APPENDIX M

Environmental Risk Assessment

Illawarra Metallurgical Coal, Dendrobium Mine Extension Project
Environmental Risk Assessment

Report Title:	**Dendrobium Mine Extension Project ERA**
Client:	**Illawarra Metallurgical Coal**
Client Contact:	**Gary Brassington, Approvals Manager**
By:	**Peter Standish, Director and Principal Consultant**
Team Session:	**29 November 2021**
Job:	**RM19143**
Version Date:	**29 March 2022**
Revision:	**V1**

DOCUMENT DISTRIBUTION AND CONTROL

Ref No.	RM19143
Title	Illawarra Metallurgical Coal, Dendrobium Mine Extension Project – Environmental Risk Assessment
General Description	Identification and assessment of key potential environmental issues associated with the mining of metallurgical coal from Area 5.
Key Supporting Documentation	AS/NZS ISO 31000: 2019 Risk Management – Principles and Guidelines. IEC61882:2016 Hazard and Operability Studies (HAZOP)

Versions

Rev	Description	Date
1	Final	29 March 2022

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1 Introduction

The Dendrobium Mine is an underground coal mine situated in the Southern Coalfield of New South Wales (NSW) approximately 8 kilometres (km) west of Wollongong (Figure 1).

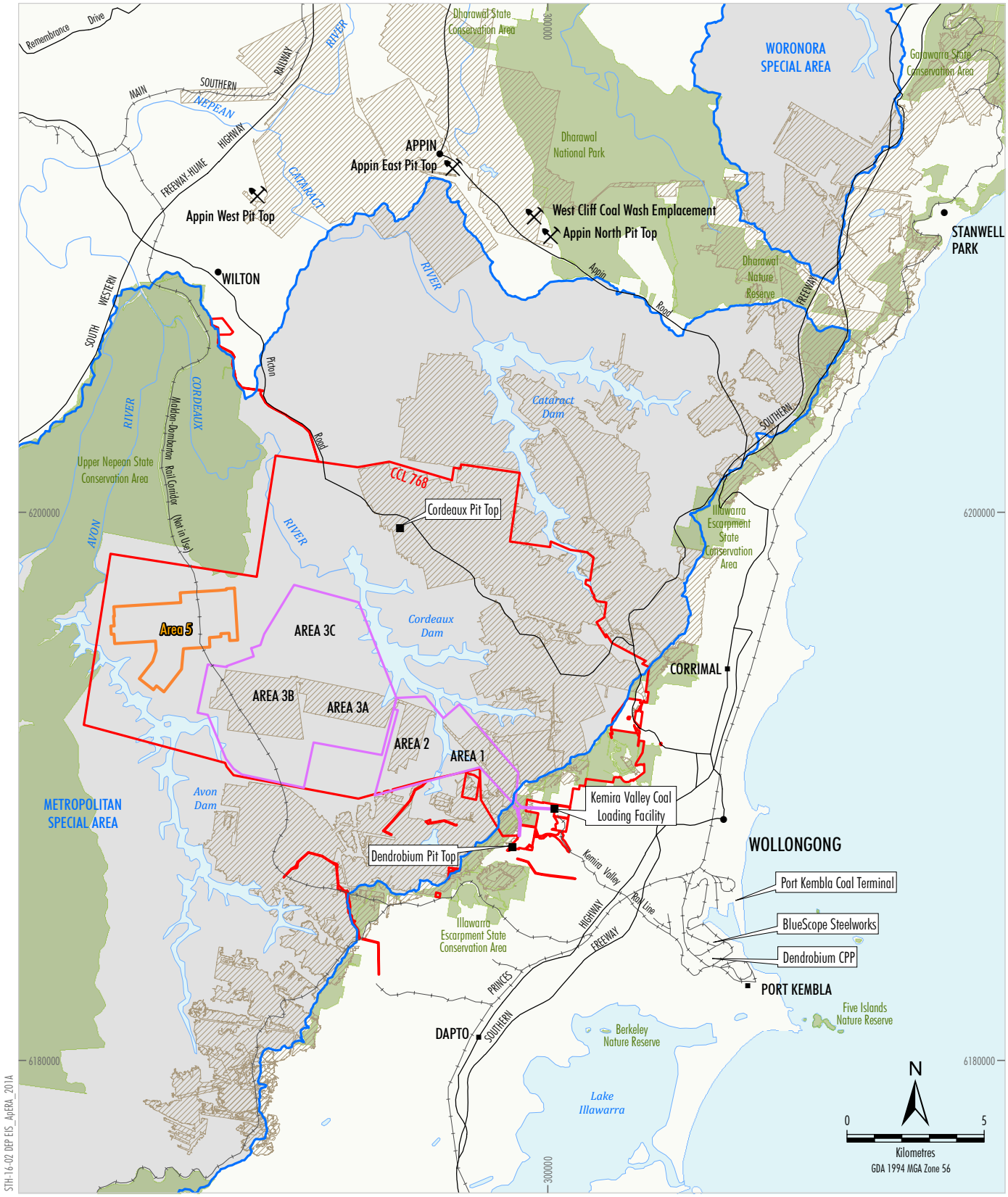
Illawarra Coal Holdings Pty Ltd (Illawarra Metallurgical Coal [IMC]), a wholly owned subsidiary of South32 Limited (South32), is the owner and operator of the Dendrobium Mine. The Dendrobium Mine, Appin Mine and supporting operations are managed by IMC.

Development Consent DA 60-03-2001 for the Dendrobium Mine was granted by the NSW Minister for Urban Affairs and Planning under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in November 2001.

The Dendrobium Mine extracts coal from the Wongawilli Seam (also known as the No 3 Seam) within Consolidated Coal Lease (CCL) 768 using underground longwall mining methods. The Dendrobium Mine includes five approved underground mining domains, named Areas 1, 2, 3A, 3B and 3C. Longwall mining is currently being undertaken in Area 3B, with extraction largely complete in Areas 1, 2 and 3A (Figure 1).

The Dendrobium Mine has an approved operational capacity of up to 5.2 million tonnes per annum (Mtpa) of run of mine (ROM) coal until 31 December 2030. IMC is seeking approval for the Dendrobium Mine Extension Project (the Project), which would support the extraction of approximately 31 million tonnes (Mt) of ROM coal from Area 5 (Figure 2), within CCL 768. The life of the Project includes longwall mining in Area 5 up to approximately 31 December 2034, and ongoing use of existing surface facilities for handling of Area 3C ROM coal until 2041.

This Environmental Risk Assessment (ERA) forms part of an Environmental Impact Statement (EIS) which has been prepared to accompany an application for the Project in accordance with Part 5 of the EP&A Act and identifies the key potential environmental risks associated with the Project.



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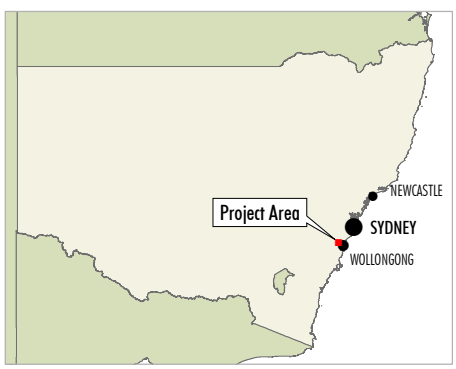

LEGEND

- Dendrobium Mining Lease
- Road
- Railway
- National Park, Nature Reserve and State Conservation Area
- Historic Mine Workings
- Declared Catchment Area
- Dendrobium Underground Mining Area - Existing Mine (DA 60-03-2001)
- Dendrobium Underground Mining Area Extension Project

Source: Geoscience Australia, (2006); Department of Industry (2018); Department Finance, Services & Innovation (2018);

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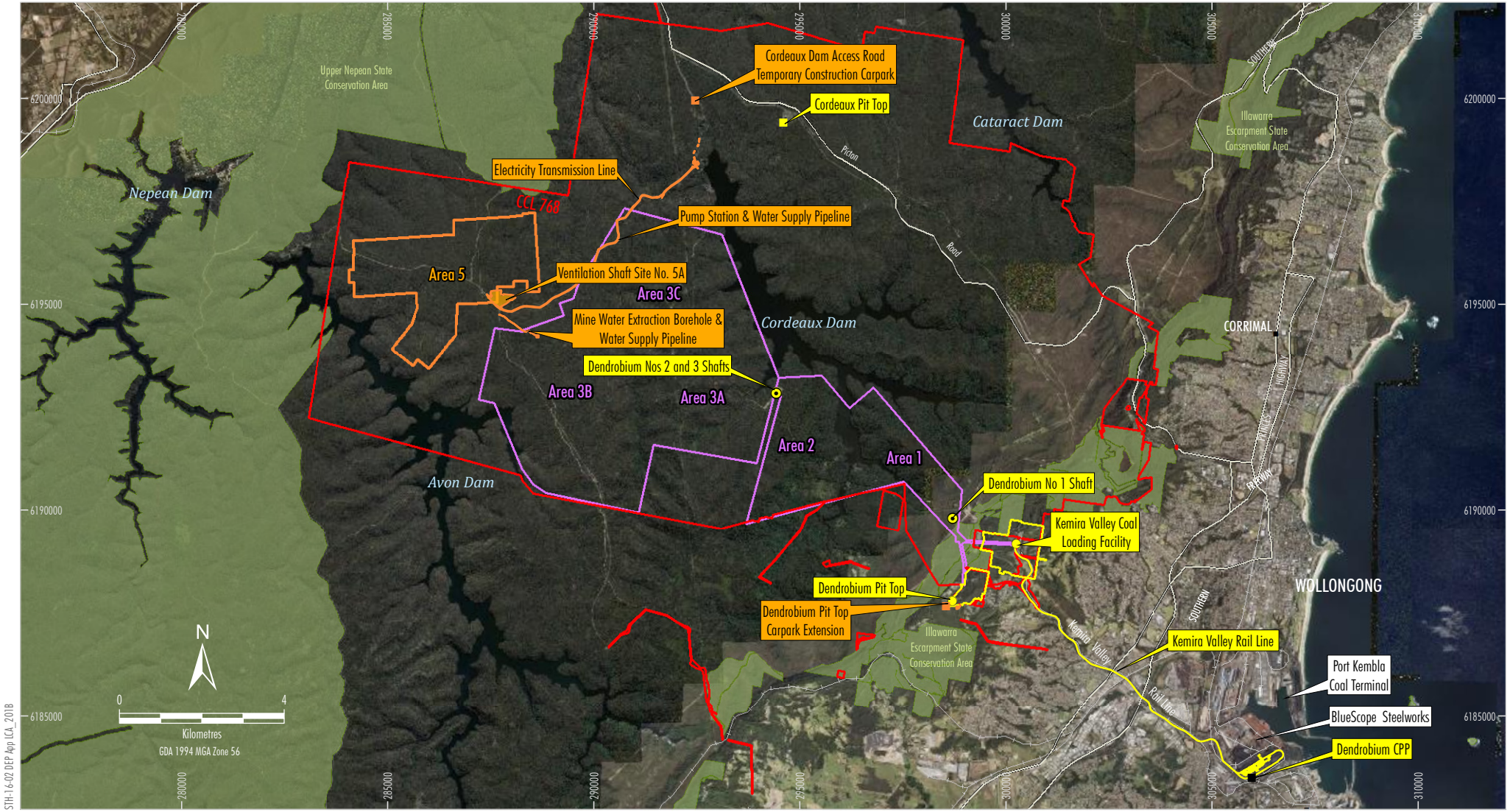
DENDROBIUM MINE

Regional Location

Figure 1



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LEGEND

- Dendrobium Mining Lease
- Road
- Railway
- National Park, Nature Reserve and State Conservation Area

Dendrobium Mine

- Dendrobium Underground Mining Area - Existing Mine (DA 60-03-2001)

Dendrobium Mine Extension Project

- Underground Mining Area
- Surface Facilities (Existing Dendrobium Mine)
- Surface Facilities (Proposed Dendrobium Mine Extension Project)

Source: Geoscience Australia, (2006); Department of Industry (2018); Department Finance, Services & Innovation (2018);

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DENDROBIUM MINE

General Arrangement
Dendrobium Mine Extension Project

Figure 2

1.1 Purpose and Scope

This ERA has been conducted in consideration of the Secretary's Environmental Assessment Requirements (SEARs) for the Project, as outlined below:

> *Notwithstanding the key issues specified below, the EIS must include an environmental risk assessment to identify the potential environmental impacts associated with the infrastructure.*
>
> *Where relevant, the assessment of key issues below, and any other significant issues identified in the risk assessment, must include:*
>
> - *adequate baseline data*
> - *consideration of the potential cumulative impacts due to other developments in the vicinity (completed, underway or proposed); and*
> - *measures to avoid, minimise and if necessary, offset predicted impacts, including detailed contingency plans for managing any significant risks to the environment.*

As outlined in the SEARs, the purpose for conducting this ERA was to identify key potential environmental risks associated with the Project. The scope confirmed by the IMC and the ERA review team was:

> *Identify the potential impacts of underground mining activities (including associated surface infrastructure activities) on surface features, groundwater and conditions posed by the mine plan for the Project. For each potential impact identify controls intended to be in place and determine the consequences and likelihoods of a loss occurring.*

This scope was further detailed by noting that the analysis should consider the controls in place and available to Dendrobium Mine – particularly identifying adaptive management opportunities for the identified controls where unmitigated risks could be considered intolerable.

Consistent with recent recommendations from the Independent Expert Panel for Mining in the Catchment, the ERA included assessment of the potential impacts of mining: near and under lineaments on surface water features, including dam walls, waterfalls and swamps.

1.2 Structure of this Report

The remainder of the ERA Report is structured as follows:

Section 2 Provides a description of the Project.

Section 3 Details the ERA workshop and outcomes.

Section 4 Provides the concluding remarks for this ERA.

Section 5 Lists the references cited in this ERA.

2 Project Description

2.1 *Overview*

IMC is seeking approval for the Project, which would support the extraction of approximately 31 Mt of ROM coal from Area 5 (Figure 2), within CCL 768. The life of the Project includes longwall mining in Area 5 up to approximately 31 December 2034, and ongoing use of existing surface facilities for handling of Area 3C ROM coal until 2041[1].

The Project would include the following activities:

- longwall mining of the Bulli Seam in a new underground mining area (Area 5);
- development of underground roadways from the existing Dendrobium Mine underground areas (namely Area 3) to Area 5;
- use of existing Dendrobium Mine underground roadways and drifts for personnel and materials access, ventilation, dewatering and other ancillary activities related to Area 5;
- development of new surface infrastructure associated with mine ventilation and gas management and abatement, water management and other ancillary infrastructure;
- handling and processing of up to 5.2 Mtpa of ROM coal (no change from the approved Dendrobium Mine);
- extension of underground mining operations within Area 5 until approximately 2035;
- use of the existing Dendrobium Pit Top, Kemira Valley Coal Loading Facility, Dendrobium Coal Processing Plant (CPP) and Dendrobium Shafts with minor upgrades and extensions until approximately 2041;
- transport of ROM coal from the Kemira Valley Coal Loading Facility to the Dendrobium Coal Preparation Plant (CPP) via the Kemira Valley Rail Line;
- handling and processing of coal from the Dendrobium Mine (including the Project) and IMC's Appin Mine (if required) at the Dendrobium CPP to 2041;
- delivery of coal from the Dendrobium CPP to Port Kembla for domestic use at the Port Kembla Steelworks and Liberty Primary Steel Whyalla Steelworks or export through the Port Kembla Coal Terminal;
- transport of coal wash by road to customers for engineering purposes (e.g. civil construction fill), for other beneficial uses and/or for emplacement at the West Cliff Stage 3 and/or Stage 4 Coal Wash Emplacement;
- development and rehabilitation of the West Cliff Stage 3 Coal Wash Emplacement (noting that opportunities for beneficial use of coal wash would be maximised);

1 The Project does not include approved underground mining operations in the Wongawilli Seam in Areas 1, 2, 3A, 3B and 3C at the Dendrobium Mine and associated surface activities (such as monitoring and remediation). These activities will continue to operate in accordance with Development Consent DA 60-03-2001 (as modified).

