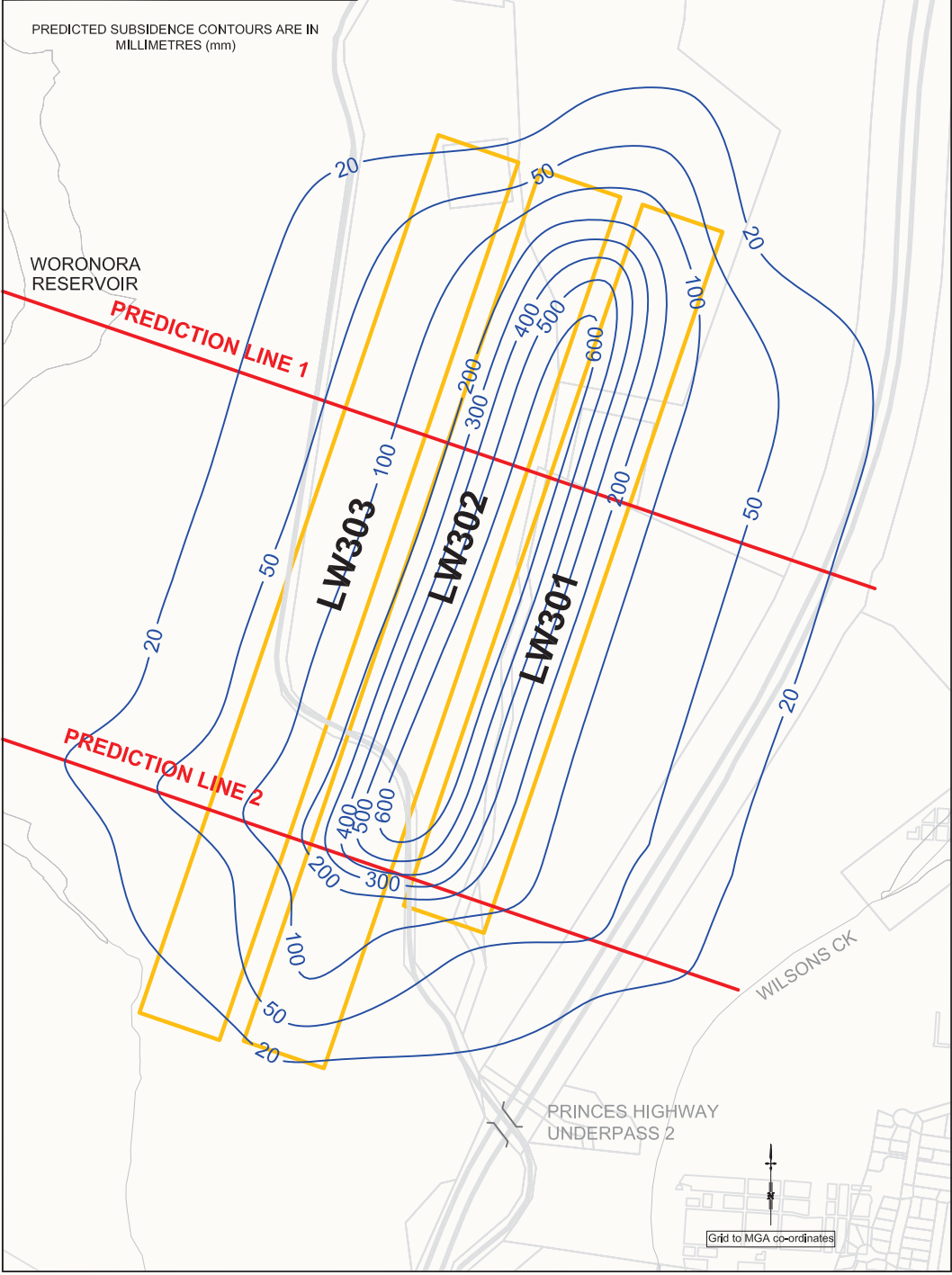


ME1-15-10\_301-303 RP.MT\_002C

Source: MSEC (2016)

Figure 4

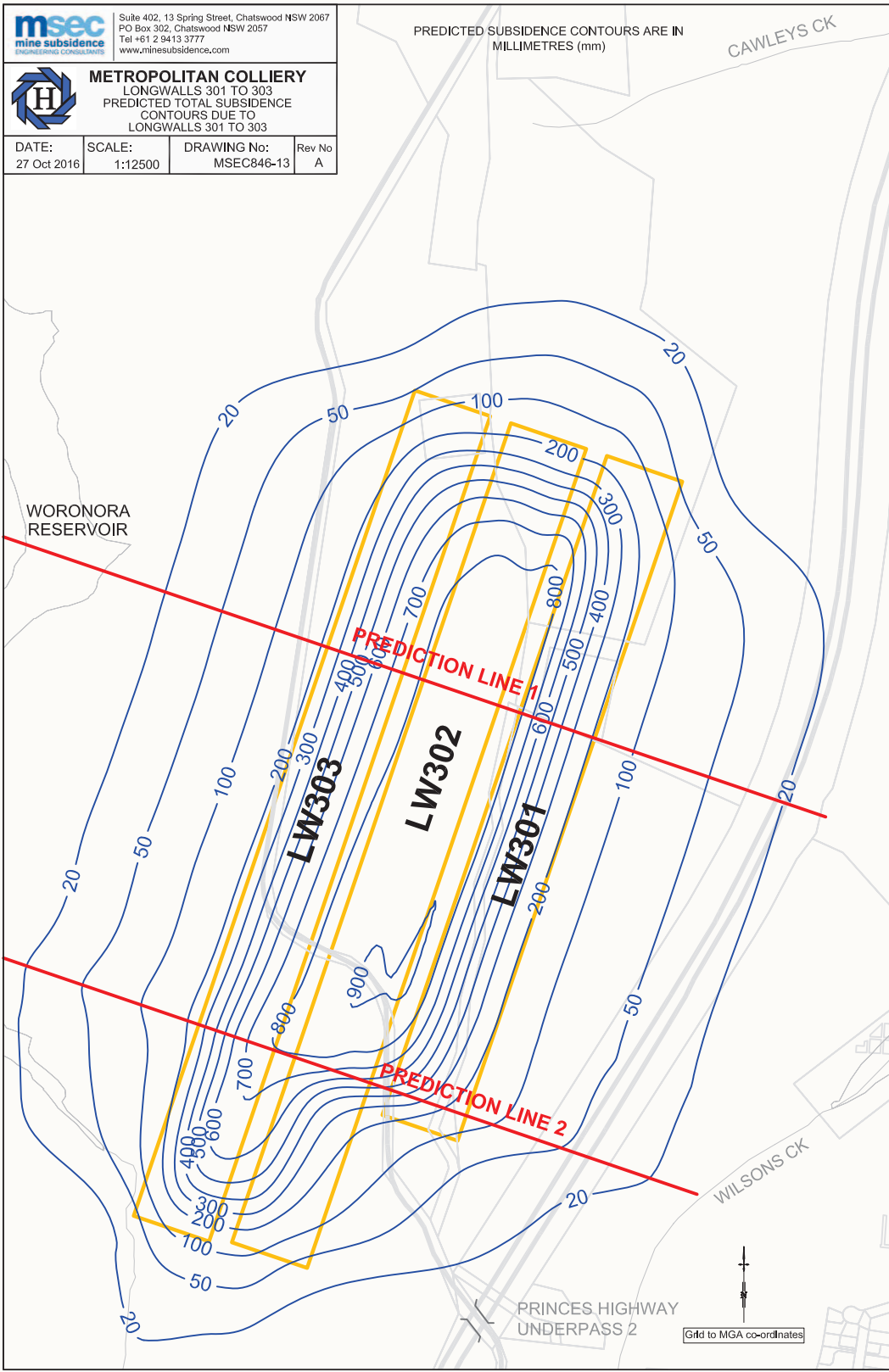
 Suite 402, 13 Spring Street, Chatswood NSW 2067 PO Box 302, Chatswood NSW 2057 Tel +61 2 9413 3777 www.minesubsidence.com			
 <b>METROPOLITAN COLLIERY</b> LONGWALLS 301 TO 303 PREDICTED TOTAL SUBSIDENCE CONTOURS DUE TO LONGWALLS 301 AND 302			
DATE:	SCALE:	DRAWING No:	Rev No
27 Oct 2016	1:10000	MSEC846-12	A



ME1-15-10\_301-303 RP.MT\_003C

Source: MSEC (2016)

Figure 5



ME1-15-10\_301-303 RP.MT\_004C

Source: MSEC (2016)

**Figure 6**

## 1.5 SUBSIDENCE IMPACT PERFORMANCE MEASURES

The Project Approval requires Metropolitan Coal not to exceed the subsidence impact performance measures outlined in Table 1 of Condition 1, Schedule 3. The subsidence impact performance measures are detailed in Table 6.

**Table 6**  
**Subsidence Impact Performance Measures**

<b>Water Resources</b>	
<i>Catchment yield to the Woronora Reservoir</i>	<i>Negligible reduction to the quality or quantity of water resources reaching the Woronora Reservoir</i> <i>No connective cracking between the surface and the mine</i>
<i>Woronora Reservoir</i>	<i>Negligible leakage from the Woronora Reservoir</i> <i>Negligible reduction in the water quality of Woronora Reservoir</i>
<b>Watercourses</b>	
<i>Waratah Rivulet between the full supply level of the Woronora Reservoir and the maingate of Longwall 23 (upstream of Pool P)</i>	<i>Negligible environmental consequences (that is, no diversion of flows, no change in the natural drainage behaviour of pools, minimal iron staining, and minimal gas releases)</i>
<i>Eastern Tributary between the full supply level of the Woronora Reservoir and the maingate of Longwall 26</i>	<i>Negligible environmental consequences over at least 70% of the stream length (that is no diversion of flows, no change in the natural drainage behaviour of pools, minimal iron staining and minimal gas releases)</i>
<b>Biodiversity</b>	
<i>Threatened species, populations, or ecological communities</i>	<i>Negligible impact</i>
<i>Swamps 76, 77 and 92</i>	<i>Set through condition 4 below</i>
<b>Land</b>	
<i>Cliffs</i>	<i>Less than 3% of the total length of cliffs (and associated overhangs) within the mining area experience mining-induced rock fall</i>
<b>Heritage</b>	
<i>Aboriginal heritage sites</i>	<i>Less than 10% of Aboriginal heritage sites within the mining area are affected by subsidence impacts</i>
<i>Items of historical or heritage significance at the Garrawarra Centre</i>	<i>Negligible damage (that is fine or hairline cracks that do not require repair), unless the owner of the item and the appropriate heritage authority agree otherwise in writing.</i>
<b>Built Features</b>	
<i>Built features</i>	<i>Safe, serviceable and repairable, unless the owner agrees otherwise in writing</i>



## 1.6 SUBSIDENCE MANAGEMENT APPROACH

Potential environmental consequences during the mining of Longwalls 301-303 will be managed in accordance with the relevant requirements of the Project Approval and other approvals, through:

- **Mine Design (including avoidance and subsidence mitigation measures)** – The layout of Longwalls 301-303 has been developed based on geological considerations and to reduce potential subsidence effects at the Garrawarra Centre Complex and at Bridge 2 (M1 Princes Motorway).
- **Subsidence Monitoring** – Monitoring to confirm predictions of subsidence effects and potential subsidence impacts and environmental consequences (Section 3.7).
- **Management Measures and Remediation** – Implementation of management measures and/or remediation, as required, to address subsidence impacts and/or environmental consequences.
- **Contingency Plans** – Implementation of Contingency Plans in the event an exceedance of a subsidence impact performance measure or an unexpected impact is detected (Section 4.1), including consideration of identified potential contingency measures (Sections 3.1 to 3.6).
- **Adaptive Management** – The implementation of adaptive management where appropriate (Section 4.2).

## 2 DEVELOPMENT OF THE EXTRACTION PLAN

### 2.1 RISK ASSESSMENTS

In accordance with the DP&E and DRE (2015) *Guidelines for the Preparation of Extraction Plans*, a number of risk assessments have been undertaken for the Metropolitan Coal Longwalls 301-303 Extraction Plan to ensure that appropriate consideration was given to risk assessment and risk management in each component management plan.

#### 2.1.1 Environmental Risk Assessment

An Environmental Risk Assessment (ERA) was conducted for four of the key component plans of this Extraction Plan *viz.* WMP, LMP, BMP and HMP.

The suitably qualified and experienced experts endorsed by the Secretary of the DP&E for the preparation of this Extraction Plan participated in the ERA. The ERA process involved the key steps described below.

#### Review of Relevant Documentation

In preparation for the ERA workshop, the ERA participants reviewed a number of documents relevant to the risk assessment. This included (but was not limited to):

- The *Environmental Risk Analysis* (SP Solutions, 2008) conducted for the Project EA (Appendix O of the Project EA).
- The Preferred Project Report (HCPL, 2009).
- The revised subsidence predictions and assessments for the approved changes to the first workings layout for Longwalls 301-303 (Metropolitan Coal, 2016a) (incorporating the rotation of Longwalls 301-317 to be square with the 300 Mains approved in April 2016, and the changes to the first workings layout approved in June 2016).

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### Risk Identification

The participants were asked to identify any additional (specific) issues/risks and/or changes to previously assessed levels of risk in preparation for the ERA workshop.

### ERA Workshop

The ERA workshop was conducted on 21 June 2016 via teleconference and was facilitated by an independent specialist, Operational Risk Mentoring.

While the general consensus of the workshop participants was the additional (specific) issues/risks were broadly assessed and ranked as part of the previous *Environmental Risk Analysis* (SP Solutions, 2008) conducted for the Project EA, it was considered necessary to assess some specific potential environmental issues (upland swamps and the Eastern Tributary) in further detail for Longwalls 301-303, considering experience to date from Longwalls 20-27 and other local mines. These were assessed using the same probability, consequence and risk rankings tables as used in the original *Environmental Risk Analysis* (SP Solutions, 2008). The re-assessed risk rankings for Longwalls 301-303 were within the "low" range and consequently it was determined that the potential outcomes could still be integrated into the existing management systems for effective review and monitoring (Metropolitan Coal, 2016b).

### ERA Report Review

All ERA participants were asked to review the draft report that was prepared to summarise the outcomes of the risk assessment workshop. Participants' comments were incorporated into the final Metropolitan Coal (2016b) report.

Subsequent to the completion of the ERA, Metropolitan Coal made further revisions to the lengths of Longwalls 302 and 303 (as described in Section 1.3.2). The panel void length of Longwall 302 was reduced from 1,954 m to 1,775 m, and the panel void length of Longwall 303 was reduced from 2,122 m to 1,788 m.

## **2.1.2 Built Features Management Plan Risk Assessments**

Individual risk assessment meetings were held with each infrastructure owner (facilitated by an independent specialist) to inform the development of the Longwalls 301-303 BFMP (Appendix E).

In summary, the investigation and analysis methods used during the risk assessments typically included:

- the identification of the infrastructure owner or manager's assets;
- a review of the revised subsidence predictions and potential impacts on the infrastructure owner's or manager's assets (including consideration of past experience in the Southern Coalfield);
- the development of a preliminary monitoring plan; and
- the identification of risk control measures and procedures.

Metropolitan Coal considers all risk control measures and procedures to be feasible to manage all identified risks. The risk control measures and procedures have been incorporated in the Longwalls 301-303 BFMP (Appendix E).

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### 2.1.3 Public Safety Management Plan Risk Assessment

A risk assessment was held for the Longwalls 301-303 PSMP (Appendix F) to identify and address potential safety hazards to the public, including:

- potential subsidence impacts on built features;
- potential instability of cliff formations or steep slopes caused by subsidence;
- deformations or fracturing of any land caused by subsidence; and
- any other impacts of subsidence.

The risk assessment was held on 2 September 2016 via teleconference and was facilitated by an independent specialist, AXYS Consulting.

A number of risk control and management measures were identified during the risk assessment which considered the extraction of coal beneath land and infrastructure. Metropolitan Coal considers all risk control measures and procedures to be feasible to manage all identified risks.

## 2.2 REVIEW OF RELEVANT INFORMATION OBTAINED SINCE PROJECT APPROVAL

The six management plans of this Extraction Plan (i.e. the WMP [Appendix A], LMP [Appendix B], BMP [Appendix C], HMP [Appendix D], BFMP [Appendix E] and PSMP [Appendix F]) have been prepared in consideration of the information obtained since Project Approval (i.e. the results of monitoring of subsidence impacts and environmental consequences) during the implementation of the Metropolitan Coal Longwalls 20-22 and Longwalls 23-27 Extraction Plans.

In particular, Appendices A to D provide a detailed summary of the information obtained since Project Approval by the relevant Longwalls 20-22 and Longwalls 23-27 Water, Land, Biodiversity and Heritage Management Plans, respectively.

During the preparation of the management plans all of the subsidence impact performance measures detailed in Table 5 had been met. However, subsequent to the finalisation of the Longwalls 301-303 WMP (Appendix A), monitoring conducted in accordance with the Metropolitan Coal Longwalls 23-27 Water Management Plan identified that the following subsidence impact performance measure for the Eastern Tributary between the full supply level of the Woronora Reservoir and the maingate of Longwall 26 had been exceeded in relation to iron staining (emphasis added):

*Negligible environmental consequences over at least 70% of the stream length (that is no diversion of flows, no change in the natural drainage behaviour of pools, **minimal iron staining** and minimal gas releases)*

The Secretary of the DP&E and other relevant agencies were notified of the exceedance as soon as practicable after Metropolitan Coal became aware of the exceedance in accordance with Condition 6, Schedule 7 of the Project Approval and in accordance with the Metropolitan Coal Longwalls 23-27 Water Management Plan Contingency Plan. Metropolitan Coal has also provided the Secretary of the DP&E and other relevant agencies with a detailed report on the incident in accordance with Condition 6, Schedule 7 of the Project Approval.

In accordance with the Contingency Plan, Metropolitan Coal will identify an appropriate course of action with respect to the identified impact(s), in consultation with specialists and relevant agencies. Contingency measures will be developed in consideration of the specific circumstances of the exceedance and the assessment of environmental consequences.

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## 2.3 REVIEW OF PREDICTIONS

The predicted subsidence effects, subsidence impacts and environmental consequences of the Project were assessed in the Project EA and Preferred Project Report. This section describes the process of reviewing and updating these predictions to consider the Extraction Plan Layout.

### 2.3.1 Predicted Subsidence Effects and Subsidence Impacts

A detailed subsidence assessment for Longwalls 301-303 has been prepared in support of this Extraction Plan by MSEC (2016), with the outcomes of this assessment incorporated into the management plans in Appendices A to F. The Subsidence Report by MSEC (2016) is provided in Appendix I.

#### *Review of Subsidence Prediction Methodology*

The predictions of subsidence effects for Longwalls 301-303 were developed by MSEC (2016) using the Incremental Profile Method, calibrated using observed monitoring data above the previously extracted longwalls at Metropolitan Coal (Appendix I). The Incremental Profile Method is based on a large database of observed subsidence movements in the Southern Coalfield and has been found, in most cases, to give reasonable, if not conservative, predictions of maximum subsidence, tilt and curvature.

Based on monitoring data from the Southern Coalfield, there is an approximate 90% confidence level that the maximum observed incremental subsidence will be less than the maximum predicted incremental subsidence using the standard model (Appendix I).

#### *Comparison with Previous Predictions of Subsidence Effects*

MSEC (2016) (Appendix I) provides a comparison of the maximum predicted conventional total subsidence parameters for the Extraction Plan Layout and the Preferred Project Layout for Longwalls 301-303. The maximum predicted total subsidence and tilt for the Extraction Plan Layout are slightly less than predicted based on the Preferred Project Layout. The maximum predicted total hogging curvature for the Extraction Plan Layout is similar but slightly greater than the hogging curvature based on the Preferred Project Layout. The maximum predicted total sagging curvature is the same for both layouts.

While the predicted maxima are generally similar to those for the Preferred Project Layout for Longwalls 301-303, the predicted subsidence parameters at the southern ends of Longwalls 302 and 303 are greater than those predicted for the Preferred Project Layout. However, these parameters remain below the maximum predicted subsidence parameters based on the Preferred Project Layout across previous Longwalls 20-27 and future 300 series longwalls (e.g. maximum predicted total conventional hogging curvature of  $0.11 \text{ km}^{-1}$ ).

Streams within the  $35^\circ$  angle of draw and/or predicted 20 mm subsidence contour are expected to experience localised and elevated compressive strains resulting from valley related movements (Appendix I). The maximum predicted vertical subsidence, upsidence and closure for the Eastern Tributary, based on the Extraction Plan Layout, are less than the maxima predicted based on the Preferred Project Layout for Longwalls 301-303 (Appendix I).

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### ***Predicted Subsidence Impacts***

MSEC (2016) (Appendix I) has conducted a detailed assessment of potential subsidence impacts for each of the natural and built features identified in the vicinity of Longwalls 301-303. Potential subsidence impacts identified by MSEC (2016) are consistent with those identified in the Project EA and Preferred Project Report and include:

- surface cracking, heaving, buckling, humping and stepping;
- sub-surface fracturing;
- changes in gradients, ponding, scouring/erosion and changes in stream alignment; and
- instability of land features, including rock falls.

Potential impacts with respect to structures include cracking of road surfaces, opening of joints in pipelines, alteration of tension of electricity transmission lines and cracks in masonry.

The revised subsidence predictions for the Extraction Plan Layout do not change the subsidence impact assessments provided in the Project EA and Preferred Project Report (Appendix I).

### **2.3.2 Potential Environmental Consequences**

Detailed discussion of potential environmental consequences is provided in the management plans in Appendices A to F.

The suitably qualified experts (endorsed by the Secretary of the DP&E) conducted a review of the potential environmental consequences due to the extraction of Longwalls 301-303 for the preparation of each management plan. The reviews concluded that there are no additional potential subsidence impacts or environmental consequences resulting from the extraction of Longwalls 301-303 to those identified in the Project EA and Preferred Project Report.

## **2.4 CONSULTATION**

Consultation has been conducted for the Extraction Plan in accordance with the requirements of the Project Approval and in consideration of the DP&E and DRE (2015) *Guidelines for the Preparation of Extraction Plans*. Consultation undertaken with relevant stakeholders to date is described below.

### **2.4.1 Government Agencies**

A summary of the consultation with government agencies and the key issues raised is provided in Table 7. Draft management plans were distributed to relevant government agencies for comment as described in Table 7.

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**Table 7**  
**Summary of Consultation with Government Agencies**

Agency	Consultation Conducted	Key Issues Raised
DP&E	<ul style="list-style-type: none"> <li>• 1 June 2016 – Metropolitan Coal requested the endorsement of Extraction Plan team as suitably qualified and experienced experts.</li> <li>• 15 August 2016 – Draft LMP (Version A) and Draft HMP (Version A) provided.</li> <li>• 9 September 2016 – Draft WMP (Version A) provided.</li> <li>• 20 September 2016 – Draft BMP (Version A) provided.</li> <li>• 10 October 2016 – Draft PSMP (Version A) provided.</li> <li>• 14 October 2016 – revised Draft WMP (Version B), revised Draft LMP (Version B) and Draft MSEC (2016) Subsidence Report provided.</li> <li>• 18 October 2016 – revised Draft BMP (Version B) and revised Draft HMP (Version B) provided.</li> <li>• November 2016 – Submission of Longwalls 301-303 Extraction Plan.</li> </ul>	<ul style="list-style-type: none"> <li>• DP&amp;E endorsement of Extraction Plan team provided (June 2016).</li> <li>• DP&amp;E indicated support for Extraction Plan to include relevant post-mining requirements of the two previously approved Extraction Plans.</li> </ul>
DRE	<ul style="list-style-type: none"> <li>• Discussions with the DRE Principal Subsidence Engineer in relation to the 300 series longwalls, built features and subsidence.</li> <li>• 10 October 2016 – Draft PSMP (Version A) provided.</li> <li>• November 2016 – Submission of Longwalls 301-303 Extraction Plan.</li> </ul>	<ul style="list-style-type: none"> <li>• Discussions with DRE Principal Subsidence Engineer in relation to: <ul style="list-style-type: none"> <li>- 132 kV and 330 kV electricity structures.</li> <li>- Garrawarra Centre Complex – impacts to buildings.</li> <li>- Subsidence monitoring.</li> </ul> </li> </ul>
WaterNSW	<ul style="list-style-type: none"> <li>• 15 August 2016 – Draft LMP (Version A) provided.</li> <li>• 9 September 2016 – Draft WMP (Version A) provided.</li> <li>• 10 October 2016 – Draft PSMP (Version A) provided.</li> <li>• 14 October 2016 – revised Draft WMP (Version B), revised Draft LMP (Version B) and Draft MSEC (2016) Subsidence Report provided.</li> <li>• 18 October 2016 – email from Metropolitan Coal advising the Extraction Plan is required to be submitted prior to the planned workshop, with request for any comments WaterNSW has to date on the draft LMP and draft WMP.</li> <li>• November 2016 – Submission of Longwalls 301-303 Extraction Plan.</li> </ul>	<ul style="list-style-type: none"> <li>• WaterNSW requested Subsidence Report to assist with review of Draft LMP and Draft WMP.</li> <li>• WaterNSW requested workshop with Metropolitan Coal and relevant specialists to discuss Woronora Reservoir leakage, water quality, subsidence monitoring, and groundwater and subsidence modelling. Workshop with WaterNSW arranged for 17 November 2016.</li> </ul>
DPI-Water	<ul style="list-style-type: none"> <li>• 9 September 2016 – Draft WMP (Version A) provided.</li> <li>• 5 October 2016 – email from DPI-Water with queries and request for water level and quality data.</li> <li>• 7 and 13 October 2016 – emails from Metropolitan Coal responding to DPI-Water's queries and provision of requested data.</li> <li>• 14 October 2016 – revised Draft WMP (Version B) provided.</li> <li>• 26 October 2016 – receipt of DPI-Water's comments on Draft WMP.</li> <li>• November 2016 – Submission of Longwalls 301-303 Extraction Plan and provision of Metropolitan Coal's response to DPI-Water's comments.</li> </ul>	<ul style="list-style-type: none"> <li>• Key issues raised in DPI-Water's comments on Draft WMP included the availability of baseline data, deep groundwater quality monitoring, monitoring sites and equipment, Chart presentation, groundwater model development, and bore census information.</li> </ul>

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**Table 7 (Continued)**  
**Summary of Consultation with Government Agencies**

<b>Agency</b>	<b>Consultation Conducted</b>	<b>Key Issues Raised</b>
DPI-Fishing	<ul style="list-style-type: none"> <li>20 September 2016 – Draft BMP (Version A) provided.</li> <li>14 October 2016 – revised Draft BMP (Version B) provided.</li> <li>November 2016 – Submission of Longwalls 301-303 Extraction Plan.</li> </ul>	<ul style="list-style-type: none"> <li>No issues raised to date.</li> </ul>
OEH	<ul style="list-style-type: none"> <li>9 September 2016 – Draft WMP (Version A) provided.</li> <li>20 September 2016 – Draft BMP (Version A) provided.</li> <li>14 October 2016 – revised Draft WMP (Version B), revised Draft BMP (Version B) and Draft MSEC (2016) Subsidence Report provided.</li> <li>November 2016 – Submission of Longwalls 301-303 Extraction Plan.</li> </ul>	<ul style="list-style-type: none"> <li>OEH requested Subsidence Report to assist with review of Draft WMP and Draft BMP.</li> <li>Requested clarification regarding revisions made to swamp vegetation mapping.</li> </ul>
OEH (Heritage Branch)	<ul style="list-style-type: none"> <li>15 August 2016 – Draft HMP (Version A) provided.</li> <li>18 October 2016 – revised Draft HMP (Version B) provided.</li> <li>November 2016 – Submission of Longwalls 301-303 Extraction Plan.</li> </ul>	<ul style="list-style-type: none"> <li>No issues raised to date.</li> </ul>
Dams Safety Committee (DSC)	<ul style="list-style-type: none"> <li>10 October 2016 – Draft PSMP (Version A) provided.</li> <li>28 October 2016 – email from DSC indicating the DSC has no comments on the PSMP.</li> <li>3 November 2016 – Email sent to DSC confirming DSC had no particular comments on the draft PSMP and that the DSC will consider the mining of Longwalls 301-303 in the Woronora Notification Area as part of the <i>Dams Safety Act, 1978</i> requirements.</li> <li>November 2016 – Submission of Longwalls 301-303 Extraction Plan.</li> </ul>	<ul style="list-style-type: none"> <li>No issues raised to date.</li> </ul>
Mine Subsidence Board (MSB) (recently changed to Subsidence Advisory NSW)	<ul style="list-style-type: none"> <li>25 July 2016 – Metropolitan Coal letter to MSB requesting confirmation of MSB's consultation requirements.</li> <li>MSB response (31 July 2016) – Metropolitan Coal to provide a copy of the Extraction Plan on submission.</li> <li>A representative of the MSB is on the Roads and Maritime Services (RMS) Technical Committee, which has been consulted in relation to the BFMP-RMS.</li> <li>November 2016 – Submission of Longwalls 301-303 Extraction Plan.</li> </ul>	<ul style="list-style-type: none"> <li>No issues raised to date.</li> </ul>
Environment Protection Authority (EPA)	<ul style="list-style-type: none"> <li>25 July 2016 – Metropolitan Coal letter to EPA requesting confirmation of the EPA's consultation requirements.</li> <li>15 August 2016 – Email from EPA confirming the EPA has no consultation requirements in regard to the Extraction Plan.</li> </ul>	<ul style="list-style-type: none"> <li>No requirements for Extraction Plan.</li> </ul>
Land and Property Information (LPI) NSW, Department of Lands	<ul style="list-style-type: none"> <li>20 July 2016 – Metropolitan Coal letter to LPI-NSW describing potential subsidence effects on survey marks and notification in accordance with the <i>Surveyor General's Directions No.11 Preservation of Survey Infrastructure</i>.</li> </ul>	<ul style="list-style-type: none"> <li>No issues raised to date.</li> </ul>

### 2.4.2 Landholders

Metropolitan Coal has consulted with all landowners within 600 m of Longwalls 301-303. A title search of land within 600 m of Longwalls 301-303 identified the following (Figure 7):

- two lots are owned by WaterNSW; four lots are owned by The State of NSW (Crown Land);
- two lots are owned by The State of NSW (Garawarra State Conservation Area);
- two lots are owned by the Health Administration Corporation (NSW Health); and
- two lots are owned by Robert and Carolyn Stewart.

