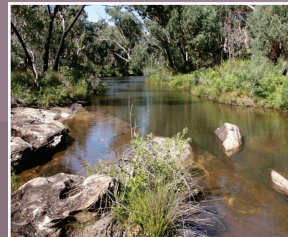


METROPOLITAN COAL LONGWALLS 305-307

BUILT FEATURES MANAGEMENT PLAN



METROPOLITAN COAL

LONGWALLS 305-307

BUILT FEATURES MANAGEMENT PLAN

ENDEAVOUR ENERGY

ME-TSE-MNP-0085

Revision Status Register

Section/Page/ Annexure	Revision Number	Amendment/Addition	Distribution	DPIE Approval Date
All	LW305-307 BFMP_END-R01-A	Original	Endeavour Energy, DRG and DPIE	16 March 2020
All	LW305-307 BFMP_END-R01-B	Updated to reflect 50 m extension of Longwall 307	DPIE	

June 2021

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1 INTRODUCTION

Metropolitan Coal is a wholly owned subsidiary of Peabody Energy Australia Pty Ltd (Peabody). Metropolitan Coal was granted approval for the Metropolitan Coal Project (the Project) under section 75J of the New South Wales (NSW) *Environmental Planning and Assessment Act, 1979* 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 (Longwalls 20-27 and Longwalls 301-317) and surface facilities at Metropolitan Coal. The underground mining longwall layout is shown on Figure 1. Longwalls 305-307 are situated to the west of Longwalls 301-304, and define the next mining sub-domains within the Project underground mining area (Figures 1 to 3).

1.1 PURPOSE AND SCOPE

In accordance with Condition 6(f), Schedule 3 of the Project Approval, this Built Features Management Plan – Endeavour Energy (BFMP-END) has been developed to manage the potential consequences of longwall extraction on the Endeavour Energy assets associated with the 132 kV transmission line and towers, and other high voltage powerlines and poles.

The relationship of this BFMP-END to the Metropolitan Coal Environmental Management Structure is shown on Figure 4.

This BFMP-END includes post-mining monitoring and management of Endeavour Energy assets subject to the previously approved Metropolitan Coal Longwall 304 Extraction Plan

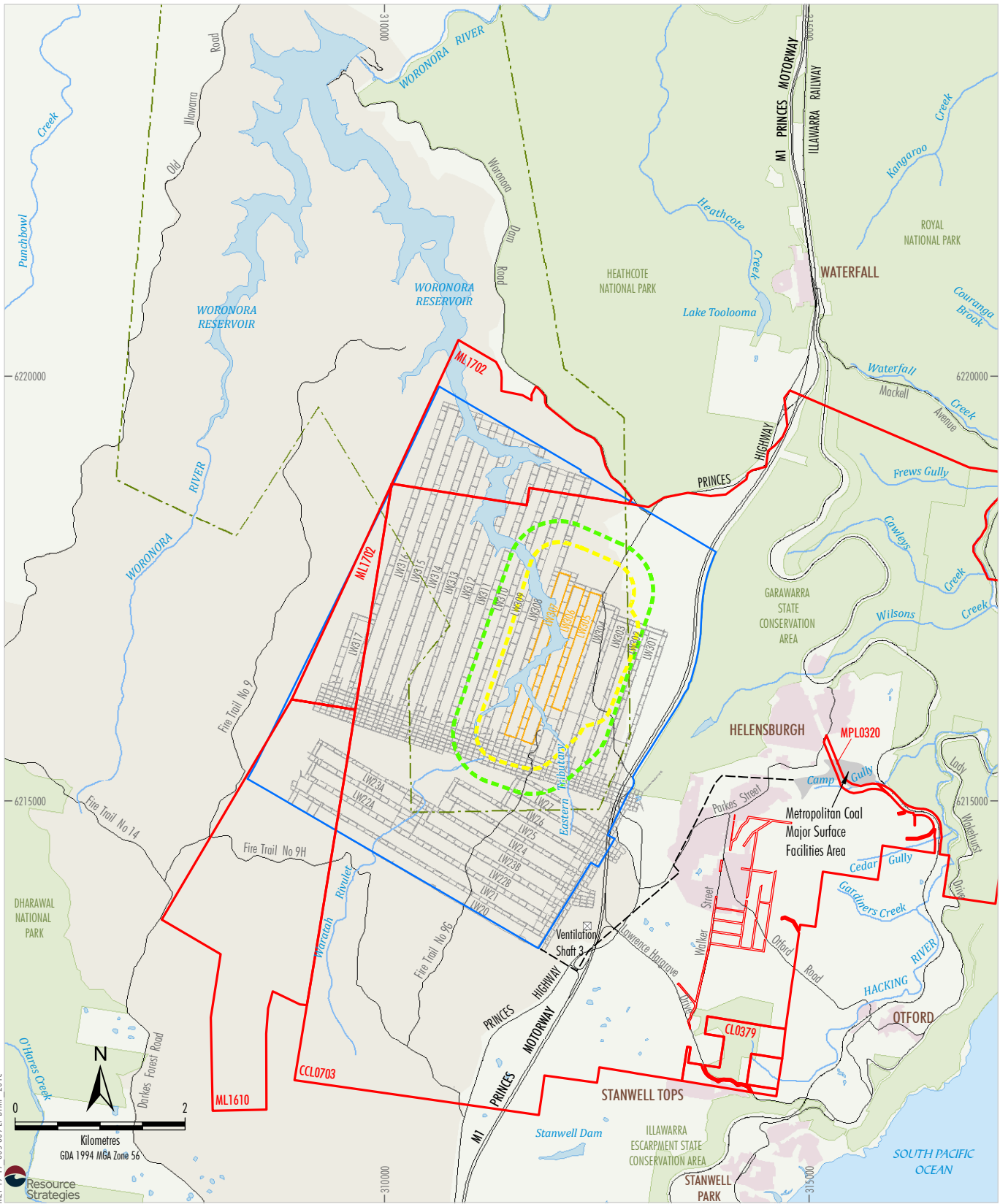
In accordance with Condition 6, Schedule 3 of the Project Approval, the suitably qualified and experienced experts that have prepared this BFMP-END, namely representatives from Mine Subsidence Engineering Consultants (MSEC) and Metropolitan Coal were endorsed by the Secretary of the Department of Planning and Environment (DP&E) (now the NSW Department of Planning, Industry and Environment [DPIE]). This BFMP-END has been prepared in consultation with Endeavour Energy, including consideration of prior consultation during the development of the previously approved Built Features Management Plans.

1.2 STRUCTURE OF THE BFMP-END

The remainder of the BFMP-END is structured as follows:

- Section 2: Describes the review and update of the BFMP-END.
- Section 3: Outlines the statutory requirements applicable to the BFMP-END.
- Section 4: Provides a revised assessment of the potential subsidence impacts and environmental consequences for Longwalls 305-307.
- Section 5: Details the performance measures and indicators that will be used to assess the Project.
- Section 6: Provides the detailed baseline data.
- Section 7: Describes the monitoring program.
- Section 8: Describes the management measures that will be implemented.
- Section 9: Provides a contingency plan to manage any unpredicted impacts and their consequences.

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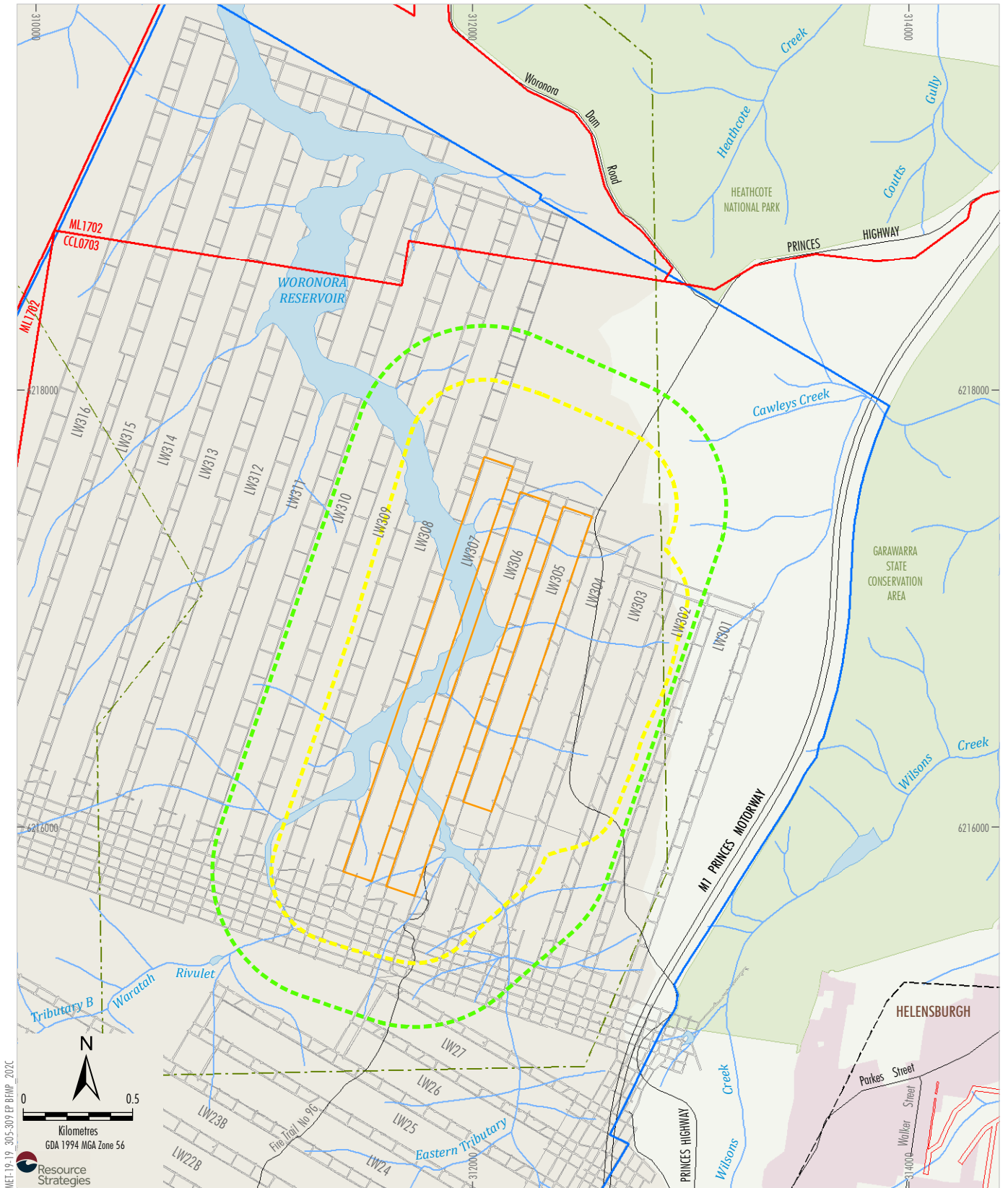


- LEGEND**
- Mining Lease Boundary
 - Woronora Special Area
 - Railway
 - Project Underground Mining Area
Longwalls 20-27 and 301-317
 - Longwalls 305-307 Secondary Extraction
 - Longwalls 305-307 35° Angle of Draw and/or
Predicted 20 mm Subsidence Contour
 - 600 m from Longwalls 305-307
Secondary Extraction
 - Woronora Notification Area
 - Existing Underground Access Drive (Main Drift)

Source: Land and Property Information (2015); Department of Industry (2015); Metropolitan Coal (2019); MSEC (2019)