- continued use of the Cordeaux Pit Top for mining support activities such as exploration, environmental monitoring, survey, rehabilitation, administration and other ancillary activities;
- progressive development of sumps, pumps, pipelines, water storages and other water management infrastructure;
- controlled release of excess water (similar to the current regime in the Environmental Protection Licence [EPL] 3241) and/or beneficial use;
- monitoring, rehabilitation and remediation of subsidence and other mining effects; and
- other associated infrastructure, plant, equipment and activities.

A detailed description of the Project is provided in Section 4 of the Main Text of the EIS.

2.2 Project Design and Constraints

Prior to the preparation of this ERA, IMC had made the decision that the Project would target the Bulli Seam metallurgical coal resource within CCL 768 shown in Figure 3 (i.e. 'Area 5'), and would not seek approval to mine 'Area 6' (which was previously considered for mining).

The feasible metallurgical coal resource within the Bulli Seam is constrained by CCL 768, igneous intrusions and heat-affected areas in the Bulli Seam. In the Project underground mining area (i.e. Area 5), it is not feasible to extract metallurgical coal resource in the Wongawilli Seam due to the presence of sills.

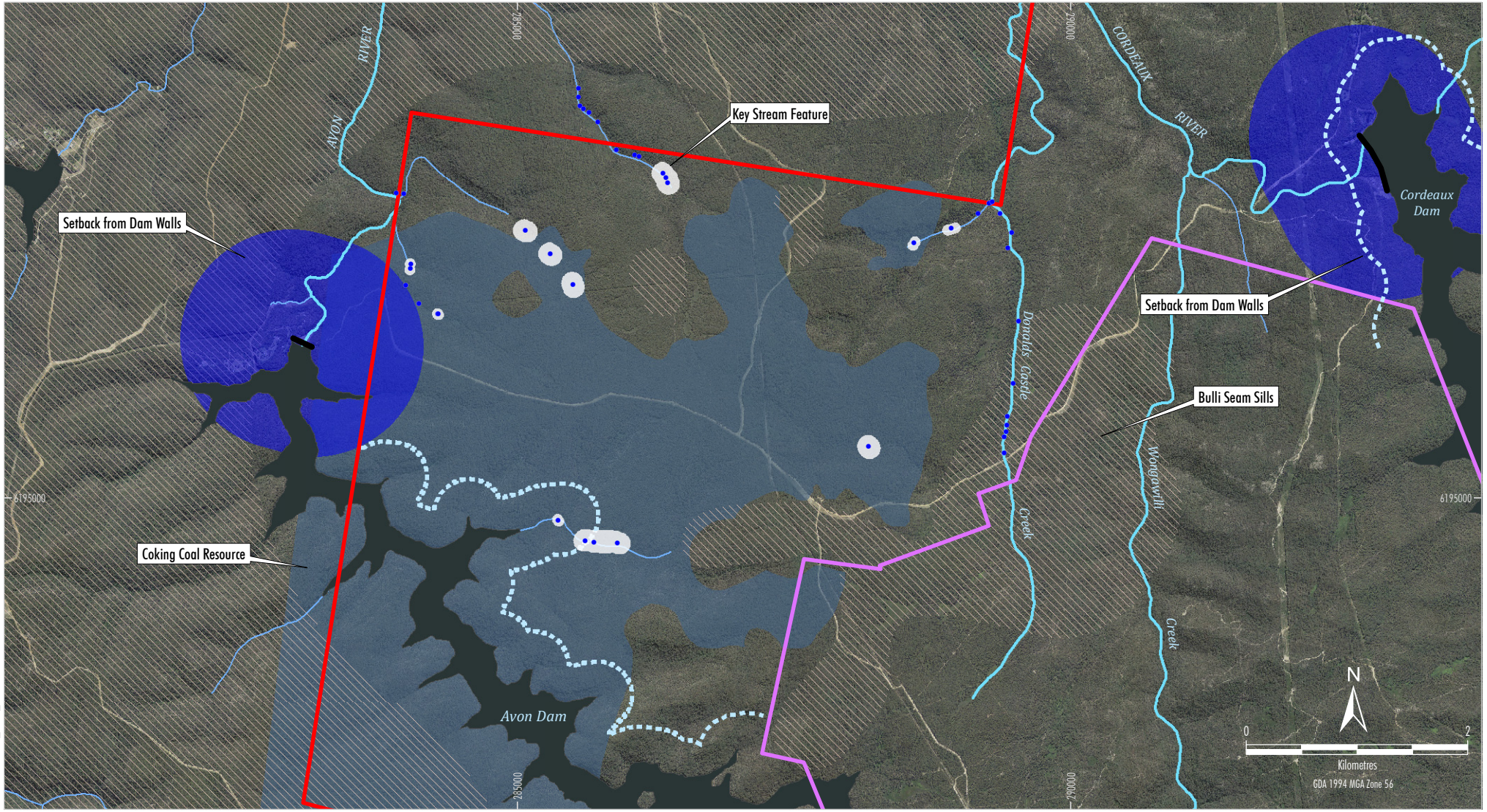
Therefore, the proposed mine plan would target areas in the Bulli Seam that would predominantly yield the highest quality metallurgical coal resource as provided in Figure 3. The design of the proposed mine plan included previous IMC commitments and avoided the following key features through the implementation of setbacks and risk management zones (Figure 3):

- minimum longwall mining setback distance of 1,000 metres (m) from dam walls;
- minimum longwall mining setback distance of 300 m from the Full Supply Level of the Avon Dam;
- no longwall mining beneath named watercourses; and
- no longwall mining beneath identified key stream features.

Based on the above target metallurgical coal resource and setbacks (Figure 3) an economic mine plan (i.e. the proposed mine plan in Area 5 for the Project) was identified (Figure 4).

Other key features potentially impacted by the proposed mine plan in Area 5 for the Project were identified and potential risks to these features assessed in consideration of risk management zones. In summary the proposed mine plan in Area 5 for the Project results in (Figure 4):

- minimum distance of at least 400 m from longwall mining from regulated rivers (Avon River and Cordeaux River) and other named watercourses (Donalds Castle Creek and Wongawilli Creek);
- no longwall mining beneath third, fourth and fifth order (or above) streams; and
- no longwall mining beneath previously identified high archaeological (scientific) significance Aboriginal heritage sites (location of the Aboriginal heritage sites has not been included on Figure 4).



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LEGEND

- Dendrobium Mining Lease
- Dendrobium Underground Mining Area - Existing Mine (DA 60-03-2001)
- 3rd Order and Above Watercourses
- 300 m Full Supply Level Setback
- Key Stream Feature
- Setback from Dam Walls
- Metallurgical Coal Resource
- Bulli Seam Sills

Source: Geoscience Australia, (2006); Department of Industry (2018); Department Finance, Services & Innovation (2018);

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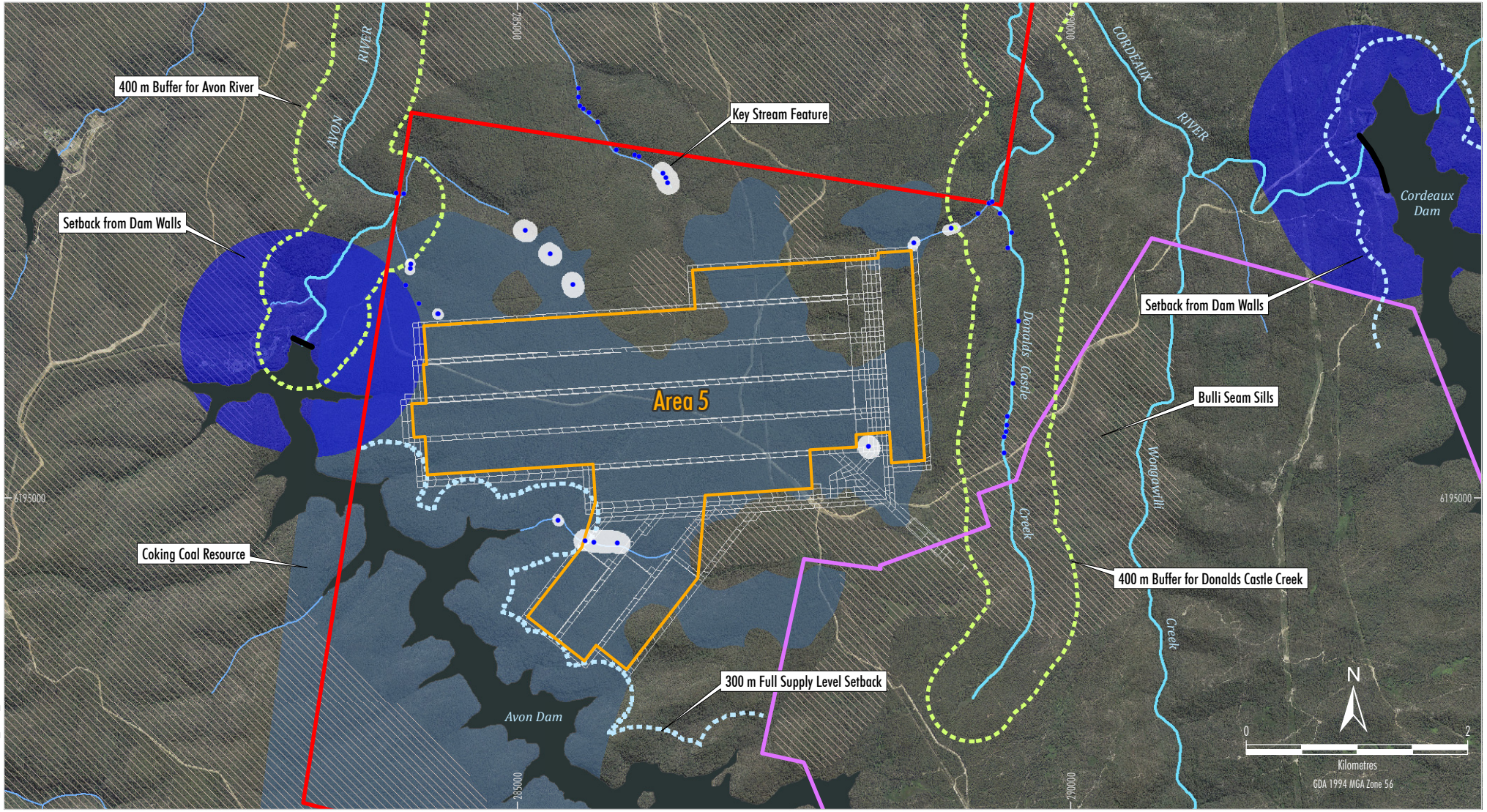
DENDROBIUM MINE

Project Mine Plan Constraints

Figure 3



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LEGEND

- Dendrobium Mining Lease
- Dendrobium Underground Mining Area - Existing Mine (DA 60-03-2001)
- Project Underground Mine Area
- 3rd Order and Above Watercourses
- 300 m Full Supply Level Setback
- 400 m Buffer for Regulated and Named Watercourses
- Key Stream Feature
- Setback from Dam Walls
- Metallurgical Coal Resource
- Bulli Seam Sills

Source: Geoscience Australia, (2006); Department of Industry (2018); Department Finance, Services & Innovation (2018);

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DENDROBIUM MINE

Project Mine Plan Design

Figure 4

The Project also includes use of existing infrastructure (namely the Dendrobium Pit Top, Kemira Valley Coal Loading Facility, Kemira Valley Rail Line, Dendrobium CPP, Shaft Sites Nos 1, 2 and 3 and the West Cliff Stage 3 Coal Wash Emplacement) which would reduce the requirement for additional surface disturbance.

Other features and risks, as well as controls and mitigations, that were identified by the ERA team and have been considered include and are shown in Appendix B:

- moderate and low archaeological (scientific) significance Aboriginal heritage sites;
- first and second order streams;
- swamps;
- cliffs;
- built features;
- risks to water resources and quality (including in the Metropolitan Special Area);
- risks associated with mine closure; and
- potential risks to amenity.

3 Environmental Risk Assessment

3.1 ERA Team

IMC and the relevant expert specialists participated in the ERA workshop via a Microsoft Teams Meeting on 29 November 2021. A team-based approach was utilised in order to have an appropriate mix of skills and experience to identify the potential loss scenarios/issues. Details of the team members and their relevant qualifications and experience are included in Table 1.

Table 1 – ERA Team Members

Name	Organisation/Position	Qualifications and Experience
Gary Brassington	South32/Approvals Manager	Formal qualifications and over 20 years' experience.
Chris McEvoy	South32/Approvals Manager Dendrobium Next Domain Project	Formal qualifications and over 20 years' environmental management experience.
James Barbato	Mine Subsidence Engineering Consultants	Formal qualifications and 17 years' experience in mine subsidence (and 8 years civil engineering prior).
Will Minchin	Watershed HydroGeo	Formal qualifications and over 15 years' experience.
Stuart Brown	Watershed HydroGeo	Formal qualifications and over 15 years of hydro-geological and groundwater experience.
Camilla West	ATC Williams	Formal qualifications and over 15 years of surface water consulting experience (predominantly in impact assessment).
Luke Baker	Niche Environment and Heritage/Discipline Manager	Formal qualifications and over 15 years of consulting experience. BAM Accredited Assessor.
Renée Regal	Niche Environmental and Heritage Consulting/ Discipline Manager - Heritage	Formal qualifications and over 15 years' experience.
James Steele	Resource Strategies/Principal	Formal qualifications and over 10 years consulting experience.
Sam Webber	Resource Strategies/ Environmental Project Manager	Formal qualifications and over 4 years consulting experience.
Justin Hocking	Resource Strategies/ Environmental Project Manager	Formal qualifications and over 5 years consulting experience.
Peter Standish	Risk Mentor (RM)/ Director and Principal Consultant	Formal engineering and scientific qualifications and over 30 years operational and consulting experience.

3.2 Review of Relevant Documentation in Prior to the ERA Workshop

In preparation for the workshop, the ERA participants reviewed a number of documents relevant to the ERA, including the documents listed in Section 5.

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

Each of the above risks were explained systematically by the relevant workshop participants and each risk in the register was carefully reviewed.

3.3 Probability and Maximum Reasonable Consequence

The loss scenarios previously identified in earlier studies were reviewed in the light of more recent subsidence analyses and considering the operating experience to date. The risk measures of probability and consequence applied are presented in Table 2 and Table 3 below.

Table 2 – Qualitative Measures of Probability

Event	Likelihood	Description
10	Almost Certain	Could be expected to occur more than once during the study or project. Could occur once per year.
3	Likely	Could easily be incurred and has generally occurred in similar studies or projects. Could be incurred in 1 to 2 years.
1	Possible	Incurred in a minority of similar studies or projects. Could be incurred within a 5 year strategic budget period.
0.3	Unlikely	Know to happen, but only rarely. Could be incurred within a 5 to 20 year timeframe.
0.1	Rare	Has not occurred in similar studies or projects, but could. Could be incurred in 20 to 50 years.
0.03	Very Rare	Conceivable, but only in extreme circumstances. Has not happened in industry in the last 50 years.

