



xenith

# Liddell Coal Operations Modification 9

**Modification Report**  
**Liddell Coal Operations Pty. Limited**  
**December 2025**

# Executive Summary

## Background

Liddell Coal Operations Pty. Limited (LCO) operates the Liddell Coal Operations (Liddell) which is located approximately 25 kilometres north west of Singleton and 26 kilometres south east of Muswellbrook in the Upper Hunter Region of New South Wales. LCO is a subsidiary of Glencore Coal Pty Limited (Glencore).

Liddell operates in accordance with Integrated State Significant Development Consent DA 305-11-01 (as modified). DA 305-11-01 was originally granted on 20 November 2002 under the former sections 76(A)9 & 80 of Part 4 of the *Environmental Planning and Assessment Act 1979* and has since been modified on eight separate occasions. DA 305-11-01, as originally granted, facilitated the continued open cut operations at Liddell as well as consolidating previous development approvals for open cut and underground mining operations into a single consent. Active mining operations at Liddell have concluded, with the last coal being mined in 2023 and LCO is currently progressing mine closure and rehabilitation works.

Rehabilitation efforts at Liddell are guided by the conditions set out in DA 305-11-01 (as modified). Notably, Schedule 3, Condition 37 of DA 305-11-01 includes the rehabilitation objectives for Liddell, including for the “*mine site (as a whole) to be safe, stable and non-polluting*”. LCO’s mine closure activities are being planned to achieve the rehabilitation objectives at Liddell.

Liddell has a long history of underground mining with some of the remnant first workings situated beneath the Main Northern Rail Line (MNRL) and other public infrastructure. An assessment of these workings indicates that the current pillar geometry is long-term stable. However, pillar area reduction may occur overtime as a result of external influences, such as spontaneous combustion.

In order to alleviate any pillar failure risk and subsequent subsidence beneath the MNRL and other public infrastructure, LCO has identified the need to complete a work program involving the backfilling of remnant underground workings to provide long-term stability in select locations (Target Areas comprising two locations; Target Area 1 and Target Area 2) across the Liddell site.

## The Modification

LCO is seeking to modify DA 305-11-01 by way of a modification application (MOD 9) under section 4.55(1A) of the *Environmental Planning and Assessment Act 1979* to permit the targeted backfilling of remnant underground workings at Liddell.

MOD 9 proposes the backfilling of remnant underground workings across two Target Areas to provide long-term stability. This includes the use of grout (a cementitious mix of either coal ash or blended coal ash (i.e. materials which comply with the *Coal Ash Exemption 2014*, and are referred to as “fly ash” within the Modification Report) mixed with general purpose cement).

Grout will be delivered into the targeted underground workings via a series of boreholes to be installed. The boreholes and other surface disturbance activities associated with MOD 9 will occur within areas of existing and areas of approved surface disturbance at Liddell (Approved Disturbance Area).

MOD 9 generally proposes the following:

- › Construction and use of a temporary grout batching compound for each Target Area (batch plant to be relocated between Target Areas) with minor ancillary infrastructure on predominantly existing hardstand areas that have already been cleared and compacted;
- › Drilling of boreholes to access the former underground workings within the two Target Areas. Approximately 70 boreholes are expected to be required to undertake and monitor the filling of the underground workings. However, the final number of boreholes may change depending on the performance of backfilling activities. To avoid disturbance of areas outside of the Approved Disturbance Area at Liddell, LCO will drill angled holes (where required) to reach targeted workings underneath the MNRL corridor and other public infrastructure;
- › Pumping and emplacement of grout into the targeted underground workings;
- › Transportation of materials used for the activities (including those required for batching of grout onsite) via approximately 40 truck deliveries (i.e. 80 truck movements) per day generally transported to Liddell via highway routes; and
- › Decommissioning and rehabilitation of disturbed areas following the completion of works, including sealing of boreholes, decommission and removal of temporary infrastructure from the site, releveling and rehabilitation of drill pads and access tracks in accordance with Liddell's Rehabilitation Management Plan.

The proposed works are expected to take approximately 12 months to complete with an estimated contractor workforce of around 10 to 20 personnel.

Other than the works associated with the backfilling of select underground workings within the Target Areas, all other aspects of the approved operations will remain consistent with DA 305-11-01 (as modified).

Modifications sought under section 4.55(1A) must be substantially the same development for which the original consent was granted. In this instance, the relevant approval for the purpose of the comparison exercise required under section 4.55(1A) is the development approved by DA 305-11-01 as modified up to and including modification 7 (MOD 7), which was approved on 12 February 2019 (the Authorised Development). MOD 7 was the last modification approved under the now repealed section 75W of the EP&A Act (clause 3BA of Schedule 2 of the *Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017*).

The development as proposed to be modified by MOD 9 (including the changes approved by MOD 8) is considered to be substantially the same development as the Authorised Development, for the reasons set out in the Modification Report. Accordingly, with the minor environmental impacts identified within this Modification Report, it is available for MOD 9 to be considered and determined under section 4.55(1A) of the *Environmental Planning and Assessment Act 1979*.

## Environmental Assessment

This Modification Report includes an assessment of the potential environmental impacts of MOD 9 in accordance with applicable legislative requirements and relevant Government guidelines and policies. Where appropriate, the environmental assessments completed for this Modification Report have identified any further management and mitigation measures required to be implemented for the development.

A summary of the key environmental assessments completed for this Modification Report is provided in following sections.

## **Air Quality and Greenhouse Gas**

An Air Quality and Greenhouse Gas Assessment for MOD 9 was undertaken by Airen Consulting. Potential air quality impacts for MOD 9 were identified for the following activities: borehole drilling, wheel generated dust from vehicles delivering grout materials, and wind erosion from fly ash stockpiles and exposed areas.

The assessment identified that annual dust emissions from these activities (as PM<sub>10</sub>) are minimal, representing less than 2% of annual dust emissions associated with historical approved mining operations at Liddell. Consequently, MOD 9 will continue to meet the relevant criteria in Condition 16, Schedule 3 of DA 305-11-01. Standard management and mitigation measures outlined in Liddell's Air Quality Management and Monitoring Plan will be relied upon to control potential impacts.

The assessment calculated greenhouse gas (GHG) emissions associated with MOD 9 which demonstrates that Scope 1 and Scope 2 emissions will not exceed 25,000 tonnes of CO<sub>2</sub>-e in any financial year. GHG emissions below this threshold means that MOD 9 is not considered to be a 'large emitter' under the Environment Protection Authority's (EPA's) '*NSW Guide for Large Emitters: Guidance on How to Prepare a Greenhouse Gas Assessment as Part of the NSW Environmental Planning Processes*' (GHG Guide). The GHG emissions from MOD 9 are unlikely to result in a material contribution to the effects of climate change within the locality. The GHG management measures described within the existing Air Quality Management and Monitoring Plan at Liddell will continue to be applied to manage impacts from MOD 9 activities.

## **Acoustics**

An Acoustics Assessment for MOD 9 was completed by Bridges Acoustics. The Acoustics Assessment concluded that environmental noise from MOD 9 is unlikely to cause any appreciable changes to the currently approved noise levels at any privately owned receptor. Predicted noise levels from MOD 9 alone are expected to remain at least 4 dBA below the relevant DA 305-11-01 criteria under simultaneous worst-case operating and weather conditions. This ensures that MOD 9 can be undertaken in conjunction with other mine closure and rehabilitation activities currently being undertaken at Liddell.

The activities proposed by MOD 9 are expected to contribute to cumulative noise levels at Liddell in conjunction with other mine closure and rehabilitation activities. Assuming that the current mine closure and rehabilitation activities produce a noise level of 33 LAeq,15min, noise from MOD 9 activities can produce no more than 2 LAeq,15min under prevailing weather conditions. The assessment found that MOD 9 will contribute less than 2 LAeq,15min which was determined to represent a negligible change in noise levels that will unlikely be perceptible at any receptor.

Consequently, no additional noise mitigation measures are considered necessary. MOD 9 activities will be managed in conjunction with approved mine closure and rehabilitation works, in accordance with the Liddell Noise Monitoring Program.

## Groundwater

A Groundwater Assessment focussing on the potential impacts to groundwater as a result of MOD 9 was completed by James Tomlin Consulting. The potential risks to groundwater associated with utilising grout to backfill the former underground workings were due to impacts on water quality and groundwater flows.

The Groundwater Assessment adopted a qualitative approach using the existing conceptual model developed for Liddell and surrounds and a MOD 9 specific 'source-pathway-receptor model' to assess the potential flow on impacts of grouting activities on the groundwater regime. In the context of the 'source-pathway-receptor model', the 'source' is the grout materials to be emplaced into the Target Areas within the Liddell seam. The 'pathway' is associated with the movement of water from the location where the source is injected (i.e. Target Areas) towards the South Cut final void as confirmed by pit floor contours.

It is noted that both Target Areas are within the Liddell dirty-water catchment and within the catchments of the final voids within the South Cut and Entrance Pit. Both voids have been designed and approved as long-term groundwater sinks. Accordingly, the only possible 'receptor' for potential impact from MOD 9 is identified to be the water body that is being formed within the South Cut void.

The Groundwater Assessment found that the risk of the grout affecting groundwater alkalinity and water quality is low. This is due to the former underground workings within the Target Areas currently being dry. This will allow the grout to cure before any potential future flooding of the former underground workings occurs, substantially reducing the risk for any water flows to be exposed to the alkalinity of the uncured grout materials.

The flow direction of any water that may come into contact with grout within both Target Areas is towards the South Cut open void (the receptor). There is no direct short-term connectivity between the South Cut void and the surrounding groundwater regime, so local groundwater quality is not considered at risk.

The potential for the grouting works to impact on groundwater flows within the regional hydrological regime was also considered within the Groundwater Assessment. Given the localised nature of the works, impacts to the flow of groundwater at the regional scale will be minimal and is expected to circumvent the grouted areas. This means there will be negligible impacts on the broader groundwater regime and on the long-term recovery of this system.

MOD 9 is not expected to result in impacts that exceed the Level 1 Minimal Impact thresholds under the NSW Aquifer Interference Policy. Water quality thresholds will not be breached and beneficial use of water in the final voids will remain unchanged. The proposed grouting does not require extraction of groundwater and therefore no water licences will need to be accounted for.

In summary, MOD 9 has been assessed to present a low risk of impact to water quality and groundwater flows, will adhere to all relevant policy requirements, and will not compromise the established beneficial use of the affected waters.

The Water Management Plan for Liddell will be updated to include monthly pH monitoring of the South Cut void waters during the grouting period and for a period of 12 months following completion of works. A trigger action response plan will also be incorporated to allow for an investigation if three consecutive samples exceed the 95th percentile of the baseline void water quality.

## Traffic

A Transport Impact Assessment has been completed by PDC Consultants for MOD 9. MOD 9 will generate around 80 daily truck movements (40 deliveries) and associated light vehicle movements associated with the 10-20 contractors proposed. The Transport Impact Assessment concludes that the combined workforce for MOD 9 and existing closure and rehabilitation activities combined is, well below Liddell's approved workforce for mining operations of 460 workers.

The Traffic Impact Assessment undertaken for Liddell Modification 3 (Parsons Brinckerhoff, 2006) identified the distribution of vehicle movements associated with Liddell workers to be 78% to the east, towards Singleton, and 22% to the west, towards Muswellbrook. Liddell's workforce at peak operations (i.e. 460 workers) were noted in Modification 5 (Parsons Brinckerhoff, 2013). Based on the 460 workers when Liddell was fully operational, this would result in potentially up to 920 daily vehicle trips of which 718 daily vehicle movements would be to/from the east towards Singleton and 202 daily vehicle movements would be to/from the west towards Muswellbrook, via the New England Highway.

The 20 MOD 9 workers along with the on-site workforce associated with existing activities is expected to generate approximately 170 daily vehicle movements from Liddell, which is substantially lower than the estimated 920 daily trips approved at Liddell's peak operations. Consequently, worker and contractor traffic associated with MOD 9 remains well within those approved for peak operations at Liddell.

The proposed 80 daily truck movements for MOD 9 are expected to be spread throughout the work day with up to eight movements in a peak hour. These truck movements are generally consistent with those assessed for Modification 3 to DA 305-11-01 for mining operations associated with Liddell.

Furthermore, the proposed truck movements for MOD 9 remain well within Liddell's existing approval of 114 daily truck movements for transporting 'old tailings' along the New England Highway.

Overall, the Transport Impact Assessment confirmed that MOD 9 will generate significantly less traffic movements than the peak traffic generation previously assessed and approved for Liddell's mining operations. Combined with current mine closure and rehabilitation activities, cumulative traffic impacts will remain below the approved conditions, and the level of service at the Old New England Highway / New England Highway intersection (primary access point for MOD 9 vehicles) is expected to remain unchanged.

The existing parking facilities onsite at Liddell has been assessed to be sufficient to accommodate the 10 –20 contractors proposed under MOD 9, with formal parking at the Administration Building which has over 200 car parking spaces and informal parking near the batching plants and grouting area.

LCO will continue to manage impacts on traffic in accordance with existing measures implemented at Liddell.

## Ecology

The Ecological Assessment was undertaken within a defined Study Area which encompasses 12.92 ha of land at Liddell where MOD 9 activities may result in surface disturbance (such as borehole drilling activities, proposed infrastructure and some haul roads). The MOD 9 Study Area is located within the Approved Disturbance Area at Liddell.

The Study Area comprises:

- › A 0.1 ha of native vegetation already approved for disturbance under Modification 5 to DA 305-11-01, with impacts to this vegetation avoided or minimised by MOD 9 where possible;
- › A 6.57 ha area consists primarily of exotic vegetation, dominated by aggressive exotic grasses with few hardy common native groundcover species present; and
- › The remaining 6.25 ha is largely unvegetated, with only sparse exotic grasses present along haul roads.

The Ecological Assessment concluded that disturbance proposed under MOD 9 will not result in any additional biodiversity impacts beyond those already approved under DA 305-11-01 (as modified) and therefore will not have any significant impact on biodiversity values. All activities associated with MOD 9 will occur within the Approved Disturbance Area at Liddell.

The vegetation proposed to be disturbed is predominantly exotic in nature, with limited ecological value, comprising few native species. Habitat quality across the Study Area is low, with limited connectivity to remnant vegetation and minimal suitability for threatened flora and fauna. The presence of young shrubs, exotic pastures, and ongoing site operations further reduce ecological function and potential to support amphibians or provide suitable habitat for denning or breeding. The likelihood of threatened flora occurring is very low due to historical land use and existing soil conditions.

Biodiversity management has been a key consideration in the planning of MOD 9. The planned drilling approach for MOD 9 was revised to prioritise avoidance measures. Initially, some boreholes were planned within the MNRL corridor, overlying the workings proposed to be filled. Following further evaluation, the boreholes are now proposed to be installed wholly within the Approved Disturbance Area at Liddell, utilising angled drilling, where required to target workings. This avoids the need to disturb areas outside of Liddell's Approved Disturbance Area. LCO is also committed to siting the boreholes in areas to avoid or minimise disturbance to woodland species within the 0.1 ha of native vegetation where possible. All disturbance resulting from MOD 9 activities will be rehabilitated in accordance with Liddell's Rehabilitation Management Plan.

## **Other Environmental Aspects**

The impacts of MOD 9 to other environmental aspects were considered as part of this Modification Report. Given that MOD 9 will occur entirely within the Approved Disturbance Area at Liddell, there are no significant impacts anticipated on these environmental values.

Liddell's existing environmental management plans and procedures provide the ongoing monitoring and management of environmental impacts at Liddell and will be implemented for managing impacts associated with MOD 9.

## Justification

The primary objective of MOD 9 is to backfill sections of remnant underground workings at Liddell to provide long-term stability for the overlying MNRL and other public infrastructure. The backfilling of the remnant underground workings will have the following benefits:

- › Provide buttressing to coal pillars and structural support to the overlying strata and infrastructure for the long-term;
- › Reduce the potential for oxygen ingress within the targeted underground workings and minimise the risk of external influences such as spontaneous combustion; and
- › Assist in achieving the rehabilitation objectives for Liddell such as ensuring the "*Mine site (as a whole) to be safe, stable and non-polluting*".

The proposed outcomes of MOD 9 are environmentally beneficial and assist LCO in meeting its rehabilitation objectives. A key aspect of MOD 9 is that all surface disturbance will be undertaken entirely within the Approved Disturbance Area at Liddell. Comprehensive environmental assessments of key environmental risks conclude that potential impacts are minimal and can be managed using existing environmental management practices at Liddell, updated as required for MOD 9.

In circumstances where the environmental impacts have been assessed to be minimal, the overall benefits of MOD 9 (protection of infrastructure and achievement of rehabilitation objectives) are considered to outweigh any potential environmental impacts.

The development as proposed to be modified by MOD 9 (including the changes approved by MOD 8) is considered to be substantially the same development as the Authorised Development, and with the minor environmental impacts identified within this Modification Report, it is available for MOD 9 to be considered and determined under section 4.55(1A) of the *Environmental Planning and Assessment Act 1979*.

# Contents

1.	Introduction	13
1.1	Background	13
1.2	Modification Overview	13
1.3	Proponent	16
1.4	Document Purpose	16
1.5	Document Structure	16
2.	Strategic Context	17
2.1	Natural Environment	17
2.1.1	Topography and Natural Features	17
2.1.2	Land Use	17
2.2	Land Ownership	19
2.3	Planning Constraints	19
2.3.1	Flood Prone Land	19
2.3.2	Bushfire Prone Land	19
2.3.3	Mine Subsidence Districts	19
2.3.4	Other Matters	20
2.4	Planning Considerations	20
2.4.1	Government Policies and Plans	20
2.4.2	Cumulative Impacts	21
2.4.3	Planning Agreements	21
2.4.4	Rehabilitation and Mine Closure	21
3.	Modification Description	23
3.1	Overview	23
3.2	Grout Batching Compound	29
3.3	Borehole Drilling	29
3.4	Filling of Workings	30
3.5	Transportation	30
3.6	Decommissioning and Rehabilitation	30
3.7	Workforce and Operational Hours	30

3.8	Modification Justification	31
3.9	Alternatives Considered	31
3.9.1	Do Nothing	31
3.9.2	Backfilling with Tailings	31
3.9.3	Preferred Option – MOD 9	31
4.	Statutory Context	32
4.1	Overview	32
4.2	Key Regulatory Matters	35
4.2.1	Power to Modify	35
5.	Stakeholder Engagement	37
5.1	Regulatory Consultation	37
5.2	Community Consultation	39
6.	Impacts, Management and Mitigation	40
6.1	Air Quality and Greenhouse Gas	40
6.1.1	Background	40
6.1.2	Methodology	40
6.1.3	Assessment of Impacts	41
6.1.4	Mitigation and Management	43
6.2	Acoustics	43
6.2.1	Background	43
6.2.2	Methodology	43
6.2.3	Assessment of Impacts	45
6.2.4	Mitigation and Management	45
6.3	Groundwater	46
6.3.1	Background	46
6.3.2	Methodology	46
6.3.3	Assessment of Impacts	47
6.3.4	Mitigation and Management	48
6.4	Traffic	49
6.4.1	Background	49
6.4.2	Methodology	49
6.4.3	Assessment of Impacts	50

6.4.4	Mitigation and Management	51
6.5	Ecology	51
6.5.1	Background	51
6.5.2	Methodology	51
6.5.3	Assessment of Impacts	52
6.6	Other Environmental Aspects	54
7.	Merit Evaluation	58
7.1	Ecologically Sustainable Development	58
7.2	Justification for the Modified Project	59
8.	References	61
9.	Abbreviations	62

## Tables

Table 1	Comparison of MOD 9 and MOD 8 to the Approved Development	24
Table 2	Relevant Legislative Provisions	32
Table 3	Regulatory Consultation	37
Table 4	GHG Source Inclusions and Exclusions	41
Table 5	Estimated Fugitive Dust Emissions for MOD 9	41
Table 6	Estimated GHG Emissions from MOD 9	42
Table 7	Noise Impact Assessment Criteria dB(A) (source DA 305-11-01, as modified)	44
Table 8	Nearest Privately-Owned Receptors and Noise Criteria	44
Table 9	Calculated Noise Levels to Receptors, LAeq,15min	45
Table 10	Study Area Extent	51
Table 11	Study Area Vegetation Extent	52
Table 12	BioNET Wildlife Atlas and PMST Database Search Results	53
Table 13	Other Environmental Aspects	55
Table 14	Principles of Ecologically Sustainable Development	58




## Figures

Figure 1	Regional Locality	14
Figure 2	Conceptual Modification Layout	15
Figure 3	Land Ownership	18

## Appendices

Appendix A	Air Quality and Greenhouse Gas Assessment
Appendix B	Acoustic Assessment
Appendix C	Groundwater Assessment
Appendix D	Transport Impact Assessment
Appendix E	Ecological Assessment

Document issue approval			
<b>Title</b>	Liddell Coal Operations Modification 9		
<b>Client</b>	Liddell Coal Operations Pty. Limited		
<b>Status</b>	Final for Submission	<b>Project/document no.</b>	3325GLEN
<b>Date</b>	December 2025	<b>Revision no.</b>	05

Approvals				
	Name	Position	Signature	Date
<b>Prepared by</b>	Eiko Fuimaono	Environmental Scientist		18/12/2025
<b>Reviewed by</b>	Nathan Cooper	Team Leader – Environment & Planning		18/12/2025
<b>Approved by</b>	Nathan Cooper	Team Leader – Environment & Planning		23/12/2025

Distributions				
Organisation	Attention	Hard copies	Electric copies	Actioned
Liddell Coal Operations Pty. Limited	Sean Pigott	0	1	NC

To be initialled and dated by the person who actions the issue of the documents.