Metropolitan Coal also consulted with the Sutherland Shire Sport Flying Association, as the Sutherland Shire Sport Flying Association club house and air strip are located on one of the State of NSW (Crown Land) properties within 600 m of Longwalls 301-303 (although the club house and air strip are located beyond 600 m of Longwalls 301-303).

The Trustees of the Macedonian Orthodox Monastery were also consulted because their land was initially within 600 m of the original planned extent for Longwalls 301-303. The revised extent of Longwalls 301-303 is greater than 600 m from their land (Figure 7).

A summary of consultation undertaken with the landholders (with the exception of WaterNSW and NSW Health) within 600 m of Longwalls 301-303 is provided in Table A2-1 of Attachment 2.

A summary of consultation undertaken with WaterNSW in relation to the Longwalls 301-303 WMP, LMP and PSMP is provided in Table 7 (in Section 2.4.1 above). Consultation undertaken with NSW Health in relation to the Longwalls 301-303 BFMP-Garrawarra Centre Complex is described in Section 2.4.4 and summarised in Table A2-2 of Attachment 2.

### 2.4.3 Aboriginal Groups

A draft of the Longwalls 301-303 HMP was provided to Aboriginal stakeholders registered at Metropolitan Coal for their review and comment on 15 August 2016. Comments were received on the draft Longwalls 301-303 HMP from Cubbitch Barta Native Title Claimants on 22 August 2016.

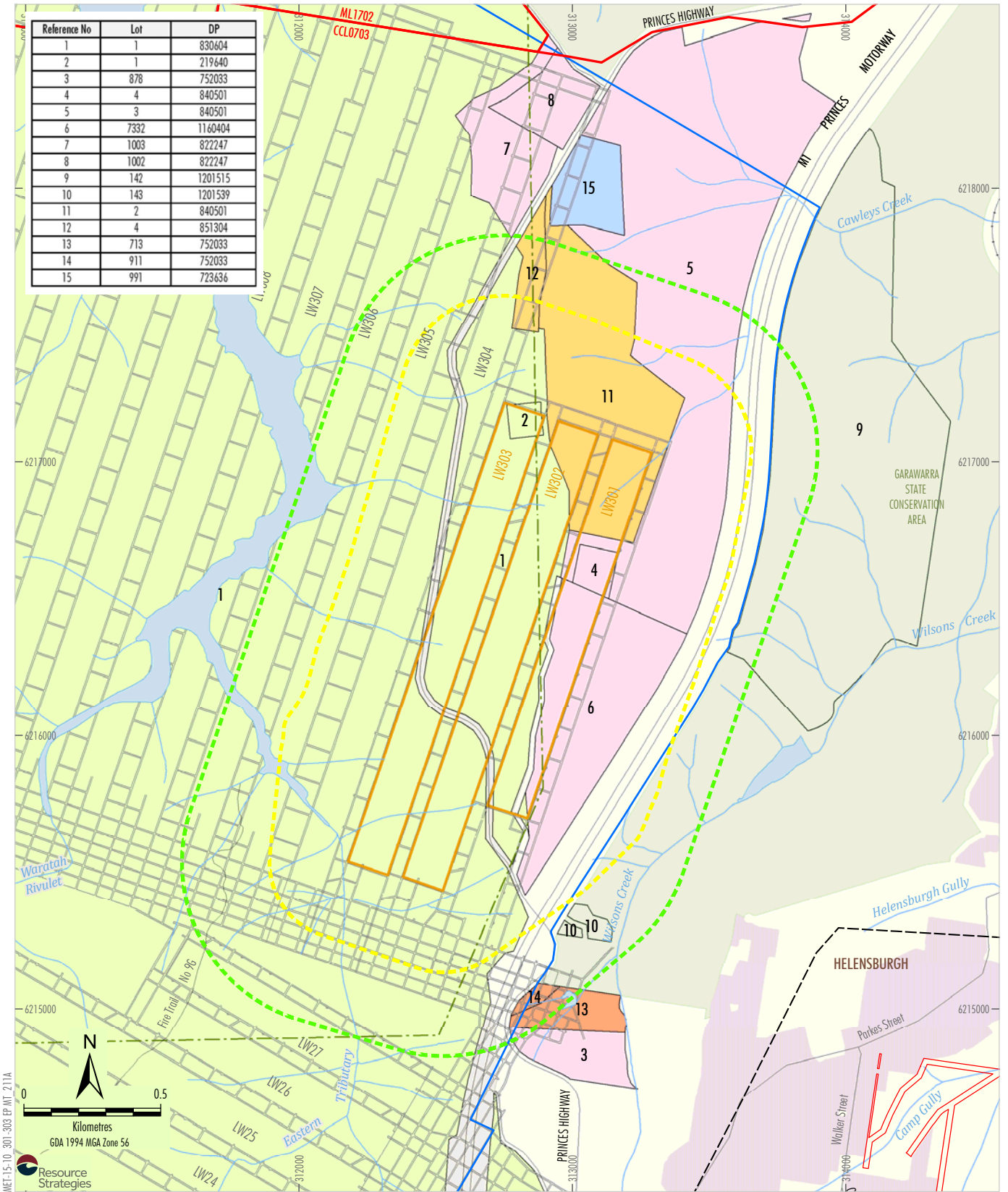
The Longwalls 301-303 HMP was subsequently revised in consideration of the comments received and to reflect the shortening of Longwalls 302 and 303. The revised draft Longwalls HMP was provided to the Aboriginal stakeholders on 18 October 2016.

Metropolitan Coal understands the Illawarra Local Aboriginal Land Council has applied for Aboriginal land claims over Crown Land comprising Lot 878, DP 752033 and Lot 3, DP 840501 (Figure 7). Metropolitan Coal noted the location of these lots in relation to Longwalls 301-303 in their letter to the Illawarra Local Aboriginal Land Council.

Copies of the consultation letters are provided in Attachment 2.

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- LEGEND**
- Mining Lease Boundary
  - Woronora Special Area
  - Railway
  - Project Underground Mining Area  
Longwalls 20-27 and 301-317
  - Longwalls 301 - 303 Secondary Extraction
  - 35° Angle of Draw and/or Predicted  
20 mm Subsidence Contour
  - 600 m from Secondary Extraction of  
Longwalls 301-303
  - Woronora Notification Area
  - Existing Underground Access Drive (Main Drift)

- Landholder**
- WaterNSW
  - The State of New South Wales  
(Crown Land)
  - The State of New South Wales  
(Garawarra State Conservation Area)
  - Health Administration Corporation
  - The Trustees of the  
Macedonian Orthodox Monastery  
R & C Stewart

Source: Land and Property Information (2015, 2016); Department of Industry (2015); Metropolitan Coal (2016); MSEC (2016)

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ENERGY  
**METROPOLITAN COAL**  
**Land Ownership Within  
600 m of Longwalls 301 - 303**

**Figure 7**

#### 2.4.4 Infrastructure Owners

Consultation with each infrastructure owner/manager was generally conducted in accordance with the following protocol:

- Initial contact to confirm the appropriate infrastructure representative and initial briefing.
- Provision of a specific report by MSEC outlining the subsidence predictions and impact assessment for each infrastructure item.
- Where relevant, Metropolitan Coal funded additional expertise to assist the infrastructure owner to assess appropriate monitoring and management strategies and/or measures.
- Risk assessment workshops were held with representatives from Metropolitan Coal, the infrastructure owner and relevant specialists.
- A draft of the relevant Longwalls 301-303 BFMP was distributed for comment to the relevant infrastructure owner.
- A final draft Longwalls 301-303 BFMP was prepared incorporating comments from the infrastructure owner.

A summary of consultation undertaken with the infrastructure owners is provided in Table A2-2 of Attachment 2.

#### 2.4.5 Public Consultation

The Metropolitan Coal Community Consultative Committee (CCC) was advised of the development of the Longwalls 301-303 Extraction Plan at a meeting on 6 April 2016, and was provided with an update on the preparation of the Extraction Plan at a meeting on 10 August 2016. The CCC was informed that submission of the Extraction Plan was anticipated in October 2016.

An electronic copy of the Extraction Plan will be provided to the members of the CCC upon submission to the DP&E. Metropolitan Coal will provide a detailed briefing to the CCC in relation to the Extraction Plan at the December 2016 meeting.

#### 2.4.6 Summary of Management Plans Distributed for Comment

A summary of the draft management plans that were distributed for comment is provided in Table 8.

Copies of consultation letters provided to the consultees in Table 8 are provided in Attachment 2.

**Table 8**  
**Draft Management Plans Distributed for Comment**

Management Plan	Stakeholder	Date Distributed
Water Management Plan	DP&E, WaterNSW, OEH and DPI-Water	9 September 2016 (Version A) 14 October 2016 (Version B)
Land Management Plan	DP&E and WaterNSW	15 August 2016 (Version A) 14 October 2016 (Version B)
Biodiversity Management Plan	DP&E, OEH and DPI-Fishing	20 September 2016 (Version A) 14 October 2016 (Version B)
Heritage Management Plan	DP&E, OEH (Heritage Branch) and Aboriginal Stakeholders	15 August 2016 (Version A) 18 October 2016 (Version B)

**Table 8 (Continued)**  
**Draft Management Plans Distributed for Comment**

Management Plan	Stakeholder	Date Distributed
Built Features Management Plan	NSW Health (Garrawarra Centre Complex)	Refer Attachment 2 (Table A2-2)
	Endeavour Energy	
	TransGrid	
	Nextgen	
	Optus	
	Telstra	
	Axicom	
	Sydney Trains	
	Roads and Maritime Services (RMS)	
	Wollongong City Council (WCC) – Old Princes Highway	
	WCC – Waterfall General (Garrawarra) Cemetery	
	Sydney Water	
Public Safety Management Plan	DP&E, DRE, DSC and WaterNSW	10 October 2016 (Version A)

### 3 SUBSIDENCE MANAGEMENT AND MONITORING

Surface and sub-surface features within the vicinity of Longwalls 301-303 are listed in Table 9. Features within the Study Area (i.e. within the 35° angle of draw and/or 20 mm predicted subsidence contour of Longwalls 301-303) may potentially be impacted by the secondary extraction of Longwalls 301-303. There are also features that lie outside the Study Area that are expected to experience either far-field movements, or valley related movements. The surface features which are sensitive to such movements have been identified and have been included in the subsidence assessments provided in MSEC (2016) (Appendix I).

The location of natural features and known Aboriginal heritage sites within 600 m of Longwalls 301-303 and surrounds is shown on Figures 8, 9 and 10. The location of surface infrastructure/built features over and adjacent to the Longwalls 301-303 Study Area is shown on Figures 11a, 11b and 12. Descriptions of each of these features are contained within the relevant management plan referenced in Table 9.

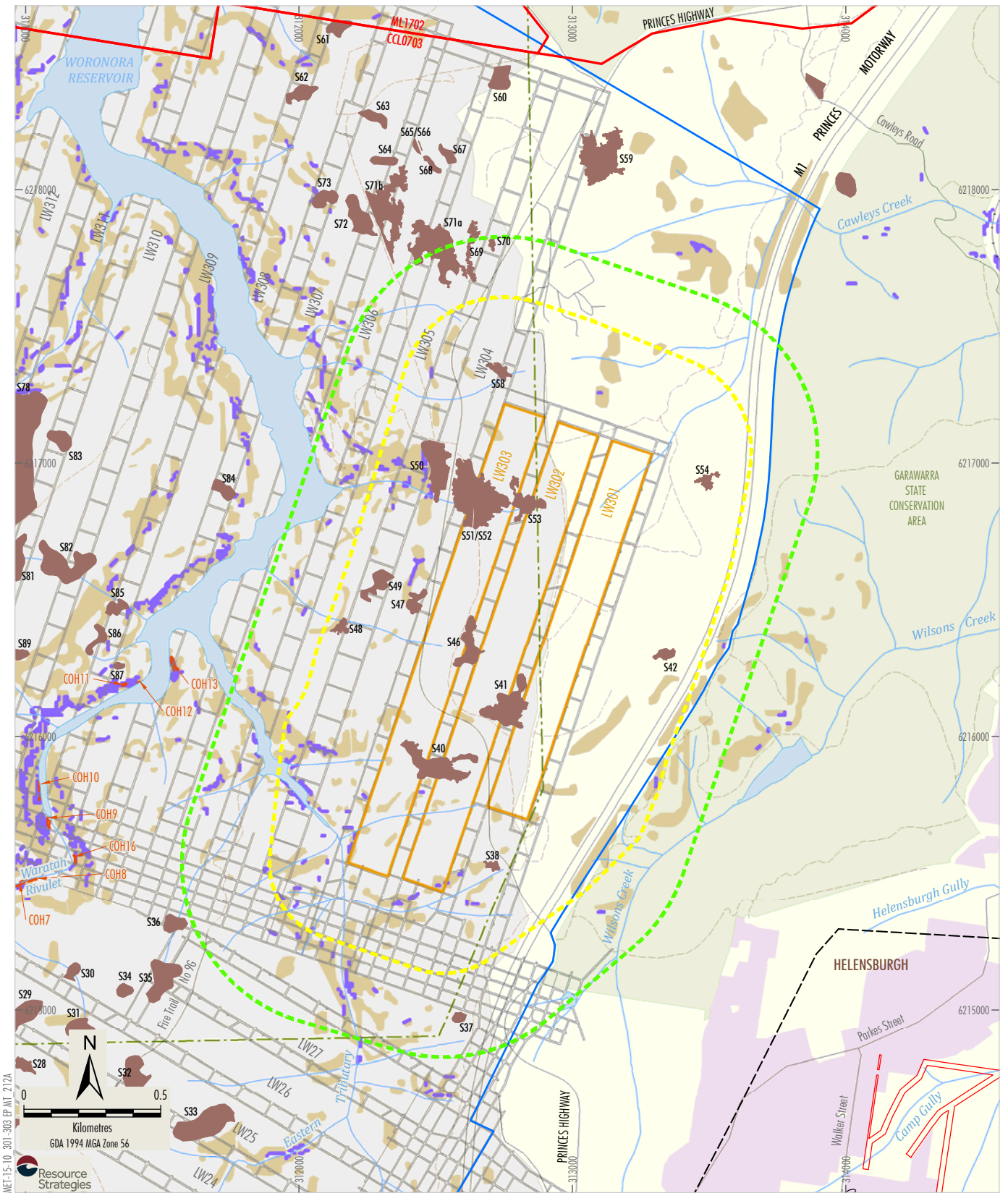
Subsidence predictions and potential impacts to surface and sub-surface features are provided and described in MSEC (2016) (Appendix I).

Management measures and monitoring for each feature are included in each of the management plans as indicated in Table 9 and summarised in Sections 3.1 to 3.6.

The Longwalls 301-303 SMP (Appendix G) has been prepared to validate the subsidence predictions and analyse the relationship between the subsidence effects and subsidence impacts of the Extraction Plan and any ensuing environmental consequences. A summary of the proposed monitoring for the Extraction Plan is provided in Section 3.7.

**Table 9**  
**Surface and Sub-surface Features**

Feature	Section/Management Plan Reference
<b>Natural Features</b>	
Streams (including Eastern Tributary and other small first and second order tributaries)	Section 3.1 and WMP (Appendix A)
Steep Slopes and Land in General (including rock ledges and outcrops)	Section 3.2 and LMP (Appendix B)
Upland Swamps	Section 3.3 and BMP (Appendix C)
Threatened Species, Populations and Ecological Communities and their Habitat	
Natural Vegetation	
<b>Public Utilities and Other Infrastructure</b>	
NSW Health – Garrawarra Centre Complex	Section 3.5 and BFMP (Appendix E)
Endeavour Energy – Electrical Infrastructure	
TransGrid – Electrical Infrastructure	
Nextgen – Telecommunications Infrastructure	
Optus – Telecommunications Infrastructure	
Telstra – Telecommunications Infrastructure	
Axicom – Telecommunications Infrastructure	
Sydney Trains – Illawarra Railway and Telecommunications Infrastructure	
RMS – M1 Princes Motorway and Bridges	
WCC – Old Princes Highway	
WCC – Waterfall General (Garrawarra) Cemetery	
Sydney Water – Water Pipelines	
Woronora Reservoir	Section 3.1 and WMP (Appendix A)
Exploration Boreholes	Section 3.5 and Subsidence Report (Appendix I)
Survey Control Marks	
Fire Trails and Vehicular Tracks	Sections 3.2 and 3.5, LMP (Appendix B) and BFMP (Appendix E)
<b>Areas of Archaeological and/or Heritage Significance</b>	
Known Aboriginal Heritage Sites	Section 3.4 and HMP (Appendix D)
Waterfall General (Garrawarra) Cemetery	Section 3.5 and BFMP (Appendix E)
Garrawarra Centre Complex	



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Resource Strategies

**LEGEND**

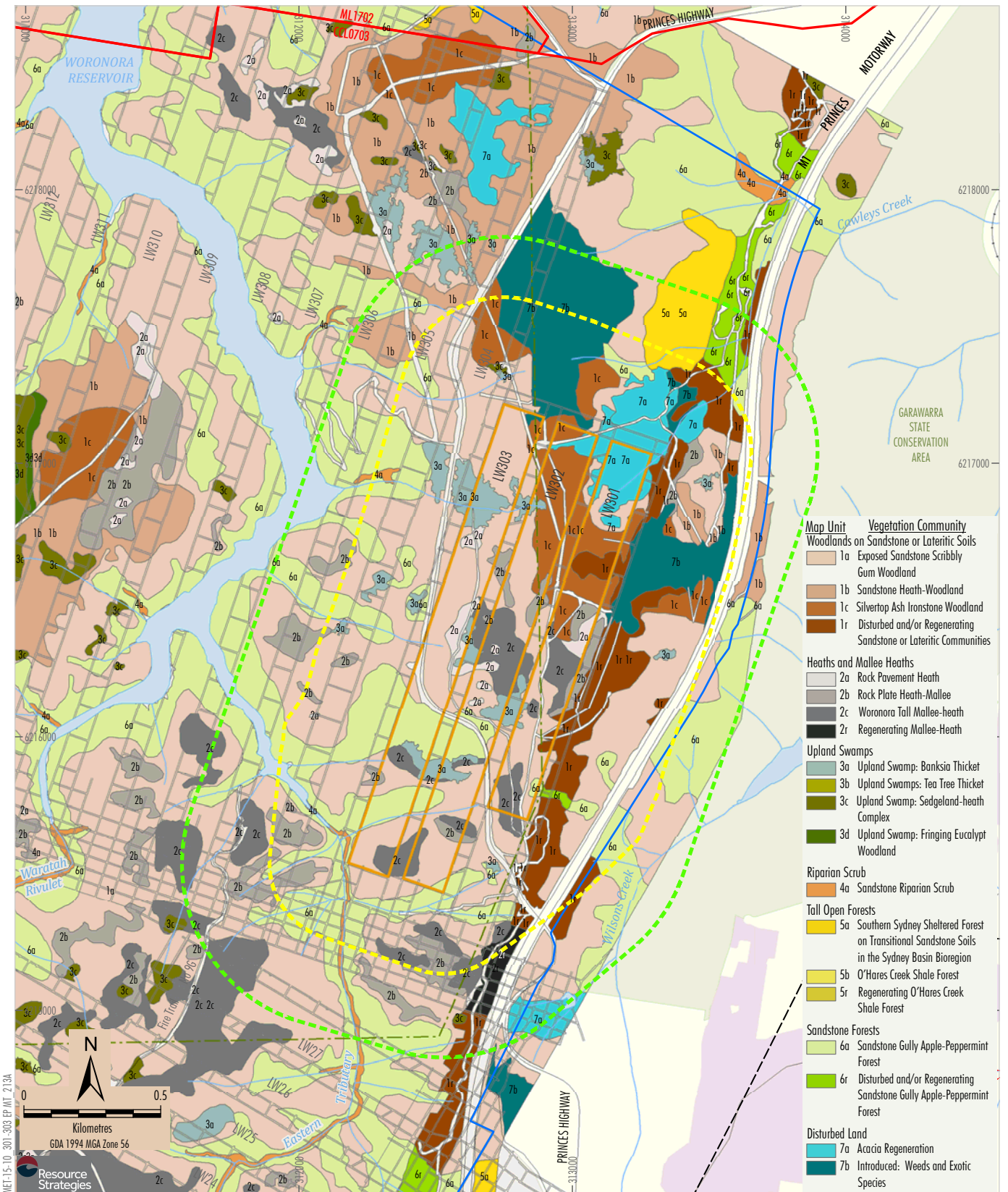
- Mining Lease Boundary
- Woronora Special Area
- Railway
- Project Underground Mining Area  
Longwalls 20-27 and 301-317
- Longwalls 301 - 303 Secondary Extraction
- 35° Angle of Draw and/or Predicted  
20 mm Subsidence Contour
- 600 m from Secondary Extraction of  
Longwalls 301-303
- Woronora Notification Area
- Existing Underground Access Drive (Main Drift)
- Road
- Vehicular Track
- Streams
- Cliffs and Overhangs
- Steep Slopes (Project Approval)
- Steep Slopes (Project Environmental Assessment)
- Upland Swamp

Source: Land and Property Information (2015); Department of Industry (2015);  
Metropolitan Coal (2016); MSEC (2016)



**METROPOLITAN COAL**  
Streams, Cliffs and Overhangs, Steep Slopes  
and Upland Swamps within 600 m of  
Longwalls 301 - 303 and Surrounds

**Figure 8**



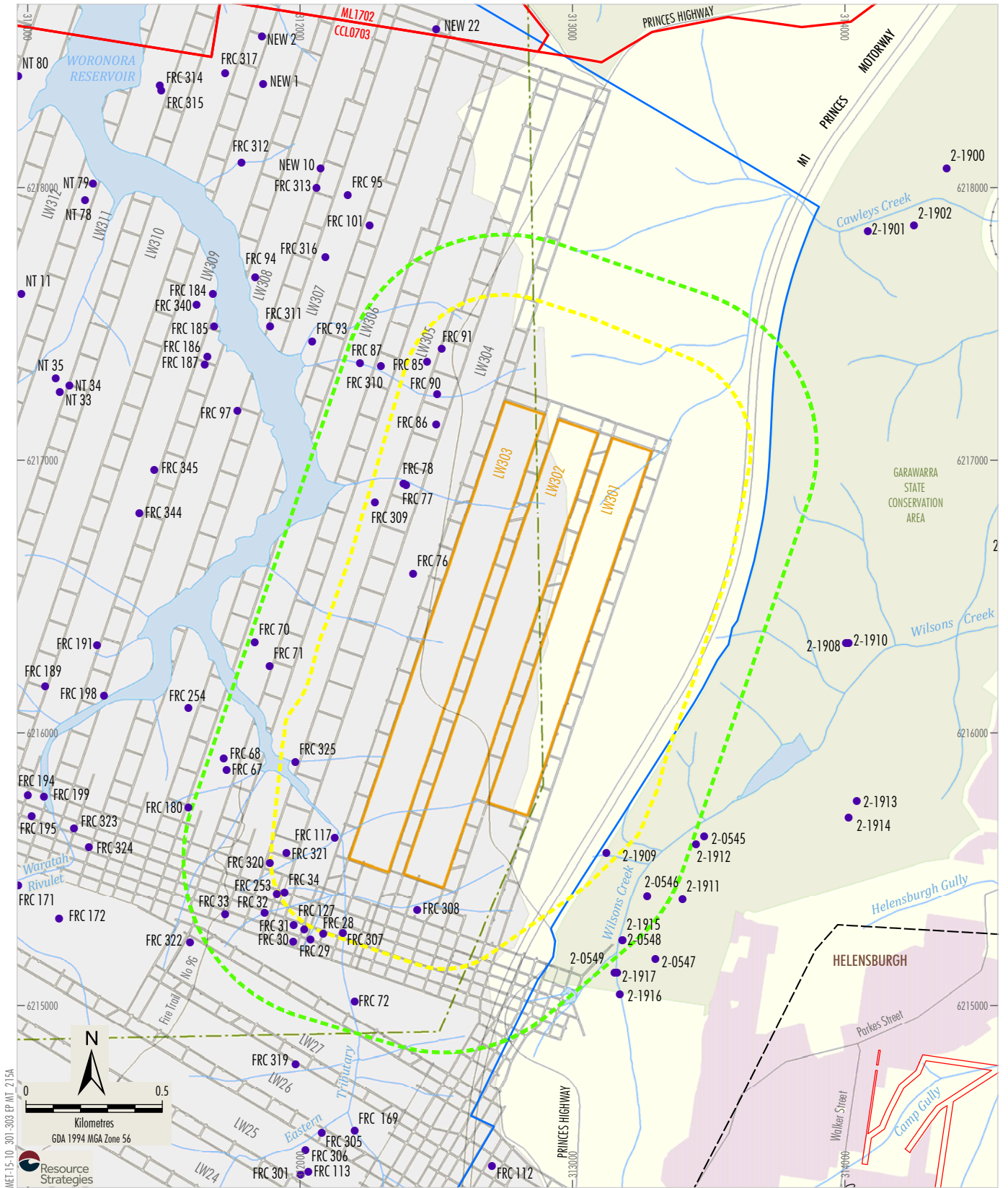
- LEGEND**
- Mining Lease Boundary
  - Woronora Special Area
  - Railway
  - Project Underground Mining Area Longwalls 20-27 and 301-317
  - Longwalls 301 - 303 Secondary Extraction
  - 35° Angle of Draw and/or Predicted 20 mm Subsidence Contour
  - 600 m from Secondary Extraction of Longwalls 301-303
  - Woronora Notification Area
  - Existing Underground Access Drive (Main Drift)

Source: Land and Property Information (2015); Department of Industry (2015); Metropolitan Coal (2016); MSEC (2016); after Bangalay Botanical Surveys (2008) and Eco Logical Australia (2016)



**METROPOLITAN COAL**  
**Longwalls 301 - 303**  
**Vegetation Mapping**

**Figure 9**



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**LEGEND**

- Mining Lease Boundary
- Woronora Special Area
- Railway
- Project Underground Mining Area Longwalls 20-27 and 301-317
- Longwalls 301 - 303 Secondary Extraction
- 35° Angle of Draw and/or Predicted 20 mm Subsidence Contour
- 600 m from Secondary Extraction of Longwalls 301-303
- Existing Underground Access Drive (Main Drift)
- Woronora Notification Area
- Aboriginal Heritage Site

