WAMBO COAL PTY LIMITED

SOUTH BATES EXTENSION UNDERGROUND MINE

EXTRACTION PLAN
LONGWALLS 21 TO 24

APPENDIX H
SUBSIDENCE MONITORING PROGRAM

Peabody

WAMBO COAL PTY LIMITED
SOUTH BATES EXTENSION UNDERGROUND MINE

SUBSIDENCE MONITORING PROGRAM
LONGWALLS 21 - 24

PREPARED BY
WAMBO COAL PTY LIMITED

JULY 2020
Project No. WAM-09-15
Document No. 1016831

DOCUMENT CONTROL

Document No.	SMP LW21-24
Title	Subsidence Monitoring Program for South Bates Extension Underground Mine Longwalls 21 to 24
General Description	Monitoring program for subsidence effects for mining of Longwalls 21 to 24 at the South Bates Extension Underground Mine

Revisions

Rev No	Date	Description	By	Checked
A	July 2020	Final for Submission	WCPL	M. Walker/P. Jaeger

The nominated Coordinator for this document is	Technical Services Manager

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

1 INTRODUCTION

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

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

The South Bates Extension Underground Mine is a component of the approved Wambo Coal Mine. An application to modify the Development Consent (DA 305-7-2003 MOD 17) to allow the development of the South Bates Extension Underground Mine (Longwalls 17 to 25) in the Whybrow Seam was approved in December 2017. The application was accompanied by the *South Bates Extension Modification Environmental Assessment* (WCPL, 2017).

The South Bates Extension Underground Mine commenced in Longwall 17 in December 2018 and involves extraction of coal by longwall mining methods from the Whybrow Seam within Coal Lease (CL) 397, Mining Lease (ML) 1594, ML 1572 and Mining Lease Application Area (MLA) 557.

2 SCOPE

Purpose: This Subsidence Monitoring Program (SMP) for Longwalls 21 to 24 outlines the monitoring program for subsidence effects for mining of Longwalls 21 to 24 at the South Bates Extension Underground Mine.

Scope: This SMP covers the Longwalls 21 to 24 Application Area.

This SMP has been prepared in accordance with Condition B7(e) of Schedule 2 of the Development Consent (DA 305-7-2003), as a component of the South Bates Extension Underground Mine Longwalls 21 to 24 Extraction Plan.

This program has been prepared in consideration of the Draft *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) (Department of Planning and Environment and NSW Trade & Investment – Division of Resources and Energy, 2015), which requires:

- proposed subsidence monitoring activities (individually specified);
- information or subsidence parameters to be obtained from each monitoring activity;
- proposed locations and/or extents where each monitoring activity will be undertaken, in particular, the proposed layout and/or locations of instrumentation, monitoring points or inspections (including graphical plans);
- proposed timing, frequency and duration of each monitoring activity;
- proposed monitoring methods, technologies, industry standards or Codes of Practice to be applied in undertaking each monitoring activity;
- proposed measures and procedures for quality assurance and competence of personnel undertaking monitoring activities;
- proposed procedures to record monitoring results;

- proposed reporting of monitoring results;
- capacity of the program to detect early warning of deviations from the defined performance measures and associated performance indicators;
- summarise and consolidate the various monitoring programs presented in each of the key component plans; and
- figures showing the monitoring sites for each of the various monitoring programs.

Proposed monitoring and reporting of subsidence effects for Longwalls 21 to 24 is described in **Section 3**. A summary of monitoring of subsidence impacts and environmental consequences is described in **Section 4**.

This SMP has been prepared by WCPL. The appointment of the team of suitably qualified and experienced experts (which includes representatives from WCPL) has been endorsed by the Secretary of the Department of Planning, Industry and Environment (DPIE).

3 SUBSIDENCE EFFECTS MONITORING AND REPORTING

3.1 SUBSIDENCE MONITORING DETAILS

Subsidence monitoring lines are monitored until negligible subsidence is detected. Discontinuance of survey of these lines will be totally at the discretion of the Principal Subsidence Engineer (NSW Resources Regulator).

The monitoring lines for Longwalls 21 to 24 (Lines 8XL, CL21B and CL23B) will be installed as star pickets driven to refusal with a mark then punched into the top and labelled. The marks will be capped with a protective cover that will be removed during survey.

Survey pegs shall generally be a minimum of 10 m and a maximum of 20 m apart.

Surveys shall be carried out using either differential levelling to class LC accuracy or Trig heightening methods to an accuracy of class B as specified in the Inter-Governmental Committee on Surveying and Mapping Special Publication 1.

