SOUTH32 Illawarra Metallurgical Coal

APPIN MINE AREAS 7 AND 9 LONGWALLS 709 TO 711 AND 905 EXTRACTION PLAN MAIN DOCUMENT

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DOCUMENT REVISION LOG

Persons authorising this Plan

Name	Title	Date
Gary Brassington	Manager Approvals	July 2022

Document Revisions

Revision	Description of Changes	Date
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1.0	Original Document	July 2021
1.1	Updated to address feedback on draft EP application	October 2021
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Persons involved in the review of this Plan

Name	Title	Company	Exp (yrs)
Cody Brady	Principal Approvals	South32	6
Gary Brassington	Manager Approvals	South32	25

1. OVERVIEW OF THE EXTRACTION PLAN

South32 Illawarra Metallurgical Coal (IMC) operates the Bulli Seam Operations (BSO) Appin Mine located in the Southern Coalfield of New South Wales (NSW). Mining is currently underway in two areas, referred to as Appin Area (AA) 7 and 9. Appin Mine produces high quality hard coking coal for steel production.

On 22 December 2011 the Planning and Assessment Commission (PAC), under delegation of the Minister for Planning (now the Secretary of the Department of Planning and Environment DPE), approved BSO (MP 08_0150) under Part 3A of the Environmental Planning and Assessment Act 1979 (EP&A Act) to continue mining operations until 2041.

1.1 Purpose and Scope

This Extraction Plan outlines the proposed management, mitigation, monitoring and reporting of potential subsidence impacts and environmental consequences in the BSO underground mining area during the extraction of Longwalls 709 to 711 and 905 at Appin Mine.

IMC have Subsidence Management Plan approval to extract Longwalls 709 and 710B in AA7, which was granted by the Resources Regulator 23 November 2020 (Appin Mine Longwalls 705 – 710 Subsidence Management Plan Approval). Longwalls 709 and 710B have been included in this extraction plan application to supplant the SMP approval and consolidate the extraction approvals in AA 7 and 9.

The objectives of this Extraction Plan are to:

- provide detailed plans of Longwalls 709 to 711 and 905;
- outline potential subsidence effects, subsidence impacts and environmental consequences of Longwalls 709 to 711 and 905;
- describe the measures that will be implemented to manage, mitigate and remediate potential subsidence impacts and environmental consequences during the mining of Longwalls 709 to 711 and 905;
- detail the monitoring of subsidence effects, subsidence impacts and environmental consequences during the mining of Longwalls 709 to 711 and 905; and
- provide a contingency plan for subsidence impacts and environmental consequences in relation to the BSO's subsidence impact performance measures.

The Study Area for the Extraction Plan is defined in accordance with MSEC (2021) as the surface area predicted to be affected by the proposed mining of Longwalls 709 to 711 and 905 and encompasses the areas bounded by the following limits:

- A 35° angle of draw line from the maximum depth of cover, which equates to a horizontal distance varying between 530 m and 750 m around the limits of the proposed extraction areas for Longwalls 709 to 711 and 905, and
- The predicted limit of vertical subsidence, taken as the 20 mm subsidence contour, resulting from the extraction of the proposed Longwalls 709 to 711 and 905.

Additionally, features potentially sensitive to far field movements, which includes horizontal, valley closure and upsidence movements that may be outside the 20 mm subsidence zone or 35° angle of draw line have been assessed.

The location of the Longwalls 709 to 711 and 905 Study Area within the BSO is shown in Figure 1. The General Arrangement of Longwalls 709 to 711 and 905 is shown in Figure 2.

This Extraction Plan has been prepared by IMC with assistance from a team of suitably qualified and experienced persons including Mine Subsidence Engineering Consultants (MSEC), Cardno, SLR Consulting, Biosis Research, GHD and Niche Environment and Heritage.

This Extraction Plan forms part of Appin's Environmental Management Framework. The relationship of this Extraction Plan to the Appin Mine Environmental Management Framework is shown on Figure 3.

1.1.1 Statutory Requirements

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

BSO Approval (MP 08_0150)

This Extraction Plan has been prepared in accordance with Conditions 5 and 6, Schedule 3 of the BSO Approval. The requirements of Conditions 5 and 6, Schedule 3 of the BSO Approval are summarised in Table 1, along with the relevant section(s) of this Extraction Plan in which the requirements are addressed.

Table 1 Management Plan Requirements

BSO Approval Conditions	Extraction Plan Reference
Condition 5, Schedule 3	This document
5. The Proponent shall prepare and implement an Extraction Plan for first and second workings within each longwall mining domain to the satisfaction of the Secretary. Each extraction plan must:	
a) be prepared by suitably qualified and experienced persons whose appointment has been endorsed by the Secretary;	Section 2.2
b) be approved by the Secretary before the Proponent carries out any of the second workings covered by the plan;	Section 1.1.1
c) include detailed plans of existing and proposed first and second workings and any associated surface development;	Attachment A
d) include detailed performance indicators for each of the performance measures in Tables 1 and 2;	Section 1.3 and 3
e) provide revised predictions of the potential subsidence effects, subsidence impacts and environmental consequences of the proposed second workings, incorporating any relevant information obtained since this approval;	Section1.7
f) describe the measures that would be implemented to ensure compliance with the performance measures in Tables 1 and 2, and	Section 3

manage or remediate any impacts and/or environmental consequences;	
g) include a Built Features Management Plan, which has been prepared in consultation with DRE and the owners of affected public infrastructure, to manage the potential subsidence and/or environmental consequences of the proposed second workings, and which: – address in appropriate detail all items of key public infrastructure and other public infrastructure and all classes of other built features; – has been prepared following consultation with the owner/s of potentially affected feature/s; – recommends appropriate pre-mining mitigatory measures to reduce subsidence impacts; – recommends appropriate remedial measures and includes commitments to mitigate, repair, replace or compensate all predicted impacts on potentially affected built features in a timely manner; and; – in the case of all key public infrastructure, and other public infrastructure except roads, trails and associated structures, reports external auditing for compliance with ISO1300 (or alternative standard agreed with the infrastructure owner) and provides for annual auditing of compliance and effectiveness during extraction of longwalls which may impact the infrastructure;	Appendix H
h) include a Water Management Plan, which has been prepared in consultation with OEH, WaterNSW and DPI Water, which provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on watercourses and aquifers, including: – surface and groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse impacts on water resources and quality; – a program to monitor and report stream flows and assess any changes resulting from subsidence impacts; – a program to monitor and report groundwater inflows to underground workings; and – a program to predict, manage and monitor impacts on groundwater bores on privately owned land;	Appendix C
i) include a Biodiversity Management Plan, which has been prepared in consultation with OEH and DPI (fisheries), which provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on aquatic and terrestrial flora and fauna, with a specific focus on threatened species,	Appendix D

populations and their habitats, endangered ecological communities, and water dependant ecosystems, including (for Appin Areas 7, 8 and 9): – additional targeted surveys for threatened species, sufficient to identify any actions required to protect significant populations from potential impacts;	
j) include a Land Management Plan, which has been prepared in consultation with any affected public authorities, to manage the potential impacts and/or environmental consequences of the proposed second workings on land in general, with a specific focus on cliffs and steep slopes;	Appendix E
k) include a Heritage Management Plan, which has been prepared in consultation with OEH and relevant stakeholders for both aboriginal and historic heritage, to manage the potential environmental consequences of the proposed second workings on both aboriginal and non- aboriginal heritage sites and which: – includes additional investigations (such as surveys and current register searches) for aboriginal heritage items (including previously known sites) and historic heritage items, sufficient to identify the significance (including 'special significance') of all sites which may be impacted by subsidence and to identify any actions required to ensure that the performance measures in Table 1 are met; and – is prepared in accordance with the relevant requirements for preparation of the heritage management plan required under condition 23 of Schedule 4;	Appendix F
l) include a Public Safety Management Plan, which has been prepared in consultation with DRE, to ensure public safety in the mining area;	Appendix G
m) include a Subsidence Monitoring Program, which has been prepared in consultation with DRE, OEH, and WaterNSW, to: – provide data to assist with the management of the risks associated with subsidence; – validate the subsidence predictions; – analyse the relationship between the predicted and resulting subsidence effects and predicted and resulting impacts under the plan and any ensuing environmental consequences; and – inform the contingency plan and adaptive management process;	Appendix B
n) include a Regional Seismic Event Monitoring Program, which has been prepared in consultation with DRE, and which includes analysis of outcomes and proposed triggers for review of potential correlations with mining operations;	BSO RSEMP
o) include a contingency plan that expressly provides for adaptive management where monitoring indicates that there has been an	Section 4.1

exceedance of any performance measure in tables 1 and 2, or where any such exceedance appears likely. p) proposes appropriate revisions to the Rehabilitation Management Plan required under condition 33 of Schedule 4; and q) include a program to collect sufficient baseline data for future Extraction Plans.	BSO MOP Appendix C - H
Condition 6, Schedule 3 The Proponent shall ensure that the management plans required under Condition 5 (g)-(l) above include: a) an assessment of the potential environmental consequences of the Extraction Plan, incorporating any relevant information that has been obtained since this approval; b) a detailed description of the measures that would be implemented to remediate predicted impacts.	Section 1.7 and Appendix A – H Appendix C - H
Condition 2, Schedule 6 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; (b) a description of: - the relevant statutory requirements (including any relevant approval, licence or lease conditions); - any relevant limits or performance measures/criteria; - the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures; (c) a description of the measures that would be implemented to comply with the relevant statutory, limits, requirements or performance measures/criteria; (d) a program to monitor and report on the: - impacts and environmental performance of the project; - effectiveness of any management measures (see c above); (e) a contingency plan to manage any predicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible; (f) a program to investigate and implement ways to improve the environmental performance of the project over time; (g) a protocol for managing and reporting any:	Appendix A – I Section 1.1.1 Appendix B – H Appendix C – H and Section 3 Section 3 Appendix B and Section 4.3 Section 4.1 Section 4.9 Section 4.3.1

- incidents;	Section 4.7
- complaints;	Section 4.3
- non-compliances with statutory requirements; and	Section 4.3
- exceedances of the impact assessment criteria and/or performance criteria; and	Section 4.9
(h) a protocol for periodic review of the plan.	

Notes:

- The DRE is now the MEG and the Resources Regulator.
- NSW Division of Resources and Energy (DRE) is now NSW Mining, Exploration and Geoscience [MEG] and the Resources Regulator.
- The Department of Primary Industries – Water is now the Department of Industry Water Department of Planning, Industry and Environment – Water (DPIE – Water) and the Natural Resources Access Regulator.

1.2 Legislation and Guidelines

This Extraction Plan has been designed to conform to the requirements of the relevant advisory documents and guidelines and other legislation that is applicable under the EP&A Act. The following Acts may be applicable:

- *Contaminated Land Management Act, 1997*
- *Dangerous Goods (Road and Rail Transport) Act, 2008;*
- *Mining Act, 1992*
- *Biosecurity Act, 2015*
- *Rail Safety National Law (NSW), 2012*
- *Roads Act, 1993*
- *Protection of the Environment Operations Act, 1997*
- *Biodiversity Conservation Act, 2016*
- *National Parks and Wildlife Act, 1974*
- *Environmental Protection Biodiversity and Conservation Act, 1999*
- *WaterNSW Act, 2014*
- *Work Health and Safety (Mines) Act, 2013;*
- *Coal Mine Subsidence Compensation Act, 2017;*
- *Heritage Act, 1977;*
- *Roads Act, 1993;*
- *Crown Lands Management Act, 2016*
- *Dams Safety Act, 2015*
- *Energy and Utilities Administration Act, 1987*

- *Fisheries Management Act, 1994*
- *Water Management Act, 2000*
- *Work Health and Safety Act, 2011.*

Further details of advisory documentation and guidelines can be found in the relevant management plans attached to this document.

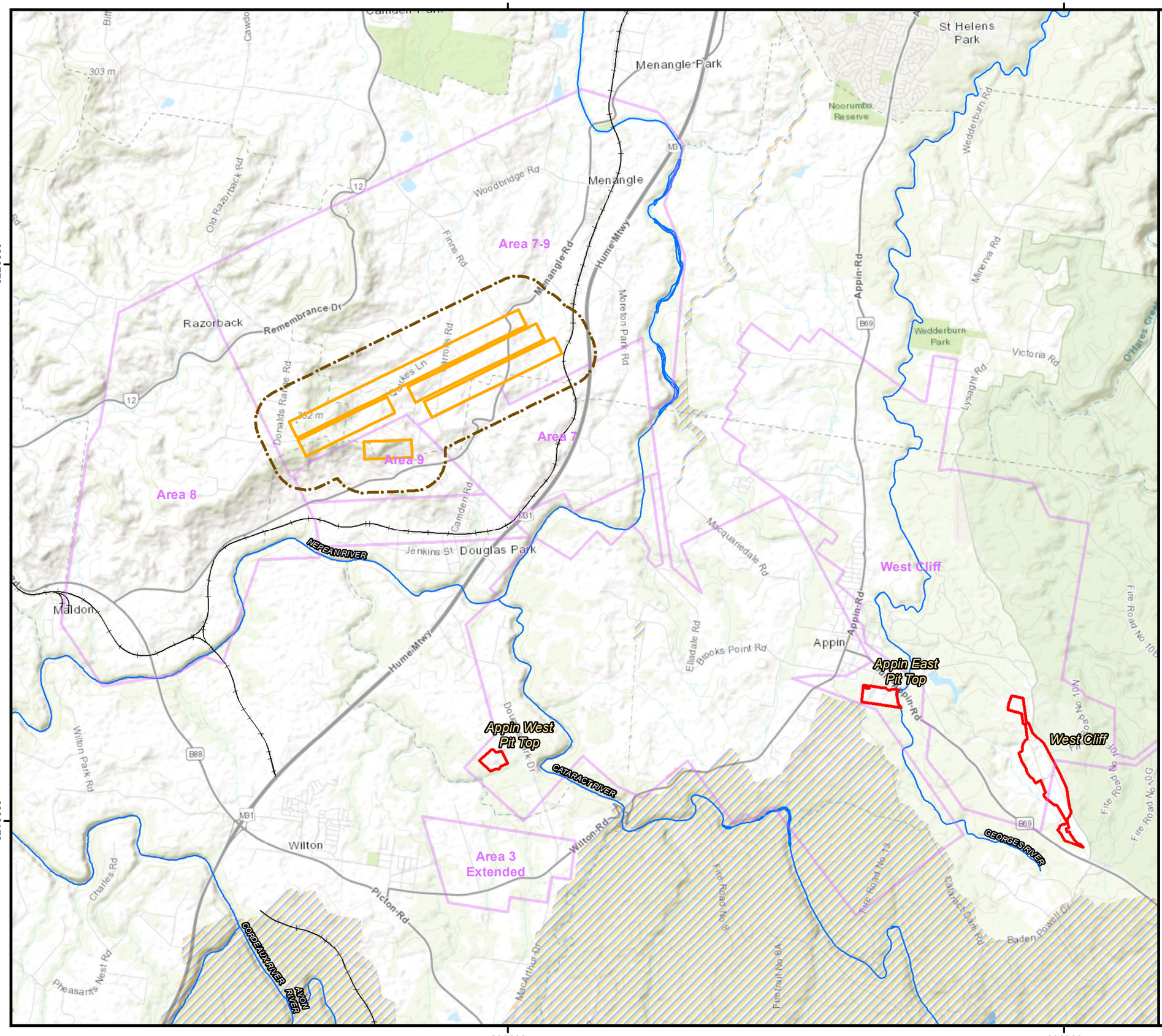
BULLI SEAM OPERATIONS

Appin Areas 7 and 9 Longwalls 709-711 and 905

Figure 1

SOUTH32

- Longwalls 709-711 and 905
- 600 m Study Area
- Mining Domains
- IMC Pit Top
- Railway Lines
- Rivers
- Creeks
- Metropolitan Special Areas



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Author: B.Agland

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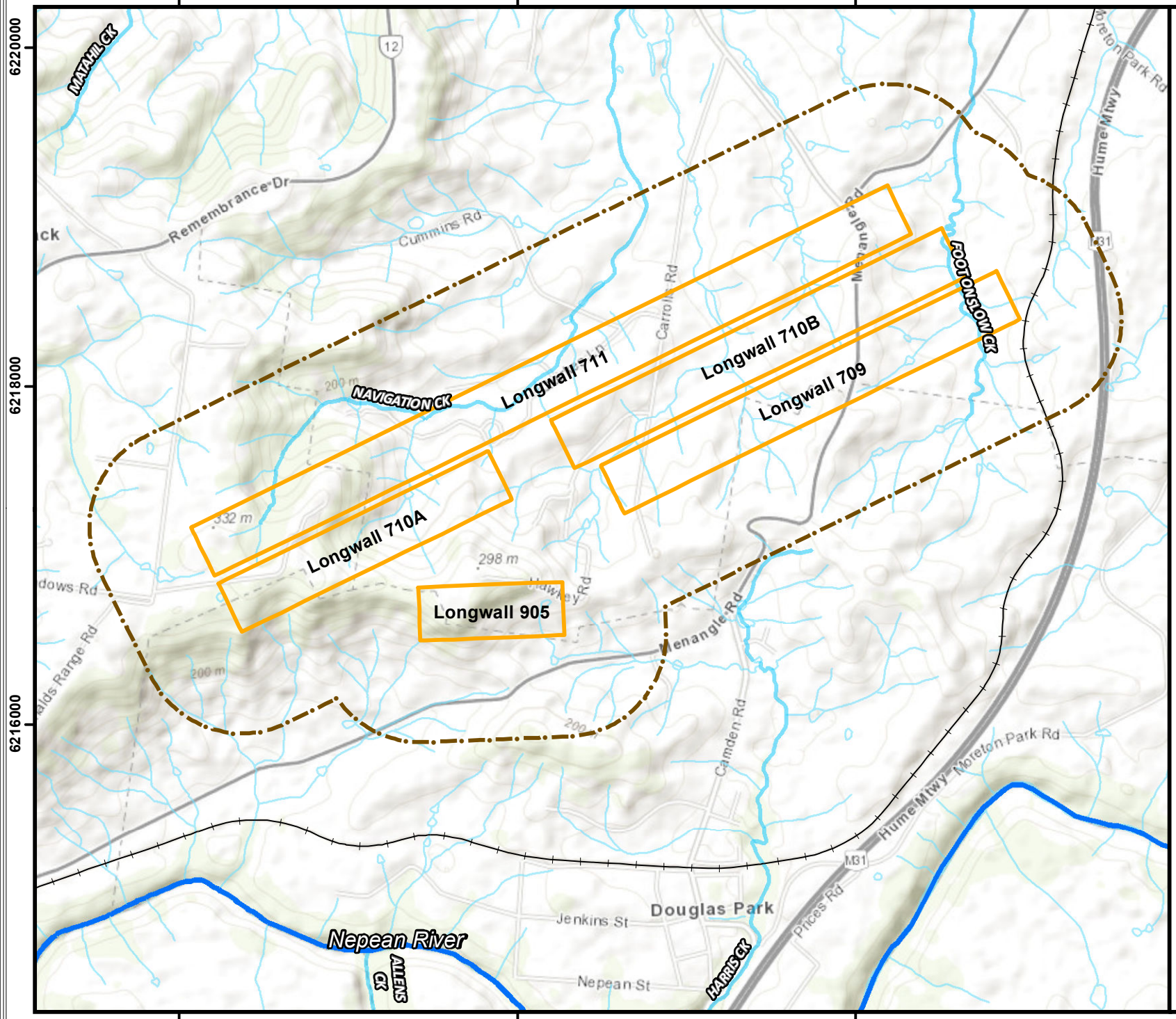

Appin Areas 7 and 9

Longwalls 709-711 and 905 Study Area

Figure 2

- Longwalls 709-711 and 905
- 600 m Study Area
- Railway Lines
- Rivers
- Creeks
- Tributaries