Peabody
METROPOLITAN COAL
Longwalls 305-307 and
Project Underground Mining Area

Figure 1



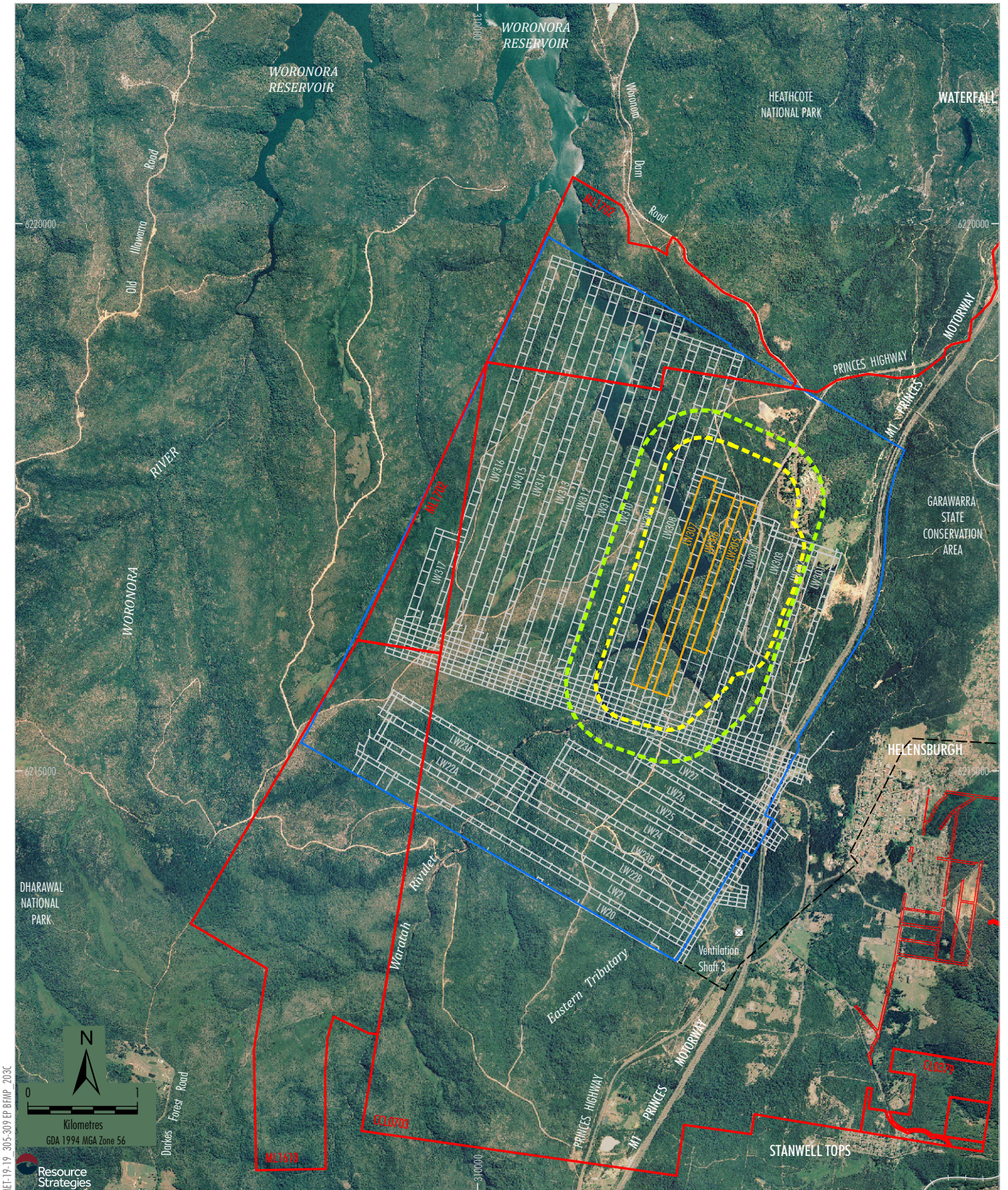
LEGEND

- Mining Lease Boundary
- Woronora Special Area
- Project Underground Mining Area
Longwalls 20-27 and 301-317
- Longwalls 305-307 Secondary Extraction
- Longwalls 305-307 35° Angle of Draw and/or
Predicted 20 mm Subsidence Contour
- 600 m from Longwalls 305-307
Secondary Extraction
- Woronora Notification Area
- Existing Underground Access Drive (Main Drift)

Source: Land and Property Information (2015); Department of Industry (2015);
Metropolitan Coal (2019); MSEC (2019)

Peabody
METROPOLITAN COAL
Longwalls 305-307 Layout

Figure 2

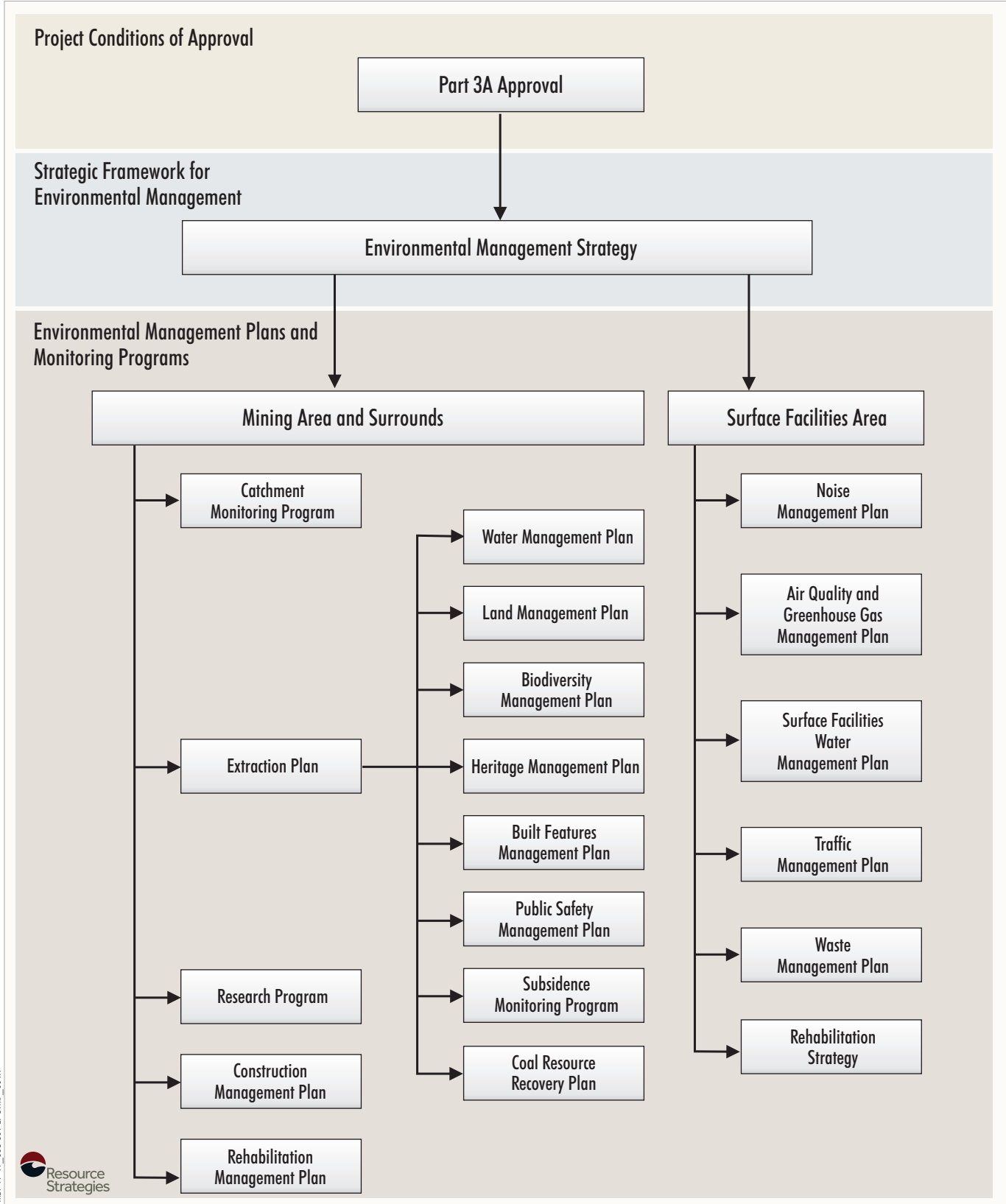


- LEGEND
- Mining Lease Boundary
 - Railway
 - Project Underground Mining Area
Longwalls 20-27 and 301-317
 - Longwalls 305-307 Secondary Extraction
 - Longwalls 305-307 35° Angle of Draw and/or
Predicted 20 mm Subsidence Contour
 - 600 m from Longwalls 305-307
Secondary Extraction
 - Existing Underground Access Drive (Main Drift)

Source: Land and Property Information (2015); Date of Aerial Photography 1998;
Department of Industry (2015); Metropolitan Coal (2019); MSEC (2019)

Peabody
METROPOLITAN COAL
Longwalls 305-307 and
Project Underground Mining Area-
Aerial Photograph

Figure 3



ME1-19_305-309 EP BRMP_001A

Figure 4

- Section 10: Describes the Trigger Action Response Plan (TARP) management tool.
- Section 11: Describes the program to collect sufficient baseline data for future Extraction Plans.
- Section 12: Describes the annual review and improvement of environmental performance.
- Section 13: Outlines the management and reporting of incidents.
- Section 14: Outlines the management and reporting of complaints.
- Section 15: Outlines the management and reporting of non-compliances with statutory requirements.
- Section 16: Lists the references cited in this BFMP-END.

2 BFMP-END REVIEW AND UPDATE

In accordance with Condition 4, Schedule 7 of the Project Approval, this BFMP-END 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;
- an annual review under Condition 3, Schedule 7; and

if necessary, revised to the satisfaction of the Director-General (now Secretary) of the DPIE, to ensure the plan is updated on a regular basis and to incorporate any recommended measures to improve environmental performance.

This BFMP will also be reviewed within three months of approval of any Project modification and if necessary, revised to the satisfaction of the DPIE.

The revision status of this document is indicated on the title page of each copy of the BFMP-END. The distribution register for controlled copies of the BFMP-END is described in Section 2.1.

Revisions to any documents listed within this BFMP-END will not necessarily constitute a revision of this document.

2.1 DISTRIBUTION REGISTER

In accordance with Condition 10, Schedule 7 'Access to Information', Metropolitan Coal will make the BFMP-END publicly available on the Peabody website. A hard copy of the BFMP-END 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 BFMP-END, will be distributed;
- the format (i.e. electronic or hard copy) of distribution; and
- the format of revision notification.

Metropolitan Coal has made the Distribution Register publicly available on the Peabody website.

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Metropolitan Coal will be responsible for maintaining the Distribution Register and for ensuring that the notification of revisions is 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 BFMP-END 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.

3 STATUTORY REQUIREMENTS

Metropolitan Coal’s statutory obligations are contained in:

- (i) the conditions of the Project Approval;
- (ii) relevant licences and permits, including conditions attached to mining leases; and
- (iii) other relevant legislation.

These are described below.

3.1 EP&A ACT APPROVAL

Condition 6(f), Schedule 3 of the Project Approval requires the preparation of a BFMP as a component of Extraction Plan(s) for second workings. Project Approval Condition 6(f), Schedule 3 states:

SECOND WORKINGS

Extraction Plan

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. This plan must:*

...

(f) *include a:*

...

- *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;*

...

In addition, Condition 2, Schedule 7 and Condition 7, Schedule 3 of the Project Approval outline management plan requirements that are applicable to the preparation of the BFMP-END. Table 1 indicates where each component of the conditions is addressed within this BFMP-END.