LiDAR monitoring lines (Lines CL21A, CL22A, CL23A and CL24A) will be analysed by creating a surface profile along the line from 3 dimensional LiDAR data. The potential for survey error due to displacement of the data will be minimised through the use of fixed reference points outside the angle of draw. This data will be used to provide an estimate of the actual angle of draw to the limit of vertical subsidence data at the commencement ends. LiDAR analysis is considered the most suitable monitoring method given the terrain constrains the ability to use other survey methods.

Details of any subsidence impacts observed will be recorded in the Subsidence Impact Register with visual observations documented in the Subsidence Impact Register Assessment Form (**Attachment 2**). Visual inspections will be undertaken in accordance with the inspection checklist provided in **Attachment 2**. The Subsidence Impact Register will be maintained as an electronic spreadsheet on-site, with hard copies of assessment forms filed in a folder.

The data collected under this monitoring program for Longwalls 21 to 24 will be provided to the NSW Resources Regulator in a timely fashion and a suitable format.

3.2 SURVEY ACCURACY AND FREQUENCY

The prescribed accuracy, as defined by the Inter-Governmental Committee on the Survey and Mapping Special Publication 1 (ICSM SP1) and the required frequency of the surveys can be seen in **Table 1**.

3.3 SUBSIDENCE EFFECTS RECORDING AND REPORTING

Subsidence survey data for the South Bates Extension Underground Mine will be stored by WCPL in a centralised database, with results from each survey clearly demarcated.

Subsidence survey data will be provided to the Principal Subsidence Engineer (NSW Resources Regulator) promptly following each survey. Subsidence effects will also be reported under the reporting framework of the Extraction Plan.

Table 1
Subsidence Effects Monitoring Program Summary

Survey Line	Data Type	Survey Accuracy Classification	Survey Frequency	Survey Status
Visual Inspections	As per the Subsidence Impact Register provided in **Attachment 2**	N/A	• Within 1 month of longwall extraction that may cause surface movement. • 3 monthly or more frequent in areas of significance such as creeks, roads and buildings.	• As per monitoring program.
Line 8XL	z (level and strain distances)	ICSM Class B or LC	• Twice prior to longwall extraction that will cause surface movement. • After completion of each longwall block.	• Line to be installed and surveyed prior to commencement of mining.
Line CL21B	z (level and strain distances)	ICSM Class B or LC	• Twice prior to longwall extraction that will cause surface movement. • After completion of each longwall block.	• Line to be installed and surveyed prior to commencement of mining.
Line CL23B	z (level and strain distances)	ICSM Class B or LC	• Twice prior to longwall extraction that will cause surface movement. • After completion of each longwall block.	• Line to be installed and surveyed prior to commencement of mining.
Line CL21A	Random x, y, z (LiDAR)	<150mm Vert (1 sigma)	• Prior to longwall extraction that will cause surface movement. • After completion of each longwall block.	• Baseline data to be collected prior to commencement of mining.
Line CL22A	Random x, y, z (LiDAR)	<150mm Vert (1 sigma)	• Prior to longwall extraction that will cause surface movement. • After completion of each longwall block.	• Baseline data to be collected prior to commencement of mining.
Line CL23A	Random x, y, z (LiDAR)	<150mm Vert (1 sigma)	• Prior to longwall extraction that will cause surface movement. • After completion of each longwall block.	• Baseline data to be collected prior to commencement of mining.
Line CL24A	Random x, y, z (LiDAR)	<150mm Vert (1 sigma)	• Prior to longwall extraction that will cause surface movement. • After completion of each longwall block.	• Baseline data to be collected prior to commencement of mining.

4 MONITORING OF ENVIRONMENTAL CONSEQUENCES

The various monitoring programs presented in each of the management plans under the Extraction Plan are summarised in **Table 2** and the location of environmental monitoring sites included in WCPL's various environmental monitoring programs are presented in **Figures 1** and **2**.

Figure 1 presents the location of surface water and groundwater monitoring sites.

Figure 2 presents the location of biodiversity monitoring sites. As described in **Table 2**, visual observation of the Wollemi National Park escarpment will be undertaken as part of the BMP monitoring program.

Details of any subsidence impacts observed will be recorded in the Subsidence Impact Register with visual observations documented in the Subsidence Impact Register Assessment Form as provided in **Attachment 2**. Visual inspections will be undertaken in accordance with the inspection checklist provided in **Attachment 2**.