#### DISCLAIMER

Xenith Consulting Pty Ltd makes no representation, undertakes no duty, and accepts no responsibility to any third party who may use or rely upon this document, or the drawings, information and data recorded in this document.

We do not accept responsibility or liability for losses arising from the assessment and determination of the Project, or if approved, the reliance on this document for any other purpose.

Any operating or capital cost estimation (as relevant) is current as at the date of estimation only. The estimation assessed herein may change significantly and unexpectedly over a relatively short period (including as a result of general market movements and factors specific to the particular mine, project or deposit). We do not accept responsibility or liability for losses arising from such subsequent changes in cost.

# 1. Introduction

*This section provides a background to the Modification, introduces the proponent and explains the purpose and structure of this Modification Report.*

## 1.1 Background

Liddell Coal Operations Pty. Limited (LCO) operates the Liddell Coal Operations (Liddell) in the Upper Hunter Region of New South Wales (NSW). Liddell is located at Ravensworth directly east of Lake Liddell, approximately 25 kilometres (km) north west of Singleton, and 26 km south east of Muswellbrook (see **Figure 1**). LCO is a subsidiary of Glencore Coal Pty Limited (Glencore).

Liddell operates in accordance with Integrated State Significant Development Consent DA 305-11-01 originally granted on 20 November 2002. DA 305-11-01 was granted by the then Minister for Planning under the former sections 76(A)9 & 80 of Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). DA 305-11-01, as originally granted, facilitated the continued open cut operations at Liddell as well as consolidating previous development approvals for open cut and underground mining operations into a single consent. DA 305-11-01 has been modified on eight separate occasions to date.

DA 305-11-01 (as modified) enables mining operations to be undertaken until 31 December 2028 and water and tailings management activities until 31 December 2050 (or as otherwise required for rehabilitation requirements). Active mining operations at Liddell have concluded, with the last coal being mined in 2023. LCO is currently progressing mine closure and rehabilitation works.

As part of the mine closure planning process, LCO has identified the need to complete a work program involving the backfilling of remnant underground workings to provide long-term stability in select locations across the Liddell site.

## 1.2 Modification Overview

Rehabilitation efforts at Liddell are guided by the conditions set out in DA 305-11-01 (as modified). Notably, Schedule 3, Condition 37 of DA 305-11-01 includes the rehabilitation objectives for Liddell, including for the “*mine site (as a whole) to be safe, stable and non-polluting*”. LCO’s mine closure activities are being planned to achieve the rehabilitation objectives at Liddell.

Liddell has a long history of underground mining with some of the remnant first workings situated beneath the Main Northern Rail Line (MNRL) and other public infrastructure. An assessment of these workings indicates that the current pillar geometry is long-term stable. However, pillar area reduction may occur overtime as a result of external influences, such as spontaneous combustion.

In order to alleviate any pillar failure risk and subsequent subsidence beneath the MNRL and other public infrastructure, LCO is proposing the targeted backfilling of remnant underground workings to provide long-term stability. This includes the use of grout (a cementitious mix of either coal ash or blended coal ash (i.e. materials which comply with the *Coal Ash Exemption 2014*, and are referred to as “fly ash” throughout the remainder of this Modification Report) mixed with general purpose cement). The select historical underground workings that are to be targeted are referred to in this Modification Report as Target Areas, comprising two locations; Target Area 1 and Target Area 2 as shown in **Figure 2**.

Proposed surface disturbance activities associated with MOD 9 will occur within areas of existing and areas of approved surface disturbance at Liddell (Approved Disturbance Area). **Figure 2** illustrates the Approved Disturbance Area, along with the indicative locations where the proposed surface disturbance activities will take place (Proposed Disturbance Area).

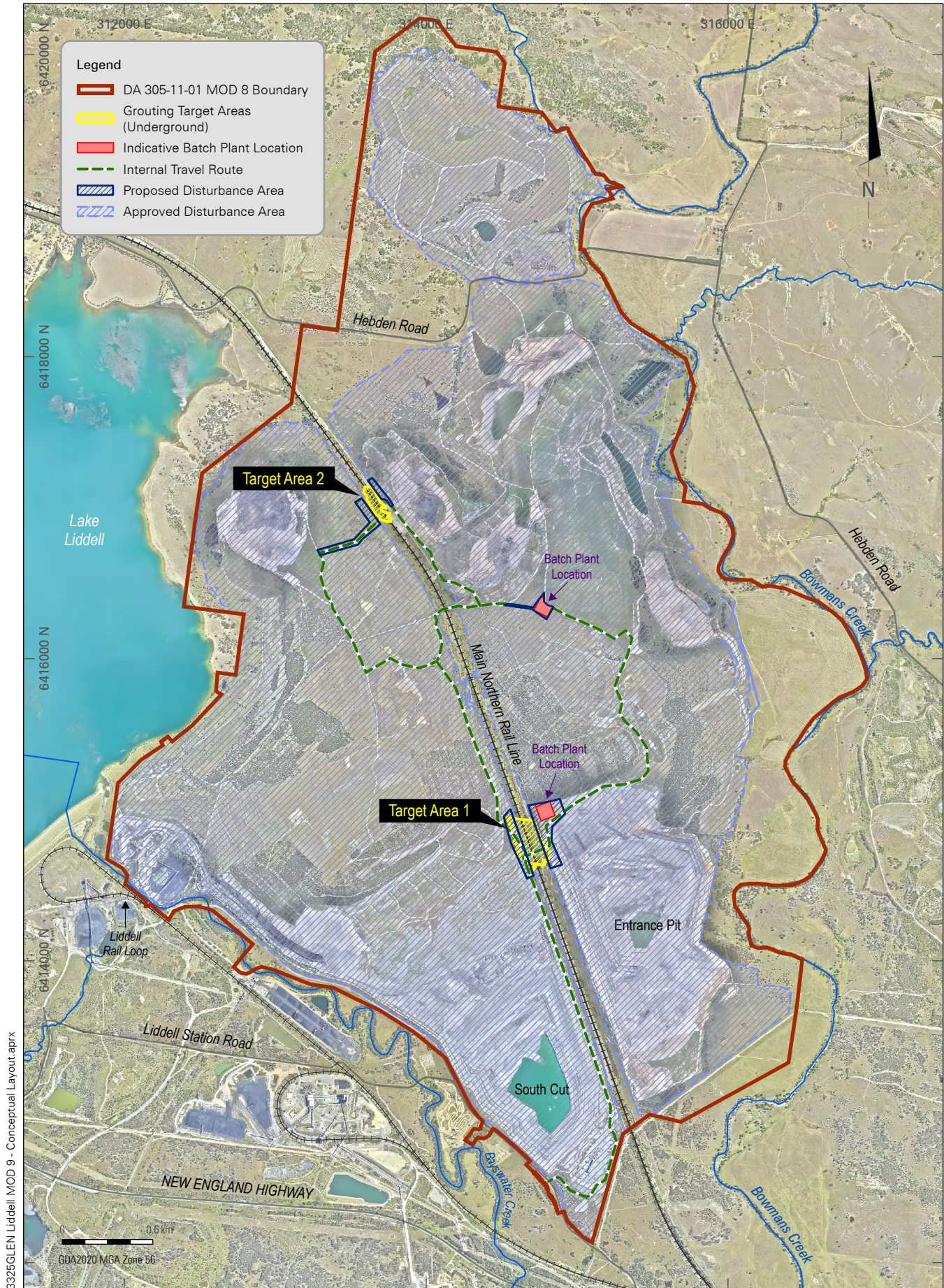


3325GLEN Liddell MOD 9 - Regional Locality.aprx

LIDDELL COAL OPERATIONS

Regional Locality

FIGURE 1



3325GLEN Liddell MOD 9 - Conceptual Layout.aprx

LCO is seeking minor amendments to DA 305-11-01 by way of a modification application under section 4.55(1A) of the EP&A Act to permit works required to backfill select underground workings within the Target Areas (MOD 9).

Other than the works associated with the targeted backfilling of remnant underground workings, all other aspects of the approved operations will remain consistent with DA 305-11-01 including mining methods, maximum production rate, disturbance footprints and ancillary activities.

The Target Areas and temporary grout batching compound locations for MOD 9 are conceptually illustrated with approved operations in **Figure 2**. Further details of MOD 9 are provided in **Section 3**.

## 1.3 Proponent

The contact details for the proponent are provided below:

### **Liddell Coal Operations Pty. Limited**

PO Box 7

SINGLETON NSW 2330

Phone: (02) 6570 9947

<https://www.glencore.com.au/operations-and-projects/coal/current-operations/liddell-coal-operations>

## 1.4 Document Purpose

This Modification Report has been prepared by Xenith Consulting Pty Ltd (Xenith) on behalf of LCO to support the application to modify DA 305-11-01 (MOD9) under section 4.55 of the EP&A Act.

This Modification Report has been prepared to satisfy section 100 of the *Environmental Planning and Assessment Regulation 2021* (EP&A Regulation) and with consideration of the '*State significant development guidelines – preparing a modification report*' (DPE, 2022).

## 1.5 Document Structure

This Modification Report is structured as follows:

- › **Section 1** introduces MOD 9 and outlines the background and purpose of this Modification Report;
- › **Section 2** outlines the environmental and planning context for MOD 9;
- › **Section 3** provides a detailed description of the activities proposed by MOD 9, including the alternatives considered;
- › **Section 4** summarises the regulatory framework applicable to MOD 9;
- › **Section 5** summarises the stakeholder engagement conducted for MOD 9, the issues raised during this process and where they have been addressed within this Modification Report;
- › **Section 6** discusses the potential environmental impacts of MOD 9 and the proposed management and mitigation measures to minimise these impacts;
- › **Section 7** summarises the conclusions from the environmental assessments completed and evaluates the merits of MOD 9;
- › **Section 8** lists the reference materials used in the preparation of this Modification Report; and
- › **Section 9** defines the abbreviations used in this Modification Report.

## 2. Strategic Context

*This section provides the strategic context that is relevant to MOD 9, including the relevant environmental and key planning considerations.*

### 2.1 Natural Environment

#### 2.1.1 Topography and Natural Features

The topography within the vicinity of Liddell is generally characterised by undulating to hilly terrain, extending to lower areas associated with waterways and drainage lines. Significant alterations to the natural landform within and surrounding the approved mining operations at Liddell have occurred as a result of progressive open cut mining activities undertaken since the early 1950s.

Liddell is situated within the catchments of Bowmans and Bayswater Creeks, along with their minor tributaries. These watercourses flow predominantly in a southerly direction, ultimately discharging into the Hunter River.

#### 2.1.2 Land Use

Liddell is located within an industrial setting, with coal mining and associated power generation being the dominant land uses. Mining operations within the vicinity of Liddell include:

- › Ravensworth Operations to the south;
- › Ravensworth Underground Mine and Ravensworth Central Coal Processing facility to the south west; and
- › The Mount Owen Complex, incorporating Mount Owen, Ravensworth East and Glendell mining operations (MGO), to the east.

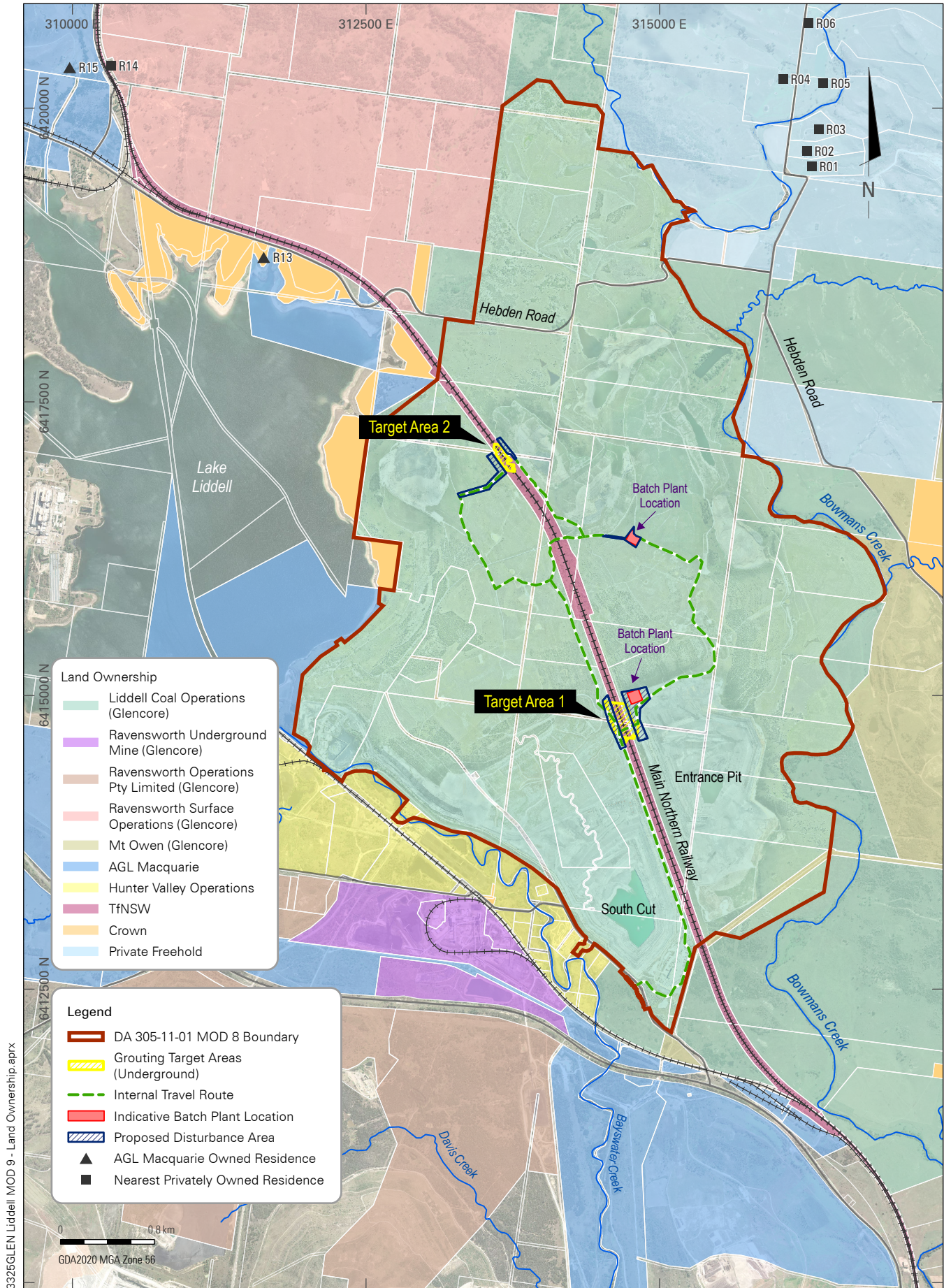
Ashton Coal, Integra Underground Mine (Integra) and Hunter Valley Operations are mining operations within the wider surrounding area.

Liddell also forms part of a mining precinct known as the Greater Ravensworth Area (GRA), which also includes Integra, MGO and Ravensworth Operations. The operations within the GRA are managed by subsidiaries of Glencore.

Lake Liddell lies immediately west of Liddell. The former AGL Liddell Power Station (currently in its decommissioning phase) is located on the western bank of Lake Liddell and the AGL Bayswater Power Station further to the south west, as depicted in **Figure 1**.

The MNRL traverses through Liddell from north west to south east. The New England Highway (NEH) is located to the south of Liddell and together with the MNRL forms the major transport corridors in the locality.

The remaining land within the vicinity of Liddell is predominantly used for grazing purposes with a small number of privately owned rural residences located to the north east and north west. Land use within and immediately surrounding Liddell is shown on **Figure 3**.



3325GLEN Liddell MOD 9 - Land Ownership.aprx

LIDDELL COAL OPERATIONS

LIDDELL  
GLENCORE



Land Ownership

**FIGURE 3**

## 2.2 Land Ownership

Land ownership within and surrounding Liddell in relation to MOD 9 is shown on **Figure 3**.

LCO own the land which is required for access for MOD 9, albeit the target underground workings are largely situated beneath land owned by Transport for New South Wales (TfNSW) forming the MNRL corridor, which is controlled by the Australian Rail Track Corporation (ARTC). The proposed borehole drilling activities and associated infrastructure will be sited wholly within Liddell's approved development consent boundary (DA Boundary) and existing boundary of mining lease 1597 (expires on 5 November 2028). The boreholes and other surface disturbance activities associated with MOD 9 will occur within the Approved Disturbance Area and on land owned by LCO.

## 2.3 Planning Constraints

### 2.3.1 Flood Prone Land

Liddell is not located within any flood planning areas identified under the *Singleton Local Environmental Plan 2013* (Singleton LEP). *The Muswellbrook Local Environmental Plan 2009* (Muswellbrook LEP) does not designate any flood planning areas.

All activities associated with MOD 9 will be confined entirely within the approved DA Boundary for Liddell and will not encroach upon any flood-prone land. MOD 9 does not involve any major activities that would alter existing flood regimes, such as landform elevation changes or the construction of significant infrastructure.

As such, no further assessment of flood-related impacts is considered necessary.

### 2.3.2 Bushfire Prone Land

As is typical for rural areas, areas of mapped bushfire prone land are present within the approved DA boundary for Liddell.

The bushfire prone land at Liddell is Vegetation Category 3, which is consistent with the land being predominantly grassland.

Chapter 8.3.6 of *'Planning for Bush Fire Protection'* (NSW Rural Fire Service, 2019) (PBFP) provides guidance regarding bushfire protection measures for mining development. PBFP recommends that an asset protection zone (APZ) of at least 10 m should be established around all infrastructure associated with mining. An APZ is a buffer zone with minimal fuel zones (i.e. vegetation). Temporary infrastructure which is proposed for MOD 9 (as described in **Section 3**) will be sited within areas of hardstand, already cleared and compacted. Furthermore, MOD 9 does not propose any activities that increase the risk of fires igniting. Consequently, MOD 9 will be consistent with the bushfire protection measures under the PBFP guidance.

### 2.3.3 Mine Subsidence Districts

Liddell is located within the Patrick Plains Mine Subsidence District. Section 21 of the *Coal Mine Subsidence Compensation Act 2017* (CMSC Act) states:

*21 (1) A person must not carry out work in connection with the erection or alteration of an **improvement** within a mine subsidence district, except in accordance with the approval of the Chief Executive...*

The definition of "improvement" under the CMSC Act includes "any building or work erected on land" and "infrastructure whether above or below the surface of the land". Therefore, the approval of the Chief Executive of Subsidence Advisory NSW may be required in accordance with section 22 of the CMSC Act prior to construction of temporary infrastructure described in **Section 3**.

Section 4.42 of the EP&A Act provides that an approval under section 22 of the CMSC Act cannot be refused if it is necessary for the carrying out of an approved State Significant Development (SSD).

### 2.3.4 Other Matters

The Environment Protection Authority (EPA) maintains a register of contaminated land in NSW. There are 12 notified contaminated sites located in the Muswellbrook Local Government Area (LGA) and 6 in the Singleton LGA. Of the 18 sites on record across the two LGAs, 16 are noted as '*Regulation under the Contaminated Land Management Act 1997 (CLM Act) not required*' with the remaining two sites (located in the Singleton LGA) requiring regulation under the CLM Act. These two sites are not located near Liddell.

MOD 9 is not located on or near any land mapped as a landslide risk area.

## 2.4 Planning Considerations

### 2.4.1 Government Policies and Plans

#### 2.4.1.1 Climate Change Policy

The NSW EPA has a critical role in protecting the environment from climate related threats and delivering appropriate actions to assist in achieving net zero emissions in NSW by 2050. The EPA's Climate Change Policy (CCP) outlines the statutory objectives to protect the environment and reduce risks to human health (NSW EPA, 2023). The CCP aims to provide clear objectives and guidelines to ensure environmental protection from climate change in NSW. The policy adopts, supports, and builds on the NSW Government's overarching climate change objectives.