Table 3 – Qualitative Measures of Maximum Reasonable Consequence (Impact Table)

Estimated Level of Consequence	Area of Effect			
	Harm to People	Environmental	Community	Financial
1	Low-level short-term subjective symptoms or inconvenience. No medical treatment.	Low-level impact to land, biodiversity, ecosystem services, water resources or air.	Single low-level community health, safety or security impact, low-level inconvenience <2 weeks, minor, low-level disturbance to a single house or structure.	Less than US$500,000 loss or production delay.
3	Objective but reversible impairment. Medical treatment, injury or illness.	Minor impacts (<3 months) to land, biodiversity, ecosystem services, water resources or air.	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.	US$5,000,000 to US$500,000 loss or production delay.
10	Permanent impairment <30 percent (%) of body to one or more persons.	Moderate impacts (<1 year) to land, biodiversity, ecosystem services, water resources or air.	Moderate community health, safety or security impacts (<50 households). Single allegation of human rights violations, moderate disruption to people's lives (<50 households).	US$25,000,000 to US$5,000,000 loss or production delay.
30	Single fatality. Permanent impairment >30% of body to one or more persons.	Major impacts (<5 years) to land, biodiversity, ecosystem services, water resources or air.	Serious community health, safety or security impacts (<50 households). Multiple allegations of human rights violations, extended disruption to people's lives (>50 households).	US$100,000,000 to US$25,000,000 loss or production delay.
100	2-20 fatalities. Permanent impairment >30% of body to more than 10 persons.	Serious or extensive impacts (<20 years) to land, biodiversity, ecosystem services, water resources or air.	Serious community health, safety or security impacts (>50 households) or human rights violation, extended disruption to people's lives (>200 households).	US$250,000,000 to US$100,000,000 loss or production delay.
300	>20 fatalities. Permanent impairment >30% of body to more than 100 persons.	Severe impacts (>20 years) to land, biodiversity, ecosystem services, water resources or air.	Extensive community health, safety or security impacts (>200 households) or human rights violations, extended serious disruption to people's lives (>1000 households).	Greater than US$250,000,000 to US$1 billion loss or production delay.
1000	>50 fatalities. Permanent impairment >30% of body to more than 500 persons.	Permanent severe impact/s to land, biodiversity, ecosystem services, water resources or air.	Severe, widespread community health, safety or security impacts (>1000 households) or human rights violations; complete destruction of >1000 houses or community infrastructure; complete irreversible desecration of multiple structures/objects/places of global significance.	Greater than US$1 billion loss or production delay.

Source: South32 Material Risk Management Standard. Version 4.

The probability and consequence combine to determine the risk ranking as presented in Table 4.

Table 4 – Risk Ranking Table

Likelihood	Consequence					
	Low 1	Minor 3	Moderate 10	Significant 30	Major 100	Catastrophic 300
10 Almost Certain	10	30	100	300	1,000	3,000
3 Likely	3	9	30	90	300	900
1 Possible	1	3	10	30	100	300
0.3 Unlikely	0.3	0.9	3	9	30	90
0.1 Rare	0.1	0.3	1	3	10	30
0.03 Very Rare	0.03	0.09	0.3	0.9	3	9

The risk rankings below the bold line represent rankings that are within or below the 'As Low as Reasonably Practicable (ALARP)' region.

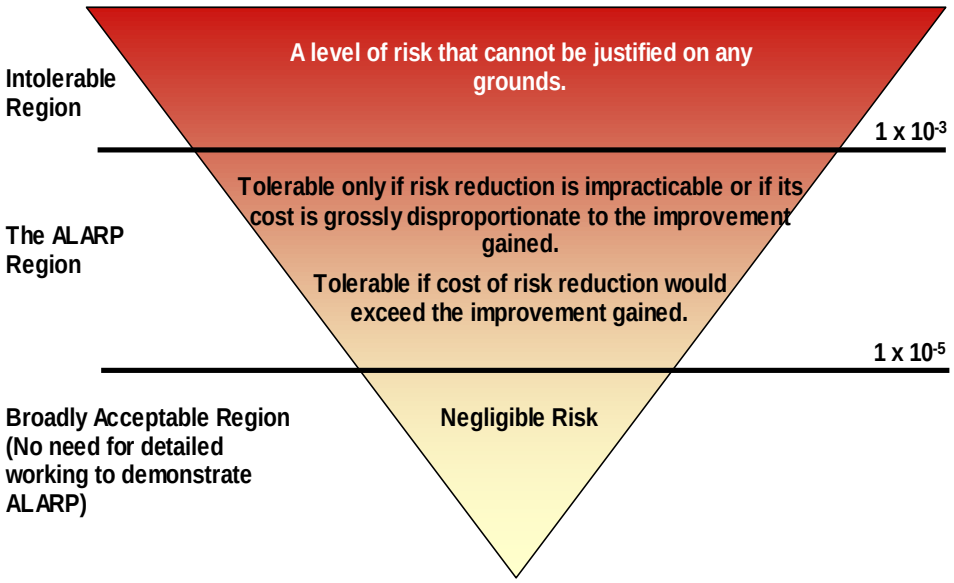
3.4 Risk Criteria

The risk criteria utilised is to reduce the risk to As Low as Reasonably Practicable (ALARP) or lower. Figure 5 schematically shows the three risk management zones, namely, intolerable, ALARP and tolerable. The middle zone is referred to as the ALARP region.

The purpose of risk criteria is to allow an organisation to clearly define unacceptable levels of risk, or conversely the level of risk which is acceptable or tolerable. Through the use of the risk criterion, an organisation can prioritise proposed actions to control the risk during the risk assessment.

The ALARP principle, as represented in the diagram below, was developed to assist in the definition of the acceptability of risk and to demonstrate that an organisation has done all that is considered to be practical in reducing the level of exposure to a risk. More often this is done qualitatively rather than as a quantitative probability as shown on the right-hand side of the diagram presented in Figure 5. A risk may be tolerable in the ALARP zone if the cost of removing the risk is disproportionate to the benefits gained.

Figure 5: Risk Criteria "ALARP"



3.5 Risk Ranking

While previous IMC commitments regarding setbacks from dam walls and Full Supply Levels of the Avon and Cordeaux Dams were adopted as constraints for the Project, these key adopted controls were re-assessed in the ERA to support that the residual risk for the Project was ALARP. The risk ranking for these key features is provided in Table 5.

Other key features were identified by the ERA team, namely regulated streams, named watercourses, high scientific significance Aboriginal heritage sites, third order streams and key stream features. Risk rankings for these features in consideration of risk management zones is provided in Table 6.

Other key features and risks identified by the ERA team, including moderate and low scientific significance Aboriginal heritage sites, second and first order streams, swamps, natural and built features and risks associated with the Metropolitan Special Area, mine closure, biodiversity and amenity. The risk ranking for these other features and risks are provided in Table 7.

The risk rankings indicated that the loss scenarios ranked for the Project were within the "Low" to "Moderate" range with the implementation of controls as necessary, and the outcomes could be adequately addressed through the existing Dendrobium Mine management system elements. The complete risk register is provided in Appendix A.

A draft of the ERA report was provided to the ERA participants for review, and the participants' comments are incorporated into the final version of this report.

Table 5 – Risk Ranking for Project Setbacks Based on IMC Avoidance Commitments

Ref	Feature (Representative Feature)	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
DW.01	Dam Wall (Avon Dam Wall)	Mine subsidence results in impacts to dams and associated infrastructure, leading to impacts to water storage and public safety issues.	300	3	As a feasible metallurgical coal resource within CCL 768 is available that would require longwall mining in close proximity to the Avon Dam Wall (i.e. if a different mine plan were proposed) there would be measurable differential subsidence-related effects that could cause adverse impacts on the Avon Dam Wall (Dam Engineer would need to prepare an assessment). Consequences of damage to the Avon Dam Wall if proximal mining was undertaken would be very high and could lead to a likely incident (e.g. Avon Dam Wall has low Factor of Safety in current state).	**900**	Minimum longwall mining setback distance of 1,000 m from dam walls, including Avon Dam Wall.	No measurable differential subsidence-related movements at 1,000 m (based on extensive far-field monitoring in the Southern Coalfield), with previous experience from longwall mining at the Dendrobium Mine within 900 m and 1.5 km to Upper Cordeaux No 1 and No 2 Dam Walls where there were no observed impacts. Longwalls within the series are mined in succession towards Avon Dam wall (which will allow for monitoring ahead of time allowing for adaptive management to be implemented). Mining is intended to occur on one side of the Avon Dam Wall only. There are also no known geological structures (PSM Consulting Pty Limited [PSM], 2022) that coincide with this feature, which supports the subsidence predictions in Mine Subsidence Engineering Consultants (MSEC) (2022). Planned implementation of a TARP including advice from a specialist Dam Engineer (to support rigour of adaptive management). With the control, it is very unlikely there would be an impact to the Avon Dam Wall.	0.03	300	**9 (ALARP)**
RV.05	Reservoirs (Avon Dam)	Mine subsidence results in drainage of water into the underground workings.	300	3	As a feasible metallurgical coal resource within CCL 768 is available that would require longwall mining beneath Avon Dam (i.e. if a different mine plan were proposed) there would be subsidence-related effects that could cause adverse impacts. Connective cracking from longwall mining the metallurgical coal resource could lead to extensive loss of water storage and impact many members of the community.	**900**	Minimum longwall mining setback distance of 300 m from the Full Supply Level of the Avon Dam.	Longwall mining in Area 3B at the existing Dendrobium Mine has been consistently 300 m from the Avon Dam and there has been no observed inflow from the storage (e.g. no sign of Tritium increase which would be a marker of waters from Avon Dam detected in water in the underground workings). There are also no known geological structures (PSM, 2022) that coincide with this feature, which supports the subsidence predictions in MSEC (2022). Inflows per unit area to the existing Dendrobium Mine has continued to decline despite increasing perimeter adjacent to Avon Dam. With the control, it is very unlikely there would be an impact to the Avon Dam.	0.03	300	**9 (ALARP)**

Table 6 – Risk Ranking for Risk Management Zone Key Features

Ref	Feature (Representative Feature)	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
RS.09	Regulated Streams (Avon River)	Mine subsidence and reduced groundwater pressures reduces water quantity and/or quality within rivers. Loss or degradation of aquatic habitat and riparian vegetation.	100	3	Feature located within the vicinity of the feasible metallurgical coal resource and CCL 768 with potential for impacts if the resource was mined.	**300**	Economic mine plan has minimum distance of 900 m from longwall mining.	Based on observations and previous experience of longwall mining, fracturing in streams and loss of surface water flows is not expected to occur at the proposed minimum distances to regulated streams. There are also no known geological structures (PSM, 2022) that coincide with this feature, which supports the subsidence predictions in MSEC (2022). Water table drawdown likely to be minimal (and subsequent impact on surface water flows will be negligible) with the minimum 900 m separation distance.	0.03	100	**3 (ALARP)**
NW.12	Named Watercourses (Donalds Castle Creek)	Mine subsidence and reduced groundwater pressures reduces water quantity and/or quality within streams, creeks and other water features. Loss or degradation of aquatic habitat and riparian vegetation.	30	0.03	Minimum distance of greater than 400 m from longwall mining (no further control required).	**0.9 (ALARP)**	Economic mine plan has minimum distance of greater than 400 m from longwall mining in Area 5 (no further control required).				
HSAHS.14	High Scientific Significance Aboriginal Heritage Sites (Site 52-2-1780 [Upper Avon 43])	Mine subsidence results in impacts to high archaeological Aboriginal heritage sites and/or heritage values.	30	3	Feature located within feasible metallurgical coal resource and CCL 768.	**90**	Economic mine plan has minimum distance of 170 m from longwall mining in Area 5.	With the minimum distance of 170 m from longwall mining, experience in the Southern Coalfield has indicated impacts are not expected to occur. It is worth noting that the feature is within feasible metallurgical coal resource and CCL 768, but would not be directly mined beneath by the proposed mine plan. Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as very rare (less than 1%).	0.1	30	**3 (ALARP)**
TOS.18	Third Order Streams (DC8)	Mine subsidence and reduced groundwater pressures reduces water quantity within streams, creeks and other water features. Loss or degradation of aquatic habitat and riparian vegetation.	10	3	Feature located within feasible metallurgical coal resource and CCL 768.	**30**	Economic mine plan has minimum distance of 35 m from longwall mining (210 m of stream within 35 degree angle of draw) and remediation of potential impacts, if required.	Some level of impact from subsidence is possible (based on observations around Area 3 at Dendrobium Mine), with potential loss of biodiversity and habitat as a result of loss of flow. Potential remediation of damaged streams/rock bars in third order streams is proposed where practical.	0.3	10	**3 (ALARP)**

Ref	Feature (Representative Feature)	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
KSF.29	Key Stream Features (large pools on any order of stream or >5 m step) (DC8-Pool 16)	Mine subsidence and reduced groundwater pressures reduces water quantity within key water stream features. Loss or degradation of aquatic habitat and riparian vegetation.	10	3	Feature located within feasible metallurgical coal resource and CCL 768.	**30**	Economic mine plan has minimum distance of 50 m from longwall mining, remediation of potential impacts and offset of biodiversity values up to 400 m upstream/down stream of the proposed longwalls.	Potential impacts from subsidence are possible. Based on observations at Dendrobium Mine, potential loss of biodiversity and habitat could occur as a result of loss of flow. At this distance from longwall mining there is potential for subsidence impacts (e.g. fracturing) that may cause loss of pool water (Type 3 impact) based on previous experience at the Dendrobium Mine or in the Southern Coalfield.	0.1	10	**1 (ALARP)**

Table 7 – Risk Ranking for Other Features and Risks

Ref	Feature (Representative Feature)	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
MSAHS.35	Moderate Scientific Significance Aboriginal Heritage Sites (Site 52-2-1730 [Ricki Lee 2])	Mine subsidence results in impacts to moderate archaeological Aboriginal heritage sites and/or heritage values.	3	0.1	220 m away from longwall mining (no further control required). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as rare (less than 5%).	**0.3 (ALARP)**					
LSAHS.36	Low Scientific Significance Aboriginal Heritage Sites (Site 52-2-1566 [Donald Castle Creek Site 5])	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.3	Directly mining beneath could cause impacts to Aboriginal heritage sites (no further controls proposed). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as unlikely (less than 10%).	**0.9 (ALARP)**					
SFS.63	Second and First Order Streams (AR19)	Loss of surface water supply and biodiversity values for streams due to subsidence-related impacts.	3	10	Directly mining beneath is likely to cause surface deformation or changes to groundwater resulting in changes to water losses and loss of biodiversity values.	**30**	Offset water losses and biodiversity values for species up to 400 m upstream/downstream of longwalls, if required.	Precautionary basis for biodiversity and water impacts related to streams. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets. Surface water loss offsets intended to be based on real-life data (e.g. flow monitoring) and value determined by IPART.	10	1	**10 (ALARP)**
SW.73	Swamps (Den86)	Mine subsidence, including far field effects, causes surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	3	10	Directly mining beneath could cause surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	**30**	Offset impacts to swamp and relevant biodiversity values, if impacted.	Precautionary basis for biodiversity and groundwater impacts related to swamps. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	1	3	**3 (ALARP)**

Ref	Feature (Representative Feature)	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
NF.94	Illawarra Escarpment	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	30	0.03	12 km away from longwall mining (no further control required). Major consequence (with damage to the Illawarra Escarpment) but rare potential for impacts.	**0.9 (ALARP)**	Minimum 12 km away from longwall mining (no further control required).				
NF.95	Upper Nepean State Conservation Area	Upper Nepean State Conservation Area affected by downstream and far-field effects causing impacts to conservation value.	10	0.03	400 m away from longwall mining (no further control required). Additional protection as beyond 400 m and no expectation of physical impacts at this distance. Minor or negligible impacts on flows.	**0.3 (ALARP)**	Minimum 400 m away from longwall mining (no further control required).				
CL.97	Cliffs (DC8-CF1)	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.3	Directly mining beneath could cause rock falls or surface deformation at cliffs which may result in impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	**0.9**	Monitoring of potential impacts and remediation of environmental damage to the ground surface, if required.	Monitoring of potential impacts and remediation of environmental damage to the ground surface, would reduce the potential consequence.	0.3	1	**0.3 (ALARP)**
BF.143	Built Features (Registered groundwater users/privately-owned bores)	Drawdown (e.g. greater than 2 m drawdown) from longwall mining impacts water supply for privately-owned bores.	1	0.1	Distance greater than approximately 4.5 km from nearest registered bore.	**0.1 (ALARP)**	Monitoring of bores (including piezometers) around existing Dendrobium Mine and make-good provisions for any potential impacts.				