Date: December, 2020
Author: B.Agland

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Horizontal Datum
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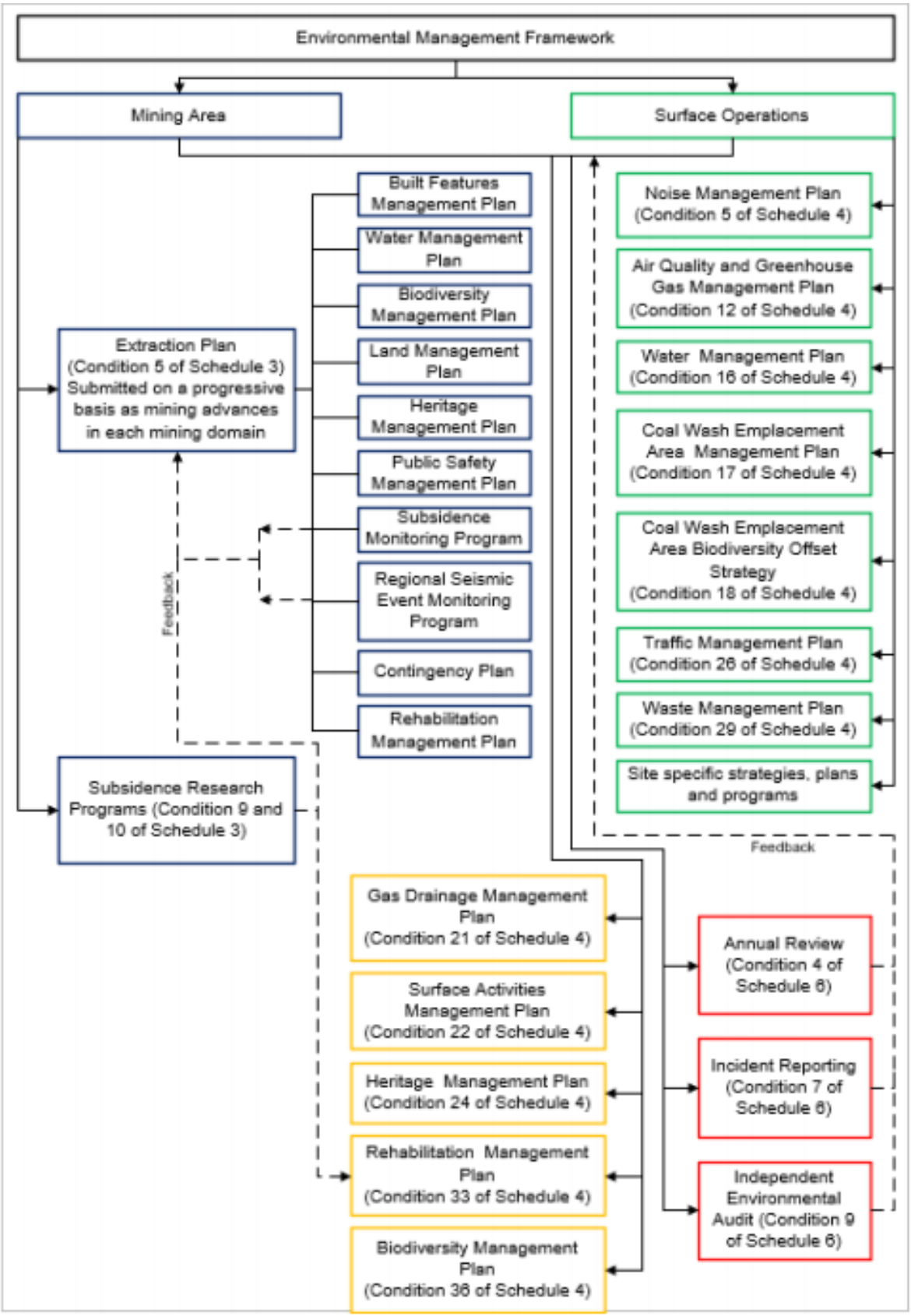


Figure 3 Appin Environmental Management Framework

Licences, Permits and Leases

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

- The conditions of mining leases issued by the Resources Regulator, under the *NSW Mining Act, 1992* Consolidated Coal Lease 767, Coal Lease 388, Mine Lease 1382, Mine Lease 1433 and Mine Lease1678.
- The *Appin Mine, Mining Operations Plan*, 1 October 2020 to 30 September 2024' (Version 1.3 dated 9/10/2020), approved by the Resources Regulator.
- Environment Protection Licence (EPL) 2504 which applies to BSO, including Appin and West Cliff Mines. A copy of the licence can be accessed at the EPA website via the following link http://www.epa.nsw.gov.au/prpoeo/index.htm
- Water Access Licences (WALs) issued by the NSW DPIE - Water (formerly the Department of Industry - Water) under the *NSW Water Management Act, 2000*, including WAL 36481, 36477 and 37464 under the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011* and WAL 30145 and 35519 under the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011*.

1.3 Structure of the Extraction Plan

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

Section 1 Provides an overview of the Extraction Plan, including a description of the purpose and scope of the Extraction Plan and a summary of the mine plan and design, subsidence predictions, subsidence impact performance measures and subsidence management approach.

Section 2 Describes the process of development of the Extraction Plan, including the conduct of risk assessments, the update and review of predicted subsidence effects and potential subsidence impacts and environmental consequences since the BSO Approval, and a summary of consultation conducted with key stakeholders.

Section 3 Describes the measures that will be implemented to manage, mitigate, remediate and monitor potential subsidence impacts and environmental consequences on natural and built features.

Section 4 Outlines the key elements of plan implementation, including reporting, regular review and key responsibilities.

Section 5 Lists the references cited in Sections 1 to 4 of this Extraction Plan.

1.4 Mine Planning and Design

1.4.1 Geology and Stratigraphy

Appin Mine is located in the NSW Southern Coalfield within the southern portion of the

Permo-Triassic Sydney Basin. Underground mining currently occurs at the Appin Mine in the Bulli Seam of the Late Permian Illawarra Coal Measures. The Illawarra Coal Measures contain a number of workable seams throughout the Southern Coalfield, but of these coal seams, only the Bulli Seam is presently considered to be of economic significance at Appin Mine.

In the Approved Appin Mine extent of longwall mining area, the Bulli Seam is located between approximately 300 m (in the south-east) and 850 m (in the north-west) below the surface and is the uppermost seam of the Illawarra Coal Measures. It has a regional dip to the north-west of about 1 in 30 and reflects the synclinal structure of the Douglas Park and Camden Synclines within the BSO area. The stratum around the Bulli Seam provides good conditions for longwall mining and in particular the floor is hard and competent (NSW Department of Mineral Resources [DMR], 2000). The immediate roof can range from mudstone, interbedded siltstone and sandstone, to sandstone (DMR, 2000).

Above the Bulli Seam, the stratigraphy of the area consists of a sequence of sandstone, shale and claystone units within the Narrabeen Group, which are in turn, overlain by the Hawkesbury Sandstone.

The Wianamatta Group is stratigraphically located above the Hawkesbury Sandstone and has been eroded for a significant portion of the Southern Coalfield. However, within the BSO area the Wianamatta Group outcrops generally north-west of the Nepean River and Georges River and ranges in thickness up to greater than 150 m across the Razorback Range.

Exploration continues to develop a geological model across the Appin Mine area that is progressively updated with the most recent and reliable data. There are a number of known major structures (e.g. faults or fault systems) in the vicinity of the BSO extent of longwall mining area e.g. Nepean Fault Zone and O'Hares Fault.

In addition to the surface based exploration, the underground mining operations at Appin Mine undertake in-seam drilling in advance of mining. In-seam drilling is undertaken in order to identify minor geological structures and drain the gas from the Bulli Seam (and adjacent strata). The in-seam drilling has been undertaken since the 1970s to prevent outbursts (gas driven ejection of coal from the active mining face).

IMC plan to extract high quality coking coal from the Bulli Seam within AA7 and 9 as detailed in the BSO EA. A typical stratigraphic section of the Study Area and further description of the resource can be found in MSEC (2021) Appendix A.

1.5 Mining Geometry

The layout and dimensions of the proposed longwalls have been modified from the base case layout of the BSO EA. The BSO EA base case layout within AA7 and 9 comprised longwalls having overall lengths varying between 1,150 m and 5,575 m, overall void widths varying between of 320 m and 325 m with chain pillars varying between 35 - 45 m.

Two important objectives which formed part of the longwall layout optimization were:

- Setback from the Nepean River and the cliffs within the valley, so as to minimise potential for impact; and

- Minimisation of the volume of sterilised coal which could be efficiently extracted while meeting the stream impact minimisation criteria from the BSO EA and the requirements of the BSO Approval.

The depth of cover directly above the proposed longwalls varies between 530 - 750 m. The minimum depth of cover occurs along Foot Onslow Creek where it crosses the finishing (i.e. eastern) end of Longwall 709. The maximum depth of cover occurs along the Razorback Range above the western end of Longwall 711. Surface depth contours can be found in MSEC (2021) Drawing No. 1117-05.

The Bulli Seam floor within the Study Area generally dips from the south to the north. The seam thickness within the proposed longwall goaf areas varies between 2.8 m and 3.3 m. The proposed longwall dimensions are provided in Table 2. The lengths of longwall extraction excluding the installation headings are approximately 9 m less than the overall void length provided in the above table. The longwall face widths excluding the first workings are 315 m. The longwalls will be extracted from west to east.

Table 2 Geometry of the Proposed Longwalls 709 to 711 and 905

Longwall	Overall Void Length Including Installation Heading (m)	Overall Void Width Including First Workings (m)	Overall Tailgate Chain Pillar Width (m)
709	2615	324	45
710A	1787	324	-
710B	2529	324	45
711	4469	324	55
905	858	324	49

1.6 Extraction Sequence

Appin Mine operates seven days a week, 24 hours a day on a rotating shift basis. The extraction of Longwalls 708B and 904 are currently underway.

Extraction of longwalls in AA7 will occur in a staged process commencing with Longwall 709 and finishing with Longwall 711. The actual/scheduled mining of Longwalls 709 to 711 and 905 is provided below in Table 3.

Table 3 Expected Schedule for Longwall Extraction 709 to 711 and 905

Longwall	Start	Finish
709	December 2021	June 2023
905	July 2022	December 2022
710A	June 2023	February 2024

710B	March 2024	December 2024
711	December 2024	May 2026

Future Extraction Plans will consider cumulative subsidence effects, subsidence impacts and/or environmental consequences. The layouts of Longwalls 712 and onwards will be subject of future extraction plan applications.

1.7 Subsidence Predictions

Revised predictions of subsidence effects for Longwalls 709 to 711 and 905 were developed by MSEC (2021) (Appendix A).

Predicted Conventional Subsidence Movements

MSEC (2021) provides a detailed description of the development of mine subsidence and the method used to predict the mine subsidence movements resulting from the extraction of Longwalls 709 to 711 and 905.

The report includes the maximum predicted conventional subsidence parameters for Longwalls 709 to 711 and 905 including:

- Incremental subsidence parameters, which are the predicted subsidence parameters due to the extraction of Longwalls 709 to 711 and 905.
- Total subsidence parameters, which include the accumulated subsidence parameters after the completion of a series of longwalls.

The maximum predicted incremental and total subsidence, tilt and curvatures for Longwalls 709 to 711 and 905 are summarised in Table 4.

Table 4 Maximum Predicted Subsidence, Tilt and Curvature for Longwalls

Subsidence Parameter	Incremental Subsidence Predictions					Total Subsidence Predictions (after Longwalls 709 to 711 and 905
	Longwall 709	Longwall 710A	Longwall 710B	Longwall 711	Longwall 905	
Maximum Subsidence (mm)	950	425	925	950	650	1550
Maximum Tilt (mm/m)	6.5	2.5	6.5	6.5	4.5	7.5
Maximum Hogging Curvature	0.07	0.02	0.06	0.07	0.04	0.08

Maximum Sagging Curvature (km^{-1})	0.14	0.05	0.12	0.14	0.08	0.15

Non-Conventional Ground Movements

MSEC (2021) (Appendix A) considers it likely that non-conventional ground movements will occur due to near surface geological conditions, steep topography and valley related movements, which are often accompanied by elevated strains, tilts and curvatures. The potential subsidence impacts from non-conventional subsidence movements are described for natural and built features in Appendix A.

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

Predicted Far-Field Movements

Based on an empirical model for the Southern Coalfield, MSEC (2021) (Appendix A) concluded that the predicted far-field horizontal movements resulting from the extraction of the longwalls are very small and could only be detected by precise surveys. Such movements tend to be bodily movements towards the extracted goaf area and are accompanied by very low-levels of strain, which are generally less than survey tolerance. The impacts of far-field horizontal movements on the natural features and items of surface infrastructure within the vicinity of the Study Area are not expected to be significant, except where they occur at large structures which are sensitive to small differential movements. The BFMP (Appendix H) has been developed to manage the potential impact of far-field movements on sensitive infrastructure.

1.8 Subsidence Management Approach

Potential environmental consequences from the mining of Longwalls 709 to 711 and 905 will be managed in accordance with relevant requirements of the BSO Approval and other approvals, through:

- Mine planning and design, including avoidance and reduction of subsidence movements.
- Subsidence monitoring to confirm predictions of subsidence effects and potential subsidence impacts and environmental consequences (Appendix B).
- Management measures and remediation, as required, to address subsidence impacts and/or environmental consequences.
- Adaptive management implementation where appropriate.
- Contingency plans in the event an exceedance of a subsidence impact performance measure or an unexpected impact is detected, including consideration of identified potential contingency measures.

2. DEVELOPMENT OF THE EXTRACTION PLAN

Condition 5, Schedule 3 of the BSO Approval requires the preparation and implementation of an Extraction Plan for first and second workings within each mining domain to the satisfaction of the Secretary of DPE. This Plan has been prepared in accordance with the requirements of this Condition.

Each management plan (appended to this report) also addresses the relevant Performance Measures (Condition 1 and 3, Schedule 3) and has been prepared in accordance with the requirements for management plans detailed in Condition 2, Schedule 6. The required reporting and review of the management plans is also documented in each Plan and is in accordance with the requirements of Conditions 3 to 10, Schedule 6.

Notwithstanding the above, due consideration has been given to all the BSO Approval Conditions in the preparation of this Extraction Plan, including those relating to auditing, rehabilitation and environmental management.

2.1 Risk Assessment

As suggested by the DPE and DRE (2015) *Draft Guidelines for the Preparation of Extraction Plans*, an environmental risk assessment was undertaken for the Longwalls 709 to 710 and 905 Extraction Plan to ensure that appropriate consideration was given to risk assessment and risk management in each management plan.

A scoping session was held prior to the assessment and the detail was agreed and confirmed. The objective of the risk assessment was to identify hazards associated with the changes to the mine plan for mining of Longwalls 709 to 711 and 905 at the Appin Mine, and to determine what controls, if any, are required to reduce or eliminate any identified hazards to tolerable levels as far as practicable.

The risk assessment was undertaken 7 June 2021 with participants attending via video conference and used the *Guideline for Applications for Subsidence Management Approvals* to assist with the identification of the subsidence effects. Suitably qualified and experienced experts participated in the environmental risk assessment. The risk assessment workshop was facilitated by an independent specialist, Mr Shane Chiddy of AXYS Consulting and conducted in accordance with *AS/NZS ISO 31000: 2009 Risk Management – Principles and Guidelines*.

2.2 Consultant Suitability and Endorsement

In accordance with Condition 5 (a), Schedule 3, the suitably qualified and experienced experts that have prepared this Extraction Plan and supporting management plans are listed in Table 5.

Table 5 List of Specialist Consultants

Consultant	Contribution
Mine Subsidence Engineering Consultants	Subsidence Impact Assessment
Niche Environment and Heritage	Biodiversity Assessment

Cardno	Aquatic Biodiversity Assessment
GHD	Landslide Risk Assessment
SLR	Surface Water Assessment
SLR	Groundwater Modelling
Biosis Research	Heritage Assessment

2.3 Consultation

The draft Extraction Plan and associated management plans were provided for agency review in July 2021. The following agencies were consulted:

- Biodiversity and Conservation Division;
- DPI – Fisheries;
- Heritage NSW;
- MEG;
- Natural Resources Access Regulator;
- Resources Regulator;
- Subsidence Advisory NSW; and
- WaterNSW.

Agency feedback on the draft Extraction Plan has been incorporated into Table 7.

3. SUBSIDENCE MANAGEMENT AND MONITORING STATUTORY REQUIREMENTS

Surface and sub-surface features within the vicinity of Longwalls 709 to 711 and 905 are listed in Table 2.1 of MSEC (2021) (Appendix A). Features within the Longwalls 709 to 711 and 905 35° angle of draw and/or 20 mm predicted subsidence contour may potentially be impacted by the extraction of Longwalls 709 to 711 and 905. There are also features that lie outside the Longwalls 709 to 711 and 905 35° angle of draw and/or 20 mm predicted subsidence contour that may experience either far-field movements, or valley related movements. The surface features which are sensitive to such movements have been identified and have been included in the subsidence assessments provided in MSEC (2021) (Appendix A).

Subsidence predictions and potential impacts to surface and sub-surface features are provided and described in MSEC (2021) (Appendix A).

Management measures and monitoring for each feature are included in each of the management plans (Appendices C – H).

The Subsidence Monitoring Program (Appendix B) has been prepared to validate the subsidence predictions and analyse relationships between the subsidence effects, impacts and consequences.

4. IMPLEMENTATION

4.1 Contingency Response

In the event subsidence impacts or consequences are greater than those predicted or authorised by the BSO Approval, IMC will implement the relevant Contingency Plan detailed in the WMP (Appendix C), LMP (Appendix E), BMP (Appendix D), HMP (Appendix F), BFMP (Appendix H) or the PSMP (Appendix G). In general, the Contingency Plans include the following:

- IMC will report the exceedance to the DPE, relevant agencies and stakeholders as soon as practicable after IMC becomes aware of the exceedance.
- IMC will conduct an investigation to evaluate the potential contributing factors.
- IMC will identify an appropriate course of action with respect to the identified impact(s), in consultation with specialists, relevant agencies and relevant stakeholders as necessary. For example:
- proposed management and/or mitigation measures;
- a program to review the effectiveness of the management and/or mitigation measures; and
- consideration of offsets or adaptive management.
- Contingency measures will be developed in consideration of the specific circumstances of the exceedance and the assessment of environmental consequences.
- IMC will submit the proposed course of action to the DPE for approval.
- IMC will implement the approved course of action to the satisfaction of the DPE.

If the contingency measures implemented by IMC fail to remediate the impact or the Secretary determines that it is not reasonable or feasible to remediate the impact IMC will provide a suitable offset to compensate for the impact to the satisfaction of the Secretary of DPE in accordance with the BSO Approval Conditions 2 and 4, Schedule 3.

4.2 Adaptive Management

IMC will implement an adaptive management approach for the BSO. Adaptive management will involve:

- Planning – developing management strategies to meet performance measures; identifying performance indicators to assess performance; and establishing monitoring programs to monitor against the performance measures.
- Implementation – implementing management strategies and monitoring impacts against performance indicators.
- Review – reviewing and evaluating the effectiveness of management strategies by analysis of monitoring data against predicted impacts, performance indicators and performance measures.
- Contingency response – implementing contingency plans where an exceedance of a subsidence impact performance measure or an unexpected impact is detected.

- Adjustment – adjusting management strategies to improve performance.

4.3 Reporting Framework

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

Table 6 provides a summary of the proposed reporting framework, including which stakeholders will receive reports and the distribution method. The subsections below provide further detail on each reporting mechanism.

4.3.1 Incident Report

An incident is defined as a set of circumstances that has caused, or threatens to cause, material harm to the environment.