The objectives of the CCP are:

- › To maximise the economic, social, and environmental wellbeing of NSW in the context of climate change;
- › To reduce greenhouse gas emissions (GHG) in accordance with the NSW Governments net zero targets; and
- › To make NSW more adaptable to a changing climate.

#### 2.4.1.2 Greenhouse Gas Assessment Guide

In January 2025, the NSW EPA published the guidelines entitle '*NSW Guide for Large Emitters: Guidance on How to Prepare a Greenhouse Gas Assessment as Part of the NSW Environmental Planning Processes*' (GHG Guide) which outlines the climate change assessment requirements for '*large emitters*' (NSW EPA, 2025). The GHG Guide applies to proposed developments that satisfy the following criteria for a '*large emitter*':

- › The project proposal requires development assessment and approval, or a change to an approval, under the EP&A Act;
- › The project involves one or more scheduled activities under Schedule 1 of the *Protection of the Environment Operations Act* (POEO Act) and/or will be carried out at an existing licensed premises; and
- › The project is likely to emit 25,000 tonnes (t) or more of Scope 1 and 2 emissions carbon dioxide equivalent (CO<sub>2</sub>-e) in any financial year during the operational life of the project (based on planned operational throughput and as designed).

In the case of modifications, the 25,000 t threshold applies to any additional emissions over and above those of the existing development.

An Air Quality and Greenhouse Gas Assessment (AQGHG Assessment) was completed to determine whether GHG emissions from MOD 9 would exceed 25,000 t of scope 1 and 2 emissions CO<sub>2</sub>-e in any financial year, and consequently whether the criteria outlined in the GHG Guide would apply. The findings of the AQGHG Assessment are presented in **Section 6.1**.

### 2.4.1.3 Commonwealth NGER Act & Safeguard Mechanism

The Australian Government has employed numerous policies and legislative requirements that aim to achieve a reduction in GHG emissions over time. The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) Safeguard Mechanism is the Australian Government's scheme for reducing emissions from large industrial facilities within Australia. Established under the *National Greenhouse and Energy Reporting Act 2007* (NGER Act), the policy requires facilities that emit upwards of 100,000 t CO<sub>2</sub>-e of Scope 1 GHG emissions (in a financial year), to keep their net emission levels at or below its baseline.

Reforms to the Safeguard Mechanism took effect from 1 July 2023. Under these reforms, new baseline emissions numbers ('baselines') for designated large facilities are set on a declining trajectory aligned with achieving Australia's emissions reduction targets set out in the Climate Change Act 2022 and its Nationally Determined Contribution (NDC) under the Paris Agreement. The decline rate for Safeguard baselines is currently 4.9% per year to 2030, followed by 3.285% per year thereafter.

LCO (as part of the Glencore corporate reporting requirements) reports GHG emissions in accordance with the NGER Act each financial year. Liddell has previously been designated a Safeguard facility as it has previously emitted more than 100,000 t of CO<sub>2</sub>-e of Scope 1 emissions within a financial year. However, in the 2023/2024 financial year, following the cessation of mining operations, Scope 1 emissions from the facility decreased significantly, with a total of 20,057 t of CO<sub>2</sub>-e reported at the end of the financial year. Consequently, Liddell is no longer classified as a Safeguard facility.

As noted in **Section 2.4.1.2**, an AQGHG Assessment was undertaken to estimate GHG emissions from MOD 9 with findings of the Assessment provided in **Section 6.1**.

## 2.4.2 Cumulative Impacts

Following the cessation of mining operations at Liddell in 2023, site activities have significantly reduced to mine closure and rehabilitation activities. Accordingly, the approach in the assessment of potential cumulative impacts under MOD 9 has primarily focussed on evaluating the proposed activities in the context of the currently approved operations, taking into account the substantial reduction in activity at Liddell since mining operations concluded. The assessment has focused on key environmental risks where cumulative impacts are most relevant, particularly in relation to air quality and GHG emissions, noise, and traffic.

Potential impacts associated with MOD 9 are anticipated to be negligible in the context of the approved development. Environmental impact assessments were undertaken to identify and evaluate any potential impacts, with the results of these assessments presented in **Section 6**.

## 2.4.3 Planning Agreements

LCO has previously entered into Planning Agreements with both the Singleton Council and Muswellbrook Shire Council in accordance with Schedule 2, Condition 13 and 14 of DA 305-11-01.

MOD 9 is not expected to affect public infrastructure or services and as such, no further development contributions are warranted.

## 2.4.4 Rehabilitation and Mine Closure

With Liddell in its closure and rehabilitation phase, the implementation of the Liddell Rehabilitation Management Plan (RMP) to ensure rehabilitation objectives are achieved is the main focus of site activities.

The RMP has been prepared to satisfy conditions of the relevant mining leases for Liddell and relevant conditions of DA 305-11-01.

The RMP was initially prepared in accordance with the Resources Regulator (2021) version of the Form and Way Rehabilitation Management Plan for Large Mines, with the RMP reviewed and updated as required to ensure ongoing compliance and alignment with regulatory requirements. It sets out the approved rehabilitation outcomes for Liddell, including rehabilitation objectives and completion criteria and final landforms, risks to rehabilitation and proposed rehabilitation activities (LCO, 2024). In 2024, LCO secured NSW Government signoff on 52 hectares (ha) of mine rehabilitation at Liddell.

The relevant conditions relating to mine closure, final landform and post mining land use for Liddell are under Schedule 3, Conditions 37 – 39 of DA 305-11-01. Table 8 of Schedule 3, Condition 37 of DA 305-11-01 provides the site's rehabilitation objectives. Of particular relevance to MOD 9 is the rehabilitation objective for the "*mine site (as a whole) to be safe, stable and non-polluting*".

As outlined in **Section 1.2**, Liddell has a long history of underground mining with remnant first workings situated beneath the MNRL and other public infrastructure. An assessment of these workings indicates that the current pillar geometry is long-term stable. However, pillar area reduction may occur overtime as a result of external influences such as spontaneous combustion.

MOD 9's proposed backfilling program will provide long-term stability to select underground workings (first workings) and will assist in achieving the rehabilitation objectives for Liddell such as ensuring the "*mine site (as a whole) to be safe, stable and non-polluting*".

## 3. Modification Description

*This section provides a detailed description of MOD 9. It also provides a justification for these changes and discussions on the alternatives considered.*

### 3.1 Overview

LCO seeks to modify DA 305-11-01 to facilitate the targeted backfilling of remnant underground workings situated beneath the MNRL and other public infrastructure to provide long-term stability.

Section 4.55 of the EP&A Act governs the modifications of approvals. For a proposal to constitute a modification rather than a new development, it must satisfy the “substantially the same development” test. DA 305-11-01 was previously modified under the former provisions of section 75W (under Part 3A) of the EP&A Act.

In accordance with clause 3BA(6) of Schedule 2 of the *Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017* (EP&A Savings & Transitional Regulation 2017), which relevantly states:

*(6) "In the application of section 4.55(1A) or (2) or 4.56(1) of the Act to the following development, the consent authority need only be satisfied that the development to which the consent as modified relates is substantially the same development as the development authorised by the consent (as last modified under section 75W):*

*(a) development that was previously a transitional Part 3A project whose approval was modified under section 75W*

*(b) development that was taken to be an approved project pursuant to clause 8J of the [Environmental Planning and Assessment Regulation 2000](#) and whose consent was modified under section 75W.”;*

the development that the “substantially the same development” test is applied against is the development, as last modified under the former section 75W, being MOD 7 to DA 305-11-01, which was granted on 12 February 2019. Following the approval of MOD 7, DA 305-11-01 was modified on 15 May 2023 to allow for operational and economic efficiencies across the operations by facilitating more efficient water and tailings transfers, and to enable additional tailings emplacement within the South Cut Void at Liddell Coal Operations in order to minimise the overall size and depth of the final void (MOD 8).

**Table 1** below provides an overview of the key aspects of MOD 9 and the changes approved by MOD 8, as compared to the Authorised Development as modified up to and including MOD 7.

As outlined in the table and explained in **Section 4.2.1**, the activities to be undertaken are generally consistent with the activities permitted under the Authorised Development, there are no changes to the development footprint as a result of either MOD 8 or the proposed MOD 9 and all surface disturbance works will be undertaken within the Approved Disturbance Area.

For these reasons, amongst others, the development as proposed to be modified by MOD 9 (including the changes approved by MOD 8) is considered to be substantially the same development as the Approved Development.

**Table 1 Comparison of MOD 9 and MOD 8 to the Approved Development**

<b>DA 305-11-01 Aspect</b>	<b>Authorised Development (DA 305-11-01 as modified up to MOD 7)</b>	<b>MOD 8 to DA 305-11-01 (granted on 15 May 2023)</b>	<b>The Proposed Modification (MOD 9)</b>
<b>Land Use</b>	Continued Open Cut Coal mining operations at Liddell Colliery and associated activities.	No change.	No change. Although it is noted that active mining operations have ceased at Liddell with the site now in the closure phase.
<b>DA Boundary</b>	Approved DA Boundary, inclusive of an approved extension to the north to incorporate a portion of the Mountain Block Offset Area and a minor contraction from a small portion of privately owned land (as part of MOD 7).	No change.	No change.
<b>Project Duration</b>	Continued mining operations until 31 December 2028.	No change in duration of mining operations. Tailings and water management activities as part of rehabilitation activities approved until the end of 2050.	No change.
<b>Surface Disturbance</b>	Within the Approved Disturbance Area.	No change.	No change. All surface disturbance works will be undertaken within the Approved Disturbance Area. Disturbed areas will be rehabilitated as per the site approved RMP.

DA 305-11-01 Aspect	Authorised Development (DA 305-11-01 as modified up to MOD 7)	MOD 8 to DA 305-11-01 (granted on 15 May 2023)	The Proposed Modification (MOD 9)
<b>Surface Infrastructure</b>	<p>Continued use of the Coal Handling and Preparation Plant (CHPP), rail loadout facility, offices, bathhouse, workshop, fuel storages, vehicle wash bays, powerlines, access roads and water management infrastructure.</p>	<p>Continued use of existing infrastructure necessary for rehabilitation activities until the end of 2050.</p> <p>Additional ancillary infrastructure including flocculation plant, water staging station, pipelines, powerlines and access roads.</p>	<p>Approximately 70 boreholes are expected to be required to undertake and monitor the filling of the underground workings within the two Target Areas. However, the location and number of boreholes may change depending on the performance of backfilling activities. However all surface disturbance including for drill pads, access tracks and temporary infrastructure will occur within the Approved Disturbance Area.</p> <p>A temporary grout batching compound will be developed to support grouting activities for each Target Area (batch plant to be relocated between Target Areas) with ancillary infrastructure located within the Approved Disturbance Area at Liddell.</p> <p>The compound will include:</p> <ul style="list-style-type: none"> <li>› Grout batching plant(s);</li> <li>› Cement storage silos and water tanks;</li> <li>› Material stockpile areas;</li> <li>› Temporary office and ablution buildings;</li> </ul>

DA 305-11-01 Aspect	Authorised Development (DA 305-11-01 as modified up to MOD 7)	MOD 8 to DA 305-11-01 (granted on 15 May 2023)	The Proposed Modification (MOD 9)
			<ul style="list-style-type: none"> <li>› Water pipeline from site water source to water tanks;</li> <li>› Pipelines from the batching plant to the boreholes; and</li> <li>› Other ancillary infrastructure as required to support the activities.</li> </ul> <p>Infrastructure for MOD 9 will be decommissioned and removed as per the requirements of the site approved RMP at the completion of works.</p>
<b>Water Management</b>	<p>Water captured within mining areas is stored in mine water dams and reused for operational purposes.</p> <p>Use of Entrance Pit void as a storage for water.</p> <p>Export of water to surrounding mines via the Greater Ravensworth Area Water and Tailings Scheme (GRAWTS).</p> <p>Option to discharge water in accordance with the Hunter River Salinity Trading Scheme.</p> <p>Option to treat mine water using a desalination plant and discharge of treated water to Lake Liddell.</p>	<p>Transfer of water to and from surrounding mines via the GRAWTS.</p> <p>Removal of volumetric limitations on water transfers with the surrounding mines.</p> <p>Use of Entrance Pit void as a storage for water shared within the GRAWTS.</p>	<p>No change.</p> <p>Minor erosion and sediment management measures to be implemented during borehole drilling and grouting process.</p> <p>Water for grout batching process to be supplied from the Liddell water management system.</p>

DA 305-11-01 Aspect	Authorised Development (DA 305-11-01 as modified up to MOD 7)	MOD 8 to DA 305-11-01 (granted on 15 May 2023)	The Proposed Modification (MOD 9)
<b>Tailings Management</b>	<p>On-site tailings emplacement areas include the Antiene, Durham, Reservoir West, Reservoir South and South Pit tailings dams.</p> <p>Pumping of up to 2 Million cubic metres of tailings material to Mount Owen Operations as part of the GRAWTS.</p>	<p>Continuation of the approved tailings transfer from LCO to Mount Owen Operations for the life of those operations.</p> <p>Receipt and deposition of tailings within the South Cut void from Ravensworth and Mount Owen Operations and other operations (subject to separate approvals).</p>	<p>No change.</p>
<b>Road Traffic and Transport</b>	<p>Continued transportation of <i>'old tailings'</i> to power stations using a maximum of 114 truck movements per day (i.e. 57 loaded trucks) along the NEH, 5 days per week.</p> <p>Continued transportation of ROM coal to and from Ravensworth Central Coal Processing Facility restricted to internal mine haul roads, Pikes Gully Road and Liddell Station Road.</p> <p>Traffic movements accounted for 360 employees and 100 contractors (i.e. approximately 920 vehicle movements per day).</p>	<p>No change.</p>	<p>Transportation of fly ash (or similar) to site via approximately 40 truck deliveries (i.e. approximately 80 truck movements) per day:</p> <p>Given that transportation of <i>'old tailings'</i> was approved until the end of mining operations as well as considering the traffic movements associated with the employees and contractors until 2028, the trucking of the proposed fly ash (or similar material) as part of the mine closure activities at Liddell would be within that previously assessed and approved.</p>
<b>Operational Hours</b>	<p>24 hours per day, 7 days per week</p>	<p>No change.</p>	<p>No change.</p>

DA 305-11-01 Aspect	Authorised Development (DA 305-11-01 as modified up to MOD 7)	MOD 8 to DA 305-11-01 (granted on 15 May 2023)	The Proposed Modification (MOD 9)
			Proposed drilling and backfilling works will be limited to Monday to Friday, between 7:00am and 5:30pm
<b>Workforce</b>	360 employees and 100 contractors.	No change.	No change, noting that current workforce numbers associated with mine closure activities are lower and well within the approved operational workforce.

## 3.2 Grout Batching Compound

MOD 9 proposes the construction and operation of a grout batching compound and ancillary infrastructure within the Approved Disturbance Area at Liddell. The grout batching compound will be constructed in locations that will support the backfilling program associated with the two Target Areas, on predominantly existing hardstand areas that have already been cleared and compacted. Appropriate erosion and sediment controls will be installed prior to commencement of construction works.

General details of required infrastructure include:

- › Hardstand compound within predominantly existing hardstand areas already cleared and compacted;
- › Grout batching plant (batch plant will be relocated between Target Areas);
- › Cement storage silos and water storage tanks;
- › Material Stockpile areas;
- › Temporary office and ablution buildings;
- › Water pipeline from site water source to water tanks;
- › Pipelines from the batching plant to the boreholes; and
- › Other Ancillary infrastructure as required to support the grout batching activities.

Power for the batching plant and associated infrastructure will be supplied using portable diesel generators.

All infrastructure will be temporary and will be fully decommissioned and removed upon completion of proposed works. Disturbed areas will be rehabilitated in accordance with the RMP.

Dust from hardstand areas and exposed stockpiles will be managed by stockpile sprays and/or water cart. Cement will be stored in enclosed silos to minimise dust emissions and haul roads for the tanker deliveries will be regularly watered and maintained to minimise dust generation. All runoff from the grout batching compound will drain to Liddell's mine water management system.

## 3.3 Borehole Drilling

Boreholes will be drilled to access the former underground workings within the two Target Areas. The final location and the number of boreholes that are ultimately required are yet to be finalised, however the surface disturbance activities associated with the drilling of boreholes will be located entirely within the Approved Disturbance Area at Liddell. The boreholes will be drilled into the remnant underground workings to facilitate the delivery of grout into the targeted areas. LCO may need to consider drilling angled holes to reach targeted underground workings beneath the MNRL.

Proposed drilling activities will include:

- › Clearance (where required within the Approved Disturbance Area at Liddell) and levelling to allow for drill rig access and installation of drill pad areas;
  - Drill pad sizes will be nominally 20 m x 20 m in size, however dimensions may be adjusted as required to account for topography and clearing requirements. All boreholes will be drilled using above ground sumps to manage drilling fluids and minimise ground disturbance;
- › Drilling of boreholes to provide suitable access across the targeted areas;
  - Current planning work has identified that approximately 70 boreholes are expected to be required to undertake and monitor the filling of the underground workings. However, the final number of boreholes may change depending on the performance of backfilling activities. To avoid new disturbance outside of the Approved Disturbance Area at Liddell, LCO will drill angled holes to reach targeted workings underneath the MNRL corridor.

- The boreholes will generally be up to approximately 200 millimetres (mm) in diameter. The estimated depths of the former underground workings within Target Area 1 range from 110 – 170 meters (m), with those for Target Area 2 within the depth range of 45 – 55 m.
- › Use of boreholes to pump grout to the targeted underground workings as discussed in **Section 3.4**;
- › Decommissioning of boreholes upon completion of grouting works and final rehabilitation of the drill pads and access tracks:
  - Borehole casing will be removed to 1.5 m below surface;
  - Drill pads and associated access tracks will be recontoured and rehabilitated in accordance with the Liddell RMP; and
  - All runoff from the surface disturbance associated with the borehole drilling will be managed as part of Liddell’s mine water management system.

Additional boreholes may also be drilled if required for backfilling of additional areas of remnant underground workings, with any disturbance to remain within the Approved Disturbance Area at Liddell.

### 3.4 Filling of Workings

To facilitate the filling of the targeted underground workings, it is proposed to utilise a series of 'plug holes' that are drilled around the perimeter of each target area. These 'plug holes' will enable floor to roof filling of roadways with concrete or other inert material (such as sand or gravel) to create a sealed boundary. This will then be followed by the use of a series of boreholes, referred to as 'fill holes', which will be used to deliver highly flowable infill grout into the targeted underground workings.

Grout which is batched and pumped from the grout batching compound will be delivered to the boreholes via pipeline. Grout, comprising a mix of cement, fly ash and water will be pumped into each borehole and emplaced into the targeted remnant underground workings.

### 3.5 Transportation

Materials used as part of batching grout onsite are proposed to be transported to Liddell via approximately 40 truck deliveries (i.e. approximately 80 truck movements) per day. These truck deliveries will generally be via highway routes during the same operational hours described in **Section 3.7**.

It is proposed for fly ash to be sourced and hauled from Power Stations within the region (including the Eraring Power Station and Bayswater Power Station), with cement deliveries to occur from regional concrete suppliers via powder tanker. Pre-mixed concrete for use in the 'plug holes' will either be delivered via agitator trucks from regional suppliers or will be mixed onsite at the batch plant.

### 3.6 Decommissioning and Rehabilitation

At the completion of grouting works, each of the boreholes will be decommissioned and sealed, drill pads and access tracks relevelled and rehabilitated in accordance with the Liddell RMP. Borehole casing will be removed to a depth of at least 1.5 m below the ground surface and boreholes sealed in general accordance with the *Guideline for mineral exploration drilling; drilling and integrity of petroleum exploration and production wells* (DISRD – DRE, 2016).

Temporary infrastructure will also be decommissioned and removed from the site and the areas rehabilitated in accordance with the Liddell RMP and associated mine closure activities.

### 3.7 Workforce and Operational Hours

Construction and operational activities for MOD 9 will be limited to Monday-Friday between the hours of 7:00 am and 5:30 pm. The proposed works are estimated to take approximately 12 months to complete.

An estimated contractor workforce of around 10-20 personnel is anticipated for MOD 9. These will be in addition to the existing LCO staff and contractor workforce delivering the closure and rehabilitation activities at Liddell.

## 3.8 Modification Justification

Liddell has a long history of underground mining with remnant first workings situated beneath the MNRL and other public infrastructure. An assessment of these workings indicates that the current pillar geometry is long-term stable. However, pillar area reduction may occur overtime as a result of external influences such as spontaneous combustion.