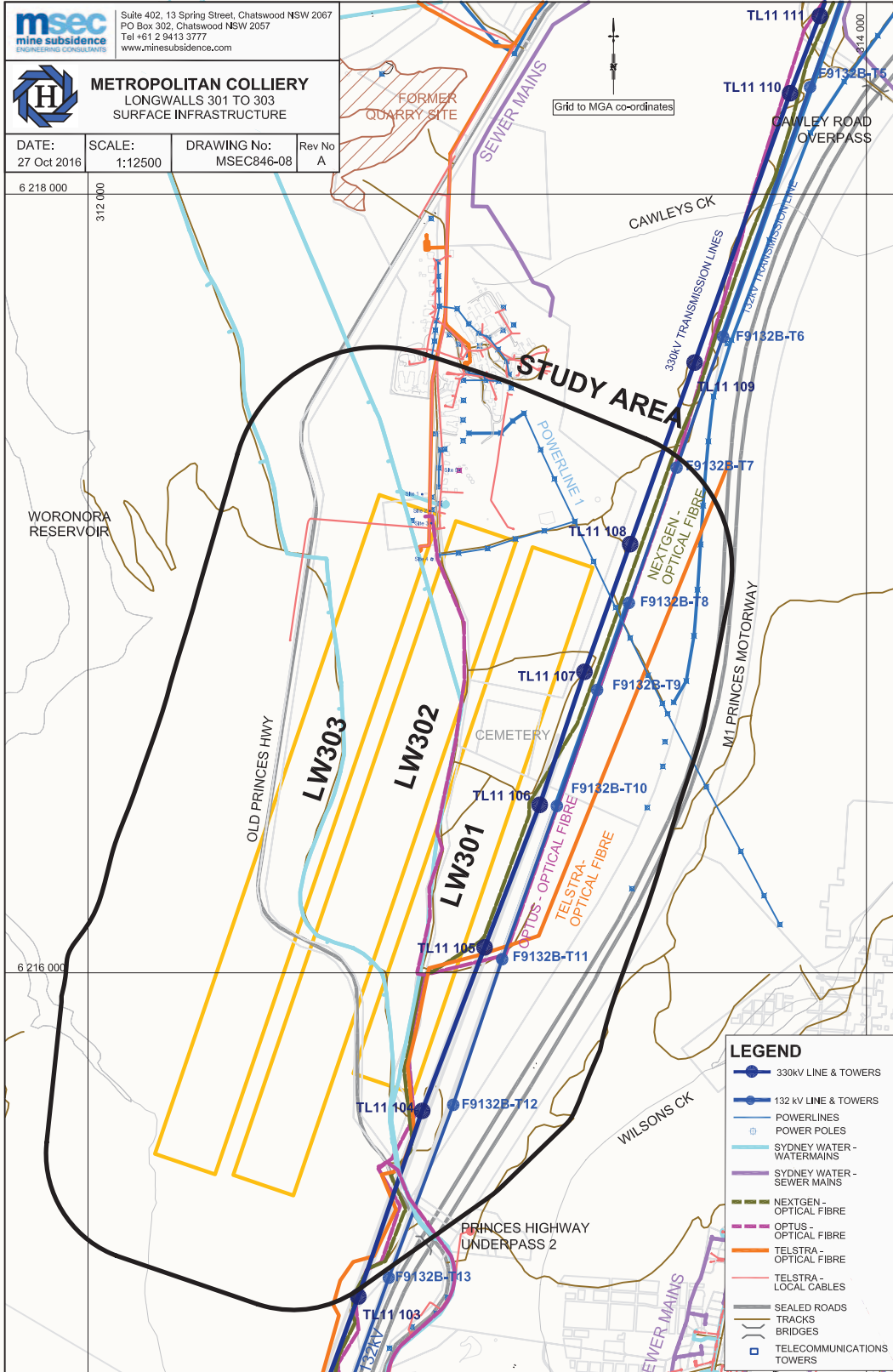
Source: Land and Property Information (2015); Department of Industry (2015); Metropolitan Coal (2016); MSEC (2016); Illawarra Prehistory Group (2007; 2008); AHIMS (2007); Kayandel Archaeological Services (2006; 2007; 2008); Niche Environmental and Heritage (2013)

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ENERGY

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**Known Aboriginal Heritage Sites  
within 600 m of Longwalls 301 - 303  
and Surrounds**

**Figure 10**



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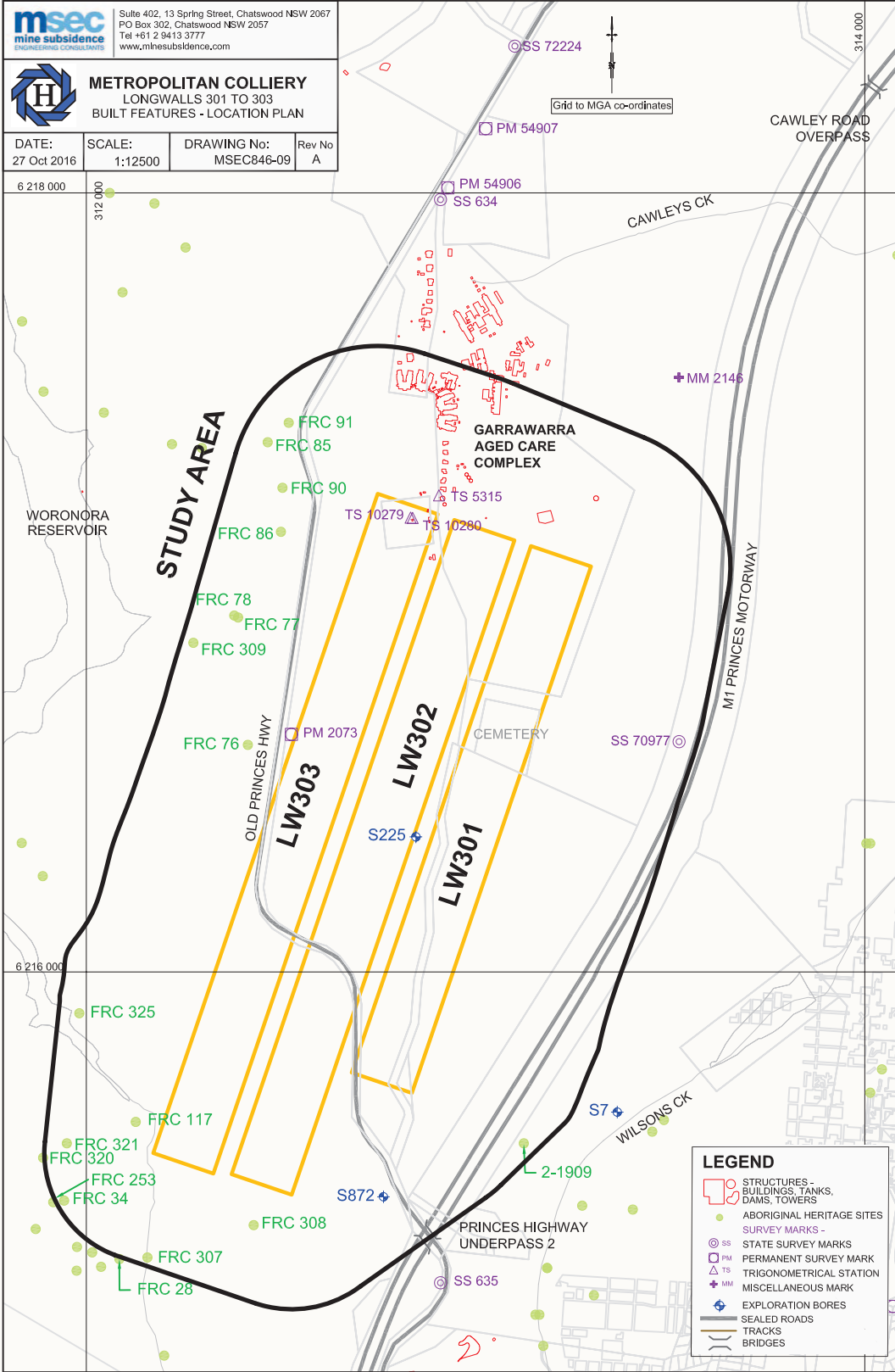
Source: MSEC (2016)



METROPOLITAN COAL  
Surface Infrastructure Over and Adjacent to  
the Longwalls 301 - 303 Study Area

Figure 11a

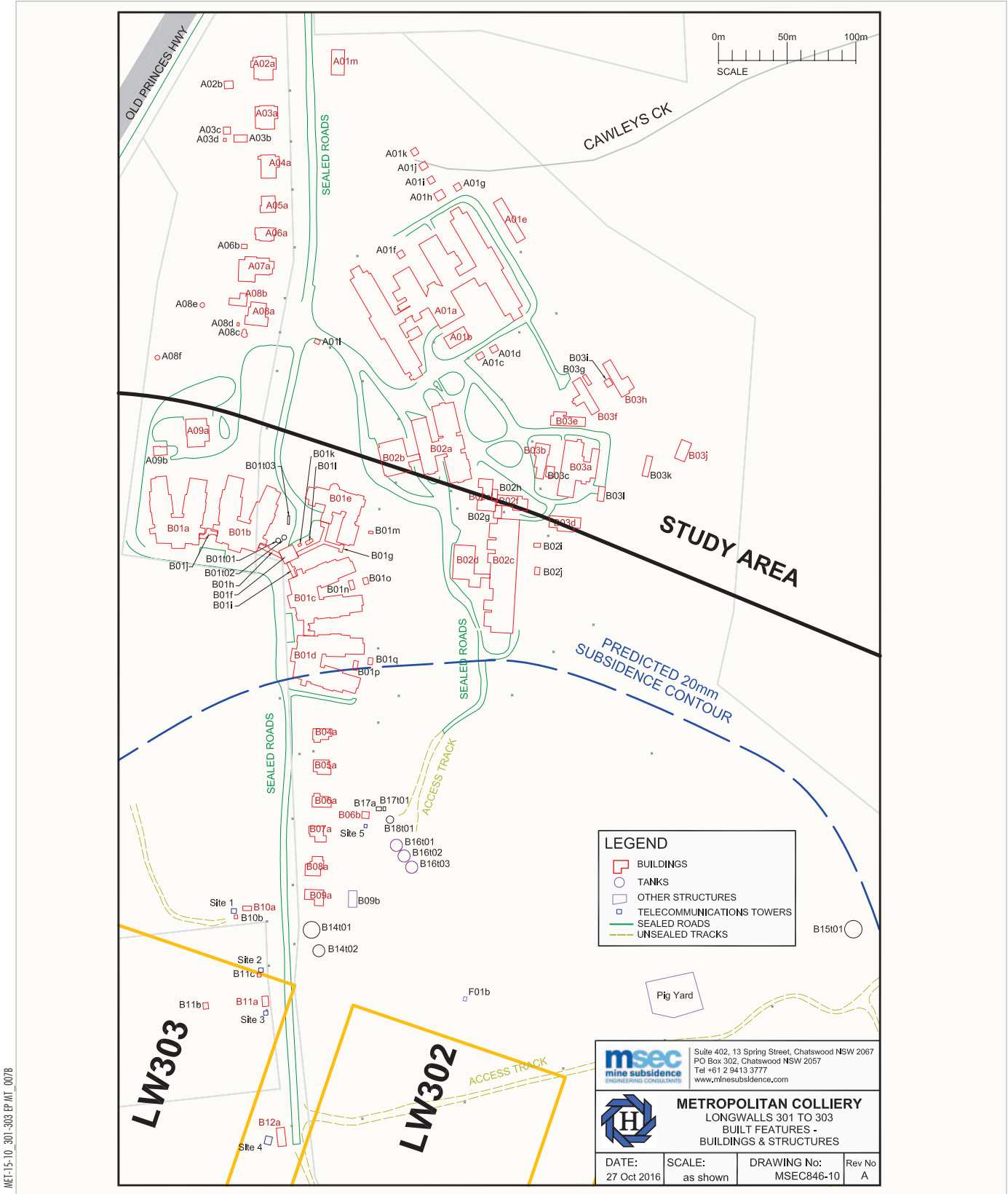




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Source: MSEC (2016)

Figure 11b



Source: MSEC (2016)



METROPOLITAN COAL  
Location of the Garrawarra Centre Complex  
Building Structures and Built Features

Figure 12

ME1-15-10\_301-303 BP.MT\_0078

### 3.1 WATER MANAGEMENT

#### 3.1.1 Overview

The Longwalls 301-303 WMP is provided in Appendix A. The purpose and scope of the WMP are summarised below:

**Purpose:** To manage the potential environmental consequences of the Extraction Plan on watercourses (including the Woronora Reservoir), aquifers and catchment yield.

**Scope:** Surface water and groundwater resources during the mining of Longwalls 301-303.

#### 3.1.2 Key Water Issues, Monitoring and Management Measures

The Waratah Rivulet is located approximately 1 km west of Longwall 303, at its closest point to Longwalls 301-303 secondary extraction (Figure 8). At this distance, the Waratah Rivulet is not predicted to experience any measurable subsidence or valley related movements resulting from the extraction of Longwalls 301-303 (Appendix I).

The Eastern Tributary flows in a northerly direction into the Woronora Reservoir. Within the Longwalls 301-303 35° angle of draw and/or predicted 20 mm subsidence contour, the Eastern Tributary flows into the full supply level of the Woronora Reservoir (Figure 8). Longwalls 301-303 do not directly mine beneath the Eastern Tributary (Figure 8). Following the completion of Longwalls 301-303, an additional 30 m of the Eastern Tributary (in Boulderfield ETAM) upstream of Longwalls 301-303 is predicted to experience greater than 200 mm total closure as a result of the Extraction Plan Layout compared to the Preferred Project Layout for Longwalls 301-303 (Appendix I).

Small first and second order streams also occur over and adjacent to Longwalls 301-303 (Figure 8) and could experience the full range of predicted subsidence movements.

The key issues relating to subsidence impacts on surface water and groundwater resources are described in the WMP and the relevant monitoring and management measures are summarised in Table 10 and Section 3.7.

#### 3.1.3 Assessment of Performance Indicators and Measures

Performance indicators developed for the subsidence impact performance measures relating to water resources and watercourses are presented in the WMP and are summarised in Table 11. Monitoring against these performance indicators during the mining of Longwalls 301-303 is summarised in Table 10 and Section 3.7 and described in detail in Appendix A.

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**Table 10**  
**Management Issues for Water Resources and Watercourses**  
**During the Extraction of Longwalls 301-303**

Issue	Approved Impact	Monitoring	Management
Catchment yield to the Woronora Reservoir	<ul style="list-style-type: none"> <li>Negligible reduction to the quality or quantity of water resources reaching the Woronora Reservoir.</li> <li>No connective cracking between the surface and the mine.</li> </ul>	Monitoring in accordance with the WMP, including: <ul style="list-style-type: none"> <li>Groundwater pressure/level monitoring.</li> <li>Groundwater quality monitoring.</li> <li>Stream flow monitoring.</li> <li>Pool water level monitoring.</li> <li>Surface water quality monitoring.</li> <li>Visual inspections of stream cracking, gas releases, iron staining and drainage behaviour.</li> <li>Inspections of underground workings for water accumulation.</li> <li>Mine water make.</li> </ul> Subsidence monitoring in accordance with the SMP.	<ul style="list-style-type: none"> <li>Stream remediation.</li> <li>Additional monitoring (e.g. increase in monitoring frequency or additional sampling).</li> <li>Offsets.</li> <li>Adaptive management.</li> <li>Revegetation measures.</li> </ul>
Woronora Reservoir	<ul style="list-style-type: none"> <li>Negligible leakage from the Woronora Reservoir.</li> <li>Negligible reduction in water quality of Woronora Reservoir.</li> </ul>		
Waratah Rivulet between the full supply level of the Woronora Reservoir and the maingate of Longwall 23 (upstream of Pool P)	<ul style="list-style-type: none"> <li>Negligible environmental consequences (that is, no diversion of flows, no change in the natural drainage behaviour of pools, minimal iron staining, and minimal gas releases).</li> </ul>		
Eastern Tributary between the full supply level of the Woronora Reservoir and the maingate of Longwall 26	<ul style="list-style-type: none"> <li>Negligible environmental consequences over at least 70% of the stream length (that is no diversion of flows, no change in the natural drainage behaviour of pools, minimal iron staining and minimal gas releases).</li> </ul>		

**Table 11**  
**Water Resources and Watercourses Performance Measures and Performance Indicators**

Performance Measure	Performance Indicator(s)
Negligible reduction to the quantity of water resources reaching the Woronora Reservoir	<ul style="list-style-type: none"> <li>Changes in the quantity of water entering Woronora Reservoir are not significantly different post-mining compared to pre-mining, that are not also occurring in the control catchment(s).</li> </ul>
Negligible reduction to the quality of water resources reaching the Woronora Reservoir	<ul style="list-style-type: none"> <li>Changes in the quality of water entering Woronora Reservoir are not significantly different post-mining compared to pre-mining concentrations that are not also occurring at control site WOWQ2.</li> </ul>
No connective cracking between the surface and the mine	<ul style="list-style-type: none"> <li>Visual inspection does not identify abnormal water flow from the goaf, geological structure, or the strata generally.</li> <li>The 20-day average mine water make does not exceed 2 ML/day.</li> <li>Significant departure from the predicted envelopes of vertical potentiometric head profiles at Bores 9GGW2B and F6GW3A do not occur.</li> <li>The water tables measured at Bores F6GW4A and PHGW2A are higher than the full supply level of the Woronora Reservoir (i.e. a hydraulic gradient exists from each bore to the reservoir).</li> </ul>
Negligible leakage from the Woronora Reservoir	<ul style="list-style-type: none"> <li>The water tables measured at Bores PM02, 9GGW2B, PHGW2A, 9EGW2A and F6GW4A are higher than the full supply level of Woronora Reservoir (i.e. a hydraulic gradient exists from the bores to the Woronora Reservoir).</li> </ul>

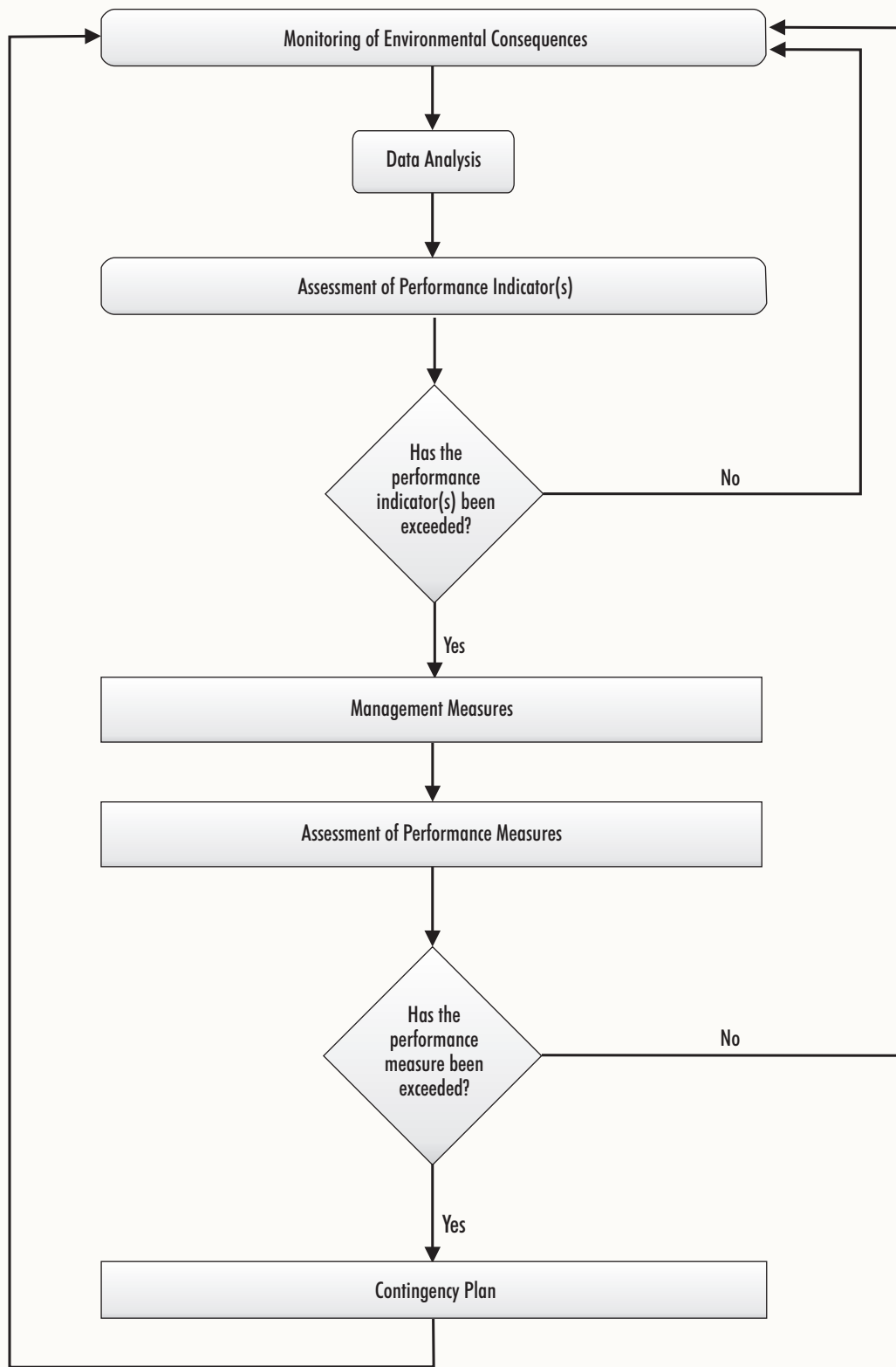
**Table 11 (Continued)**  
**Water Resources and Watercourses Performance Measures and Performance Indicators**

Performance Measure	Performance Indicator(s)
Negligible reduction in the water quality of Woronora Reservoir	<ul style="list-style-type: none"> <li>Changes in the quality of water in the Woronora Reservoir are not significantly different post-mining compared to pre-mining concentrations.</li> </ul>
Negligible environmental consequences (that is, no diversion of flows, no change in the natural drainage behaviour of pools, minimal iron staining, and minimal gas releases) on the Waratah Rivulet between the full supply level of the Woronora Reservoir and the maingate of Longwall 23 (upstream of Pool P)	<ul style="list-style-type: none"> <li>No change to the natural drainage behaviour of Pools P, Q, R, S, T, U, V and W. Specific indicators include: no new cracking within the stream bed or rock bars; continual flow over/through/below the rock bars/terminal boulder fields of pools such that water is ponded upstream; and continual surface water flow along the length of pools.</li> <li>Analysis of water level data for Pools P, T, U, V and W indicates the water level is at or above the pool's previous minimum.</li> <li>Analysis of water level data for Pools Q, R and S indicates the water levels are above that required to maintain water over the downstream rock bar.</li> <li>Visual inspection of the Waratah Rivulet from Pool P to the full supply level of the Woronora Reservoir does not show significant changes in the extent or nature of iron staining that isn't also occurring in the Woronora River (control site).</li> <li>Visual observations of gas releases in Waratah Rivulet from Pool P to the full supply level of the Woronora Reservoir indicate the gas releases have not increased beyond those observed up to the commencement of Longwall 301 extraction.</li> </ul>
Negligible environmental consequences over at least 70% of the stream length (that is no diversion of flows, no change in the natural drainage behaviour of pools, minimal iron staining and minimal gas releases) of the Eastern Tributary between the full supply level of the Woronora Reservoir and the maingate of Longwall 26	<ul style="list-style-type: none"> <li>No change to the natural drainage behaviour of at least 70% of the relevant stream length. Specific indicators include: no new cracking within the stream bed or rock bars; continual flow over/through/below the rock bars/terminal boulder fields of pools such that water is ponded upstream; and continual surface water flow along the length of pools.</li> <li>Analysis of water level data for Pools ETAI, ETAQ and ETAU indicates the water levels are above that required to maintain water over the downstream rock bar.</li> <li>Analysis of water level data for Pools ETAG and ETAH indicates the water level is at or above the pool's previous minimum.</li> <li>Visual inspection of the Eastern Tributary between the full supply level of the Woronora Reservoir and the maingate of Longwall 26 does not show significant changes in the extent or nature of iron staining over more than 30% of the stream length that isn't also occurring in the Woronora River (control site).</li> <li>Visual observations do not identify gas releases in more than 30% of the Eastern Tributary between the full supply level of the Woronora Reservoir and the maingate of Longwall 26.</li> </ul>

The procedure that will be followed to assess the extraction of Longwalls 301-303 against the performance indicators and performance measures is outlined in Figure 13 and described in detail in the WMP (Appendix A).

As described in Section 2.2, during the preparation of the WMP all of the subsidence impact performance measures had been met. However, subsequent to the finalisation of the WMP, monitoring conducted in accordance with the Metropolitan Coal Longwalls 23-27 Water Management Plan identified that the following subsidence impact performance measure for the Eastern Tributary between the full supply level of the Woronora Reservoir and the maingate of Longwall 26 had been exceeded in relation to iron staining (emphasis added):

*Negligible environmental consequences over at least 70% of the stream length (that is no diversion of flows, no change in the natural drainage behaviour of pools, **minimal iron staining** and minimal gas releases)*



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METROPOLITAN COAL

Monitoring of Environmental  
Consequences against Performance  
Indicators and Measures

Figure 13

The Secretary of the DP&E and other relevant agencies were notified of the exceedance as soon as practicable after Metropolitan Coal became aware of the exceedance in accordance with Condition 6, Schedule 7 of the Project Approval and in accordance with the Metropolitan Coal Longwalls 23-27 Water Management Plan Contingency Plan. Metropolitan Coal has also provided the Secretary of the DP&E and other relevant agencies with a detailed report on the incident in accordance with Condition 6, Schedule 7 of the Project Approval.

In accordance with the Contingency Plan, Metropolitan Coal will identify an appropriate course of action with respect to the identified impact(s), in consultation with specialists and relevant agencies. Contingency measures will be developed in consideration of the specific circumstances of the exceedance and the assessment of environmental consequences.

### 3.1.4 Contingency Plan

In the event that a water resource or watercourse subsidence impact performance measure is exceeded, Metropolitan Coal will implement a Contingency Plan as described in the WMP and summarised in Section 4.1. Potential contingency measures for an exceedance of the water resource or watercourse performance measures include:

- The conduct of additional monitoring (e.g. increase in monitoring frequency or additional sampling) to inform the proposed contingency measures.
- The implementation of stream remediation measures to reduce the extent of fracturing.
- The implementation of revegetation measures to remediate impacts of gas releases on riparian vegetation.
- The purchase of water from Sydney Water in accordance with a license agreement established to the satisfaction of WaterNSW and the DP&E.
- The provision of a suitable offset(s) to compensate for the reduction in the quantity of water resources reaching the Woronora Reservoir. Examples of potential offsets include improvement works in the Woronora Reservoir water supply catchment.
- The implementation of adaptive management measures. Examples of adaptive management measures include reducing the thickness of the coal seam extracted, narrowing of the longwall panels and/or increasing the setback of the longwalls from the affected area.

As indicated in Section 3.1.3 above, Metropolitan Coal is currently developing contingency measures in relation to the exceedance of the iron staining component of the subsidence impact performance measure for the Eastern Tributary.

## 3.2 LAND MANAGEMENT

### 3.2.1 Overview

The Longwalls 301-303 LMP is provided in Appendix B. The purpose and scope of the LMP are summarised below:

**Purpose:** To manage the potential environmental consequences of the Extraction Plan on cliffs and overhangs, steep slopes and land in general.

**Scope:** Cliffs and overhangs, steep slopes and land in general during the mining of Longwalls 301-303.

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### 3.2.2 Key Land Issues, Monitoring and Management Measures

Cliffs are defined as a continuous rock face, including overhangs, having a minimum height of 10 m and a slope of greater than 66°. Overhangs associated with cliffs and/or considered sensitive to potential mine subsidence movements (due to their location relative to the Waratah Rivulet) were also identified within the Project underground mining area (Figure 8). The nearest cliffs are located approximately 800 m to the west of Longwalls 301-303 (Figure 8). At this distance, it is unlikely that the cliffs would experience adverse impacts resulting from the extraction of Longwalls 301-303 (Appendix I).

In the Project Approval steep slopes are defined as an area of land having a natural gradient of between 33° and 66° (Figure 8). Steep slopes have been identified to highlight areas where existing ground slopes may be marginally stable. However, no significant slope failures have been observed in the Southern Coalfield as a result of longwall mining.

Land in general refers to the general landscape other than cliffs and steep slopes. There are rock ledges, also called rock outcrops and minor cliffs, which occur within 600 m of Longwalls 301-303 (Appendix I). Land in general includes other land features such as fire trails and vehicular tracks (Figure 8), however excludes surface features such as streams and upland swamps which are addressed in the WMP and BMP, respectively.

The key issues relating to subsidence impacts on land are described in the LMP and the relevant monitoring and management measures are summarised in Table 12 and Section 3.7.

**Table 12**  
**Management Issues for Land During the Extraction of Longwalls 301-303**

Issue	Approved Impact	Monitoring	Management
Cliffs and overhangs	<ul style="list-style-type: none"> <li>Less than 3% of the total length of cliffs (and associated overhangs) within the mining area experience mining-induced rock fall.</li> </ul>	Monitoring in accordance with the LMP, including visual observations of: <ul style="list-style-type: none"> <li>Cliff instabilities or cracking.</li> <li>Sandstone fracturing.</li> <li>Rock falls.</li> </ul>	<ul style="list-style-type: none"> <li>Stabilisation techniques including:               <ul style="list-style-type: none"> <li>Installation of artificial rock support.</li> <li>Installation of standing supports.</li> </ul> </li> <li>Improvement of appearance including:               <ul style="list-style-type: none"> <li>Application of product to enhance the weathered appearance of a cliff face.</li> <li>Planting of endemic native vegetation.</li> </ul> </li> <li>Implementation of erosion and sediment controls.</li> <li>Permanent filling of surface tension cracks.</li> <li>Measures to address safety hazards.</li> </ul>
Steep slopes and land in general	<ul style="list-style-type: none"> <li>Sandstone fracturing (including surface tension cracking) and subsequent rock falls consistent with that observed during the extraction of previous longwalls at Metropolitan Coal.</li> </ul>	Subsidence monitoring in accordance with the SMP.	