Ref	Feature (Representative Feature)	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
MSAC.145	Metropolitan Special Area Catchment (Water yield of Metropolitan Special Area Catchment)	Mine subsidence and/or surface disturbance effects water yield and/or the supply capacity (e.g. including community concerns).	10	1	Directly mining beneath is likely to cause surface deformation or changes to groundwater resulting in water losses.	**10**	Offset predicted water losses.	Surface water loss offsets intended to be based on real-life data (e.g. flow monitoring) and value determined by IPART.	0.1	10	**1 (ALARP)**
MC.148	Mine Closure (Surface water quantity or quality impacts attributed to the Dendrobium Mine following mine closure)	Seepage from the portal at the Dendrobium Mine post-closure impacts on water quality downstream of the portal.	10	3	Mine closure results in recovery of groundwater levels above underground workings. Post closure via seepage via existing openings at escarpment.	**30**	Attenuation bulk heads within the underground workings post-closure. These bulk heads will control flows through existing roadways and direct flows to Kemira Valley Loading Facility. Residual outflows will be assessed for quality and stored and treated and/or directed to Allan's Creek.	Attenuation bulk heads would reduce the likelihood of uncontrolled seepage downstream of the portal.	0.3	10	**3 (ALARP)**
BV.150	Biodiversity Values (Effects on flora and fauna as a result of the use of existing Dendrobium Mine Surface Facilities)	Impacts to flora and fauna habitat from the continued use/development of the surface facilities (e.g. removal of vegetation and habitat for car park extension)	3	3	Direct surface disturbance for the Project is likely to impact on biodiversity values.	**9**	Offset impacts to biodiversity values.	Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	3	1	**3 (ALARP)**
AM.156	Amenity (Impacts of continued use of Kemira Valley Rail Line on acoustic amenity)	Continued use of Kemira Valley Rail Line impacts acoustic amenity of local residents.	3	10	Existing monitoring programs, equipment design includes consideration of noise mitigation, rail only operates in nominated hours, programs and other studies to reduce wheel squeal and other noise impacts to the local residents.	**30**	Monitoring and abatement processes are the key control for potential amenity impacts.	Specific noise criteria for the Project with procedures to be followed in the event of an exceedance of applicable noise criteria as well as operation of a real-time directional noise monitoring system to proactively modify operations as required.	3	3	**9 (ALARP)**

4 Conclusion

A total of 18 generic risks were identified as part of the exhaustive risks identified during the ERA for the Project. All risks were explained systematically by the relevant workshop participants, and each carefully reviewed and ranked using the IMC risk management ranking process.

The risk rankings are within the “low/medium (ALARP)” range and consequently the potential outcomes can be integrated into the existing management systems for effective review and monitoring.

5 References

AXYS Consulting (2019) *Dendrobium Mine Plan for the Future: Coal for Steelmaking Risk Assessment Report.* Prepared for Illawarra Metallurgical Coal.

Department of Mineral Resources (2011) *MDG1010 – Minerals Industry Safety and Health Risk Management Guideline*.

Independent Advisory Panel for Underground Mining (2020) *Advice Re: Dendrobium Extension Project SSD-8194*.

Mine Subsidence Engineering Consultants (2022) *Dendrobium Mine Extension Project - Subsidence Predictions for the Natural and Built Features in Support of the Environmental Impact Statement Application.* Prepared for Illawarra Metallurgical Coal.

PSM Consulting Pty Limited (2022) *Dendrobium Mine Extension Project Geological Structures Review*.

Standards Australia (2012) *Handbook 203:2012 Managing environment-related risk*.

Standards Australia/Standards New Zealand (2018) *AS/NZS ISO 31000:2018 Risk management – Guidelines*.

APPENDIX A: COMPLETE RISK REGISTER

The complete register is presented in Tables 8 to 10. Note that the 'Ref' column has a prefix related to the nature of the issue (e.g. DW for Dam Walls) and is a sequential number.

Table 8 – Complete Risk Register for Project Setbacks Based on IMC Avoidance Commitments

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
Dam Walls											
DW.01	Avon Dam Wall	Mine subsidence results in impacts to dams and associated infrastructure, leading to impacts to water storage and public safety issues.	300	3	As a feasible metallurgical coal resource within CCL 768 is available that would require longwall mining in close proximity to the Avon Dam Wall (i.e. if a different mine plan were proposed) there would be measurable differential subsidence-related effects that could cause adverse impacts on the Avon Dam Wall (Dam Engineer would need to prepare an assessment). Consequences of damage to the Avon Dam Wall if proximal mining was undertaken would be very high and could lead to a likely incident (e.g. Avon Dam Wall has low Factor of Safety in current state).	**900**	Minimum longwall mining setback distance of 1,000 m from dam walls, including Avon Dam Wall.	No measurable differential subsidence-related movements at 1,000 m (based on extensive far-field monitoring in the Southern Coalfield), with previous experience from longwall mining at the Dendrobium Mine within 900 m and 1.5 km to Upper Cordeaux No 1 and No 2 Dam Walls where there were no observed impacts. Longwalls within the series are mined in succession towards Avon Dam wall (which will allow for monitoring ahead of time allowing for adaptive management to be implemented). Mining is intended to occur on one side of the Avon Dam Wall only. There are also no known geological structures (PSM Consulting Pty Limited [PSM], 2022) that coincide with this feature, which supports the subsidence predictions in Mine Subsidence Engineering Consultants (MSEC) (2022). Planned implementation of a TARP including advice from a specialist Dam Engineer (to support rigour of adaptive management). With the control, it is very unlikely there would be an impact to the Avon Dam Wall.	0.03	300	**9 (ALARP)**
DW.02	Cordeaux Dam Wall	Mine subsidence results in impacts to dams and associated infrastructure, leading to impacts to water storage and public safety issues.	300	0.03	4 km away from longwall mining (no further control required)	**9 (ALARP)**	4 km away from longwall mining (no further control required)				
DW.03	Nepean Dam Wall	Mine subsidence results in impacts to dams and associated infrastructure, leading to impacts to water storage and public safety issues.	300	0.03	3.5 km away from longwall mining (no further control required)	**9 (ALARP)**	3.5 km away from longwall mining (no further control required)				
DW.04	Cataract Dam Wall	Mine subsidence results in impacts to dams and associated infrastructure, leading to impacts to water storage and public safety issues.	300	0.03	12 km away from longwall mining (no further control required)	**9 (ALARP)**	12 km away from longwall mining (no further control required)				

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
Reservoirs											
RV.05	Avon Dam	Mine subsidence results in drainage of water into the underground workings.	300	3	As a feasible metallurgical coal resource within CCL 768 is available that would require longwall mining beneath Avon Dam (i.e. if a different mine plan were proposed) there would be subsidence-related effects that could cause adverse impacts. Connective cracking from longwall mining the metallurgical coal resource could lead to extensive loss of water storage and impact many members of the community.	**900**	Minimum longwall mining setback distance of 300 m from the Full Supply Level of the Avon Dam.	Longwall mining in Area 3B at the existing Dendrobium Mine has been consistently 300 m from the Avon Dam and there has been no observed inflow from the storage (e.g. no sign of Tritium increase which would be a marker of waters from Avon Dam detected in water in the underground workings). There are also no known geological structures (PSM, 2022) that coincide with this feature, which supports the subsidence predictions in MSEC (2022). Inflows per unit area to the existing Dendrobium Mine has continued to decline despite increasing perimeter adjacent to Avon Dam. With the control, it is very unlikely there would be an impact to the Avon Dam.	0.03	300	**9 (ALARP)**
RV.06	Lake Cordeaux	Mine subsidence results in drainage into the underground workings.	300	0.03	4 km away from longwall mining (no further control required)	**9 (ALARP)**	4 km away from longwall mining (no further control required).				
RV.07	Lake Nepean	Mine subsidence results in drainage into the underground workings.	300	0.03	3.5 km away from longwall mining (no further control required)	**9 (ALARP)**	3.5 km away from longwall mining (no further control required).				
RV.08	Lake Cataract	Mine subsidence results in drainage into the underground workings.	300	0.03	10 km away from longwall mining (no further control required)	**9 (ALARP)**	10 km away from longwall mining (no further control required).				

Table 9 – Complete Risk Register for Risk Management Zone Key Features

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
Regulated Streams											
RS.09	Avon River	Mine subsidence and reduced groundwater pressures reduces water quantity and/or quality within rivers. Loss or degradation of aquatic habitat and riparian vegetation.	100	3	Feature located within the vicinity of the feasible metallurgical coal resource and CCL 768 with potential for impacts if the resource was mined.	**300**	Economic mine plan has minimum distance of 900 m from longwall mining.	Based on observations and previous experience of longwall mining, fracturing in streams and loss of surface water flows is not expected to occur at the proposed minimum distances to regulated streams. There are also no known geological structures (PSM, 2022) that coincide with this feature, which supports the subsidence predictions in MSEC (2022). Water table drawdown likely to be minimal (and subsequent impact on surface water flows will be negligible) with the minimum 900 m separation distance.	0.03	100	**3 (ALARP)**
RS.10	Cordeaux River	Mine subsidence and reduced groundwater pressures reduces water quantity and/or quality within rivers. Loss or degradation of aquatic habitat and riparian vegetation.	100	0.03	2.5 km away from longwall mining (no further control required)	**3 (ALARP)**	Economic mine plan has minimum distance of 2.5 km from longwall mining (no further control required).				
RS.11	Nepean River	Mine subsidence and reduced groundwater pressures reduces water quantity and/or quality within rivers. Loss or degradation of aquatic habitat and riparian vegetation.	100	0.03	2.5 km away from longwall mining (no further control required)	**3 (ALARP)**	Economic mine plan has minimum distance of 2.5 km from longwall mining (no further control required).				
Named Watercourses											
NW.12	Donalds Castle Creek	Mine subsidence and reduced groundwater pressures reduces water quantity and/or quality within streams, creeks and other water features. Loss or degradation of aquatic habitat and riparian vegetation.	30	0.03	Minimum distance of greater than 400 m from longwall mining (no further control required).	**0.9 (ALARP)**	Economic mine plan has minimum distance of greater than 400 m from longwall mining in Area 5 (no further control required).				
NW.13	Wongawilli Creek	Mine subsidence and reduced groundwater pressures reduces water quantity and/or quality within streams, creeks and other water features. Loss or degradation of aquatic habitat and riparian vegetation.	30	0.03	1.9 km away from longwall mining (no further control required)	**0.9 (ALARP)**	Economic mine plan has minimum distance of 1.9 km from longwall mining (no further control required).				

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
High Scientific Significance Aboriginal Heritage Sites											
HSAHS.14	Site 52-2-1780 [Upper Avon 43]	Mine subsidence results in impacts to high archaeological Aboriginal heritage sites and/or heritage values.	30	3	Feature located within feasible metallurgical coal resource and CCL 768.	**90**	Economic mine plan has minimum distance of 170 m from longwall mining in Area 5.	With the minimum distance of 170 m from longwall mining, experience in the Southern Coalfield has indicated impacts are not expected to occur. It is worth noting that the feature is within feasible metallurgical coal resource and CCL 768, but would not be directly mined beneath by the proposed mine plan. Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as rare (less than 5%).	0.1	30	**3 (ALARP)**
HSAHS.15	Site 52-2-1752 [Upper Avon 47]	Mine subsidence results in impacts to high archaeological Aboriginal heritage sites and/or heritage values.	30	0.1	300 m away from longwall mining due to protection from 300 m FSL buffer protection. Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as very rare (less than 1%).	**3 (ALARP)**	Minimum distance of 300 m from longwall mining due to protection from the FSL of the Avon Dam (no further control required).				
HSAHS.16	Site 52-2-1754 [Upper Avon 49]	Mine subsidence results in impacts to high archaeological Aboriginal heritage sites and/or heritage values.	30	0.1	400 m away from longwall mining due to protection from 300 m FSL buffer protection. Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as very rare (less than 1%).	**3 (ALARP)**	Minimum distance of 300 m from longwall mining due to protection from the FSL of the Avon Dam (no further control required).				
Third Order Streams											
TOS.17	AR32	Mine subsidence and reduced groundwater pressures reduces water quantity within streams, creeks and other water features. Loss or degradation of aquatic habitat and riparian vegetation.	10	3	Feature located within feasible metallurgical coal resource and CCL 768 (consequence is less than regulated and named order streams).	**30**	Economic mine plan has minimum distance of 550 m from longwall mining (located outside the 35 degree angle of draw) and remediation of potential impacts.	This third order stream is intermittent (10-90%) and receives a contribution from base flows/groundwater. The stream is a tributary of the Avon River and contributes to the drinking water catchment and is within extent of metallurgical coal resource. Some level of impact from subsidence is possible (based on observations around Area 3 at Dendrobium Mine), with potential loss of biodiversity and habitat as a result of loss of flow. Potential remediation of damaged streams/rock bars in third order streams is proposed where practical.	0.1	10	**1 (ALARP)**
TOS.18	DC8	Mine subsidence and reduced groundwater pressures reduces water quantity within streams, creeks and other water features. Loss or degradation of aquatic habitat and riparian vegetation.	10	3	Feature located within feasible metallurgical coal resource and CCL 768.	**30**	Economic mine plan has minimum distance of 35 m from longwall mining (210 m of stream within 35 degree angle of draw) and remediation of potential impacts, if required.	Some level of impact from subsidence is possible (based on observations around Area 3 at Dendrobium Mine), with potential loss of biodiversity and habitat as a result of loss of flow. Potential remediation of damaged streams/rock bars in third order streams is proposed where practical.	0.3	10	**3 (ALARP)**