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

An Incident Report will include the following:

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

Table 6 Summary of Reporting Framework

Report	Frequency	Distribution	Distribution Method	Responsibility for Data Collation and Preparation	Responsibility for Submission
Incident Report	As required	DPE (Secretary of the DPE, c/- Executive Director) MEG and Resources Regulator (Manager and Principal Inspector, Environment) Other regulators as specified in management plans	Email and via upload to the DPE Major Projects Portal	Environment Coordinator and Survey Coordinator	Principal Approvals
End of Panel	After longwalls are completed	DPE (Secretary of the DPIE, c/- Executive Director) MEG and Resources Regulator (Manager and Principal Inspector, Environment) Other regulators as specified in management plans	Upload to the DPE Major Projects Portal and South32 Website	Environmental Field Team Coordinator and Survey Coordinator	Environmental Field Team Coordinator or Principal Approvals
Annual Review	Annually	DPE (Secretary of the DPIE, c/- Executive Director) MEG and Resources Regulator (Manager and Principal Inspector, Environment) Other regulators as specified in management plans	Upload to the DPE Major Projects Portal and South32 Website	Environmental Field Team Coordinator and Superintendent Environment	Superintendent Environment

4.3.2 *End of Panel Report*

An End of Panel Report will be prepared and submitted to stakeholders four months after the completion of the longwall. It will report on subsidence impacts and environmental consequences associated with the Longwalls 709 to 711 and 905 Extraction Plan. The End of Panel Report will include:

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

4.3.3 *Annual Review*

An Annual Review will be prepared and submitted in accordance with Condition 4, Schedule 6 of the BSO Approval. The Annual Review will review the performance of the BSO to the satisfaction of the Secretary of the DPE and will:

- describe the development (including any rehabilitation) that was carried out in the past financial year, and the development that is proposed to be carried out over the following year;
- include a comprehensive review of the monitoring results and complaints records of the project over the past financial year, which includes a comparison of these results against the:

- relevant statutory requirements, limits or performance measures/criteria;
- requirements of any plan or program required under this approval;
- monitoring results of previous years; and
- relevant predictions in the EA;

- identify any non-compliance over the past financial 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 current financial year to improve the environmental performance of the BSO.

4.4 Roles and Responsibilities

Statutory obligations applicable to this Plan are identified and managed via an online compliance management system (TICKIT). The online system can be accessed from the link below:

https://illawarracoal.tod.net.au/login.

The overall responsibility for the implementation of this Plan resides with the Manager Approvals who is the Plan's authorising officer.

Parties responsible for environmental management in AA7 and 9 and the implementation of the Plan include:

Manager Approvals

- Ensure that the requisite personnel and equipment are provided to enable this Plan to be implemented effectively.
- Authorise the Plan and any amendments thereto.

Principal Approvals

- Document any changes to the Plan, recognising the potential for those changes to affect other aspects of the Plan.
- Provide regular updates to IMC on the results of the Plan.
- Arrange information forums for key stakeholders as required.
- Prepare any report in accordance with the Plan.
- Maintain records required by the Plan.
- Organise and participate in assessment meetings called to review mining impacts.
- Within 24 hours, respond to any queries or complaints made by members of the public in relation to aspects of this Plan.
- Organise audits and reviews of the Plan.
- Address any identified non-conformances, assess improvement ideas submitted and implement if considered appropriate.
- Arrange for the implementation of any agreed actions, responses or remedial measures.
- Check surveys required by this Plan are conducted and record details of instances where circumstances prevent these from taking place.

Environmental Field Team Coordinator

- Instruct suitable person(s) in the required standards for inspections, recording and reporting and be satisfied that these standards are maintained.
- Investigate significant subsidence impacts.
- Identify and report any non-conformances with the Plan.
- Participate in any other assessment meetings called to review subsidence impacts in the area affected by mining.

Survey Coordinator

- Collate survey data and present in an acceptable form for review at assessment meetings.
- Bring to the attention of the Principal Approvals any findings indicating an immediate response may be warranted.
- Bring to the attention of the Principal Approvals any non-conformances identified with the Plan provisions or ideas aimed at improving the Plan.

Technical Experts

- Conduct the roles assigned to them in a competent and timely manner to the satisfaction of the Principal Approvals and formally provide expert opinion as requested.

Person(s) Performing Inspections

- Formally bring to the attention of the Environment Field Team Coordinator any nonconformances identified with the Plan, or ideas aimed at improving the Plan.
- Conduct inspections in a safe manner.

4.5 Resources Required

The Manager Approvals provides resources sufficient to support this Plan.

Equipment may be needed for this Plan. Where this equipment is of a specialised nature, it will be provided by the supplier of the relevant service. All equipment is to be appropriately maintained, calibrated and serviced as required in operation manuals.

It is the responsibility of the Manager Approvals to ensure that personnel and equipment are provided as required to allow the provisions of this Plan to be implemented.

4.6 Training

All staff and contractors working on IMC sites are required to complete the IMC training program which includes:

- An initial site induction (including all relevant aspects of heritage, environment, safety and community).
- Safe Work Methods Statements and Job Safety Analyses, Toolbox Talks and Pre-shift communications.
- On-going job specific training and re-training (where required).

All training records are maintained by the IMC Training Department.

It is the responsibility of the Manager Approvals to ensure that all persons and organisations having responsibilities under this Plan are trained and understand their responsibilities.

The person(s) performing regular inspections will be under the supervision of the Environment Field Team Coordinator and be trained in observation and reporting. The Environment Field Team Coordinator shall be satisfied that the person(s) performing the inspections are capable of meeting and maintaining this standard.

4.7 Complaints

IMC has a 24 hour, free call community number (1800 102 210) and email address (illawarracommunity@south32.net) through which all complaints and general enquiries regarding environmental or community issues associated with IMC's operations can be reported.

All complaints received in relation to Appin Mine are managed in accordance with the Handling Community Complaints, Enquiries and Disputes Procedure.

Upon receipt of a community complaint, preliminary investigations will commence as soon as practicable to determine the likely cause of the complaint using information such as activities being undertaken on site at the time or area of the complaint.

An initial response will be provided to the complainant within 24 hours of the complaint being made, with a follow up response being provided as soon as practicable once a more detailed investigation is complete.

A summary of all complaints received during the reporting year will be provided as part of the Annual Review. A log of complaints is also maintained on the South32 website at:

https://www.south32.net/our-business/australia/illawarra-metallurgical-coal/documents.

4.8 Distribution

IMC will make the Extraction Plan and other relevant environmental documentation publicly available on the South32 website (Condition 11, Schedule 6).

Individual management plans will be developed in consultation with, and copies will be provided to, the relevant Government agencies and stakeholders as detailed in the appropriate Plan.

4.9 Review and Update

In accordance with Condition 5 of Schedule 6 of the BSO Approval, the Extraction Plan will be reviewed, and if necessary revised, within three months, of:

- the submission of an Annual Review;
- the submission of an incident report;
- the submission of an Independent Environmental Audit (IEA) report; or
- any modification to the conditions of the BSO approval (unless the conditions require otherwise).

If significant deficiencies in this Extraction Plan are identified in the interim period, the plans will be modified as required. This process has been designed to ensure that environmental documentation continues to meet current environmental requirements, including changes in technology and operational practice, and expectations of stakeholders.

Table 7 Feedback and Responses

COMMENT	RESPONSE
Biodiversity and Conservation Division (*Letter dated 6 August 2021*)	
Attachment 1 Longwalls 709 to 711 and 905 will directly undermine 3rd order sections of Navigation Creek, Navigation Creek Tributary 1 and Foot Onslow Creek. Geomorphically, these creeks appear to be a chain of ponds system, with a significant number of farm dams in both the Navigation and Foot Onslow Creek catchments. Where there are permanent (or near permanent pools) on these drainage lines, they are poorly studied.	Navigation Creek is ephemeral and only flows during periods of extended, moderate or high rainfall. The headwaters of Navigation Creek are located within the Longwalls 709 to 711 and 905 Study Area with first and second order streams within the steep ridgeline of remnant bushland to the northwest of Appin Mine. The majority of the remaining catchment, including that of the third order stream, is comprised of agricultural land. Navigation Creek is predominantly highly disturbed and in poor condition. Stream banks are often steep with vegetation often consisting of weeds, and areas of minimal vegetation with evidence of erosion and scouring. Some pools have naturally established along the reaches; however the majority of the upper reaches consist of depressions and minor drainage lines intersected by a number of farm dams with little to no signs of flow. Any surface water flows from the upper reaches are predominantly captured within these established farm dams with runoff likely to only contribute to the downstream Nepean River during periods of extended or significant flow. Hence, the influence of this watercourse on flow and water quality within the Nepean River is minimal (SLR 2021b). Foot Onslow Creek is ephemeral and likely only flows during periods of extended, moderate or high rainfall. Foot Onslow Creek exists as a third order creek within the Study Area, with some minor first and second order streams. Within the Study Area the watercourse resides chiefly within agricultural land. Foot Onslow Creek is predominantly highly disturbed and in poor condition. Stream banks show areas of significant scouring and erosion with steep to near vertical walls. On shallower banks vegetation consist primarily of grassland and weeds. Stream bed material consists of loose sediment with grass and reed growth in some locations. Surface water flows from the upper reaches are predominantly captured within a number of established farm dams with runoff likely to contribute to the Nepean River during periods of extended or significant flow only. Hence, the influence of this watercourse on flow and water quality within the Nepean River is minimal (SLR 2021b). The sections of Navigation Creek and Foot Onslow Creek above the longwall goaf within the Study Area are located on private property, limiting the accessibility to these areas. However, monitoring sites above the longwall on sections of Navigation Creek and Foot Onslow Creek available on public property were investigated during the development of the Extraction Plan application. For example, Sites NAV2 and NAV3 shown in the image below were visited and no

suitable sites were located near the longwalls, particularly for pool water level monitoring. At F02 on Foot Onslow Creek, pools were identified. IMC has a long term monitoring site at F01 which measures the presence or absence of water in the pools. No site is proposed to be established at F02. F01 is located downstream of mining and is considered suitable for monitoring on this watercourse.

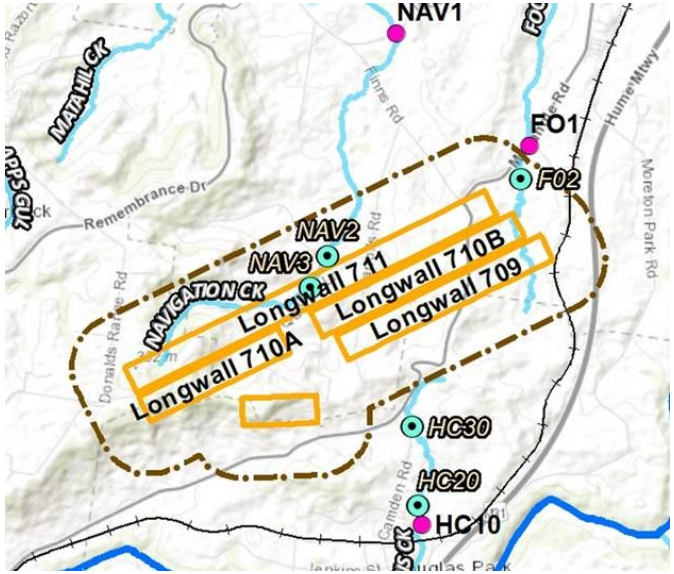


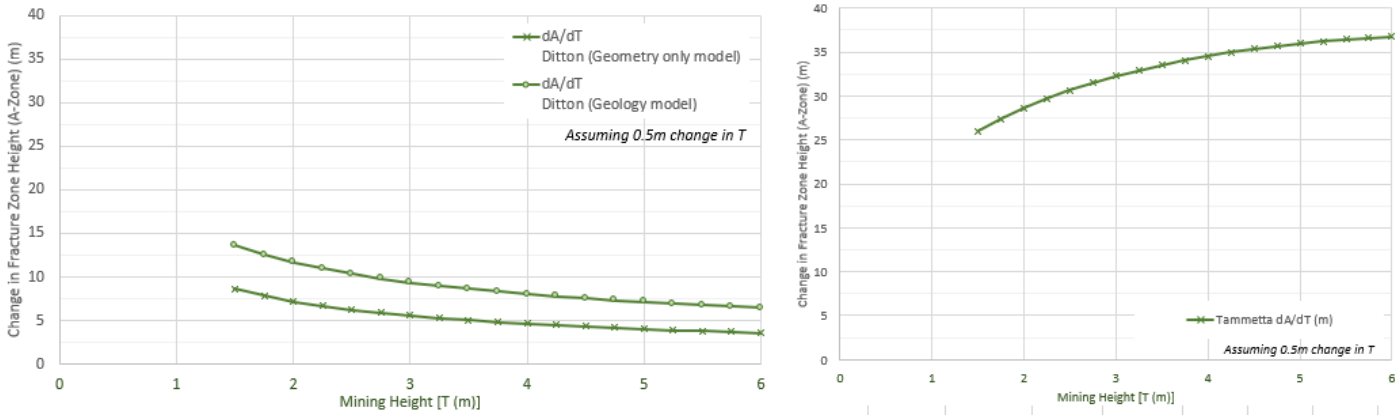
Figure 4 Investigated sites NAV2, NAV3 and F02.

Figure 5 Photograph of the NAV2 location

Figure 6 Photograph of the NAV3 location

Macroinvertebrates were surveyed for the original Bulli Seam proposal (in 2009), but do not appear to have been assessed since that time.	Foot Onslow Creek was sampled for macroinvertebrates by Bioanalysis in autumn 2008 (Bioanalysis 2009). Cardno sampled Foot Onslow Creek and Navigation Creek in Autumn 2008 (The Ecology Lab 2008), Foot Onslow Creek in spring 2008 (Cardno (The Ecology Lab 2008) and both creeks in spring 2010 (Cardno Ecology Lab 2011). These surveys were undertaken primarily to help characterise the existing aquatic environment as part of the BSO EA and aquatic ecology assessment for Appin Longwalls 701 to 710. Monitoring in Foot Onslow Creek and Navigation Creek ceased following the spring 2010 survey. The aquatic habitat in the sections of these creek visited is limited and consists of a series of disconnected pools connected by surface flow following rainfall. They are located in disturbed agriculture land-use with a disturbed riparian strip with evidence of poor water quality including electrical conductivity and turbidity in excess of the upper ANCECC default trigger values. Based on this, it was considered ongoing monitoring following the spring 2010 survey was unnecessary (Cardno Ecology Lab 2014).
This conclusion is not accepted. MSEC 2021 map some of the individual pools on Navigation Creek and Google images (below) identify a near permanent pool on Navigation Creek near the Navigation Creek downstream site. Even if permanent (or near permanent) pools do go dry in response to drought, automated pressure sensors can still record (until the pools fill again). Piezometers in the alluvium (where water levels are suggested to be 5-8m below the surface) are also feasible (and are considered necessary).	As stated above, the majority of these watercourses are located on private property which IMC is unable to access. Installing pool water monitoring equipment or boreholes with piezometers on public property is not viable. IMC has been conducting monitoring in the Appin Area for a significant period of time over which installed equipment on public property has been either vandalised or stolen. For example pool water level loggers were established in the George's River as part of an IMC monitoring program. The majority of this equipment was stolen or vandalised within a few months after having been installed. The majority of the upper section of Navigation Creek (and other watercourses) within the Longwalls 709 to 711 and 905 Study Area consists of depressions and minor drainage lines intersected by a number of farm dams with little to no signs of flow. Therefore, monitoring sites have been established further downstream on these watercourse where pools are more substantial with more permanency. IMC has installed a piezometer in the alluvium at a depth of ~16 m within the Longwalls 709 to 711 and 905 Study Area to monitor groundwater levels. Borehole S2536 shows the location of this monitoring site which is also near Navigation Creek. The Water Management Plan (WMP) has been updated to include this information.

	 Figure 7 Groundwater monitoring borehole S2536
SLR (2021) suggests that there is an extensive groundwater monitoring program for the area associated with the longwalls 709 to 711 and 905 (and earlier mining; see Figure 9 below). However, they do not provide piezometer records for all these piezometers, nor do they identify which piezometers are no longer recording. The presentation and assessment of the data also does not conform to a BACI design. This potentially leads to a degree of subjectivity rather than objective statistical	IMC has engaged SLR to conduct supplementary groundwater modelling investigations to the SLR (2021a) Groundwater Impact Assessment. As part of this work, the groundwater model will be updated and calibrated with the most up to date groundwater monitoring data available. Piezometer records for all monitoring sites and their status will be included in a revised WMP which will be submitted to the Department for approval. Updated hydrographs for Boreholes S1913, S1941, S2060, S2281, S2282, S2283, S2080, S2315 and S2308 have been included in the WMP.

assessment in the conclusions.	
Use of Tammetta's equation suggests a height of connective fracturing of 338-360m for a panel width 324m and extraction height of 3.3m. Such a height would likely take it up into the Bulgo Sandstone and Hawkesbury Sandstone. If the groundwater model architecture is based on an assumption that groundwater depressurisation can only go as high as the lower Bulgo Sandstone, then it is likely to be inadequate in modelling groundwater impacts for the proposed longwalls. In fact, there appears to be a suggestion from the modelling that CSG wells cause greater impacts to groundwater than longwall mining. Such a conclusion needs far better substantiation for this area, especially if it is based purely on the model and its architecture/assumptions.	The existing Appin Model fracture heights are determined using the Ditton algorithm. The Ditton algorithm is preferred over the Tammetta method at Appin Mine for the following reasons: 1. There is no evidence (e.g. site measurements) that favours the Tammetta formula over the Ditton formula at Appin Mine. 2. Tammetta algorithm is highly sensitive to extraction height (T) and therefore, overestimates fracture zone height with increase in extraction height. This is due to the nature of the Tammetta algorithm which uses a power law (exponent of 1.4). As shown in Figure 8 below, the power law causes large increases in fracture zone height for small increases in extraction height. The Ditton method uses an exponent of 0.5 which is consistent with laboratory evidence (Whittaker and Reddish, 1989).  Figure 8 Sensitivity to extraction height (T), Ditton method and Tammetta method 3. Effective thickness of the strata (t') which supports the larger mining height is not included in the Tammetta algorithm. Therefore, the algorithm disregards this parameter and tends to overestimate the fracture height. As a part of recent Appin post mining closure investigations, a sensitivity analysis was carried out with the aim of comparing the fracture zone height using different approaches. The sensitivity analysis included the following methods:

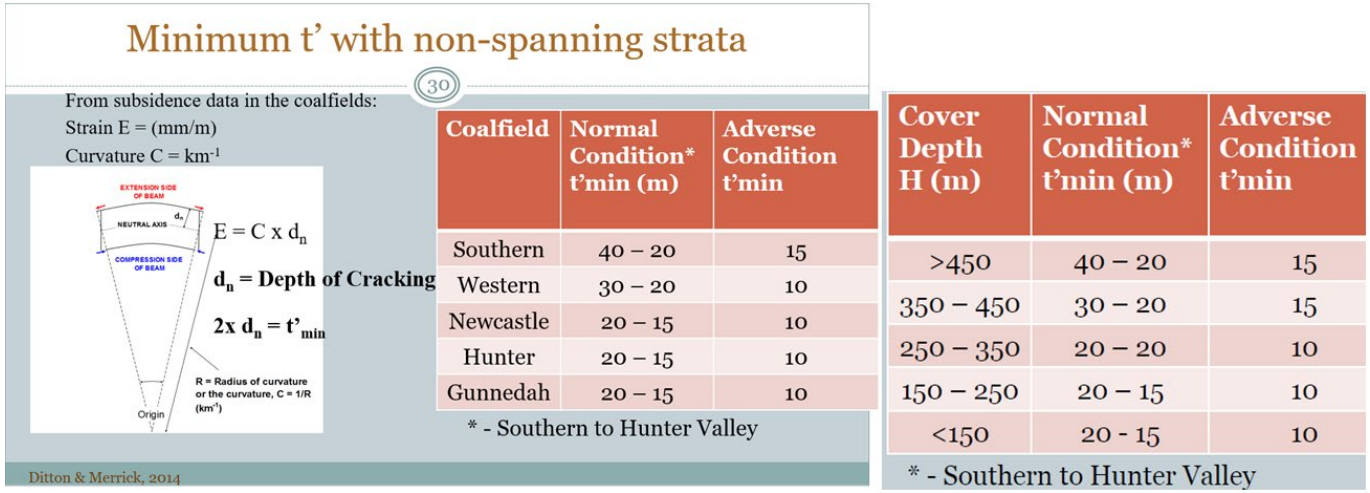
- Ditton method with t'=20 m [base case];
- Ditton method with t'=15 m;
- Ditton method with t'=10 m; and
- Tammetta method.