### 3.2.3 Assessment of Performance Indicators and Measures

The Project Approval requires Metropolitan Coal not to exceed the subsidence impact performance measure relating to land, as specified in Table 1 of Condition 1, Schedule 3:

*Less than 3% of the total length of cliffs (and associated overhangs) within the mining area experience mining-induced rock fall.*

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Metropolitan Coal will assess steep slopes and land in general against the following performance indicator:

*Steep slopes and land in general are expected to experience sandstone fracturing and subsequent rock falls consistent with that observed during the extraction of previous longwalls at Metropolitan Coal.*

Monitoring against the performance indicator and performance measure during the mining of Longwalls 301-303 is summarised in Table 12 and Section 3.7 and described in detail in Appendix B.

The procedure that will be followed to assess the extraction of Longwalls 301-303 against the performance indicator and performance measure is outlined in Figure 13 and described in detail in the LMP (Appendix B).

### 3.2.4 Contingency Plan

In the event that subsidence impacts observed exceed the land subsidence impact performance measure, Metropolitan Coal will implement a Contingency Plan as described in the LMP and summarised in Section 4.1.

## 3.3 BIODIVERSITY MANAGEMENT

### 3.3.1 Overview

The Longwalls 301-303 BMP is provided in Appendix C. The purpose and scope of the BMP are summarised below:

**Purpose:** To manage the potential environmental consequences of the Extraction Plan on aquatic and terrestrial flora and fauna, with a specific focus on swamps.

**Scope:** Aquatic and terrestrial flora and fauna (including swamps) during the mining of Longwalls 301-303.

### 3.3.2 Key Biodiversity Issues, Monitoring and Management Measures

Fourteen upland swamps are located within the 35° angle of draw and/or predicted 20 mm subsidence contour, including six located directly above Longwalls 301-303 (Figure 8). All of the upland swamps are valley side swamps.

Riparian vegetation and habitats for aquatic biota occur along streams which flow to the Woronora Reservoir (including the Eastern Tributary), and some of their tributaries (Figure 9). No threatened aquatic biota listed under the *Fisheries Management Act, 1994*, *NSW Threatened Species Conservation Act, 1995* (TSC Act) or Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) has been recorded within the Project underground mining area or in the Woronora Reservoir.

Vegetation communities mapped on slopes and ridgetops within 600 m of Longwalls 301-303 secondary extraction include woodlands on sandstone or lateritic soils, heaths and mallee heaths, tall open forests, sandstone forests and disturbed land (Figure 9).

The cliffs and overhangs, steep slopes, and land in general described in Section 3.2 also provide habitat for terrestrial flora and fauna.

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A number of threatened terrestrial flora and fauna species listed under the TSC Act or EPBC Act are known to occur, or have the potential to occur within the Project underground mining area or surrounds. No endangered flora or fauna populations occur within the Project underground mining area or surrounds.

Endangered Ecological Communities (EECs) listed under the TSC Act at the time of Project Approval and identified as occurring in the Project underground mining area or surrounds includes the Southern Sydney Sheltered Forest on Transitional Sandstone Soils in the Sydney Basin Bioregion EEC and the O'Hares Creek Shale Forest EEC. An occurrence of the Southern Sydney Sheltered Forest on Transitional Sandstone Soils in the Sydney Basin Bioregion EEC is situated approximately 280 m to the north of Longwall 301 (Figure 9).

The key issues relating to subsidence impacts on biodiversity are described in the BMP and the relevant monitoring and management measures are summarised in Table 13 and Section 3.7.

Other subsidence impact performance measures and indicators of relevance to biodiversity include the water resource and watercourse performance measures detailed in the WMP and the land subsidence impact performance measure detailed in the LMP.

### **3.3.3 Assessment of Performance Indicators and Measure**

Performance indicators developed for the subsidence impact performance measure relating to biodiversity are presented in the BMP and are summarised in Table 14. Monitoring against these performance indicators during the mining of Longwalls 301-303 is summarised in Table 13 and Section 3.7 and described in detail in the BMP (Appendix C).

The procedure that will be followed to assess the extraction of Longwalls 301-303 against the performance indicators and performance measures is outlined in Figure 13 and described in detail in the BMP.

### **3.3.4 Contingency Plan**

In the event the subsidence impact performance measure for threatened species, populations or ecological communities is considered to have been exceeded, Metropolitan Coal will implement a Contingency Plan as described in the BMP and summarised in Section 4.1.

**Table 13**  
**Management Issues for Biodiversity During the Extraction of Longwalls 301-303**

Issue	Approved Impact	Monitoring	Management
Threatened species, populations, or ecological communities	Negligible impact	<p><b><i>Upland Swamps</i></b></p> <ul style="list-style-type: none"> <li>• Vegetation monitoring.               <ul style="list-style-type: none"> <li>- Visual inspections.</li> <li>- Transect/Quadrat monitoring.</li> <li>- Indicator species.</li> </ul> </li> <li>• Groundwater monitoring.</li> </ul>	<ul style="list-style-type: none"> <li>• Swamp remediation techniques.</li> <li>• Additional monitoring (e.g. increase in monitoring frequency or additional sampling).</li> </ul>
		<p><b><i>Riparian Vegetation</i></b></p> <ul style="list-style-type: none"> <li>• Vegetation monitoring.               <ul style="list-style-type: none"> <li>- Visual inspections.</li> <li>- Quadrat monitoring.</li> <li>- Indicator species.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Stream remediation.</li> <li>• Weed control measures.</li> <li>• Planting of endemic species.</li> <li>• Stream bank erosion control measures in accordance with the WMP.</li> <li>• Management measures for impacts associated with cliffs and overhang sites include:               <ul style="list-style-type: none"> <li>– the implementation of erosion and sediment control measures; and</li> <li>– stabilisation techniques; in accordance with the LMP.</li> </ul> </li> <li>• Additional monitoring (e.g. increase in monitoring frequency or additional sampling).</li> </ul>
		<p><b><i>Slopes and Ridgetops</i></b></p> <ul style="list-style-type: none"> <li>• Visual inspections of cliffs and overhangs, steep slopes and land in general.</li> <li>• Monitoring of subsidence parameters at Southern Sydney Sheltered Forest on Transitional Sandstone Soils in the Sydney Basin Bioregion EEC.</li> </ul>	<ul style="list-style-type: none"> <li>• Management measures for impacts associated with cliffs and overhang sites include:               <ul style="list-style-type: none"> <li>– the implementation of erosion and sediment control measures; and</li> <li>– stabilisation techniques; in accordance with the LMP.</li> </ul> </li> <li>• Filling of surface tension cracks in accordance with the LMP.</li> <li>• Additional monitoring (e.g. increase in monitoring frequency, monitoring of subsidence impacts in EEC).</li> </ul>
		<p><b><i>Aquatic Biota and their Habitats</i></b></p> <ul style="list-style-type: none"> <li>• Watercourses (i.e. aquatic habitats) in accordance with WMP.</li> <li>• Aquatic biota stream monitoring.</li> <li>• Aquatic biota pool monitoring.</li> </ul>	<ul style="list-style-type: none"> <li>• Stream remediation.</li> <li>• Additional monitoring (e.g. increase in monitoring frequency or additional sampling).</li> <li>• Adaptive management.</li> </ul>

**Table 13 (Continued)**  
**Management Issues for Biodiversity During the Extraction of Longwalls 301-303**

Issue	Approved Impact	Monitoring	Management
Threatened species, populations, or ecological communities (Cont.)	Negligible impact (Cont.)	<p><b>Terrestrial Fauna and their Habitats</b></p> <ul style="list-style-type: none"> <li>Terrestrial fauna habitats, as discussed for upland swamps, riparian vegetation, slopes and ridgetops and aquatic habitats above.</li> <li>Amphibian monitoring.</li> </ul>	<ul style="list-style-type: none"> <li>Swamp remediation techniques.</li> <li>Stream remediation.</li> <li>Weed control measures.</li> <li>Planting of endemic species.</li> <li>Stream bank erosion control measures in accordance with the WMP.</li> <li>Management measures for impacts associated with cliffs and overhang sites include: <ul style="list-style-type: none"> <li>the implementation of erosion and sediment control measures; and</li> <li>stabilisation techniques; in accordance with the LMP.</li> </ul> </li> <li>Filling of surface tension cracks in accordance with the LMP.</li> <li>Additional monitoring (e.g. increase in monitoring frequency or additional sampling).</li> <li>Adaptive management.</li> </ul>

**Table 14**  
**Biodiversity Performance Measure and Performance Indicators**

Performance Measure	Performance Indicators
Negligible impact to threatened species, populations, or ecological communities.	<p><b>Upland Swamps</b></p> <ul style="list-style-type: none"> <li>The vegetation in upland swamps is not expected to experience changes significantly different to vegetation in control swamps.</li> <li>Surface cracking within upland swamps resulting from mine subsidence is not expected to result in measurable changes to swamp groundwater levels when compared to control swamps or seasonal variations in water levels experienced by upland swamps prior to mining.</li> </ul> <p><b>Riparian Vegetation</b></p> <ul style="list-style-type: none"> <li>Impacts to riparian vegetation are expected to be localised and limited in extent, similar to the impacts previously experienced at Metropolitan Coal.</li> </ul> <p><b>EECs</b></p> <ul style="list-style-type: none"> <li>Subsidence movements are not expected to adversely affect the occurrence of the Southern Sydney Sheltered Forest on Transitional Sandstone Soils in the Sydney Basin Bioregion EEC situated to the north of Longwall 301.</li> </ul> <p><b>Aquatic Biota</b></p> <ul style="list-style-type: none"> <li>The aquatic macroinvertebrate and macrophyte assemblages in streams and pools are not expected to experience long-term impacts as a result of mine subsidence.</li> </ul> <p><b>Terrestrial Fauna</b></p> <ul style="list-style-type: none"> <li>The amphibian assemblage is not expected to experience changes significantly different to the amphibian assemblage at control sites.</li> </ul>

### 3.4 HERITAGE MANAGEMENT

#### 3.4.1 Overview

The Longwalls 301-303 HMP is provided in Appendix D. The purpose and scope of the HMP are summarised below:

**Purpose:** To manage the potential environmental consequences of the Extraction Plan on Aboriginal heritage sites or values.

**Scope:** Aboriginal heritage sites or values that could experience subsidence effects during the mining of Longwalls 301-303.

#### 3.4.2 Key Aboriginal Heritage Issues, Monitoring and Management Measures

No known Aboriginal heritage sites occur directly above Longwalls 301-303 (Figure 10). One open site with grinding grooves (FRC 307) is located within the Longwalls 301-303 35° angle of draw and/or predicted 20 mm subsidence contour and approximately 250 m from the nearest longwall. Fourteen known sandstone overhang sites are located within the Longwalls 301-303 35° angle of draw and/or predicted 20 mm subsidence contour (Figure 10). Of the 14 sites with overhangs, six have art only and eight have art and/or artefacts and/or Potential Archaeological Deposit (PAD).

No Aboriginal heritage sites of high archaeological significance are located within the 35° angle of draw and/or predicted 20 mm subsidence contour of Longwalls 301-303. No sites or areas of particular cultural significance have been identified within the area bound by the Longwalls 301-303 35° angle of draw and/or predicted 20 mm subsidence contour. Notwithstanding, Metropolitan Coal acknowledges that all Aboriginal heritage sites are of cultural significance to the Aboriginal people who have a traditional connection to Country.

The key issues relating to subsidence impacts on Aboriginal heritage sites and values are described in the HMP and the relevant monitoring and management measures are summarised in Table 15 and Section 3.7.

**Table 15**  
**Management Issues for Aboriginal Heritage During the Extraction of Longwalls 301-303**

Issue	Approved Impact	Monitoring	Management
Aboriginal heritage sites	Less than 10% of Aboriginal heritage sites within the mining area are affected by subsidence impacts.	<ul style="list-style-type: none"> <li>Aboriginal heritage sites.</li> </ul>	<ul style="list-style-type: none"> <li>Installation of an artificial dripline (e.g. silicone dripline) to direct increased moisture/water seepage away from art panels.</li> <li>Installation of artificial rock support (e.g. rock bolts, cable bolts, cement sprays [e.g. shotcrete], injections of a binding agent [PUR or similar]).</li> <li>Installation of standing supports (e.g. timber props, timber cogs, sandbags and metal [hydraulic] props).</li> <li>Scaling/dislodgement/removal of remaining loose rock.</li> <li>Salvage of artefacts for safekeeping and storage and/or display at a suitable location in consultation with the Aboriginal community.</li> <li>Use of cosmetic treatments (e.g. in the form of coloured grout or similar) to restore aesthetic values.</li> <li>Installation of a stress relief slot or stress focus notch.</li> </ul>

### 3.4.3 Assessment of Performance Indicators and Measure

The Project Approval requires Metropolitan Coal not to exceed the subsidence impact performance measure relating to Aboriginal heritage sites, as specified in Table 1 of Condition 1, Schedule 3:

*Less than 10% of Aboriginal Heritage sites within the mining area are affected by subsidence impacts.*

The performance indicator developed for the subsidence impact performance measure relating to Aboriginal heritage sites is presented in the HMP and is summarised in Table 16. Monitoring against the performance indicator during the mining of Longwalls 301-303 is summarised in Table 15 and Section 3.7 and described in detail in the HMP (Appendix D).

**Table 16**  
**Heritage Performance Measure and Performance Indicator**

Performance Measure	Performance Indicator
Less than 10% of Aboriginal heritage sites within the mining area are affected by subsidence impacts.	<p>Sites are considered to be “affected by subsidence impacts” if they exhibit one or more the following consequences that cannot be attributed to natural weathering or deterioration:</p> <ul style="list-style-type: none"> <li>• overhang collapse;</li> <li>• cracking of sandstone that coincides with Aboriginal art or grinding grooves; and</li> <li>• rock fall that damages Aboriginal art.</li> </ul>

The procedure that will be followed to assess the extraction of Longwalls 301-303 against the performance indicator and performance measure is outlined in Figure 13 and described in detail in the HMP (Appendix D).

### 3.4.4 Contingency Plan

In the event the Aboriginal heritage sites subsidence impact performance measure has been exceeded, Metropolitan Coal will implement a Contingency Plan as described in the HMP and summarised in Section 4.1.

## 3.5 BUILT FEATURES MANAGEMENT

### 3.5.1 Overview

The Longwalls 301-303 BFMP is provided in Appendix E and includes component plans for the individual infrastructure owners. The purpose and scope of the BFMP are summarised below:

**Purpose:** To manage the potential environmental consequences of the Extraction Plan on built features.

**Scope:** Built features that could experience subsidence effects during the mining of Longwalls 301-303.

### 3.5.2 Key Built Features Issues, Monitoring and Management Measures

Built features within the vicinity of Longwalls 301-303 consist of (Figures 11a, 11b and 12):

- telecommunication towers and compounds (Telstra, Axicom and Sydney Trains);
- telecommunication (e.g. optical fibre, copper) cabling (Telstra, Nextgen, Optus, Garrawarra Centre Complex);
- underground water mains (Sydney Water);
- Waterfall General (Garrawarra) Cemetery;
- public roads (M1 Princes Motorway [RMS] and Old Princes Highway [WCC]) and associated infrastructure (e.g. culverts, cuttings, roadside furniture);
- private roads (Garrawarra Centre Complex);
- bridges (RMS);
- Illawarra Railway (Sydney Trains);
- local power distribution and wooden poles (Endeavour Energy, Garrawarra Centre Complex);
- electricity transmission lines and transmission structures (330 kilovolt [kV] [TransGrid] and 132 kV [Endeavour Energy]);
- access roads/tracks (including fire trails and vehicular tracks);
- water storage tanks (Garrawarra Centre Complex);
- gas storage tank and connecting pipelines (Garrawarra Centre Complex);
- aged care (occupied) buildings (Garrawarra Centre Complex);
- abandoned buildings (Garrawarra Centre Complex); and
- houses and associated infrastructure (Garrawarra Centre Complex).

The access roads/tracks (including fire trails and vehicular tracks) will be managed in accordance with the LMP and the BFMP component plans.

Appendix I of the Extraction Plan (Subsidence Report) also assesses potential subsidence effects, impacts and environmental consequences of other built features not subject to the component plans including survey marks, exploration boreholes and the Woronora Dam.

The key issues relating to management of built features in regard to subsidence impacts are described in the relevant component plans of the BFMP (Appendix E). The relevant monitoring and management measures for these built features are summarised in Table 17 and Section 3.7.

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**Table 17**  
**Built Features Performance Indicators, Monitoring and Management Measures**

Built Features	Performance Indicator(s)	Monitoring	Relevant Management Measures
<p>Garrawarra Centre Complex (NSW Health) abandoned hospital buildings, aged care building structures and houses and associated infrastructure, water storage tanks, trickle filter tank, gas storage tank, kiln and telecommunications towers and associated compounds</p>	<ul style="list-style-type: none"> <li>• No greater tilt impacts to buildings than Category A or B for items of historical or heritage significance.</li> <li>• No greater strain impact to buildings than Category 0 or 1 for items of historical or heritage significance.</li> <li>• No more than repairable (minor) defects (cracks, etc.) in the structural integrity for all other buildings, houses, structures and other services due to mining.</li> <li>• The electrical clearance from vegetation is maintained.</li> <li>• Serviceability of the private roads and access roads/tracks has been maintained.</li> <li>• The land in general is expected to experience minor cracking consistent with that observed during the extraction of previous longwalls at Metropolitan Coal (i.e. no more than minor cracking).</li> </ul>	<ul style="list-style-type: none"> <li>• Subsidence, tilt, tensile strain and compressive strain.</li> <li>• Structural integrity.</li> <li>• Cracking at pre-existing rock joints.</li> <li>• Tilt at pre-existing tilted piers.</li> <li>• Opening and closing of joints.</li> <li>• Leaks.</li> <li>• Cracking in columns, elevated ring beam or central access shaft.</li> <li>• Structural integrity of the kiln chimney.</li> <li>• Structural integrity of the telecommunications tower and compound.</li> <li>• Degradation of structure.</li> <li>• Movement of conductors.</li> <li>• Vegetation, land and road clearance.</li> <li>• Integrity and function of support clamps or other items.</li> <li>• Cracks or leaks in the pipelines.</li> <li>• Fittings can be accessed beneath surface fittings and are operable.</li> <li>• Surface cracks, buckling and general safety.</li> </ul>	<p>A number of potential management measures in relation to the Garrawarra Centre Complex are considered to be applicable. These include:</p> <ul style="list-style-type: none"> <li>• For buildings or houses requiring repairs, normal building maintenance techniques could be applied in consultation with NSW Health and relevant authorities.</li> <li>• For the water storage tanks, if the tank base or lower sections of the tank walls were to develop leakage or if pre-existing leakage were to increase, the tank could be temporarily drained and lined with high-density polyethylene (HDPE) to establish a watertight envelope. For water pipelines, leaks could be remediated by locally exposing the pipeline and repairing or replacing the affected section.</li> <li>• For powerlines and poles, management measures may include alteration of conductor tensions or strengthening of timber poles footings.</li> <li>• For the kiln, a barrier fence will be erected to maintain an exclusion zone with a radius of 1.5 times the chimney height during active mining (i.e. which may result in impact on the kiln).</li> </ul> <p>Management measures for access roads/tracks will be implemented in accordance with the LMP.</p> <p>Management measures for other services at the Garrawarra Centre Complex have also been developed separately with each asset owner in the BFMPs (e.g. Endeavour Energy, Sydney Water, Telstra, Axicom and Sydney Trains).</p> <p>Follow-up inspections will be conducted to assess the effectiveness of the management measures implemented and the requirement for any additional management measures.</p>



**Table 17 (Continued)**  
**Built Features Performance Indicators, Monitoring and Management Measures**

Built Features	Performance Indicator(s)	Monitoring	Relevant Management Measures
<p>Endeavour Energy 132 kV transmission line and towers and other high voltage powerlines and poles</p>	<ul style="list-style-type: none"> <li>• The structural integrity of the 132 kV transmission lines and towers is maintained.</li> <li>• The structural integrity of the timber poles and high voltage powerlines is maintained.</li> <li>• The electrical clearance from vegetation is maintained.</li> <li>• The serviceability of the access roads/tracks is maintained.</li> </ul>	<ul style="list-style-type: none"> <li>• Subsidence, tilt, tensile strain, compressive strain, absolute horizontal translation, and differential leg movement.</li> <li>• Degradation of tower structure.</li> <li>• Degradation of tower foundations/footings.</li> <li>• Vegetation, land and road clearance.</li> <li>• Integrity and function of support clamps or other items.</li> <li>• Movement of insulator strings/conductors.</li> <li>• Surface cracks, buckling, and general safety.</li> </ul>	<p>A number of potential management measures in relation to 132 kV towers and transmission lines are considered to be applicable. These include:</p> <ul style="list-style-type: none"> <li>• alteration of conductor tensions;</li> <li>• modification to attachment points such as placement of stringing sheaves to earth wires and/or phase conductors;</li> <li>• strengthening of tower structures through installation of cruciform elements; and</li> <li>• strengthening of timber poles' footings.</li> </ul> <p>Management measures for access roads/tracks will be implemented in accordance with the LMP.</p> <p>Follow-up inspections will be conducted to assess the effectiveness of the management measures implemented and the requirement for any additional management measures.</p>
<p>TransGrid 330 kV transmission line and towers</p>	<ul style="list-style-type: none"> <li>• The structural integrity of the transmission line and towers is maintained.</li> <li>• The electrical clearance from vegetation is maintained.</li> <li>• The serviceability of access roads/tracks is maintained.</li> </ul>	<ul style="list-style-type: none"> <li>• Subsidence, tilt, tensile strain, compressive strain, absolute horizontal translation and differential leg movement.</li> <li>• Surface cracks, buckling and general safety.</li> <li>• Real-time survey monitoring trial.</li> <li>• Degradation of tower structure.</li> <li>• Degradation of tower foundations/footings.</li> <li>• Movement of insulator strings.</li> <li>• Vegetation, land and road clearance.</li> <li>• Integrity and function of support clamps or other items.</li> <li>• Visual check by TransGrid of earthwire/optical ground wire and conductor movement.</li> <li>• Calculation of differential leg movement (TransGrid to be notified if total differential movement exceeds 4 mm).</li> </ul>	<p>A number of potential management measures considered to be applicable to transmission lines, include:</p> <ul style="list-style-type: none"> <li>• alteration of conductor tensions;</li> <li>• modification to attachment points such as placement of stringing sheaves to earth wires and/or phase conductors; and</li> <li>• strengthening of tower structures through installation of cruciform footings.</li> </ul> <p>Management measures for access roads/tracks will be implemented in accordance with the LMP.</p> <p>Follow-up inspections will be conducted to assess the effectiveness of the management measures implemented and the requirement for any additional management measures.</p>

**Table 17 (Continued)**  
**Built Features Performance Indicators, Monitoring and Management Measures**

Built Features	Performance Indicator(s)	Monitoring	Relevant Management Measures
Nextgen optical fibre cable	<ul style="list-style-type: none"> <li>Negligible transmission loss in fibre optic cables from mine subsidence impacts.</li> <li>Structural integrity of the cable line and associated joint housing pit is maintained.</li> <li>Serviceability of the access roads/tracks is maintained.</li> </ul>	<ul style="list-style-type: none"> <li>Subsidence, tilt, tensile strain and compressive strain.</li> <li>Signal integrity.</li> <li>Movement of conduit, degree of freedom of cable in conduit, ground compression/tension.</li> <li>Surface cracks, buckling and general safety.</li> </ul>	<p>A number of potential management measures in relation to fibre optic cables are considered to be applicable. These are described in the Nextgen Management Plan Agreement (Appendix E).</p> <p>Follow-up inspections will be conducted to assess the effectiveness of the management measures implemented and the requirement for any additional management measures.</p>
Optus optical fibre cables	<ul style="list-style-type: none"> <li>Negligible transmission loss from mine subsidence impacts.</li> <li>The structural integrity of the cable lines and associated facilities is maintained.</li> <li>The serviceability of the access roads/tracks is maintained.</li> </ul>	<ul style="list-style-type: none"> <li>Subsidence, tilt, tensile strain and compressive strain.</li> <li>Signal integrity.</li> <li>Movement of conduit, degree of freedom of cable in conduit, ground compression/tension.</li> <li>Surface cracks, buckling and general safety.</li> </ul>	<p>A number of potential management measures in relation to cable lines are considered to be applicable (e.g. stabilisation).</p> <p>Follow-up inspections will be conducted to assess the effectiveness of the management measures implemented and the requirement for any additional management measures.</p>
Telstra telecommunications tower and compound, optical fibre cables, associated infrastructure and copper telecommunication cables	<ul style="list-style-type: none"> <li>Negligible transmission loss in fibre optic cables from mine subsidence impacts.</li> <li>Structural integrity of the cable line and associated facilities is maintained.</li> <li>Structural integrity of the telecommunications tower and compound is maintained.</li> <li>Serviceability of the access roads is maintained.</li> </ul>	<ul style="list-style-type: none"> <li>Subsidence, tilt, tensile strain and compressive strain.</li> <li>Signal integrity.</li> <li>Structural integrity of the telecommunications tower and compound.</li> <li>Surface cracks, buckling and general safety.</li> </ul>	<p>A number of potential management measures in relation to cable lines are considered to be applicable. These are described in the Telstra Management Plan Agreement (Appendix E).</p> <p>Follow-up inspections will be conducted to assess the effectiveness of the management measures implemented and the requirement for any additional management measures.</p>

**Table 17 (Continued)**  
**Built Features Performance Indicators, Monitoring and Management Measures**

Built Features	Performance Indicator(s)	Monitoring	Relevant Management Measures
RMS M1 Princes Motorway, Bridge 2 and Cawley Road Overbridge	<ul style="list-style-type: none"> <li>• Measured absolute horizontal movements.</li> <li>• Distortion of bridge elements.</li> <li>• Cracking of bridge elements.</li> <li>• Pavement cracking and deformation.</li> <li>• Visual consequence of slope movement.</li> <li>• Defects in culverts.</li> </ul>	<ul style="list-style-type: none"> <li>• Subsidence, tilt, tensile strain and compressive strain.</li> <li>• Horizontal movement.</li> </ul> <p><i>Bridge 2</i></p> <ul style="list-style-type: none"> <li>• Real-time survey monitoring trial.</li> <li>• Monitoring of movements including: Absolute three dimensional (3D) movement of the survey reference pillar, relative 3D movements of all bridge monitoring points, changes in length of Fibre Bragg Grating (FBG) sensors and tilts of FBG tiltmeters.</li> <li>• Visual inspection for impacts on: abutments, pier frames, elastomeric bearings, soffits of girders, deck expansion joints, steel traffic barrier joints and other areas of substructure and adjoining areas including concrete paths, stairs, and slope protection.</li> </ul> <p><i>Cawley Road Overbridge</i></p> <ul style="list-style-type: none"> <li>• Monitoring of movements including: absolute 3D movement of the survey reference pillar and relative 3D movements of all bridge monitoring points.</li> <li>• Visual inspection for impacts on: abutments, pier blade wall, Tetron bearings, deck expansion joints, steel traffic barrier joints and safety screen joints.</li> </ul>	<p>A number of general management measures in relation to RMS assets are applicable. These include:</p> <ul style="list-style-type: none"> <li>• review of scope and frequency of monitoring;</li> <li>• site inspections;</li> <li>• review by relevant specialists;</li> <li>• initiate traffic management procedures;</li> <li>• review of potential factors contributing to the exceedance of the performance trigger including review of subsidence measurements and predictions; and</li> <li>• review of effectiveness of management measures.</li> </ul> <p>A number of potential management measures in relation to M1 Princes Motorway, bridges, cuttings and culverts are detailed in Appendix E.</p>

**Table 17 (Continued)**  
**Built Features Performance Indicators, Monitoring and Management Measures**

Built Features	Performance Indicator(s)	Monitoring	Relevant Management Measures
RMS M1 Princes Motorway, Bridge 2 and Cawley Road Overbridge (Cont.)	As above.	<p><i>Other Relevant Infrastructure</i></p> <ul style="list-style-type: none"> <li>• Monitoring of movements including absolute 3D movement of the survey reference pillar, and relative 3D movements of Towers TL11-103 to TL11-108, including: <ul style="list-style-type: none"> <li>- subsidence line along the transmission line corridor within 600 m of Longwalls 301-303 extraction;</li> <li>- tower legs;</li> <li>- four ground points at each tower; and</li> <li>- top of tower at fixed point.</li> </ul> </li> <li>• Visual inspection for impacts on: asphaltic concrete surface, kerbs, gutters and pits, signs or other road infrastructure, cuttings along the M1 Princes Motorway and closed circuit television (CCTV) inspection for impacts on internal surfaces of culverts.</li> </ul>	As above.