In order to alleviate any pillar failure risk and subsequent subsidence beneath the MNRL and other public infrastructure, the proposed targeted backfilling will assist in providing long-term stability to these workings. The backfilling of remnant underground workings within the Target Areas will have the following benefits:

- › Provide buttressing to coal pillars and structural support to the overlying strata and infrastructure for the long-term;
- › Reduce the potential for oxygen ingress within the targeted underground workings and minimise the risk of external influences such as spontaneous combustion; and
- › Assist in achieving the rehabilitation objectives for Liddell such as ensuring the "*Mine site (as a whole) to be safe, stable and non-polluting*".

## 3.9 Alternatives Considered

In assessing the potential controls to alleviate any potential pillar failure risk of the former underground workings and subsequent subsidence to the MNRL and other public infrastructure, LCO considered a number of options and approaches as described in the following sections.

### 3.9.1 Do Nothing

The '*Do Nothing*' approach entails leaving the underground workings as is, and whilst an assessment of the remnant pillars in their current configuration indicates they are long-term stable, the existing pillars are at risk of possible pillar area reduction as a result of external influences such as spontaneous combustion. Given the critical infrastructure that overlies these workings, this is not LCO's preferred option.

### 3.9.2 Backfilling with Tailings

Another alternative considered involved filling the targeted underground workings with tailings. Although this approach would flood the workings and reduce the potential for oxygen ingress (and the risk of spontaneous combustion), this alternative was not considered further as the use of tailings offers little confining strata support when compared to the cementitious grout method.

### 3.9.3 Preferred Option – MOD 9

The backfilling of remnant underground workings within the Target Areas (MOD 9) was deemed the most feasible solution. This is due to this option providing the following benefits:

- › Provide buttressing to coal pillars and structural support to the overlying strata and infrastructure for the long-term;
- › Reduce the potential for oxygen ingress within the targeted underground workings and minimise the risk of external influences such as spontaneous combustion; and
- › Assist in achieving the rehabilitation objectives for Liddell (under Schedule 3, Condition 37 of DA 305-11-01) such as ensuring the "*Mine site (as a whole) to be safe, stable and non-polluting*".

## 4. Statutory Context

*This section provides a summary of the legislative provisions that are relevant to MOD 9.*

### 4.1 Overview

**Table 2** summarises the regulatory framework relevant to MOD 9. The aspects of the regulatory framework that warrant greater analysis are discussed further in **Section 4.2**.

**Table 2 Relevant Legislative Provisions**

Aspect	Relevant Provisions	Applicability to MOD 9
Power to modify approval	Section 4.55(1A) of the EP&A Act and clause 3BA(6) of the EP&A Savings & Transitional Regulation 2017	<p>Under section 4.55 of the EP&amp;A Act, the consent authority may modify an existing approval if the proposed development is considered 'substantially the same development' as the authorised development. Relevantly, as DA 305-11-01 was previously modified under (the now repealed) section 75W, the 'substantially the same development' test applies to the development authorised by DA 305-11-01 up to (and including) MOD 7 (as per clause 3BA(6) of the EP&amp;A Savings &amp; Transitional Regulation 2017). MOD 9 is considered to meet this requirement (as explained in <b>Section 4.2.1</b>).</p> <p>Section 4.55(1A) of the EP&amp;A Act allows the consent authority to modify an existing approval under this part if it is satisfied the proposed modification is of minimal environmental impact. This Modification Report has described the minor nature of changes proposed to the approved development and includes environmental impact assessments for key risks to determine any potential impacts. The findings of these assessments are provided in <b>Section 6</b>.</p>
Permissibility	<p>Singleton Local Environmental Plan 2013 (Singleton LEP)</p> <p>Muswellbrook Local Environmental Plan 2009 (Muswellbrook LEP)</p> <p>Section 2.9(1) of the State Environmental Planning Policy (Resources and Energy) 2021 (Resources and Energy SEPP)</p>	<p>Liddell is located predominantly on land zoned RU1 (Primary Production) in both the Singleton LEP and Muswellbrook LEP, with a small portion of land zoned SP2 (Infrastructure) under the Muswellbrook LEP.</p> <p>Section 2.9(1) of the Resources and Energy SEPP provides that mining is permissible with development consent on land where development for the purposes of agriculture or industry may be carried out (with or without development consent). Land zoned under both Singleton and Muswellbrook LEP permits agriculture and therefore is permissible with development consent. MOD 9 activities will be located entirely within Liddell's DA Boundary and is therefore permissible development.</p>

Aspect	Relevant Provisions	Applicability to MOD 9
Matters for consideration	<p>Sections 4.15(1) and 4.55(3) of the EP&amp;A Act</p> <p>Part 2.3 of the Resources and Energy SEPP</p>	<p>Section 4.55(3) of the EP&amp;A Act requires the consent authority to consider the matters under section 4.15(1) of the EP&amp;A Act that are relevant to MOD 9 and the reasons given by the consent authority for the grant of the consent that is sought to be modified.</p> <p>Part 2.3 of the Resources and Energy SEPP prescribes additional matters that must be considered for mining proposals.</p>
Other Approvals	<p><i>Protection of the Environment Operations Act 1997</i> (POEO Act) - section 48.</p> <p><i>Mining Act 1992</i> (Mining Act)</p> <p><i>Heritage Act 1977</i> (Heritage Act)</p> <p><i>National Parks and Wildlife Act 1974</i> (NPW Act)</p> <p><i>Water Management Act 2000</i> (WM Act)</p> <p><i>Coal Mine Subsidence Compensation Act 2017</i> – section 22</p>	<p>LCO hold the necessary Environment Protection Licence (EPL) 2094 granted under the POEO Act, for existing scheduled activities at Liddell.</p> <p>The proposed use of fly ash in MOD 9 will comply with the <i>Coal Ash Exemption 2014</i> (the Exemption) and the use of suppliers who comply with the <i>Coal Ash Order 2014</i>.</p> <p>An administrative variation to the conditions of the EPL will be required to permit the receipt of fly ash on site in accordance with the Exemption and the <i>Coal Ash Order 2014</i>.</p> <p>Section 5 of the Mining Act states that mining can only be conducted in accordance with a mining lease.</p> <p>All activities associated with MOD 9 will be undertaken within the existing mining lease 1597.</p> <p>No places of heritage significance will be impacted by MOD 9.</p> <p>All activities associated with MOD 9 will be undertaken within Liddell’s approved DA Boundary and surface disturbance will occur entirely within the Approved Disturbance Area at Liddell.</p> <p>MOD 9 will occur within the Approved Disturbance Area at Liddell. Previously recorded Aboriginal heritage sites (on Aboriginal Heritage Information Management System (AHIMS)), have previously been salvaged as part of Liddell operations and therefore the potential for impacts to Aboriginal objects is considered a low risk.</p> <p>MOD 9 will not necessitate any changes to the proponent’s water licensing arrangements.</p> <p>Approval from the Subsidence Advisory NSW may be required for the construction of the temporary infrastructure associated with MOD 9 that falls within the Patrick Plains Mine Subsidence District.</p>

Aspect	Relevant Provisions	Applicability to MOD 9
		<p>Section 4.42 of the EP&amp;A Act provides that an approval under section 22 of the CMSC Act cannot be refused if it is necessary for the carrying out of an approved SSD.</p>
	<p><i>Biodiversity Conservation Act 2016 (BC Act) and the Biodiversity Conservation (Savings and Transitional) Regulation 2017 (NSW)</i></p>	<p>DA 305-11-01 was granted in 2002, prior to the commencement of the BC Act. As such, the provisions of the Biodiversity Conservation (Savings and Transitional) Regulation 2017 (NSW) (S&amp;T Regulation) apply to MOD 9 to DA 305-11-01. Specifically, sections 30A(2)(b) and section 30A(2)(c) of the S&amp;T Regulation provides a Biodiversity Development Assessment Report (BDAR) is not required if the determining authority is satisfied the modification will not increase the impact on biodiversity values.</p> <p>Surface disturbance activities for MOD 9 are proposed within the Approved Disturbance Area. Further to this, the Ecological Assessment prepared for this Modification Report demonstrates no further impact to biodiversity values are expected.</p>
	<p><i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth) (EPBC Act)</i></p>	<p>MOD 9 will occur entirely within the Approved Disturbance Area at Liddell. Therefore no significant impacts are expected to occur to any biodiversity related Matters of National Environmental Significance (MNES).</p> <p>An Ecological Assessment and a Groundwater Assessment were completed for MOD 9 to evaluate whether the proposed grouting activity pose any risk to MNES. The findings of these assessments are discussed in <b>Section 6.3</b> and <b>Section 6.5</b>.</p>
	<p>CCP; and GHG Guide</p>	<p>Potential GHG emissions from MOD 9 are not projected to exceed 25,000 t of Scope 1 and 2 emissions CO<sub>2</sub>-e in any financial year.</p> <p>An AQGHG Assessment has been prepared for MOD 9 with findings discussed in <b>Section 6.1</b>.</p> <p>Further details on the CCP and the GHG Guide were included in <b>Section 2.4.1.1</b> and <b>Section 2.4.1.2</b>.</p>
	<p>NSW Aquifer Interference Policy (AIP)</p>	<p>The Groundwater Assessment completed for MOD 9 was also undertaken to determine whether the proposed activities are likely to result in impacts exceeding Impact Thresholds defined under the AIP. The findings of the Groundwater Assessment are discussed in <b>Section 6.3</b>.</p>

## 4.2 Key Regulatory Matters

### 4.2.1 Power to Modify

DA 305-11-01 was originally approved on 20 November 2002 for the "Continued open cut coal mining at the Liddell Colliery and associated surface facilities and infrastructure". The approval consolidated a number of consents that existed at the time, including approvals for previous underground workings and operations, and to permit the continuation of mining (then) for an additional 21 years at the Liddell Colliery.

MOD 9 to DA 305-11-01 is sought under section 4.55(1A) of the EP&A Act. The power to modify consents under section 4.55 of the EP&A Act can only be exercised where the modified development would be 'substantially the same development'. As DA 305-11-01 was previously modified under the former section 75W of Part 3A of the EP&A Act, the relevant reference point for the substantially the same development test is the development consent as last modified under section 75W, being MOD 7 (in accordance with clause 3BA(6) of Schedule 2 of the EP&A Savings & Transitional Regulation 2017, as detailed in **Section 3.1**).

The proposed changes sought by MOD 9 (along with the changes approved by MOD 8) in comparison with the original approval (MOD 7) is provided in **Table 1**. The changes approved by MOD 8 and now sought by MOD 9 will not result in substantial changes to the original development (DA 305-11-01 as approved by and up to MOD 7).

MOD 9 (including previously approved changes for MOD 8) would satisfy the 'substantially the same development' requirement for the following reasons:

- › The modification is seeking approval to modify DA 305-11-01 to carry out rehabilitation activities (by backfilling underground workings) to ensure that the final landform achieves the Rehabilitation Objectives under Schedule 3, Condition 37 of DA 305-11-01 for example to ensure the "Mine site (as a whole) to be safe, stable and non-polluting";
- › The proposed activities will take place within Liddell's DA boundary and existing boundary of Mining Lease 1597;
- › The proposed drilling activity component of MOD 9 is similar in nature to exploration programs previously conducted by LCO at Liddell;
- › All proposed disturbances including drill pads, access tracks and temporary infrastructure will be located within the Approved Disturbance Area at Liddell. Any disturbed area as a result of the proposed MOD 9 activities will be rehabilitated in accordance with the site approved RMP upon completion of works;
- › The construction and use of temporary infrastructure at Liddell is not materially different from the approved mine infrastructure area (MIA) facilities;
- › Proposed transportation of fly ash from coal-fired power stations in the region to Liddell will be a new activity, albeit is expected to remain well within the overall vehicle movements that were previously assessed and approved for Liddell open cut operations on the local and regional road networks;
- › Traffic and truck movements associated with MOD 9 are minimal in comparison to that approved for mining (Schedule 3, Condition 32(a) of DA 305-11-01);
- › The acceptance and deposition of tailings from neighboring mining operations within the South Cut void at Liddell (as approved by MOD 8) is consistent with that previously envisaged under DA 305-11-01 and is a consistent use to other mining voids at Liddell;
- › Sharing and bi-directional transfers of water with participants of the Greater Ravensworth Water and Tailings Scheme (GRAWTS) and other neighboring mining operations (as approved by MOD 8) will reduce the need for alternate fresh water supplies; and
- › The final landform design (as approved by MOD 8) with the emplacement of tailings in the South Cut void assists LCO to meet rehabilitation objectives at Liddell in relation to final voids, including to

"minimise to the greatest extent possible, the size and depth of the final voids; and the drainage catchment of final voids".

Based on the above, the key components of MOD 9 are minor in nature and in conjunction with the changes previously approved by MOD 8, the modified development is considered to satisfy the '*substantially the same development*' requirement and can be sought under section 4.55 of the EP&A Act.

Based on the environmental assessments described in **Section 6**, it is concluded that MOD 9 will lead to minor environmental impact and is suitable for consideration under section 4.55(1A) of the EP&A Act. Minor environmental impacts of MOD 9 will occur for the following reasons:

- › Surface disturbance will occur within the Approved Disturbance Area at Liddell;
- › The Biodiversity Assessment has confirmed that the vegetation present across all areas of surface disturbance (within the Approved Disturbance Area at Liddell) is largely exotic and of low biodiversity value. The current conditions of the vegetation do not provide suitable habitat structure for flora and fauna species that would support the establishment of native vegetation communities;
- › Construction of temporary infrastructure required for MOD 9 would take place primarily in areas of hardstand, already cleared and compacted;
- › No material increase in noise levels or additional risk to neighbouring receivers;
- › Changes in permeability associated with the cement grouting of underground workings and its influence in the long-term recovery of the groundwater regime and associated risk is expected to be negligible;
- › There is no direct hydraulic connectivity between Liddell's South Cut void (ultimate receptor) and the surrounding groundwater regime. Therefore, the activity is not considered to pose a consequential risk to local groundwater quality;
- › Proposed activities will not result in impacts beyond the Level 1 Minimal Impact Considerations of the NSW AIP;
- › Dust emissions from MOD 9 (as PM<sub>10</sub>) would be less than 2% of historical operational emissions at Liddell. Such emissions are also immaterial in the context of the mining operations in the locality;
- › GHG estimates show that Scope 1 and Scope 2 emissions will not exceed 25,000 t of CO<sub>2</sub>-e in any financial year and therefore does not trigger additional assessment in accordance with the GHG Guide; and
- › Traffic generation associated with MOD 9 is assessed to be below peak traffic levels previously associated with Liddell's mining operations and is not expected to result in traffic impacts beyond those already considered and approved.

## 5. Stakeholder Engagement

### 5.1 Regulatory Consultation

LCO has undertaken a targeted stakeholder engagement program throughout the preparation of this Modification Report. **Table 3** outlines the regulatory consultation activities undertaken for MOD 9. The general objectives of consultation were to provide stakeholders with information about the proposed activities and to seek any feedback or concerns which needed to be addressed. Outcomes from discussions have been incorporated into this Modification report (where relevant).

**Table 3** Regulatory Consultation

Stakeholder	Methods of Engagement	Purpose of Consultation
DPHI	Meeting on 28 July 2025 (via MS Teams)	Meeting was held to provide DPHI with an overview of the proposed modification, present the proposed approvals pathway under the provisions of the EP&A Act, and to provide the scope of environmental assessments required.
	Meeting on 25 September 2025 (via MS Teams)	Meeting held to update DPHI on revised changes to the proposed modification, confirming that proposed MOD 9 activities will take place entirely within the Approved Disturbance Area at Liddell.  DPHI confirmed that a modification application under section 4.55 of the EP&A Act is the appropriate approvals pathway and also confirmed the assessment requirements and agreed on the content to be addressed in the Modification Report.
	Scoping Letter dated 22 October 2025	LCO submitted a scoping letter to DPHI on the 22 October 2025, outlining the scope of MOD 9 and the environmental considerations proposed to be addressed during the approval process.
NSW Resources Regulator	Site Visit on 11 August 2025	The NSW Resources Regulator visited Liddell on 11 August 2025 as part of its Rehabilitation Landform Targeted Assessment Program (TAP).  During this visit, LCO also presented an overview of the proposed MOD 9 and sought feedback from the Regulator.  There were no issues raised.
EPA	Meeting on 19 November 2025	Briefing meeting held with EPA representatives to provide an overview of MOD 9 and seek any initial feedback. The primary topic of discussion concerns the receipt and use of fly ash on site in accordance with the Exemption provisions and potential EPL variation.

<b>Stakeholder</b>	<b>Methods of Engagement</b>	<b>Purpose of Consultation</b>
<b>Muswellbrook Shire Council</b>	Meeting on 19 November 2025 (via MS Teams)	Briefing meeting held with Muswellbrook Shire Council representatives to provide an overview of MOD 9 and to seek any initial feedback. There were no issues raised.
<b>Singleton Council</b>	Meeting on 03 December 2025 (via MS Teams)	Briefing meeting held with Singleton Council representatives to provide an overview of MOD 9 and to seek any initial feedback. Singleton Council raised the matter of traffic in Singleton.
<b>ARTC</b>	Meeting on 6 August 2025 (via MS Teams)	Briefing meeting held with ARTC representatives to provide an overview of MOD 9 and to seek details over access to the MNRL corridor (based on earlier plans to complete drilling within the corridor rather than entirely within the Approved Disturbance Area at Liddell). No issues were raised during the meeting and preliminary information shared over land access arrangements.
	Meeting on 12 November 2025	Meeting was held to notify ARTC that access to the MNRL corridor is no longer required as initially planned. MOD 9 drilling will now occur entirely on LCO-owned land, within the Approved Disturbance Area at Liddell, with angled drilling proposed to access areas beneath the corridor. No issues were raised regarding the change.
<b>AusGrid</b>	Letter dated 9 December 2025	Letter providing an overview of the proposed activities for MOD 9, approvals process sought and offer of briefing.
<b>Telstra</b>	Letter dated 9 December 2025	Letter providing an overview of the proposed activities for MOD 9, approvals process sought and offer of briefing.
<b>Subsidence Advisory NSW</b>	Letter dated 15 December 2025	Letter providing an overview of the proposed activities for MOD 9, approvals process sought and offer of briefing.
<b>Transport for NSW</b>	Letter dated 15 December 2025	Letter providing an overview of the proposed activities for MOD 9, approvals process sought and offer of briefing.
<b>Registered Aboriginal Parties (RAPs)</b>	Meeting on 12 November 2025	Overview of MOD 9 was presented during the LCO Annual Cultural Heritage Meeting. An impact summary was also included noting no additional impact to any heritage sites with MOD 9 works occurring entirely within the Approved Disturbance Area at Liddell.
<b>LCO Community Consultative Committee (CCC)</b>	CCC Meeting on 20 November 2025	Overview of MOD 9 and environmental assessment findings provided. No issues were raised during the meeting.

## 5.2 Community Consultation

The Proponent have consulted with the local community in relation to MOD 9 via the following methods:

- › Presentation provided to the Liddell CCC on the 20 November 2025; and
- › Community newsletter titled 'Glencore Greater Ravensworth News - Spring 2025' was released in November 2025, where it included an overview of MOD 9.

The CCC includes representatives of the local community, Singleton Council and Muswellbrook Shire Council. To date, no feedback has been received from community stakeholders in relation to MOD 9.

## 6. Impacts, Management and Mitigation

*This section presents the results of the environmental assessments completed in respect of MOD 9 and outlines the measures that will be implemented to manage and mitigate potential impacts.*

### 6.1 Air Quality and Greenhouse Gas

#### 6.1.1 Background

An Air Quality and Greenhouse Gas Assessment (AQGHG Assessment) has been completed for MOD 9 by Airen Consulting (Airen Consulting, 2025). This assessment is provided in **Appendix A** with a summary provided in the subsequent sections.

#### 6.1.2 Methodology

##### 6.1.2.1 Air Quality

A semi-quantitative air quality assessment was undertaken for MOD 9 which entailed a review of historical activities, proposed activities and recent air quality and meteorological monitoring to determine the potential risks of the proposed activities.

The area surrounding Liddell is predominantly characterised by power generation and mining operations, with some agricultural land use and dispersed residential settlements.

There are fifteen nearby private dwellings, the closest located approximately 3 km from the Target Areas. The closest sensitive receptors to Liddell are generally located to the north east and north west of the Target Areas (see **Figure 3**).

LCO monitors meteorological conditions via an automatic weather station (AWS) located near Liddell's administration building. The AWS collects records of temperature, wind speed, wind direction, rainfall, and other parameters continuously. Data collected from the AWS between 2020 and 2024 indicate little variability in wind patterns, with prevailing winds recorded to be from the north west and south east.

##### 6.1.2.2 Greenhouse Gas

The level of assessment of greenhouse gas (GHG) emissions for MOD 9 has been informed by the GHG Guide.