The results of the sensitivity analysis are presented in the Table 8 below. As it can be seen in the table, Ditton with t'=10 m results in fracture height values consistent with the Tammetta method. A study by Ditton and Merrick (2014) on longwall mines in the NSW coalfields indicated that t'=15 m to 20 m is considered appropriate for the Southern Coalfield (Figure 9). The 2014 study considered t'=10 as an extreme value (i.e., worst case scenario).

Given that the depth of cover above the Appin longwalls varies between 530 and 750 m, the exiting Appin groundwater model uses Ditton calculation with t'=20 for the longwalls simulated in the model. However, as a part of the new round of updates to the groundwater model, SLR suggests as a part of the new round of updates to the model, a Ditton method with a variable t' (between 15 to 20) to be used in calculation of fracture height for different depth of cover areas above the Appin longwalls.

Table 8 Calculated Ditton and Tammetta Methods Average Heights, Vertical Buffer Depths (m) and extent of fracturing

Methods	**Average Height (m)**	**Average Vertical Buffer (m)**	**Fractured into Model Layers**
Ditton A t'=20m [base case]	198 – 286	306 – 536	7 [BGSS]
Ditton A t'=15m	223 – 321	280 – 501	6 [BACS]
Ditton A t'=10m	262 – 378	239 – 448	5 [Lower HBSS]



Coalfield	Normal Condition* t'min (m)	Adverse Condition t'min
Southern	40 – 20	15
Western	30 – 20	10
Newcastle	20 – 15	10
Hunter	20 – 15	10
Gunnedah	20 – 15	10

* - Southern to Hunter Valley

Cover Depth H (m)	Normal Condition* t'min (m)	Adverse Condition t'min
>450	40 – 20	15
350 – 450	30 – 20	15
250 – 350	20 – 20	10
150 – 250	20 – 15	10
<150	20 - 15	10

* - Southern to Hunter Valley

Figure 9 Recommended values for effective thickness of the strata (t') for different depth covers in longwall mines in the NSW coalfields (Ditton and Merrick, 2014)

It is noted that there is quite poor agreement between many of the modelled and observed groundwater levels (see Appendix D Calibration Hydrographs). Given the level of disagreement for some piezometers (at times 10m - 50 m variance), not much faith is currently placed in this groundwater model (or its results).	As stated above, SLR are conducting further update and calibration work which is aimed at improving correlation of observed and modelled groundwater levels in the hydrographs. Findings and recommendations will be incorporated into the WMP as required.
SLR (2021) specifically state:	The hydraulic properties of overburden material above a mined coal seam will change in time due to caving and subsidence above longwall panels. It is generally accepted that there will be a sequence of deformational zones

There is no visible depressurisation or drawdown within the HBSS in response to mining or CSG. Drawdown in the HBSS is visible outside of the mine area in localised areas around registered landholder water supply bores, which appears to relate to local bore usage and not related to mining. Overall, no adverse impacts beyond those previously predicted have been observed due to existing operations at Appin Mine. This statement is considered misleading and is contradicted by HGEO for the LW902 EOP…	consisting of the caved zone, the fracture zone (a lower zone of connective cracking and an upper zone of disconnected cracking), the constrained zone and the surface zone. High permeability is expected in the caved zone where there is direct connectivity with the mined goaf. In the lower part of the fracture zone, the collapsed rocks will have a substantially higher vertical hydraulic conductivity than the undisturbed host rocks. In the disconnected-cracking fractured zone, the vertical hydraulic conductivity is not predicted to be significantly greater than under natural conditions. While no drawdown is predicted within the surficial strata as a result of depressurisation at depth, the subsidence assessment states "groundwater bores could experience adverse impacts due to the extraction of the proposed Longwalls 709 to 711 and 905, particularly the bores located directly above the proposed mining area. Impacts could include lowering of the piezometric surface, blockage of the bores due to differential horizontal displacements at different horizons within the strata and changes to groundwater quality). Additionally, the groundwater impact assessment states that "local subsidence effects such as shear and localised fracturing of a bore can result in additional changes to groundwater level at that location." There are two impact mechanisms that are described in the subsidence assessment and the groundwater assessment. The subsidence assessment predicts movements and impacts to the surficial strata caused by the buckling and dilation as a consequence of subsidence induced stains, while the predictions from the regional groundwater model relate to changes in groundwater levels and pressures due to regional depressurisation from the proposed mining. The regional groundwater model is limited in its ability to predict localised impacts.
It is additionally noted that: • Figure 11 Hydrograph – S1913 suggests the equipment in many of the strata for S1913 are no longer working. This needs to rectified if it is to be useful in assessing groundwater impacts	The Appin groundwater model will be updated and calibrated with the most up to date groundwater monitoring data available. Records for all piezometers and their status will be included in a revised WMP which will be submitted to the Department for approval once this work is complete. The following boreholes have been reviewed and the supporting hydrographs included in the updated WMP: • Bore S1913 - the sensors are still working. The hydrograph for S1913 has now been updated using the latest data for this bore. The model calibration data set has also been updated to include the missing measurements for S1913. The groundwater levels declined in HBSS in 2018 is likely a response to the drought period and water supply bores close to this site. • Bore S1936 has only one remaining piezometer operational (65 m) as all other piezometers have sheared.

of longwalls 709 to 711 and 905. • Figure 17 Hydrograph - S1936 suggests the equipment in S1913 is no longer working • HGEO identifies impacts to S1941 • No information is presented for S2060, S2282, S2283 and the NGW series of bores. • S2080 sensor in the HBSS (65m) declined by approximately 7m during mining at longwalls 901 and 902 HGEO EOP LW902 • Declines in HBSS were observed for S2281 - see HGEO EOP LW902 • There is no match between predicted and observed alluvial groundwater levels provided	• Bore S1941 - Review of the latest data for S1941 indicates gradual decline in groundwater level in lower HBSS, lower BGSS, SBSS and significant decline (>200 m) in groundwater level in the Bulli Coal Seam. The decline in the observed groundwater levels is a result of the longwall mining approaching this bore. • Borehole S2060- The hydrograph for this bore is shown in WMP and shows a decline in groundwater levels in Bulli Coal Seam and Balgownie Seam due to the longwall mining. • Boreholes S2281, S2282 and S2283 - The bores are located close to the Harris Creek and Longwall 901 and monitor the HBSS. The hydrographs for these bores are shown in WMP. As shown in three hydrographs, there is a decline of between 5 to 7 m recorded in the lower sensor in HBSS in S2281, S2282 and S2283 between 2016 to 2017. These changes in groundwater levels correlate with the CRD but also the timing of the longwall mining. Therefore, it is likely the groundwater levels in HBSS were both impacted by mining and climate. The groundwater levels in HBSS in these bores show steady groundwater levels between 2017 to 2020 (during the drought period in NSW). However, since 2020 the bores are showing slight signs of recovery with gradual increase in groundwater levels. • Borehole S2080 - The hydrograph for the bore shows decline in groundwater levels in HBSS is consistent with the timing of the longwall panels but it also correlates with the CRD. Therefore, it is likely the groundwater level in HBSS in S2280 are a response to more than one system stresses (mining and climate). • Alluvium Bores - A review of the NSW GW registered bores database showed there are no alluvium bores available to be used in the model calibration. Most of the groundwater bores in the NSW database monitor the HBSS. IMC have recently installed a monitoring bore in the alluvium near bore S1913 in alluvial. Once suitable data is available, the measurements from this new bore will be used in the future version of the model to better inform the model calibration in matching the alluvium groundwater levels . • Borehole S2315 - hydrograph shows significant decline in groundwater levels in Bulli Coal Seam in response to longwall mining. However, S2308 located 1.8 km to the west of S2315 has recorded stable groundwater level due to further distance from the current mining works.

<table>
<tr>
<td>It is recommended that the plans be amended to incorporate:
…
• monitors groundwater levels in deeper bores so that there is adequate baseline established and an adequate assessment of impact on groundwater aquifer levels can be achieved.
• An improved groundwater model for the area which addresses the mismatch between modelled and observed groundwater levels.</td>
<td>IMC has established four groundwater monitoring boreholes in the Longwalls 709 to 711 and 905 Study Area to monitor groundwater levels. Details of the monitoring bores are provided in Table 9. These sites have been incorporated into the WMP.
Table 9 Recently installed monitoring bores
<table>
<tr><th>Borehole</th><th>Piezometer Depth (m)</th><th>Established</th></tr>
<tr><td>S2536</td><td>15.6 (alluvium)</td><td>27/08/2021</td></tr>
<tr><td>S2536A</td><td>136.6 (HBSS)</td><td>27/07/21</td></tr>
<tr><td>S2537</td><td>129.5 (HBSS)</td><td>05/07/21</td></tr>
<tr><td>S2538</td><td>129.5 (HBSS)</td><td>12/07/21</td></tr>
</table>
IMC has engaged SLR to conduct supplementary groundwater modelling to update the SLR (2021a) Groundwater Impact Assessment. As part of this work, the groundwater model will be updated and calibrated with the most up to date groundwater monitoring data available. Records for all piezometers and their status will be included in a revised WMP which will be submitted to the Department for approval.</td>
</tr>
<tr>
<td>To assist with water monitoring, it is recommended that South32 install:
• …</td>
<td>IMC maintains a groundwater monitoring database which is routinely updated. As part of the supplementary investigation being undertaken by SLR, a review of the monitoring data will be undertaken to identify and omit erroneous data from the calibration of the numerical groundwater model.</td>
</tr>
</table>

• It is also recommended that a quality assurance/quality control process is implemented that, as far as is reasonably possible, ensures data collected is free of major errors and significant gaps in records.	
DPI Fisheries *(submission via the Major Projects Portal)*	
Fisheries NSW has reviewed the information and determined that the waterways that will be directly impacted, namely Foot Onslow and navigation Creek are not considered as Key Fish Habitat due to the highly modified and fragmented nature of the waterways. Potential impacts on the Nepean River impacts are considered minor and short term.	Noted.
HeritageNSW *(letter dated 18 August 2021)*	

AHIMS sites are not labelled.	Figure 2 of the Heritage Management Plan (HMP) has been updated to include AHIMS numbers on all sites within the Longwalls 709 to 711 and 905 Study Area.
The SSD 6695 Development Consent conditions includes requirements for a number of other environmental plans to be prepared. It is not clear from this section how the HMP may interact with other plans required under the Consent.	Figure 3 of the Longwalls 709 to 711 and 905 Extraction Plan (this document) shows the Appin Environmental Management Framework. This flowchart shows how various environmental disciplines and the corresponding management plans are managed in accordance with the BSO Approval. An additional figure demonstrating the interaction between the HMP and other management plans has also been added to the updated HMP. If additional Aboriginal cultural heritage sites are identified within the Longwalls 709 to 711 and 905 Study Area, the HMP will be updated to record details of these sites. Additionally, if sites are suitable for monitoring than a monitoring plan will be included in the HMP and also the Subsidence Monitoring Program.
The consent conditions require the HMP to outline a program/ procedure for the salvage and excavation of archaeological deposits.	Biosis (2021) and MSEC (2021) predict that there will be negligible impacts to Aboriginal Cultural heritage sites due to the extraction of Longwalls 709 to 711 and 905. No salvage or excavation of Aboriginal sites or objects are required. The Appin Mine Heritage Management Plan (South32 2020), the over-arching HMP for the Appin Mine details the salvage and excavation procedures for applicable sites within the BSO area. If additional Aboriginal sites were identified within the Longwalls 709 to 711 and 905 Study Area that required either salvage or excavation procedures, it would be completed in accordance with the procedures in this document. The Appin Mine Heritage Management Plan (South32 2020) is available on the South32 Website (https://www.south32.net/our-business/australia/illawarra-metallurgical-coal/documents).
This section should include a list of all AHIMS sites within the study area and a brief description of each site.	Section 3.1.1 of the HMP has been updated to include all AHIMS sites located within the Longwalls 709 to 711 and 905 Study Area and provides a description of each.
The 600m study area boundary differs between these two figures.	The 600 m boundary on Figure 4 of the Heritage Impact Assessment (HIA) has been updated. An updated version of the HIA has been attached to the HMP.

Sites 52-2-4226 and 52-2-4227 plot directly within Longwall 711, yet Table 3 and Section 4.1.3 identify negligible risk of impact.	Both AHIMS sites 52-2-4226 and 52-2-4227 are comprised of two artefacts at each site. Both are located directly above the western end of Longwall 711. Surface cracking could develop above the proposed longwalls (MSEC 2021). However it is considered unlikely that the artefacts and deposits themselves would be impacted by surface cracking (Biosis 2021).
This section should describe whether any subsurface sites are likely to occur within the study area.	Section 6.1.1 of the HMP has been updated to consider the potential for subsurface sites within the Longwalls 709 to 711 and 905 Study Area.
It is unclear whether new unexpected finds will be added to the project mapping?	Section 8.1 of the HMP has been updated to include a statement that newly recorded sites will be added to Figure 4.
Recommends attempting to survey previously inaccessible properties within the Picton soil landscape.	A figure showing soil landscape mapping in relation to Longwalls 709 to 711 and 905 has been included in the HIA.
Mining, Exploration and Geosciences *(letter dated 15 July 2021)*	
MEG considers the longwall layout described in the Extraction Plan to adequately recover coal resources and provide an appropriate return to the State. MEG has no objection to the design for	Noted.

LW709 to 711 and LW905 at the Appin underground mine.	
Resources Regulator *(letter dated 1 September 2021)*	
A significant portion of a well-defined escarpment called Razorback Range, comprising cliff formations and steep slopes, will be directly undermined by the proposed longwalls. This is likely to cause instability along sections of the Razorback Range, and may result in physical and visual impacts in a populated area. These visual effects may be evident from some distance due to the prominence of the Razorback Range within the application area;	Steep slopes within the Study Area were identified by MSEC (2021). Slope instability has historically occurred along Razorback Range and Douglas Park Ridge as part of the natural processes that occur in the region. A slope stability assessment was therefore undertaken at these locations by GHD (2021) to assess the potential effects of longwall mining on the known hazards at these slopes. Mass movement of steep slopes is unlikely to be induced by the proposed mining activities. Notwithstanding, IMC will develop and implement ongoing monitoring in consultation with potentially affected landowners through the Public Safety Management Plan process. Any mitigation or management measures would also be developed and implemented in consultation with, and agreement of, the affected landowner through this process. Environmental consequences of a rock fall could potentially include changes to the visual landscape of the Study Area. A rock fall or landslide may result in the exposure of a fresh face of rock and debris scattered around the base of the cliff. As with naturally occurring instabilities, the exposed fresh rock-face weathers and erodes over time to a point where it blends in with the remainder of the cliff face and in time the vegetation below the cliff regenerates. IMC has developed and implements a successful Cliff and Steep Slope Management Plan for Longwalls 701 to 708B and Longwalls 901 to 904. The Management Plan addresses monitoring, response action, reporting and public safety. This management plan will be reviewed and, where required, revised to include the proposed Longwalls 709 to 711 and 905, prior to extraction.
There are private properties / houses that are located along the Razorback Range above the proposed longwalls. Of particular concern are the houses which are located near the edge of the cliff formations	The management of private assets and infrastructure items will be addressed in the Built Features Management Plans (BFMPs), Property Subsidence Management Plans, Management (PSMPs) and associated agreements between IMC and the relevant infrastructure or property owners. There are 114 houses that have been identified within the Study Area. There are 77 houses within the Study Area located on or near the steep slopes, of which 26 are located at the top of slopes. GHD (2021) have undertaken site inspections and detailed risk assessments for houses and built features within close proximity to Razorback Range. Properties which have been assessed to have a significant risk due to subsidence

at the top of the Razorback Range, which are to be directly undermined by the subject longwalls;	impacts on steep slopes will be subject to robust monitoring in accordance with the PSMP. Subsidence impacts on built features has been successfully undertaken by IMC for several decades.
The occurrence of any instability on the undermined cliff formations or steep slopes will be difficult or impossible to predict in terms of its timing, speed, location and distribution; There are potentially high risks of damage to the natural or built features, if they are affected by the above-mentioned instability, depending on the nature of instability, and	IMC has recognised the significance of the cliffs and steep slopes associated with Razorback Range which is why IMC has adopted a well-recognised risk management approach. Cliffs and steep slopes are natural features which are metastable. Natural processes of weather, erosion and gravity are changing the features most notably seen as cliff falls and landslides. The Razorback Range geomorphology has been recognised as an area of cliff falls and endemic landslides in numerous scientific papers over many decades. There are recognised procedures for assessing cliff & steep slope stability: AGS (2007) – a generic term that covers the suite of 5 papers of which AGS (2007c), AGS (2007d) and AGS (2007e) form part. AGS (2007c) "Practice Note Guidelines for Landslide Risk Management 2007", Australian Geomechanics Society, Landslide Taskforce, Practice Note Working Group, Australian Geomechanics, V42 N1, March 2007. [copy can be downloaded from: www.australiangeomechanics.org] AGS (2007d) "Commentary on Practice Note Guidelines for Landslide Risk Management 2007", Australian Geomechanics Society, Landslide Taskforce, Practice Note Working Group, Australian Geomechanics, V42 N1, March 2007. [copy can be downloaded from: www.australiangeomechanics.org] AGS (2007e) "Australian GeoGuides for slope management and maintenance", Australian Geomechanics Society, Australian Geomechanics, Vol 42 No 1, March 2007. [copy can be downloaded from: www.australiangeomechanics.org] There are recognised procedures for predicting subsidence. Hence it is possible to predict areas which are prone to increased instability due to mining. Predictions enable the determination of the location and extent of instability. The extent of instability enables the risk to be evaluated in relation to safety and the environment. Prediction and monitoring enable the timing of instability to be determined. The speed of instability is a function of the type of failure and there is historical data on the speed of cliff falls and landslides.

	GHD (2021) relating to mine subsidence influences that is attached to the Longwalls 709 to 711 and 905 Land Management Plan specifically addresses the risk to properties on steep slopes. IMC Appin Area 9 Longwall 904 Management Plan for Potential Impacts to Building Structures address the risk and provides the monitoring and management of houses on or adjacent to steep slopes. The existing Management Plan will be revised to manage each successive longwall.
Other infrastructure items, such as roads, powerlines and a major telecommunication tower are also located adjacent to the edge of cliff formations or on steep slopes within the Razorback Range that will be undermined.	The BFMP process involves frequent consultation with infrastructure owners and key stakeholders, as well as thorough revision and planning. Each IMP is a live document and may be modified at any time (with relevant stakeholder input as required) to reflect monitoring outcomes and lessons learnt. IMC continues to consult with key stakeholders on a regular basis as part of current IMP's with regards to the management of their assets in current and future mining areas. IMC has developed and implements successful infrastructure management plans for Longwalls 701 to 708B and Longwalls 901 to 904. The management plan addresses monitoring, response actions, reporting and public safety. These management plans will be reviewed and, where required, revised to include the proposed Longwalls 709 to 711 and 905 in consultation with the infrastructure owner, prior to extraction.
Wollondilly Shire Council *(letter dated 9 August 2021)*	
• Investigate the opportunity to adjust longwall layouts to minimise the extent of impacts to third order watercourses, or require scientific based demonstration from South32 for the reasons this cannot be achieved based on operational grounds.	Several layout alternatives for Longwalls 709 to 710 and 905 were assessed by South32 using a multi-disciplinary team including environment, community, mining and exploration expertise. These included variations in the number of longwalls and orientations, lengths, and setbacks of the longwalls from key surface features. These options were reviewed, analysed and modified until an optimised longwall layout was achieved. Condition 1, Schedule 3 of the BSO Approval states that impacts to watercourses (other than the Nepean River) are "no greater subsidence impact or environmental consequences than those predicted in the EA and PPR". The impacts to third order watercourses are consistent with those predicted in the BSO EA. Further to this, the longwall design for Longwalls 709 to 711 and 905 is within the BSO Approval boundary.