The Subsidence Impact Register will be maintained as an electronic spread sheet on-site, with hard copies of assessment forms filed in a folder.

Table 2
Longwalls 21 to 24 Monitoring Program Summary

Management Plan	Monitoring Component	Parameter	Frequency
Water Management Plan	Monitoring of surface water quality and flow monitoring sites.	• Monitoring of surface water flow and quality along North Wambo Creek, North Wambo Creek Diversion, Stony Creek and Wollombi Brook in accordance with the SWMP.	• In accordance with the SWMP.
	Monitoring of groundwater level and quality, including additional alluvial sites along North Wambo Creek (GW27 to GW35).	• Monitoring of groundwater level and quality (including depth to water, electrical conductivity, pH and temperature) within the vicinity of the Wambo Coal Mine.	• In accordance with the GWMP.
	Inflows to underground workings.	• Dewatering volumes and underground water levels in accordance with the GWMP.	• In accordance with the GWMP.
	Diversion and subsidence monitoring program, including six additional sites (UA, UB, UC, UD, UE and UF).	• As outlined in the SWMP, including: monitoring of Index of Diversion Condition; Landscape Function Analysis (LFA); riparian vegetation; aerial photography; long and cross-section surveys (extracted from LiDAR); and geomorphic condition and efficacy of subsidence management or rehabilitation works.	• In accordance with the SWMP.
	Visual inspection of the North Wambo Creek.	• Inspections for surface cracking and/or surface ponding.	• Weekly inspections when extraction is occurring within 100 m of North Wambo Creek.
	Visual inspection of drainage line flow paths.	• Evidence of erosion or channelisation.	• Following a rainfall event of greater than 40 mm in 24 hours.[1]
Land Management Plan	Fences.	• Visual observation to record the condition of fences.	• Prior to secondary extraction of Longwalls 21 to 24. • Prior to secondary extraction within 100 m of any active WCPL fences (i.e. fences being used to hold stock or prevent public access) and undertaken at 50 m intervals until the active mining face is 100 m past the WCPL fence. • Following completion of secondary extraction of Longwalls 21 to 24.

Table 2 (Continued)
Longwalls 21 to 24 Monitoring Program Summary

Management Plan	Monitoring Component	Parameter	Frequency
Land Management Plan (Cont.)	Ground surface.	• Visual observations to record the initial condition of the ground surface. • Visual observations of the ground surface behind the longwall face to identify potential surface cracks.	• Prior to secondary extraction of Longwalls 21 to 24. • Monthly inspections during secondary extraction of Longwalls 21 to 24, increased to weekly inspections when extraction is within 100 m of the North Wambo Creek.
	Cliffs[2].	• Visual observations of cliffs[2] for signs of recent rock fall and/or instability (high definition video/photos recorded via an unmanned aerial vehicle [UAV]).	• Prior to, and following completion of, secondary extraction of each of Longwalls 21 to 24.
	Low lying areas.	• Visual observations of low lying areas to identify potential surface ponding.	• Following a significant rainfall event (i.e. 40 mm within 24 hours).[1]
	Surface areas which required remediation.	• Visual observations of the ground surface to identify stabilisation of erosion and groundcover.	• Monthly inspections until stabilisation of erosion and groundcover is >60%.
Biodiversity Management Plan	General monitoring of flora, fauna and aquatic ecosystems (including groundwater dependent ecosystems).	• Monitoring in accordance with the BMP.	• In accordance with the BMP.
	Subsidence impacts to Wollemi National Park escarpment.	• Visual observations of the Wollemi National Park escarpment for signs of recent rock fall and/or instability (high definition video/photos recorded via an UAV).	• Prior to secondary extraction of Longwalls 21 to 24 and following completion of each longwall in accordance with the LMP.
Heritage Management Plan	Artefact scatters, isolated finds and PADs.	• Significant surface cracks and/or erosion in the vicinity of artefact scatters or isolated finds.	• In accordance with the HMP (prior to secondary extraction of Longwalls 21 to 24 and monthly during extraction of longwall panels in immediate proximity to a site).
	Rock Shelters with PAD.	• Inspections to identify instances of block/rock fall, cracking, opening of bedding planes, exfoliation and/or overhang collapse at Wambo Site 499 and Wambo Site 507.	• Following completion of secondary extraction of Longwall 24.