Incremental emissions for MOD 9 alone are expected to remain well below the 25,000 t of CO<sub>2</sub>-e (Scope 1 and 2) threshold in any financial year. Accordingly, the requirements of the GHG Guide do not apply.

Notwithstanding, Airen Consulting has identified all relevant emission sources for MOD 9 and completed an estimate of these emissions.

**Table 4** lists the sources that have been included and excluded from the assessment. Excluded sources are those unlikely to produce emissions significant enough to materially change impacts or influence stakeholder decision-making.

Emissions have been considered over the anticipated 12-month duration of activities proposed by MOD 9.

**Table 4 GHG Source Inclusions and Exclusions**

Activity	Description	Scope
<b>Included Sources</b>		
Diesel usage (vehicles)	Combustion of diesel fuel from on-site mobile equipment	1
Diesel usage (generators)	Combustion of diesel fuel from on-site generators	1
Vegetation removal	Loss of carbon sink from vegetation removal	1
Electricity	Electricity usage from on-site activities	2
Diesel transport	Combustion of diesel fuel from transporting materials to site	3
Grout Manufacture	Embodied energy in cement for grouting product manufacture	3
<b>Excluded Sources</b>		
Industrial processes	Sulphur hexafluoride (high voltage switch gear) Hydrofluorocarbon (commercial and industrial refrigeration)	1
Wastewater handling (industrial)	Methane emissions from wastewater management	1
Solid waste	Solid waste to landfill	3
Business travel	Employees travelling for business purposes	3
Employee travel	Employees travelling between their place of residence and Liddell	3

## 6.1.3 Assessment of Impacts

### 6.1.3.1 Air Quality

Dust emissions are the primary area of focus for MOD 9, driven by the types of activities proposed to be carried out, including wind erosion from material stockpiles and exposed surface disturbance, drilling activities and vehicle movements on unpaved areas.

Dust emissions from MOD 9 activities were estimated and are summarised in **Table 5**.

**Table 5 Estimated Fugitive Dust Emissions for MOD 9**

MOD 9 Activities During Closure and Rehabilitation	Annual Emissions (kilograms per year (kg/y))		
	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>
Drilling holes for grouting	12	6	1
Wheel generated dust	58,448	17,252	1,725
Wind erosion from fly ash and exposed areas	9,697	4,849	727
<b>Total</b>	<b>68,158</b>	<b>22,107</b>	<b>2,453</b>

When compared with dust emissions from historical operations at Liddell (as shown within Table 7 of **Appendix A**), dust emissions associated with MOD 9 activities (shown in **Table 5**) are minimal, representing only a small fraction (i.e. <2%) of emissions associated with historical approved mining operations at Liddell. In this regard, it is expected that MOD 9 is unlikely to result in the risk of exceedances of the relevant air quality impact assessment criteria as identified in Condition 16, Schedule 3 of DA 305-11-01.

### 6.1.3.2 Greenhouse Gas

Estimated emissions due to all identified GHG generating activities associated with MOD 9 are shown in **Table 6**. The estimates show that Scope 1 and Scope 2 emissions will not exceed 25,000 t of CO<sub>2</sub>-e in any financial year. MOD 9 will therefore not generate “significant” emissions as per the EPA definition of a “large” emitter, and the detailed assessment steps of the GHG Guide are not applicable and no further assessment is required.

The potential climate change impacts on the locality have been considered with reference to the ‘Hunter Climate Change Snapshot’ (NSW DCCEEW, 2025) which summarises the latest climate projections for regions from the NSW and Australian Regional Climate Modelling (NARCLiM) project. The projected impacts of climate change across the Hunter Region, as modelled by the NARCLiM project include:

- › Increase in average temperature and number of hot days per year;
- › Decrease in the number of cold nights;
- › Rainfall is projected to remain variable, however climate change will likely influence rainfall patterns and decrease the average winter rainfall; and
- › Increase in severe fire weather days per year.

**Table 6 Estimated GHG Emissions from MOD 9**

Activity	Usage	Units	Emission Factor (kg CO <sub>2</sub> -e/unit)			Emission (t CO <sub>2</sub> -e)			
			Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
Diesel (on-site)	301*	kL	2,709.72	0	667.78	817	-	201	<b>1,018</b>
Land clearing	8 <sup>#</sup>	ha	311,625	0.00	0.00	2,493	-	-	<b>2,493</b>
Electricity usage	-	kWh	0	0.47	0.03	-	-	-	-
Diesel (material transport)	957**	kL	0	0	2,717.44	-	-	2,600	<b>2,600</b>
Grout manufacture	11,500	t	0	0	161.59	-	-	1,858	<b>1,858</b>
<b>Total</b>	-	-	-	-	-	<b>3,310</b>	-	<b>4,660</b>	<b>7,970</b>

<sup>#</sup>Land clearing relates to disturbance of previously disturbed areas which have since been rehabilitated. Emissions from this activity will therefore be conservatively high.

\* Calculated from LCO estimates of equipment fuel burn, and hours per day usage

\*\* Calculated from 40 truck deliveries per day, 5 days per week, 230 km return site distance, and fuel consumption of 40 L/100 km

As noted above, the GHG emissions from MOD 9 are minor and are not anticipated to materially contribute to climate change or result in any associated impacts on the locality. Given the cumulative and globally dispersed nature of GHG emissions, no discernible or measurable localised climate impacts can be directly attributed to MOD 9.

## 6.1.4 Mitigation and Management

### 6.1.4.1 Air Quality

LCO manages and monitors impacts of its operations on air quality in accordance with the approved Air Quality Management and Monitoring Plan (AQMMP) (LCO, 2022).

MOD 9 will continue to meet the relevant criteria in Condition 16, Schedule 3 of DA 305-11-01. Accordingly, standard air quality management and mitigation measures are considered appropriate to manage impacts from the proposed activities. Standard mitigation measures which are described within the AQMMP will be implemented for MOD 9 and will include:

- › Minimising the area of disturbed land at any one time;
- › Adopting controls for unsealed haul road dust emissions;
- › Use of water sprays when drilling if / as required;
- › Use of water sprays on stockpile areas if / as required;
- › Storing cement in silos to minimise dust; and
- › Visual monitoring to identify excessive dust generation.

The AQMMP will be reviewed and updated for MOD 9, as relevant.

### 6.1.4.2 Greenhouse Gas

As the activities proposed by MOD 9 will not generate “*significant*” emissions under the EPA’s definition of a “*large emitter*”, the detailed assessment steps outlined in the GHG Guide are not applicable. Therefore, the GHG management measures included in the existing site approved AQMMP will continue to apply.

## 6.2 Acoustics

### 6.2.1 Background

An assessment of the noise impacts associated with MOD 9 has been undertaken by Bridges Acoustics (Bridges Acoustics, 2025). A copy of the Acoustics Assessment is provided in **Appendix B**, with a summary outlined in the following sections.

### 6.2.2 Methodology

The closest noise-sensitive receptors to Liddell are generally located to the north east and north west of the Target Areas (see **Figure 3**).

As the activities proposed by MOD 9 are to be undertaken during the day period, the Acoustics Assessment has relied upon the day period noise impact assessment criteria dB(A) specified in Schedule 3, Condition 1 of DA 305-11-01, reproduced in **Table 7**.

**Table 7 Noise Impact Assessment Criteria dB(A) (source DA 305-11-01, as modified)**

Assigned Residential Location Number	Day LAeq 15min
1, 5, 6, 7, 8, 9, 10, 11, 12, 14	35
2	35
3	36
4	36
All other privately-owned land	35

Receptor 1 and Receptor 14 were identified as the nearest receptors to activities proposed under MOD 9. The nearest receptors were identified based on the receptor locations and associated noise impact assessment criteria. The distances from the relevant components of MOD 9 to receptors, along with the applicable noise criteria for the day period, are summarised in **Table 8**.

Winds from the south west are likely to enhance noise levels from the proposed activities to Receptor 1 and other nearby receptors. In contrast, winds from the south east may result in elevated noise levels at Receptor 14.

Meteorological data from Liddell’s AWS for the period January 2020 to August 2025 demonstrate prevailing winds from the west over 30% of the time in winter which is considered significant under the *NSW Noise Policy for Industry (NPI)* (NSW EPA, 2017). These westerly winds could result in a moderate increase in noise levels to Receptor 1 and other nearby receptors. Winds from other directions were below the NPI significance threshold. However, southeasterly winds (up to 27% in autumn) would enhance noise levels to Receptor 14.

Noise levels from the activities proposed by MOD 9 were calculated using the Harmonoise Engineering Method, considered to be the most accurate and reliable noise propagation assessment available for general use.

Indicative major noise sources for each location and project stage, along with the estimated combined sound power levels for standard equipment operating without specific noise mitigation measures include:

- › Grout Batching Plant:
  - Pad construction (excavator, dozer) – 114 LAeq,15min;
  - Batch plant construction (truck, crane, excavator, hand tools) – 114 LAeq,15min; and
  - Batch plant operation (plant, loader, water cart, truck, slurry pump, generator) – 120 LAeq,15min.
- › Borehole Target Area:
  - Pad construction (backhoe, excavator, truck and skid steer) – 112 LAeq,15min;
  - Drilling (drill rig x3) – 120 LAeq,15min; and
  - Grouting (backhoe or excavator to occasionally relocate grout pipeline) – 106 LAeq,15min.

**Table 8 Nearest Privately-Owned Receptors and Noise Criteria**

Parameter	Receptor 1	Receptor 14
Distance from closest Target Area	3,480 m	4,600 m
Distance from closest grout batching plant	3,420 m	5,930 m
Noise criteria - day period	35	35

Worst-case estimated sound power levels are 120 LAeq,15min during grout batching plant operation and borehole drilling at each Target Area.

Truck movements required for the transportation of materials (fly ash and cement) to the batch plant along the Liddell haul route were also considered within this assessment.

### 6.2.3 Assessment of Impacts

Noise levels were calculated separately for the northern batch plant and northern borehole drilling activities (Target Area 2) at Receptor 1 and Receptor 14 under both calm and windy conditions.

A summary of the calculated noise levels at the nearest receptors is presented in **Table 9**.

Based on the results, calculated noise levels are expected to meet the DA-305-11-01 (as modified) noise criteria at the nearest receptors and therefore at all receptors.

The estimated 40 delivery trucks (i.e. 80 truck movements) are expected per day to the batching plant, averaging just under two movements every 15 minutes during the 10.5-hour workday. Truck movements along the haul route are expected to be inaudible at all receptors and are not expected to significantly contribute to cumulative noise levels from MOD 9.

LCO has scheduled a number of approved mine closure and rehabilitation activities that are likely to coincide with MOD 9. The closest of these works to sensitive receptors include Durham TSF Capping, Reservoir West TSF Capping and Reservoir South TSF Capping which are expected to involve a maximum of nine dozers operating concurrently. As these mine closure and rehabilitation works are already approved, they are required to comply with the DA 305-11-01 noise criterion of 35 LAeq,15min at the nearest receptors.

The activities proposed for MOD 9 are expected to increase cumulative noise levels from Liddell, assuming currently approved activities produce a cumulative noise level of 33 LAeq,15min, by no more than 2 LAeq,15min, and only under prevailing weather conditions. This represents a negligible change in noise levels and will unlikely be perceptible at any receptor.

### 6.2.4 Mitigation and Management

LCO currently manages noise from mine closure and rehabilitation activities in accordance with the approved Liddell Noise Monitoring Program (LCO, 2023) and RMP (LCO, 2024). MOD 9 activities will be managed alongside approved mine closure and rehabilitation activities. No additional noise control measures beyond those in the existing plan are proposed for MOD 9.

**Table 9** Calculated Noise Levels to Receptors, LAeq,15min

Receptor	Receptor 1		Receptor 14	
	Calm Wind	3 m/s W Wind	Calm Wind	3 m/s SE Wind
Received Level, Drilling, LAeq,15min	8	19	4	28
Received Level, Batch Plant, LAeq,15min	9	31	-1	23
Combined Received Level, LAeq,15min	12	31	5	29
DA 305-11-01 Noise Criteria, LAeq,15min	35			

## 6.3 Groundwater

### 6.3.1 Background

James Tomlin Consulting (JTC) has completed an assessment of the potential impacts to the regional groundwater regime as a result of the proposed activities to be completed for MOD 9 (JTC, 2025). A copy of the groundwater assessment report is provided in **Appendix C** with a summary provided within the following sections.

The components of MOD 9 which have a potential to result in impacts to the groundwater regime include the drilling of boreholes across the two Target Areas and the pumping and emplacement of grout into the targeted underground workings.

### 6.3.2 Methodology

The groundwater assessment adopted a qualitative approach. This entailed reference to the conceptual model which has been developed for Liddell and surrounding Greater Ravensworth Area (AGE, 2022) and a MOD 9 specific '*source-pathway-receptor model*' to assess impacts of grouting activities on the groundwater regime.

The groundwater regime proximate to the two Target Areas is considered highly disturbed. The Middle Liddell coal seam has been partially extracted through bord and pillar mining, with the Vane subgroup target seams (including Middle Liddell coal seam) removed in the adjacent backfilled open cuts at South Cut and Entrance Pit.

The Permian strata consist of low to moderately permeable coal seams, which are the most transmissive strata within the Permian sequence. The non-coal inter-burden forms aquitards within the Permian sequence. The coal seam aquifers proximate to the Target Areas have been depressurised as a result of historical underground and open cut mining activities at Liddell. Drilling undertaken by LCO indicates that the Middle Liddell seam at both Target Areas is currently dry.

Outside of the footprint of previous open cut mining areas, the Permian sediments are unconformably overlain by thin quaternary alluvial sediments deposited along drainage line flood plains. These deposits comprise clay, silt, sand, and gravel along the present-day alignments of Bowmans Creek and Bayswater Creek that form a shallow aquifer system with connectivity to the creeks. The source-pathway-receptor model determines if a hazard can lead to risk or harm. For MOD 9, the model has been established as follows:

- › The '*source*' is the origin of the hazard. For MOD 9, the '*source*' is the grout to be emplaced into the Target Areas within the Liddell seam.
- › The '*pathway*' is the mechanism the hazard travels by. The pathway for MOD 9 is the direction of which potentially affected water could move from the '*source*' to a '*receptor*'. The pit floor contours (Figures 2, 3 and 4 of **Appendix C**) demonstrate that any water accumulating within the Target Areas of the Middle Liddell coal seam underground workings, continue to flow through the adjacent backfilled spoils of the former open cut mining area, continue along the pit floor of the South Cut open cut pit and into the South Cut final void. Flow from the Target Areas towards the Entrance Pit void is not anticipated, as the Middle Liddell coal seam floor slopes westward towards the South Cut void from these areas.
- › The '*receptor*' is the entity that could be harmed by the hazard. The regional coal seam floor contours indicate that the only possible '*receptor*' is the water body that has formed within the South Cut void.

LCO has been monitoring water levels in both the South Cut and Entrance Pit voids since open cut mining ceased in 2023. Figure 5 of **Appendix C** illustrates that water levels in both voids are recovering slowly and remain as a sink within the regional groundwater system.

Previous numerical modelling demonstrates that water levels within the final voids are expected to remain well below the regional groundwater system, including levels of the adjacent alluvial aquifers. This suggests that the waters in the final void will not interact with the neighbouring alluvial systems.

Periodical monitoring of water quality within the final voids is undertaken by LCO in accordance with the Water Management Plan (WMP) (LCO, 2024a). The pH values of monitoring to date show that moderately alkaline conditions occur in both the South Cut and Entrance Pit voids with Total Dissolved Solids (TDS) levels ranging from 3,500 mg/L to 5,000 mg/L, indicating a brackish salinity typical of coal mining waters.

### 6.3.3 Assessment of Impacts

#### 6.3.3.1 Potential Hazards

The primary potential hazard associated with MOD 9 is the potential for cement to alter the alkalinity of any water it comes into contact with. Freshly mixed cement is highly alkaline and can increase water alkalinity upon contact. However, as the cement/grout cures, its compounds become less soluble and less permeable, thereby reducing the potential for alkalinity leaching over time.

The proposed use of fly ash in the cementitious grout can also pose an environmental risk depending on its trace metal composition and mobility following mixing with cement. Under the *Coal Ash Order 2014*, NSW EPA sets maximum allowable concentrations of trace metals in fly ash for which the suppliers must comply with to limit this environmental risk.

Another potential hazard relates to changes in permeability associated with the cement grouting of the underground workings. Currently, the historical underground workings within the Target Areas exhibit very high permeability, allowing water to move freely through these portions of the Middle Liddell coal seam. Grouting is expected to reduce this permeability, replacing void space with grout. This has the potential to influence groundwater flow locally around the Target Areas.

The potential for the identified hazards to pose a significant risk on the regional groundwater system depends on their likelihood of occurring, and the associated consequences. The assessment of these risks is discussed in **Section 6.3.3.2**.

#### 6.3.3.2 Risk Assessment

##### 6.3.3.2.1 Water Quality

The 'pathway' identified for MOD 9 is associated with the water movement from both Target Areas (i.e. 'source') to the South Cut final void. Any water that comes into contact with both grouting areas flows toward the South Cut void. The grouting areas lie within the Liddell dirty-water catchment and within the final void catchment which is designed and approved as a long-term sink. At the northern Target Area, several low points (or sumps) on the South Cut mining area floor would need to reach capacity and overflow before any flow would continue to the South Cut void. Notwithstanding, the South Cut final void is considered the ultimate 'receptor'.

The potential for the cement grout to influence the alkalinity and water quality of underground waters is contingent on whether the Target Areas are saturated or dry during the grout curing period. Both Target Areas are currently dry, allowing the grout to fully cure. This will substantially reduce the risk for release of alkalinity.

The posed risk of fly ash depends on the presence and mobility of trace metals after it is blended with cement. Under the NSW EPA *Coal Ash Order 2014*, suppliers must ensure that trace metal concentrations in fly ash remain below stipulated thresholds to minimize potential risks. Consumers under the Exemption are generally exempt from further testing when the supplier has conducted the mandated tests and the fly ash is used in cementitious mixes.

When fly ash is blended with cement, the alkalinity of the grout mixture reduces the solubility of trace metals. This chemical process, together with the decrease in permeability as grout hardens over time, limits the leaching of metals. Combined with the regulatory limits on trace metals in the source fly ash, these factors help minimise leaching risks.

While future flooding of the Target Areas is possible, the grout should be fully cured before any potential inundation occurs. Any water that does pass through the Target Areas would ultimately flow into the South Cut open void. Water quality within the South Cut void is already slightly alkaline and has previously been identified to remain as a groundwater sink, remaining hydraulically disconnected from the surrounding groundwater regime. The South Cut open void also contains a significant quantity of water, providing considerable dilution capacity for any seepage that may occur. Accordingly, the proposed grouting activity is not expected to pose a significant risk to regional water quality.

#### **6.3.3.2.1 Groundwater Flow**

The other potential hazard involves changes in permeability within the Target Areas as a result of the cement grouting of existing open voids within the former underground workings. The Target Areas are relatively small, when compared to the scale of the open cut and underground mining footprints. While groundwater flow may be locally affected in the grouted areas, it is expected that groundwater will circumvent these areas via the remaining areas of the Middle Liddell coal seam and residual underground workings. The effect on the long-term recovery of the groundwater regime and associated risk is anticipated to be negligible.

#### **6.3.3.2.2 Aquifer Interference Policy**

The NSW Aquifer Interference Policy (AIP) requires proponents to ensure necessary licences are held to account for any water taken from a groundwater or surface water source. MOD 9 does not require the extraction of groundwater and therefore accounting for water take with licensing is not required.

The AIP also outlines the '*Minimal Impact Considerations*' which are a set of thresholds and criteria used to assess whether aquifer interference activities have no more than minimal impact on water sources and water-dependent assets. Level 1 '*Minimal Impact Considerations*' include thresholds for water table drawdown, water pressure decline, and water quality changes. MOD 9 does not involve any groundwater take, therefore thresholds for water table drawdown and water pressure decline are not applicable. For water quality changes, the Level 1 water quality threshold is "*any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40m from the activity*". Water in the final voids is slightly alkaline and brackish, with beneficial use limited to mining purposes. The proposed grouting under MOD 9 will not influence the current beneficial use of the void waters.

#### **6.3.3.3 Assessment Summary**

MOD 9 has been assessed to present a low risk of impact to water quality and groundwater flow, will adhere to all relevant policy requirements, and will not compromise the established beneficial use of the affected waters.

### **6.3.4 Mitigation and Management**

LCO manages and monitors its impacts to water at Liddell in accordance with its WMP last updated in July 2024 (LCO, 2024a). Although the risk to groundwater is low, the WMP will be revised for MOD 9 to include monthly pH monitoring of the South Cut void waters during the grouting period and for a period of 12 months following completion. Additionally, a trigger action response plan will be incorporated into the WMP, that triggers an investigation if three consecutive samples exceed the 95th percentile of the baseline void water quality.