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
TOS.19	LA13	Mine subsidence and reduced groundwater pressures reduces water quantity within streams, creeks and other water features. Loss or degradation of aquatic habitat and riparian vegetation.	10	3	Feature located within feasible metallurgical coal resource and CCL 768.	**30**	Economic mine plan has minimum distance of 50 m setback from longwall mining (1,080 m of stream within 35 degree angle of draw) and remediation of potential impacts, if required.	Some level of impact from subsidence is possible (based on observations around Area 3 at Dendrobium Mine), with potential loss of biodiversity and habitat as a result of loss of flow. Potential remediation of damaged streams/rock bars in third order streams is proposed where practical.	0.3	10	**3 (ALARP)**
Key Stream Features (larger pools on any order of stream or >5m step)											
KSF.20	AR31-Pool 52	Mine subsidence and reduced groundwater pressures reduces water quantity within key water stream features. Loss or degradation of aquatic habitat and riparian vegetation.	10	0.1	Feature located within feasible metallurgical coal resource and CCL 768.	**1 (ALARP)**	Economic mine plan has minimum distance of 570 m from longwall mining, remediation of potential impacts and offset of biodiversity values up to 400 m upstream/downstream of the proposed longwalls.	Potential impacts from subsidence are possible. Based on observations at Dendrobium Mine, potential loss of biodiversity and habitat could occur as a result of loss of flow. No previous signs of subsidence impacts (e.g. fracturing) that would cause loss of pool water (Type 3 impact) at this distance (greater than 400 m) from longwall mining at the Dendrobium Mine or in the Southern Coalfield.			
KSF.21	AR31-Pool 63	Mine subsidence and reduced groundwater pressures reduces water quantity within key water stream features. Loss or degradation of aquatic habitat and riparian vegetation.	10	3	Feature located within feasible metallurgical coal resource and CCL 768.	**30**	Economic mine plan has minimum distance of 270 m from longwall mining, remediation of potential impacts and offset of biodiversity values up to 400 m upstream/downstream of the proposed longwalls.	Potential impacts from subsidence are possible. Based on observations at Dendrobium Mine, potential loss of biodiversity and habitat could occur as a result of loss of flow. At this distance from longwall mining there is potential for subsidence impacts (e.g. fracturing) that may cause loss of pool water (Type 3 impact) based on previous experience at the Dendrobium Mine or in the Southern Coalfield.	0.1	10	**1 (ALARP)**
KSF.22	AR32-Pool 17	Mine subsidence and reduced groundwater pressures reduces water quantity within key water stream features. Loss or degradation of aquatic habitat and riparian vegetation.	10	0.1	Feature located within feasible metallurgical coal resource and CCL 768.	**1 (ALARP)**	Economic mine plan has minimum distance of 560 m from longwall mining, remediation of potential impacts and offset of biodiversity values up to 400 m upstream/downstream of the proposed longwalls.	Potential impacts from subsidence are possible. Based on observations at Dendrobium Mine, potential loss of biodiversity and habitat could occur as a result of loss of flow. No previous signs of subsidence impacts (e.g. fracturing) that would cause loss of pool water (Type 3 impact) at this distance (greater than 400 m) from longwall mining at the Dendrobium Mine or in the Southern Coalfield.			

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
KSF.23	AR32-Step 5	Mine subsidence and reduced groundwater pressures reduces water quantity within key water stream features. Loss or degradation of aquatic habitat and riparian vegetation.	10	0.1	Feature located within feasible metallurgical coal resource and CCL 768.	**1 (ALARP)**	Economic mine plan has minimum distance of 530 m from longwall mining, remediation of potential impacts and offset of biodiversity values up to 400 m upstream/downstream of the proposed longwalls.	Potential impacts from subsidence are possible. Based on observations at Dendrobium Mine, potential loss of biodiversity and habitat could occur as a result of loss of flow. No previous signs of subsidence impacts (e.g. fracturing) that would cause loss of pool water (Type 3 impact) at this distance (greater than 400 m) from longwall mining at the Dendrobium Mine or in the Southern Coalfield.			
KSF.24	AR32-Pool 22	Mine subsidence and reduced groundwater pressures reduces water quantity within key water stream features. Loss or degradation of aquatic habitat and riparian vegetation.	10	3	Feature located within feasible metallurgical coal resource and CCL 768.	**30**	Economic mine plan has minimum distance of 390 m from longwall mining, remediation of potential impacts and offset of biodiversity values up to 400 m upstream/downstream of the proposed longwalls.	Potential impacts from subsidence are possible. Based on observations at Dendrobium Mine, potential loss of biodiversity and habitat could occur as a result of loss of flow. At this distance from longwall mining there is potential for subsidence impacts (e.g. fracturing) that may cause loss of pool water (Type 3 impact) based on previous experience at the Dendrobium Mine or in the Southern Coalfield.	0.1	10	**1 (ALARP)**
KSF.25	AR32-Step 8	Mine subsidence and reduced groundwater pressures reduces water quantity within key water stream features. Loss or degradation of aquatic habitat and riparian vegetation.	10	3	Feature located within feasible metallurgical coal resource and CCL 768. Consequence considers larger biodiversity and the steps have a great aesthetic impact.	**30**	Economic mine plan has minimum distance of 200 m from longwall mining, remediation of potential impacts and offset of biodiversity values up to 400 m upstream/downstream of the proposed longwalls.	Potential impacts from subsidence are possible. Based on observations at Dendrobium Mine, potential loss of biodiversity and habitat could occur as a result of loss of flow. At this distance from longwall mining there is potential for subsidence impacts (e.g. fracturing) that may cause loss of pool water (Type 3 impact) based on previous experience at the Dendrobium Mine or in the Southern Coalfield.	0.1	10	**1 (ALARP)**
KSF.26	AR32-Pool 31	Mine subsidence and reduced groundwater pressures reduces water quantity within key water stream features. Loss or degradation of aquatic habitat and riparian vegetation.	10	3	Feature located within feasible metallurgical coal resource and CCL 768.	**30**	Economic mine plan has minimum distance of 100 m from longwall mining, remediation of potential impacts and offset of biodiversity values up to 400 m upstream/downstream of the proposed longwalls.	Potential impacts from subsidence are possible. Based on observations at Dendrobium Mine, potential loss of biodiversity and habitat could occur as a result of loss of flow. At this distance from longwall mining there is potential for subsidence impacts (e.g. fracturing) that may cause loss of pool water (Type 3 impact) based on previous experience at the Dendrobium Mine or in the Southern Coalfield.	0.1	10	**1 (ALARP)**

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
KSF.27	AR32-Step 11	Mine subsidence and reduced groundwater pressures reduces water quantity within key water stream features. Loss or degradation of aquatic habitat and riparian vegetation.	10	3	Feature located within feasible metallurgical coal resource and CCL 768. Consequence considers larger biodiversity and the steps have a great aesthetic impact.	**30**	Economic mine plan has minimum distance of 100 m from longwall mining, remediation of potential impacts and offset of biodiversity values up to 400 m upstream/downstream of the proposed longwalls.	Potential impacts from subsidence are possible. Based on observations at Dendrobium Mine, potential loss of biodiversity and habitat could occur as a result of loss of flow. At this distance from longwall mining there is potential for subsidence impacts (e.g. fracturing) that may cause loss of pool water (Type 3 impact) based on previous experience at the Dendrobium Mine or in the Southern Coalfield.	0.1	10	**1 (ALARP)**
KSF.28	DC8-Pool 9	Mine subsidence and reduced groundwater pressures reduces water quantity within key water stream features. Loss or degradation of aquatic habitat and riparian vegetation.	10	3	370 m away from longwall mining due to feasible metallurgical coal resource.	**30**	Economic mine plan has minimum distance of 370 m from longwall mining due to targeting of metallurgical coal resource. Offset of biodiversity up to 400 m upstream/downstream of the proposed longwalls.	Potential impacts from subsidence are possible. Based on observations at Dendrobium Mine, potential loss of biodiversity and habitat could occur as a result of loss of flow. At this distance from longwall mining there is potential for subsidence impacts (e.g. fracturing) that may cause loss of pool water (Type 3 impact) based on previous experience at the Dendrobium Mine or in the Southern Coalfield.	0.1	10	**1 (ALARP)**
KSF.29	DC8-Pool 16	Mine subsidence and reduced groundwater pressures reduces water quantity within key water stream features. Loss or degradation of aquatic habitat and riparian vegetation.	10	3	Feature located within feasible metallurgical coal resource and CCL 768.	**30**	Economic mine plan has minimum distance of 50 m from longwall mining, remediation of potential impacts and offset of biodiversity values up to 400 m upstream/downstream of the proposed longwalls.	Potential impacts from subsidence are possible. Based on observations at Dendrobium Mine, potential loss of biodiversity and habitat could occur as a result of loss of flow. At this distance from longwall mining there is potential for subsidence impacts (e.g. fracturing) that may cause loss of pool water (Type 3 impact) based on previous experience at the Dendrobium Mine or in the Southern Coalfield.	0.1	10	**1 (ALARP)**
KSF.30	DC10C-Pool 7	Mine subsidence and reduced groundwater pressures reduces water quantity within key water stream features. Loss or degradation of aquatic habitat and riparian vegetation.	10	3	Feature located within feasible metallurgical coal resource and CCL 768.	**30**	Economic mine plan has minimum distance of 100 m from longwall mining, remediation of potential impacts and offset of biodiversity values up to 400 m upstream/downstream of the proposed longwalls.	Potential impacts from subsidence are possible. Based on observations at Dendrobium Mine, potential loss of biodiversity and habitat could occur as a result of loss of flow. At this distance from longwall mining there is potential for subsidence impacts (e.g. fracturing) that may cause loss of pool water (Type 3 impact) based on previous experience at the Dendrobium Mine or in the Southern Coalfield.	0.1	10	**1 (ALARP)**

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
KSF.31	LA13-Pool 2	Mine subsidence and reduced groundwater pressures reduces water quantity within key water stream features. Loss or degradation of aquatic habitat and riparian vegetation.	10	3	310 m away from longwall mining due to protection from 300 m FSL buffer protection of Avon Dam.	**30**	Economic mine plan has minimum distance of 310 m from longwall mining due to targeting of metallurgical coal resource. Offset of biodiversity up to 400 m upstream/downstream of the proposed longwalls.	Potential impacts from subsidence are possible. Based on observations at Dendrobium Mine, potential loss of biodiversity and habitat could occur as a result of loss of flow. At this distance from longwall mining there is potential for subsidence impacts (e.g. fracturing) that may cause loss of pool water (Type 3 impact) based on previous experience at the Dendrobium Mine or in the Southern Coalfield.	0.1	10	**1 (ALARP)**
KSF.32	LA13-Pool 4	Mine subsidence and reduced groundwater pressures reduces water quantity within key water stream features. Loss or degradation of aquatic habitat and riparian vegetation.	10	3	Feature located within feasible metallurgical coal resource and CCL 768.	**30**	Economic mine plan has minimum distance of 60 m from longwall mining, remediation of potential impacts and offset of biodiversity values up to 400 m upstream/downstream of the proposed longwalls.	Potential impacts from subsidence are possible. Based on observations at Dendrobium Mine, potential loss of biodiversity and habitat could occur as a result of loss of flow. At this distance from longwall mining there is potential for subsidence impacts (e.g. fracturing) that may cause loss of pool water (Type 3 impact) based on previous experience at the Dendrobium Mine or in the Southern Coalfield.	0.1	10	**1 (ALARP)**
KSF.33	LA13-Pool 9	Mine subsidence and reduced groundwater pressures reduces water quantity within key water stream features. Loss or degradation of aquatic habitat and riparian vegetation.	10	3	Feature located within feasible metallurgical coal resource and CCL 768.	**30**	Economic mine plan has minimum distance of 100 m from longwall mining, remediation of potential impacts and offset of biodiversity values up to 400 m upstream/downstream of the proposed longwalls.	Potential impacts from subsidence are possible. Based on observations at Dendrobium Mine, potential loss of biodiversity and habitat could occur as a result of loss of flow. At this distance from longwall mining there is potential for subsidence impacts (e.g. fracturing) that may cause loss of pool water (Type 3 impact) based on previous experience at the Dendrobium Mine or in the Southern Coalfield.	0.1	10	**1 (ALARP)**
KSF.34	LA13-Pool 17	Mine subsidence and reduced groundwater pressures reduces water quantity within key water stream features. Loss or degradation of aquatic habitat and riparian vegetation.	10	3	Feature located within feasible metallurgical coal resource and CCL 768.	**30**	Economic mine plan has minimum distance of 100 m from longwall mining, remediation of potential impacts and offset of biodiversity values up to 400 m upstream/downstream of the proposed longwalls.	Potential impacts from subsidence are possible. Based on observations at Dendrobium Mine, potential loss of biodiversity and habitat could occur as a result of loss of flow. At this distance from longwall mining there is potential for subsidence impacts (e.g. fracturing) that may cause loss of pool water (Type 3 impact) based on previous experience at the Dendrobium Mine or in the Southern Coalfield.	0.1	10	**1 (ALARP)**

Table 10 – Complete Risk Register for Other Features

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
Moderate Scientific Significance Aboriginal Heritage Sites											
MSAHS.35	Site 52-2-1730 [Ricki Lee 2]	Mine subsidence results in impacts to moderate archaeological Aboriginal heritage sites and/or heritage values.	3	0.1	220 m away from longwall mining (no further control required). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as rare (less than 5%).	**0.3 (ALARP)**					
Low Scientific Significance Aboriginal Heritage Sites											
LSAHS.36	Site 52-2-1566 [Donald Castle Creek Site 5]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.3	Directly mining beneath could cause impacts to Aboriginal heritage sites (no further controls proposed). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as unlikely (less than 10%).	**0.9 (ALARP)**					
LSAHS.37	Site 52-2-1567 [Donald Castle Creek Site 6]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.03	470 m away from longwall mining (no further control required). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as very rare (less than 1%).	**0.09 (ALARP)**					
LSAHS.38	Site 52-2-1568 [Donald Castle Creek Site 7]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.1	30 m away from longwall mining (no further control required). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as rare (less than 5%).	**0.3 (ALARP)**					
LSAHS.39	Site 52-2-1591 [Donald Castle Creek Site 30]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.03	450 m away from longwall mining (no further control required). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as very rare (less than 1%).	**0.09 (ALARP)**					
LSAHS.40	Site 52-2-1592 [Donald Castle Creek Site 31]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.3	Directly mining beneath could cause impacts to Aboriginal heritage sites (no further controls proposed). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as unlikely (less than 10%).	**0.9 (ALARP)**					
LSAHS.41	Site 52-2-1729 [Ricki Lee 1]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.1	230 m away from longwall mining (no further control required). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as rare (less than 5%).	**0.3 (ALARP)**					

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
LSAHS.42	Site 52-2-1747 [Upper Avon 53]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.3	Directly mining beneath could cause impacts to Aboriginal heritage sites (no further controls proposed). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as unlikely (less than 10%).	**0.9 (ALARP)**					
LSAHS.43	Site 52-2-1753 [Upper Avon 48]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.03	440 m away from longwall mining (no further control required). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as very rare (less than 1%).	**0.09 (ALARP)**					
LSAHS.44	Site 52-2-1754 [Upper Avon 49]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.03	400 m away from longwall mining (no further control required). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as very rare (less than 1%).	**0.09 (ALARP)**					
LSAHS.45	Site 52-2-1755 [Upper Avon 50]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.03	430 m away from longwall mining (no further control required). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as very rare (less than 1%).	**0.09 (ALARP)**					
LSAHS.46	Site 52-2-1756 [Upper Avon 51]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.1	210 m away from longwall mining (no further control required). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as rare (less than 5%).	**0.3 (ALARP)**					
LSAHS.47	Site 52-2-1757 [Upper Avon 52]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.1	90 m away from longwall mining (no further control required). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as rare (less than 5%).	**0.3 (ALARP)**					
LSAHS.48	Site 52-2-1758 [Upper Avon 54]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.3	Directly mining beneath could cause impacts to Aboriginal heritage sites (no further controls proposed). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as unlikely (less than 10%).	**0.9 (ALARP)**					