• require an assessment of likely impacts to the ecological health of watercourses within and downstream of the Study Area including the Nepean River.	Specialist assessments appended to the Extraction Plan have undertaken thorough assessment of potential impacts to ecological heath of watercourses within the Study Area. This is detailed in Section 4 of Cardno (2021). The findings of this assessment is provided below. <u>Nepean River</u> No fracturing is predicted to occur in the Nepean River, thus there would be no reductions in the availability and connectivity of aquatic habitat. Longwall extraction is not anticipated to have any significant impacts on surface water quality as a result of mining the proposed longwalls (SLR 2021b). Mining of previous longwalls within Appin Areas 7 and 9 has not led to induction of any detectable ferruginous springs in the walls of the Nepean River. It is therefore considered that there is a low likelihood of ferruginous springs induced by the mining of the proposed Longwalls 709 to 711 and 905 (SLR 2021b). It is possible that gas releases may result in localised changes in water quality, such as reductions in DO, though localised changes are not expected to result in significant impacts to aquatic biota. No impacts to aquatic biota have been observed in the Nepean River associated with gas releases observed during extraction of previous AA7 and 9 longwalls (Cardno 2020). Similarly, no impacts to aquatic habitat and biota have been observed associated with the relatively minor changes in water levels and water quality that occurred during extraction of AA9 Longwalls 901 and 902 (Cardno 2021). Based on predictions of subsidence, changes to water quality and observations from previous aquatic ecology monitoring in the Nepean River, impacts to aquatic habitat and biota are not expected to occur in the Nepean River due to extraction of Longwalls 709 to 711 and 905 (Cardno 2021). <u>Other watercourses</u> Localised and minor changes in habitat availability and connectivity may occur along the first, second and third order drainage lines due to tilt but these effects will be difficult to detect due the high variability in natural flows within these ephemeral watercourses. The impacts resulting from the changes in surface water flows are expected to be small in comparison with those which occur during natural flooding conditions. Consequently, impacts to aquatic habitat and biota due to tilt, if any, are expected to be minor and localised in drainage lines located directly above and within 400 m of the proposed longwalls (Cardno 2021). Although impacts at the scale of individual pools and watercourses could be significant, at the scale of the Nepean River catchment, and considering the abundance of comparable first, second and third order watercourse habitat in the local area, such impacts represent a minor impact to aquatic habitat and biota at these scales. The aquatic habitat

	provided by these watercourses is also relatively degraded and associated with historic land clearing and pasture land-use. It is also largely ephemeral aquatic habitat, which would naturally consist of disconnected pools during the majority of the time during natural conditions. Thus, there would be no substantial change to the nature of these watercourses (i.e. they are largely ephemeral prior to any potential mining related impacts) (Cardno 2021). Table 4-3 of Cardno (2021) compares the predicted impacts of the Extraction Plan against those predicted and approved in the BSO EA. Findings show that the potential impacts from the Extraction Plan are the same as, or less than those predicted in the BSO EA.
• Request for the Extraction Plan to be amended to contain an enhanced assessment and modelling of likely subsidence induced impacts (including potential gas emissions) on watercourses (including aquatic ecology), to a similar level that would be required for Environmental Impact Statements for mining applications.	The Extraction Plan application has been prepared in accordance with the BSO Approval, specifically Condition 5, Schedule 3. The supporting specialist assessments have been developed by suitably qualified experts in their respective fields. Mine Subsidence Engineering Consultants (MSEC) are the same consultants who undertook the subsidence modelling and assessment for the BSO EA. MSEC (2021) state that further gas release zones could develop along the Nepean River, which has been observed due to the mining of previous longwalls in AA7 and 9. Cardno (2021) provide assessment and previous observations of potential aquatic ecology impacts “It is possible that gas releases may result in localised changes in water quality, such as reductions in DO, though localised changes are not expected to result in significant impacts to aquatic biota. No impacts to aquatic biota have been observed in the Nepean River associated with gas releases observed during extraction of previous Appin Area 7 and 9 longwalls (Cardno 2020 and references therein).”
• Request to require a risk assessment of all	South32 undertook an environmental risk assessment as part of the Extraction Plan application process. During this risk assessment, third order watercourses were considered by the group. Potential impacts to watercourses has been assessed across multiple disciplines including: subsidence impacts, surface and groundwater impacts, terrestrial and

orders of potentially impacted streams.	aquatic ecology. The predicted impacts to these watercourse were in line with or less than those predicted in the BSO EA.
• Request appropriate updating of the Surface Water Quality Indicator to include inspections for the presence of, and monitoring of, any re-emergence of water to the surface from mine induced fractures.	Fracturing of the uppermost bedrock can occur along the streams that are located directly above or adjacent to the proposed mining area. Surface water flow diversions could occur along the creeks and tributaries that are located directly above the mining area. It is unlikely, however, that there would be a net loss of water from the catchment. These watercourses are highly ephemeral and only tend to flow during large rainfall events. The suggested monitoring is not considered appropriate for Appin Mine. The IMCEFT undertake visual inspections as part of routine monitoring across the Longwalls 709 to 711 and 905 Study Area. If mining induced fractures were observed to be diverting water from a watercourse, this would be recorded and investigated by a suitability qualified expert. This would be reported in the End of Panel Report and Annual Review.
• Development of a specific criteria within the Trigger Action Response Plan that would trigger assessment of impacts and/or rehabilitation for threatened ecological communities potentially impacted.	Table 11 of the Biodiversity Management Plan is a trigger action response plan. This program includes visual inspections of the landscape across the active mining area. The triggers of this TARP for Level 1 are as follows: • Impacts detectable via observational monitoring (e.g. canopy thinning, thinning of shrub layer, minor loss of ground cover) to a single vegetation strata. • Subsidence impacts (such as surface cracking, rock falls) resulting in small areas of disturbance that will mitigate without corrective management actions. This monitoring is designed to record impacts to threatened vegetation communities. If impacts greater than those predicted by the BSO Approval are observed, South32 would provide offsets in accordance with the BSO Approval.
• Require that all dwellings subject to potential subsidence be inspected by a suitably qualified	The management of private assets and infrastructure items will be addressed in the Built Features Management Plans (BFMPs), PSMPs and associated agreements between IMC and the relevant infrastructure or property owners. As part of the this process, IMC endeavours to proactively complete a landholder engagement campaign with all landholders within the area that may be subject to potential subsidence movements as defined by the 20 mm subsidence contour, prior to being effected by each longwall, to discuss our operations and future subsidence

structural engineer and that any recommended retrofitting arising from these inspections be undertaken prior to the commencement of any mining operations.	movements; and how we manage subsidence through pre-mining structural and geotechnical inspections and land survey monitoring, the implementation of recommended mitigatory and monitoring measures, and required actions from the landholder to ensure their on-going safety. This engagement programme has proven successful in increasing access to >90% of residences for Longwall 903 for structural (and as required geotechnical) inspections. Accordingly, IMC requests any conditions to this effect be subject to reasonable attempts to gain landholder access to the property to undertake pre-mining inspections and to implement recommended mitigatory or monitoring measures.
• Provision of a dilapidation report for the bridges, roads and culverts in the Study Area. A further request is for copies of the design of the rehabilitation of any road infrastructure impacted by mining operations be provided to Council's Engineers for review prior to finalisation.	Experience of mining beneath road culverts in the Southern Coalfield indicates that the incidence of impacts is low. Impacts have generally been limited to cracking in the concrete headwalls which can be readily remediated. In some cases, however, cracking in the culvert pipes occurred which required the culverts to be replaced. IMC has an approved Local Roads Management Plan which includes drainage culverts, for Longwalls 701 to 708B and Longwalls 901 to 904. This management plan will be updated and submitted for approval prior to the commencement of Longwalls 709 or 905. As part of this process a suitably qualified structural engineer will conduct a dilapidation assessment of the bridges, local roads and drainage culverts within the Study Area, and this assessment will be provided to Wollondilly Shire Council' for review prior to finalisation. In order for the dilapidation report to fully assess the condition of the assets to be mined under and the design of rehabilitation works t is requested that WSC provide; design specifications, as built drawings, engineering reports and maintenance reports.

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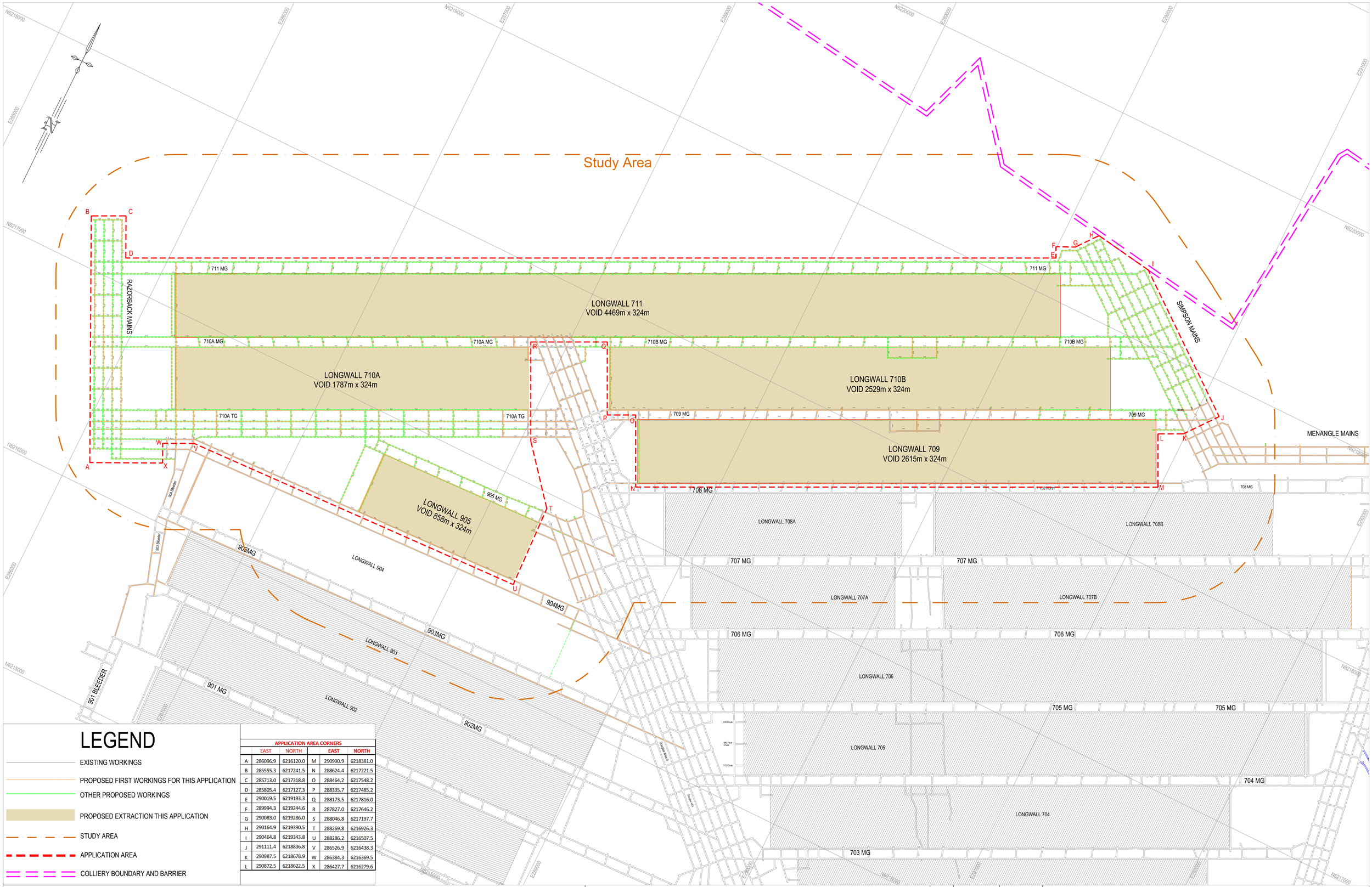
6. ATTACHMENTS

Attachment A - Approved Plan



LEGEND

- EXISTING WORKINGS
- PROPOSED FIRST WORKINGS FOR THIS APPLICATION
- OTHER PROPOSED WORKINGS
- PROPOSED EXTRACTION THIS APPLICATION
- STUDY AREA
- APPLICATION AREA
- COLLIERY BOUNDARY AND BARRIER

APPLICATION AREA CORNERS

	EAST	NORTH		EAST	NORTH
A	286096.9	6216120.0	M	290990.9	6218381.0
B	285555.3	6217241.5	N	288624.4	6217221.5
C	285713.0	6217318.8	O	288464.2	6217548.2
D	285805.4	6217127.3	P	288335.7	6217485.2
E	290019.5	6219193.3	Q	288173.5	6217816.0
F	289994.3	6219244.6	R	287827.0	6217646.2
G	290083.0	6219286.0	S	288046.8	6217197.7
H	290164.9	6219390.5	T	288269.8	6216926.3
I	290464.8	6219343.8	U	288286.2	6216507.5
J	291111.4	6218836.8	V	286526.9	6216438.3
K	290987.5	6218678.9	W	286384.3	6216369.5
L	290872.5	6218622.5	X	286427.7	6216279.6

PILLAR DIMENSIONS ±0.5m
VOID DIMENSIONS ±1.5m

SCALE IN METRES

0 100 200 300 400 500 600 700 800 900 1000

MGA COORDINATES AHD CONTOURS

CERTIFICATION ENDORSEMENT

THE INFORMATION SHOWN ON THIS PLAN IS THE RESPONSIBILITY OF THE RELEVANT COLLIERY OFFICIAL TO BE A TRUE AND CORRECT RECORD, AND IS DRAWN BY THE SURVEYOR, AND IS DEEMED CORRECT AT THE DATE SHOWN, TO THE BEST OF OUR KNOWLEDGE.

SOUTH32

R:\Technical Services-Surveying\07 SMP\APNSVY00111A - LW's 709 - 711 and LW905 Extraction Plan - Approved Plan.dwg

Appin Mine

Illawarra Metallurgical Coal
South32

	Name	Date
DRN	D.Jolliffe	22/6/2021
REV		
APP		06/07/2021
SCALE	A0 1 : 6,000	

Title
Appin Longwall 709 to 711 and Longwall 905 Extraction Plan
Approved Plan

DRAWING NUMBER APNSVY00111A

REV 0

Attachment B - Surface Features Plan

EXTENT OF STUDY AREA

LONGWALL 711

LONGWALL 710A

LONGWALL 710B

LONGWALL 709

LONGWALL 905

66 kV Line

MENANGLE ROAD

M31 MOTORWAY

MORETON PARK ROAD

MINE SUBSIDENCE SOUTH CAMPBELLTOWN DISTRICT

MINE SUBSIDENCE WILTON DISTRICT

LEGEND

PROPOSED EXTRACTION	SLOPE 1 in 1.5 to 1 in 1
EXTENT OF APPLICATION	SLOPE 1 in 3 to 1 in 1.5
SURFACE CONTOUR (m AHD)	ARCHAEOLOGICAL SITES
POWER LINES 330Kv, 66Kv	EUROPEAN HERITAGE SITES
POWER LINES 11Kv, Low Voltage	SURVEY CONTROL MARK
ROAD/TRACK	TELSTRA OPTICAL FIBRE CABLES
RAILWAY	TELSTRA - COPPER
CUTTING / EMBANKMENT	OPTUS OPTIC FIBRE CABLES
CREEK/ RIVER/ DAM	AAPT OPTIC FIBRE CABLES
SYDNEY WATER MAIN	GW104154 GROUNDWATER BORE
BUILDING/ TANK/ POOL	S2057 EXPLORATION BORE
CLIFFS	THREATENED ECOLOGICAL COMMUNITIES
COLLIERY HOLDINGS BOUNDARY WITH 20m BARRIER	OPTUS GSM TOWER
	MINE SUBSIDENCE DISTRICT BOUDARY

PILLAR DIMENSIONS ±0.5m
VOID DIMENSIONS ±1.5m

SCALE IN METRES

0 100 200 300 400 500 600 700 800 900 1000

MGA COORDINATES AHD CONTOURS

CERTIFICATION ENDORSEMENT

THE INFORMATION SHOWN ON THIS PLAN IS THE RESPONSIBILITY OF THE RELEVANT COLLIERY OFFICIAL TO BE A TRUE AND CORRECT RECORD, AND IS DRAWN BY THE SURVEYOR, AND IS DEEMED CORRECT AT THE DATE SHOWN, TO THE BEST OF OUR KNOWLEDGE.

SOUTH32

R:\Technical Services-Surveying\07 SMP\APNSVY00112A - LW's 709 - 711 and LW905 Extraction Plan - Plan 2 Surface Features.dwg

Appin Mine

Illawarra Metallurgical Coal
South32

	Name	Date
DRN	D.Jolliffe	22/6/2021
REV		
APP		
SCALE	A0 1 : 6,000	

Title
Appin Longwall 709 to 711 and Longwall 905 Extraction Plan
Plan 2 - Surface Features

DRAWING NUMBER APNSVY00112A

REV 0

Attachment C - Environmental Risk Assessment

South32 - Illawarra Metallurgical Coal

Extraction Plan for Longwalls 709 to 711 and 905

Risk Assessment Report

AR3121

Revision 2

18 June 2021

Assessment and report completed by;
AXYS Consulting Pty Ltd
PO Box 1011, Wilton, 2571
NSW, Australia
+61417281115

1. Revisions

Rev No	Date	Description
1	07 June 2021	Initial Release
2	18 June 2021	Minor corrections to wording, following review by South32 IMC

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2. Participants

Name	Position	Relevant Years' Experience
James Barbato	Mine Subsidence Engineering Consultants Subsidence Engineer	17 Years
Sain Griffiths	Niche Environmental Senior Ecologist	15 Years
Sarah Hart	Niche Environmental Ecologist	8 Years
Jon Thompson	GHD Technical Director - Geotech	42 Years
Paul Delaney	SLR Consulting Technical Director - Surface Water	39 Years
Graham Hawkes	SLR Consulting Technical Director - Hydrogeology	30 Years
Daniel Pygas	Cardno Aquatic Ecologist	15 Years
Cody Brady	South32 - IMC Principal Mining Approvals	5 Years
Richard Walsh	South32 - IMC Superintendent Infrastructure Protection	30 Years

3. Introduction

South32 Illawarra Metallurgical Coal (IMC) operates the Bulli Seam Operations (BSO) Appin Mine, extracting hard coking coal used for steel production which is located in the Southern Coalfield of New South Wales (NSW). Appin Mine is located approximately 25 kilometres (km) north-west of Wollongong. Mining is currently underway in two areas, referred to as Appin Areas 7 and 9.

The mine's underground working section is proposed to mine between 650 and 750 metres below the surface by longwall retreat methods. Coal extracted from the mine is conveyed out of the mine either directly to the on site coal handling and preparation plant or transported by road to the to preparation plant. From the preparation plan coal is transported by road to the Wollongong coal terminal where it is loaded into ships for export to its customers.

Illawarra Metallurgical Coal are to develop an Extraction Management Plan (EP) for the mining of Longwalls 709 to 711 and 905.

This risk assessment has been completed as support for the submission of the Extraction Plan at the Appin Mine. It was completed on 7 June 2021 and used the Guideline for Applications for Subsidence Management Approvals to assist with the identification of the subsidence effects.