## 6.4 Traffic

### 6.4.1 Background

A Traffic Impact Assessment (TIA) was undertaken by PDC Consultants to assess potential traffic impacts associated with the proposed traffic movements under MOD 9 (PDC Consultants, 2025). The TIA was undertaken in the context of the approved traffic and transport conditions at Liddell for mining operations and the traffic movements associated with mine closure and rehabilitation works following the cessation of coal mining operations. The TIA is provided in **Appendix D**, with a summary in the following sections.

### 6.4.2 Methodology

#### 6.4.2.1 Existing Conditions

LCO's primary access to Liddell is via the Old New England Highway (ONEH) which intersects with the NEH. The NEH has been the main route for employee movements and for the delivery of equipment and supplies during the life of mining operations at Liddell for many years. The NEH continues to serve the primary access for the existing mine closure and rehabilitation activities at Liddell. Background traffic along the NEH comprises high volumes of heavy vehicles and general regional traffic.

The primary route for both truck and contractor vehicles associated with MOD 9 will continue to be the ONEH via the ONEH / NEH intersection.

The road network in the vicinity of Liddell includes the following:

- › The NEH is a major state road running from the Queensland border to Hexham, with a 100 kilometre per hour (km/h) speed limit and one lane in each direction near Liddell.
- › The ONEH is a local road with an 80 km/h speed limit and one lane in each direction near Liddell. The road runs in a north west to south east direction between Pikes Gully Road (same road) in the north-west and NEH in the south east.

Traffic volumes on the NEH shows the following:

- › Approximately 14,000 to 15,000 vehicle movements per day.
- › Peak hour flows of around 1,500 two-way vehicle movements between 5:00 am – 6:00 am and 1,400 two way vehicle movements between 4:00 pm – 5:00 pm.
- › A vehicle classification of approximately 77% light vehicles and 23% heavy vehicles.

Public transport provision in the area is outlined below:

- › There are no bus services operating in proximity to Liddell, the workforce is assumed to all rely on private vehicles for travel to and from the site.
- › The MNRL runs through Liddell, with the site's internal rail loop connected with the MNRL and was previously used to transfer product coal via rail to the Port of Newcastle prior to cessation of mining operations. No rail services are provided to transport personnel to Liddell. Workers travel to site via private vehicle.

#### 6.4.2.2 Existing Traffic Generation

Under DA 305-11-01 (as modified), Liddell is approved for a maximum workforce of 460 personnel, comprising 360 full-time employees and approximately 100 contractors (DPE, 2023). The distribution of trips associated with these 460 workers has been determined to be 78% to the east, towards Singleton, and 22% to the west, towards Muswellbrook (Parsons Brinckerhoff, 2006).

Since the cessation of active mining operations in 2023, the workforce has substantially reduced to numbers well below the workforce Liddell is currently approved for (noting that mining operations are approved until 31 December 2028). Given the current levels of on-site workers compared with those during active mining operations, it is reasonable to assume a corresponding reduction in light-vehicle movements to and from Liddell.

The intersection of ONEH / NEH was assessed in 2011 when Liddell was fully operational with the 460 workers as part of Modification 5 (MOD 5) to DA 305-11-01 (Parsons Brinckerhoff, 2013). The intersection's operation was assessed to be Level of Service (LOS) 'B' which is reflective of good operation with acceptable delays and spare capacity. With the current workforce numbers, light vehicle traffic is expected to be lower, leading to similar or improved intersection performance.

Liddell is currently approved to transport 'old tailings' to local power stations using up to 114 truck movements per day (57 loaded trucks) along the NEH (DPE, 2023). This approval was granted as part of Modification 3 (MOD 3) to DA 305-11-01. Additionally, the MOD 3 TIA noted that Liddell operations generate a minimum of eight additional heavy vehicles per hour at the ONEH / NEH intersection (Parsons Brinckerhoff, 2006).

## 6.4.3 Assessment of Impacts

### 6.4.3.1 Parking Requirements

MOD 9 proposes the retention of the existing car park and vehicle access arrangements approved under DA305-11-01 (as modified).

DA 305-11-01 9 (as modified) provided LCO approval to accommodate 360 full time personnel and 100 contractors within the confines of the site. Given that active mining operations at Liddell concluded in 2023, the workforce has significantly reduced. Consequently, the existing car parking near the Administration Building and informal car parking area near the batching plant/s will readily accommodate the estimated maximum 10-20 person workforce associated with MOD 9.

### 6.4.3.2 Traffic Impacts

MOD 9 is expected to generate around 80 daily truck movements (40 deliveries) and associated worker trip generation from 10-20 contractors. Combined with the on-site workforce associated with closure and rehabilitation activities, the total workforce with MOD 9 will remain well below the site's approved peak of 460 workers.

As noted in **Section 6.4.2.2**, a Traffic Impact Assessment completed for MOD 3 determined that around 78% of the workforce travelled to and from the east towards Singleton, while 22% travelled to and from the west toward Muswellbrook. Based on a workforce of 460 workers when Liddell was fully operational, this equates to approximately 920 daily vehicle movements, comprising around 718 vehicle movements to/ from the east towards Singleton and 202 vehicle movements to/from the west towards Muswellbrook, via the NEH. In comparison, the 20 workers for MOD 9, together with the existing on-site workers, would generate approximately 170 daily vehicle movements. This is significantly lower than the estimated 920 daily vehicle movements during Liddell's peak operation, meaning that the worker and contractor traffic associated with MOD 9 remains well within the limits approved for peak operations at Liddell.

Consequently, the primary access point via the ONEH / NEH intersection is expected to experience lower traffic volumes compared to those during active mining operations with the LOS expected to remain unchanged. Furthermore, the generation of some 80 truck movements and 20 - 40 daily light vehicle movements associated with the 10 - 20 contractors, is less than one percent of the average daily traffic along the NEH. Based on current vehicle classifications along the NEH, approximately 77% of vehicles are light vehicles and 23% are heavy vehicles. An increase of 80 daily heavy vehicle movements would have a negligible effect on the overall heavy vehicle total.

The proposed 80 truck movements per day will be spread out throughout the day with an estimated eight truck movements occurring in a peak hour.

The proposed truck movements are also well within Liddell’s existing approval of 114 daily truck movements for transporting ‘old tailings’ along the NEH.

Overall, the traffic generation associated with MOD 9 is below peak traffic levels previously associated with Liddell and is not expected to result in traffic impacts beyond those already considered and approved.

### 6.4.4 Mitigation and Management

LCO will continue to manage impacts on traffic in accordance with existing measures implemented at Liddell. These include management measures such as heavy vehicles complying with the Heavy Vehicle National Law (HVNL) and its associated Chain of Responsibility (COR) requirements.

## 6.5 Ecology

### 6.5.1 Background

An Ecological Assessment for the disturbance proposed by MOD 9 was undertaken by Umwelt (Umwelt, 2025). A copy of the Ecological Assessment is provided in **Appendix E** with a summary provided within the following sections.

MOD 9 will occur entirely within the Approved Disturbance Area at Liddell. MOD 9 will result in some disturbance of previously mined areas that have been rehabilitated, but not yet relinquished, certified or demonstrated to meet the rehabilitation completion criteria. As such, the objective of the Ecological Assessment was to determine if MOD 9 would result in additional impacts to biodiversity values beyond those already approved for DA 305-11-01 (as modified).

### 6.5.2 Methodology

To determine the potential impacts to biodiversity values, a desktop and field assessment was conducted within the Proposed Disturbance Area as shown in **Figure 2** (which is defined as the Study Area within the Ecological Assessment). The Study Area encompasses 12.92 ha of land at Liddell where MOD 9 activities are proposed, that may result in surface disturbance (such as borehole drilling activities, proposed infrastructure and some haul roads). Land within the Study Area is located within the Approved Disturbance Area at Liddell. The Study Area is divided across five locations indicative of areas likely to be disturbed by MOD 9. Details and extents of these areas are provided in Table 10 and illustrated in Figure 1.1 of **Appendix E**.

**Table 10 Study Area Extent**

Study Area	Area (ha)
North-1	2.79
North-2	0.72
East-1	1.29
South-1	2.8
South-2	5.32
<b>Total Area</b>	<b>12.92</b>

The desktop assessment included a review of the NSW BioNet Atlas, the Commonwealth EPBC Act Protected Matters Search Tool (PMST), and the NSW Draft Native Vegetation Regulatory Map (NVR Map). An initial desktop review of the NVR Map was undertaken to review land categorisation, including to determine whether lands within the Study Area were cleared as of January 1990 or lawfully cleared thereafter. The land categorisation review incorporated an overlay of historical aerial imagery with the NVR Map to assess when clearing had occurred.

Field assessment included the collection of a floristic plot in accordance with the Biodiversity Assessment Method (BAM) and three transects in accordance with the Interim Grass and Groundcover Assessment Method (IGGAM) in areas of pasture.

## 6.5.3 Assessment of Impacts

### 6.5.3.1 Study Area Vegetation Extent

The Study Area covers 12.92 ha of land located within the Approved Disturbance Area at Liddell, although MOD 9 activities are not expected to disturb this entire area. A larger area was defined to provide flexibility in selecting final drilling pad locations, access tracks and to ensure efficient access to grouting target areas.

The Study Area is further broken down into areas of similar condition or land use, with the extent of each land use and vegetation type identified during field surveys summarised in **Table 11**.

The Study Area includes approximately 4.62 ha of exotic pasture, dominated by exotic grass species. These areas are in various conditions where rehabilitation works have occurred. The groundcover is primarily exotic species with common native species that often persist amongst exotic pasture present at very low density. The approved final land use within the Liddell rehabilitation areas is for grazing pasture land use and native vegetation corridors to enhance habitat connectivity. The Study Area is dominated by exotic pastures and sparse native vegetation with fragmented habitat. The ecological assessment has identified the existing condition of vegetation within the Study Area limits the potential of these areas to act as functional habitat for native fauna. The three IGGAM transects recorded estimates of between 83–96% exotic cover, 3–7% native cover, and 5–15% bare soil.

Approximately 0.89 ha of the Study Area consists of exotic ground layer with mixed shrub vegetation, typically located on the edges of operational areas and in a small area of early-stage rehabilitation. The vegetation is often dominated by exotic grasses and forbs with a mixed shrub layer of regenerating native and exotic species.

**Table 11 Study Area Vegetation Extent**

Area Description	North-1 Area (ha)	North-2 Area (ha)	East-1 Area (ha)	South-1 Area (ha)	South-2 Area (ha)	Total Area (ha)
Exotic Pasture	2.79	0.61	0.91	0.1	0.21	<b>4.62</b>
Exotic with mixed shrub	-	-	-	0.35	0.54	<b>0.89</b>
Native Canopy	-	-	-	-	0.10	<b>0.10</b>
Rehabilitation	-	-	-	1.06	-	<b>1.06</b>
Operational Area	-	0.11	0.38	1.29	4.47	<b>6.25</b>
<b>Total Area (ha)</b>	<b>2.79</b>	<b>0.72</b>	<b>1.29</b>	<b>2.8</b>	<b>5.32</b>	<b>12.92</b>

A small area of vegetation in South-2 comprises approximately 0.1 ha of a native canopy of *Eucalyptus moluccana* (Grey Box), *E. crebra* (Narrow-leaved ironbark), and *Allocasuarina luehmannii* (Buloke), with a primarily exotic understorey and occasional native grasses and forbs observed. Trees in this area are approximately 10–20 years old and do not contain habitat features such as hollows and deep fissures. The identified native canopy was part of a larger extent of native vegetation that was approved to be disturbed and was offset for Liddell under Modification 5 to DA 305-11-01. The vegetation recorded within this small portion of South-2 would most likely align with PCT 3431 Central Hunter Ironbark Grassy Woodland which is associated with the BC Act endangered ecological community (EEC) *Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions*.

Approximately 1.06 ha of the Study Area is in early-stages of rehabilitation. LCO has confirmed that some of this rehabilitation has undergone landform redesign in the past 12-18 months. The landform redesign included the redistribution of substrates such as overburden and a mix of topsoil and spoil. The rehabilitated vegetation is in the early establishment phase and does not yet provide habitat features that would support flora and fauna species known within the area. Vegetation in these areas also does not conform to any PCT in their current conditions. The IGGAM transect placed in South-1 identified 92% exotic vegetation, 6% bare soil, and 2% native cover. Vegetation was mostly absent from the 6.25 ha of operational areas, with only occasional exotic grasses along active haul roads.

### 6.5.3.2 Threatened Species

Results from a 10 km NSW BioNet Atlas and PMST database search conducted as part of the desktop analysis to identify recorded and potentially present threatened species in the area, are provided in **Table 12**. Species identified by the PMST search but not recorded in the State BioNet database are shown in parentheses beneath the PMST totals.

A likelihood of occurrence table is provided **Appendix E** with all threatened species considered unlikely to occur in the Study Area due to its disturbed condition and limited connection to any surrounding large remnants. During the May 2025 site visit and September 2025 field assessment, no threatened flora or fauna were observed in vegetated areas and additionally, no stick nests, hollow-bearing trees, or decorticating bark were observed.

### 6.5.3.3 Impact Assessment Summary

The biodiversity assessment has identified the disturbance proposed by MOD 9 will not exceed the impacts to biodiversity values beyond those already approved under DA 305-11-01 (as modified). MOD 9 will occur within the Approved Disturbance Area at Liddell.

**Table 12 BioNET Wildlife Atlas and PMST Database Search Results**

Species Group Number of Species	Number of Species Recorded (BioNet)	Number of Species (PMST)	Total Threatened Entities
Flora	9	14 (10)	19
Amphibians	1	2 (1)	2
Avifauna	29	19 (5)	34
Mammals	16	11 (4)	20
Reptiles	0	2 (2)	2
Total	55	48 (22)	77

The vegetation that is proposed to be disturbed by MOD 9 is largely exotic, of low ecological value, comprising few native species. Of the 12.92 ha, the Study Area comprises:

- › 0.1 ha of native vegetation, which was previously approved to be disturbed and offset under Modification 5 to DA 305-11-01. Impacts to this vegetation will be avoided or minimised by the MOD 9 activities wherever possible to protect existing native canopy species.
- › 6.57 ha of exotic vegetation that does not correspond to any recognised PCT in the Hunter Valley. This area is dominated by aggressive exotic grasses that suppress the establishment of native flora, with only a few hardy common native groundcover species present.
- › The remaining 6.25 ha of the Study Area is largely devoid of vegetation with only occasional exotic grasses along active haul roads.

Habitat quality across the Study Area is low, with limited connectivity to remnant vegetation and minimal suitability for threatened flora and fauna. The presence of young shrub layers and exotic pastures further limits ecological function, and the site's operational nature reduces its capacity to support amphibians or provide viable habitat for denning or breeding. The likelihood of threatened flora occurring is very low due to historical land use and existing soil conditions.

Overall, MOD 9 is not expected to cause any additional biodiversity impacts beyond those already assessed and approved under DA 305-11-01 (as modified).

## 6.5.4 Mitigation and Management

MOD 9 has been designed to avoid or minimise impacts to sensitive biodiversity values. For example, the initial plans to drill boreholes within the MNRL corridor was revised to relocate boreholes within the Approved Disturbance Area at Liddell.

The Study Area includes a small 0.1 ha patch of native canopy vegetation, would most likely align with PCT 3431 Central Hunter Ironbark Grassy Woodland which is associated with the BC Act endangered ecological community (EEC) *Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions*. Although currently approved for disturbance, LCO will avoid or minimise impacts to patches of trees associated with this woodland vegetation where possible through the design and planning of the borehole locations.

Upon the completion of the backfilling works proposed by MOD 9, all affected areas will be rehabilitated in line with Liddell's RMP. The rehabilitation activities will seek to reinstate disturbed vegetation cover (noting its exotic dominance) to establish these areas as part of the approved final land use for these areas. The approved final land uses at Liddell include pasture grazing and establishment of a native ecosystem (woodland) as currently approved under DA 305-11-01 (as modified).

## 6.6 Other Environmental Aspects

An overview of additional environmental impacts considered for MOD 9 is provided in **Table 13**. No specialised studies were undertaken for these aspects as MOD 9 occurs entirely within the Approved Disturbance Area at Liddell and is not anticipated to materially impact these environmental values.

LCO has an established Environmental Management System (EMS) at Liddell which includes a suite of environmental management plans and procedures for the management, monitoring and reduction of potential impacts of its operations to the surrounding environment. These plans and procedures provide the ongoing monitoring and management of environmental impacts at Liddell and will be implemented for managing impacts associated with MOD 9.

**Table 13 Other Environmental Aspects**

Environmental Aspect	Assessment of Impacts and Mitigation
Surface Water	<ul style="list-style-type: none"> <li>› Water use for MOD 9 will be sourced from Liddell’s Integrated Water Management System (IWMS) as described within the approved Water Management Plan (WMP). The primary water use for MOD 9 is the amount required for the grout mixture, estimated at approximately 115 megalitre (ML) of water. Water may also be used for dust suppression on materials stockpiles from time to time, as per the current practice at Liddell. The 2024 Annual Review (LCO, 2025) reported 8,027 ML of stored water at Liddell at the end of the reporting period, demonstrating that Liddell’s IWMS has sufficient water available to support MOD 9 in addition to current rehabilitation and closure activities.</li> <li>› MOD 9 surface activities will be located within the Approved Disturbance Area at Liddell. Accordingly, no additional surface water catchment will be affected beyond that currently envisaged.</li> <li>› Runoff from MOD 9 activities will generally be contained within Liddell’s water management system and within erosion and sediment control structures.</li> <li>› Construction of infrastructure would primarily take place on existing hardstand areas, that have already been cleared and compacted. Disturbance for the additional facilities and for borehole drilling activities will be minimal with standard erosion and sediment controls to be implemented.</li> <li>› Surface water management controls as described in the WMP have been effective for Liddell operations and will continue to be implemented for MOD 9. Some of the management controls relevant to MOD 9 include: <ul style="list-style-type: none"> <li>▪ The completion and approval of a Ground Disturbance Permit (GDP) before any disturbance to identify and manage potential environmental, community, infrastructure, and safety hazards associated with the proposed works;</li> <li>▪ An Erosion and Sediment Control Plan (ESCP) will be developed for proposed works as part of completing the GDP and the associated controls to be implemented prior to the main disturbance activity occurring. The ESCP inclusions are comprehensive and project specific but will include stockpile areas, access roads / haulage tracks, and a map of the construction site including planned areas of disturbances and no-go zones;</li> <li>▪ Environmental training and induction including toolbox talks to be undertaken for specific project/tasks requiring GDP;</li> <li>▪ Measures to minimise erosion and generation of sediment during construction and operation generally include the following: <ul style="list-style-type: none"> <li>→ Diversion of clean runoff through drains away from disturbed areas;</li> <li>→ Regular maintenance of all erosion and sediment controls;</li> <li>→ Regular inspection of access tracks/roads to ensure that drainage is working effectively, particularly after rain;</li> <li>→ Prompt revegetation of areas as soon as earthworks are complete; and</li> <li>→ Maximising onsite water re-use for dust suppression.</li> </ul> </li> <li>▪ Ongoing surface water quality monitoring; and</li> <li>▪ Implementation of the Trigger Action Response Plan (TARP) when required as described within the WMP.</li> </ul> </li> </ul>

Environmental Aspect	Assessment of Impacts and Mitigation
Historic and Cultural heritage	<ul style="list-style-type: none"> <li>› The surface disturbance activities associated with MOD 9 will be undertaken within the Approved Disturbance Area at Liddell.</li> <li>› Recorded Aboriginal heritage sites (on AHIMS) have previously been salvaged as part of the Liddell operations.</li> <li>› MOD 9 will be managed in accordance with the approved Liddell Aboriginal Cultural Heritage Management Plan (LCO, 2024b) which includes the following management measures:               <ul style="list-style-type: none"> <li>▪ Liddell’s GDP process which includes due diligence to ensure proposed activities are assessed for potential impacts on Aboriginal heritage sites. The process will also identify controls to be implemented if proposed work activities are approved to proceed; and</li> <li>▪ All employees and contractors undergo a site induction and specific training before accessing Liddell and commencing work activities. The induction and training cover Aboriginal Cultural Heritage management and ensures they understand relevant controls and legal obligations in respect of Aboriginal cultural heritage under the NPW Act.</li> <li>▪ Implementation of the <i>'Protocol for previously unrecorded finds within the approved disturbance area'</i>. Under the Protocol, should items that are believed to be of Aboriginal origin be noted, all work in the immediate vicinity of the find will cease and a qualified archaeologist must be consulted. Work activities cannot resume until the find has been properly assessed.</li> </ul> </li> </ul>
Importation of Fly Ash	<ul style="list-style-type: none"> <li>› The proposed use of fly ash for MOD 9 will comply with the Exemption and the <i>Coal Ash Order 2014</i> including:               <ul style="list-style-type: none"> <li>▪ Fly ash will be used in a grout mix as an 'engineering material' for sealing and stabilisation of underground workings.</li> <li>▪ Fly ash will be applied to land in a cementitious form (fly ash, cement and water).</li> <li>▪ Only suppliers who are in full compliance with the <i>Coal Ash Order 2014</i> will be engaged for MOD 9. Compliance will be verified prior to engagement, and suppliers will be required to maintain adherence to all relevant provisions for the duration of their contract.</li> </ul> </li> <li>› A variation to EPL 2094 (specifically Condition L4.1) will be submitted to permit the receipt of fly ash on site in accordance with the Exemption and the <i>Coal Ash Order 2014</i>. Given the compliance with the Exemption and the <i>Coal Ash Order 2014</i>, the scheduled activities permitted under the EPL will not need to be varied to allow for the activity.</li> </ul>
Social	<ul style="list-style-type: none"> <li>› MOD 9 is contained within the approved DA boundary of Liddell and does not require additional workforce beyond that already approved under DA 305-11-01 (as modified). As such, it is unlikely to generate any new social impacts or alter the existing social dynamics in the area. The traffic in Singleton was raised as an issue within consultation with Singleton Council. Traffic movements are expected to remain within those previously approved for mining operations at Liddell.</li> </ul>
Visual	<ul style="list-style-type: none"> <li>› Additional infrastructure proposed for MOD 9 will be located entirely within the Approved Disturbance Area at Liddell. The proposed infrastructure including the</li> </ul>

Environmental Aspect	Assessment of Impacts and Mitigation
	<p>grout batching plant, is temporary in nature and will be located in areas that have previously been disturbed.</p> <ul style="list-style-type: none"> <li>› Any associated visual impacts are considered negligible within the context of the existing approved mining infrastructure at Liddell and surrounding mining operations.</li> <li>› Proposed pipelines, access tracks and drill pads will be at ground level and therefore have negligible visual impacts.</li> </ul>
Rehabilitation post sealing & stabilisation works	<ul style="list-style-type: none"> <li>› Rehabilitation of the proposed disturbance areas will be carried out in accordance with the RMP to ensure these areas meet the conditions stipulated under DA 305-11-01 (as modified).</li> </ul>

## 7. Merit Evaluation

### 7.1 Ecologically Sustainable Development

The principles of ecologically sustainable development (ESD) are described in section 6(2) of the *Protection of the Environment Administration Act 1991*. **Table 14** lists the four principles of ESD and explains how MOD 9 is proposed to continue to satisfy these principles.