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
LSAHS.49	Site 52-2-1759 [Upper Avon 55]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.1	30 m away from longwall mining (no further control required). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as rare (less than 5%).	**0.3 (ALARP)**					
LSAHS.50	Site 52-2-1761 [Upper Avon 46]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.03	230 m away from longwall mining (no further control required). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as very rare (less than 1%).	**0.09 (ALARP)**					
LSAHS.51	Site 52-2-1779 [Upper Avon 42]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.1	110 m away from longwall mining (no further control required). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as rare (less than 5%).	**0.3 (ALARP)**					
LSAHS.52	Site 52-2-1781 [Upper Avon 44]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.1	50 m away from longwall mining (no further control required). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as rare (less than 5%).	**0.3 (ALARP)**					
LSAHS.53	Site 52-2-1782 [Upper Avon 45]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.3	Directly mining beneath could cause impacts to Aboriginal heritage sites (no further controls proposed). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as unlikely (less than 10%).	**0.9 (ALARP)**					
LSAHS.54	Site 52-2-3204 [Avon Dam IF1]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.03	500 m away from longwall mining (no further control required). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as very rare (less than 1%).	**0.09 (ALARP)**					
LSAHS.55	Site 52-2-3955 [M2D PAD2]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.3	Directly mining beneath could cause impacts to Aboriginal heritage sites (no further controls proposed). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as unlikely (less than 10%).	**0.9 (ALARP)**					

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
LSAHS.56	Site 52-2-4465 [Dendrobium ACHA AGG-4]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.1	170 m away from longwall mining (no further control required). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as rare (less than 5%).	**0.3 (ALARP)**					
LSAHS.57	Site 52-2-4466 [Dendrobium ACHA AGG-3]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.03	430 m away from longwall mining (no further control required). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as very rare (less than 1%).	**0.09 (ALARP)**					
LSAHS.58	Site 52-2-4467 [Dendrobium ACHA AGG-2]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.03	510 m away from longwall mining (no further control required). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as very rare (less than 1%).	**0.09 (ALARP)**					
LSAHS.59	Site 52-2-4468 [Dendrobium ACHA AGG-1]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.1	210 m away from longwall mining (no further control required). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as rare (less than 5%).	**0.3 (ALARP)**					
LSAHS.60	Site AHIMS Pending [Dendrobium ACHA Shelter-3]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.03	400 m away from longwall mining (no further control required). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as very rare (less than 1%).	**0.09 (ALARP)**					
LSAHS.61	Site AHIMS Pending [Dendrobium ACHA Shelter-4]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.1	130 m away from longwall mining (no further control required). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as rare (less than 5%).	**0.3 (ALARP)**					
LSAHS.62	Site AHIMS Pending [Dendrobium ACHA AGG-5]	Mine subsidence results in impacts to low archaeological Aboriginal heritage sites and/or heritage values.	3	0.03	270 m away from longwall mining (no further control required). Potential for mining-induced fracturing on this site has been assessed by MSEC (2022) as very rare (less than 1%).	**0.09 (ALARP)**					

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
Second and First Order Streams											
SFS.63	AR19	Loss of surface water supply and biodiversity values for streams due to subsidence-related impacts.	3	10	Directly mining beneath likely to cause surface deformation or changes to groundwater resulting in changes to water losses and loss of biodiversity values.	**30**	Offset water losses and biodiversity values for species up to 400 m upstream/downstream of longwalls, if required.	Precautionary basis for biodiversity and water impacts related to streams. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets. Surface water loss offsets intended to be based on real-life data (e.g. flow monitoring) and value determined by IPART.	10	1	**10 (ALARP)**
SFS.64	AR31	Loss of surface water supply and biodiversity values for streams due to subsidence-related impacts.	3	10	Directly mining beneath likely to cause surface deformation or changes to groundwater resulting in changes to water losses and loss of biodiversity values.	**30**	Offset water losses and biodiversity values for species up to 400 m upstream/downstream of longwalls, if required.	Precautionary basis for biodiversity and water impacts related to streams. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets. Surface water loss offsets intended to be based on real-life data (e.g. flow monitoring) and value determined by IPART.	10	1	**10 (ALARP)**
SFS.65	AR32	Loss of surface water supply and biodiversity values for streams due to subsidence-related impacts.	3	10	Directly mining beneath likely to cause surface deformation or changes to groundwater resulting in changes to water losses and loss of biodiversity values.	**30**	Offset water losses and biodiversity values for species up to 400 m upstream/downstream of longwalls, if required.	Precautionary basis for biodiversity and water impacts related to streams. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets. Surface water loss offsets intended to be based on real-life data (e.g. flow monitoring) and value determined by IPART.	10	1	**10 (ALARP)**

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
SFS.66	DC8	Loss of surface water supply and biodiversity values for streams due to subsidence-related impacts.	3	10	Directly mining beneath likely to cause surface deformation or changes to groundwater resulting in changes to water losses and loss of biodiversity values.	**30**	Offset water losses and biodiversity values for species up to 400 m upstream/downstream of longwalls, if required.	Precautionary basis for biodiversity and water impacts related to streams. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets. Surface water loss offsets intended to be based on real-life data (e.g. flow monitoring) and value determined by IPART.	10	1	**10 (ALARP)**
SFS.67	DC9	Loss of surface water supply and biodiversity values for streams due to subsidence-related impacts.	3	10	Directly mining beneath likely to cause surface deformation or changes to groundwater resulting in changes to water losses and loss of biodiversity values.	**30**	Offset water losses and biodiversity values for species up to 400 m upstream/downstream of longwalls, if required.	Precautionary basis for biodiversity and water impacts related to streams. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets. Surface water loss offsets intended to be based on real-life data (e.g. flow monitoring) and value determined by IPART.	10	1	**10 (ALARP)**
SFS.68	DC10C	Loss of surface water supply and biodiversity values for streams due to subsidence-related impacts.	3	10	Directly mining beneath likely to cause surface deformation or changes to groundwater resulting in changes to water losses and loss of biodiversity values.	**30**	Offset water losses and biodiversity values for species up to 400 m upstream/downstream of longwalls, if required.	Precautionary basis for biodiversity and water impacts related to streams. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets. Surface water loss offsets intended to be based on real-life data (e.g. flow monitoring) and value determined by IPART.	10	1	**10 (ALARP)**
SFS.69	LCA12	Loss of surface water supply and biodiversity values for streams due to subsidence-related impacts.	3	10	Directly mining beneath likely to cause surface deformation or changes to groundwater resulting in changes to water losses and loss of biodiversity values.	**30**	Offset water losses and biodiversity values for species up to 400 m upstream/downstream of longwalls, if required.	Precautionary basis for biodiversity and water impacts related to streams. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets. Surface water loss offsets intended to be based on real-life data (e.g. flow monitoring) and value determined by IPART.	10	1	**10 (ALARP)**

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
SFS.70	LA13	Loss of surface water supply and biodiversity values for streams due to subsidence-related impacts.	3	10	Directly mining beneath likely to cause surface deformation or changes to groundwater resulting in changes to water losses and loss of biodiversity values.	**30**	Offset water losses and biodiversity values for species up to 400 m upstream/downstream of longwalls, if required.	Precautionary basis for biodiversity and water impacts related to streams. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets. Surface water loss offsets intended to be based on real-life data (e.g. flow monitoring) and value determined by IPART.	10	1	**10 (ALARP)**
SFS.71	LA13A	Loss of surface water supply and biodiversity values for streams due to subsidence-related impacts.	3	10	Directly mining beneath likely to cause surface deformation or changes to groundwater resulting in changes to water losses and loss of biodiversity values.	**30**	Offset water losses and biodiversity values for species up to 400 m upstream/downstream of longwalls, if required.	Precautionary basis for biodiversity and water impacts related to streams. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets. Surface water loss offsets intended to be based on real-life data (e.g. flow monitoring) and value determined by IPART.	10	1	**10 (ALARP)**
Swamps											
SW.72	Den85	Mine subsidence, including far field effects, causes surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	3	0.3	Not mined beneath as located outside the proposed mine plan for the Project.	**0.9**	Offset impacts to swamp and relevant biodiversity values, if impacted.	Precautionary basis for biodiversity and groundwater impacts related to swamps. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	1	0.3	**0.3 (ALARP)**
SW.73	Den86	Mine subsidence, including far field effects, causes surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	3	10	Directly mining beneath could cause surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	**30**	Offset impacts to swamp and relevant biodiversity values, if impacted.	Precautionary basis for biodiversity and groundwater impacts related to swamps. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	1	3	**3 (ALARP)**

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
SW.74	Den97	Mine subsidence, including far field effects, causes surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	3	10	Not mined beneath as located outside the proposed mine plan for the Project.	**30**	Offset impacts to swamp and relevant biodiversity values, if impacted.	Precautionary basis for biodiversity and groundwater impacts related to swamps. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	1	0.3	**0.3 (ALARP)**
SW.75	Den98	Mine subsidence, including far field effects, causes surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	10	0.3	Not mined beneath as located outside the proposed mine plan for the Project. Den98 is a more significant swamp in comparison to those identified in Area 5 due to size, complexity and vegetation community (a swamp of significant). Likelihood based on subsidence impacts, effects of drying out hydrology (bushfire likelihood still low) and distance from mining.	**3**	Offset impacts to swamp and relevant biodiversity values, if impacted.	Precautionary basis for biodiversity and groundwater impacts related to swamps. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	3	0.3	**0.9 (ALARP)**
SW.76	Den99	Mine subsidence, including far field effects, causes surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	3	10	Directly mining beneath could cause surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	**30**	Offset impacts to swamp and relevant biodiversity values, if impacted.	Precautionary basis for biodiversity and groundwater impacts related to swamps. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	1	10	**10 (ALARP)**
SW.77	Den100	Mine subsidence, including far field effects, causes surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	3	10	Directly mining beneath could cause surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	**30**	Offset impacts to swamp and relevant biodiversity values, if impacted.	Precautionary basis for biodiversity and groundwater impacts related to swamps. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	1	10	**10 (ALARP)**
SW.78	Den101	Mine subsidence, including far field effects, causes surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	3	10	Directly mining beneath could cause surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	**30**	Offset impacts to swamp and relevant biodiversity values, if impacted.	Precautionary basis for biodiversity and groundwater impacts related to swamps. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	1	10	**10 (ALARP)**

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
SW.79	Den102	Mine subsidence, including far field effects, causes surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	3	10	Directly mining beneath could cause surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	**30**	Offset impacts to swamp and relevant biodiversity values, if impacted.	Precautionary basis for biodiversity and groundwater impacts related to swamps. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	1	10	**10 (ALARP)**
SW.80	Den103	Mine subsidence, including far field effects, causes surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	3	10	Directly mining beneath could cause surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	**30**	Offset impacts to swamp and relevant biodiversity values, if impacted.	Precautionary basis for biodiversity and groundwater impacts related to swamps. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	1	10	**10 (ALARP)**
SW.81	Den104	Mine subsidence, including far field effects, causes surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	3	0.3	Not mined beneath as swamp is proximal to key stream features and not located within the proposed mine plan for the Project.	**0.9**	Offset impacts to swamp and relevant biodiversity values, if impacted.	Precautionary basis for biodiversity and groundwater impacts related to swamps. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	1	0.3	**0.3 (ALARP)**
SW.82	Den105	Mine subsidence, including far field effects, causes surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	3	0.3	Not mined beneath as swamp is proximal to key stream features and not located within the proposed mine plan for the Project.	**0.9**	Offset impacts to swamp and relevant biodiversity values, if impacted.	Precautionary basis for biodiversity and groundwater impacts related to swamps. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	1	0.3	**0.3 (ALARP)**
SW.83	Den106	Mine subsidence, including far field effects, causes surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	3	10	Directly mining beneath could cause surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	**30**	Offset impacts to swamp and relevant biodiversity values, if impacted.	Precautionary basis for biodiversity and groundwater impacts related to swamps. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	1	3	**3 (ALARP)**

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
SW.84	Den107	Mine subsidence, including far field effects, causes surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	3	10	Directly mining beneath could cause surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	**30**	Offset impacts to swamp and relevant biodiversity values, if impacted.	Precautionary basis for biodiversity and groundwater impacts related to swamps. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	1	3	**3 (ALARP)**
SW.85	Den108	Mine subsidence, including far field effects, causes surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	3	10	Directly mining beneath could cause surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	**30**	Offset impacts to swamp and relevant biodiversity values, if impacted.	Precautionary basis for biodiversity and groundwater impacts related to swamps. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	1	3	**3 (ALARP)**
SW.86	Den109	Mine subsidence, including far field effects, causes surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	3	10	Directly mining beneath could cause surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	**30**	Offset impacts to swamp and relevant biodiversity values, if impacted.	Precautionary basis for biodiversity and groundwater impacts related to swamps. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	1	3	**3 (ALARP)**
SW.87	Den110	Mine subsidence, including far field effects, causes surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	3	10	Directly mining beneath could cause surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	**30**	Offset impacts to swamp and relevant biodiversity values, if impacted.	Precautionary basis for biodiversity and groundwater impacts related to swamps. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	1	3	**3 (ALARP)**
SW.88	Den111	Mine subsidence, including far field effects, causes surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	3	10	Directly mining beneath could cause surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	**30**	Offset impacts to swamp and relevant biodiversity values, if impacted.	Precautionary basis for biodiversity and groundwater impacts related to swamps. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	1	3	**3 (ALARP)**

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
SW.89	Den114	Mine subsidence, including far field effects, causes surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	3	10	Directly mining beneath could cause surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	**30**	Offset impacts to swamp and relevant biodiversity values, if impacted.	Precautionary basis for biodiversity and groundwater impacts related to swamps. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	1	3	**3 (ALARP)**
SW.90	Den120	Mine subsidence, including far field effects, causes surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	3	0.3	Not mined beneath as located outside the proposed mine plan for the Project.	**0.9**	Offset impacts to swamp and relevant biodiversity values, if impacted.	Precautionary basis for biodiversity and groundwater impacts related to swamps. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	1	0.3	**0.3 (ALARP)**
SW.91	Den121	Mine subsidence, including far field effects, causes surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	3	10	Directly mining beneath could cause surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	**30**	Offset impacts to swamp and relevant biodiversity values, if impacted.	Precautionary basis for biodiversity and groundwater impacts related to swamps. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	1	3	**3 (ALARP)**
SW.92	Den122	Mine subsidence, including far field effects, causes surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	3	10	Directly mining beneath could cause surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	**30**	Offset impacts to swamp and relevant biodiversity values, if impacted.	Precautionary basis for biodiversity and groundwater impacts related to swamps. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	1	3	**3 (ALARP)**
SW.93	Den123	Mine subsidence, including far field effects, causes surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	3	10	Directly mining beneath could cause surface deformation or changes to groundwater resulting in changes to erosion potential, swamp size and swamp vegetation.	**30**	Offset impacts to swamp and relevant biodiversity values, if impacted.	Precautionary basis for biodiversity and groundwater impacts related to swamps. Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	1	3	**3 (ALARP)**