**Table 1
Management Plan Requirements**

Project Approval Condition	BFMP-END Section
Condition 2 of Schedule 7	
2. The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:	
a) detailed baseline data;	Section 6
b) a description of:	
• the relevant statutory requirements (including any relevant approval, licence or lease conditions);	Section 3
• any relevant limits or performance measures/criteria;	Section 5
• the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;	Section 5
c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Sections 7, 8, 9 and 10
d) a program to monitor and report on the:	
• impacts and environmental performance of the project;	Sections 7, 8 and 12
• effectiveness of any management measures (see c above);	
e) a contingency plan to manage any unpredicted impacts and their consequences;	Section 9 and Appendix 3
f) a program to investigate and implement ways to improve the environmental performance of the project over time;	Sections 7 and 12
g) a protocol for managing and reporting any:	
• incidents;	Section 13
• complaints;	Section 14
• non-compliances with statutory requirements; and	Section 15
• exceedances of the impact assessment criteria and/or performance criteria; and	Section 9 and Appendix 3
h) a protocol for periodic review of the plan.	Section 2
Condition 7 of Schedule 3	
7. In addition to the 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:	
a) a program to collect sufficient baseline data for future Extraction Plans;	Section 11
b) a revised assessment of the potential environmental consequences of the Extraction Plan, incorporating any relevant information that has been obtained since this approval;	Section 4
c) a detailed description of the measures that would be implemented to remediate predicted impacts; and	Section 8
d) a contingency plan that expressly provides for adaptive management.	Section 9 and Appendix 3

3.2 LICENCES, PERMITS AND LEASES

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

- The conditions of mining leases issued by the NSW Division of Resources and Geoscience (DRG) (now the Resources Regulator), under the NSW *Mining Act, 1992* (e.g. Consolidated Coal Lease [CCL] 703, Mining Lease [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 DRG.
- 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 Industry – Water (now the DPIE – 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 Resources Regulator and WorkCover NSW.
- Supplementary approvals obtained from WaterNSW for surface activities within the Woronora Special Area (e.g. fire road maintenance activities).

3.3 OTHER LEGISLATION

Metropolitan Coal will conduct the Project consistent with the Project Approval and any other legislation that is applicable to an approved Part 3A Project under the EP&A Act.

The following Acts may be applicable to the conduct of the Project (Helensburgh Coal Pty Ltd [HCPL], 2008)¹:

- *Biodiversity Conservation Act, 2016*;
- *Biosecurity Act, 2015*;
- *Contaminated Land Management Act, 1997*;
- *Crown Land Management Act, 2016*;
- *Dams Safety Act, 2015*;
- *Dangerous Goods (Road and Rail Transport) Act, 2008*;
- *Energy and Utilities Administration Act, 1987*;
- *Fisheries Management Act, 1994*;
- *Mining Act, 1992*;
- *Protection of the Environment Operations Act, 1997*;
- *Rail Safety (Adoption of National Law) Act, 2012*;
- *Roads Act, 1993*;

¹ The list of potentially applicable Acts has been updated to reflect changes to the Acts that were in force at the time of submission of the Metropolitan Coal Project Environmental Assessment (Project EA) (HCPL, 2008).

- *Water Act, 1912;*
- *Water Management Act, 2000;*
- *Water NSW Act, 2014;*
- *Work Health and Safety Act, 2011; and*
- *Work Health and Safety (Mines and Petroleum Sites) Act, 2013.*

Relevant licences or approvals required under these Acts will be obtained as required.

4 REVISED ASSESSMENT OF POTENTIAL ENVIRONMENTAL CONSEQUENCES

4.1 EXTRACTION LAYOUT

Longwalls 305-307 and the area of land within 600 metres (m) of Longwalls 305-307 secondary extraction are shown on Figures 2 and 3. Longwall extraction occurs from north to south. The Longwall 305 layout includes a 138 m panel width (void), a 45 m tailgate pillar width and a 70 m maingate pillar width. The layout of Longwalls 306 and 307 includes 138 m panel widths (void) and 70 m pillar widths (solid).

The provisional extraction schedule for Longwalls 305-307 is provided in Table 2.

Table 2
Provisional Extraction Schedule

Longwall	Estimated Start Date	Estimated Duration	Estimated Completion Date
Longwall 305	April 2020	8 Months	November 2020
Longwall 306	June 2021	11 Months	April 2022
Longwall 307	May 2022	8 Months	December 2022

The future Extraction Plans will consider the cumulative subsidence effects, subsidence impacts and/or environmental consequences. Note that the total cumulative predicted subsidence effects, subsidence impacts and/or environmental consequences at the completion of the Project are considered in the Metropolitan Coal Project Environmental Assessment (Project EA) (HCPL, 2008) and the Preferred Project Report (HCPL, 2009).

4.1.1 Endeavour Energy Assets

Figure 5 illustrates the Endeavour Energy 132 kilovolt (kV) transmission line and towers. The Bellambi Heathcote 132 kV double circuit transmission line consists of:

- Circuit OS/98E which is out of service and is used for emergency backup supply to the Bellambi 132/33 kV Transmission Substation; and
- Circuit 7028 which supplies Helensburgh Zone Substation.

The Bellambi Transmission Substations supplies all northern suburbs of Wollongong and the associated major commercial areas, industrial areas and mines including Metropolitan Coal. Circuit 7028 is one of three 33 kV lines which supply Helensburgh Zone Substation which directly supplies Metropolitan Coal.

The 132 kV transmission line and towers are located to the east of Longwalls 301-307 and the longwalls will not pass beneath these electrical services (Figure 5). The distances from the towers to the nearest longwall are summarised in Table 3 below.

Table 3
Transmission Towers Distance to Longwalls 301-307

Tower Number	Tower Type	Nearest Longwall	Approximate Distance to Longwall 301 (m)
F9132B – T13	Suspension	Longwall 301	320
F9132B – T12	Suspension	Longwall 301	100
F9132B – T11	Suspension	Longwall 301	100
F9132B – T10	Suspension	Longwall 301	110
F9132B – T9	Suspension	Longwall 301	110
F9132B – T8	Suspension	Longwall 301	120
F9132B – T7	Suspension	Longwall 301	330

Figure 5 also illustrates the Endeavour Energy infrastructure which consists of aerial and buried high voltage powerlines which service the Garrawarra Centre Complex. The feeder aerial powerline that runs between Helensburgh and the Garrawarra Centre Complex is referred in this BFMP as Powerline 1 (Figure 5).

4.2 REVISED SUBSIDENCE AND IMPACT PREDICTIONS


4.2.1 Revised Subsidence Predictions


Subsidence predictions for Longwalls 20-44 in relation to the Endeavour Energy assets was conducted by MSEC (2008) as part of the Metropolitan Coal Project EA. MSEC (2008) includes a table summarising the incremental systematic subsidence parameters for the extraction of each longwall from Longwalls 20-44.

These include:

- maximum predicted incremental subsidence (vertical movement);
- maximum predicted incremental tilt along alignment;
- maximum predicted incremental tilt across alignment;
- maximum predicted incremental tensile strain; and
- maximum predicted incremental compressive strain.

Revised subsidence and impact predictions for the extraction of Longwalls 305-307 on Endeavour Energy assets were conducted by MSEC and reported in MSEC (2019) (Appendix 1).


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METROPOLITAN COLLIERY
 LONGWALL 305
 ENDEAVOUR ENERGY

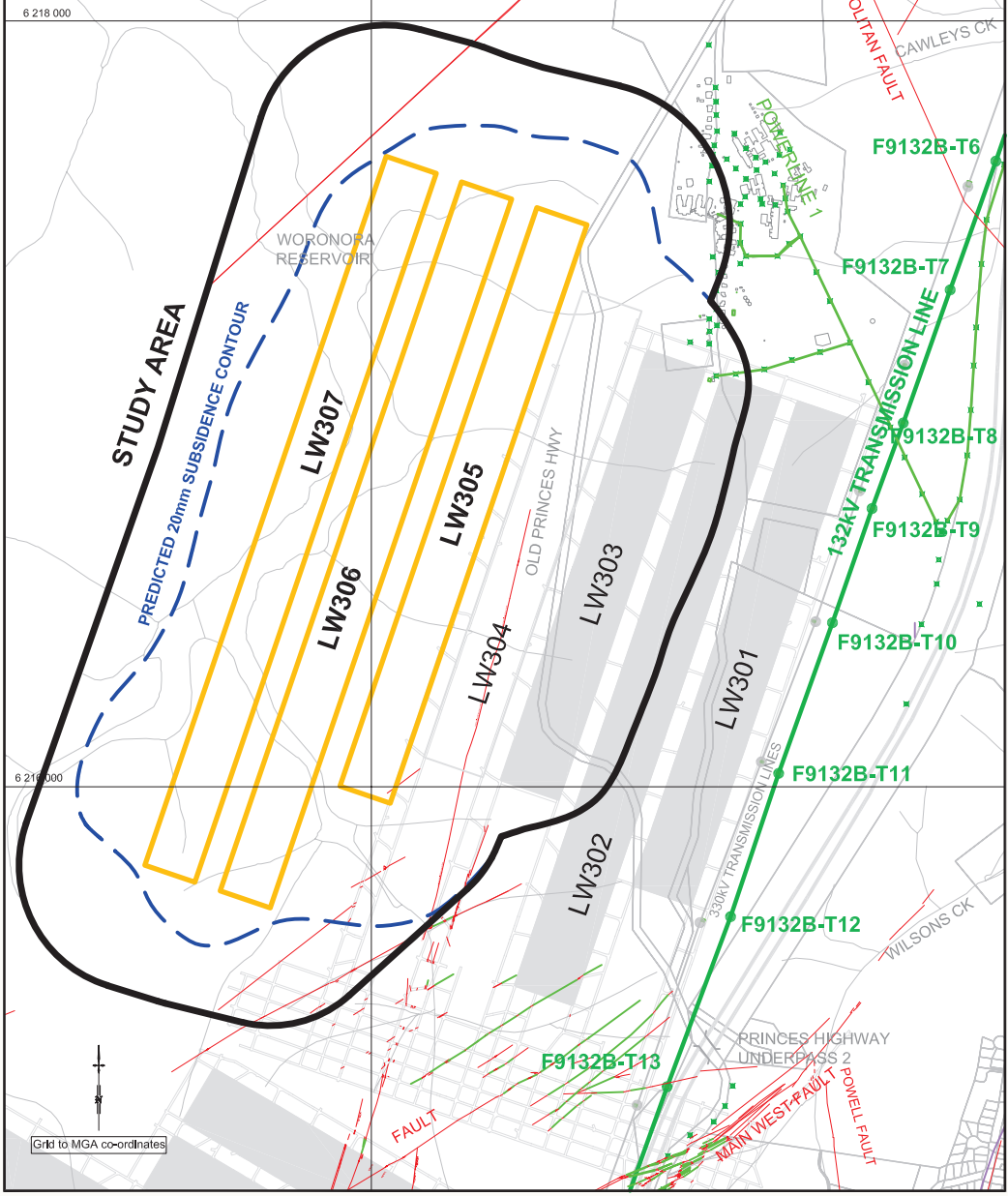
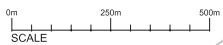
DATE: 16 Jul 2019	SCALE: as shown	DRAWING No: MSEC1059-01	Rev No 01
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GEOLOGICAL STRUCTURES

- FAULTS
- DYKES

LEGEND

- 132 kV LINE & TOWERS
- POWERLINES
- POWER POLES



MET-19-19-305-309-EP-BFMF-005B

Figure 5

In relation to subsidence predictions for Longwalls 305-307, MSEC (2019) make the following conclusions:

- The 132 kV transmission line is located to the east of Longwall 305 and is located outside the Study Area at distances of 930 m or more from Longwall 305. At this distance, the transmission line is not expected to experience measurable conventional vertical subsidence, tilts or curvatures due to the extraction of Longwalls 305-307. The transmission towers could experience low level far-field horizontal movement. It is considered unlikely that the transmission lines would experience adverse impacts as a result of predicted movements due to the extraction of Longwalls 305-307.
- The aerial low voltage powerlines are located in the north-eastern part of the Study Area and are not directly above Longwalls 305-307. Experience of mining beneath these types of cables in the Southern Coalfield indicates that the potential impacts on these types of cables are rare and generally of a minor nature.
- It is possible that the transmission towers and power poles could experience localised and elevated strains due to the presence of geological structures (known or unknown), if the surface expressions of these features are coincident with them. Non-conventional subsidence movements have not been observed during the extraction of Longwalls 301-303 and the likelihood of non-conventional subsidence movements at the transmission towers and power poles due to Longwalls 305-307 is considered to be very low.