Table 2 (Continued)
Longwalls 21 to 24 Monitoring Program Summary

Management Plan	Monitoring Component	Parameter	Frequency
Heritage Management Plan (Cont.)	Scarred trees.	• Baseline recording[3] of the confirmed and possible scarred trees (Wambo Site 324) will be undertaken by a suitably qualified archaeologist (and a surveyor where required), including noting the tilt of the trees.	• Prior to secondary extraction of Longwalls 21 to 24.
		• The tilt and condition of the confirmed and possible scarred trees (Wambo Site 324) will be recorded to identify if there is any change from the baseline recording[4].	• Following completion of secondary extraction of Longwall 24.
Built Features Management Plan – WCPL Asset Management Plan	All built features.	• Visual observations to record the general condition of WCPL assets including safety and serviceability.	• Prior to secondary extraction within 1,000 m of WCPL assets. • Monthly inspection during secondary extraction of Longwalls 21 to 24.
	Active service lines.[5]	• Visual observations to record the general condition of WCPL active service lines including safety and serviceability.	• Weekly inspections.
		• Monitoring of pipeline integrity at fixed points.	• Daily inspections commencing when secondary extraction is within 100 m of WCPL pipelines and undertaken until the active mining face is 100 m past the pipeline.
		• Monitoring to detect abnormal changes in flow.	• Continuous (SCADA) monitoring of pump and pipeline conditions.
	Ventilation shaft.	• Monitoring of ventilation shaft, fan surface infrastructure and underground workings at base of shaft.	• Weekly inspections in mines inspections program.
	Groundwater monitoring bores.	• Integrity of groundwater monitoring bores by reviewing groundwater monitoring data.	• Once the active mining face is 100 m past the bore.
	Culverts.	• Visual observations to record cracking of concrete culverts or grade reversal.	• Prior to secondary extraction within 100 m of culverts and undertaken at 50 m intervals until the active mining face is 100 m past the culverts.

Table 2 (Continued)
Longwalls 21 to 24 Monitoring Program Summary

Management Plan	Monitoring Component	Parameter	Frequency
Built Features Management Plan – WCPL Asset Management Plan (Cont.)	Roads and tracks.	• Visual observations to record condition of roads and tracks, including surface cracks, buckling and general safety.	• Prior to secondary extraction within 100 m of any WCPL asset and undertaken at 50 m intervals until the active mining face is 100 m past the WCPL asset.
	Farm buildings, sheds, tanks and house (Whynot Homestead).	• Structural assessment.	• Following completion of active mining.
Public Safety Management Plan	Fences.	• Visual observation to record the condition of fences.	• Prior to secondary extraction of each longwall. • Prior to secondary extraction within 100 m of any active WCPL fences (i.e. fences being used to hold stock or prevent public access) and undertaken at 50 m intervals until the active mining face is 100 m past the WCPL fence. • Following completion of secondary extraction of Longwalls 21 to 24.
	Warning signs.	• Visual observation to record the initial condition of existing warning signs (e.g. legibility). • Visual observations to record the condition of warning signs (e.g. legibility) during extraction of Longwalls 21 to 24.	• Prior to secondary extraction of each longwall. • Monthly inspections during secondary extraction of Longwalls 21 to 24.
	Whynot Homestead.	• Structural assessment to determine if demolition is required.	• Following completion of active mining.

Table 2 (Continued)
Longwalls 21 to 24 Monitoring Program Summary

Management Plan	Monitoring Component	Parameter	Frequency
Rehabilitation Management Plan (MOP)	Remediated subsidence areas.	• Visual monitoring to identify any requirement for maintenance measures and/or remedial works.	• Monthly inspections until monitoring confirms stabilisations of erosion and groundcover is >60%.
	Installed sediment control structures.	• Inspection of capacity, structural integrity and effectiveness in accordance with the ESCP.	• Monthly and/or following a significant rainfall event (i.e. 20 mm within 24 hours, midnight to midnight).