**Table 17 (Continued)**  
**Built Features Performance Indicators, Monitoring and Management Measures**

Built Features	Performance Indicator(s)	Monitoring	Relevant Management Measures
WCC Old Princes Highway	<ul style="list-style-type: none"> <li>No pavement cracking exceeding 5 mm, or other defects of the road pavement resulting in deterioration of ride quality.</li> <li>No ponding of water on the road surface as a result of changes in grade from subsidence associated with Longwalls 301-303.</li> <li>No joint displacement or cracking or other defects of the drainage structure (e.g. pipes/culverts) in excess of 5 mm.</li> <li>Serviceability of guard rails, marker posts and signage is maintained.</li> </ul>	<ul style="list-style-type: none"> <li>Subsidence, tilt, tensile strain and compressive strain.</li> <li>Impacts to the surface including cracks, buckling and stepping.</li> <li>Impacts to the visible surfaces of pipes/culverts including cracking, buckling, shearing and collapse.</li> <li>Visible impacts to furniture.</li> </ul>	<p>A number of potential management measures in relation to the Old Princes Highway pavement, drainage structures and other furniture are considered to be applicable. These include:</p> <ul style="list-style-type: none"> <li>mill and/or replace pavement layers;</li> <li>crack sealing/repair;</li> <li>point repairs;</li> <li>replace sections of pipe/culvert;</li> <li>grouting/sealing of cracks; and</li> <li>repair/replacement of furniture.</li> </ul> <p>In the event that repairs are required, traffic control measures such as contra-flow of traffic or partial carriageway closures may be used to divert traffic off one carriageway, lane or shoulder. Repairs would be carried out as soon as practicable in consultation with the WCC.</p> <p>Follow-up inspections will be conducted to assess the effectiveness of the management measures implemented and the requirement for any additional management measures.</p>
WCC Waterfall General (Garrawarra) Cemetery	<ul style="list-style-type: none"> <li>No defects to the structural integrity of headstones or fencing (beyond the baseline [pre-mining] conditions).</li> <li>The land in general is expected to experience minor cracking consistent with that observed during the extraction of previous longwalls at Metropolitan Coal.</li> </ul>	<ul style="list-style-type: none"> <li>Subsidence, tilt, tensile strain and compressive strain.</li> <li>Pre and post mining audits (photographic record and commentary).</li> <li>Surface cracks, buckling and general safety.</li> </ul>	<p>A number of potential management measures are considered to be applicable and are summarised in the relevant rectification plan/protocol (Appendix E).</p> <p>Follow-up inspections will be conducted to assess the effectiveness of the management measures implemented and the requirement for any additional management measures.</p>

**Table 17 (Continued)**  
**Built Features Performance Indicators, Monitoring and Management Measures**

Built Features	Performance Indicator(s)	Monitoring	Relevant Management Measures
Sydney Water water pipelines	<ul style="list-style-type: none"> <li>No more than repairable (minor) leakages of the water pipelines occur during mining.</li> <li>No more than repairable (minor) defects (cracks, etc.) in the structural integrity of the pipes and associated connections occur due to mining.</li> </ul>	<ul style="list-style-type: none"> <li>Subsidence, tilt, tensile strain and compressive strain.</li> <li>Surface ground cracks.</li> <li>Cracks or leaks in the pipelines.</li> <li>Fittings can be accessed beneath surface fittings and are operable.</li> <li>Leakage in pipeline.</li> <li>Acoustic monitoring.</li> </ul>	<p>A number of potential management measures in relation to pipelines are considered to be applicable. These include:</p> <ul style="list-style-type: none"> <li>repair of broken pipes or fittings by Sydney Water maintenance staff; and</li> <li>if major adjustment is required to re-align pipe, the pipe can be temporarily end capped to maintain supply to customers either side of break and/or alternative water supply provided to service properties while repair of water main is in process.</li> </ul> <p>Follow-up inspections will be conducted to assess the effectiveness of the management measures implemented and the requirement for any additional management measures.</p>
Sydney Trains Illawarra Railway Line and telecommunications tower (and compound)	<ul style="list-style-type: none"> <li>No defects or deformation of the Illawarra Railway Line due to mining.</li> <li>The structural integrity of the telecommunications tower (and compound) is maintained.</li> </ul>	<ul style="list-style-type: none"> <li>Subsidence, tilt, tensile strain and compressive strain.</li> <li>Any defects or deformation of the rail line and associated infrastructure.</li> <li>Structural integrity of the telecommunications tower and compound.</li> </ul>	<p>Although the Illawarra Railway is approximately 1.4 km from Longwalls 301-303, potential management measures in relation to the rail line may include:</p> <ul style="list-style-type: none"> <li>speed restriction of trains; and</li> <li>minor repair of track.</li> </ul> <p>Potential management measures for the telecommunications tower and compound include pre-mining bracing and/or strengthening members to the frame and/or implementation of building maintenance techniques.</p> <p>Follow-up inspections will be conducted to assess the effectiveness of the management measures implemented and the requirement for any additional management measures.</p>
Axicom telecommunications tower (and compound)	<ul style="list-style-type: none"> <li>Structural integrity of the telecommunications towers and compounds has been maintained.</li> <li>Serviceability of the access roads/tracks has been maintained.</li> </ul>	<ul style="list-style-type: none"> <li>Subsidence, tilt, tensile strain and compressive strain.</li> <li>Structural integrity of the telecommunications tower and compound.</li> <li>Surface cracks, buckling and general safety.</li> </ul>	<p>A number of potential management measures in relation to telecommunications towers and compounds are considered to be applicable and further measures are summarised in the BFMP (Appendix E).</p> <p>Management measures for access roads/tracks will be implemented in accordance with the LMP.</p> <p>Follow-up inspections will be conducted to assess the effectiveness of the management measures implemented and the requirement for any additional management measures.</p>

### 3.5.3 Assessment of Performance Indicators and Measures

The subsidence impact performance measure specified in Table 1 of Condition 1, Schedule 3 of the Project Approval in relation to built features is:

*Safe, serviceable and repairable, unless the owner and the MSB agree otherwise in writing.*

Performance indicators developed for the subsidence impact performance measure relating to built features are presented in the component plans of the BFMP and are summarised in Table 17. Monitoring against the performance indicators is described in detail in the component plans of the BFMP and summarised in Table 17 and Section 3.7.

Of specific relevance to the Garrawarra Centre Complex, a subsidence impact performance measure outlined in Table 1 of Condition 1, Schedule 3 in relation to items of historical or heritage significance at the Garrawarra Centre Complex is:

*Negligible damage (that is fine or hairline cracks that do not require repair), unless the owner of the item and the appropriate heritage authority agree otherwise in writing.*

Performance indicators developed for the subsidence impact performance measure relating to items of historical or heritage significance are presented in the Garrawarra Centre Complex component of the BFMP, and are summarised in Table 17. Monitoring conducted against the performance indicators is described in detail in the Garrawarra Centre Complex component of the BFMP and is summarised in Table 17 and Section 3.7.

The procedure followed to assess the extraction of Longwalls 301-303 against the performance indicators and performance measures is outlined in Figure 13 and described in detail in the component plans of the BFMP (Appendix E).

### 3.5.4 Contingency Plan

In the event that a subsidence impact performance measure relating to built features is considered to have been exceeded, Metropolitan Coal will implement a Contingency Plan as described in detail in the component plans of the BFMP and summarised in Section 4.1.

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## 3.6 PUBLIC SAFETY MANAGEMENT

### 3.6.1 Overview

The Longwalls 301-303 PSMP is provided in Appendix F. The purpose and scope of the PSMP are summarised below:

**Purpose:** To ensure public safety in the mining area.

**Scope:** Land within the mining area where potential risks to the public could be encountered.

### 3.6.2 Key Public Safety Issues, Monitoring and Management Measures

The primary hazards associated with the extraction of Longwalls 301-303 include:

- potential subsidence impacts on built features;
- potential instability of cliff formations or steep slopes caused by subsidence;
- deformations or fracturing of any land caused by subsidence; and
- any other impacts of subsidence.

A large proportion of the land within 600 m of Longwalls 301-303 is owned and/or managed by WaterNSW or The State of New South Wales (Crown Land), and therefore accessibility to the general public is restricted (Figure 7). The general public are not allowed in the Woronora Special Area for any recreational or other purpose. Access restrictions are also applicable to some of the identified built features in the vicinity of Longwalls 301-303.

Longwalls 301-303 are located partly within the Woronora Notification Area (Figure 2). No risks have been identified to public safety as a result of the extraction of Longwalls 301-303 within the Woronora Notification Area. The Woronora Dam wall is located approximately 7.1 km to the commencing end of Longwall 303 and the distance from the labyrinth spillway, which is to the south of the dam wall, is approximately 6.7 km (Figure 1). The dam wall and spillway are located at large distances from Longwalls 301-303. It is not expected that measurable conventional subsidence movements would occur at the dam wall and spillway (Appendix I). In addition, it is unlikely that non-conventional subsidence movements would be observed at the distances of the dam wall and spillway from Longwalls 301-303 (Appendix I).

Metropolitan Coal is required to obtain all necessary approvals from the Minister administering the NSW *Mining Act, 1992* in accordance with the requirements of the NSW *Dams Safety Act, 1978* and the DSC.

The key issues relating to potential risks to public safety during the extraction of Longwalls 301-303 are described in the PSMP (Appendix F). The relevant monitoring and management measures are summarised in Table 18 and Section 3.7.

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**Table 18**  
**Management Issues for Public Safety During the Extraction of Longwalls 301-303**

Issue	Approved Impact	Monitoring	Management
Public Safety	<ul style="list-style-type: none"> <li>• Public safety to be ensured within the mining area.</li> <li>• Built features – Safe, serviceable and repairable, unless the owner and the MSB agree otherwise in writing.</li> </ul>	<ul style="list-style-type: none"> <li>• Monitoring in accordance with the LMP.</li> <li>• Monitoring in accordance with the BFMP.</li> </ul>	<ul style="list-style-type: none"> <li>• Restricted access.</li> <li>• Woronora Special Areas Consent.</li> <li>• Woronora Special Area Catchment Induction.</li> <li>• Management of roads/tracks (including fire trails and vehicular tracks) in accordance with the LMP and BFMP.</li> <li>• Management of built features in accordance with the BFMP.</li> <li>• DSC approval requirements.</li> <li>• Consultation with landowners and infrastructure owners.</li> <li>• Other management measures in relation to public safety may include:               <ul style="list-style-type: none"> <li>- traffic control including diversion of traffic;</li> <li>- temporary speed restrictions;</li> <li>- warning signs/lights;</li> <li>- restriction of public access;</li> <li>- erection of barriers;</li> <li>- implementation of security services; and</li> <li>- use of emergency services for public control.</li> </ul> </li> </ul>

### 3.6.3 Assessment of Performance Indicators and Measures

The Project Approval requires Metropolitan Coal not to exceed the subsidence impact performance measure relating to built features, as specified in Table 1 of Condition 1, Schedule 3:

*Safe, serviceable and repairable, unless the owner and the MSB agree otherwise in writing.*

Metropolitan Coal will also assess the Project against the following public safety performance indicator:

*Public safety will be ensured in the event that any hazard to the general public arising from subsidence effects becomes evident.*

Specific performance indicators have also been developed with each asset owner as described in Section 3.5 and the BFMP (Appendix E).

Monitoring against the performance indicator and performance measure during the mining of Longwalls 301-303 is summarised in Table 18 and Section 3.7 and described in detail in Appendix F.

The procedure that will be followed to assess the extraction of Longwalls 301-303 against the performance indicator and performance measure is outlined in Figure 13 and described in detail in the PSMP (Appendix F).

### **3.6.4 Contingency Plan**

In the event the built features subsidence impact performance measure of 'safe' is considered to have been exceeded or is likely to be exceeded, Metropolitan Coal will implement a Contingency Plan as described in the PSMP and summarised in Section 4.1.

## **3.7 SUBSIDENCE MONITORING**

The various monitoring programs that are detailed in each of the management plans (Appendices A to F) are summarised in Table 19. The location of environmental monitoring sites included in Metropolitan Coal's various environmental monitoring programs as detailed in Table 19 are presented on Figure 10 and Figures 14 to 22.

Plan 7 in Attachment 1 of Appendix G shows the subsidence monitoring locations for Longwalls 301-303.

**Table 19**  
**Longwalls 301-303 Environmental Monitoring Program Summary**

Management Plan	Monitoring Component	Sites	Monitoring Parameter/Analysis	Monitoring Frequency
WMP	Stream Features	<ul style="list-style-type: none"> <li>The Eastern Tributary from full supply level of the Woronora Reservoir to the maingate of Longwall 26.</li> <li>The Waratah Rivulet from Pool P to the full supply level of the Woronora Reservoir.</li> </ul>	<ul style="list-style-type: none"> <li>Location, approximate dimensions (length, width and depth), and orientation of surface cracks (specifically whether cracks are developed perpendicular to the stream flow or are controlled by rock joints or other factors, etc.).</li> <li>Nature of iron staining (e.g. whether isolated or across the entire streambed).</li> <li>Extent of iron staining (e.g. the length of stream affected).</li> <li>Description of gas release (e.g. isolated bubbles or continuous stream, and type of gas [methane or carbon dioxide]).</li> <li>Nature of scouring, for example the depth of scouring, type of soil exposed, any obvious vegetation impact, potential for severe erosion, etc.</li> <li>Water discoloration or opacity if present.</li> <li>Rock bar characteristics such as extent of cracking, seepage, underflow.</li> </ul>	<ul style="list-style-type: none"> <li>Visual inspection and photographic survey of the Eastern Tributary conducted monthly when mining is within 400 m of the stream.</li> <li>Visual inspection and photographic survey of the Waratah Rivulet within 3 months of the completion of each longwall.</li> <li>Weekly monitoring at pools observed with gas releases on the Eastern Tributary and Waratah Rivulet, until no gas releases have been observed at the pool for three consecutive weeks.</li> </ul>
	Surface Water Flow	<ul style="list-style-type: none"> <li>Eastern Tributary (GS 300078).</li> <li>Waratah Rivulet (GS 2132102).</li> </ul> <p><i>Control Sites</i></p> <ul style="list-style-type: none"> <li>Woronora River (GS 2132101).</li> <li>Honeysuckle Creek (GS 300077).</li> <li>O'Hares Creek (GS 213200).</li> </ul>	<ul style="list-style-type: none"> <li>Stream flow data.</li> </ul>	<ul style="list-style-type: none"> <li>Continuous (downloaded monthly).</li> </ul>
	Pool Water Levels and Drainage Behaviour	<ul style="list-style-type: none"> <li>Eastern Tributary Pools ETG, ETJ, ETM, ETU, ETW, ETAF, ETAG, ETAH, ETAI, ETAQ and ETAU.</li> <li>Waratah Rivulet Pools A, F, J, K, L, M, N, O, P, Q, R, S, T, U, V and W.</li> </ul> <p><i>Control Sites</i></p> <ul style="list-style-type: none"> <li>Woronora River Control Pools WRP1, WRP2, WRP3 and WRP4.</li> </ul>	<ul style="list-style-type: none"> <li>Pool water levels.</li> </ul>	<ul style="list-style-type: none"> <li>Continuous water level sensor and logger (downloaded monthly).</li> </ul>

**Table 19 (Continued)**  
**Longwalls 301-303 Environmental Monitoring Program Summary**

Management Plan	Monitoring Component	Sites	Monitoring Parameter/Analysis	Monitoring Frequency
WMP (Cont.)	Pool Water Levels and Drainage Behaviour (Cont.)	<ul style="list-style-type: none"> <li>Waratah Rivulet Pools B, C, E, G, G1, H and I.</li> </ul>	<ul style="list-style-type: none"> <li>Pool water levels.</li> </ul>	<ul style="list-style-type: none"> <li>Manually monitored daily, until such time that continuous sensors are installed.</li> </ul>
		<ul style="list-style-type: none"> <li>Pools on the Eastern Tributary situated downstream of the maingate of Longwall 26 to the full supply level of the Woronora Reservoir.</li> </ul>	<ul style="list-style-type: none"> <li>Evidence of new cracking within the stream bed or rock bar.</li> </ul>	<ul style="list-style-type: none"> <li>Visual inspections conducted weekly when mining is within 400 m of the stream.</li> </ul>
		<ul style="list-style-type: none"> <li>Pools on the Waratah Rivulet from Pool P to the full supply level of the Woronora Reservoir.</li> </ul>	<ul style="list-style-type: none"> <li>Whether the pools continue to flow over, through and/or below the rock bars (where relevant).</li> <li>Whether surface flow is evident along the length of the pools prior to flowing over/through/below the rock bars or boulder fields.</li> </ul>	<ul style="list-style-type: none"> <li>Visual inspections conducted at the time of download (monthly).</li> </ul>
	Stream Water Quality	<ul style="list-style-type: none"> <li>Eastern Tributary sites ETWQF, ETWQJ, ETWQN, ETWQU, ETWQW, ETWQAF, ETWQAH, ETWQAQ and ETWQAU.</li> <li>Waratah Rivulet sites WRWQ2, WRWQ6, WRWQ8, WRWQ9, WRWQM, WRWQN, WRWQP, WRWQR, WRWQT, WRWQU, WRWQV, and WRWQW.</li> <li>Tributary B site RTWQ1.</li> <li>Tributary D site UTWQ1.</li> <li>Far Eastern Tributary site FEWQ1.</li> <li>Honeysuckle Creek site HCWQ1.</li> <li>Bee Creek site BCWQ1.</li> </ul> <p><i>Control Sites</i></p> <ul style="list-style-type: none"> <li>Woronora River control sites WOWQ1 and WOWQ 2.</li> </ul>	<ul style="list-style-type: none"> <li>Water quality parameters as described in the WMP (samples collected for metal analysis to be field filtered).</li> </ul>	<ul style="list-style-type: none"> <li>Monthly.</li> </ul>
	<ul style="list-style-type: none"> <li>Eastern Tributary sites ETWQF, ETWQJ, ETWQN, ETWQAF and ETWQAQ.</li> <li>Waratah Rivulet sites WRWQ2, WRWQ6, WRWQ8, WRWQ9, WRWQM, WRWQN and WRWQP.</li> </ul> <p><i>Control Site</i></p> <ul style="list-style-type: none"> <li>Woronora River site WOWQ2.</li> </ul>	<ul style="list-style-type: none"> <li>Unfiltered water quality samples analysed for total iron.</li> </ul>	<ul style="list-style-type: none"> <li>Monthly.</li> </ul>	

**Table 19 (Continued)**  
**Longwalls 301-303 Environmental Monitoring Program Summary**

Management Plan	Monitoring Component	Sites	Monitoring Parameter/Analysis	Monitoring Frequency
WMP (Cont.)	Woronora, Nepean and Cataract Reservoir Water Quality	<ul style="list-style-type: none"> <li>Woronora Reservoir (site DW01).</li> <li>Nepean Reservoir.</li> <li>Cataract Reservoir.</li> </ul>	<ul style="list-style-type: none"> <li>Total iron, total manganese and total aluminium.</li> </ul>	<ul style="list-style-type: none"> <li>As made available by WaterNSW.</li> </ul>
	Shallow Groundwater Levels	<ul style="list-style-type: none"> <li>Eastern Tributary site ETGW1.</li> <li>Waratah Rivulet sites WRGW1, WRGW2 and WRGW7.</li> </ul>	<ul style="list-style-type: none"> <li>Groundwater levels.</li> </ul>	<ul style="list-style-type: none"> <li>Data downloaded monthly; analysis on a six monthly basis.</li> </ul>
		<ul style="list-style-type: none"> <li>Transect sites T1, T2, T3, T4 and T5.</li> <li>Stage board at the water's edge of the Woronora Reservoir.</li> </ul>	<ul style="list-style-type: none"> <li>Groundwater levels.</li> <li>Woronora Reservoir level.</li> </ul>	<ul style="list-style-type: none"> <li>Data downloaded/reading monthly; analysis on a six monthly basis.</li> </ul>
	Deep Groundwater Levels/Pressures	<ul style="list-style-type: none"> <li>Site 9HGW0 (Longwall 10 Goaf Hole).</li> <li>Site 9EGW1B.</li> <li>Site 9FGW1A.</li> <li>Site 9GGW2B.</li> <li>Site 9HGW1B.</li> <li>Site PM02.</li> <li>Site 9GGW1-80.</li> <li>Site PM01 (9DGW1B).</li> <li>Site 9EGW2A.</li> <li>Site PM03.</li> <li>Site PHGW1B.</li> <li>Site PHGW2A.</li> <li>Site F6GW3A.</li> <li>Site F6GW4A.</li> </ul>	<ul style="list-style-type: none"> <li>Groundwater levels/pressures.</li> </ul>	<ul style="list-style-type: none"> <li>Data downloaded monthly; analysis on a six monthly basis.</li> </ul>
	Groundwater Quality	<ul style="list-style-type: none"> <li>Eastern Tributary site ETGW1.</li> <li>Waratah Rivulet sites WRGW1, WRGW2 and WRGW7.</li> </ul>	<ul style="list-style-type: none"> <li>Water quality parameters as described in the WMP (samples collected for metal analysis to be field filtered).</li> </ul>	<ul style="list-style-type: none"> <li>Monthly.</li> </ul>
	Mine Water Make	Underground	<ul style="list-style-type: none"> <li>Groundwater inflow to the mine (20 day average).</li> </ul>	<ul style="list-style-type: none"> <li>Mine water balance inputs (as described in the WMP).</li> <li>Weekly statutory inspections.</li> </ul>

**Table 19 (Continued)**  
**Longwalls 301-303 Environmental Monitoring Program Summary**

Management Plan	Monitoring Component	Sites	Monitoring Parameter/Analysis	Monitoring Frequency
LMP	Cliffs and overhangs	<p><i>Previous Longwalls</i></p> <ul style="list-style-type: none"> <li>Any of the cliff sites (COH1, COH2, COH3, COH4, COH5, COH6, COH6A, COH7, COH8, COH9, COH10, COH14, COH15 and COH16) that have been recorded with subsidence impacts during the mining of Longwalls 23-27.</li> </ul>	<ul style="list-style-type: none"> <li>Any change in the subsidence impact (e.g. cliff instabilities or cracking) recorded at the site(s) during the mining of Longwalls 23-27.</li> <li>If yes, cliff instabilities – length of cliff/overhang that experiences mining-induced rock fall (i.e. the exposure of a fresh face of rock and debris scattered around the base of the cliff or overhang), compared against the land subsidence impact performance measure.</li> </ul>	<ul style="list-style-type: none"> <li>Within one month of the completion of Longwall 27 extraction.</li> </ul>
	Steep slopes and land in general	<ul style="list-style-type: none"> <li>Steep slopes and other land within 600 m of Longwalls 20-27 and Longwalls 301-303 secondary extraction.</li> </ul>	<ul style="list-style-type: none"> <li>Sandstone fracturing and rock falls (nature and extent of surface tension cracks and rock ledge collapse, compared against the land subsidence impact performance indicator).</li> </ul>	<ul style="list-style-type: none"> <li>Opportunistic visual observations during catchment visits.</li> </ul>
BMP	Upland Swamps – Vegetation	<p><i>Longwalls 301-303</i></p> <ul style="list-style-type: none"> <li>Swamps 38, 40, 41, 46, 47, 48, 49, 50, 51/52, 53 and 58.</li> <li>Control Swamps 101, 111a, 125, 135, 136, 137a, 137b and 138.</li> </ul> <p><i>Previous Longwalls</i></p> <ul style="list-style-type: none"> <li>Swamps 16, 17, 20, 24, 25, 30, 31, 32, 33, 34, 35, 36 and 95.</li> </ul>	<ul style="list-style-type: none"> <li>Cracking of exposed bedrock areas and/or swamp substrate.</li> <li>Areas of increased erosion, particularly along any existing drainage line.</li> <li>Any changes in water colour, particularly evidence of iron precipitation.</li> <li>Changes in vegetation condition, including areas of stressed vegetation (i.e. plants that demonstrate symptoms of stress) and dead/dying plants that appear unusual.</li> <li>Whether the amount of seepage (at the terminal step/over exposed surfaces of the swamp) at the time of inspection appears unusual (relative to recent rainfall).</li> </ul>	<ul style="list-style-type: none"> <li>Visual inspections bi-annually in spring and autumn.</li> </ul>

**Table 19 (Continued)**  
**Longwalls 301-303 Environmental Monitoring Program Summary**

Management Plan	Monitoring Component	Sites	Monitoring Parameter/Analysis	Monitoring Frequency
BMP (Cont.)	Upland Swamps - Vegetation (Cont.)	<p><i>Longwalls 301-303</i></p> <ul style="list-style-type: none"> <li>Swamps 40, 41, 46, 51/52 and 53.</li> <li>Control Swamps 101, 135, 136, 137a and 137b.</li> </ul> <p><i>Previous Longwalls</i></p> <ul style="list-style-type: none"> <li>Swamps 16, 17, 18, 20, 24 and 25 (Longwalls 20-22).</li> <li>Swamps 28, 30, 33, 35 and 94 (Longwalls 23-27).</li> <li>Control Swamps 101, 111a, 125, 135, 136, 137a, 137b, 138, Bee Creek Swamp, Woronora River 1, Woronora River south arm and Dahlia Swamp.</li> </ul>	<ul style="list-style-type: none"> <li>Vegetation structure.</li> <li>Dominant species.</li> <li>Estimated cover and height for each stratum.</li> <li>Full floristics.</li> <li>Estimated cover abundance for each species using seven point Braun-Blanquet scale.</li> <li>Condition/health rating for each species in the quadrat.</li> </ul>	<ul style="list-style-type: none"> <li>Transect and quadrat monitoring bi-annually in spring and autumn.</li> </ul>
		<p><i>Longwalls 301-303</i></p> <ul style="list-style-type: none"> <li>Twenty tagged individuals (<i>Epacris obtusifolia</i> and <i>Sprengelia incarnata</i>) in each of Swamps 40, 51/52 and 53.</li> <li>Twenty tagged individuals (<i>Epacris obtusifolia</i>) in each of Control Swamps 101, 136 and 137a.</li> <li>Twenty tagged individuals (<i>Sprengelia incarnata</i>) in each of Control Swamps 101, 136 and 137b.</li> </ul> <p><i>Previous Longwalls</i></p> <ul style="list-style-type: none"> <li>Twenty tagged individuals (<i>Epacris obtusifolia</i>) in each of Swamps 18, 24 and 25 (Longwalls 20-22) and Control Swamps 101, 111a and 125.</li> <li>Twenty tagged individuals (<i>Epacris obtusifolia</i>) in each of Swamps 19, 30, 33, 35 and 94 (Longwalls 23-27) and Control Swamps 135, 136, 137a, 137b and 138.</li> <li>Twenty tagged individuals (<i>Sprengelia incarnata</i>) in each of Swamps 24 (Longwalls 20-22) and Control Swamps 101 and 125.</li> </ul>	<ul style="list-style-type: none"> <li>Population monitoring data including condition/health rating for each plant and reproductive rating.</li> </ul>	<ul style="list-style-type: none"> <li>Indicator species monitoring bi-annually in spring and autumn.</li> </ul>

**Table 19 (Continued)**  
**Longwalls 301-303 Environmental Monitoring Program Summary**

Management Plan	Monitoring Component	Sites	Monitoring Parameter/Analysis	Monitoring Frequency
BMP (Cont.)	Upland Swamps - Vegetation (Cont.)	<p><i>Previous Longwalls (Cont.)</i></p> <ul style="list-style-type: none"> <li>Twenty tagged individuals (<i>Sprengelia incarnata</i>) in each of Swamps 19, 33, 35 and 94 (Longwalls 23-27) and Control Swamps 135, 136, 137a and 138.</li> <li>Twenty tagged individuals (<i>Pultenaea aristata</i>) in each of Swamps 18, 24 and 25 (Longwalls 20-22) and Control Swamps 101 and 111a.</li> <li>Twenty tagged individuals (<i>Pultenaea aristata</i>) in each of Swamps 19, 30, 33, 35 and 94 (Longwalls 23-27) and Control Swamps 135, 136, 137a and 138.</li> <li>Twenty tagged individuals (<i>Banksia robur</i>, <i>Callistemon citrinus</i> and <i>Leptospermum juniperinum</i>) in each of Swamps 20 (Longwalls 20-22) and Control Swamps Woronora River 1, Woronora River south arm and Dahlia Swamp.</li> <li>Twenty tagged individuals (<i>Banksia robur</i> and <i>Callistemon citrinus</i>) in each of Swamps 28 (Longwalls 23-27) and Control Swamps Woronora River 1, Woronora River south arm and Dahlia Swamp.</li> </ul>	<ul style="list-style-type: none"> <li>Population monitoring data including condition/health rating for each plant and reproductive rating.</li> </ul>	<ul style="list-style-type: none"> <li>Indicator species monitoring bi-annually in spring and autumn.</li> </ul>
	Upland Swamps - Groundwater	<p><i>Longwalls 301-303</i></p> <ul style="list-style-type: none"> <li>Paired piezometers (i.e. one swamp substrate piezometer to a depth of approximately 1 m and one sandstone piezometer to a depth of approximately 10 m) in Swamps 40, 41, 46, 51, 52 and 53.</li> </ul>	<ul style="list-style-type: none"> <li>Groundwater levels.</li> </ul>	<ul style="list-style-type: none"> <li>Datalogger (continuous).</li> </ul>
		<p><i>Previous Longwalls</i></p> <ul style="list-style-type: none"> <li>Swamp substrate monitoring in Swamps 20 and 25 (Longwalls 20-22).</li> <li>Swamp substrate monitoring in Swamps 28, 30, 33 and 35 (Longwalls 23-27).</li> <li>Swamp substrate monitoring in Control Swamps 101, 137a, 137b, Bee Creek Swamp and Woronora River 1.</li> </ul>	<ul style="list-style-type: none"> <li>Groundwater levels.</li> </ul>	<ul style="list-style-type: none"> <li>Datalogger (continuous).</li> </ul>