It is expected that the potential impacts on the Endeavour Energy infrastructure can be managed with the implementation of the necessary monitoring and management strategies.

4.2.2 Risk Assessment

In accordance with the *Guidelines for the Preparation of Extraction Plans* (DP&E and DRE, 2015) a risk assessment meeting was held on 19 August 2016 for Longwalls 301-303. Attendees at the risk assessment meeting included representatives from Metropolitan Coal, Endeavour Energy, MSEC, Resource Strategies and Axy Consulting (risk assessment facilitator).

The investigation and analysis methods used during the risk assessment included:

- preliminary identification of Endeavour Energy assets;
- review of the revised subsidence predictions and potential impacts on Endeavour Energy assets (including consideration of past experience in the Southern Coalfield); and
- development of a preliminary monitoring plan.

A number of risk control measures and procedures were identified during the risk assessment which considered the extraction of coal beneath the land within the Study area and in proximity to the Endeavour Energy assets. The proposed risk control measures and procedures were incorporated into the Longwalls 301-303 BFMP and the program and status of implementation is summarised in Table 4.

The risk control measures and procedures identified during the risk assessment for Longwalls 301-303 were implemented and continued for the extraction of Longwall 304.

Table 4
Program for Implementation of Proposed Risk Control Measures and Procedures

Risk Control Measure / Procedure		Timing
<i>Baseline Data / Validation</i>		
1	Carry out a visual audit of the Endeavour Energy assets (i.e. 132kV transmission line and high voltage powerlines) in the Study area	Complete
2	Obtain available information from Endeavour Energy regarding the make-up of the 132 kV structures and foundations	Complete
3	Conduct a visual inspection of the access roads/tracks to the Endeavour Energy assets	Complete
4	Carryout an investigation (dial before you dig) to identify the presence and ownership of the 11 kV cables that may be buried underground in the areas that may be affected by Longwalls 301 to 303	Complete
<i>Management / Monitoring / Response Measures</i>		
5	Establish key contacts list in the BFMP	Complete
6	Include a schedule of times/frequency of communication with Endeavour Energy for the status of mining of Longwalls 301-303 in the BFMP	Complete
7	Include in the TARP triggers for conditions that may need to be actioned by Endeavour Energy	Complete
8	Include in the BFMP relevant details regarding the potential for underground blast vibration impacts at the surface	Complete

The risk control measures and procedures identified during the risk assessment for Longwalls 301-303 and continued for the extraction of Longwall 304 will be continued for Longwalls 305-307.

4.3 UNDERGROUND BLAST VIBRATION IMPACTS

Use of explosives is not required for existing or proposed general underground coal mining. Occasionally, geological structures (e.g. dykes) may be encountered underground that have to be broken up using very low mass explosives. This underground blasting would be undertaken at significant depth (e.g. greater than 400 m below the surface).

Ground vibration and airblast levels which cause human discomfort are generally lower than the recommended structural damage limits. Therefore, compliance with the lowest applicable human comfort criteria ensures that the potential to cause structural damage is minimal. Based on the assessment results presented in the Metropolitan Coal Project Noise Impact Assessment (Heggies, 2008), ground vibration levels are predicted to meet the most stringent night-time criteria of 1 mm/s at a distance of 500 m from the blast site. As blasting is conducted at least 400 m below the surface, vibration impacts are likely to be minimal (which is consistent with the existing Metropolitan Colliery blasting practices and experience).

5 PERFORMANCE MEASURES AND INDICATORS

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 measure specified in Table 1 of Condition 1, Schedule 3 in relation to built features is:

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

The performance indicators proposed to ensure that the above performance measure is achieved include:

- the structural integrity of the 132 kV transmission lines and towers is maintained;
- the structural integrity of the timber poles and high voltage powerlines is maintained;
- the electrical clearance from vegetation is maintained; and
- the serviceability of the access roads/tracks is maintained.

Section 7 of this BFMP-END describes the monitoring that will be conducted to assess the Project against the above performance measure. Section 9 of this BFMP-END provides a Contingency Plan in the event the performance measure is exceeded.

6 BASELINE DATA

A photograph of a 132 kV transmission tower is shown in Plate 1.



Plate 1 – 132 kV Transmission Tower (Source: MSEC, 2016)

The powerlines which service the Garrawarra Centre Complex comprise copper conductors supported by timber poles (Plates 2 and 3).



Plates 2 and 3 – Aerial Powerlines (Source: MSEC, 2016)

A visual audit / site inspection of the 132 kV transmission line and towers within the Study area was conducted prior to commencement of secondary extraction of Longwall 301 to establish the condition of the structures. The inspection included:

- recording of existing structure conditions;
- two dimensional image records of the potentially affected structures; and
- condition of the access roads/tracks with specific attention to surface cracks.

A site inspection of the timber poles and powerlines within the Study area also occurred to record the existing structure conditions and access roads/tracks prior to commencement of secondary extraction of Longwall 301.

The audits / site inspections were conducted by representative(s) from Endeavour Energy and Metropolitan Coal.

6.1 KEY CONTACTS LIST

The list of key contacts for Peabody and Endeavour Energy during the development and implementation of this BFMP are provided in Table 5.

**Table 5
List of Key Contacts**

Company	Position	Name
Peabody (Metropolitan Coal)	Technical Services Manager Jon Degotardi	Metropolitan Coal Control Room 24hr 02 4294 7333
Endeavour Energy	Operations Manager Substations – Southern Region Steve Dent Operations Manager Mains – Southern Region Brian Gray Transmission Asset Engineer – Southern Region Sally Bell	Endeavour Energy 24hr Contact 131 003 General enquiry 133 718

7 MONITORING

A monitoring program will be implemented to monitor the impacts of the Project on the 132 kV transmission line and towers, high voltage powerlines and access roads/tracks as determined in consultation with Endeavour Energy. Table 6 summarises the BFMP-END monitoring components.

**Table 6
BFMP-END Monitoring Program Overview**

Program	Aspect	Method	How	Why	Timing	Frequency
Baseline	132 kV Towers (T8 to T12)	Survey (relative)	4 x ground points outside each leg for each tower	Establish base conditions	Prior to LW301 extraction	Complete
			4 x tower leg mounted prisms for each tower	Establish base condition	Prior to LW301 extraction	Complete
		Condition Review (recording of existing structure conditions and two-dimensional image records of structures)	Establish base condition	Prior to LW301 extraction	Complete	
	Timber Poles (11 kV)	Condition Review (recording of existing structure conditions and two-dimensional image records of structures)	Establish base condition	Prior to LW301 extraction	Complete	
	High voltage powerlines (11 kV)	Visual inspection (including notes on clearance heights of powerlines)	Establish base condition	Prior to LW301 extraction	Complete	
	Access roads/tracks	Visual inspection (including notes on general condition of access roads/tracks)	Establish base condition	Prior to LW301 extraction	Complete	
During Mining	132 kV Towers (T8 to T12)	Survey	4 x ground points outside each leg for each tower	Monitor subsidence effects during mining (subsidence, tilt, strain, absolute horizontal translation)	Specifically LW305	Measurement at intervals of 2 months during extraction
					Within 3 months of completion of extraction of each longwall	Once per longwall
		4 x tower leg mounted prisms for each tower	Monitor subsidence effects during mining (differential leg movement)	Specifically LW305	Measurement at intervals of 2 months during extraction	
				Within 3 months of completion of extraction of each longwall	Once per longwall	
	Visual inspection (Metropolitan)	Field notes and observations recorded by surveyors	Monitor for evidence of subsidence effects on Towers including any observable surface deformations (e.g. degradation of foundations/footings) or other subsidence related effects (noted quantitatively in regards width, length, orientation)	Within 3 months of completion of extraction of each longwall	Once per longwall	

Table 6 (Continued)
BFMP-END Monitoring Program Overview

Program	Aspect	Method	How	Why	Timing	Frequency
During Mining (Cont.)		Visual inspection (Endeavour Energy)	Inspection of structural integrity from the ground		As determined by Endeavour Energy	Annual (where coinciding)
			Fault and emergency patrols from either the air or ground		At any time in case of fault or emergency	
	Timber Poles (11 kV)	Visual inspection (Metropolitan)	Field notes and observations recorded by surveyors	Monitor for evidence of subsidence effects on Poles including any observable surface deformations (e.g. degradation of structure) or other subsidence related effects (e.g. movement of conductors)	Within 3 months of completion of extraction of each longwall	Once per longwall
		Visual inspection (Endeavour Energy)	Inspection of structural integrity from the ground		As determined by Endeavour Energy	Four yearly (where coinciding)
			Fault and emergency patrols from either the air or ground		At any time in case of fault or emergency	
	High voltage powerlines	Visual inspection (Metropolitan)	Field notes and observations recorded by surveyors	Monitor for evidence of subsidence effects on powerlines including changes in clearance heights for roads, land and vegetation, or movement of insulator strings	Within 3 months of completion of extraction of each longwall	Once per longwall
		Visual inspection (Endeavour Energy)	Inspection of vegetation growth and electrical clearances from the air		As determined by Endeavour Energy	Annual (where coinciding)
			Fault and emergency patrols from either the air or ground		At any time in case of fault or emergency	
	Access roads/tracks	Visual inspection (Metropolitan)	Field notes on general condition of access roads/tracks by surveyors	Monitor for surface cracks, buckling and general safety	At the completion of each longwall as per Land Management Plan	Once per longwall

Table 6 (Continued)
BFMP-END Monitoring Program Overview

Program	Aspect	Method	How	Why	Timing	Frequency
Post Mining	132 kV Towers (T8 to T12)	Survey	4 x ground points outside each leg for each tower	Determine level of impact of mining (if any)	Within 3 months of the completion of Longwall 307	Once
			4 x tower leg mounted prisms for each tower	Determine level of impact of mining (if any)	Within 3 months of the completion of Longwall 307	Once
		Visual inspection (Endeavour Energy)	Ground inspection	Validation	Next scheduled post mining	Once
			Climbing inspection	Validation	Next scheduled post mining	Once
	Timber Poles (11 kV)	Visual inspection	Observations by surveyors	Determine level of impact of mining (if any)	Within 3 months of the completion of Longwall 307	Once
	High voltage powerlines	Visual inspection	Observations by surveyors	Determine level of impact of mining (if any)	Within 3 months of the completion of Longwall 307	Once
	Access roads/tracks	Visual inspection	Observations by surveyors	Determine level of impact of mining (if any)	Within 3 months of the completion of Longwall 307	Once

Where relevant, inspections of subsidence impacts will include photographic record of the impacts for comparison with baseline photographic records

Endeavour Energy or their delegates will conduct the various visual inspections. Metropolitan Coal will be notified of the timing of inspections and accompany Endeavour Energy or delegates if considered necessary. All personnel will complete necessary inductions or orientation relevant to the tasks required.