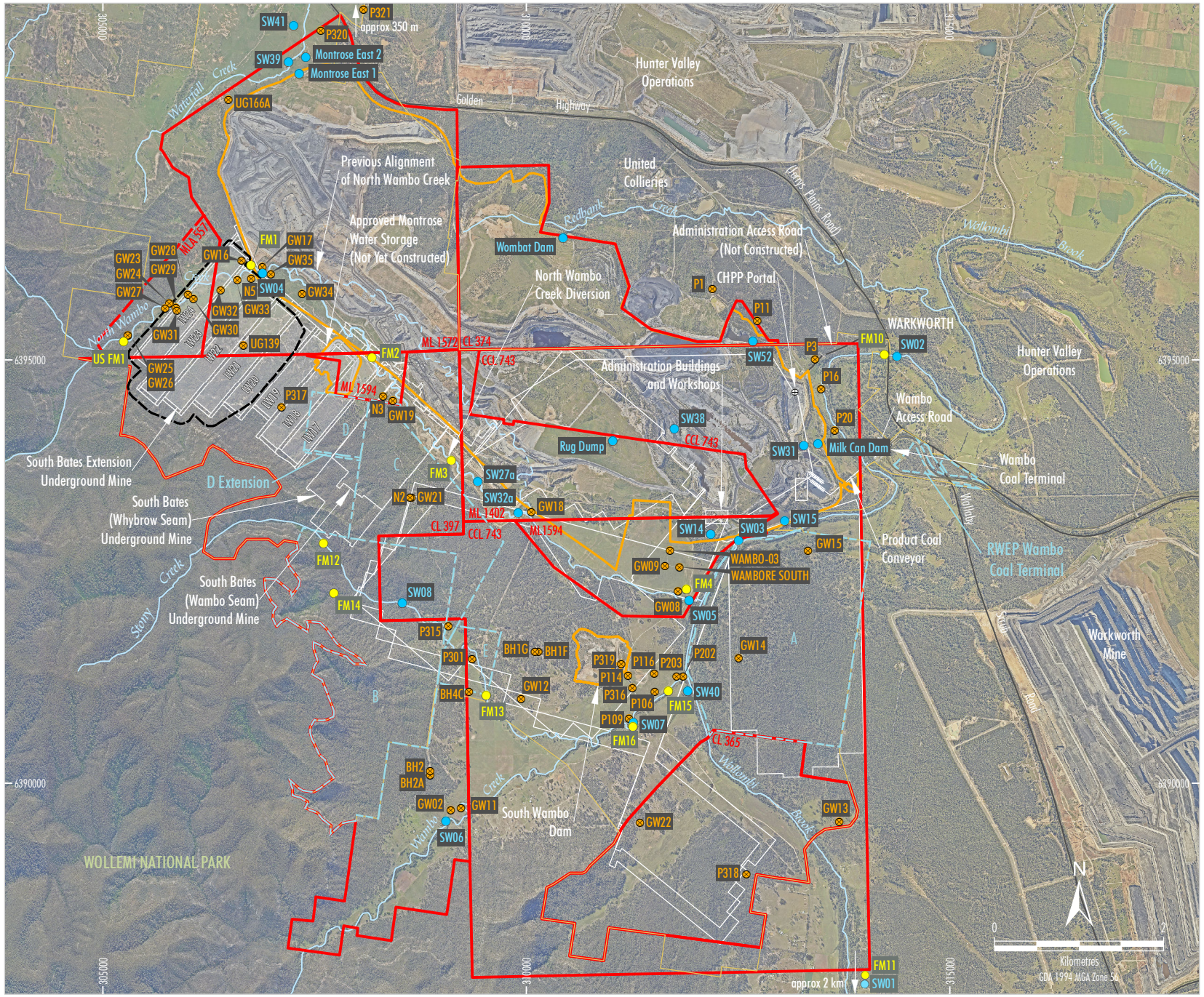
[1] Inspection to occur once access is practicably available following the rainfall event. Inspections will not occur for subsequent rainfall events within 7 days of previous inspection.

[2] Cliffs include: the low level cliffs, intermediate level cliffs and cliffs associated with the Wollemi National Park escarpment located within the vicinity of Longwalls 21 to 24.

[3] Where sufficient data for a baseline record has not already been obtained by WCPL.

[4] If no change is detected then this will be documented. If any adverse changes that threaten the stability of the tree are identified, then appropriate stabilisation works and/or salvage will be considered and undertaken as required.

[5] Active service lines include all services required for mining at the Wambo Coal Mine (electricity supply, telecommunications, water supply and mine dewatering).