4. System Description

The key steps in the process were:

1. Background analyses on the subsidence issues and experiences for Appin Mine;

2. Conducting a scoping session with decision making personnel to discuss the topic, and to confirm the risk analysis process and key outcomes sought;

3. Conduct team-based analysis to evaluate and treat the risks:
   a. An open discussion with the team on “what do we want to achieve” in relation to the analysis as identified within the assessment scope;
   b. Presentation by James Barbato on the project and subsidence experiences at Appin Mine;
   c. Complete assessment using the "Guideline For Applications For Subsidence Management Approvals" To identify the impacts to identified surface features
   d. Risk Ranking of the identified hazards
   e. Identification of risk mitigation measures to reduce risk levels to a tolerable state
   f. Generation of action plan of identified treatments options

5. Context Summary

5.1 Strategic Context

Illawarra Metallurgical Coal (IMC) is committed to providing an environmentally friendly operation.

When changes to mining new mining processes are implemented, IMC management insist that Risk Assessment techniques are used to reduce the risks to the environment.

5.2 Corporate Context

As IMC is committed to providing an environmentally friendly operation, with changes to the mine plan the mine management have insisted that Risk Assessment techniques are used identify any hazards and to minimise exposure to its people, the environment and to operations.

5.3 Risk Management Context

The primary objective of this risk assessment is to identify hazards associated with the changes to the mine plan for mining of Longwalls 709 to 711 and 905 at the Appin Mine site, and to determine what controls, if any, are required to reduce or eliminate any identified hazards to tolerable levels as far as practicable.

6. Objectives and Scope

A scoping session was held prior to the assessment and the detail was agreed and confirmed, the scope included:

The objective of this risk assessment is to identify hazards associated with the changes to the mine plan for mining of Longwalls 709 to 711 and 905 at the Appin Mine site, and to determine what controls, if any, are required to reduce or eliminate any identified hazards to tolerable levels as far as practicable.

7. Assumptions and Constraints

The following assumptions and limitations were applied to this risk assessment:

- This assessment relates Longwalls 709 to 711 and 905 at the Appin Mine only
- All commitments, including monitoring programs, will proceed as identified in the EP

Related Document Include;

- AS NZS ISO 31000-2009
  Risk management - Principles and guidelines

- MDG1010 - Risk Management Handbook for the Mining Industry.
  Dated. January 2011

- MDG1014 - Guide to Reviewing a Risk Assessment of Mine Equipment
  and Operations
  Dated. July 1997

- New South Wales
  Work Health and Safety (Mines) Act 2013

- New South Wales
  Work Health and Safety (Mines) Regulation 2014

- Work Health and Safety Act 2011

- Work Health and Safety Regulation 2011

- EDG17
  Guideline for Applications for Subsidence Management Approvals

8. Risk Treatment

An audit system needs to be in place to ensure all recommendations from this assessment are implemented.

The group were introduced to the Risk Assessment Process at the commencement of the session by the facilitator. The various steps were explained and the group reviewed the Likelihood, Consequence and Risk Ranking matrix.

The risk ranking was done with consideration to existing controls being in place.

Controls were developed using the following forms.

1. Avoidance – avoid the risk by deciding not to proceed with the activity likely to generate the risk (where this is practicable).
2. Reduction – reduce the likelihood of the event.
3. Reduction – reduce the consequences of the event.
4. Accept – accept the risk within the organisation and establish an appropriate plan to manage the consequences of these risk if they are to occur.

The above risk control options were applied by reference to the following control methodologies in a hierarchical sequence.

1. Design – to the extent reasonable and practicable ensure that hazards are designed out when new materials, equipment or work systems are being planned for the workplace.
2. Remove the hazard or substitute less hazardous materials, equipment or substances.
3. Adopt a safer process – alter tool, equipment or work practices to make them safer.
4. Enclose or isolate the hazard – provide guards or remote operation and handling techniques.
5. Provide effective ventilation – install local or general exhaust ventilation systems.
6. Establish appropriate administrative procedures. Set up, document and implement new procedures that provide for:
   - Scheduling of the job so that fewer workers are exposed;
   - Routine maintenance and housekeeping procedures;
   - Training on hazards and correct work procedures.
7. Personal Protective Equipment – provide suitable and properly maintained personal protective equipment and training in its use.

9. Facilitator Qualifications and Experience

Shane Chiddy holds an Associate Diploma in Engineering (Electrical), is an Officer of the Institution of Engineers (Australia) and is a member of the Asset Management Council of Australia (AMC) and the Mining Electrical and Mining Mechanical Engineering Society (MEMMES). He has also completed Contract Law through Macquarie University, G2 and Establish the Risk Management Systems (Mine 7033 - G3) through Queensland University and is certified as a Functional Safety Engineer by TÜV Rheinland for both Safety Instrumented Systems and Machine Safety.

Prior to commencing his consulting career, Shane Chiddy qualified as an electrician and worked underground for 9 years. He then occupied a number of engineering roles within Rio Tinto, including such roles as electrical supervisor, Development Engineer and Senior Production Engineer. This latest role was responsible for the Longwall, underground diesel equipment and conveyors.

Additionally Shane Chiddy has been trained and accredited by John Moubray in the UK as a certified RCM II practitioner, and has conducted a number of extensive Reliability-centred Maintenance II analyses including underground and surface equipment such as Longwalls, Continuous Miners and conveying systems.. He has facilitated RCM II analysis and delivered training in the mining, defence and telecommunications industries.

His consulting experience includes the application of Reliability-centred Maintenance II and extensive Risk Management and Project Management assignments. Shane is also experienced in software development and in the development and presentation of training packages.

10. Sub-Systems Considered in the Assessment

Sub-System		STEP IN PROCESS	
1	Natural Features	A	Catchment Areas or Declared Special Areas
		B	Rivers or Creeks (Nepean River and its tributaries)
		C	Aquifers or Known Groundwater Resources
		D	Springs
		E	Sea or Lake
		F	Shorelines
		G	Natural Dams
		H	Cliffs, Steep Slopes or Pagodas (associated with upper Razorback Range)
		I	Minor Cliffs, Steep Slopes or Pagodas (associated with lower Razorback Range)
		J	Minor Cliffs, Steep Slopes or Pagodas (areas not associated with Razorback Range)
		K	Nepean River Cliff lines
		L	Escarpments
		M	Land Prone to Flooding or Inundation
		N	Swamps, Wetlands or Groundwater Related Ecosystems
		O	Threatened or Protected Species and Communities
		P	National Parks
		Q	State Conservation Areas
		R	State Forests
		S	Natural Vegetation
		T	Areas of Major Geological Interest
		U	Any other feature considered significant
2	Public Utilities	A	Railways (including culverts, embankments, cuttings, level crossings, and Douglas Park Station)
		B	Roads (M31 - Hume Highway, including Morton Park Road (North and South) bridges, culverts, embankments, cuttings and rest areas)
		C	Roads (All Types - excluding the M31 - Hume Highway)
		D	Bridges
		E	Tunnels
		F	Culverts
		G	Water, Gas or Sewerage Infrastructure
		H	Liquid Fuel Pipelines
		I	Electricity Power Lines or Associated Plants
		J	Telecommunication Lines or Associated Plants
		K	Water Tanks, Water or Sewage Treatment Works
		L	Dams, Reservoirs or Associated Works
		M	Air Strips
		N	Any Other Public Utilities

3	Public Amenities	A	Hospitals
		B	Places of Worship
		C	Schools
		D	Shopping Centres
		E	Community Centres
		F	Office Buildings
		G	Swimming Pools
		H	Bowling Greens
		I	Ovals or Cricket Grounds
		J	Race Courses
		K	Golf Courses
		L	Tennis Courts
		M	Visual Amenity
4	Farm Land And Facilities	A	Agricultural Utilisation or Agricultural Suitability of Farm Land
		B	Farm Buildings or Sheds
		C	Gas or Fuel Storage
		D	Poultry Sheds
		E	Glass Houses
		F	Hydroponic Systems
		G	Irrigation Systems
		H	Fences
		I	Farm Dams
		J	Wells or Bores
		K	Any other feature considered significant including access tracks
5	Industrial, Commercial And Business Establishments	A	Factories
		B	Workshop
		C	Business or Commercial Establishments
		D	Gas or Fuel Storages or Associated Plants
		E	Waste Storages or Associated Plants
		F	Buildings, Equipment or Operations that are Sensitive to Surface Movements
		G	Surface Mining (Open Cut) Voids or Rehabilitated Areas
		H	Mine Infrastructure Including Tailings Dams or Emplacement Areas
		I	Any Other Industrial, Commercial or Business Features
6	Areas Of Archaeological Or Heritage Importance	A	Areas of Archaeological and/or Heritage Significance
7	Items Of Architectural Importance	A	Items of Architectural Significance
8	Permanent Survey Control Marks	A	Permanent Survey Control Marks
9	Residential Establishments	A	Houses
		B	Flats or Units
		C	Caravan Parks
		D	Retirement or Aged Care Villages
		E	Associated Structures such as Workshops, Garages, On-Site Waste Water Systems, Water or Gas Tanks, Swimming Pools or Tennis Courts
		F	Any Other Residential Features of relevance
10	Any Other Item Of Importance	A	Any Other Item of Importance

11. Risk Assessment Methodology

11.1 Qualitative Risk Analysis

This Risk Assessment has been performed using Qualitative Risk Analysis techniques and has been performed to align with the principles of the Australian Standard AS31000 - Risk Management Principles and Guidelines and the Department of Mineral Resource Guideline MDG1010.

The Risk Assessment has followed the WRAC (Workplace Risk Assessment and Control) principles as outlined in the guideline.

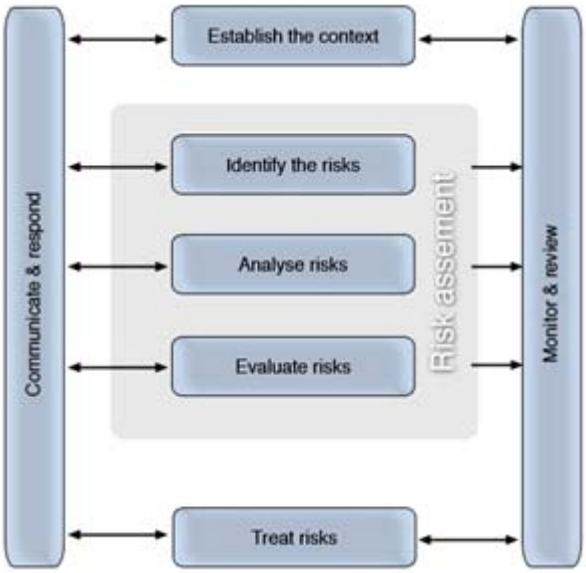
The qualitative approach succeeds by using local expert knowledge and relevant historical data.

This system of analysis uses a participative approach which is very powerful for identifying potential hazard scenarios.

The following steps outline the systematic identification of hazards, ranking of risks, and identification of new and/or improved controls that were used in the Risk Assessment session:

1. Introduce team to the Risk Assessment process and the context of the Risk Assessment. This includes the scope and method of the Risk Assessment.
2. Identify discrete components, or elements, of the Project.
3. Identify and add potential deviation steps.
4. Review each sub-system and identify loss scenarios - (Potential Incidents and Accidents).
5. For those hazards evaluate the risk using the risk rank method by determining the probability, consequence, and risk rank of each loss scenario.
6. Identify existing controls for each hazard.
7. Specify additional controls required to control the hazard(s).
8. Close the Risk Assessment.
9. Document and distribute to the team for proof reading.
10. Undertake verification of the assessment by a nominated person.

The available Standards on Risk Management (including MDG1010) define the Risk Management process as that shown below.



11.2 Establish the Context

This risk analysis has been performed using Qualitative Risk Analysis techniques and is performed in compliance with the Department of Mineral Resources (now the Resources Regulator) Guideline MDG1010.

11.3 Identify Hazards

This step involves identification of all the hazards to be managed. To correctly apply this step a well structured systematic process must be used, because controls may not be able to be implemented to reduce or eliminate any hazards missed at this point in the analysis.

For each hazard, the team identifies:
1. What Can Happen; and
2. How and Why it Can Happen.

Checklists, Flowcharts and Brainstorming are used to identify hazards.

11.4 Analyse Risks

The main objectives of an analysis is to separate minor risks from major risks and to provide data to assist in the evaluation and treatment of hazards.

Risk Analysis involves considering the following:
1. Likelihood of the hazard occurring (identifed as 'L' within the worksheets).
2. Consequences if the hazard does occur (identified as 'C' in the worksheets).
3. Determining any existing controls.

The combination of the likelihood and the consequence determines the level of the risk involved. The likelihood and consequence categories used are outlined in Section 13.

During the assessment the consequences are categorised as either hazards to personnel, the environment or to the site operations. Reputation, legal compliance and community are also considered where appropriate.

The consequence category is identified on the Analysis Worksheets in the Column labelled 'T' for Type.

11.5 Evaluate Risks

Evaluation involves comparing the level of risk found during the analysis with previously established risk criteria.

The output of this part of the process is a list of prioritised hazards for further action.

If the resulting hazards fall into the low or tolerable risk categories they may be accepted with minimal further treatment. Although, low and tolerable hazards should be monitored and periodically reviewed to ensure that they remain tolerable.

If hazards do not fall into the low or tolerable risk category then they should be treated using other options.

11.6 Treat Risks

Risk treatment involves identifying the range of options for treating risks, assessing the options and preparing risk treatment plans and implementing them.

Risk treatment may be in one of the following forms:

1. Risk avoidance. Decide not to proceed with the activity.
2. Reduce likelihood. Reduce the chance of the risk occurring.
3. Reduce the risk consequences. Reduce the consequence if the risk occurs.
4. Retain (or accept) the risk. Plans should be put in place to mitigate the consequences of these risks in the event that they occur.

Risk treatment options should be assessed on the extent of any additional benefits or opportunities created. A number of options may be considered and applied either individually or in a combination.

Risk treatment plans should be developed to identify responsibilities, schedules, budgets and performance measures and the review process that is to be established.

11.7 Monitor and Review

It is essential to monitor the effectiveness of the risk management system and the risk treatment implementation.

Risks and the effectiveness of control measures need to be monitored to ensure that the changing environments do not alter risk priorities. Few risks remain static.

Factors affecting likelihood and/or consequence change as do factors regarding suitability of controls.

11.8 Communications and Consultations

Communication and consultation are important during the entire risk management process. It is important to develop a communication plan for both internal and external stakeholders.

This should be a two-way consultation not a one-way flow of information.

Effectiveness of internal and external communications is important to ensure that those responsible for implementing risk management understand the basis on which all decisions have been made, and why particular actions are required.

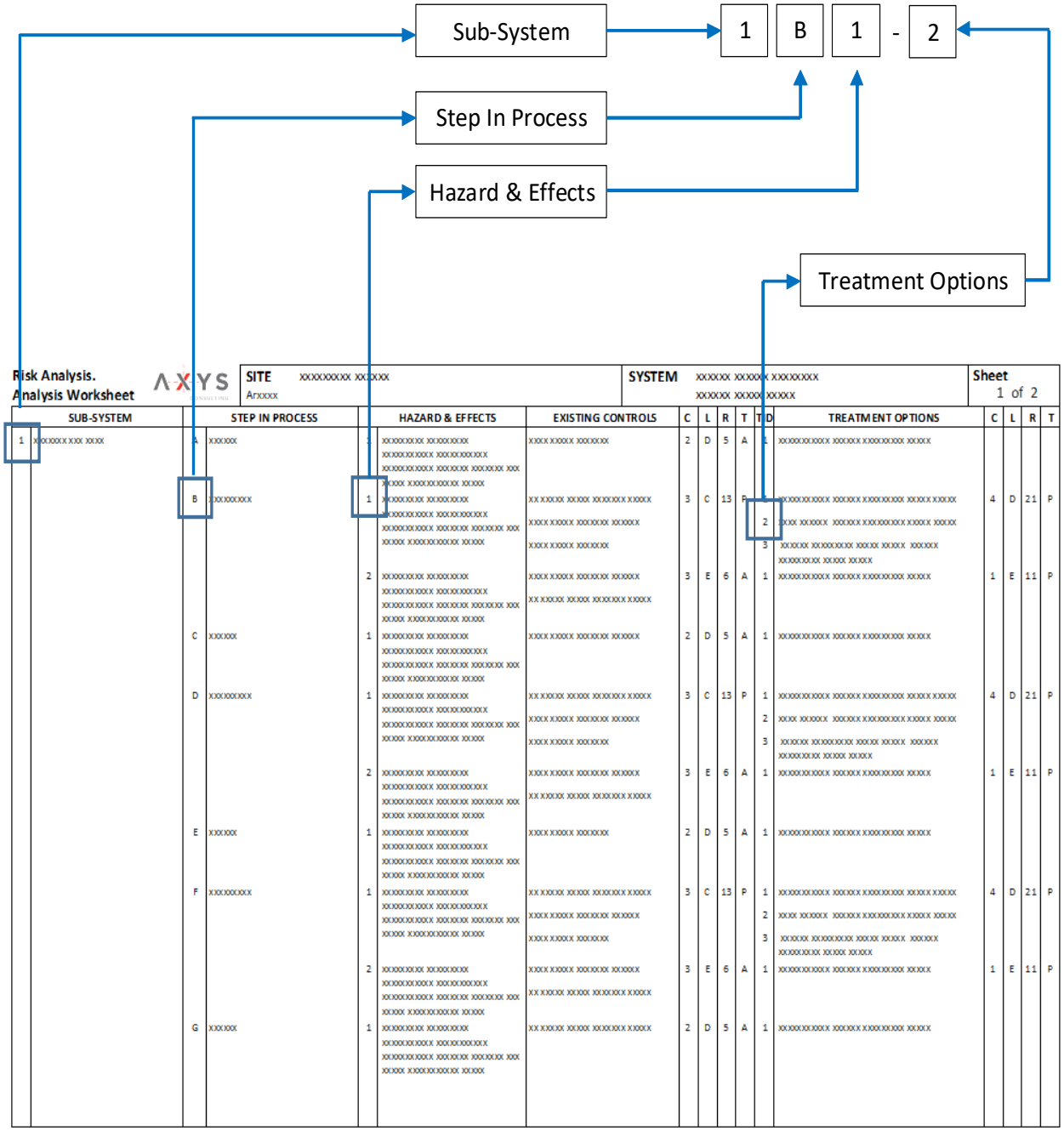
12. Risk Assessment Numbering

The assessment uses an alphanumeric numbering system to differentiate each component, the step in the process, the hazard and the treatment options.

The sub system number is found in the first column of the worksheets, the step is identified as a letter and is found in the third column, the hazard number in the fifth column and the treatment options in the TID (Treatment ID) column.

Using this method each hazard and treatment option throughout the analysis has a distinct identifier. This identifier then flows through all of the worksheets and can be referenced back to the Analysis Worksheets.

The example below shows the distinct identifier for the hazard is 1B1, the treatment option identified below would be identified as 1B1-2.



13. Risk Rank Method

For each event, the Likelihood and Consequence is determined and selected. If an event affects more than one area of consequence (e.g. affects people and operations), the highest rank number is always selected.