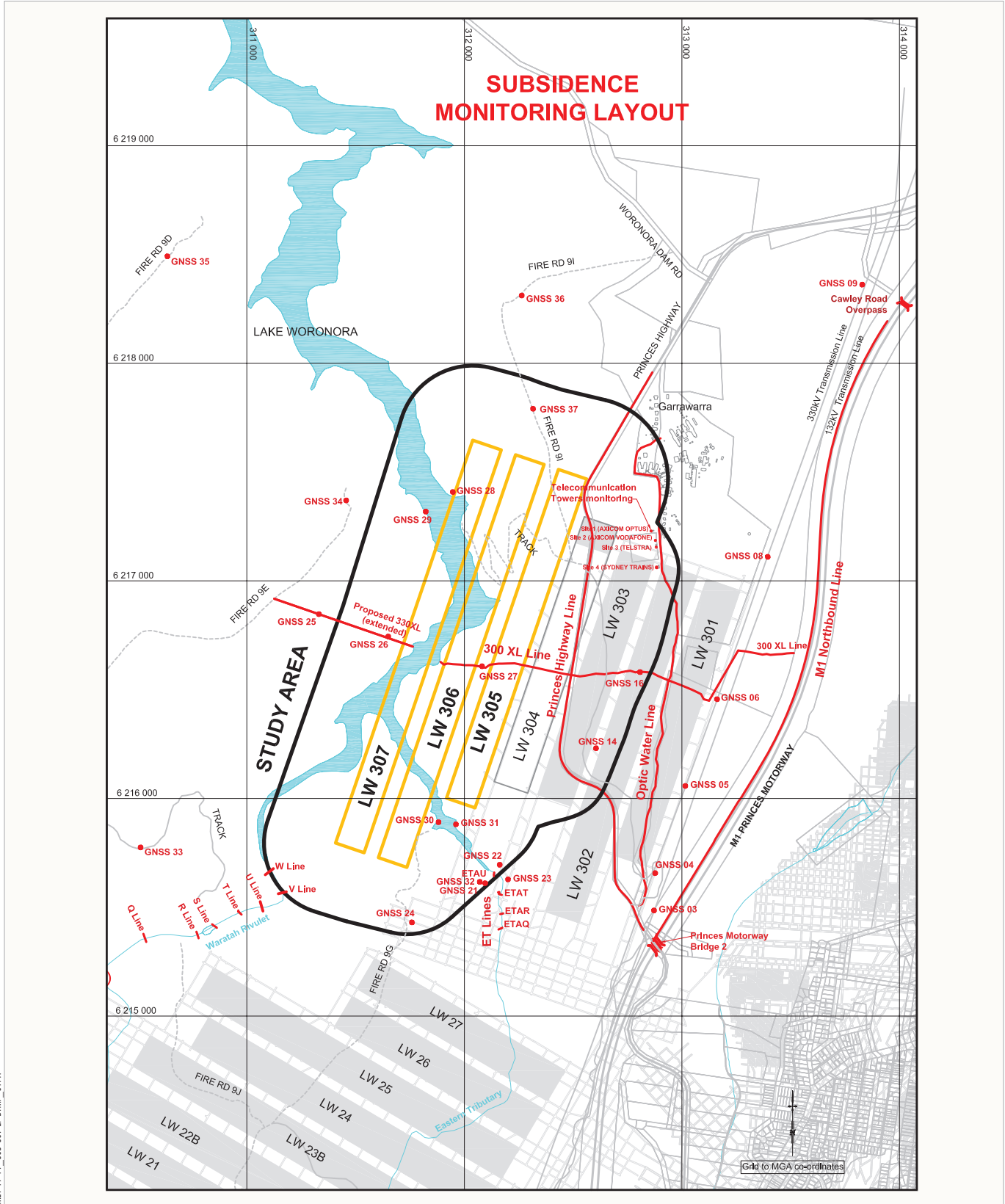
The frequency of monitoring will be reviewed either:

- in accordance with the Annual Review outlined in Section 12; or
- if triggered as a component of the Contingency Plan as outlined in Section 9 of this BFMP-END.

7.1 SUBSIDENCE PARAMETERS

Subsidence parameters (i.e. subsidence, tilt, tensile strain, compressive strain, absolute horizontal translation, and differential leg movement) associated with mining will be measured in accordance with the Longwalls 305-307 Subsidence Monitoring Program (Figure 6).

In summary, surveys will be conducted to measure subsidence movements in three dimensions using a total station survey instrument.



NET-19-19_305-309 EP BFMP_017A

Source: MSEC (2019)

Figure 6

Monitoring of subsidence parameters specific to the Endeavour Energy 132 kV towers will be measured by relative survey at each Tower leg, (T8 to T12), and by absolute movements by continuous 3D monitoring units, (GNSS 4, 5, 6 & 8), located adjacent to Transgrid towers running in parallel to Endeavour Energy towers.

7.2 SUBSIDENCE IMPACTS

7.2.1 132 kV Transmission Line and Towers

Visual inspections of the 132 kV transmission line and towers will be conducted between Towers T8 and T12 inclusive, in accordance with the Endeavour Energy inspection program. This generally includes:

- annual inspection of the structural integrity of sites from the ground;
- annual inspection of vegetation growth and electrical clearances from the air;
- six yearly climbing inspections; and
- fault and emergency patrols from either the air or ground at any time.

A visual inspection was conducted prior to commencement of Longwall 301. Ground observations will be conducted by Metropolitan Coal during the mining of Longwalls 305-307 at end of panel survey events. Additional observations of subsidence impacts will be conducted during routine works.

Specific details that will be noted and/or photographed include:

- the date of the inspection;
- the location of longwall extraction (i.e. the longwall chainage);
- assessment against the performance indicators and performance measure;
- whether any actions are required (e.g. initiation of the Contingency Plan, incident notification, implementation of appropriate safety controls, review of public safety, etc.); and
- any other relevant information.

7.2.2 Timber Poles and High Voltage Powerlines (Aerial and Buried)

A visual inspection of the timber poles² and powerlines was conducted prior to commencement of Longwall 301. Additional observations of subsidence impacts will be conducted during routine works and sampling by Metropolitan Coal and its contractors.

Specific details that will be noted and/or photographed include:

- the date of the inspection;
- the location of longwall extraction (i.e. the longwall chainage);
- assessment against the performance indicators and performance measure;
- whether any actions are required (e.g. initiation of the Contingency Plan, incident notification, implementation of appropriate safety controls, review of public safety, etc.); and
- any other relevant information.

² For example, where a timber pole lean of greater than 15 degrees from vertical is identified.

The information will be recorded in the Built Features Management Plan - Subsidence Impact Register (Appendix 2) and reported in accordance with the Project Approval conditions.

7.2.3 Access Roads/Tracks

Visual inspection of the access roads/tracks to the Endeavour Energy assets was conducted prior to the commencement of Longwall 301, and will be conducted following extraction of each longwall panel.

Visual observations of access roads/tracks would occur as part of routine works and inspections within 600 m of Longwalls 305-307 secondary extraction as described in the Metropolitan Coal Longwalls 305-307 Land Management Plan (Longwalls 305-307 LMP).

Specific details that will be noted and/or photographed that are relevant to the Endeavour Energy access roads/tracks include:

- the location, approximate dimensions (length, width and depth), and orientation of surface tension cracks;
- the location of the surface tension crack in relation to the access road/track to the Endeavour Energy asset;
- whether any actions are required (e.g. implementation of management measures as outlined in the Longwalls 305-307 LMP, initiation of the Contingency Plan as outlined in the Longwalls 305-307 LMP, incident notification, implementation of appropriate safety controls, review of public safety, etc.); and
- any other relevant information.

The date of the observation, details of the observer and the location of longwall extraction will also be documented.

The information obtained will be recorded in the Longwalls 305-307 LMP - Subsidence Impact Register and reported in accordance with the Project Approval conditions.

The information obtained will be used to assess the potential environmental consequences of the subsidence impact (described in the Longwalls 305-307 LMP) and to identify required management measures. Management measures are discussed in the Longwalls 305-307 LMP.

In the event the subsidence impacts are deemed to present a safety hazard (i.e. regardless of the nature or extent of the subsidence impact), actions will be implemented in accordance with the Metropolitan Coal Longwalls 305-307 Public Safety Management Plan.

7.3 ENVIRONMENTAL CONSEQUENCES

Metropolitan Coal and Endeavour Energy will compare the results of the subsidence impact monitoring against the built features performance measure and indicators. In the event the observed subsidence impacts exceed the performance measure or indicators, Metropolitan Coal and Endeavour Energy will assess the consequences of the exceedance in accordance with the Contingency Plan described in Section 9.

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8 MANAGEMENT MEASURES

A number of potential management measures in relation to 132 kV towers and transmission lines, and other high voltage powerlines and poles are considered to be applicable. These include:

- alteration of conductor tensions;
- modification to attachment points such as placement of stringing sheaves to earth wires and/or phase conductors;
- strengthening of tower structures through installation of cruciform footings; and
- strengthening of timber poles footings.

The requirement for these management measures will be determined by Endeavour Energy and if required, constructed prior to mining within 600 m of the structure.

Where significant subsidence impacts on access roads/tracks are detected (e.g. those that affect the serviceability) or at any time Metropolitan Coal, Endeavour Energy or the landholder considers that the integrity of the access roads/tracks may be compromised, the following management measures will be implemented. Where significant cracks are detected, the cracks would be repaired as soon as practicable in consultation with the landholder. This may include the use of earthmoving equipment if considered the most appropriate means of repair. Appropriate sedimentation controls will be implemented during repair works. Management measures for access roads/tracks will be implemented in accordance with the Longwalls 305-307 Land Management Plan.

Metropolitan Coal will assess the potential impacts to public safety and where appropriate, implement measures in accordance with the Longwalls 305-307 Public Safety Management Plan.

Follow-up inspections will be conducted to assess the effectiveness of the management measures implemented and the requirement for any additional management measures.

Management measures will be reported in the Annual Review (Section 12).

9 CONTINGENCY PLAN

In the event the subsidence impacts observed exceed the performance measure or indicators detailed in Section 5 of this BFMP-END, Metropolitan Coal will implement the following Contingency Plan (Appendix 3):

- The observation will be reported to the Metropolitan Coal Technical Services Manager within 24 hours.
- With the exception of access roads/tracks, the observation will be recorded in the Built Features Management Plan – Subsidence Impact Register (Appendix 2) consistent with the monitoring program described in Section 7 of this BFMP-END.
- If relating to an access road/track, the observation will be recorded in the Metropolitan Coal Longwalls 305-307 Land Management Plan – Subsidence Impact Register.
- Metropolitan Coal will report any exceedance of the performance measure or indicators to the DPIE and Endeavour Energy as soon as practicable after Metropolitan Coal becomes aware of the exceedance.
- Metropolitan Coal will assess public safety and where appropriate implement safety measures in accordance with the Metropolitan Coal Longwalls 305-307 Public Safety Management Plan.

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- Metropolitan Coal will conduct an investigation to evaluate the potential contributing factors. The investigation will:
 - include the re-survey of relevant subsidence monitoring lines;
 - compare and critically analyse measured versus predicted subsidence parameters;
 - review measured subsidence parameters against the observed impact; and
 - review the subsidence monitoring program and update the program where appropriate.
- The course of action with respect to the identified impact(s), in consultation with specialists and relevant agencies, will include:
 - a program to review the effectiveness of the contingency measures; and
 - consideration of adaptive management.

Contingency measures are provided in Section 9.1.

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

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 DPIE if either the contingency measures implemented by Metropolitan Coal have failed to remediate the impact or the Secretary determines that it is not reasonable or feasible to remediate the impact.

Metropolitan Coal will comply with the NSW *Coal Mine Subsidence Compensation Act, 2017* in the event that property damages occur as a result of mining Longwalls 305-307.

9.1 CONTINGENCY MEASURES

Contingency measures will be developed in consideration of the specific circumstances of the feature (e.g. the location, nature and extent of the impact, and the assessment of environmental consequences).

Contingency measures that could be considered in the event the performance measure for the 132 kV towers and transmission lines or the timber poles and high voltage powerlines is exceeded are summarised in Table 7. The decision tree for the contingency measures for the 132 kV towers and transmission lines are shown in Appendix 3.

**Table 7
Contingency Measures**

Environmental Consequence	Contingency Measures	
	Measure	Description
Impact on:		
Towers	Stabilisation techniques	Installation of tower supports such as cruciform elements.
	Rebuilding	Construction of new tower(s) or emergency structures.
Transmission Wires	Stabilisation techniques	Sheaving of conductors and/or earth wires.
	Rebuilding	Construction of new transmission lines.
Timber Poles	Stabilisation techniques	Installation of supports.
	Rebuilding	Construction of new pole(s) or emergency structures.
Powerline Wires	Stabilisation techniques	Sheaving of conductors and/or earth wires.
	Rebuilding	Construction of new powerlines.

10 TARP – MANAGEMENT TOOL

The framework for the various components of this BFMP-END are summarised in the BFMP-END TARP shown in Table 8. The BFMP-END TARP illustrates how the various predicted subsidence impacts, monitoring components, performance measures, and responsibilities are structured to achieve compliance with the relevant statutory requirements, and the framework for management and contingency actions.