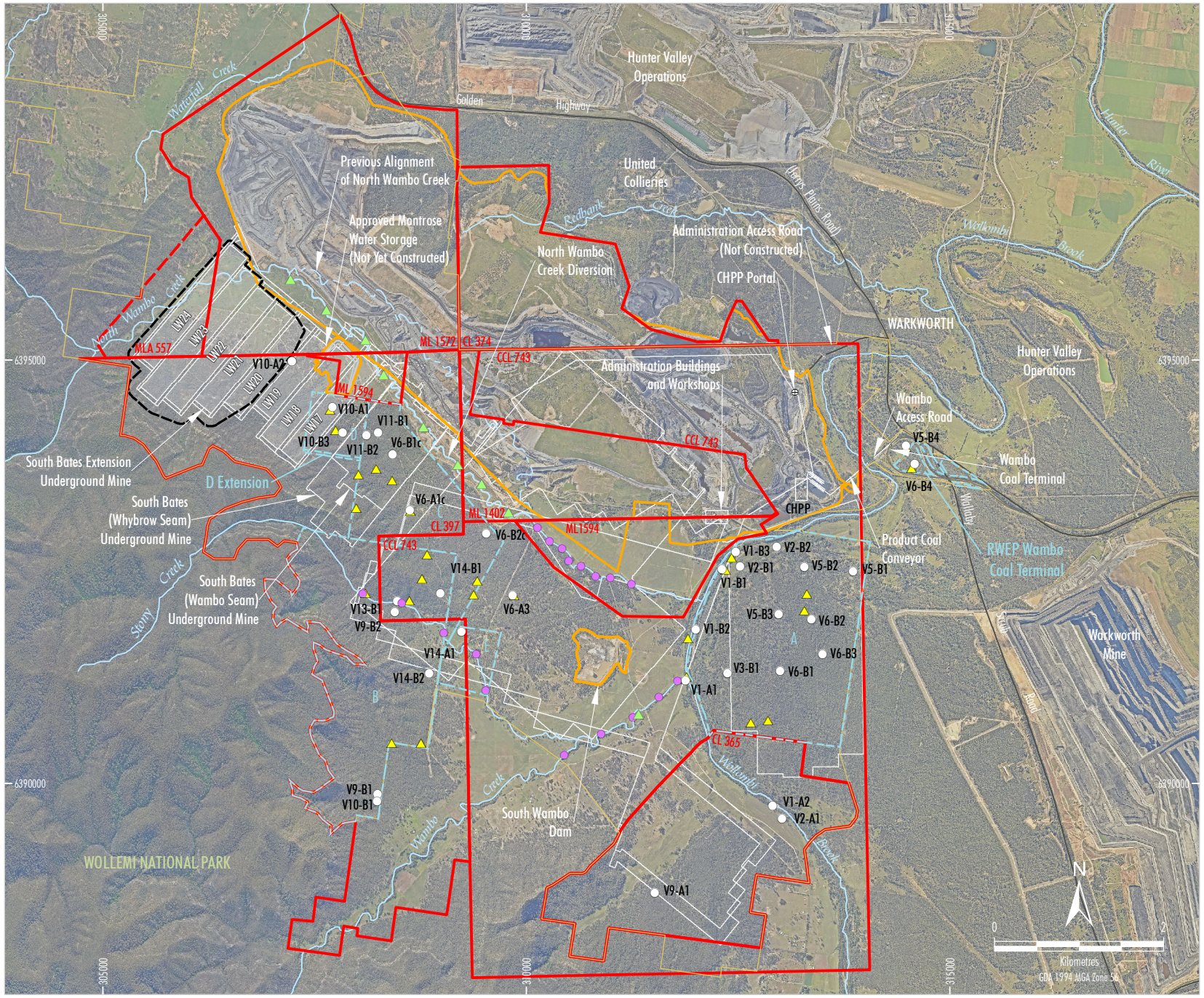
Peabody

WAMBO COAL MINE

Locations of Surface Water and Groundwater Monitoring Sites

Figure 1

WAM-09-15_SBX EP_LW 17-20_SMP_201C



Peabody

WAMBO COAL MINE

Locations of Relevant Biodiversity Monitoring Sites

Figure 2

WAM-09-15_SBX EP_LW 17-20_SMP_202A

5 ROLES AND RESPONSIBILITIES

Key responsibilities of WCPL personnel in relation to this SMP are summarised in **Table 3**. Responsibilities may be delegated as required.

Table 3
Subsidence Monitoring Program Responsibilities Summary

Responsibility	Task
General Manager	• Ensure resources are available to WCPL personnel to facilitate the completion of responsibilities under this SMP.
Mining Engineering Manager (Underground Mine Manager)	• Ensure this SMP is implemented.
Technical Services Manager	• Ensure monitoring and reporting required in accordance with this SMP is carried out within specified timeframes, are adequately checked and processed and are prepared to the required standard.
Environment and Community Manager	• Undertake environmental monitoring required in accordance with the Extraction Plan and ensure the Subsidence Impact Register is kept up to date and hard copies of the assessment forms are filed / stored correctly.
Underground Mining Engineer	• Become familiarised with environmental aspects which require monitoring in accordance with the Extraction Plan.
Mine Surveyor	• Undertake all monitoring in accordance with this SMP to the required standard within the specified timeframes and ensure data are adequately checked, processed and recorded.