**Table 19 (Continued)**  
**Longwalls 301-303 Environmental Monitoring Program Summary**

Management Plan	Monitoring Component	Sites	Monitoring Parameter/Analysis	Monitoring Frequency
BMP (Cont.)	Riparian Vegetation	<ul style="list-style-type: none"> <li>Sites MRIP01 to MRIP12.</li> </ul>	<ul style="list-style-type: none"> <li>Areas of new water ponding.</li> <li>Any cracking or rock displacement.</li> <li>Changes in vegetation condition, including areas of stressed vegetation that appear unusual.</li> </ul>	<ul style="list-style-type: none"> <li>Visual inspections bi-annually in spring and autumn.</li> </ul>
		<ul style="list-style-type: none"> <li>Sites MRIP01 to MRIP08, MRIP11 and MRIP12.</li> </ul>	<ul style="list-style-type: none"> <li>Vegetation structure.</li> <li>Dominant species.</li> <li>Estimated cover and height for each stratum.</li> <li>Full floristics.</li> <li>Estimated cover abundance for each species using seven point Braun-Blanquet scale.</li> <li>Condition/health rating for each species in the quadrat.</li> </ul>	<ul style="list-style-type: none"> <li>Permanent quadrat (20 m x 2 m) monitoring bi-annually in spring and autumn.</li> </ul>
		<ul style="list-style-type: none"> <li>Existing tagged individuals (<i>Prostanthera linearis</i>, <i>Schoenus melanostachys</i> and <i>Lomatia myricoides</i>) at sites MRIP01 to MRIP12.</li> </ul>	<ul style="list-style-type: none"> <li>Population monitoring data including condition/health rating for each plant and reproductive rating.</li> </ul>	<ul style="list-style-type: none"> <li>Indicator species monitoring bi-annually in spring and autumn.</li> </ul>
	Aquatic Biota and their Habitats	<ul style="list-style-type: none"> <li>Surface water resources and watercourses in accordance with the WMP.</li> </ul>	<ul style="list-style-type: none"> <li>Monitoring of aquatic habitats in accordance with the WMP.</li> </ul>	<ul style="list-style-type: none"> <li>In accordance with the WMP.</li> </ul>
		<ul style="list-style-type: none"> <li>Stream monitoring at following Locations; <ul style="list-style-type: none"> <li>WT3, WT4 and WT5, ET1, ET2, ET3, ET4, B1 and B2.</li> <li>Control Locations: WR1; OC; BC; and WOT.</li> </ul> </li> </ul>	Impacts on aquatic ecology: <ul style="list-style-type: none"> <li>Habitat Characteristics.</li> <li>Water Quality</li> <li>Aquatic Macroinvertebrates</li> <li>Aquatic Macrophytes</li> </ul>	<ul style="list-style-type: none"> <li>Biannually in spring (15 September to 15 December) and autumn (15 March to 15 June).</li> </ul>
		<ul style="list-style-type: none"> <li>Pool monitoring at the following Pools: <ul style="list-style-type: none"> <li>Larger pools J, M1, N and ETAH.</li> <li>Larger control pools (Pool WP and Pool OC).</li> </ul> </li> </ul>	The response of aquatic ecosystems to the implementation of potential future stream remediation works: <ul style="list-style-type: none"> <li>Habitat Characteristics.</li> <li>Water Quality</li> <li>Aquatic Macroinvertebrates</li> <li>Aquatic Macrophytes</li> </ul>	<ul style="list-style-type: none"> <li>Biannually in spring (15 September to 15 December) and autumn (15 March to 15 June).</li> </ul>

**Table 19 (Continued)**  
**Longwalls 301-303 Environmental Monitoring Program Summary**

Management Plan	Monitoring Component	Sites	Monitoring Parameter/Analysis	Monitoring Frequency
BMP (Cont.)	Aquatic Biota and their Habitats (Cont.)	<ul style="list-style-type: none"> <li>Smaller pools K, L, M, ETAG, ETAI and ETAK.</li> <li>Smaller control pools (Pools WP-A, WP-B, WP-C, OC-A, OC-B and OC-C).</li> </ul>	As above.	<ul style="list-style-type: none"> <li>Biannually in spring (15 September to 15 December) and autumn (15 March to 15 June).</li> </ul>
	Amphibian Monitoring	<p><i>Longwalls 301-303</i></p> <ul style="list-style-type: none"> <li>Sites 23-28.</li> </ul> <p><i>Previous Longwalls</i></p> <ul style="list-style-type: none"> <li>Sites 1-6 (Longwalls 20-22) and 13-17 (Longwalls 23-27).</li> <li>Control Sites 7, 8, 9, 10, 11, 12, 18, 19, 20, 21 and 22.</li> </ul>	<ul style="list-style-type: none"> <li>Species assigned to relative abundance categories for tadpole and adult stages.</li> </ul>	<ul style="list-style-type: none"> <li>Survey annually in spring/summer (i.e. October to February) during suitable weather conditions.</li> </ul>
HMP	Aboriginal Heritage	<p><i>Longwalls 301-303</i></p> <ul style="list-style-type: none"> <li>Sites FRC 76 and FRC 117</li> </ul> <p><i>Previous Longwalls</i></p> <ul style="list-style-type: none"> <li>Monitoring of the Longwalls 20-27 Aboriginal heritage sites at which previous monitoring indicates continued change due to mine subsidence (as determined by the Round 5 survey for Longwalls 23-27).</li> </ul>	<ul style="list-style-type: none"> <li>Inspections of rock surfaces for cracking and/or exfoliation and/or blockfall.</li> <li>Inspection of art motifs for damage or deterioration.</li> <li>Identification of any natural weathering processes that may result in deterioration (e.g. fire, vegetation growth and water seepage).</li> <li>Comparison of the physical characteristics of the site at the time of monitoring against the previous monitoring and the baseline record.</li> </ul>	<ul style="list-style-type: none"> <li>Within three months of the completion of Longwall 303.</li> </ul>

**Table 19 (Continued)**  
**Longwalls 301-303 Environmental Monitoring Program Summary**

Management Plan	Monitoring Component	Sites	Monitoring Parameter/Analysis	Monitoring Frequency
BFMP-Garrawarra Centre Complex	Subsidence impacts	Hospital buildings	<ul style="list-style-type: none"> <li>Structural integrity.</li> <li>Cracking at pre-existing rock joints (at buildings prescribed in the BFMP).</li> <li>Tilt at pre-existing tilted piers (Seamstress building).</li> </ul>	<ul style="list-style-type: none"> <li>Prior to the commencement of Longwall 301 extraction, or as otherwise agreed with NSW Health.</li> <li>Within 3 months following the completion of extraction of Longwalls 301-303.</li> <li>Weekly visual inspection of water storage tank (B14t02) on commencement of Longwall 303 until wall has retreated away 400 m from tank.</li> <li>Weekly visual inspection of kiln on commencement of Longwalls 302 and 303 until wall has retreated 400 m away from kiln chimney.</li> </ul>
		Aged care buildings	<ul style="list-style-type: none"> <li>Structural integrity.</li> <li>Cracking at pre-existing rock joints (at buildings prescribed in the BFMP).</li> <li>Opening and closing of joints (at buildings prescribed in the BFMP).</li> </ul>	
		House structures	<ul style="list-style-type: none"> <li>Structural integrity.</li> <li>Cracking at pre-existing rock joints.</li> </ul>	
		Water storage tanks	<ul style="list-style-type: none"> <li>Structural integrity.</li> <li>Leaks.</li> <li>Cracking in columns, elevated ring beam or central access shaft (at tank prescribed in the BFMP).</li> </ul>	
		Gas storage tank	<ul style="list-style-type: none"> <li>Structural integrity.</li> <li>Leaks.</li> </ul>	
		Kiln	<ul style="list-style-type: none"> <li>Structural integrity of the kiln chimney.</li> </ul>	
		Telecommunications towers	<ul style="list-style-type: none"> <li>Structural integrity of the telecommunications towers and compounds.</li> </ul>	
		Pipelines	<ul style="list-style-type: none"> <li>Surface ground cracks.</li> <li>Cracks or leaks in the pipelines.</li> <li>Fittings can be accessed beneath surface fittings and are operable.</li> </ul>	

**Table 19 (Continued)**  
**Longwalls 301-303 Environmental Monitoring Program Summary**

Management Plan	Monitoring Component	Sites	Monitoring Parameter/Analysis	Monitoring Frequency
BFMP-Garrawarra Centre Complex (cont.)	Subsidence impacts (cont.)	Powerlines and poles	<ul style="list-style-type: none"> <li>Degradation of structure.</li> <li>Movement of conductors.</li> <li>Vegetation, land and road clearance.</li> <li>Integrity and function of support clamps or other items.</li> </ul>	<ul style="list-style-type: none"> <li>Prior to the commencement of Longwall 301 extraction, or as otherwise agreed with NSW Health.</li> <li>Within 3 months following the completion of extraction of Longwalls 301-303.</li> <li>At any time in case of fault or emergency.</li> </ul>
		Private roads and access roads/tracks	<ul style="list-style-type: none"> <li>Surface cracks, buckling and general safety.</li> </ul>	<ul style="list-style-type: none"> <li>Prior to the commencement of Longwall 301 extraction.</li> <li>Within 3 months following the completion of extraction of Longwalls 301-303.</li> <li>Opportunistic visual observations during catchment visits as per the LMP.</li> </ul>
BFMP-Endeavour Energy	Subsidence impacts	132 kV Towers (T7 to T13).	<ul style="list-style-type: none"> <li>Degradation of tower structure.</li> <li>Degradation of tower foundations/footings.</li> <li>Movement of insulator strings.</li> </ul>	<ul style="list-style-type: none"> <li>Prior to the commencement of Longwall 301 extraction.</li> <li>Within 3 months following the completion of extraction of each of Longwalls 301, 302 and 303.</li> <li>More frequently (e.g. weekly) at each tower within 400 m of the active longwall face.</li> <li>Routinely as per Endeavour Energy inspections (annual ground inspection, six yearly climbing inspection).</li> <li>At any time in case of fault or emergency.</li> </ul>

**Table 19 (Continued)**  
**Longwalls 301-303 Environmental Monitoring Program Summary**

Management Plan	Monitoring Component	Sites	Monitoring Parameter/Analysis	Monitoring Frequency
BFMP- Endeavour Energy (Cont.)	Subsidence impacts (Cont.)	132 kV Transmission Line from Towers T7 to T13. <ul style="list-style-type: none"> <li>Ground survey.</li> <li>Climbing inspection.</li> </ul>	<ul style="list-style-type: none"> <li>Vegetation clearance.</li> <li>Land clearance.</li> <li>Road clearance.</li> <li>Integrity and function of support clamps or other items.</li> </ul>	<ul style="list-style-type: none"> <li>Prior to the commencement of Longwall 301 extraction.</li> <li>Within 3 months following the completion of extraction of each of Longwalls 301, 302 and 303.</li> <li>Routinely as per Endeavour Energy inspections (annual ground inspection, six yearly climbing inspection).</li> <li>At any time in case of fault or emergency.</li> </ul>
		Timber poles.	<ul style="list-style-type: none"> <li>Degradation of structure.</li> <li>Movement of conductors.</li> </ul>	<ul style="list-style-type: none"> <li>Prior to the commencement of Longwall 301 extraction.</li> </ul>
		High Voltage Powerline. <ul style="list-style-type: none"> <li>Ground survey.</li> </ul>	<ul style="list-style-type: none"> <li>Vegetation clearance.</li> <li>Land clearance.</li> <li>Road clearance.</li> <li>Integrity and function of support clamps or other items.</li> </ul>	<ul style="list-style-type: none"> <li>Within 3 months following the completion of extraction of Longwalls 301-303.</li> <li>Routinely as per Endeavour Energy inspections.</li> <li>At any time in case of fault or emergency.</li> </ul>
		Access roads/tracks within 600 m of Longwalls 301-303 extraction.	<ul style="list-style-type: none"> <li>Surface cracks, buckling and general safety.</li> </ul>	<ul style="list-style-type: none"> <li>Prior to the commencement of Longwall 301 extraction.</li> <li>Within 3 months following the completion of extraction of Longwalls 301-303.</li> <li>Opportunistic visual observations during catchment visits as per the LMP.</li> <li>Routinely as per Endeavour Energy inspections.</li> </ul>

**Table 19 (Continued)**  
**Longwalls 301-303 Environmental Monitoring Program Summary**

Management Plan	Monitoring Component	Sites	Monitoring Parameter/Analysis	Monitoring Frequency
BFMP - TransGrid	Subsidence impacts	Towers TL11-103 to TL11-108.	<ul style="list-style-type: none"> <li>Degradation of tower structure.</li> <li>Degradation of tower foundations/footings.</li> <li>Movement of insulator strings.</li> <li>Visual check by TransGrid of earthwire/optical ground wire and conductor movement.</li> <li>Calculation of differential leg movement (TransGrid to be notified if total differential movement exceeds 4 mm).</li> </ul>	<ul style="list-style-type: none"> <li>Prior to the commencement of Longwall 301 extraction.</li> <li>Weekly at each tower within 400 m of the active longwall face (or at an increased frequency for TL11-107 and TL11-108 as determined in consultation with TransGrid during the first month of mining Longwalls 301, 302 and 303).</li> <li>Within 3 months following the completion of extraction of Longwalls 301-303.</li> <li>Routinely as per TransGrid inspections (annual ground inspection, six yearly climbing inspection).</li> <li>At any time in case of fault or emergency.</li> </ul>
		Transmission Line from Towers TL11-103 to TL11-108. <ul style="list-style-type: none"> <li>Ground survey.</li> <li>Climbing inspection.</li> </ul>	<ul style="list-style-type: none"> <li>Vegetation, land and road clearance.</li> <li>Integrity and function of support clamps or other items.</li> </ul>	<ul style="list-style-type: none"> <li>Routinely as per TransGrid inspections (annual ground inspection, six yearly climbing inspection).</li> <li>At any time in case of fault or emergency.</li> </ul>
		Access roads/tracks within 600 m of Longwalls 301-303 extraction.	<ul style="list-style-type: none"> <li>Surface cracks, buckling and general safety.</li> </ul>	<ul style="list-style-type: none"> <li>Prior to the commencement of Longwall 301 extraction.</li> <li>Within 3 months following the completion of extraction of Longwalls 301-303.</li> <li>Opportunistic visual observations during catchment visits as per the LMP.</li> <li>Routinely as per TransGrid inspections.</li> </ul>

**Table 19 (Continued)**  
**Longwalls 301-303 Environmental Monitoring Program Summary**

Management Plan	Monitoring Component	Sites	Monitoring Parameter/Analysis	Monitoring Frequency
BFMP-Nextgen	Remote Fibre Monitoring System (RFMS) Monitoring	1,625 nanometres Optical Time Domain Reflectometer (OTDR) monitoring on spare fibre.	<ul style="list-style-type: none"> <li>Signal integrity.</li> </ul>	<ul style="list-style-type: none"> <li>Continuous.</li> </ul>
	Subsidence impacts	Access roads/tracks within 600 m of Longwalls 301-303 extraction.	<ul style="list-style-type: none"> <li>Surface cracks, buckling and general safety.</li> </ul>	<ul style="list-style-type: none"> <li>Prior to the commencement of Longwall 301 extraction.</li> <li>Following the completion of extraction of Longwalls 301-303.</li> </ul>
		Monitoring of cable line and/or joint housing pit for point loss or area of loss within 600 m of Longwalls 301-303 extraction.	<ul style="list-style-type: none"> <li>Movement of conduit, degree of freedom of cable in conduit, ground compression/tension.</li> </ul>	<ul style="list-style-type: none"> <li>If RFMS records loss event <math>\pm 0.3</math> dB; <math>\pm 0.5</math> dB; or exceeds <math>\pm 1.0</math> dB.</li> </ul>
BFMP-Optus	RFMS Monitoring (Fibre Optic Cable Loss Signal)	1,625 nanometres OTDR monitoring.	<ul style="list-style-type: none"> <li>Signal integrity.</li> </ul>	<ul style="list-style-type: none"> <li>Continuous (monitoring commencement to occur as longwall face approaches within 400 m of asset to establish more frequent communications).</li> </ul>
	Subsidence impacts	Access roads/tracks within 600 m of Longwalls 301-303 extraction.	<ul style="list-style-type: none"> <li>Surface cracks, buckling and general safety.</li> </ul>	<ul style="list-style-type: none"> <li>Prior to the commencement of Longwall 301 extraction.</li> <li>Opportunistic visual observations as part of routine works and inspections.</li> <li>Following the completion of extraction of Longwalls 301-303.</li> </ul>

**Table 19 (Continued)**  
**Longwalls 301-303 Environmental Monitoring Program Summary**

Management Plan	Monitoring Component	Sites	Monitoring Parameter/Analysis	Monitoring Frequency
BFMP-Telstra	RFMS Monitoring	1,625 nanometres OTDR monitoring on spare fibres.	<ul style="list-style-type: none"> <li>Signal integrity.</li> </ul>	<ul style="list-style-type: none"> <li>Continuous for Cable 1.</li> <li>Continuous for Cable 2 (during commencing 400 m of extraction from Longwalls 302 and 303).</li> </ul>
	Subsidence impacts	Monitoring of cable lines and/or joint housing pits for point loss or areas of loss within 600 m of Longwalls 301-303 extraction.	<ul style="list-style-type: none"> <li>Movement of conduit, degree of freedom of cable in conduit, ground compression/tension.</li> </ul>	<ul style="list-style-type: none"> <li>If RFMS records loss event <math>\pm 0.3</math> dB; or exceeds <math>\pm 1.0</math> dB.</li> </ul>
		Telecommunications tower (and compound)	<ul style="list-style-type: none"> <li>Structural integrity of the telecommunications tower and compound.</li> <li>Tower tilt (<math>&gt; 1</math> degree).</li> </ul>	<ul style="list-style-type: none"> <li>Prior to the commencement of Longwall 301 extraction or as otherwise agreed with Telstra.</li> <li>After commencing 400 m of extraction from Longwalls 302 and 303.</li> <li>Within 3 months following the completion of extraction of Longwalls 301-303.</li> </ul>
	Access roads/tracks within 600 m of Longwalls 301-303 extraction.	<ul style="list-style-type: none"> <li>Surface cracks, buckling and general safety.</li> </ul>	<ul style="list-style-type: none"> <li>Prior to the commencement of Longwall 301 extraction.</li> <li>Opportunistic visual observations as part of routine works and inspections.</li> <li>Following the completion of extraction of Longwalls 301-303.</li> </ul>	
BFMP-RMS	Movements	Bridge 2.	<p>Monitoring of movements including:</p> <ul style="list-style-type: none"> <li>Absolute 3D movement of the survey reference pillar.</li> <li>Relative 3D movements of all bridge monitoring points.</li> </ul> <p>To measure absolute ground movement at survey reference pillar and hence potential for relative movement of bridge elements and to measure distortion of structure.</p>	<ul style="list-style-type: none"> <li>Real-time (continuous) monitoring subject to review of current trial.</li> <li>Monthly when active longwall mining is within 600 m of the bridge.</li> <li>Greater frequency or commencing earlier if determined in consultation with the Technical Committee.</li> </ul>



**Table 19 (Continued)**  
**Longwalls 301-303 Environmental Monitoring Program Summary**

Management Plan	Monitoring Component	Sites	Monitoring Parameter/Analysis	Monitoring Frequency
BFMP-RMS (cont.)	Movements (cont.)	Bridge 2 (cont.).	Monitoring of movements including: <ul style="list-style-type: none"> <li>Changes in length of FBG sensors and tilts of FBG tiltmeters.</li> </ul> <p>To determine the range of movements due to environmental effects, (diurnal and seasonal) and to measure distortion of structure.</p>	<ul style="list-style-type: none"> <li>Program of varying (diurnal and seasonal) sampling rates.</li> <li>Weekly from the commencement of Longwall 301 extraction for a duration determined in consultation with the Technical Committee.</li> <li>Greater frequency if determined in consultation with the Technical Committee.</li> </ul>
		Cawley Road Overbridge.	Monitoring of movements including: <ul style="list-style-type: none"> <li>Absolute 3D movement of the survey reference pillar.</li> <li>Relative 3D movements of all bridge monitoring points.</li> </ul> <p>To measure absolute ground movement at survey reference pillar and hence potential for relative movement of bridge elements and to measure distortion of structure.</p>	<ul style="list-style-type: none"> <li>Prior to the commencement of Longwall 301 extraction.</li> <li>Real-time (continuous) monitoring subject to review of current trial.</li> <li>Following the completion of extraction of each Longwall 301, 302 and 303.</li> </ul>
		Other relevant infrastructure (adjacent transmission line/towers).	Monitoring of movements including: <ul style="list-style-type: none"> <li>Subsidence line along the transmission line corridor within 600 m of Longwalls 301-303 extraction.</li> <li>Tower legs (TL11-103 to TL11-108).</li> <li>TL11-103 to TL11-108 four ground points at each tower.</li> <li>TL11-103 to TL11-108 top of tower at fixed point.</li> </ul> <p>To measure the following mine subsidence parameters for comparison with predicted parameters:</p> <ul style="list-style-type: none"> <li>Subsidence, tilt, tensile strain, compressive strain.</li> <li>Absolute horizontal translation.</li> <li>Differential leg movement.</li> </ul>	<ul style="list-style-type: none"> <li>Prior to the commencement of Longwall 301 extraction.</li> <li>Real-time (continuous) monitoring subject to review of current trial.</li> <li>Weekly at each tower within 400 m of the active longwall face (or at an increased frequency for TL11-107 and TL11-108 as determined in consultation with the asset owner (TransGrid) during the first month of mining Longwalls 301, 302 and 303).</li> <li>Within 3 months following the completion of extraction of Longwalls 301-303.</li> </ul>

**Table 19 (Continued)**  
**Longwalls 301-303 Environmental Monitoring Program Summary**

Management Plan	Monitoring Component	Sites	Monitoring Parameter/Analysis	Monitoring Frequency
BFMP-RMS (cont.)	Visual Impact Monitoring	Bridge 2.	Visual inspection for impacts on: <ul style="list-style-type: none"> <li>• Abutments.</li> <li>• Pier frames.</li> <li>• Elastomeric bearings.</li> <li>• Soffits of girders.</li> <li>• Deck expansion joints.</li> <li>• Steel traffic barrier joints.</li> <li>• Other areas of substructure and adjoining areas including concrete paths, stairs, and slope protection.</li> </ul> To identify development of, or changes in existing: <ul style="list-style-type: none"> <li>• Surface cracks, buckling, closing or opening of joints or distortion or damage to elastomeric bearings.</li> </ul>	<ul style="list-style-type: none"> <li>• Following the completion of each of Longwalls 301, 302 and 303.</li> <li>• Greater frequency if determined in consultation with the Technical Committee.</li> </ul>
		Cawley Road Overbridge.	Visual inspection for impacts on: <ul style="list-style-type: none"> <li>• Abutments.</li> <li>• Pier blade wall.</li> <li>• Tetron bearings.</li> <li>• Deck expansion joints.</li> <li>• Steel traffic barrier joints.</li> </ul> To identify development of, or changes in existing: <ul style="list-style-type: none"> <li>• Surface cracks, buckling, closing or opening of joints or distortion or damage to Tetron bearings.</li> </ul>	<ul style="list-style-type: none"> <li>• Following completion of each of Longwalls 301, 302 and 303.</li> <li>• Greater frequency if determined in consultation with the Technical Committee.</li> </ul>

**Table 19 (Continued)**  
**Longwalls 301-303 Environmental Monitoring Program Summary**

Management Plan	Monitoring Component	Sites	Monitoring Parameter/Analysis	Monitoring Frequency
BFMP-RMS (cont.)	Visual Impact Monitoring (cont.)	Pavement	Visual inspection for impacts on: <ul style="list-style-type: none"> <li>Asphaltic concrete surface.</li> <li>Kerbs, gutters and pits.</li> <li>Signs or other road infrastructure.</li> </ul> To identify development of, or changes in existing: <ul style="list-style-type: none"> <li>Asphaltic concrete surface including cracks, buckling and stepping.</li> <li>Kerbs and gutters including cracking, buckling and joint movement.</li> </ul>	<ul style="list-style-type: none"> <li>Prior to the commencement of Longwall 301 extraction.</li> <li>Following the completion of extraction of each Longwall 301, 302 and 303.</li> <li>At a frequency determined in consultation with the Technical Committee if triggered by strain in excess of 0.5 mm/m between adjacent pegs along the Transmission Line (which are surveyed at weekly intervals within 400 m of the active longwall face).</li> <li>Network Safety Inspection twice weekly during the extraction of each Longwalls 301-303.</li> <li>RoadCrack, Gipsicam and Laser Profilometer surveys in accordance with RMS inspection program.</li> </ul>
		Cuttings	Visual inspection for impacts on: <ul style="list-style-type: none"> <li>Cuttings along the M1 Princes Motorway.</li> </ul> To identify: <ul style="list-style-type: none"> <li>Changes in cutting condition, including opening of cracks, spalling.</li> <li>Changes in groundwater seepage or surface water flows.</li> <li>Rockfalls.</li> <li>Changes in RMS risk ranking.</li> </ul>	
		Culverts	CCTV inspection for impacts on internal surfaces. To identify changes to the visible surfaces of the culverts including cracking, buckling, shearing, and collapse.	