The TARP comprises:

- baseline conditions;
- predicted subsidence impacts;
- trigger levels from monitoring to assess performance; and
- triggers that flag implementation of contingency measures.

The TARP system provides a simple and transparent snapshot of the monitoring of environmental performance and the implementation of management and/or contingency measures.

Table 8
BFMP-END Trigger Action Response Plan

ENDEAVOUR ENERGY – 132 kV Towers (T8 to T12)	
<i>Risk: Subsidence effect on towers resulting in impact to structural integrity and reduced transmission line clearance.</i>	
TRIGGER LEVEL	RESPONSE
Level 1 – Normal - Expected subsidence conditions	
Differential tower leg movements <ul style="list-style-type: none"> less than 4.0 mm 	<u>Normal Operations</u> <ul style="list-style-type: none"> Towers are safe and serviceable. Negligible impact to towers. Continue monitoring activities as planned.
Level 3 – Cautionary - Anomalous differential leg movement or surface cracking prohibiting vehicular movements	
Differential tower leg movements between 4.0 and 8.0 mm Observable subsidence ground deformations at a tower Observable surface cracking on access road/tracks prohibiting vehicular movements	<u>Investigate & Resolve</u> <ul style="list-style-type: none"> Towers are safe and serviceable. Indication of impact to towers or surface cracking on access road/tracks prohibiting vehicular movements. <u>Metropolitan Coal</u> <ul style="list-style-type: none"> Resurvey tower leg mounted prisms to confirm results. Engage subsidence expert to assess results. Inform Endeavour Energy and NSW Principal Subsidence Engineer of subsidence results (notify within 24 hours of trigger). Report monitoring data to NSW Principal Subsidence Engineer within 48hrs following collection of data. Increase frequency of monitoring to weekly (if not already). Request Endeavour Energy assess condition of affected structure. Review the subsidence monitoring program and update the program where appropriate. Provide report to both Endeavour Energy and DPIE. <ul style="list-style-type: none"> For surface cracking on access road/tracks prohibiting vehicular movements: <ul style="list-style-type: none"> Install track signage to alert patrol staff of any access restrictions or risks to vehicular movements. Notify Endeavour Energy of any access limitations or restrictions with 24 hours and repair track within 72 hours to re-establish access. <u>Endeavour Energy</u> <ul style="list-style-type: none"> In conjunction with Metropolitan Coal identify impact location, inspect tower, assess condition and determine appropriate response. (e.g. greater monitoring data or frequency, or schedule maintenance on the structure). Make determination if other measures necessary to avoid further impact (e.g. deployment of emergency structures).

**Table 8
BFMP-END Trigger Action Response Plan**

ENDEAVOUR ENERGY – 132 kV Towers (T8 to T12)	
<i>Risk: Subsidence effect on towers resulting in impact to structural integrity and reduced transmission line clearance.</i>	
TRIGGER LEVEL	RESPONSE
Level 4 – Restoration	
Exceedance of nominated differential leg movement or transmission fault occurs	
Transmission fault occurs due to subsidence or Differential leg movement of greater than 8.0 mm measured	<p><u>Implement Contingency Plan</u></p> <ul style="list-style-type: none"> As per BFMP Section 9 and Appendix 3. <p><u>Metropolitan Coal</u></p> <ul style="list-style-type: none"> As per Level 3 event, plus: <ul style="list-style-type: none"> General Manager to be involved in all decision-making processes. Assess public safety implications and where appropriate implement safety measures in accordance with Metropolitan Coal Longwall 305-307 Public Safety Management Plan. Report exceedance of the performance measure or indicators to the DPIE and Endeavour Energy as soon as practicable. Update the 'Built Features Management Plan – Subsidence Impact Register'. Investigate circumstances of the fault and determine requirement for adaptive management of mining operations prior to future operations in vicinity of the towers and transmission lines. <p><u>Endeavour Energy</u></p> <ul style="list-style-type: none"> As per Level 3 event, plus: <ul style="list-style-type: none"> For transmission fault – Endeavour Energy to enact fault / emergency response measures. For greater than 8.0 mm differential leg movement – Endeavour Energy to determine timing of emergency restoration measure. Complete restoration works. Work in conjunction with Metropolitan Coal to investigate root cause of incident and determine appropriate future control measures.

11 FUTURE EXTRACTION PLANS

In accordance with Condition 7, Schedule 3 of the Project Approval, Metropolitan Coal will collect baseline data for the next Extraction Plan (i.e. Longwalls 308 on). However, for the 132 kV transmission lines and towers and other high voltage powerlines, the baseline (and post-mining) data collected for Longwalls 301-307 will be used as baseline for Longwalls 308 onward as longwall mining progressively moves further away from the Endeavour Energy assets.

In addition to the baseline data collection, consideration of the environmental performance and management measures in accordance with the review(s) conducted as part of this BFMP-END will inform the appropriate type and frequency of monitoring of the assets relevant to the next Extraction Plan.

12 ANNUAL REVIEW AND IMPROVEMENT OF ENVIRONMENTAL PERFORMANCE

In accordance with Condition 3, Schedule 7 of the Project Approval, Metropolitan Coal will conduct an Annual Review of the environmental performance of the Project by the end of March each year.

The Annual Review will:

- describe the works carried out in the past year, and the works proposed to be carried out over the next year;
- include a comprehensive review of the monitoring results and complaints records of the Project over the past year, including a comparison of these results against the:
 - relevant statutory requirements, limits or performance measures/criteria;
 - monitoring results of previous years; and
 - relevant predictions in the EA, 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
- describe what measures will be implemented over the next year to improve the environmental performance of the Project.

As described in Section 2, this BFMP will be reviewed within three months of the submission of an Annual Review, and revised where appropriate.

13 INCIDENTS

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

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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 DPIE and any other relevant agencies 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 DPIE and any relevant agencies with a detailed report on the incident.

Endeavour Energy will be notified within 24 hours of any access limitations or restrictions.

14 COMPLAINTS

A protocol for the managing and reporting of complaints has been developed as a component of Metropolitan Coal's Environmental Management Strategy and is described below.

The Environment & Community Superintendent 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 Environment & Community Superintendent 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 Environment & Community Superintendent.

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 Environment & Community Superintendent 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 Environment & Community Superintendent 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 Community Consultative Committee as part of the operational performance review.

15 NON-COMPLIANCE WITH STATUTORY REQUIREMENTS

A protocol for the managing and reporting of non-compliances with statutory requirements has been developed as a component of Metropolitan Coal's Environmental Management Strategy and is described below.

Compliance with all approvals, plans and procedures will be the responsibility of all personnel (staff and contractors) employed on or in association with Metropolitan Coal, and will be developed through promotion of Metropolitan Coal ownership under the direction of the General Manager.

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

As described in Section 13, Metropolitan Coal will notify the Secretary of the DPIE and any other relevant agencies of any incident associated with Metropolitan Coal 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 DPIE and any relevant agencies with a detailed report on the incident.

A review of Metropolitan Coal's compliance with all conditions of the Project Approval, mining leases and all other approvals and licenses will be undertaken prior to (and included within) each Annual Review. The Annual Review will be made publicly available on the Peabody website.

Additionally, in accordance with Condition 8, Schedule 7 of the Project Approval, an independent environmental audit was undertaken by the end of December 2011, and is undertaken a minimum of once every three years thereafter. A copy of the audit report will be submitted to the Secretary of the DPIE and made publicly available on the Peabody website. The independent audit will be undertaken by an appropriately qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary of the DPIE.

16 REFERENCES

- Department of Planning & Environment and Division of Resources and Energy (2015) *Guidelines for the Preparation of Extraction Plans*.
- Heggies (2008) *Metropolitan Coal Project Noise Impact Assessment*. Appendix J in the Metropolitan Coal Project Environmental Assessment.
- Helensburgh Coal Pty Ltd [HCPL] (2008) *Metropolitan Coal Project Environmental Assessment*.
- Helensburgh Coal Pty Ltd [HCPL] (2009) *Metropolitan Coal Project Preferred Project Report*.
- Mine Subsidence Engineering Consultants (2008) *Subsidence Assessment Report on the Prediction of Subsidence Parameters and the Assessment of Mine Subsidence Impacts on Natural Features and Surface Infrastructure Resulting from the Proposed Extraction of Longwalls 20 to 44 at Metropolitan Colliery in Support of a Part 3A Application*.
- Mine Subsidence Engineering Consultants (2019) *Metropolitan Colliery – Proposed Longwalls 305 to 307 - Subsidence Predictions and Impact Assessments for the Endeavour Energy Infrastructure*.

APPENDIX 1

MSEC (2019) METROPOLITAN COLLIERY – PROPOSED LONGWALLS 305 TO 307 –
SUBSIDENCE PREDICTIONS AND IMPACT ASSESSMENTS FOR THE ENDEAVOUR
ENERGY INFRASTRUCTURE

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19th July 2019

Jon Degotardi
Peabody Energy Australia
Metropolitan Colliery
PO Box 402
Helensburgh NSW 2508

Ref: MSEC1059-01

Dear Jon,

RE: Metropolitan Colliery – Proposed Longwalls 305 to 307 - Subsidence Predictions and Impact Assessments for the Endeavour Energy Infrastructure

This letter report summarises the predicted subsidence movements and the assessed subsidence impacts for the Endeavour Energy Infrastructure resulting from the extraction of the proposed Longwalls 305 to 307 at Metropolitan Colliery.

The locations of the infrastructure and the proposed longwall are shown in the attached Drawing No. MSEC1059-01. The infrastructure includes a 132kV transmission line and low voltage powerlines located to the east of Longwall 305.

A Study Area is shown in Drawing No. MSEC1059-01 and is based on the outer limits of a 35° angle of draw line from Longwalls 305 to 307 and the predicted 20mm subsidence contour for Longwalls 305 to 307.

The 132kV transmission line is located outside the Study Area for Longwalls 305 to 307 and is 930 m from Longwall 305 at its nearest point. The main low voltage distribution line runs between the township of Helensburgh and the Garrawarra Complex to the north east of the Study Area and is labelled Powerline 1 in Drawing No. MSEC1059-01. The low voltage powerlines within the Study Area service the Garrawarra Complex in the north-eastern part of the Study Area. The powerlines comprise aerial conductors supported on timber poles. The nearest pole is approximately 340 m from Longwall 305. Underground powerlines are also present within the Garrawarra Complex and are understood to be private lines. There are no powerlines above Longwalls 305 to 307.

132 kV Transmission Line

The transmission towers and reference numbers are shown in Drawing No. MSEC1059-01. The transmission towers are all suspension towers. A photograph of one of the 132 kV transmission towers is provided in Figure 1.



Figure 1 132 kV Transmission Tower

The predictions and impact assessments for the 132 kV transmission line are provided in the following sections.

Conventional Subsidence Parameters

The 132 kV transmission line is located 930 m from Longwall 305. At this distance, the transmission line is not expected to experience measurable conventional vertical subsidence, tilts or curvatures due to the extraction of Longwalls 305 to 307. The transmission towers could experience low level far-field horizontal movement. The far-field horizontal movements are expected to be similar to those observed for previous longwall mining in the Southern Coalfield, which tend to be bodily movements towards the extracted goaf area and are accompanied by very low levels of strain.

It is possible that localised and elevated movements could develop as the result of non-conventional ground movements due to geological structures or valley closure effects. Discussions on the potential for non-conventional movements are provided in the following section.

The observed incremental far-field horizontal movements, resulting from the extraction of longwalls in the Southern Coalfield, are provided in Figure 2. The data is based on survey marks located outside of the mining area (i.e. above solid coal).