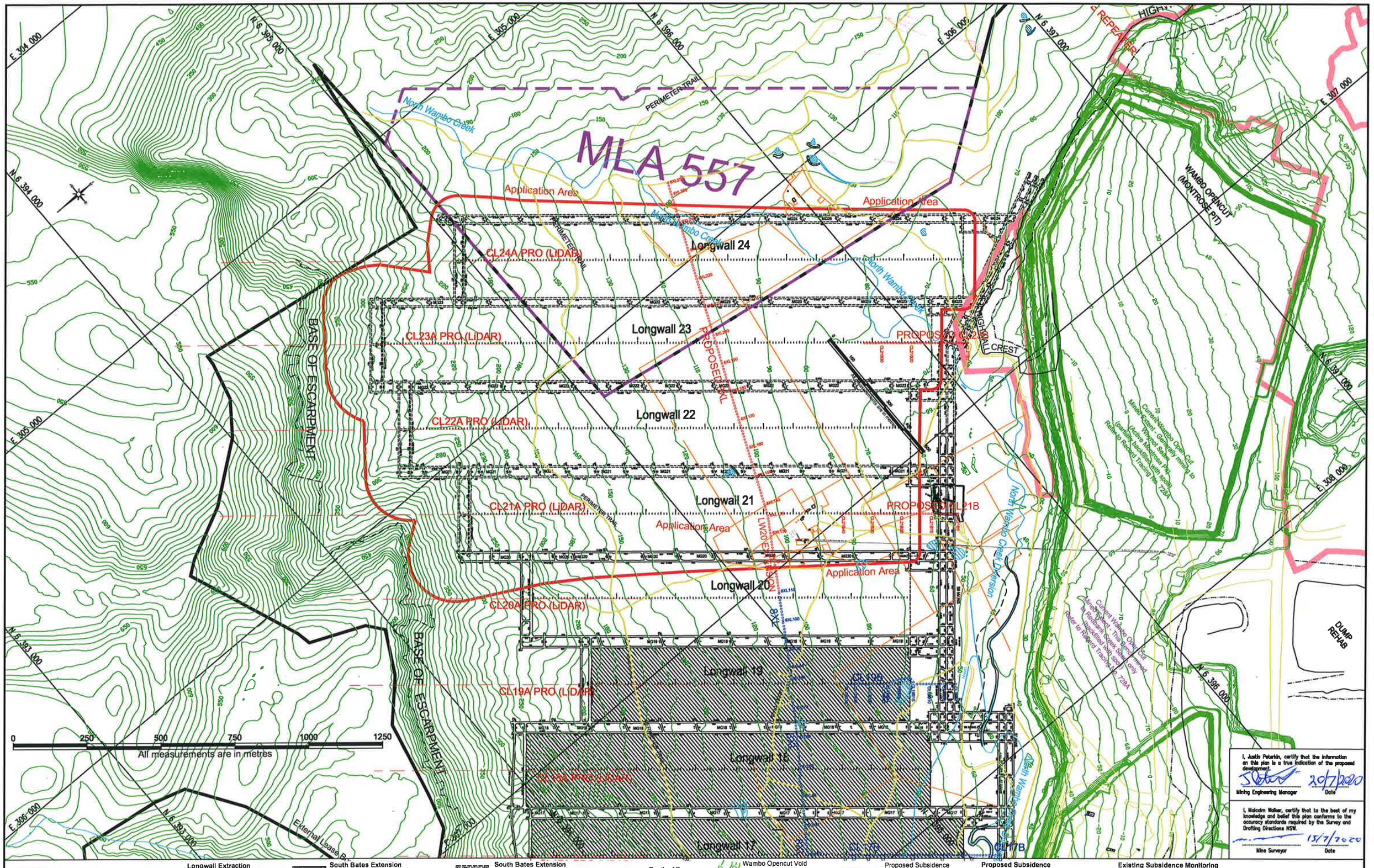
6 REFERENCES

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.

Wambo Coal Pty Limited (2003) *Wambo Development Project Environmental Impact Statement.*

ATTACHMENT 1

EXISTING AND PROPOSED SUBSIDENCE MONITORING LINES



I, Justin Peterkin, certify that the information on this plan is a true indication of the proposed development.

Mining Engineering Manager — Date 20/7/2020

I, Malcolm Walker, certify that to the best of my knowledge and belief this plan conforms to the accuracy standards required by the Survey and Drafting Directions NSW.