**Table 14 Principles of Ecologically Sustainable Development**

Principle	Application to the Modified Developments
The precautionary principle—namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.	The potential impacts of MOD 9 have been evaluated using the best available scientific methods. Specialist environmental assessments of key environmental risks conclude that MOD 9 will result in minor environmental impacts and is not expected to result in serious, irreversible or additional environmental impacts beyond those already approved for Liddell. Therefore, MOD 9 is considered to be consistent with the precautionary principle.
Inter-generational equity—namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.	<p>MOD 9 does not propose to alter the post-mining outcomes for Liddell; rather, it is proposed to support the achievement of the rehabilitation objectives for Liddell such as ensuring the <i>"Mine site (as a whole) to be safe, stable and non-polluting"</i>.</p> <p>The proposed grouting activities under MOD 9 are not expected to adversely affect the existing groundwater regime relied upon by other water users. Therefore these valuable resources will continue to remain available for future needs. In addition, the AQGHG assessment determined that MOD 9 would result in negligible impacts on air quality. Furthermore, the proposed activities are not anticipated to generate GHG emissions at levels considered <i>'significant'</i> under the EPA's definition of a <i>'large emitter'</i>. The GHG emissions for MOD 9 are minimal and temporary and will not result in significant contributions to climate change.</p>
Conservation of biological diversity and ecological integrity—namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration.	MOD 9 will not involve any new vegetation disturbance outside of the Approved Disturbance Area at Liddell. The biodiversity assessment completed for MOD 9 has concluded no additional impacts are expected to biodiversity values.
Improved valuation, pricing and incentive mechanisms—namely, that environmental factors should be included in the valuation of assets and services.	<p>MOD 9 is consistent with the <i>'polluter pays'</i> principle for the following reasons:</p> <ul style="list-style-type: none"> <li>› The proponent bears the cost of all environmental controls, including monitoring; and</li> </ul>

Principle	Application to the Modified Developments
	<ul style="list-style-type: none"> <li>› The mining operations completed by LCO over many decades has delivered material socio-economic benefits to the local community and Governments (including local Councils), including with the payment of mining royalties, company tax and other community investments. MOD 9 is seeking approval to address the potential risk of instability of former underground workings below the MNRL and other public infrastructure which aims to support its rehabilitation outcomes required under the Development Consent (as modified). This ensures that this potential risk is addressed upfront by LCO.</li> </ul>

## 7.2 Justification for the Modified Project

The primary objective of MOD 9 is to backfill sections of remnant underground workings at Liddell to provide long-term stability for the overlying MNRL and other public infrastructure. As discussed throughout this Modification Report, the targeted backfilling of remnant underground workings will have the following benefits:

- › Provide buttressing to coal pillars and structural support to the overlying strata and infrastructure for the long-term;
- › Reduce the potential for oxygen ingress within the targeted underground workings and minimise the risk of external influences such of spontaneous combustion; and
- › Assist in achieving the rehabilitation objectives for Liddell such as ensuring the *"Mine site (as a whole) to be safe, stable and non-polluting"*.

The proposed outcomes of MOD 9 are environmentally beneficial and assist Liddell in meeting its rehabilitation objectives. Comprehensive environmental assessments for key environmental risks have been undertaken to evaluate whether the pursuit of these positive outcomes could give rise to any adverse environmental effects and to inform this Modification Report. The findings of these assessments, together with recommended mitigation measures are summarised in **Section 6** with the full assessments provided in the appendices. Collectively, the assessments conclude that MOD 9 is expected to result in minimal environmental impacts which can be managed utilising existing environmental management practices in place at Liddell which will be revised and updated as relevant for MOD 9. A summary of these conclusions are outlined below:

- › Annual dust emissions from MOD 9 (as PM<sub>10</sub>) would be less than 2% of historical operational emissions at Liddell. Such emissions are immaterial in this context as well as in the context of the mining operations in the locality;
- › GHG estimates show that Scope 1 and Scope 2 emissions will not exceed 25,000 t of CO<sub>2</sub>-e in any financial year. These GHG emissions do not trigger the threshold for MOD 9 to be considered a 'large emitter' and therefore the GHG Guide does not apply;
- › No material increase in noise levels or additional risk to neighbouring receivers is expected due to the proposed MOD 9 activities and will continue to comply with noise limits in DA 305-11-01;
- › There is no direct hydraulic connectivity between the South Cut void (ultimate receptor) and the surrounding groundwater regime. Therefore, the activity is not considered to pose a consequential risk to local groundwater quality;
- › The backfilling works will not result in exceedances to the Level 1 Minimal Impact thresholds provided in the NSW AIP;

- › Traffic generation associated with MOD 9 is assessed to be well below peak traffic levels previously associated with Liddell and is not expected to result in traffic impacts beyond those already considered and approved;
- › The Biodiversity Assessment has confirmed that MOD 9 is not expected to cause any additional impacts to biodiversity values beyond those already assessed and approved under DA 305-11-01 (as modified);
- › Vegetation disturbance is minimal and will occur entirely within the Approved Disturbance Area at Liddell. The vegetation present across proposed areas of disturbance is largely exotic, of low ecological value, and contains few native species that will be avoided wherever possible. The current condition of the vegetation does not provide suitable habitat structure for flora and fauna species indicating its limited capacity to function as part of an effective habitat corridor; and
- › Infrastructure required for the proposed activities will be located within the Approved Disturbance Area at Liddell, generally in areas already compacted.

The effects of climate change have generally been considered within the relevant environmental impact assessments completed as part of this Modification Report.

- › The AQGHG assessment takes into account the existing measures in place at Liddell to minimise dust emissions during potential occurrences of extreme dry weather conditions. The GHG emissions associated with MOD 9 have been calculated (including relevant Scope 3 emissions) and have been assessed to be minimal and are unlikely to result in measurable consequences to climate change in the locality; and
- › The Groundwater Assessment has considered the potential impacts in the event that the areas proposed to be filled with grout materials become saturated (i.e. during extreme wet weather conditions) and determined that the ultimate receptor for any flow of water interacting with either of the Target Areas will be towards the South Cut open void. The South Cut open void remains as a long-term sink and accordingly no offsite impacts are anticipated.

Further to the impacts of MOD 9 that have been considered, it is acknowledged that the locality is likely to experience the effects of climate change into the future through increased prevalence of droughts, flooding and bushfires. LCO are active members of the local community and work collaboratively with local emergency services to support the local community during extreme weather events (i.e. droughts, flooding, and bushfires). As noted in **Section 5.2**, the Liddell CCC includes representatives from the community and the local Councils, working together to provide assistance as required.

The above considerations relating to the potential local effects of climate change provide suitable information for the determining authority in its consideration of section 4.15(1)(b) of the EP&A Act.

In circumstances where the environmental impacts have been assessed to be minimal, the overall benefits of MOD 9 (protection of infrastructure and achievement of rehabilitation objectives) are considered to outweigh any potential environmental impacts. The development as proposed to be modified by MOD 9 (including the changes approved by MOD 8) is considered to be substantially the same development as the Authorised Development and with the minor environmental impacts identified in the Modification Report, it is available for MOD 9 to be considered and determined under section 4.55(1A) of the EP&A Act.

## 8. References

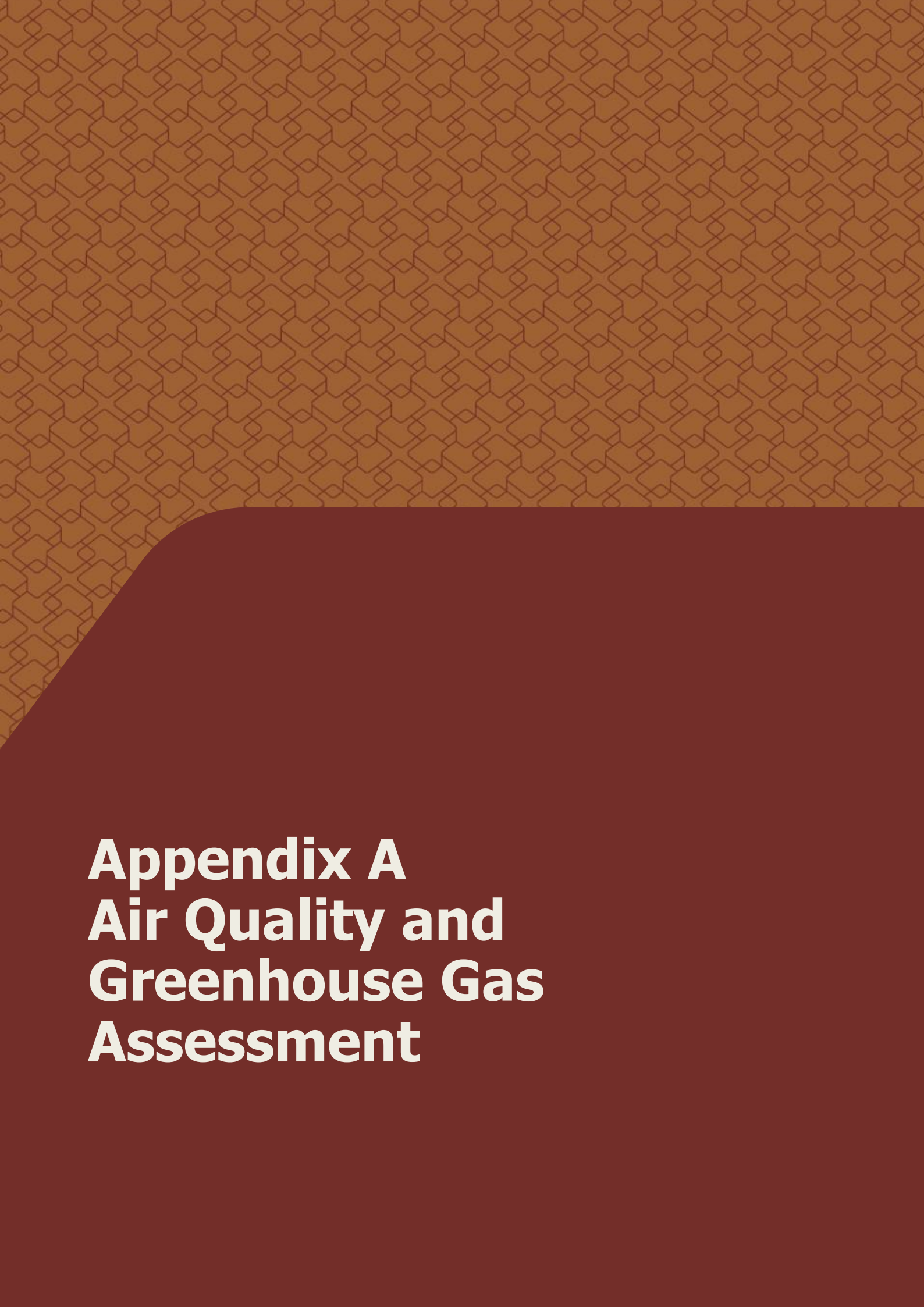
- › AGE (2022). *Groundwater Impact Assessment, GRAWTS Stage 2, Prepared for Liddell Coal Operations*. June 2022.
- › Airen Consulting (2025). *Lidell Coal Operations Modification 9: Air Quality and Greenhouse Gas Assessment*. December 2025.
- › Bridges Acoustics (2025). *Liddell Coal Operations – Modification 9 Acoustic Assessment*. December 2025.
- › Department of Planning and Environment (2022). *State significant development guidelines – preparing a modification report*.
- › Department of Planning and Environment (2023). *Environmental Planning and Assessment Act, 1979, Integrated State Significant Development, Determination of Development Application Pursuant to Section 76(a)9 & 80 – Consolidated Development Consent*.
- › Department of Primary Industries (2012). *NSW Aquifer Interference Policy*.
- › James Tomlin Consulting (2025). *Liddell MOD 9 – Groundwater Assessment*. December 2025.
- › Liddell Coal Operations (2022). *Air Quality Management and Monitoring Plan*. September 2022.
- › Liddell Coal Operations (2023). *Noise Monitoring Program Management Plan*. October 2023.
- › Liddell Coal Operations (2024). *Rehabilitation Management Plan*. August 2024.
- › Liddell Coal Operations (2024a). *Water Management Plan*. July 2024.
- › Liddell Coal Operations (2024b). *Aboriginal Cultural Heritage Management Plan*. July 2024.
- › Liddell Coal Operations (2025) *Liddell Annual Review 2024*. March 2025
- › NSW Department of Climate Change, Energy, the Environment and Water (2025). *NARClIM, Hunter Climate Change Snapshot*. November 2025.
- › NSW Environment Protection Authority (2017). *NSW Noise Policy for Industry*.
- › NSW Environmental Protection Authority (2023). *EPA Climate Change Policy*.
- › NSW Environmental Protection Authority (2025). *NSW Guide for Large Emitters: Guidance on How to Prepare a Greenhouse Gas Assessment as Part of the NSW Environmental Planning Processes*.
- › NSW Rural Fire Service (2019). *Planning for Bushfire Protection*. November 2019.
- › PDC Consultants (2025). *Transport Impact Assessment: Liddell Coal Operations – Modification 9*. December 2025.
- › Parsons Brinckerhoff (2006). *Traffic Impact Assessment Intersection of Old New England Highway and the New England Highway: Liddell Coal Operations*.
- › Parsons Brinckerhoff (2013). *Liddell Coal Operations Modification to DA 305-11-01 Traffic Impact Assessment*.
- › Umwelt (2025). *Liddell Coal Operations Modification 9: Ecological Assessment*. December 2025.

## 9. Abbreviations

Term	Definition
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
AIP	Aquifer Interference Policy
Approved Disturbance Area	Areas of existing and areas of approved surface disturbance at Liddell
APZ	Asset Protection Zone
ARTC	Australian Rail Track Corporation
BC Act	<i>Biodiversity Conservation Act 2016</i>
BDAR	Biodiversity Development Assessment Report
CCC	Community Consultative Committee
CCP	Environment Protection Authority's Climate Change Policy
CLM Act	<i>Contaminated Land Management Act 1997</i>
CMSC Act	<i>Coal Mine Subsidence Compensation Act 2017</i>
CO <sub>2</sub> -e	Carbon Dioxide Equivalent
DA Boundary	Liddell's approved development consent boundary
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DPHI	NSW Department of Planning, Housing and Infrastructure
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EP&A Regulation	<i>Environmental Planning and Assessment Regulation 2021</i>
EPA	NSW Environment Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EPI	Environmental Planning Instruments
EPL	Environment Protection Licence
ESD	Ecologically sustainable development
GHG	Greenhouse Gas
GHG Guide	NSW Guide for Large Emitters: Guidance on How to Prepare a Greenhouse Gas Assessment as Part of the NSW Environmental Planning Processes
Glencore	Glencore Coal Pty Limited

Term	Definition
GL	Gigalitres
GRA	Greater Ravensworth Area
GRAWTS	Greater Ravensworth Area Water and Tailings Scheme
Grout	A cementitious mix of either coal ash or blended coal ash (that complies with the Coal Ash Exemption 2014, or referred to as “fly ash” in this Modification Report) mixed with general purpose cement and water
Heritage Act	<i>Heritage Act 1977</i>
Infrastructure SEPP	<i>State Environmental Planning Policy (Transport and Infrastructure) 2021</i>
Integra	Integra Underground Mine
km	kilometres
km/hr	kilometre per hour
LEP	Local Environment Plan
LCO	Liddell Coal Operations Pty. Limited
LGA	Local Government Area
Liddell	Liddell Coal Operations
LOS	Level of Service
MGO	Mount Owen and Glendell Operations
Mining Act	Mining Act 1992
ML	Mining Lease
ML	Megalitres
MNES	Matters of National Environmental Significance
MNRL	Main Northern Rail Line
MOD 9	Modification 9 to DA 305-11-01
MSD	Mine Subsidence District
Muswellbrook LEP	<i>Muswellbrook Local Environmental Plan 2009</i>
NDC	Nationally Determined Contribution
NEH	New England Highway
NGER Act	<i>National Greenhouse and Energy Reporting Act 2007</i>
NPI	National Pollutant Inventory

<b>Term</b>	<b>Definition</b>
NPW Act	<i>National Parks and Wildlife Act 1974</i>
NSW	New South Wales
ONEH	Old New England Highway
PBFP	Planning for Bush Fire Protection
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
RMP	Rehabilitation Management Plan
Resources and Energy SEPP	<i>State Environmental Planning Policy (Resources and Energy) 2021</i>
SEPP	State Environmental Planning Policies
Singleton LEP	<i>Singleton Local Environmental Plan 2013</i>
SSD	State Significant Development
Study Area	Encompasses 12.92 ha of land at Liddell where MOD 9 activities that may result in surface disturbance are proposed (such as borehole drilling activities, proposed infrastructure and some haul roads). The land within the Study Area are located within the Approved Disturbance Area at Liddell.
S&T Regulation	<i>Biodiversity Conservation (Savings and Transitional) Regulation 2017 (NSW)</i>
t	tonnes
Target Areas	The remnant underground workings targeted for backfilling comprising two locations; Target Area 1 and Target Area 2
TDS	Total Dissolved Solids
TfNSW	Transport for New South Wales
the Exemption	<i>The Coal Ash Exemption 2014</i>
WM Act	<i>Water Management Act 2000</i>
WMP	Water Management Plan
Xenith	Xenith Consulting Pty Ltd



# **Appendix A Air Quality and Greenhouse Gas Assessment**



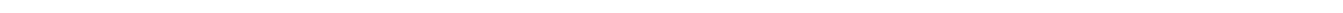
# LIDDELL COAL OPERATIONS MODIFICATION 9

## Air Quality and Greenhouse Gas Assessment

Final | Revision 1

17 December 2025

Project: 25092



## Liddell Coal Operations Modification 9

Project number	25092
Title	Liddell Coal Operations Modification 9
Subject	Air Quality and Greenhouse Gas Assessment
Version	Final
Revision	Revision 1
Date	17 December 2025
Client	Liddell Coal Operations Pty Ltd
Project manager	Shane Lakmaker
File name	25092_Liddell MOD 9_AQ & GHG_Final_rev1.docx

Version	Date	Description	Author	Review
D1R1	25/09/25	Draft report	SL	NL
D2R1	27/09/25	Draft report	SL	XC, LCO
D3R1	7/11/25	Draft report	SL	XC, LCO
Final R0	12/12/25	Final report	SL	NL, XC, LCO
Final R1	17/12/25	Final report	SL	NL, XC, LCO

© Copyright 2025 Airen Consulting ABN 44 646 147 579

Limitation: This document has been prepared on behalf of, and for the exclusive use of Airen Consulting's client, and is subject to, and issued in accordance with, the provisions of the contract between Airen Consulting and the client. In preparing this report, Airen Consulting has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Airen Consulting has not attempted to verify the accuracy or completeness of any such information. Airen Consulting has prepared this report in accordance with the usual care and thoroughness of the consulting profession. No other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law. This report should be read in full, and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Airen Consulting for use of any part of this report in any other context.