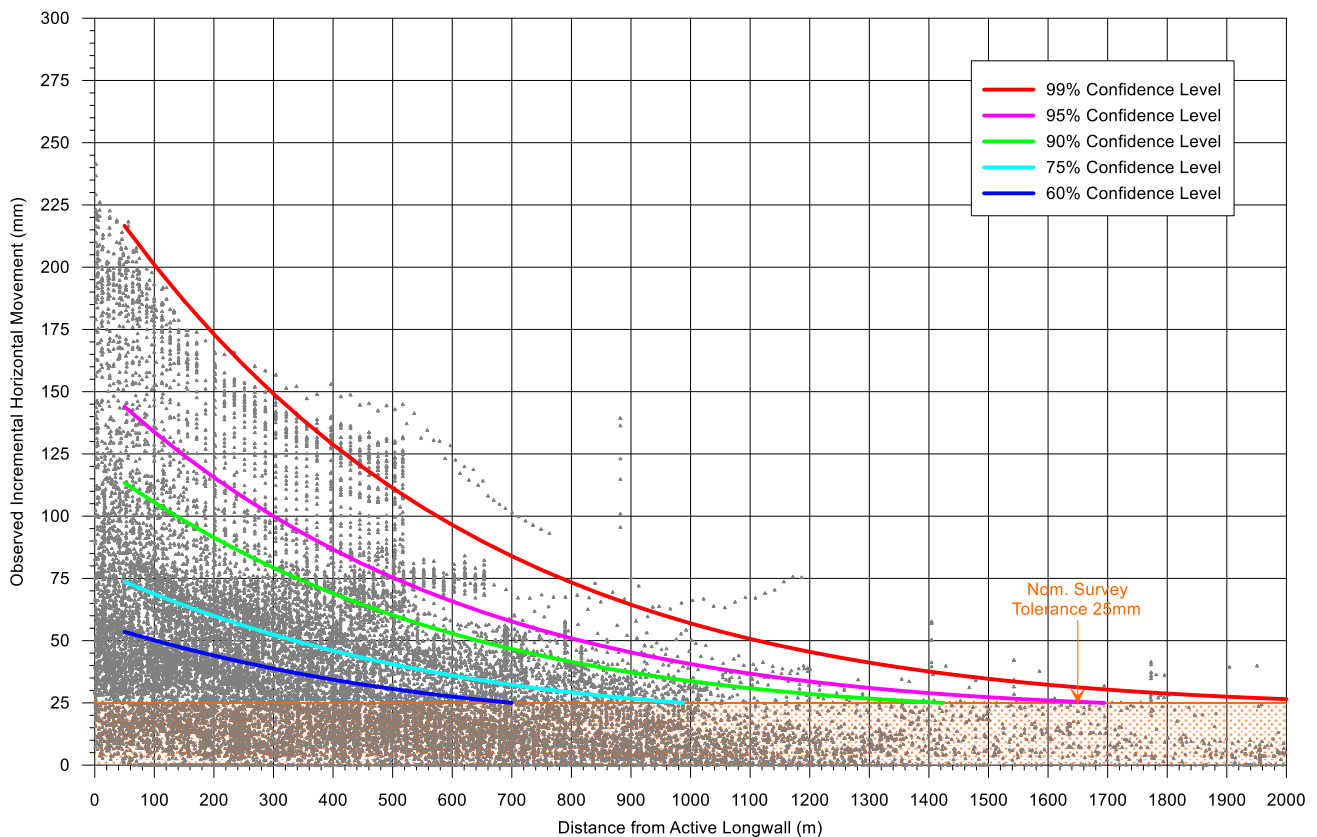


Figure 2 Observed Incremental Far-field Horizontal Movements from the Southern Coalfield (Solid Coal)

The absolute incremental horizontal movements measured at distances greater than 930 m from mining are in the order of 45 mm based on the 95% confidence level. Far-field horizontal movements tend to be bodily movements orientated towards the mining area. The strains associated with these low level horizontal movement are not expected to be measurable. The absolute far-field horizontal movements could result in minor changes in the distances between the towers since the directions of these far-field horizontal movements are generally expected to be towards the extracted longwalls.

Potential for Non-Conventional Movements

Non-conventional movements can develop due to the presence of geological structures or valley related effects. In some cases, non-conventional movements can develop with no known cause and these are often referred to as ‘anomalous’ movements.

The locations of the known geological structures at seam level and the major streams are shown in Drawing No. MSEC1059-01. There are no mapped faults located within the Study Area that extend beneath the 132 kV transmission line. It is possible that the transmission line located adjacent to the Study Area could experience localised and elevated strains due to unknown geological structures (i.e. anomalies).

Non-conventional or anomalous movements have not been identified during the extraction of Longwalls 301 to 303. The range of strains provided in previous assessments (0.4 mm/m tensile and compressive based on the 95% confidence interval) include those resulting from irregular anomalous movements.

The transmission line does not cross any major streams within the Study Area and, therefore, is not expected to experience any measurable valley closure effects.

Monitoring Data

Extensive monitoring of the transmission line towers has been undertaken since the commencement of Longwall 301 along with monitoring of the adjacent 330 kv transmission line to the west of the 132 kv transmission line. A summary of the monitoring is provided below.

Transmission Line

A survey line (the Transmission Line) comprising ground survey pegs at nominal 20 m spacings located along the alignment of the 330 kv transmission line has been monitored since the commencement of Longwall 301. Monitoring of the Transmission Line was initially carried out on a weekly basis during Longwalls 301 and 302. Monitoring of the Transmission Line encountered problems due disturbance of marks and peg stability. With the availability of accurate continuous GNSS monitoring stations at the towers and relative monitoring of the tower legs, the monitoring frequency of the Transmission Line was changed to end of panel only after the completion of Longwall 302.

The maximum total vertical subsidence along the transmission line is approximately 110mm. Ground strains along the Transmission Line are predominantly within levels of survey accuracy of ± 0.5 mm. The maximum incremental subsidence during the extraction of Longwall 303 was approximately 20mm.

GNSS Monitoring Stations

Continuous GNSS monitoring stations are located at the 330 kv transmission towers (Towers 104 to 108). GNSS Site 07, adjacent to tower 107 was vandalised soon after installation. The maximum horizontal movement at the GNSS sites occurred at Site 06, with approximately 60mm observed during Longwall 303. The horizontal movements observed during the longwall extraction are consistent with the horizontal movement data in Figure 2.

The observed relative opening and closing between the 330 kv towers, based on the GNSS sites, is approximately 25mm, which is consistent with expected movements.

Tower Tilt

Tower tilt has been monitored using changes in relative height of leg mounted prisms. Maximum observed total tilt occurs at the 132 kv towers after the extraction of Longwalls 301 to 303 is 0.7mm/m. The maximum observed tilt is slightly higher than predicted tilt of 0.5 mm/m. A tilt of 0.7mm/m (or 0.07%) equates to 0.04 degrees.

Differential movement between tower legs

The change in distance between tower legs has been monitored during the extraction of Longwalls 301 to 303. The variation in magnitude of differential movement for the monitored towers varies from 3 mm opening to 4 mm closing. The variation during the extraction of Longwall 303 varied from approximately 1mm opening to 1mm closing. This range of differential movement is predominantly generated by limits of survey accuracy and is within the range of ± 4 mm outlined in the Trigger Action Response Plan for Longwalls 301 to 303.

Impact Assessments and Recommendations for the 132 kv Transmission Line

The cables along the 132 kv transmission line are not directly affected by ground strains, as they are supported by the towers above ground level. The cables can, however, be affected by the changes in distance between the towers, i.e. the distances between the towers at the level of the cables, which result from mining induced differential subsidence, horizontal ground movements and lateral movements at the tops of the towers due to differential tilting of the towers. The stability of the transmission towers can be affected by the mining induced tilts, curvatures and ground strains at the tower locations and by changes in the catenary profiles of the cables.

Whilst the 132 kV transmission line could experience low level far-field horizontal movements, the associated tilts, curvatures or strains are not expected to be measurable. It is unlikely that the transmission lines would experience adverse impacts as a result of conventional subsidence movements due to the extraction of Longwalls 305 to 307.

Far-field horizontal movements could result in small changes in the distances between the towers, particularly those located near the ends of the longwalls. Differential far-field horizontal movements between the transmission towers due to the extraction of Longwall 305 to 307 are expected to be less than 20 mm and are not expected to result in adverse impacts to the transmission line.

Localised and elevated ground strains can develop due to the presence of geological structures. It is possible that the transmission towers could experience ground strains greater than those predicted based on conventional movements if they were coincident with the surface expression of a geological structure. The potential for non-conventional movements in the locations of the towers is very low, due to their distances from the longwalls and observations to date, however, the potential for these irregular movements cannot be discounted.

A monitoring program, including a trigger action response plan, has been in place since the commencement of Longwall 301. Observed subsidence parameters have been within expected levels with no identified non-conventional movements. Based on these results the likelihood of non-conventional movements occurring as a result of the extraction of Longwalls 305 to 307 is considered to be very low.

It is considered that monitoring and management strategies developed for the extraction of Longwalls 301 to 304 could be relaxed for the extraction of Longwalls 305 to 307. In consultation with Endeavour Energy, monitoring and management strategies could be revised to manage the transmission line for potential non-conventional ground movements. With the increased distance to Longwalls 305 to 307 and the real time GNSS monitoring units located along the adjacent 330 kv transmission line, the updated monitoring strategy could consider relaxing the frequency of monitoring of the towers to end of panel surveys.

Low Voltage Powerlines

The locations of the low voltage infrastructure and the proposed longwalls are shown in the attached Drawing No. MSEC1059-01. Aerial and buried low voltage powerlines service the Garrawarra Complex in the north-eastern part of the Study Area. The feeder aerial powerline that runs between Helensburgh and the Garrawarra Complex is referred to as Powerline 1 and it is located to the east of the Study Area.

Photographs of the aerial powerlines within the Study Area are provided in Figure 3. These powerlines comprise copper conductors supported by timber poles.



Figure 3 Aerial Powerlines

Conventional Subsidence Parameters

The following provides summaries of the maximum predicted conventional movements for the Endeavour Energy infrastructure following the extraction of Longwall 304 and after extraction of Longwalls 305 to 307. It is possible that localised and elevated movements could develop as the result of non-conventional ground movements due to geological structures or valley closure effects. Discussions on the potential for non-conventional movements are provided in this letter report.

Powerline 1 is located over 560 m from Longwall 305 and is outside the Study Area. At this distance, Powerline 1 is not expected to experience measurable conventional vertical subsidence, tilts or curvatures due to the extraction of Longwalls 305 to 307. The power poles could experience low level far-field horizontal movement of the order of 70 mm based on the 95% confidence level (Figure 2). The far-field horizontal movements are expected to be similar to those observed for previous longwall mining in the Southern Coalfield. The strains associated with these low level horizontal movement are not expected to be measurable.

The aerial powerlines and power poles within the Study Area that service the Garrawarra Complex are located to the north east of Longwalls 305 to 307. A summary of the maximum predicted values of total subsidence, tilt and curvature for these powerlines, following the extraction of Longwall 304 and after extraction of Longwall 305 to 307, is provided in Table 1.

Table 1 Maximum Predicted Total Subsidence, Tilt and Curvature for the Aerial and Buried Powerlines on the Garrawarra Complex following the Extraction of Longwalls 304 to 307

Longwall	Maximum Predicted Total Subsidence (mm)	Maximum Predicted Total Tilt (mm/m)	Maximum Predicted Total Hogging Curvature (km ⁻¹)	Maximum Predicted Total Sagging Curvature (km ⁻¹)
Total after LW304	300	3.0	0.03	< 0.01
Total after LW305	325	3.0	0.03	< 0.01
Total after LW306	325	3.0	0.03	< 0.01
Total after LW307	325	3.0	0.03	< 0.01

It can be seen from Table 1 that the predicted total subsidence increases slightly after the extraction of Longwall 305. The predicted total tilt and curvatures do not increase as a result of the extraction of Longwalls 305 to 307.

Predicted Strains

Low voltage powerlines are located within the Study Area to the east of Longwall 305. A histogram of the maximum tensile and compressive strains measured in survey bays above solid coal, for extracted longwalls in the Southern Coalfield is provided in Figure 4. The probability distribution functions, based on a fitted *Generalised Pareto Distribution (GPD)*, have also been shown in this figure.