Mine Surveyor — Date 15/7/2020

Current Open Cut Extraction Approval Area

Longwall Extraction Application Area (based on 26.5° angle of draw)

South Bates Extension Underground Existing Workings (Whybrow Seam)

South Bates Extension Underground Proposed Workings (Whybrow Seam)

90 Depth of Cover Contours

30 45 Wambo Opencut Void 5m Contours (AHD) (Whybrow/Wambo Seam)

Proposed Subsidence Monitoring LiDAR Profile Locations

1XL95 Proposed Subsidence Monitoring Marks for South Bates Extension Underground

7XL95 Existing Subsidence Monitoring Marks for South Bates Extension Underground

Fences

REVISIONS	REV.	DATE	BY	DESCRIPTION	CHK.
	A	14/07/2020	MJW	For Longwall 21 to 24 Submission	ND

Peabody

WAMBO COAL PTY LIMITED
ABN 13 000 668 057

Jerry's Plains Rd, Warkworth
Via Singleton, NSW, 2330

Phone: 02 65 702200
Fax: 02 65 702290

Prepared by NWU Survey Ph: 02 65 702318

South Bates Extension Underground Mine (Whybrow Seam)
Extraction Plan - Longwalls 21 to 24 (Revision A)
Plan 7 - Proposed and Existing Subsidence Monitoring

Drawing No.	Revision No.
2714	A_14/07/2020

Date	Scale:	Drawn	Checked	Approved	Sheet Size
25/06/2020	1: 4000	MJW	PJ	JP	A0

ATTACHMENT 2

SUBSIDENCE IMPACT REGISTER

Table A2-1
Example Subsidence Impact Register (Electronic Version Maintained On-Site)

Impact Register Number[1]	Impact Description	Does Impact Exceed the Performance Measure/Indicators? (Yes/No/ Not Applicable)	Management Measures Implemented	Were Management Measures Effective? (Yes/No)

Notes:

1: Fill out all details in the Assessment Form and record the register number here.

SUBSIDENCE IMPACT REGISTER ASSESSMENT FORM		
Date and Time		
Observer (Name and position)		
Register Number (i.e. Number 1, 2, etc.)		
Longwall Number		
Longwall Chainage		
Area Inspected Examples: location of crack, include GPS co-ordinates and a sketch		
INSPECTION ITEM	**CHECKED**	**COMMENTS** (Examples: nature and extent of impact, any relevant information, attach photographs)
Surface Cracking		
Surface Humps (compression)		
Surface Ponding		
Access Tracks/Serviceability of built features		
Warning Signage		
Powerline – poles, insulators, conductors, conductor clearance		
Other		
Actions Required		
Management or Contingency Measures Implemented		
Effectiveness of Management or Contingency Measures		
WCPL Key Personnel Notified (include date of email)		
Technical Services Manager	☐ __/__/____	
Environment and Community Manager	☐ __/__/____	

SUBSIDENCE INSPECTION CHECKLIST

WHERE TO INSPECT

- 500 metres behind and 100 metres in front of the current longwall face position.

EXTENT OF INSPECTION

- Include the area of active subsidence based on the 26.5 degree angle of draw.

WHAT TO LOOK FOR

- **Surface Cracking**: inspect edges of extraction void and travelling abutments.
- **Surface Humps**: inspect near centre of extracted panels and travelling abutment.
- **Surface Ponding**: inspect low lying areas for evidence of increased/new ponding.
- **Access Tracks**: inspect for step change in land surface and changes in access for serviceability.
- **Warning Signage**: inspect condition and legibility of relevant warning signage.
- **Powerlines**: inspect for changes of conductor clearance and power pole condition.
- Check the serviceability of built features (e.g. fences, buildings, dams and access tracks).
- Note any flooding hazards for access tracks.
- Carry out any inspections required in accordance with the Built Features Management Plan for Longwalls 21 to 24.

ACTIONS IF AN IMPACT IS IDENTIFIED

1. Employ additional subsidence warning signs if necessary.
2. Notify Key Personnel (including asset owner if relevant [e.g. if asset is not a WCPL-owned asset]).
3. Assess impact against requirements of the relevant TARP and implement actions as required.
4. Record implemented actions in the Subsidence Impact Register Assessment Form.
5. Notify the Principal Subsidence Engineer (NSW Resources Regulator) if impacts greater than predicted are identified.
6. Notify other stakeholders as required (e.g. DPIE, NSW Resources Regulator etc.).