**Table 19 (Continued)**  
**Longwalls 301-303 Environmental Monitoring Program Summary**

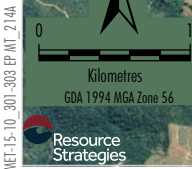
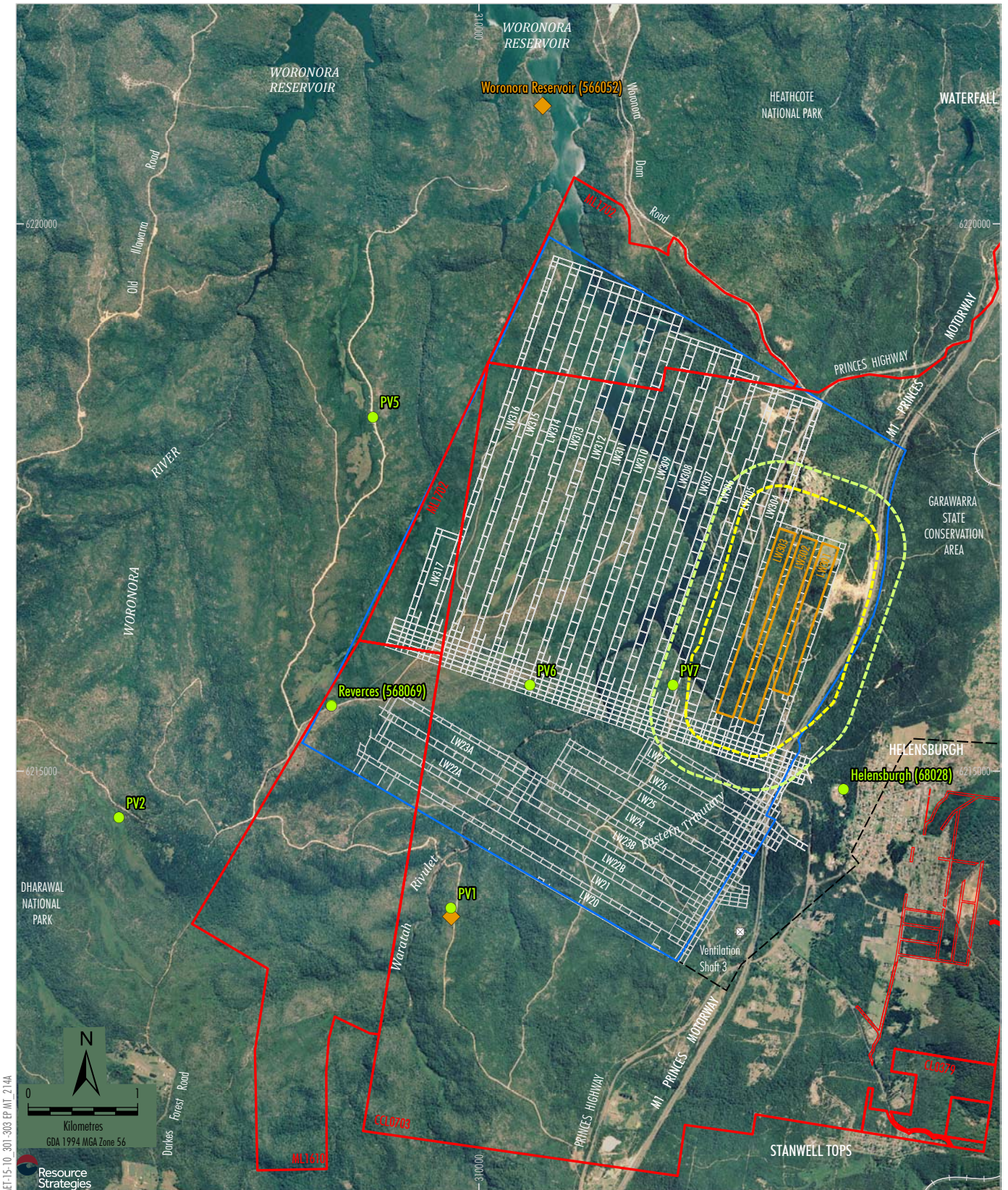
Management Plan	Monitoring Component	Sites	Monitoring Parameter/Analysis	Monitoring Frequency
BFMP-WCC [Old Princes Highway]	Subsidence impacts	Road pavement from Bridge 2 to the entrance to the Garrawarra Centre Complex.	<ul style="list-style-type: none"> <li>Impacts to the surface including cracks, buckling and stepping.</li> </ul>	<ul style="list-style-type: none"> <li>Prior to the commencement of Longwall 301 extraction.</li> <li>Progress monitoring (visual inspections) to occur as longwall face approaches within 400 m of asset to establish more frequent communications.</li> <li>Within 3 months following the completion of extraction of each of Longwalls 301, 302 and 303.</li> <li>Routinely as per WCC inspections (quarterly).</li> </ul>
		Old Princes Highway drainage structures and other furniture	<ul style="list-style-type: none"> <li>Impacts to the visible surfaces of pipes/culverts including cracking, buckling, shearing and collapse.</li> <li>Visible impacts to furniture.</li> </ul>	<ul style="list-style-type: none"> <li>Prior to the commencement of Longwall 301 extraction.</li> <li>Progress monitoring (visual inspections) to occur as longwall face approaches within 400 m of asset to establish more frequent communications.</li> <li>Within 3 months following the completion of extraction of each of Longwalls 301, 302 and 303.</li> <li>Routinely as per WCC inspections.</li> </ul>
BFMP-WCC [Waterfall General (Garrawarra) Cemetery]	Subsidence impacts	Waterfall Cemetery site.	<ul style="list-style-type: none"> <li>Pre and post mining audits (photographic record and commentary).</li> <li>Surface cracks, buckling and general safety.</li> </ul>	<ul style="list-style-type: none"> <li>Prior to the commencement of Longwall 301 extraction.</li> <li>Following the completion of extraction of Longwalls 301-303.</li> </ul>
		Access roads/tracks within 600 m of Longwalls 301-303 extraction.	<ul style="list-style-type: none"> <li>Surface cracks, buckling and general safety.</li> </ul>	<ul style="list-style-type: none"> <li>Prior to the commencement of Longwall 301 extraction.</li> <li>Following the completion of extraction of Longwalls 301-303.</li> <li>Opportunistic visual observations during catchment visits as per the LMP.</li> </ul>

**Table 19 (Continued)**  
**Longwalls 301-303 Environmental Monitoring Program Summary**

Management Plan	Monitoring Component	Sites	Monitoring Parameter/Analysis	Monitoring Frequency
BFMP-Sydney Water	Subsidence impacts	Survey lines along the Old Princes Highway and the Optic / Water Line	<ul style="list-style-type: none"> <li>• Surface ground cracks.</li> <li>• Cracks or leaks in the pipelines.</li> <li>• Fittings can be accessed beneath surface fittings and are operable.</li> </ul>	<ul style="list-style-type: none"> <li>• Prior to the commencement of Longwall 301 extraction.</li> <li>• Routinely as per Sydney Water inspections.</li> <li>• Following the completion of extraction of Longwalls 301, 302 and 303.</li> </ul>
		Sydney Water pipelines	<p>Acoustic monitoring developed in consultation with Sydney Water will be used to monitor for leakage in the Sydney Water pipelines.</p> <p>Routine visual inspections by Sydney Water will also be conducted of the pipelines in accordance with the Sydney Water inspection program.</p>	<ul style="list-style-type: none"> <li>• To be confirmed upon installation of monitoring system and TARP development.</li> </ul>
BFMP-Sydney Trains	Subsidence impacts	Illawarra Rail Line	Any defects of deformation of the rail line and associated infrastructure.	<ul style="list-style-type: none"> <li>• In accordance with the Sydney Trains inspection program (two times per week and annual inspection).</li> </ul>
		Telecommunications tower (and compound)	Structural integrity of the telecommunications tower and compound.	<ul style="list-style-type: none"> <li>• Prior to the commencement of Longwall 301 extraction.</li> <li>• Within 3 months following the completion of extraction of Longwalls 301, 302 and 303.</li> </ul>
BFMP-Axicom	Subsidence impacts	Telecommunications towers (and compounds)	Structural integrity of the telecommunications towers and compounds.	<ul style="list-style-type: none"> <li>• Prior to the commencement of Longwall 301 extraction, or as otherwise agreed.</li> <li>• Within 3 months following the completion of extraction of each of Longwalls 301, 302 and 303.</li> </ul>
		Access roads/tracks within 600 m of Longwalls 301-303 extraction.	Surface cracks, buckling and general safety.	<ul style="list-style-type: none"> <li>• Prior to the commencement of Longwall 301 extraction, or as otherwise agreed.</li> <li>• Following the completion of extraction of Longwalls 301-303.</li> <li>• Opportunistic visual observations during catchment visits as per the LMP.</li> </ul>

**Table 19 (Continued)**  
**Longwalls 301-303 Environmental Monitoring Program Summary**

<b>Management Plan</b>	<b>Monitoring Component</b>	<b>Sites</b>	<b>Monitoring Parameter/Analysis</b>	<b>Monitoring Frequency</b>
PSMP	Cliffs and overhangs, steep slopes and land in general	In accordance with the LMP.	In accordance with the LMP.	In accordance with the LMP.
	Built Features	In accordance with the BFMPs.	In accordance with the BFMPs.	In accordance with the BFMPs.

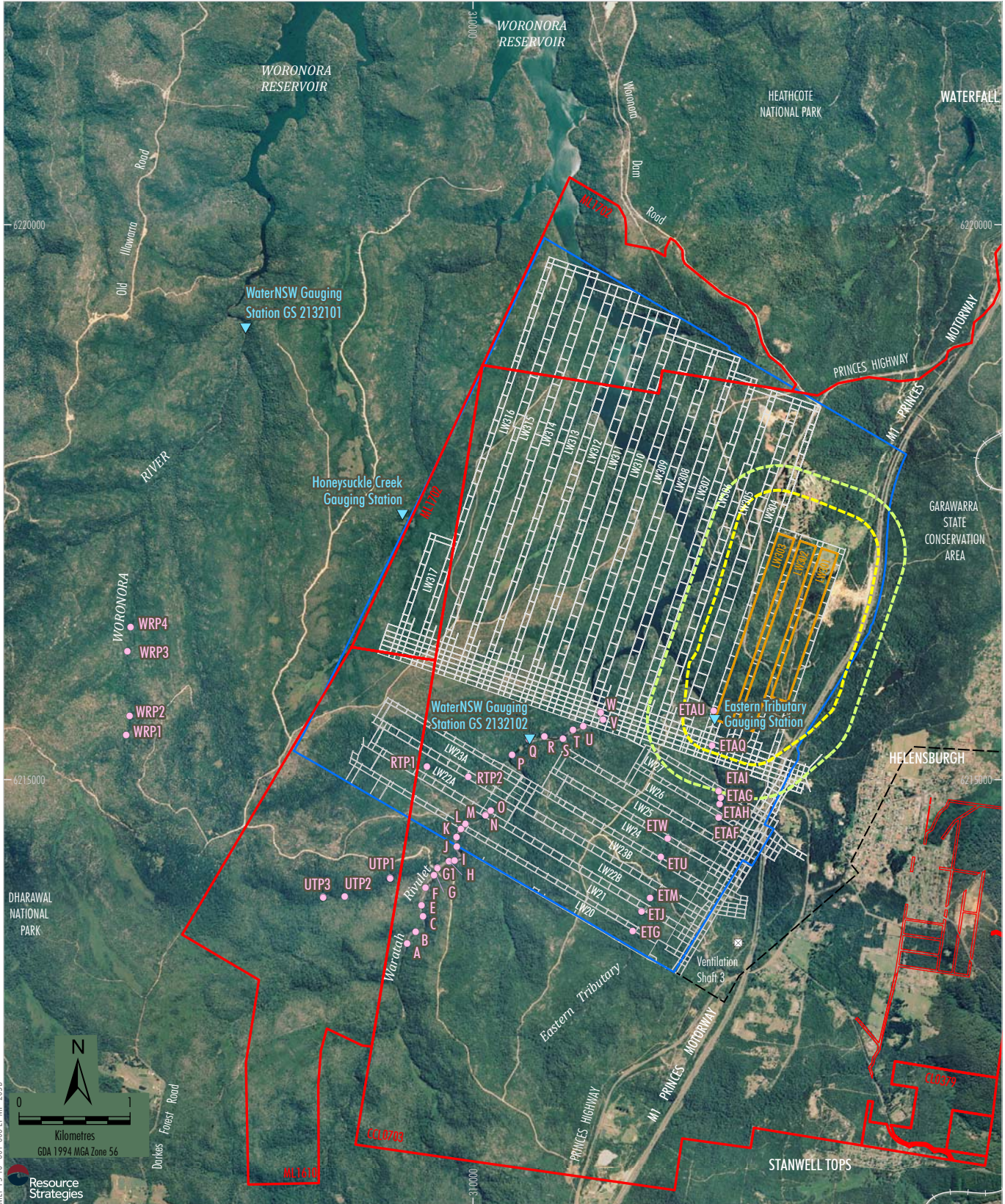


- LEGEND**
- Mining Lease Boundary
  - Railway
  - Project Underground Mining Area  
Longwalls 20-27 and 301-317
  - Longwalls 301 - 303 Secondary Extraction
  - 35° Angle of Draw and/or Predicted  
20 mm Subsidence Contour
  - 600 m from Secondary Extraction of  
Longwalls 301-303
  - Existing Underground Access Drive (Main Drift)
  - ◆ Evaporimeter
  - Pluviometer

Note: The Bureau of Meteorology pluviometer at Darkest Forest (68024) is not shown. It is located approximately 3.75 km south of the Metropolitan Coal pluviometer (PV2).

Source: Land and Property Information (2015); Date of Aerial Photography 1998; Department of Industry (2015); Metropolitan Coal (2016); MSEC (2016)

**Figure 14**



Resource Strategies

Scale: 0 to 1 Kilometres  
GDA 1994 MGA Zone 56

North Arrow

- LEGEND**
- Mining Lease Boundary
  - Railway
  - Project Underground Mining Area  
Longwalls 20-27 and 301-317
  - Longwalls 301 - 303 Secondary Extraction
  - 35° Angle of Draw and/or Predicted  
20 mm Subsidence Contour
  - 600 m from Secondary Extraction of  
Longwalls 301-303
  - Existing Underground Access Drive (Main Drift)
  - ▼ Gauging Station
  - Pool Water Level Site

Source: Land and Property Information (2015); Date of Aerial Photography 1998;  
Department of Industry (2015); Metropolitan Coal (2016); MSEC (2008, 2016)

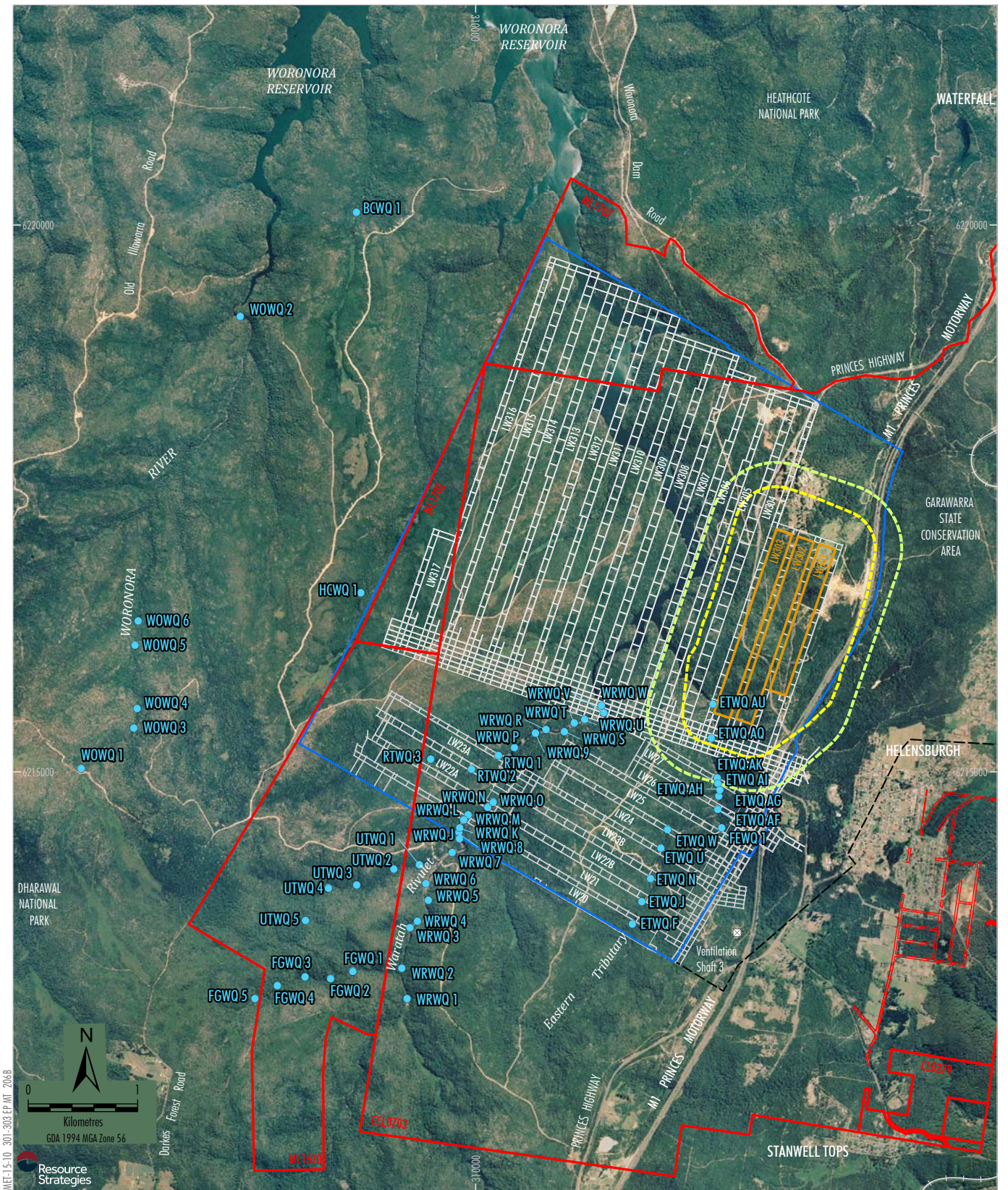
**Peabody**  
ENERGY

METROPOLITAN COAL

Surface Water Quantity Sites

Figure 15





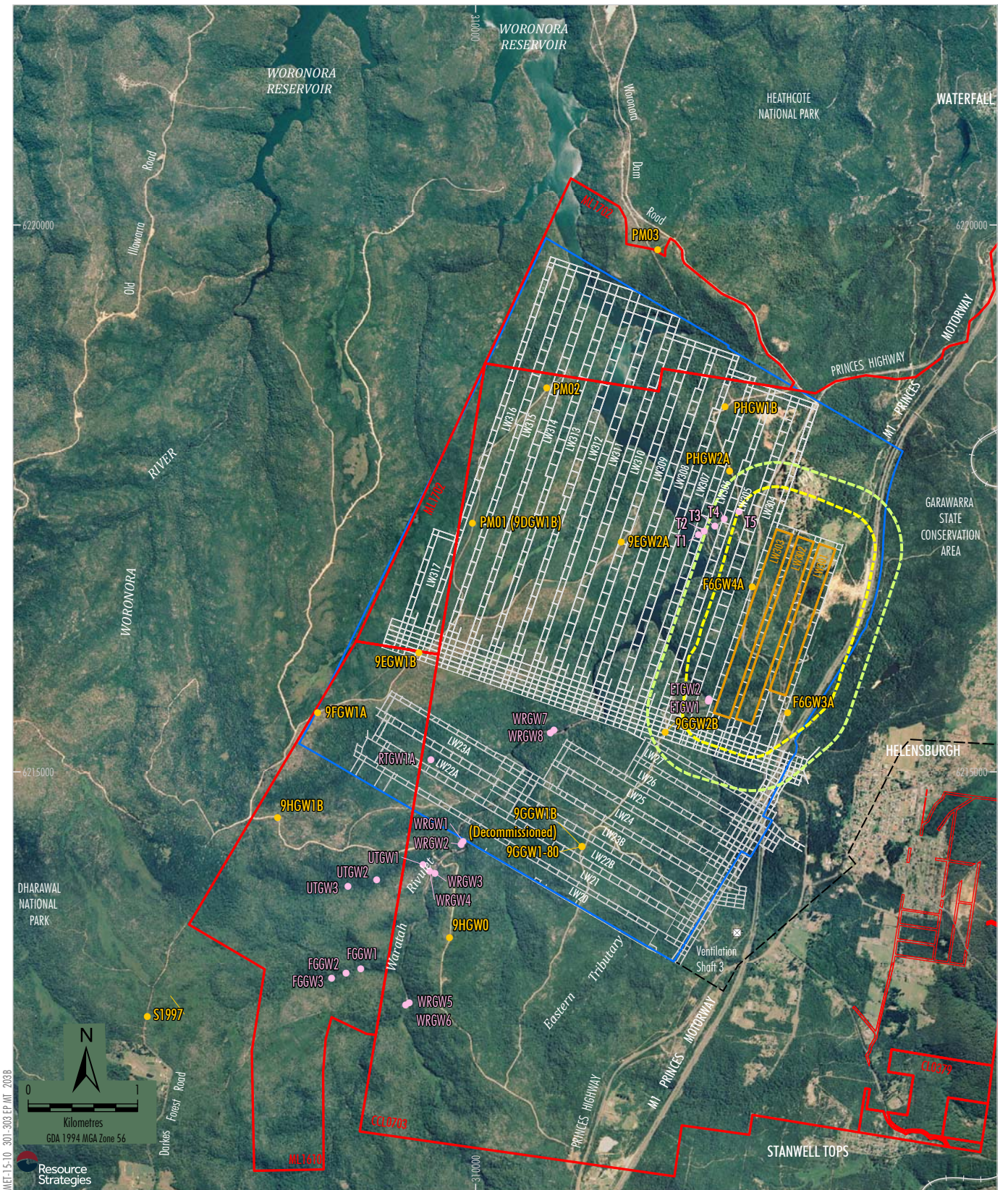
4MET15-10-301-303 EP.MT. 206B  
Resource Strategies

Source: Land and Property Information (2015); Date of Aerial Photography 1998;  
Department of Industry (2015); Metropolitan Coal (2016); MSEC (2016)

- LEGEND**
- Mining Lease Boundary
  - Railway
  - Project Underground Mining Area  
Longwalls 20-27 and 301-317
  - Longwalls 301 - 303 Secondary Extraction
  - 35° Angle of Draw and/or Predicted  
20 mm Subsidence Contour
  - 600 m from Secondary Extraction of  
Longwalls 301-303
  - Existing Underground Access Drive (Main Drift)
  - Surface Water Quality Site

**Peabody**  
ENERGY  
METROPOLITAN COAL  
Surface Water Quality Sites

Figure 16

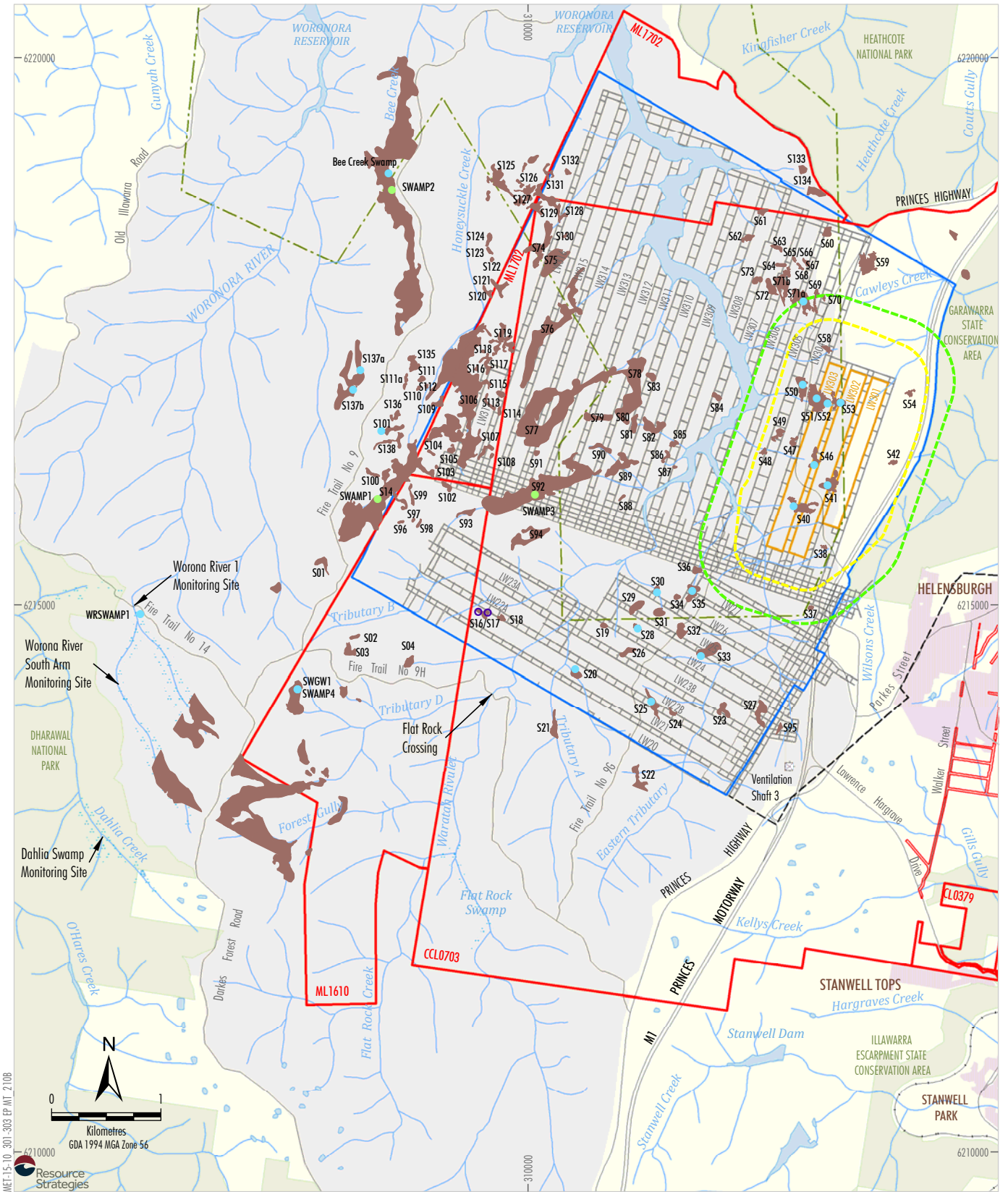


- LEGEND**
- Mining Lease Boundary
  - Railway
  - Project Underground Mining Area  
Longwalls 20-27 and 301-317
  - Longwalls 301 - 303 Secondary Extraction
  - 35° Angle of Draw and/or Predicted  
20 mm Subsidence Contour
  - 600 m from Secondary Extraction of  
Longwalls 301-303
  - Existing Underground Access Drive (Main Drift)
  - Groundwater Level/Pressure Bore
  - Groundwater Level Bore

Source: Land and Property Information (2015); Date of Aerial Photography 1998;  
Department of Industry (2015); Metropolitan Coal (2016); MSEC (2016)

**Peabody**  
ENERGY  
METROPOLITAN COAL  
Groundwater Level  
and/or Pressure Bore Locations

**Figure 17**



MEF-15-10-301-303 EP INT. 2.108

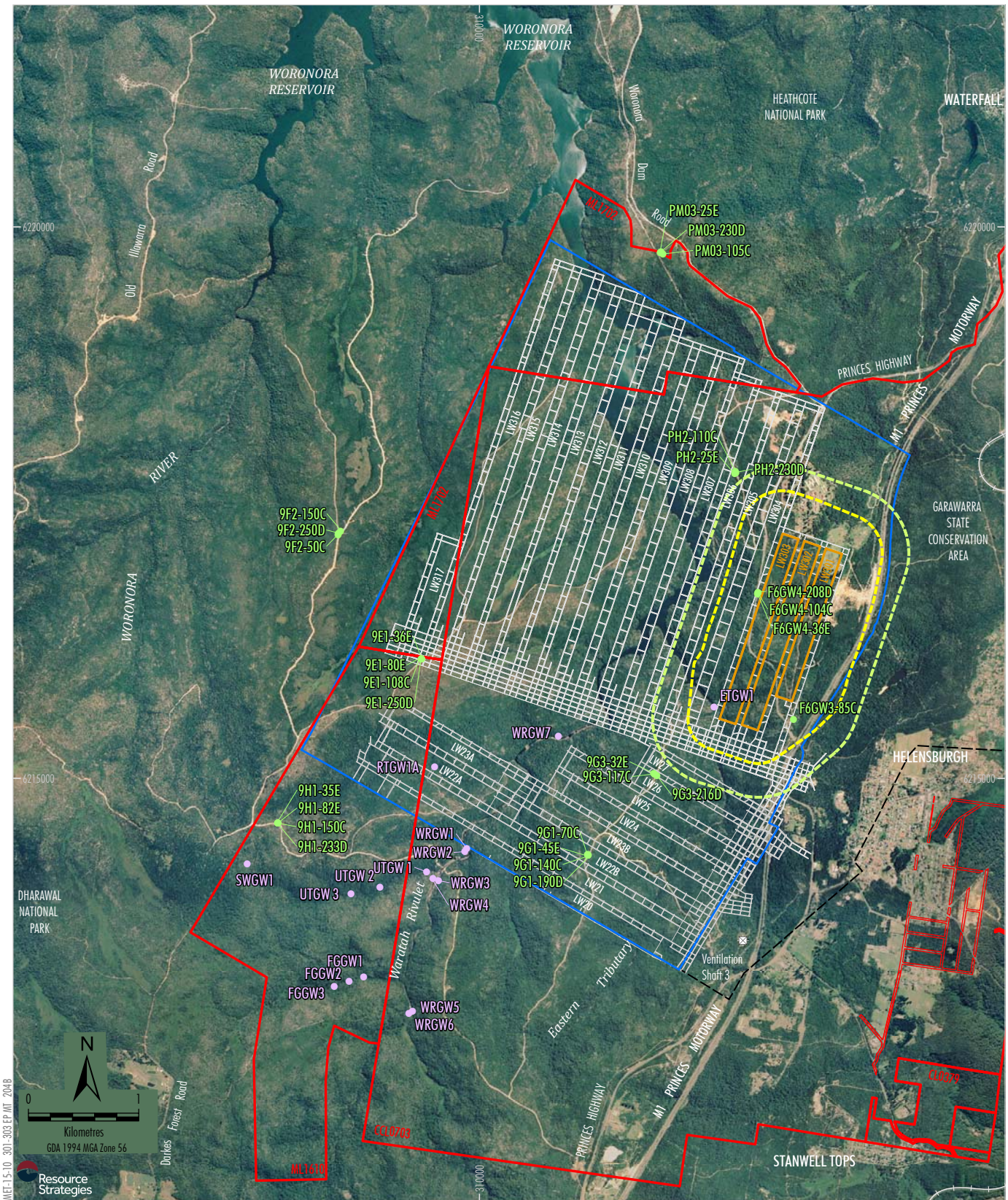
- LEGEND**
- Mining Lease Boundary
  - Woronora Special Area
  - Railway
  - Project Underground Mining Area Longwalls 20-27 and 301-317
  - Longwalls 301 - 303 Secondary Extraction
  - 35° Angle of Draw and/or Predicted 20 mm Subsidence Contour
  - 600 m from Secondary Extraction of Longwalls 301-303
  - Woronora Notification Area
  - Existing Underground Access Drive (Main Drift)

- Upland Swamp
- Swamp Substrate and Shallow Groundwater Piezometer
- Swamp Substrate Groundwater Piezometer
- Swamp Shallow Groundwater Piezometer

Source: Land and Property Information (2015); Department of Industry (2015); Metropolitan Coal (2016); MSEC (2016)