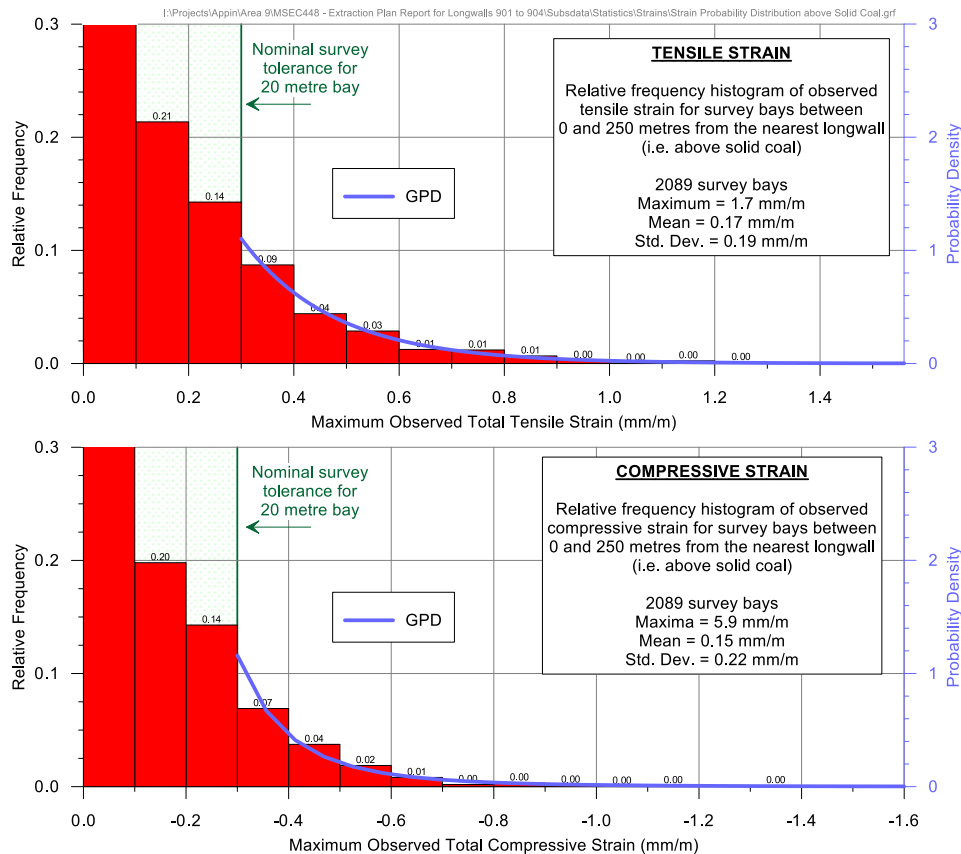


Figure 4 Distributions of the Measured Maximum Tensile and Compressive Strains during the Extraction of Previous Longwalls in the Southern Coalfield for Bays Located Above Solid Coal

The 95 % confidence levels for the maximum total strains that the individual survey bays above solid coal experienced at any time during mining were 0.6 mm/m tensile and 0.5 mm/m compressive. The 99 % confidence levels for the maximum total strains that the individual survey bays above solid coal experienced at any time during mining were 0.9 mm/m tensile and 0.8 mm/m compressive.

Potential for Non-Conventional Movements

Non-conventional movements can develop due to the presence of geological structures or valley related effects. In some cases, non-conventional movements can develop with no known cause and these are often referred to as ‘anomalous’ movements.

The locations of the known geological structures at seam level and the major streams are shown in Drawing No. MSEC1059-01. There are no mapped faults located within the Study Area that extend beneath the low voltage powerlines. It is possible that the powerlines could experience localised and elevated strains due to unknown geological structures (i.e. anomalies). Non-conventional or anomalous movements have not been identified during the extraction of Longwalls 301 to 303. The range of strains provided in the previous section include those resulting from irregular anomalous movements.

The powerlines do not cross any major streams within the Study Area. These cables, therefore, are not expected to experience any measurable valley closure effects.

Impact Assessments and Recommendations for the Powerlines

The 11 kV powerlines comprise aerial conductors supported on timber poles and buried cables. Experience from the Southern Coalfield indicates that the potential impacts on these types of powerlines are rare and generally of a minor nature. Some remedial measures have been required, which include adjustments to cable catenaries, pole tilts and consumer cables which connect between the poles and building structures. The incidence of these impacts, however, was very low.

It is expected that the 11kV powerlines can be maintained in safe and serviceable conditions with the development of the appropriate monitoring and management plans.

It is recommended that monitoring and management strategies developed for the extraction of Longwalls 301 to 304 are updated and continued for Longwalls 305 to 307, in consultation with Endeavour Energy, to manage the low voltage powerlines for potential non-conventional ground movements.

Summary

The 132 kV transmission line is located to the east of the proposed Longwall 305 and is located outside the Study Area at distances of 930 m or more from Longwall 305. At this distance, the transmission line is not expected to experience measurable conventional vertical subsidence, tilts or curvatures due to the extraction of Longwalls 305 to 307. The transmission towers could experience low level far-field horizontal movement. It is considered unlikely that the transmission lines would experience adverse impacts as a result of predicted movements due to the extraction of Longwalls 305 to 307.

The aerial low voltage powerlines are located in the north-eastern part of the Study Area and are not directly above the proposed Longwalls 305 to 307. Experience of mining beneath these types of cables in the Southern Coalfield indicates that the potential impacts on these types of cables are rare and generally of a minor nature.

It is possible that the transmission towers and power poles could experience localised and elevated strains due to the presence of geological structures (known or unknown), if the surface expressions of these features are coincident with them. Non-conventional subsidence movements have not been observed during the extraction of Longwalls 301 to 303 and the likelihood of non-conventional subsidence movements at the transmission towers and power poles due to Longwalls 305 to 307 is considered to be very low.

It is expected that the potential impacts on the Endeavour Energy infrastructure can be managed with the implementation of the necessary monitoring and management strategies.

Yours sincerely



Peter DeBono

Attachments:

Drawing No. MSEC1059-01 – Longwalls 305 to 307 – Endeavour Energy 132 kV Transmission Line



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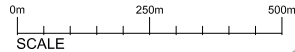


METROPOLITAN COLLIERY
 LONGWALL 305
 ENDEAVOUR ENERGY

DATE: 16 Jul 2019	SCALE: as shown	DRAWING No: MSEC1059-01	Rev No 01
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GEOLOGICAL STRUCTURES

- FAULTS
- DYKES



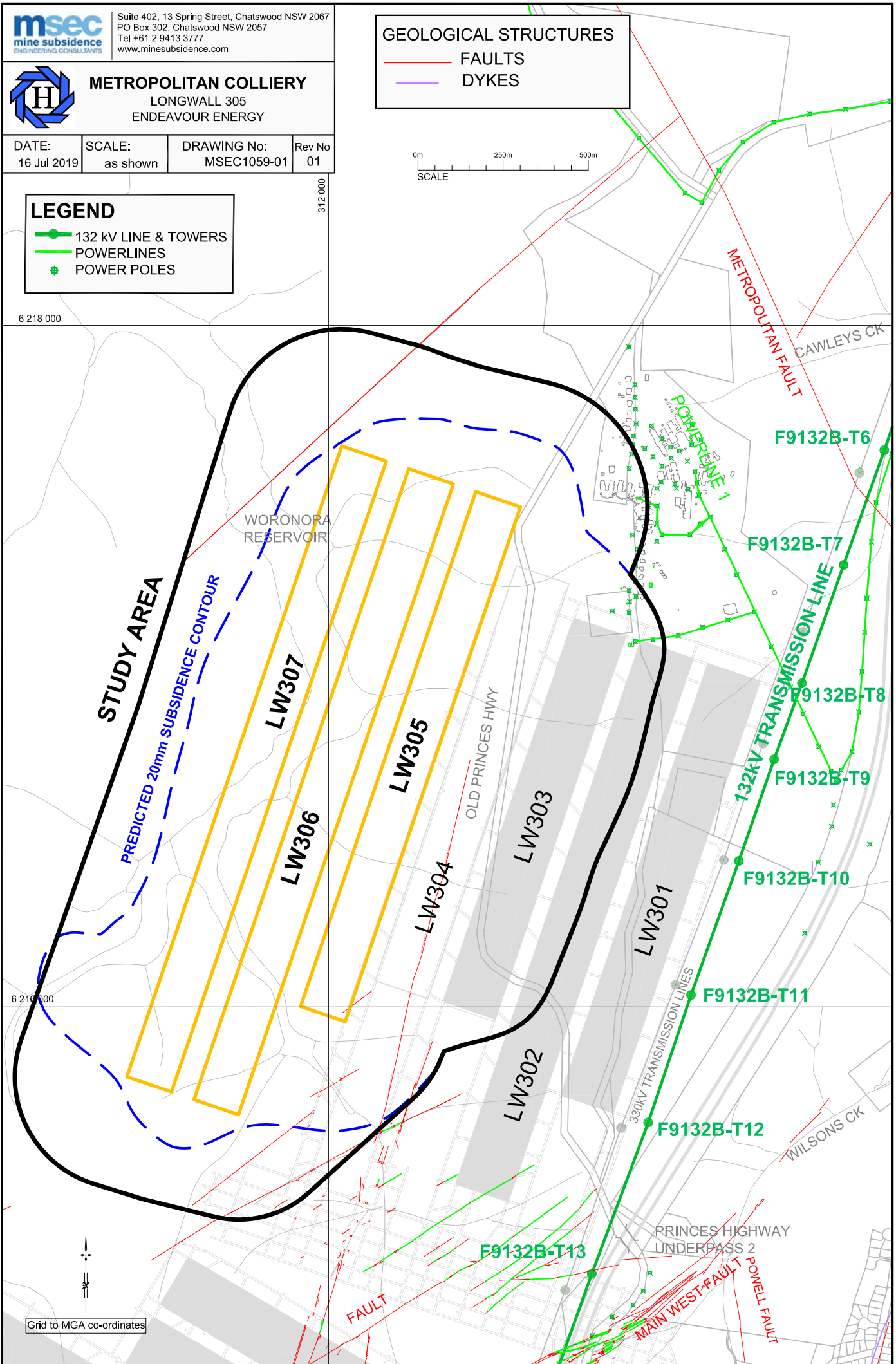
LEGEND

- 132 kV LINE & TOWERS
- POWERLINES
- ✕ POWER POLES

6 218 000

312 000

6 216 000



Grid to MGA co-ordinates

APPENDIX 2

BUILT FEATURES MANAGEMENT PLAN – SUBSIDENCE IMPACT REGISTER

Metropolitan Coal – LW305-307 Built Features Management Plan – Endeavour Energy	
Revision No. BFMP_END-R01-B	
Document ID: Built Features Management Plan – END	

**Built Feature Management Plan – Subsidence Impact Register
Assessment Form**

Date:

Observer (Name and position):

Register Number (i.e. Number 1, 2, etc.):

Longwall Number and Chainage:

Location of Observed Impact:
(Examples: location of tower, include GPS co-ordinates and a sketch)

Description of Observed Impact:
(Examples: nature and extent of impact - cracks in road etc any relevant information, attach photographs)

Person Notified: Manager - Technical Services

Description of Photographs:

Actions Required:	Contingency Plan Initiated	<input type="checkbox"/>	
	Incident Notification	<input type="checkbox"/>	
	Safety	Measures/Public	Safety
	Management Plan Requirements	<input type="checkbox"/>	

Management or Contingency Measures Implemented:

Effectiveness of Management or Contingency Measures:

APPENDIX 3

CONTINGENCY PLAN PROCEDURE AND DECISION TREE

Metropolitan Coal – LW305-307 Built Features Management Plan – Endeavour Energy	
Revision No. BFMP_END-R01-B	
Document ID: Built Features Management Plan – END	