Risk Matrix							
Likelihood		**Consequence**					
		Low 1	**Minor 3**	**Moderate 10**	**Significant 30**	**Major 100**	**Catastrophic 300**
10 Almost Certain	Could be expected to occur more than once during the study or project. Could occur once per year.	**10**	**30**	**100**	**300**	**1000**	**3000**
3 Likely	Could easily be incurred and has generally occurred in similar studies or projects Could be incurred 1 - 2 Years	**3**	**9**	**30**	**90**	**300**	**900**
1 Possible	Incurred in a minority of similar studies or projects. Could be incurred within a 5 year strategic budget period	**1**	**3**	**10**	**30**	**100**	**300**
0.3 Unlikely	Known to happen, but only rarely. Could be incurred within a 5 -20 year time frame	**0.3**	**0.9**	**3**	**9**	**30**	**90**
0.1 Rare	Has not occurred in similar studies or projects, but could Could be incurred 20 – 50 years	**0.1**	**0.3**	**1**	**3**	**10**	**30**
0,03 Very Rare	Conceivable, but only in extreme circumstances. Has not happened in industry in the last 50 years	**0.03**	**0.09**	**0.3**	**0.9**	**3**	**9**

Area of Effect	Estimated Level of Consequence					
	1	3	10	30	100	300
Harm to People (P)	Low level short term subjective symptoms or inconvenience. No medical treatment	Objective but reversible impairment. Medical treatment injury or illness	Permanent impairment <30% of body to one or more persons	Single fatality. Permanent impairment >30% of body to one or more persons	2-20 fatalities Permanent impairment >3-% of body more than 10 persons	>20 fatalities. Permanent impairment >30% of body to more than 100 persons
Environmental (E)	Low level impact to land, biodiversity, ecosystem services, water resources or air	Minor Impacts (<3 months) to land, biodiversity, ecosystem services, water resources or air	Moderate impacts. (<1 year) to land, biodiversity, ecosystem services, water resources or air	Major impacts (<5 years) to land, biodiversity, ecosystem services, water resources or air	Serious or extensive impacts (<20 years) to land, biodiversity, ecosystem services, water resources or air	Severe impacts (>20 years) to land, biodiversity, ecosystem services, water resources or air
Community (C)	Single low level community health, safety or security impact, low level inconvenience <2 weeks, minor, low level disturbance to a single house or structure.	Minor community health, safety or security impacts (<10 households) or human rights infringements, inconvenience to livelihoods <6 months, moderate damage to <50 houses or community infrastructure	Moderate community health, safety or security impacts (<50 households). Single allegation of human rights violations, moderate disruption to people's lives (<50 households)	Serious community health, safety or security impacts (<50 households). Multiple allegations of human rights violations, extended disruption to people's lives (>50 households)	Serious community health, safety or security impacts (>50 households) or human rights violation, extended disruption to people's lives (>200 households)	Extensive community health, safety or security impacts (>200 households) or human rights violations, extended serious disruption to people's lives (>1000 hosueholds)
Reputation (R)	Public concern restricted to local complaints. Low level interest from local media and/or regulator	Adverse local public or media attention and complaints. Heightened scrutiny from regulator. Asset reputation is adversely affected with a small number of people	Attention from regional media and/or heightened concern by local community. Criticism by community, NGOs or activists. Asset reputation adversely affected.	Adverse national media attention. General public and NGO adverse reaction with interest from regulators with no material outcome. Structured campaigning from employees.	Serious national and international negative media attention. General public and NGO adverse reaction with interest from regulators (<3 months). Structured campaigning from employees.	Crisis event or publication of confidential material information resulting in international media, government, regulator, NGO campaigning and employee condemnation of the company (<6 months)
Legal (L)	Low level legal issue	Minor legal issues and non-compliance with commitments	Breach of regulation. Lack of valid exploration title	Significant civil litigation	Prosecutions for criminal breaches resulting in gaol terms for employees or agents or defendant to major civil litigation	Lack of valid operating title, forced closure of an operation, competition, anti-corruption, international trade law or tax breach
Financial (F)	<US$500,000	US$5,000,000 to >US$500,000	US$25,000,000 to >US$5,000,000	US$100,000,000 to >US$25,000,000	US$250,000,000 to >US$100,000,000	>$250,000,000

Attachment 1

Analysis Worksheets

SUB-SYSTEM		STEP IN PROCESS		HAZARD & EFFECTS		EXISTING CONTROLS	C	L	R	T	TID	TREATMENT OPTIONS
1	Natural Features	A	Catchment Areas or Declared Special Areas	1	The EP study area does not include any catchment areas or declared special areas and did not require further assessment.						1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1		B	Rivers or Creeks (Nepean River and its tributaries)	1	Water flow and quality changes to tributaries feeding into the Nepean River due to mine subsidence. Flow on environmental impacts result.	No predicted impacts greater than BSO Approval conditions to the Nepean River. Note: The Nepean River is located a minimum of 1.5 km from the proposed longwalls Monitoring of water quality in Nepean River tributaries is included in the Water Management Plan Groundwater modelling does not predict impacts to surface water features	30	0.3	10	E	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1		C	Aquifers or Known Groundwater Resources	1	Greater than predicted impacts on Aquifers or Known Groundwater. Groundwater quality and depressurisation affected due to mining. Leading to non compliance to regulatory commitments.	Groundwater pressure / level modelling predictions are included within the Water Management Plan Groundwater quality monitoring is included within the Water Management Plan End of Panel reporting to confirm predicted impacts to groundwater	100	0.1	10	E	1 2	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans Periodically update the numerical groundwater model with new hydro-geological data to refine predicted impacts to groundwater
1		D	Springs	1	The EP study area does not include any identified permanent springs and did not require further assessment.							
1		E	Sea or Lake	1	The EP study area does not include any seas or lakes and did not require further assessment.							
1		F	Shorelines	1	The EP study area does not include any shorelines and did not require further assessment.							
1		G	Natural Dams	1	The EP study area does not include any natural dams and did not require further assessment.							

SUB-SYSTEM		STEP IN PROCESS		HAZARD & EFFECTS		EXISTING CONTROLS	C	L	R	T	TID	TREATMENT OPTIONS
1	Natural Features	H	Cliffs, Steep Slopes or Pagodas (associated with upper Razorback Range)	1	Greater than predicted impacts to Cliffs, Steep Slopes or Pagodas due to mine subsidence. Leading to non compliance to regulatory commitments.	No Pagodas are identified within the study area Cliffs and Steep Slopes are identified within the study area and are included within the Land Management Plan Monitoring of Cliffs and Steep Slopes is included in the Land Management Plan Existing Longwall 904 Management Plan includes detailed monitoring, real time monitoring with trigger alarms, visual inspection (geotechnical and structural) and management measures	10	0.3	3	E	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1		H		2	Greater than predicted impacts to Cliffs or Pagodas due to mine subsidence. Leading to affects to public safety	No Pagodas are identified within the study area Cliffs and Steep Slopes are identified within the study area and are included within the Land Management Plan and the Public Safety Management Plan Monitoring of Cliffs and Steep Slopes is included in the Land Management Plan Existing Longwall 904 Management Plan includes detailed monitoring, real time monitoring with trigger alarms, visual inspection (geotechnical and structural) and management measures Ground Monitoring and real time monitoring is provided on three private properties at the top of Razorback Range Inspections by geotechnical and structura engineers is provided to the three private properties at the top of Razorback Range Ground monitoring points are provided along Top Ridge Road Built features on and near steep slopes have been identified and mapped	30	0.3	10	P	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans

SUB-SYSTEM		STEP IN PROCESS		HAZARD & EFFECTS		EXISTING CONTROLS	C	L	R	T	TID	TREATMENT OPTIONS
1	Natural Features	I	Minor Cliffs, Steep Slopes or Pagodas (associated with lower Razorback Range)	1	Greater than predicted impacts to Steep Slopes due to mine subsidence. Leading to non compliance to regulatory commitments.	Steep Slopes are identified within the study area and are included within the Land Management Plan Monitoring of Steep Slopes is included in the Land Management Plan Only minor Cliffs are identified at the lower Razorback Range or elsewhere No Pagodas are identified within the study area Existing Longwall 904 Management Plan includes detailed monitoring, real time monitoring, visual inspection (geotechnical and structural) and management measures	10	0.3	3	E	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1		I		2	Greater than predicted impacts to Cliffs or Pagodas due to mine subsidence. Leading to affects to public safety	Steep Slopes are identified within the study area and are included within the Land Management Plan Monitoring of Steep Slopes is included in the Land Management Plan Only minor Cliffs are identified at the lower Razorback Range or elsewhere No Pagodas are identified within the study area Existing Longwall 904 Management Plan includes detailed monitoring, real time monitoring, visual inspection (geotechnical and structural) and management measures Built features on and near steep slopes have been identified and mapped	30	0.3	10	P	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1		J	Minor Cliffs, Steep Slopes or Pagodas (areas not associated with Razorback Range)	1	Greater than predicted impacts to Steep Slopes due to mine subsidence. Leading to non compliance to regulatory commitments.	Steep Slopes are identified within the study area and are included within the Land Management Plan Monitoring of Steep Slopes is included in the Land Management Plan No Cliffs are identified in areas not associated with Razorback Range No Pagodas are identified within areas not associated with Razorback Range Existing Longwall 904 Management Plan includes detailed monitoring, visual inspection (geotechnical and structural) and management measures	10	0.3	3	E	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans

SUB-SYSTEM		STEP IN PROCESS		HAZARD & EFFECTS		EXISTING CONTROLS	C	L	R	T	TID	TREATMENT OPTIONS
1	Natural Features	J	Minor Cliffs, Steep Slopes or Pagodas (areas not associated with Razorback Range)	2	Greater than predicted impacts to Minor Cliffs, Steep Slopes or Pagodas due to mine subsidence. Leading to affects to public safety	Steep Slopes are identified within the study area and are included within the Land Management Plan Monitoring of Steep Slopes is included in the Land Management Plan No Cliffs are identified in areas not associated with Razorback Range No Pagodas are identified within areas not associated with Razorback Range Existing Longwall 904 Management Plan includes detailed monitoring, visual inspection (geotechnical and structural) and management measures Built features on and near steep slopes have been identified and mapped	10	0.1	1	P	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1		K	Nepean River Cliff lines	1	Greater than predicted impacts to Nepean River Cliffs due to mine subsidence. Leading to non compliance to regulatory commitments.	The Nepean River is located a minimum of 1.5 km from the proposed Longwalls No cliff instability identified associated with Longwalls 702 to 708 and 901 to 903	10	0.1	1	E	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1		K		2	Greater than predicted impacts to Nepean River Cliffs due to mine subsidence. Leading to affects to public safety	The Nepean River is located a minimum of 1.5 km from the proposed Longwalls No cliff instability identified associated with Longwalls 702 to 708 and 901 to 903	30	0.03	0.9	P	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1		L	Escarpments	1	Hazards associated with Escarpments was considered in the Cliffs, Steep Slopes or Pagodas (associated with upper Razorback Range) above.							
1		M	Land Prone to Flooding or Inundation	1	The EP study area does not include any land or areas prone to flooding or inundation and did not require further assessment							
1		N	Swamps, Wetlands or Groundwater Related Ecosystems	1	The EP study area does not include any identified Swamps, Wetlands or Groundwater Related Ecosystems (including Groundwater Dependant Ecosystems) and did not require further assessment.							
1		O	Threatened or Protected Species and Communities	1	Greater than predicted impacts to Threatened or Protected Species and Communities due to mine subsidence. Leading to non compliance to regulatory commitments.	Biodiversity Management Plan includes monitoring of aquatic and terrestrial ecology Land and Water Management Plans includes monitoring of changes to vegetation and habitats	10	0.3	3	E	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans

SUB-SYSTEM		STEP IN PROCESS		HAZARD & EFFECTS		EXISTING CONTROLS	C	L	R	T	TID	TREATMENT OPTIONS
1	Natural Features	P	National Parks	1	The EP study area does not include any National Parks and did not require further assessment.							
1		Q	State Conservation Areas	1	The EP study area does not include any State Conservation Areas and did not require further assessment.							
1		R	State Forests	1	The EP study area does not include any State Forests and did not require further assessment.							
1		S	Natural Vegetation	1	Hazards associated with Natural Vegetation was considered in the Threatened or Protected Species and Communities above.							
1		T	Areas of Major Geological Interest	1	The EP study area does not include any areas of major geological interest and did not require further assessment.							
1		U	Any other feature considered significant	1	The EP study area does not include any other feature considered significant and did not require further assessment.							
2	Public Utilities	A	Railways (including culverts, embankments, cuttings, level crossings, and Douglas Park Station)	1	Impacts to the Main Southern Railway due to mine subsidence. Leading to non compliance to regulatory commitments (safe and serviceable)	Existing Longwall 702 to 708 and 901 to 904 Rail Management Plans includes detailed monitoring, real time monitoring with trigger alarms, visual inspection and management measures Proposed Longwalls are set back from the Main Southern Railway Built Features Management Plan includes the specific Rail Management Plan	100	0.1	10	P	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
2		B	Roads (M31 - Hume Highway, including Morton Park Road (North and South) bridges, culverts, embankments, cuttings and rest areas)	1	Impacts to the M31 - Hume Highway due to mine subsidence. Leading to non compliance to regulatory commitments (safe and serviceable)	Existing Longwall 702 to 708 and 901 to 904 M31 Road Management Plans includes detailed monitoring, real time monitoring with trigger alarms, visual inspection and management measures Proposed Longwalls are set back (470 metres) from the M31 - Hume Highway Built Features Management Plan includes the specific M31 Road Management Plan	100	0.1	10	P	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans

SUB-SYSTEM		STEP IN PROCESS		HAZARD & EFFECTS		EXISTING CONTROLS	C	L	R	T	TID	TREATMENT OPTIONS
2	Public Utilities	C	Roads (All Types - excluding the M31 - Hume Highway)	1	Impacts to the roads due to mine subsidence. Leading to non compliance to regulatory commitments (safe and serviceable)	Existing Longwall 702 to 708 and 901 to 904 Public Roads Management Plan includes detailed monitoring, visual inspection and management measures Built Features Management Plan includes the specific Public Roads Management Plan Public Safety Management Plan includes the specific Public Roads Management Plan Steep Slopes are identified within the study area and are included within the Land Management Plan	10	0.3	3	P	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
2		D	Bridges	1	Hazards associated with Bridges was considered in M31 - Hume Highway above.							
2		E	Tunnels	1	The EP study area does not include any tunnels and did not require further assessment.							
2		F	Culverts	1	Hazards associated with Culverts was considered in Roads and Rail above.							
2		G	Water, Gas or Sewerage Infrastructure	1	The EP study area does not include any public water, gas or sewerage infrastructure and did not require further assessment.							
2		H	Liquid Fuel Pipelines	1	The EP study area does not include any liquid fuel pipeline and did not require further assessment.							
2		I	Electricity Power Lines or Associated Plants	1	Greater than predicted impacts to Power Lines or Associated Plants due to mine subsidence. Leading to non compliance to regulatory commitments.	Power Lines within the study are 66kV or less Endeavour Energy Infrastructure Management Plan Built Features Management Plan includes the specific Endeavour Energy Infrastructure Management Plan	10	0.1	1	C	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
2		J	Telecommunication Lines or Associated Plants	1	Greater than predicted impacts to Telecommunication Lines or Associated Plants due to mine subsidence. Leading to non compliance to regulatory commitments.	Built Features Management Plan includes copper and optical fibre telecommunications lines, mobile phone tower and other associated plant Telstra and Optus Infrastructure Management Plans Nextgen and TPG infrastructure along side the M31 - Hume Highway are outside the study area	10	0.3	3	F	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans

SUB-SYSTEM		STEP IN PROCESS		HAZARD & EFFECTS		EXISTING CONTROLS	C	L	R	T	TID	TREATMENT OPTIONS
2	Public Utilities	K	Water Tanks, Water or Sewage Treatment Works	1	The EP study area does not include any public water tanks, water or sewerage treatment works and did not require further assessment.							
2		L	Dams, Reservoirs or Associated Works	1	The EP study area does not include any public Dams, Reservoirs or Associated Works and did not require further assessment.							
2		M	Air Strips	1	The EP study area does not include any public air strips and did not require further assessment.							
2		N	Any Other Public Utilities	1	The EP study area does not include any Other Public Utilities and did not require further assessment.							
3	Public Amenities	A	Hospitals	1	The EP study area does not include any hospitals and did not require further assessment.							
3		B	Places of Worship	1	The EP study area does not include any places of worship and did not require further assessment.							
3		C	Schools	1	The EP study area does not include any schools and did not require further assessment.							
3		D	Shopping Centres	1	The EP study area does not include any shopping centres and did not require further assessment.							
3		E	Community Centres	1	The EP study area does not include any community centres and did not require further assessment.							
3		F	Office Buildings	1	The EP study area does not include any office buildings and did not require further assessment.							
3		G	Swimming Pools	1	The EP study area does not include any public swimming pools and did not require further assessment.							
3		H	Bowling Greens	1	The EP study area does not include any bowling greens and did not require further assessment.							
3		I	Ovals or Cricket Grounds	1	The EP study area does not include any ovals or cricket grounds and did not require further assessment.							
3		J	Race Courses	1	The EP study area does not include any race courses and did not require further assessment.							

SUB-SYSTEM		STEP IN PROCESS		HAZARD & EFFECTS		EXISTING CONTROLS	C	L	R	T	TID	TREATMENT OPTIONS
3	Public Amenities	K	Golf Courses	1	The EP study area does not include any golf courses and did not require further assessment.							
3		L	Tennis Courts	1	The EP study area does not include any public tennis court and did not require further assessment.							
3		M	Visual Amenity	1	The EP study area does not include any public Visual Amenities and did not require further assessment.							
4	Farm Land And Facilities	A	Agricultural Utilisation or Agricultural Suitability of Farm Land	1	Impacts to Agricultural Utilisation or Agricultural Suitability of Farm Land due to mine subsidence. Leading to non compliance to regulatory commitments.	Individual Property Subsidence Management Plans Built Features Management Plan includes the Individual Property Subsidence Management Plans	3	1	3	E	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
4		B	Farm Buildings or Sheds	1	Impacts to Farm Buildings or Sheds due to mine subsidence. Leading to non compliance to regulatory commitments.	Individual Property Subsidence Management Plans Built Features Management Plan includes the Individual Property Subsidence Management Plans	1	1	1	F	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
4		C	Gas or Fuel Storage	1	Impacts to Gas or Fuel Storage due to mine subsidence. Leading to non compliance to regulatory commitments.	Individual Property Subsidence Management Plans Built Features Management Plan includes the Individual Property Subsidence Management Plans	1	0.1	0.1	F	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
4		D	Poultry Sheds	1	The EP study area does not include any commercial poultry sheds and did not require further assessment.							
4		E	Glass Houses	1	The EP study area does not include any known glass houses and did not require further assessment.							
4		F	Hydroponic Systems	1	The EP study area does not include any known commercial hydroponic system and did not require further assessment.							
4		G	Irrigation Systems	1	The EP study area does not include any known irrigation systems and did not require further assessment.							
4		H	Fences	1	Impacts to Fences due to mine subsidence. Leading to non compliance to regulatory commitments.	Individual Property Subsidence Management Plans Built Features Management Plan includes the Individual Property Subsidence Management Plans	1	0.3	0.3	F	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans

SUB-SYSTEM		STEP IN PROCESS		HAZARD & EFFECTS		EXISTING CONTROLS	C	L	R	T	TID	TREATMENT OPTIONS
4	Farm Land And Facilities	I	Farm Dams	1	Impacts to Farm Dams due to mine subsidence. Leading to non compliance to regulatory commitments.	Individual Property Subsidence Management Plans Built Features Management Plan includes the Individual Property Subsidence Management Plans	1	1	1	F	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
4		J	Wells or Bores	1	Impacts to Wells or Bores due to mine subsidence and depressurisation. Leading to non compliance to regulatory commitments.	Individual Property Subsidence Management Plans Built Features Management Plan includes the Individual Property Subsidence Management Plans Borehole monitoring and mitigation measures are included within the Water Management Plan	1	0.3	0.3	F	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
4		K	Any other feature considered significant including access tracks	1	The EP study area does not include any other feature considered significant including access tracks and did not require further assessment.							
5	Industrial, Commercial And Business Establishments	A	Factories	1	The EP study area does not include any factories and did not require further assessment.							
5		B	Workshop	1	The EP study area does not include any workshops and did not require further assessment.							
5		C	Business or Commercial Establishments	1	The EP study area does not include any Business or Commercial Establishments and did not require further assessment.							
5		D	Gas or Fuel Storages or Associated Plants	1	The EP study area does not include any Gas or Fuel Storages or Associated Plants and did not require further assessment.							
5		E	Waste Storages or Associated Plants	1	The EP study area does not include any Waste Storages or Associated Plants and did not require further assessment.							
5		F	Buildings, Equipment or Operations that are Sensitive to Surface Movements	1	The EP study area does not include any Buildings, Equipment or Operations that are Sensitive to Surface Movements and did not require further assessment.							
5		G	Surface Mining (Open Cut) Voids or Rehabilitated Areas	1	The EP study area does not include any Surface Mining (Open Cut) Voids or Rehabilitated Areas and did not require further assessment.							