  
**METROPOLITAN COAL**  
 Upland Swamp Groundwater  
 Piezometer Locations

**Figure 18**

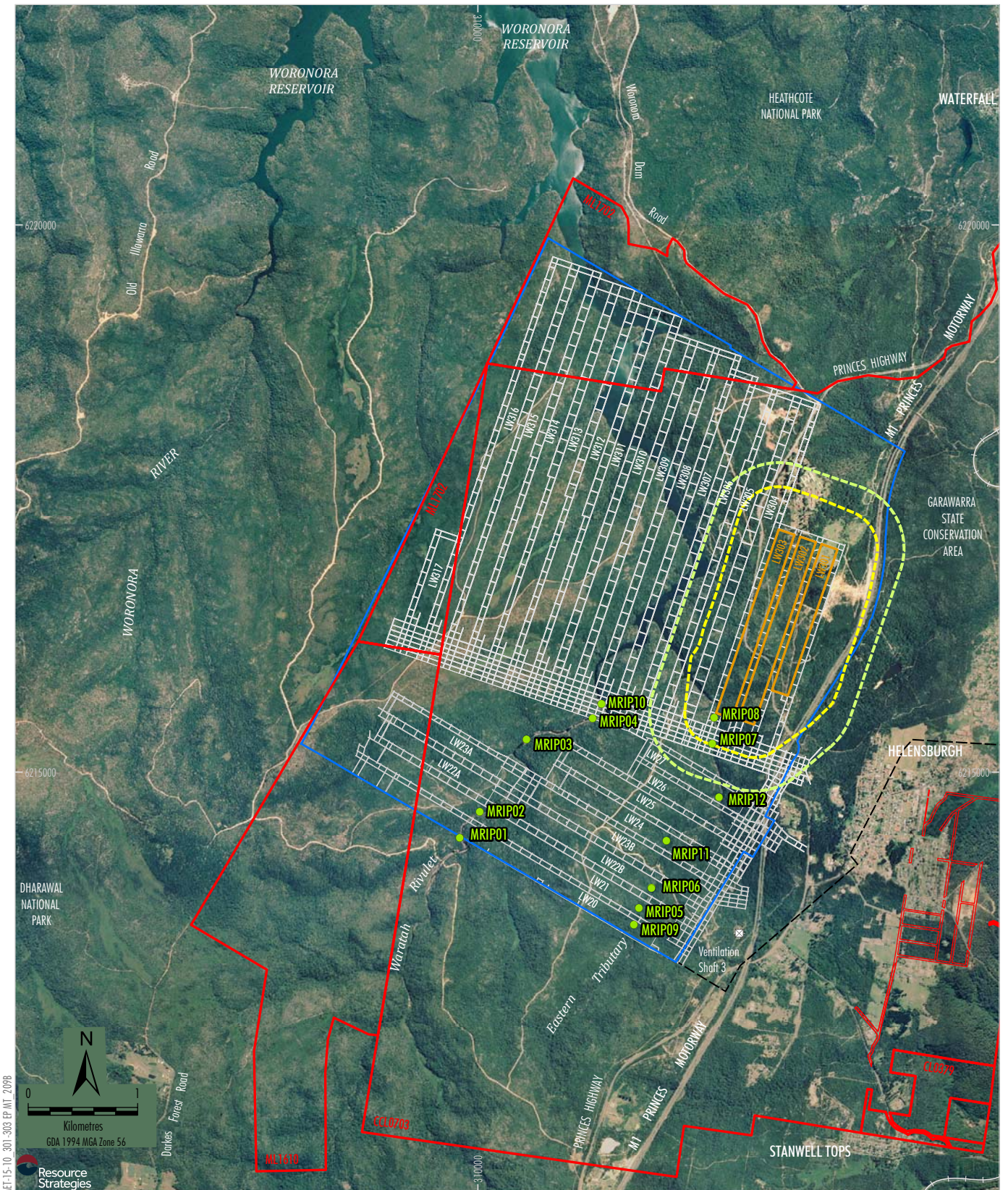


Source: Land and Property Information (2015); Date of Aerial Photography 1998; Department of Industry (2015); Metropolitan Coal (2016); MSEC (2016)

- LEGEND**
- Mining Lease Boundary
  - Railway
  - Project Underground Mining Area  
Longwalls 20-27 and 301-317
  - Longwalls 301 - 303 Secondary Extraction
  - 35° Angle of Draw and/or Predicted  
20 mm Subsidence Contour
  - 600 m from Secondary Extraction of  
Longwalls 301-303
  - Existing Underground Access Drive (Main Drift)
  - Deep Groundwater Chemistry Site
  - Shallow Groundwater Quality Site

**Peabody**  
ENERGY  
METROPOLITAN COAL  
Groundwater Quality Sites

**Figure 19**



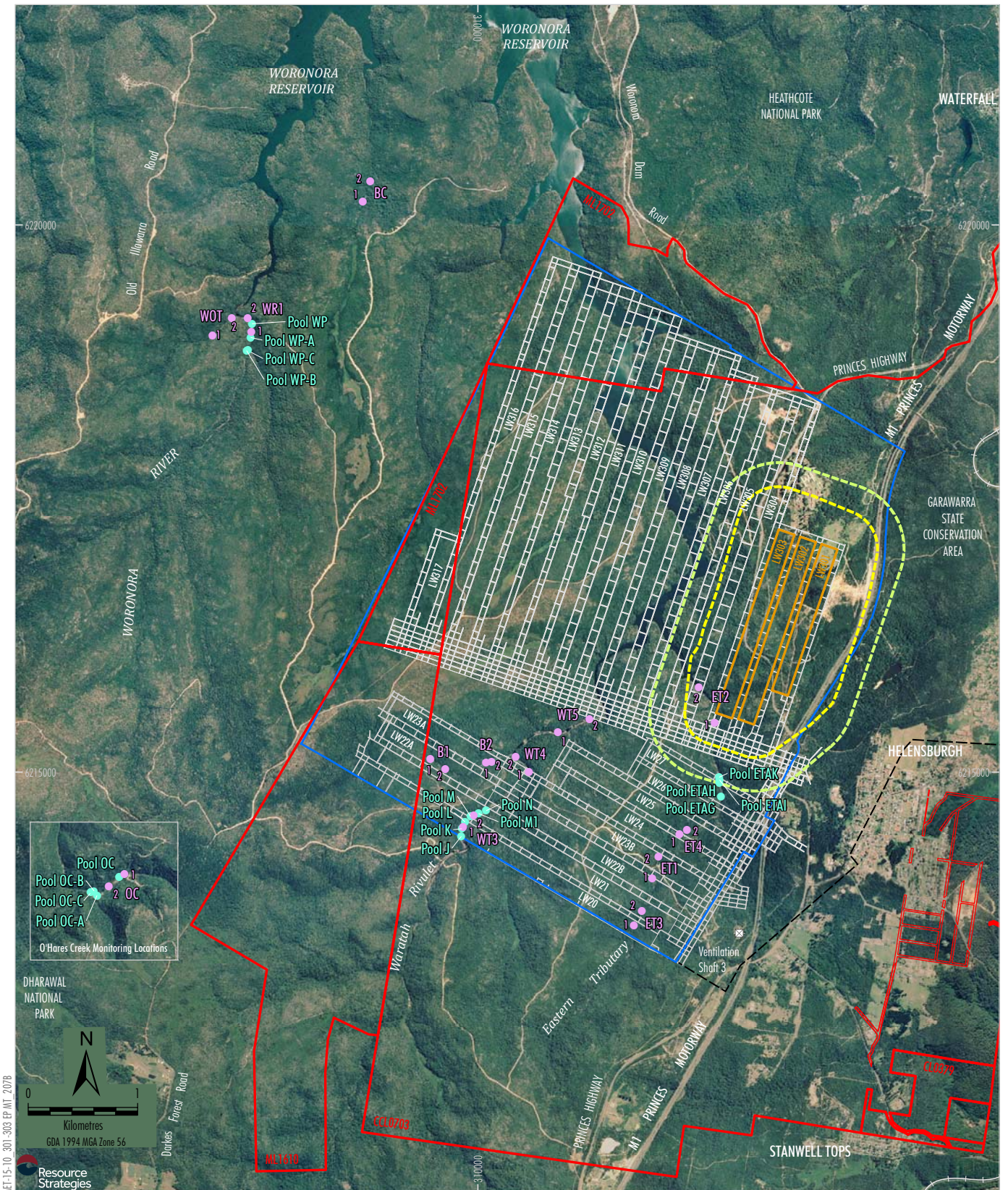
- LEGEND**
- Mining Lease Boundary
  - Railway
  - Project Underground Mining Area  
Longwalls 20-27 and 301-317
  - Longwalls 301 - 303 Secondary Extraction
  - 35° Angle of Draw and/or Predicted  
20 mm Subsidence Contour
  - 600 m from Secondary Extraction of  
Longwalls 301-303
  - Existing Underground Access Drive (Main Drift)

- Monitoring Site**
- Riparian Vegetation Monitoring Site

Source: Land and Property Information (2015); Date of Aerial Photography 1998;  
Department of Industry (2015); Metropolitan Coal (2016); MSEC (2016)

**Peabody**  
ENERGY  
**METROPOLITAN COAL**  
Riparian Vegetation Monitoring Locations

**Figure 20**



Source: Land and Property Information (2015); Date of Aerial Photography 1998; Department of Industry (2015); Metropolitan Coal (2016); MSEC (2016)

**LEGEND**

- Mining Lease Boundary
- Railway
- Project Underground Mining Area  
Longwalls 20-27 and 301-317
- Longwalls 301 - 303 Secondary Extraction
- 35° Angle of Draw and/or Predicted  
20 mm Subsidence Contour
- 600 m from Secondary Extraction of  
Longwalls 301-303
- Existing Underground Access Drive (Main Drift)

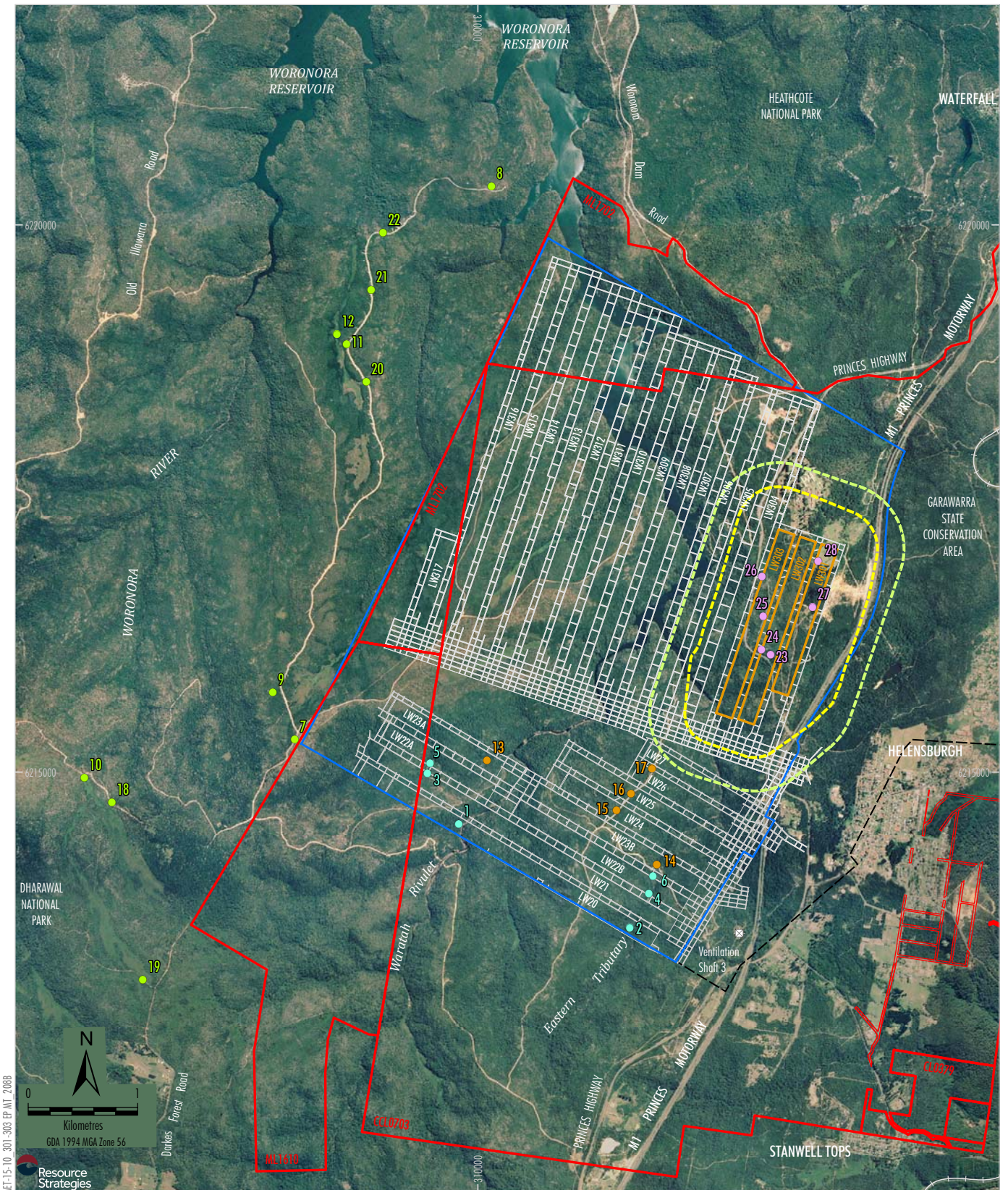
**Monitoring**

- Pool Aquatic Ecology Sampling Site
- Stream Aquatic Ecology Sampling Site



**METROPOLITAN COAL**  
Aquatic Ecology Monitoring Locations

**Figure 21**



- LEGEND**
- Mining Lease Boundary
  - Railway
  - Project Underground Mining Area  
Longwalls 20-27 and 301-317
  - Longwalls 301 - 303 Secondary Extraction
  - 35° Angle of Draw and/or Predicted  
20 mm Subsidence Contour
  - 600 m from Secondary Extraction of  
Longwalls 301-303
  - Existing Underground Access Drive (Main Drift)

- Monitoring Sites**
- Longwalls 20-22 Amphibian Monitoring
  - Longwalls 23-27 Amphibian Monitoring
  - Longwalls 301-303 Amphibian Monitoring
  - Control Site

Source: Land and Property Information (2015); Date of Aerial Photography 1998;  
Department of Industry (2015); Metropolitan Coal (2016); MSEC (2016)

**Peabody**  
ENERGY  
**METROPOLITAN COAL**  
Amphibian Monitoring Locations

**Figure 22**

## 4 IMPLEMENTATION

### 4.1 CONTINGENCY RESPONSE

In the event a subsidence impact performance measure described in Sections 3.1 to 3.6 has been exceeded, Metropolitan Coal will implement the relevant Contingency Plan detailed in the WMP (Appendix A), LMP (Appendix B), BMP (Appendix C), HMP (Appendix D), BFMP (Appendix E) or the PSMP (Appendix F). In general, the Contingency Plans include the following:

- The likely exceedance will be reported to the Manager – Technical Services and/or the Manager – Safety & Environmental Services within 24 hours.
- The Manager – Technical Services or the Manager – Safety & Environmental Services will report the likely exceedance to the General Manager as soon as practicable after becoming aware of the exceedance.
- Metropolitan Coal will report the exceedance to the DP&E, relevant agencies and relevant stakeholders as soon as practicable after Metropolitan Coal becomes aware of the exceedance.
- Metropolitan Coal will conduct an investigation to evaluate the potential contributing factors.
- Metropolitan Coal will identify an appropriate course of action with respect to the identified impact(s), in consultation with specialists, relevant agencies and relevant stakeholders as necessary. For example:
  - proposed management and/or mitigation measures (Section 3);
  - a program to review the effectiveness of the management and/or mitigation measures; and
  - consideration of offsets or adaptive management.

Contingency measures will be developed in consideration of the specific circumstances of the exceedance and the assessment of environmental consequences.

- Metropolitan Coal will submit the proposed course of action to the DP&E for approval.
- Metropolitan Coal will implement the approved course of action to the satisfaction of the DP&E.

In accordance with Condition 6, Schedule 6 of the Project Approval, Metropolitan Coal will provide a suitable offset to compensate for the impact to the satisfaction of the Secretary of the DP&E if either the contingency measures implemented by Metropolitan Coal have failed to remediate the impact or the Secretary of the DP&E determines that it is not reasonable or feasible to remediate the impact.

Relevant management and contingency measures are summarised in Section 3 and outlined in the component management plans (Appendices A to F).

Responsibilities during contingency response are outlined in Section 4.7, which is designed to clearly outline actions, levels of responsibility within Metropolitan Coal and reporting requirements where monitoring results indicate that impacts are exceeding (or likely to exceed) predicted or approved limits. This table is designed to support the Trigger Action Response Plans (TARPs) provided in the component management plans (Appendices A to F). These TARPs will be developed further as this Extraction Plan is reviewed and revised.

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## 4.2 ADAPTIVE MANAGEMENT

Metropolitan Coal will implement an adaptive management approach for the Project. Adaptive management will involve:

- Planning – developing management strategies to meet performance measures; identifying performance indicators to assess performance; and establishing monitoring programs to monitor against the performance measures.
- Implementation – implementing management strategies and monitoring impacts against performance indicators.
- Review – reviewing and evaluating the effectiveness of management strategies by analysis of monitoring data against predicted impacts, performance indicators and performance measures in accordance with the schematic presented in Figure 13.
- Contingency Response – implementing contingency plans where an exceedance of a subsidence impact performance measure or an unexpected impact is detected (Section 4.1).
- Adjustment – adjusting management strategies to improve performance.

## 4.3 REPORTING FRAMEWORK

Metropolitan Coal has developed a reporting framework for the Extraction Plan based on the nature of the predicted subsidence impacts and consequences, and streamlining of reporting requirements.

Table 20 provides a summary of the proposed reporting framework, including which stakeholders will receive copies of each report and the distribution method. The subsections below provide further detail on the contents of each reporting mechanism.

### 4.3.1 Incident Report

An incident is defined as a set of circumstances that causes or threatens to cause or threatens to cause material harm to the environment, and/or breaches or exceeds the limits or performance measures/criteria in the Project Approval.

The reporting of incidents will be conducted in accordance with Condition 6, Schedule 7 of the Project Approval. Metropolitan Coal will notify the Secretary of the DP&E and any other relevant agencies (Table 20) of any incident associated with the Project as soon as practicable after Metropolitan Coal becomes aware of the incident. Within seven days of the date of the incident, Metropolitan Coal will provide the Secretary of the DP&E and relevant agencies with a detailed report on the incident.

An Incident Report will include the following:

- details on the nature of the incident (including survey results, photographs and date of the incident);
- results of investigation(s) to identify/evaluate the contributing factors to the incident;
- proposed course of action and development of contingency measures; and
- relevant Metropolitan Coal contact details to obtain further information on the incident.

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**Table 20**  
**Summary of Reporting Framework**

<b>Report</b>	<b>Frequency</b>	<b>Distribution</b>	<b>Distribution Method<sup>1</sup></b>	<b>Responsibility for Data Collation and Preparation</b>	<b>Responsibility for Submission</b>
Incident Report	As required	DP&E (Secretary of the DP&E, c/- Executive Director) DRE (Manager and Principal Inspector, Environment) Other regulators as specified in management plans	Email	Manager – Technical Services or Manager – Safety & Environmental Services	Manager – Technical Services, Manager – Safety & Environmental Services or General Manager
Bi-monthly Subsidence Impact Report	Every two months	DP&E (Director, Resource Assessments) WaterNSW (Manager, Mining) DRE (Manager and Principal Inspector, Environment)	Email	Manager – Technical Services or Manager – Safety & Environmental Services	Manager – Technical Services or Manager – Safety & Environmental Services
Six Monthly Report	Six monthly	DP&E (Director, Resource Assessments)	Email and Post	Manager – Technical Services or Manager – Safety & Environmental Services	Manager – Technical Services or Manager – Safety & Environmental Services
Annual Review	Annually	DP&E (Director, Resource Assessments) DRE (Manager and Principal Inspector, Environment) Other regulators as specified in management plans Metropolitan Coal website	Email, Post and Website	Manager – Technical Services or Manager – Safety & Environmental Services	Manager – Technical Services or Manager – Safety & Environmental Services
Complaints Register	Updated following receipt of complaints	Metropolitan Coal website	Website	Manager – Safety & Environmental Services	Manager – Safety & Environmental Services

<sup>1</sup> See Attachment 4 for distribution details.

### 4.3.2 Bi-monthly Subsidence Impact Reporting

Bi-monthly Subsidence Impact Reports will be prepared every two months if new subsidence impacts are identified. The Bi-monthly Subsidence Impact Report will include:

- a description of the subsidence impact(s) and location;
- whether the observed/recorded impact(s) is within predictions;
- whether the observed/recorded impact(s) exceeds predictions, but remain within performance measures;
- whether the observed/recorded impact(s) exceeds the performance measure(s); and
- associated preliminary characterisation of the impact(s) in accordance with the relevant TARP(s).

### 4.3.3 Six Monthly Reporting

A Six Monthly Report will be prepared to report on subsidence impacts and environmental consequences associated with the longwalls 301-303 Extraction Plan. The Six Monthly Report will include:

- a comprehensive summary of all subsidence impacts, including a revised characterisation according to the relevant TARP(s);
- any proposed actions resulting from Triggers being met in the TARP, or other actions;
- assessment of compliance with all relevant subsidence impact performance measures and indicators; and
- a comprehensive summary of all quantitative and qualitative environmental monitoring results, including landscape monitoring, water quality data, water flow and pool level data, piezometer readings, etc.

### 4.3.4 Annual Review

An Annual Review will be prepared and submitted in accordance with Condition 3, Schedule 7 of the Project Approval. The Annual Review will review the performance of the Project to the satisfaction of the Secretary of the DP&E and will:

- Describe the works that were carried out in the past calendar year, and the works that are proposed to be carried out over the current calendar year;
- Include a comprehensive review of the monitoring results and complaints records of the Project over the past calendar year, which includes a comparison of these results against:
  - the relevant statutory requirements, limits or performance measures/criteria;
  - the monitoring results of previous years; and
  - the relevant predictions in the Project EA, Preferred Project Report and Extraction Plan.
- 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

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- Describe what measures will be implemented over the next year to improve the environmental performance of the Project.

#### 4.3.5 Complaints

The Manager – Safety & Environmental Services is responsible for maintaining a system for recording complaints.

Metropolitan Coal will maintain public signage advertising the telephone number on which environmental complaints can be made. The Manager – Safety & Environmental Services is responsible for ensuring that the currency and effectiveness of the service is maintained. Notifications of complaints received are to be provided as quickly as practicable to the Manager – Safety & Environmental Services.

Complaints and enquiries do not have to be received via the telephone line and may be received in any other form. Any complaint or enquiry relating to environmental management or performance is to be relayed to the Manager – Safety & Environmental Services as soon as practicable. All employees are responsible for ensuring the prompt relaying of complaints. All complaints will be recorded in a complaints register.

For each complaint, the following information will be recorded in the complaints register:

- date and time of complaint;
- method by which the complaint was made;
- personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;
- nature of the complaint;
- the action(s) taken by Metropolitan Coal in relation to the complaint, including any follow-up contact with the complainant; and
- if no action was taken by Metropolitan Coal, the reason why no action was taken.

The Manager – Safety & Environmental Services is responsible for ensuring that all complaints are appropriately investigated, actioned and that information is fed back to the complainant, unless requested to the contrary.

In accordance with Condition 10, Schedule 7 of the Project Approval, the complaints register will be made publicly available on the website and updated on a monthly basis. A summary of complaints received and actions taken will be presented to the CCC as part of the operational performance review.

#### 4.4 REVIEW OF THE EXTRACTION PLAN

In accordance with Condition 4, Schedule 7 of the Project Approval, this Extraction Plan will be reviewed within three months of the submission of:

- an audit under Condition 8, Schedule 7;
- an incident report under Condition 6, Schedule 7;

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(c) an annual review under Condition 3, Schedule 7; and

if necessary, revised to the satisfaction of the Secretary of the DP&E, to ensure the Extraction Plan is updated on a regular basis and to incorporate any recommended measures to improve environmental performance.

The Extraction Plan will also be reviewed within three months of approval of any Project modification and if necessary, revised to the satisfaction of the DP&E. The revision status of this Extraction Plan is indicated on the title page of each copy.

#### **4.5 DISTRIBUTION**

In accordance with Condition 10, Schedule 7 of the Project Approval, Metropolitan Coal will make the Extraction Plan publicly available on the Peabody website. A hard copy of the Extraction Plan will also be maintained at the Metropolitan Coal site.

Metropolitan Coal recognises that various regulators have different distribution requirements, both in relation to whom documents should be sent and in what format. An Environmental Management Plan and Monitoring Program Distribution Register has been established in consultation with the relevant agencies and infrastructure owners that indicates:

- to whom the Metropolitan Coal plans and programs, such as the Extraction Plan, will be distributed;
- the format (i.e. electronic or hard copy) of distribution; and
- the format of revision notification.

Metropolitan Coal will make the Distribution Register publicly available on the Peabody website.

Metropolitan Coal will be responsible for maintaining the Distribution Register and for ensuring that the notification of revisions are sent by email or post as appropriate.

In addition, Metropolitan Coal employees with local computer network access will be able to view the controlled electronic version of this Extraction Plan on the Metropolitan Coal local area network. Metropolitan Coal will not be responsible for maintaining uncontrolled copies beyond ensuring the most recent version is maintained on Metropolitan Coal's computer system and the Peabody website.

#### **4.6 REVIEW OF OTHER MANAGEMENT PLANS**

Metropolitan Coal commits to reviewing and revising if necessary the following management plans to be consistent with the Longwalls 301-303 Extraction Plan:

- Environmental Management Strategy;
- Catchment Monitoring Program;
- Construction Management Plan; and
- Rehabilitation Management Plan.

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#### 4.7 KEY RESPONSIBILITIES

Key responsibilities under this Extraction Plan are summarised in Table 21. The component management plans provide additional responsibilities under the plans.

**Table 21**  
**Key Extraction Plan Responsibilities**

<b>Responsibility</b>	<b>Task</b>
General Manager	<ul style="list-style-type: none"> <li>• Ensure resources are available to Metropolitan Coal personnel to facilitate the completion of responsibilities under this Extraction Plan.</li> <li>• Ensure the safety of Metropolitan Coal employees and the public in relation to Metropolitan Coal operations.</li> <li>• Approve and instruct implementation of remediation/corrective action/compensation, if necessary.</li> </ul>
Mine Manager	<ul style="list-style-type: none"> <li>• Ensure the safety of Metropolitan Coal employees and the public in relation to Metropolitan Coal operations.</li> <li>• Ensure adequate resources are available for implementation of remediation/corrective actions.</li> </ul>
Manager – Technical Services	<ul style="list-style-type: none"> <li>• Liaise with relevant stakeholders regarding environmental management.</li> <li>• Ensure monitoring and reporting required in accordance with this Extraction Plan are carried out within specified timeframes, are adequately checked and processed and are prepared to the required standard.</li> <li>• Ensure that any Incident Reports are lodged in a timely manner with all available information.</li> <li>• Ensure that reviews of this Extraction Plan and other plans are conducted as described in Sections 4.4 and 4.6.</li> <li>• Liaise with relevant stakeholders regarding subsidence impact management and related public safety hazards.</li> </ul>
Manager – Safety & Environmental Services	<ul style="list-style-type: none"> <li>• Liaise with relevant stakeholders regarding environmental management.</li> <li>• Ensure monitoring and reporting required in accordance with this Extraction Plan are carried out within specified timeframes, are adequately checked and processed and are prepared to the required standard.</li> <li>• Ensure that any Incident Reports are lodged in a timely manner with all available information.</li> <li>• Ensure that reviews of this Extraction Plan and other plans are conducted as described in Sections 4.4 and 4.6.</li> </ul>
Registered Mine Surveyor	<ul style="list-style-type: none"> <li>• Undertake all subsidence monitoring to the required standard within the specified timeframes and ensure data are adequately checked, processed and recorded.</li> </ul>

## 5 REFERENCES

- Department of Planning and Environment and NSW Trade & Investment – Division of Resources and Energy (2015) *Guidelines for the Preparation of Extraction Plans Required under Conditions of Development Consents, Project Approvals and Mining Lease Conditions for Underground Coal Mining*. Version 5. Draft.
- Helensburgh Coal Pty Ltd (2008) *Metropolitan Coal Project Environmental Assessment*.
- Helensburgh Coal Pty Ltd (2009) *Metropolitan Coal Project Preferred Project Report*.
- Metropolitan Coal Pty Ltd (2016a) *Letter to the NSW Department of Planning and Environment, Re: Condition 5, Schedule 3 of the Metropolitan Coal Project Approval*. 5 May 2016.
- Metropolitan Coal Pty Ltd (2016b) *Metropolitan Coal Longwalls 301-303 Environmental Risk Assessment Report*. June 2016.
- Mine Subsidence Engineering Consultants (2016) *Metropolitan Mine – Longwalls 301 to 303 Subsidence Predictions and Impact Assessments for the Natural and Built Features in Support of the Extraction Plan (MSEC Report MSEC846)*.
- SP Solutions (2008) *Metropolitan Coal Project Environmental Risk Analysis*. Appendix O in the Helensburgh Coal Pty Ltd (2008) *Metropolitan Coal Project Environmental Assessment*.

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