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
Natural Features											
NF.94	Illawarra Escarpment	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects. e.g. biodiversity, water quality, cultural heritage, aesthetics.	30	0.03	12 km away from longwall mining (no further control required). Major consequence (with damage to the Illawarra Escarpment) but rare potential for impacts.	**0.9 (ALARP)**	Minimum 12 km away from longwall mining (no further control required).				
NF.95	Upper Nepean State Conservation Area	Upper Nepean State Conservation Area affected by downstream and far-field effects causing impacts to conservation value.	10	0.03	400 m away from longwall mining (no further control required). Additional protection as beyond 400 m and no expectation of physical impacts at this distance. Minor or negligible impacts on flows.	**0.3 (ALARP)**	Minimum 400 m away from longwall mining (no further control required).				
Cliffs											
CL.96	AR32-CF1	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	175 m away from longwall mining (no further control required). Less likely to be impacted due to separation distance.	**0.3 (ALARP)**	Minimum distance of 175 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				
CL.97	DC8-CF1	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.3	Directly mining beneath could cause rock falls or surface deformation at cliffs which may result in impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	**0.9**	Monitoring of potential impacts and remediation of environmental damage to the ground surface, if required.	Monitoring of potential impacts and remediation of environmental damage to the ground surface, would reduce the potential consequence.	0.3	1	**0.3 (ALARP)**
CL.98	DC8-CF2	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.3	Directly mining beneath could cause rock falls or surface deformation at cliffs which may result in impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	**0.9**	Monitoring of potential impacts and remediation of environmental damage to the ground surface, if required.	Monitoring of potential impacts and remediation of environmental damage to the ground surface, would reduce the potential consequence.	0.3	1	**0.3 (ALARP)**

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
CL.99	DC8-CF3	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.3	Directly mining beneath could cause rock falls or surface deformation at cliffs which may result in impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	**0.9**	Monitoring of potential impacts and remediation of environmental damage to the ground surface, if required.	Monitoring of potential impacts and remediation of environmental damage to the ground surface, would reduce the potential consequence.	0.3	1	**0.3 (ALARP)**
CL.100	DC8-CF4	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.3	Directly mining beneath could cause rock falls or surface deformation at cliffs which may result in impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	**0.9**	Monitoring of potential impacts and remediation of environmental damage to the ground surface, if required.	Monitoring of potential impacts and remediation of environmental damage to the ground surface, would reduce the potential consequence.	0.3	1	**0.3 (ALARP)**
CL.101	DC8-CF5	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	120 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 120 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				
CL.102	DC8-CF6	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.3	Directly mining beneath could cause rock falls or surface deformation at cliffs which may result in impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	**0.9**	Monitoring of potential impacts and remediation of environmental damage to the ground surface, if required.	Monitoring of potential impacts and remediation of environmental damage to the ground surface, would reduce the potential consequence.	0.3	1	**0.3 (ALARP)**
CL.103	DC8-CF7	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	80 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 80 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				

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			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
CL.104	DC8D-CF1	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	90 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 90 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				
CL.105	LA10-CF1	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	170 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 170 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				
CL.106	LA10-CF2	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	180 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 180 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				
CL.107	LA13A-CF1	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	160 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 160 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				
CL.108	LA13A-CF2	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	130 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 130 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
CL.109	LA13A-CF3	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	180 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 180 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				
CL.110	LA13A-CF4	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	230 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 230 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				
CL.111	LA13A-CF5	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	265 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 265 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				
CL.112	LA13A-CF6	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	255 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 255 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				
CL.113	LA13-CF1	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	80 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 80 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				

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			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
CL.114	LA13-CF2	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	135 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 135 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				
CL.115	LA14-CF1	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.3	Directly mining beneath could cause rock falls or surface deformation at cliffs which may result in impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	**0.9**	Monitoring of potential impacts and remediation of environmental damage to the ground surface, if required.	Monitoring of potential impacts and remediation of environmental damage to the ground surface, would reduce the potential consequence.	0.3	1	**0.3 (ALARP)**
CL.116	LA14-CF2	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.3	Directly mining beneath could cause rock falls or surface deformation at cliffs which may result in impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	**0.9**	Monitoring of potential impacts and remediation of environmental damage to the ground surface, if required.	Monitoring of potential impacts and remediation of environmental damage to the ground surface, would reduce the potential consequence.	0.3	1	**0.3 (ALARP)**
CL.117	LA14-CF3	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.3	Directly mining beneath could cause rock falls or surface deformation at cliffs which may result in impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	**0.9**	Monitoring of potential impacts and remediation of environmental damage to the ground surface, if required.	Monitoring of potential impacts and remediation of environmental damage to the ground surface, would reduce the potential consequence.	0.3	1	**0.3 (ALARP)**
CL.118	LA14-CF4	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.3	Directly mining beneath could cause rock falls or surface deformation at cliffs which may result in impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	**0.9**	Monitoring of potential impacts and remediation of environmental damage to the ground surface, if required.	Monitoring of potential impacts and remediation of environmental damage to the ground surface, would reduce the potential consequence.	0.3	1	**0.3 (ALARP)**

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			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
CL.119	LA15-CF1	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.3	Directly mining beneath could cause rock falls or surface deformation at cliffs which may result in impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	**0.9**	Monitoring of potential impacts and remediation of environmental damage to the ground surface, if required.	Monitoring of potential impacts and remediation of environmental damage to the ground surface, would reduce the potential consequence.	0.3	1	**0.3 (ALARP)**
CL.120	LA15-CF2	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.3	Directly mining beneath could cause rock falls or surface deformation at cliffs which may result in impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	**0.9**	Monitoring of potential impacts and remediation of environmental damage to the ground surface, if required.	Monitoring of potential impacts and remediation of environmental damage to the ground surface, would reduce the potential consequence.	0.3	1	**0.3 (ALARP)**
CL.121	LA15-CF3	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.3	Directly mining beneath could cause rock falls or surface deformation at cliffs which may result in impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	**0.9**	Monitoring of potential impacts and remediation of environmental damage to the ground surface, if required.	Monitoring of potential impacts and remediation of environmental damage to the ground surface, would reduce the potential consequence.	0.3	1	**0.3 (ALARP)**
CL.122	LA15-CF4	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.3	Directly mining beneath could cause rock falls or surface deformation at cliffs which may result in impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	**0.9**	Monitoring of potential impacts and remediation of environmental damage to the ground surface, if required.	Monitoring of potential impacts and remediation of environmental damage to the ground surface, would reduce the potential consequence.	0.3	1	**0.3 (ALARP)**
CL.123	LA15-CF5	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	50 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 50 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				

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			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
CL.124	LA15-CF6	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	150 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 150 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				
CL.125	LA15-CF7	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	175 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 175 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				
CL.126	LA15-CF8	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	225 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 225 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				
CL.127	LA15-CF9	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	225 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 225 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				
CL.128	LA17-CF1	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.3	Directly mining beneath could cause rock falls or surface deformation at cliffs which may result in impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	**0.9**	Monitoring of potential impacts and remediation of environmental damage to the ground surface, if required.	Monitoring of potential impacts and remediation of environmental damage to the ground surface, would reduce the potential consequence.	0.3	1	**0.3 (ALARP)**

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
CL.129	LA17-CF2	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.3	Directly mining beneath could cause rock falls or surface deformation at cliffs which may result in impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	**0.9**	Monitoring of potential impacts and remediation of environmental damage to the ground surface, if required.	Monitoring of potential impacts and remediation of environmental damage to the ground surface, would reduce the potential consequence.	0.3	1	**0.3 (ALARP)**
CL.130	LA8_CF10	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.3	Directly mining beneath could cause rock falls or surface deformation at cliffs which may result in impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	**0.9**	Monitoring of potential impacts and remediation of environmental damage to the ground surface, if required.	Monitoring of potential impacts and remediation of environmental damage to the ground surface, would reduce the potential consequence.	0.3	1	**0.3 (ALARP)**
CL.131	LA8_CF11	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	220 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 220 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				
CL.132	LA8_CF12	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	220 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 220 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				
CL.133	LA8_CF13	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	230 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 230 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
CL.134	LA8_CF14	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	230 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 230 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				
CL.135	LA8_CF15	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	240 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 240 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				
CL.136	LA8_CF9	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	200 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 200 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				
CL.137	LA8A_CF1	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.3	Directly mining beneath could cause rock falls or surface deformation at cliffs which may result in impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	**0.9**	Monitoring of potential impacts and remediation of environmental damage to the ground surface, if required.	Monitoring of potential impacts and remediation of environmental damage to the ground surface, would reduce the potential consequence.	0.3	1	**0.3 (ALARP)**
CL.138	LA8A_CF2	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.3	Directly mining beneath could cause rock falls or surface deformation at cliffs which may result in impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	**0.9**	Monitoring of potential impacts and remediation of environmental damage to the ground surface, if required.	Monitoring of potential impacts and remediation of environmental damage to the ground surface, would reduce the potential consequence.	0.3	1	**0.3 (ALARP)**

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CL.139	LA8A_CF3	Mine subsidence causes rock falls or surface deformation having adverse impacts to safety and environmental aspects (e.g. biodiversity, water quality, cultural heritage, aesthetics).	3	0.1	30 m away from longwall mining (no further control required)	**0.3 (ALARP)**	Minimum distance of 30 m from longwall workings (i.e. not structurally sensitive). Remediation of environmental damage to the ground surface, if required.				
Built Features											
BF.140	Maldon-Dombarton Railway Corridor	Mine subsidence results in impacts to the railway corridor and associated infrastructure (culverts, cuttings and embankments).	1	1	No design controls for disused Maldon-Dombarton Railway Corridor.	**1 (ALARP)**	Any future track and associated infrastructure could be managed using strategies similar to those adopted for the Main Southern Railway at Appin Mine and Tahmoor Collieries. The management strategies could include the installation of rail expansion switches and real-time rail stress monitoring during active subsidence.				
BF.141	Unsealed Roads and Tracks	Mine subsidence results in impacts to unsealed roads and tracks and associated infrastructure, leading to road closure or safety issues.	3	1	No design controls for the unsealed roads and tracks.	**3 (ALARP)**	Monitoring and maintenance of the unsealed roads and access tracks (e.g. fire trails) would be detailed in future Extraction Plans. Subsidence related impacts would be remediated in accordance with existing management strategies implemented at Dendrobium Mine.				
BF.142	Survey Control Marks	Mine subsidence results in impacts to the survey control marks.	3	1	No design controls for Survey Control Marks.	**3 (ALARP)**	Survey control marks that are required for future use will be re-established after the completion of the proposed longwalls and after the ground has stabilised. This will be carried out in consultation with NSW Spatial Services.				

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
BF.143	Registered groundwater users (bores)	Subsidence effects from longwall mining damages bore casing, reduces bore yield and/or causes effect on water quality	3	0.03	Distance greater than approximately 4.5 km from nearest registered bore.	**0.09 (ALARP)**	Monitoring of bores (including piezometers) around existing Dendrobium Mine and make-good provisions for any potential impacts.				
BF.144	Registered groundwater users (bores)	Drawdown (e.g. greater than 2 m drawdown) from longwall mining impacts water supply for privately-owned bores.	1	0.1	Distance greater than approximately 4.5 km from nearest registered bore.	**0.1 (ALARP)**	Monitoring of bores (including piezometers) around existing Dendrobium Mine and make-good provisions for any potential impacts.				
Metropolitan Special Area Catchment											
MSAC.145	Water yield of Metropolitan Special Area Catchment	Mine subsidence and/or surface disturbance effects water yield and/or the supply capacity (e.g. including community concerns).	10	1	Directly mining beneath could cause surface deformation or changes to groundwater resulting in changes to water losses.	**10**	Offset predicted water losses.	Surface water loss offsets intended to be based on real-life data (e.g. flow monitoring) and value determined by IPART.	0.1	10	**1 (ALARP)**
MSAC.146	Water quality of Metropolitan Special Area Catchment	Mine subsidence and/or surface disturbance effects water quality and/or the supply capacity (e.g. including community concerns).	10	1	Directly mining beneath could cause surface deformation or changes to groundwater resulting in changes to water quality.	**10**	Water quality improvement actions are proposed as part of the Project, consistent with those proposed by the NSW Government and agreed to by IMC for the previous application.	Water quality improvement actions would provide offsets for the potential localised effects associated with subsidence-related impacts (e.g. pulses of iron and manganese) and demonstrate the Project would have a net neutral or beneficial effect on water quality.	0.1	10	**1 (ALARP)**
MSAC.147	Surface water quantity or quality impacts attributed to the existing surface facilities at the Dendrobium Mine.	Extension of the use and volume of water discharge due to the continued use of the surface facilities results in IMC being unable to meet EPL discharge requirements.	1	3	Outcomes of studies from Areas 3A and 3B, in addition to lower cutting heights in Area 5 indicates that there will not be any seam to surface fracturing. Updated groundwater modelling with discharge estimates for Area 5. Based on groundwater quality estimates for Area 5, controlled releases via LDP5 are expected to continue to comply with the existing EPL water quality limits.	**3 (ALARP)**	Controlled releases via LDP5 would be monitored to confirm EPL water quality objectives are being achieved.				