SUB-SYSTEM		STEP IN PROCESS		HAZARD & EFFECTS		EXISTING CONTROLS	C	L	R	T	TID	TREATMENT OPTIONS
5	Industrial, Commercial And Business Establishments	H	Mine Infrastructure Including Tailings Dams or Emplacement Areas	1	The EP study area does not include any Tailings Dams or Emplacement Areas and did not require further assessment.							
5		I	Any Other Industrial, Commercial or Business Features	1	The EP study area does not include any Other Industrial, Commercial or Business Features and did not require further assessment.							
6	Areas Of Archaeological Or Heritage Importance	A	Areas of Archaeological and/or Heritage Significance	1	Impacts to Areas of Archaeological and/or Heritage Significance due to mine subsidence. Leading to non compliance to regulatory commitments. Reduction to business reputation.	No European Heritage items are identified within the study area Heritage Management Plan includes Aboriginal heritage sites Aboriginal heritage sites within the study area are limited to three open sites above the proposed longwalls and six additional sites within 600 m of the mining area	1	0.03	0.03	E	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
7	Items Of Architectural Importance	A	Items of Architectural Significance	1	The EP study area does not include any Items of Architectural Significance and did not require further assessment.							
8	Permanent Survey Control Marks	A	Permanent Survey Control Marks	1	Impacts to Permanent Survey Control Marks due to mine subsidence. Leading to non compliance to regulatory commitments.	Built Features Management Plan includes commitment to develop a Property Subsidence Management Plan to re-establish Permanent Survey Control Mark Property Subsidence Management Plan	1	0.3	0.3	F	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
9	Residential Establishments	A	Houses	1	Impacts to Houses due to mine subsidence. Leading to non compliance to regulatory commitments. Safe and serviceable.	Individual Property Subsidence Management Plans Built Features Management Plan includes the Individual Property Subsidence Management Plans Pre-mining inspections of properties identified as being potentially affected by steep slopes within the study Pre-mining hazard identification assessment by a structural inspections of houses in the study area Geotechnical and Structural inspections o houses on or adjacent to steep slopes	10	1	10	F	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
9		B	Flats or Units	1	The EP study area does not include any Flats or units and did not require further assessment.							
9		C	Caravan Parks	1	The EP study area does not include any caravan parks and did not require further assessment.							

SUB-SYSTEM		STEP IN PROCESS		HAZARD & EFFECTS		EXISTING CONTROLS	C	L	R	T	TID	TREATMENT OPTIONS
9	Residential Establishments	D	Retirement or Aged Care Villages	1	The EP study area does not include any Retirement or Aged Care Villages and did not require further assessment.							
9		E	Associated Structures such as Workshops, Garages, On-Site Waste Water Systems, Water or Gas Tanks, Swimming Pools or Tennis Courts	1	Impacts to Associated Structures such as Workshops, Garages, On-Site Waste Water Systems, Water or Gas Tanks, Swimming Pools or Tennis Courts due to mine subsidence. Leading to non compliance to regulatory commitments. Safe and serviceable.	Individual Property Subsidence Management Plans Built Features Management Plan includes the Individual Property Subsidence Management Plans Pre-mining inspections of properties identified as being potentially affected by steep slopes within the study Pre-mining hazard identification assessment by a structural inspections of houses in the study area Geotechnical and Structural inspections o houses on or adjacent to steep slopes	1	1	1	F	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
9		F	Any Other Residential Features of relevance	1	The EP study area does not include any Other Residential Features of relevance and did not require further assessment.							
10	Any Other Item Of Importance	A	Any Other Item of Importance	1	Impacts to future roads (M9), houses and mining infrastructure due to mine subsidence. Leading to non compliance to regulatory commitments.	Built Features Management Plan includes the Individual Property Subsidence Management Plans Property Subsidence Management Plan Specific Infrastructure Management Plans will be modified to include new infrastructure features	10	0.3	3	C	1	None Identified

Attachment 2

Assessment Worksheets
(Risk Rank Order)

REF	Risk	HAZARD	TID	TREATMENT OPTIONS
1B1	10	Water flow and quality changes to tributaries feeding into the Nepean River due to mine subsidence. Flow on environmental impacts result.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1C1	10	Greater than predicted impacts on Aquifers or Known Groundwater. Groundwater quality and depressurisation affected due to mining. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
			2	Periodically update the numerical groundwater model with new hydro-geological data to refine predicted impacts to groundwater
1H2	10	Greater than predicted impacts to Cliffs or Pagodas due to mine subsidence. Leading to affects to public safety	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1I2	10	Greater than predicted impacts to Cliffs or Pagodas due to mine subsidence. Leading to affects to public safety	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
2A1	10	Impacts to the Main Southern Railway due to mine subsidence. Leading to non compliance to regulatory commitments (safe and serviceable)	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
2B1	10	Impacts to the M31 - Hume Highway due to mine subsidence. Leading to non compliance to regulatory commitments (safe and serviceable)	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
9A1	10	Impacts to Houses due to mine subsidence. Leading to non compliance to regulatory commitments. Safe and serviceable.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1H1	3	Greater than predicted impacts to Cliffs, Steep Slopes or Pagodas due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1I1	3	Greater than predicted impacts to Steep Slopes due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1J1	3	Greater than predicted impacts to Steep Slopes due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1O1	3	Greater than predicted impacts to Threatened or Protected Species and Communities due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
2C1	3	Impacts to the roads due to mine subsidence. Leading to non compliance to regulatory commitments (safe and serviceable)	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
2J1	3	Greater than predicted impacts to Telecommunication Lines or Associated Plants due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
4A1	3	Impacts to Agricultural Utilisation or Agricultural Suitability of Farm Land due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
10A1	3	Impacts to future roads (M9), houses and mining infrastructure due to mine subsidence. Leading to non compliance to regulatory commitments.	1	None Identified
1J2	1	Greater than predicted impacts to Minor Cliffs, Steep Slopes or Pagodas due to mine subsidence. Leading to affects to public safety	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1K1	1	Greater than predicted impacts to Nepean River Cliffs due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
2I1	1	Greater than predicted impacts to Power Lines or Associated Plants due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
4B1	1	Impacts to Farm Buildings or Sheds due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
4I1	1	Impacts to Farm Dams due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans

REF	Risk	HAZARD	TID	TREATMENT OPTIONS
9E1	1	Impacts to Associated Structures such as Workshops, Garages, On-Site Waste Water Systems, Water or Gas Tanks, Swimming Pools or Tennis Courts due to mine subsidence. Leading to non compliance to regulatory commitments. Safe and serviceable.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1K2	0.9	Greater than predicted impacts to Nepean River Cliffs due to mine subsidence. Leading to affects to public safety	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
4H1	0.3	Impacts to Fences due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
4J1	0.3	Impacts to Wells or Bores due to mine subsidence and depressurisation. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
8A1	0.3	Impacts to Permanent Survey Control Marks due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
4C1	0.1	Impacts to Gas or Fuel Storage due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
6A1	0.03	Impacts to Areas of Archaeological and/or Heritage Significance due to mine subsidence. Leading to non compliance to regulatory commitments. Reduction to business reputation.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans

Attachment 3

Assessment Worksheets
(Consequence Order)

REF	Cons	HAZARD	TID	TREATMENT OPTIONS
1C1	100	Greater than predicted impacts on Aquifers or Known Groundwater. Groundwater quality and depressurisation affected due to mining. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
			2	Periodically update the numerical groundwater model with new hydro-geological data to refine predicted impacts to groundwater
2A1	100	Impacts to the Main Southern Railway due to mine subsidence. Leading to non compliance to regulatory commitments (safe and serviceable)	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
2B1	100	Impacts to the M31 - Hume Highway due to mine subsidence. Leading to non compliance to regulatory commitments (safe and serviceable)	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1B1	30	Water flow and quality changes to tributaries feeding into the Nepean River due to mine subsidence. Flow on environmental impacts result.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1H2	30	Greater than predicted impacts to Cliffs or Pagodas due to mine subsidence. Leading to affects to public safety	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1I2	30	Greater than predicted impacts to Cliffs or Pagodas due to mine subsidence. Leading to affects to public safety	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1K2	30	Greater than predicted impacts to Nepean River Cliffs due to mine subsidence. Leading to affects to public safety	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1H1	10	Greater than predicted impacts to Cliffs, Steep Slopes or Pagodas due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1I1	10	Greater than predicted impacts to Steep Slopes due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1J1	10	Greater than predicted impacts to Steep Slopes due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1J2	10	Greater than predicted impacts to Minor Cliffs, Steep Slopes or Pagodas due to mine subsidence. Leading to affects to public safety	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1K1	10	Greater than predicted impacts to Nepean River Cliffs due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
1O1	10	Greater than predicted impacts to Threatened or Protected Species and Communities due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
2C1	10	Impacts to the roads due to mine subsidence. Leading to non compliance to regulatory commitments (safe and serviceable)	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
2I1	10	Greater than predicted impacts to Power Lines or Associated Plants due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
2J1	10	Greater than predicted impacts to Telecommunication Lines or Associated Plants due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
9A1	10	Impacts to Houses due to mine subsidence. Leading to non compliance to regulatory commitments. Safe and serviceable.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
10A1	10	Impacts to future roads (M9), houses and mining infrastructure due to mine subsidence. Leading to non compliance to regulatory commitments.	1	None Identified
4A1	3	Impacts to Agricultural Utilisation or Agricultural Suitability of Farm Land due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
4B1	1	Impacts to Farm Buildings or Sheds due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
4C1	1	Impacts to Gas or Fuel Storage due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
4H1	1	Impacts to Fences due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans

REF	Cons	HAZARD	TID	TREATMENT OPTIONS
4I1	1	Impacts to Farm Dams due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
4J1	1	Impacts to Wells or Bores due to mine subsidence and depressurisation. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
6A1	1	Impacts to Areas of Archaeological and/or Heritage Significance due to mine subsidence. Leading to non compliance to regulatory commitments. Reduction to business reputation.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
8A1	1	Impacts to Permanent Survey Control Marks due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans
9E1	1	Impacts to Associated Structures such as Workshops, Garages, On-Site Waste Water Systems, Water or Gas Tanks, Swimming Pools or Tennis Courts due to mine subsidence. Leading to non compliance to regulatory commitments. Safe and serviceable.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans

Attachment 4

Risk Treatment Schedule Action Plan

ID	HAZARD	TID	TREATMENT OPTIONS	RESPONSIBILITY	IMPLEMENTATION	COMMENTS	COMPLETED (Sign Off)
1A1	The EP study area does not include any catchment areas or declared special areas and did not require further assessment.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans				
1B1	Water flow and quality changes to tributaries feeding into the Nepean River due to mine subsidence. Flow on environmental impacts result.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
1C1	Greater than predicted impacts on Aquifers or Known Groundwater. Groundwater quality and depressurisation affected due to mining. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
		2	Periodically update the numerical groundwater model with new hydro-geological data to refine predicted impacts to groundwater	Cody Brady (Groundwater Consultant)	Tuesday, 30 June 2026		
1D1	The EP study area does not include any identified permanent springs and did not require further assessment.						
1E1	The EP study area does not include any seas or lakes and did not require further assessment.						
1F1	The EP study area does not include any shorelines and did not require further assessment.						
1G1	The EP study area does not include any natural dams and did not require further assessment.						
1H1	Greater than predicted impacts to Cliffs, Steep Slopes or Pagodas due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
1H2	Greater than predicted impacts to Cliffs or Pagodas due to mine subsidence. Leading to affects to public safety	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
1I1	Greater than predicted impacts to Steep Slopes due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
1I2	Greater than predicted impacts to Cliffs or Pagodas due to mine subsidence. Leading to affects to public safety	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		

ID	HAZARD	TID	TREATMENT OPTIONS	RESPONSIBILITY	IMPLEMENTATION	COMMENTS	COMPLETED (Sign Off)
1J1	Greater than predicted impacts to Steep Slopes due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
1J2	Greater than predicted impacts to Minor Cliffs, Steep Slopes or Pagodas due to mine subsidence. Leading to affects to public safety	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
1K1	Greater than predicted impacts to Nepean River Cliffs due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
1K2	Greater than predicted impacts to Nepean River Cliffs due to mine subsidence. Leading to affects to public safety	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
1L1	Hazards associated with Escarpments was considered in the Cliffs, Steep Slopes or Pagodas (associated with upper Razorback Range) above.						
1M1	The EP study area does not include any land or areas prone to flooding or inundation and did not require further assessment						
1N1	The EP study area does not include any identified Swamps, Wetlands or Groundwater Related Ecosystems (including Groundwater Dependant Ecosystems) and did not require further assessment.						
1O1	Greater than predicted impacts to Threatened or Protected Species and Communities due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
1P1	The EP study area does not include any National Parks and did not require further assessment.						
1Q1	The EP study area does not include any State Conservation Areas and did not require further assessment.						

ID	HAZARD	TID	TREATMENT OPTIONS	RESPONSIBILITY	IMPLEMENTATION	COMMENTS	COMPLETED (Sign Off)
1R1	The EP study area does not include any State Forests and did not require further assessment.						
1S1	Hazards associated with Natural Vegetation was considered in the Threatened or Protected Species and Communities above.						
1T1	The EP study area does not include any areas of major geological interest and did not require further assessment.						
1U1	The EP study area does not include any other feature considered significant and did not require further assessment.						
2A1	Impacts to the Main Southern Railway due to mine subsidence. Leading to non compliance to regulatory commitments (safe and serviceable)	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
2B1	Impacts to the M31 - Hume Highway due to mine subsidence. Leading to non compliance to regulatory commitments (safe and serviceable)	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
2C1	Impacts to the roads due to mine subsidence. Leading to non compliance to regulatory commitments (safe and serviceable)	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
2D1	Hazards associated with Bridges was considered in M31 - Hume Highway above.						
2E1	The EP study area does not include any tunnels and did not require further assessment.						
2F1	Hazards associated with Culverts was considered in Roads and Rail above.						
2G1	The EP study area does not include any public water, gas or sewerage infrastructure and did not require further assessment.						
2H1	The EP study area does not include any liquid fuel pipeline and did not require further assessment.						

ID	HAZARD	TID	TREATMENT OPTIONS	RESPONSIBILITY	IMPLEMENTATION	COMMENTS	COMPLETED (Sign Off)
2I1	Greater than predicted impacts to Power Lines or Associated Plants due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
2J1	Greater than predicted impacts to Telecommunication Lines or Associated Plants due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
2K1	The EP study area does not include any public water tanks, water or sewerage treatment works and did not require further assessment.						
2L1	The EP study area does not include any public Dams, Reservoirs or Associated Works and did not require further assessment.						
2M1	The EP study area does not include any public air strips and did not require further assessment.						
2N1	The EP study area does not include any Other Public Utilities and did not require further assessment.						
3A1	The EP study area does not include any hospitals and did not require further assessment.						
3B1	The EP study area does not include any places of worship and did not require further assessment.						
3C1	The EP study area does not include any schools and did not require further assessment.						
3D1	The EP study area does not include any shopping centres and did not require further assessment.						
3E1	The EP study area does not include any community centres and did not require further assessment.						
3F1	The EP study area does not include any office buildings and did not require further assessment.						

ID	HAZARD	TID	TREATMENT OPTIONS	RESPONSIBILITY	IMPLEMENTATION	COMMENTS	COMPLETED (Sign Off)
3G1	The EP study area does not include any public swimming pools and did not require further assessment.						
3H1	The EP study area does not include any bowling greens and did not require further assessment.						
3I1	The EP study area does not include any ovals or cricket grounds and did not require further assessment.						
3J1	The EP study area does not include any race courses and did not require further assessment.						
3K1	The EP study area does not include any golf courses and did not require further assessment.						
3L1	The EP study area does not include any public tennis court and did not require further assessment.						
3M1	The EP study area does not include any public Visual Amenities and did not require further assessment.						
4A1	Impacts to Agricultural Utilisation or Agricultural Suitability of Farm Land due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
4B1	Impacts to Farm Buildings or Sheds due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
4C1	Impacts to Gas or Fuel Storage due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
4D1	The EP study area does not include any commercial poultry sheds and did not require further assessment.						
4E1	The EP study area does not include any known glass houses and did not require further assessment.						

ID	HAZARD	TID	TREATMENT OPTIONS	RESPONSIBILITY	IMPLEMENTATION	COMMENTS	COMPLETED (Sign Off)
4F1	The EP study area does not include any known commercial hydroponic system and did not require further assessment.						
4G1	The EP study area does not include any known irrigation systems and did not require further assessment.						
4H1	Impacts to Fences due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
4I1	Impacts to Farm Dams due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
4J1	Impacts to Wells or Bores due to mine subsidence and depressurisation. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
4K1	The EP study area does not include any other feature considered significant including access tracks and did not require further assessment.						
5A1	The EP study area does not include any factories and did not require further assessment.						
5B1	The EP study area does not include any workshops and did not require further assessment.						
5C1	The EP study area does not include any Business or Commercial Establishments and did not require further assessment.						
5D1	The EP study area does not include any Gas or Fuel Storages or Associated Plants and did not require further assessment.						
5E1	The EP study area does not include any Waste Storages or Associated Plants and did not require further assessment.						

ID	HAZARD	TID	TREATMENT OPTIONS	RESPONSIBILITY	IMPLEMENTATION	COMMENTS	COMPLETED (Sign Off)
5F1	The EP study area does not include any Buildings, Equipment or Operations that are Sensitive to Surface Movements and did not require further assessment.						
5G1	The EP study area does not include any Surface Mining (Open Cut) Voids or Rehabilitated Areas and did not require further assessment.						
5H1	The EP study area does not include any Tailings Dams or Emplacement Areas and did not require further assessment.						
5I1	The EP study area does not include any Other Industrial, Commercial or Business Features and did not require further assessment.						
6A1	Impacts to Areas of Archaeological and/or Heritage Significance due to mine subsidence. Leading to non compliance to regulatory commitments. Reduction to business reputation.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
7A1	The EP study area does not include any Items of Architectural Significance and did not require further assessment.						
8A1	Impacts to Permanent Survey Control Marks due to mine subsidence. Leading to non compliance to regulatory commitments.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
9A1	Impacts to Houses due to mine subsidence. Leading to non compliance to regulatory commitments. Safe and serviceable.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
9B1	The EP study area does not include any Flats or units and did not require further assessment.						
9C1	The EP study area does not include any caravan parks and did not require further assessment.						

ID	HAZARD	TID	TREATMENT OPTIONS	RESPONSIBILITY	IMPLEMENTATION	COMMENTS	COMPLETED (Sign Off)
9D1	The EP study area does not include any Retirement or Aged Care Villages and did not require further assessment.						
9E1	Impacts to Associated Structures such as Workshops, Garages, On-Site Waste Water Systems, Water or Gas Tanks, Swimming Pools or Tennis Courts due to mine subsidence. Leading to non compliance to regulatory commitments. Safe and serviceable.	1	Develop Extraction Plan for Longwalls 709-711 and 905 and update all associated Management Plans	Cody Brady	Wednesday, 30 June 2021		
9F1	The EP study area does not include any Other Residential Features of relevance and did not require further assessment.						
10A1	Impacts to future roads (M9), houses and mining infrastructure due to mine subsidence. Leading to non compliance to regulatory commitments.	1	None Identified				

Appendices

Appendix A: Subsidence Predictions and Impact Assessment

Appendix B: Subsidence Monitoring Program

Appendix C: Water Management Plan

Appendix D: Biodiversity Management Plan

Appendix E: Land Management Plan

Appendix F: Heritage Management Plan

Appendix G: Public Safety Management Plan

Appendix H: Built Features Management Plan

Appendix I: Coal Resource Recovery Plan