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
Mine Closure											
MC.148	Surface water quantity or quality impacts attributed to the Dendrobium Mine following mine closure.	Seepage from the portal at the Dendrobium Mine post-closure impacts on water quality downstream of the portal.	10	3	Mine closure results in recovery of groundwater levels above underground workings. Post closure via seepage via existing openings at escarpment.	**30**	Attenuation bulk heads within the underground workings post-closure. These bulk heads will control flows through existing roadways and direct flows to Kemira Valley loading facility. Residual outflows will be assessed for quality and stored and treated and/or directed to Allen's Creek.	Attenuation bulk heads would reduce the likelihood of uncontrolled seepage downstream of the portal.	0.3	10	**3 (ALARP)**
MC.149	Surface water quantity or quality impacts attributed to the Dendrobium Mine following mine closure.	Attenuation bulk heads results in groundwater recovery that promotes seepage from the coal measure at the Dendrobium Mine post-closure with impacts on water quality in the catchment.	10	0.3	Mine closure and installation of attenuation bulk heads results in greater recovery of groundwater levels above underground workings. Outcomes of studies from Areas 3A and 3B, in addition to lower cutting heights in Area 5 indicates that there will not be any seam to surface fracturing. Residual outflows will be assessed for quality and stored and treated and/or discharged.	**3 (ALARP)**	Water quality improvement actions are proposed as part of the Project, consistent with those proposed by the NSW Government and agreed to by IMC for the previous application.	Water quality improvement actions would provide offsets for the potential localised effects associated with subsidence-related impacts (e.g. pulses of iron and manganese) and demonstrate the Project would have a net neutral or beneficial effect on water quality.	0.1	10	**1 (ALARP)**
Biodiversity Values											
BV.150	Effects on flora and fauna as a result of the use of existing Dendrobium Mine Surface Facilities.	Impacts to flora and fauna habitat from the continued use/development of the surface facilities (e.g. removal of vegetation and habitat for car park extension).	3	3	Direct surface disturbance for the Project is likely to impact on biodiversity values.	**9**	Offset impacts to biodiversity values.	Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	3	1	**3 (ALARP)**
BV.151	Impacts on flora and fauna as a result of construction and use of ventilation, gas drainage and other infrastructure for the Project.	Impacts to flora and fauna habitat from the construction and operations of the ventilation, gas drainage and other infrastructure for the Project (e.g. removal of vegetation and habitat).	3	3	Direct surface disturbance for the Project is likely to impact on biodiversity values.	**9**	Offset impacts to biodiversity values.	Regulatory process is to avoid a net-loss of values. Repeatable process using accepted government calculation for offsets.	3	1	**3 (ALARP)**

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
Amenity											
AM.152	Acoustic amenity impacts associated with the existing and development of surface facilities for the Dendrobium Mine.	Continued use of the surface facilities results in impacts to the acoustic amenity of local residents.	3	3	Existing monitoring programs and equipment design includes consideration of noise mitigation.	**9**	Monitoring and abatement processes are the key control for potential amenity impacts.	Specific noise criteria for the Project with procedures to be followed in the event of an exceedance of applicable noise criteria as well as operation of a real-time directional noise monitoring system to proactively modify operations as required.	1	3	**3 (ALARP)**
AM.153	Air quality impacts associated with the existing and new surface facilities at the Dendrobium Mine.	Continued use of the surface facilities results in impacts on air quality of local residents.	3	1	Existing monitoring programs and dust suppression.	**3**	Monitoring and abatement processes are the key control for potential amenity impacts.	Specific air quality criteria for the Project and operation of real-time monitoring equipment (optical photometers) to monitor and evaluate the emissions of the Project against contemporary particulate matter criteria.	0.3	3	**1 (ALARP)**
AM.154	Roads and road safety impacts associated with the existing and new surface facilities at the Dendrobium Mine.	Additional vehicle movements along local roads used for the Project affects the serviceability and increased risk of accidents.	30	0.3	Vehicle movement studies undertaken, existing intersection and safety infrastructure and delivery only occur in nominated hours in consideration of existing traffic management protocols, monitoring and trigger action response processes.	**9**	No additional controls.				
AM.155	Potential sources of land contamination associated with the existing and new surface facilities at the Dendrobium Mine.	Contamination of the land due to upgrades and continued operations at the surface facilities at the Dendrobium Mine.	1	0.3	Clean and dirty water separation, spill clean-up equipment and emergency response and Pollution Incident Response Management Plan.	**0.3 (ALARP)**	No additional controls.				
AM.156	Impacts of continued use of Kemira Valley Rail Line on acoustic amenity.	Continued use of Kemira Valley Rail Line impacts acoustic amenity of local residents.	3	10	Existing monitoring programs, equipment design includes consideration of noise mitigation, rail only operates in nominated hours, programs and other studies to reduce wheel squeal and other noise impacts to the local residents.	**30**	Monitoring and abatement processes are the key control for potential amenity impacts.	Specific noise criteria for the Project with procedures to be followed in the event of an exceedance of applicable noise criteria as well as operation of a real-time directional noise monitoring system to proactively modify operations as required.	3	3	**9 (ALARP)**

Ref	Feature	Hazard	Uncontrolled Risk Ranking				Controlled Risk Ranking				
			Consequence	Likelihood	Justification/Ranking Basis	Risk	Controls	Evidence Basis for Ranking	Residual Likelihood	Residual Consequence	Residual Risk
AM.157	Air Quality impacts associated with the continued use of the Kemira Valley Rail Line.	Continued use of Kemira Valley Rail Line impacts air quality of local residence.	1	3	Existing monitoring programs, dust suppression and slow train speeds and short haul.	**3**	Monitoring and abatement processes are the key control for potential amenity impacts.	Specific air quality criteria for the Project and operation of real-time monitoring equipment (optical photometers) to monitor and evaluate the emissions of the Project against contemporary particulate matter criteria.	1	1	**1 (ALARP)**
AM.158	Impacts on visual amenity as a result of construction and use of ventilation and gas drainage infrastructure.	Visual impacts to users of the surrounding services as a result of construction and operations of ventilation and gas drainage infrastructure.	1	1	Structure colouring selected to match environment and Project is located within areas that are not publicly accessible.	**1 (ALARP)**	No additional controls.				

APPENDIX B: OTHER MAPPED FEATURES

Figure B1: Swamps and Streams

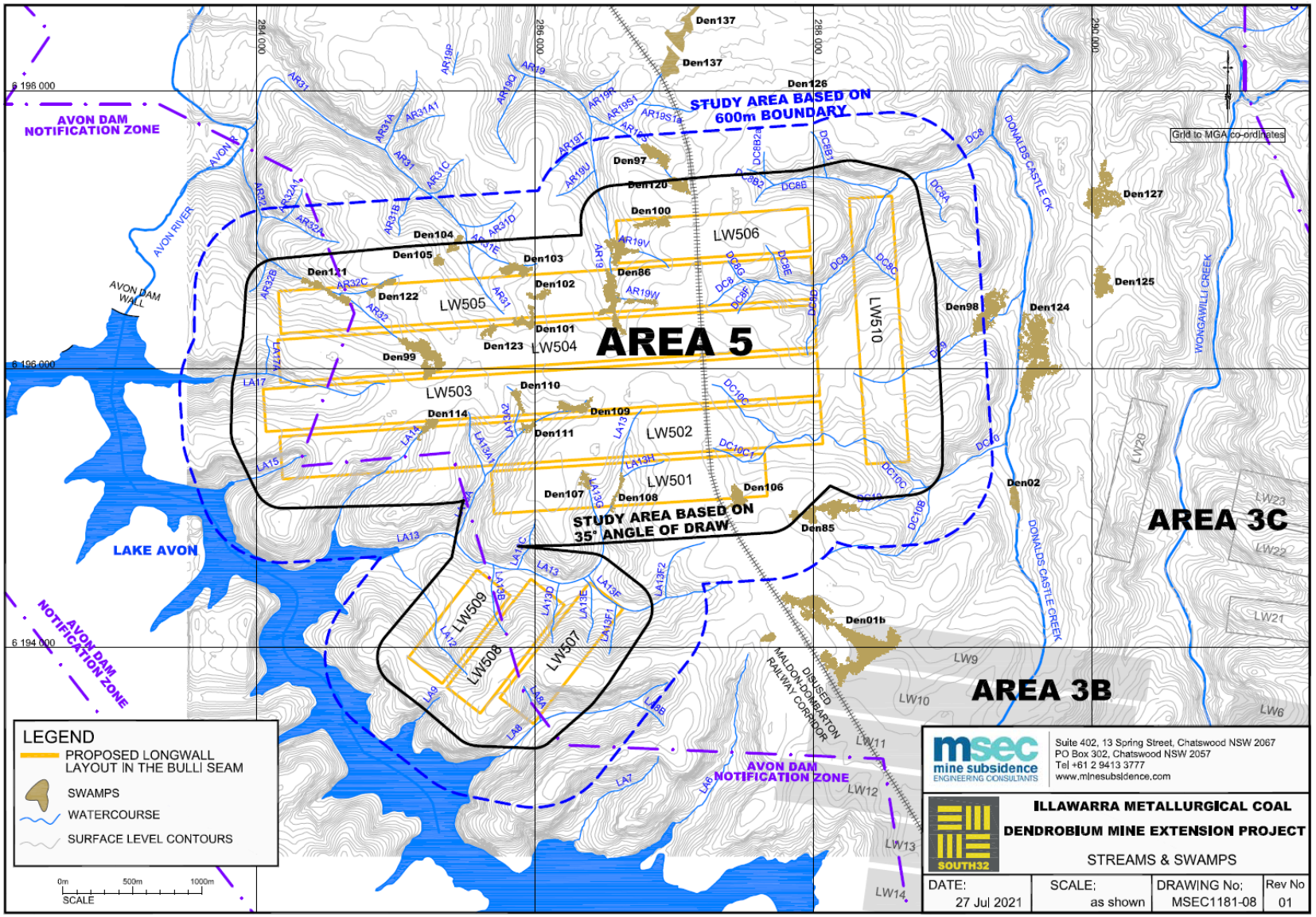


Figure B2: Cliffs

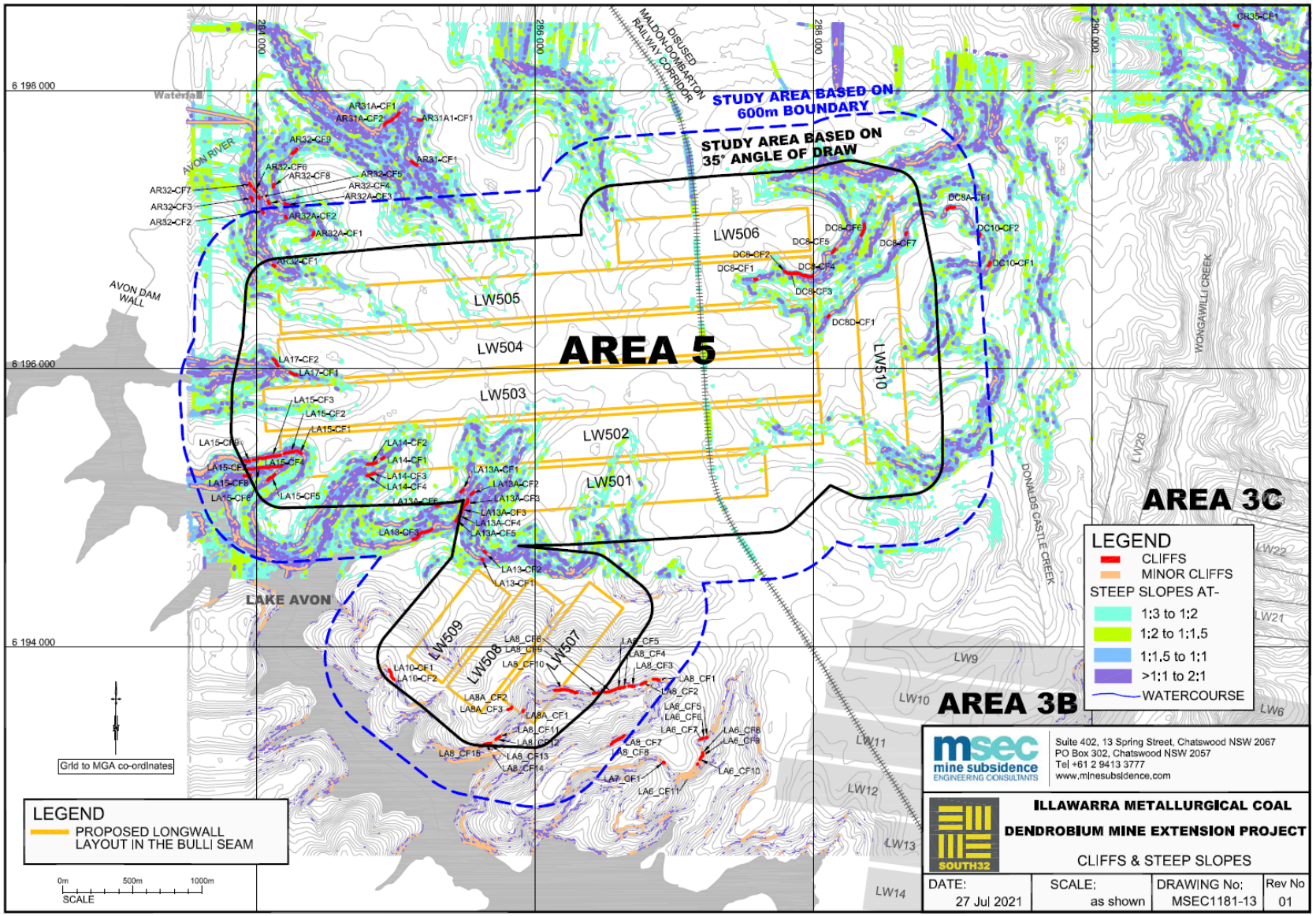
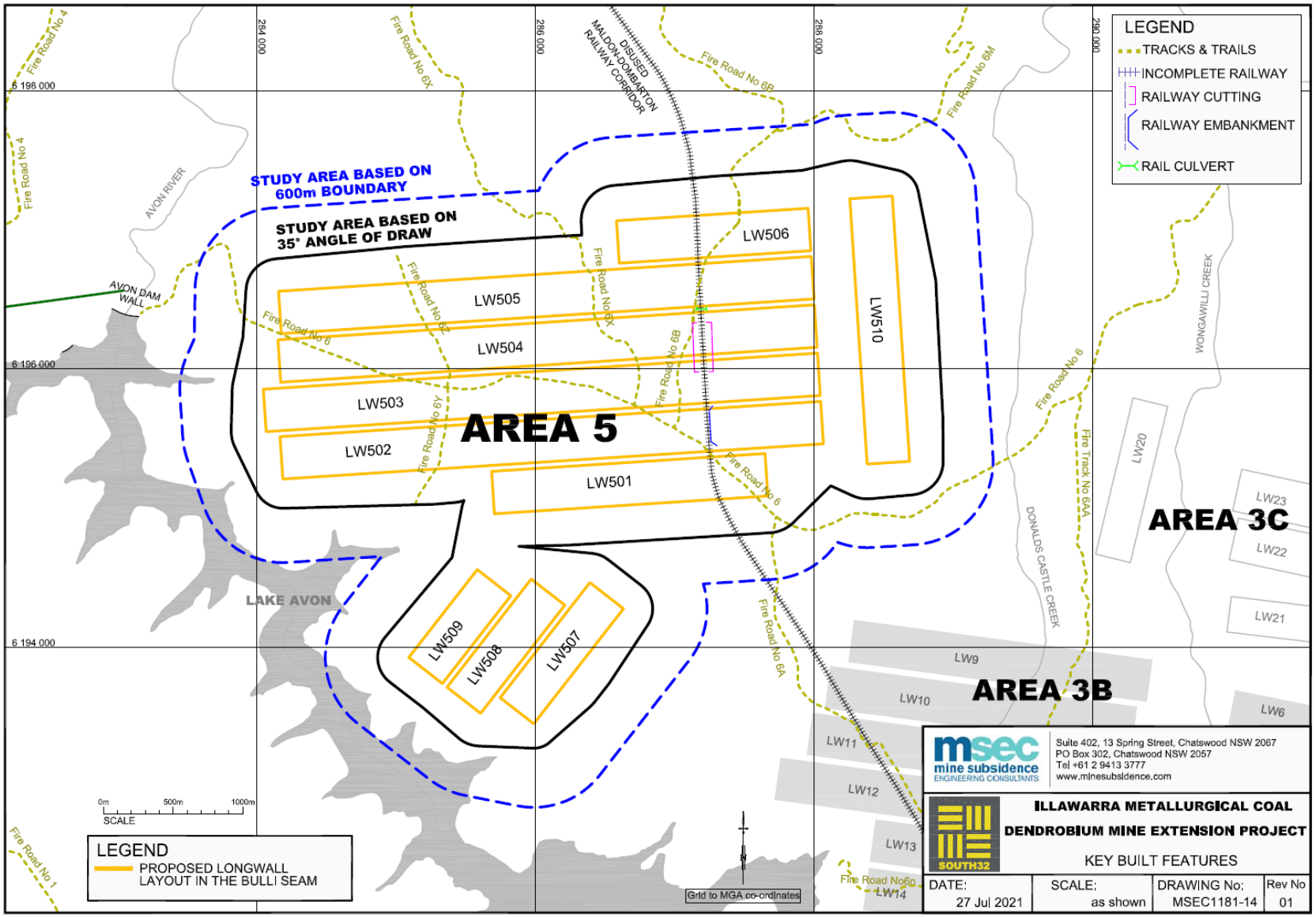


Figure B3: Built Features



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