## Contents

Executive Summary .....	iv
1 Introduction.....	1
1.1 Background.....	1
1.2 Modification Description.....	1
1.3 Report Structure.....	2
2 Air Quality Assessment.....	4
2.1 Air Quality Criteria .....	4
2.2 Assessment Methodology.....	5
2.3 Existing Environment.....	5
2.3.1 Local Setting .....	7
2.3.2 Meteorology .....	7
2.3.3 Air Quality.....	9
2.4 Potential Impacts.....	10
2.5 Air Quality Management .....	11
3 Greenhouse Gas Assessment.....	13
3.1 Background.....	13
3.2 Federal Policy .....	13
3.3 State Policy.....	14
3.4 Assessment Boundary and Scenarios.....	15
3.5 Estimated Emissions .....	16
4 Conclusions .....	18
5 References.....	19
Appendix A. Dust emission calculations.....	20

### List of figures

Figure 1 Conceptual Modification Layout.....	3
Figure 2 Location of Compliance Air Quality and Meteorological Monitors .....	6
Figure 3 Wind Roses from Data Collected at the Liddell AWS.....	8

### List of tables

Table 1 Air quality impact assessment criteria from DA 305-11-01 .....	4
Table 2 Air quality assessment criteria for relevant air quality indicators .....	5
Table 3 Summary of measured PM <sub>10</sub> concentrations .....	9
Table 4 Summary of estimated PM <sub>2.5</sub> concentrations.....	9
Table 5 Summary of measured TSP concentrations .....	9
Table 6 Summary of measured deposited dust levels .....	10
Table 7 Estimated fugitive dust emissions from historical operations at Liddell .....	11
Table 8 Estimated fugitive dust emissions from MOD 9.....	11
Table 9 Relevant NSW Government legislation and policy.....	14
Table 10 GHG source inclusions and exclusions .....	16
Table 11 GHG emission estimation methodologies for MOD 9.....	17
Table 12 Estimated GHG emissions from MOD 9.....	17
Table 13 Reported GHG emissions from Liddell .....	17

## Acronyms and definitions

Abbreviation	Definition
CER	Clean Energy Regulator
CO <sub>2</sub>	Carbon dioxide
CO <sub>2</sub> -e	Carbon dioxide equivalent
COP	Conference of the Parties
DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
EPA	NSW Environment Protection Authority
EP&A Act	Environmental Planning and Assessment Act 1979
EPL	Environment Protection Licence
FY	Financial Year
g/m <sup>2</sup> /month	Grams per square metre per month.
GHG	Greenhouse gas
Guide	NSW Guide for Large Emitters
GWP	Global Warming Potential
Measurement Determination	National Greenhouse and Energy Reporting (Measurement) Determination 2008
Kt CO <sub>2</sub> -e/y	Kilotonnes of CO <sub>2</sub> equivalent per year
m/s	Metres per second
NDC	Nationally Determined Contribution
NGA	National Greenhouse Accounts
NGER Act	National Greenhouse Gas and Energy Reporting Act 2007
NPI	National Pollutant Inventory
NSW	New South Wales
SSD	State Significant Development
WRI	World Resources Institute
µg/m <sup>3</sup>	micrograms per cubic metre.

## Executive Summary

Liddell Coal Operations (Liddell) is operated by Liddell Coal Operations Pty. Limited (LCO), a subsidiary of Glencore Coal Pty Limited. Liddell is located approximately 25 kilometres (km) north-west of Singleton and 26 km south-east of Muswellbrook in the Upper Hunter, New South Wales. Mining at Liddell has ceased and LCO is currently progressing mine closure and rehabilitation activities in accordance with Liddell's development consent DA 305-11-01 (as modified) and Environmental Protection Licence (EPL No. 2094).

LCO seeks a modification to DA 305-11-01 to permit works required to backfill targeted sections of remnant underground workings situated beneath the Main Northern Rail Line and other public infrastructure to provide long term stability. This includes the use of grout (a cementitious mix of either coal ash or blended coal ash [i.e. materials which comply with the *Coal Ash Exemption 2014*, and are referred to as "fly ash" in this assessment] mixed with general purpose cement). The backfilling of the remnant underground workings aims to:

- Provide buttressing to coal pillars and structural support to the overlying strata and infrastructure for the long term;
- Reduce the potential for oxygen ingress within the targeted underground workings and minimise the risk of external influences such as spontaneous combustion; and
- Assist in achieving the rehabilitation objectives for Liddell such as ensuring the "Mine site (as a whole) to be safe, stable and non-polluting".

The modification is being referred to as Modification 9 (MOD 9). This report provides an assessment of the potential air quality impacts and greenhouse gas (GHG) emissions associated with MOD 9.

The assessment considered historical operations, historical air quality compliance and proposed activities to determine potential air quality risks. GHG emissions were estimated in accordance with recognised methodologies.

The following key conclusions were made in relation to air quality impacts:

- Annual dust emissions from MOD 9 (as PM<sub>10</sub>) would be less than 2% of historical operational emissions. Given that historical air quality monitoring and Annual Reviews have shown that LCO complied with the air quality criteria from DA 305-11-01, it can be inferred that MOD 9 will continue to meet the relevant air quality impact assessment criteria.
- Measures described within the existing Air Quality Management and Monitoring Plan (LCO, 2022) would be appropriate for controlling dust from drilling, unsealed roads, cementitious products, and exposed areas for MOD 9.

The following key conclusions were made in relation to GHG emissions:

- MOD 9 would not generate "significant" emissions as per the Environment Protection Authority (EPA) definition of a "large" emitter, and the detailed assessment steps of the "NSW Guide for Large Emitters" (EPA, 2025) are not applicable.
- The GHG management measures included in the existing Air Quality Management and Monitoring Plan (LCO, 2022) would continue to be applicable to manage impacts from MOD 9.

# 1 Introduction

## 1.1 Background

Liddell Coal Operations (Liddell) is located approximately 25 kilometres (km) north-west of Singleton and 26 km south-east of Muswellbrook in the Upper Hunter, New South Wales. Liddell is operated by Liddell Coal Operations Pty. Limited (LCO), a subsidiary of Glencore Coal Pty Limited (Glencore). Liddell operates in accordance with development consent DA 305-11-01 (as modified) and Environmental Protection Licence (EPL No. 2094) administered under the *Protection of the Environment Operations Act 1997*.

Mining operations at Liddell are approved until 31 December 2028 with production of up to 8 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal from its open cut operations. However, mining operations at Liddell concluded in 2023, and LCO is currently progressing mine closure and rehabilitation activities.

LCO seeks a modification to DA 305-11-01 to permit works required to backfill targeted sections of remnant underground workings situated beneath the Main Northern Rail Line (MNRL) and other public infrastructure to provide long term stability. This includes the use of grout (a cementitious mix of either coal ash or blended coal ash [i.e. materials which comply with the *Coal Ash Exemption 2014*, and are referred to as “fly ash” in this assessment] mixed with general purpose cement) (Figure 1). The backfilling of the remnant underground workings will provide the following benefits:

- Provide buttressing to coal pillars and structural support to the overlying strata and infrastructure for the long term;
- Reduce the potential for oxygen ingress within the targeted underground workings and minimise the risk of external influences such as spontaneous combustion; and
- Assist in achieving the rehabilitation objectives for Liddell such as ensuring the “Mine site (as a whole) to be safe, stable and non-polluting”.

The modification is being referred to as Modification 9 (MOD 9).

This report provides an assessment of the potential air quality impacts and greenhouse gas (GHG) emissions associated with MOD 9.

## 1.2 Modification Description

The core modification activity of MOD 9 is the backfilling of the remnant underground workings across two target areas (Target Area 1 and Target Area 2) (Figure 1). MOD 9 generally proposes the following:

- Construction and operation of a grout batching compound and ancillary infrastructure on predominantly existing hardstand areas that have already been cleared and compacted. The grout batching compound will be constructed in locations that will support the backfilling works associated with the two Target Areas. General details of required infrastructure include:
  - Hardstand compound within predominantly existing hardstand areas already cleared and compacted;
  - Grout batching plant (batch plant will be relocated between Target Areas);
  - Cement storage silos and water storage tanks;
  - Material stockpile areas;
  - Temporary office and ablution buildings;
  - Water pipeline from site water source to water tanks;
  - Pipelines from the batching plant to the boreholes; and
  - Other ancillary infrastructure as required to support the grout batching activities;
- Drilling of boreholes to access the former underground workings within the two Target Areas. Approximately 70 boreholes will be required to undertake and monitor the filling of the underground workings. However, the final number of boreholes may change depending on the performance of the backfilling activities. To avoid disturbance of areas outside of the approved disturbance area at Liddell, LCO will drill angled holes (where required) to reach targeted workings underneath the MNRL rail corridor and other public infrastructure;
- Pumping and emplacement of grout into the targeted underground workings;
- Transportation of materials used for the activities (including those required for batching grout on-site) via approximately 40 truck deliveries (i.e. approximately 80 truck movements) per day generally transported to Liddell via highway routes; and

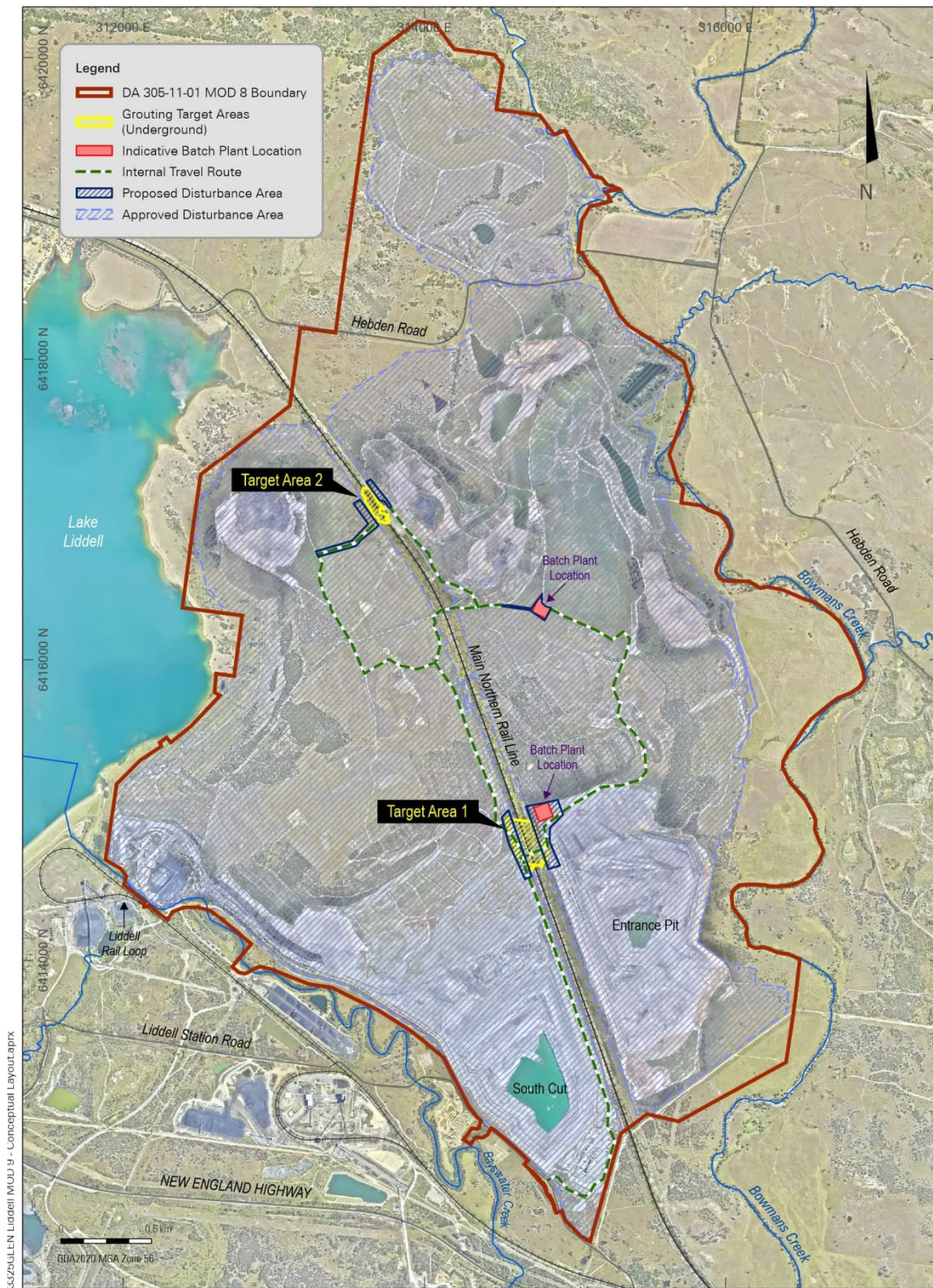
- Decommissioning and rehabilitation of disturbed areas following the completion of works, including sealing of boreholes, decommission and removal of temporary infrastructure from the site, releveling and rehabilitation of drill pads and access tracks in accordance with Liddell's Rehabilitation Management Plan.

The proposed works are expected to take approximately 12 months to complete with an estimated contractor workforce of around 10 -20 personnel.

### 1.3 Report Structure

The report is structured as follows:

- Section 1 provides the background to the proposed Modification.
- Section 2 provides an assessment of the potential air quality impacts.
- Section 3 provides an assessment of the greenhouse gas emissions.
- Section 4 provides the conclusions of the assessment.



S:\2201\EN Liddell MOD 9 - Conceptual Layout.aprx

**LIDDELL**  
GLENORE



LIDDELL COAL OPERATIONS  
Conceptual Modification Layout

Source: Xenith Consulting

Figure 1 Conceptual Modification Layout

## 2 Air Quality Assessment

### 2.1 Air Quality Criteria

Air quality is typically quantified by the concentrations of substances in the ambient air. Air pollution occurs when the concentration (or some other measure of intensity) of one or more substances known to cause health, nuisance and / or environmental effects, exceeds a certain level. With regard to human health and nuisance effects, the primary air quality issue for MOD 9 is dust, also referred to as particulate matter.

Key classifications of particulate matter include:

- Total suspended particulates (TSP).
- Particulate matter with equivalent aerodynamic diameter of 10 microns or less (PM<sub>10</sub>).
- Particulate matter with equivalent aerodynamic diameter of 2.5 microns or less (PM<sub>2.5</sub>).
- Deposited dust.

Condition 16, Schedule 3 of DA 305-11-01 (as modified) requires LCO to “ensure that all reasonable and feasible avoidance and mitigation measures are employed so that particulate emissions generated by the development do not exceed the air quality impact assessment criteria listed in Tables 3, 4 and 5 at any residence on privately-owned land”. Table 1 shows the air quality criteria from DA 305-11-01.

Table 1 Air quality impact assessment criteria from DA 305-11-01

Air quality indicator	Averaging time	<sup>d</sup> Air quality impact assessment criteria from DA 305-11-01
Particulate matter (PM <sub>10</sub> )	24-hour	<sup>b</sup> 50 µg/m <sup>3</sup>
	Annual	<sup>a</sup> 30 µg/m <sup>3</sup>
Particulate matter (TSP)	Annual	<sup>a</sup> 90 µg/m <sup>3</sup>
Deposited dust <sup>c</sup>	Annual (maximum increase)	<sup>b</sup> 2 g/m <sup>2</sup> /month
	Annual (maximum total)	<sup>a</sup> 4 g/m <sup>2</sup> /month

<sup>a</sup> Total impact (i.e. increase in concentrations due to the development plus background concentrations due to all other sources).

<sup>b</sup> Incremental impact (i.e. incremental increase in concentrations due to the development on its own).

<sup>c</sup> Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter – Deposited Matter – Gravimetric Method.

<sup>d</sup> Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Secretary.

LCO holds EPL 2094 issued under the NSW *Protection of the Environment Operations Act 1997* (POEO Act) for Liddell. Although EPL 2094 does not include air quality criteria, Condition P1.1 of EPL 2094 does identify four locations in the vicinity of Liddell where dust concentration monitoring must be conducted.

Operating conditions relevant to air quality are provided in Condition O3 of EPL 21007:

O3 Dust

O3.1 The premises must be maintained in a condition which minimises or prevents the emission of dust from the premises.

O3.2 All trafficable areas, coal storage areas and vehicle manoeuvring areas in or on the premises must be maintained, at all times, in a condition that will minimise the generation, or emission from the premises, of wind-blown or traffic generated dust.

O3.3 All operations and activities occurring at the premises must be carried out in a manner that will minimise the emission of dust from the premises.

The NSW Environment Protection Authority (EPA) has developed assessment criteria for a range of air quality indicators including particulate matter. These criteria are outlined in the “Approved Methods for the Modelling and Assessment of Air Pollutants in NSW” (EPA, 2022), hereafter referred to as the Approved Methods. Most of the EPA criteria referred to in this report have been drawn from national environment protection standards for ambient air quality set by the National Environmental Protection Council of Australia (NEPC) as part of the National Environment Protection Measures (NEPC, 1998 and updates to 2021).

The Approved Methods criteria are outlined in Table 2 and apply to existing and potentially sensitive receptors, where the Approved Methods defines a sensitive receptor as including “a location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area”.

Table 2 Air quality assessment criteria for relevant air quality indicators

Air quality indicator	Averaging time	Criterion	Application
Particulate matter (PM <sub>10</sub> )	24-hour	50 µg/m <sup>3</sup>	Cumulative, at sensitive receptors
	Annual	25 µg/m <sup>3</sup>	Cumulative, at sensitive receptors
Particulate matter (PM <sub>2.5</sub> )	24-hour	25 µg/m <sup>3</sup>	Cumulative, at sensitive receptors
	Annual	8 µg/m <sup>3</sup>	Cumulative, at sensitive receptors
Particulate matter (TSP)	Annual	90 µg/m <sup>3</sup>	Cumulative, at sensitive receptors
Deposited dust (insoluble solids)	Annual (maximum increase)	2 g/m <sup>2</sup> /month	Incremental, at sensitive receptors
	Annual (maximum total)	4 g/m <sup>2</sup> /month	Cumulative, at sensitive receptors

Source: EPA, 2022.

Many of the EPA air quality assessment criteria relate to the total concentration of pollutants in the air (that is, cumulative) and not just the contribution from project-specific sources. Therefore, some consideration of background levels needs to be undertaken when using these criteria to assess the potential impacts. In situations where background levels are elevated, the proponent must “demonstrate that no additional exceedances of the impact assessment criteria will occur as a result of the proposed activity and that best management practices will be implemented to minimise emissions of air pollutants as far as is practical” (EPA, 2022). Section 2.3 provides further discussion on historical air quality.

## 2.2 Assessment Methodology

This assessment provides a semi-quantitative review of MOD 9 in the context of historical activities, proposed activities, contemporary assessment requirements, and recent air quality and meteorological monitoring. This involved:

- Examining recent air quality and meteorological monitoring data and evaluating any assumptions made in past assessments.
- Checking the history of air quality compliance at Liddell.
- Identifying the key sources of air emissions from activities associated with MOD 9.
- Developing an air emissions inventory for activities associated with MOD 9 and comparing these emissions to those of the historical emissions from Liddell.
- Extrapolating the potential air quality impacts of MOD 9 based on relative emissions, location of sources, status of sensitive receptors, and current assessment criteria.
- Examining the existing emission controls for suitability to manage any potential changes in impacts as a result of MOD 9.

## 2.3 Existing Environment

This section provides a description of the environmental characteristics near Liddell, including a review of recent and historical meteorological and ambient air quality conditions. The main objectives of this review were to develop an understanding of existing air quality conditions and to evaluate any assumptions made in past assessments.

Figure 2 shows the location of the compliance-based air quality and meteorological monitors, the data from which have been used to inform the existing environment review.



Source: Liddell: Air Quality Management and Monitoring Plan, Figure 4-9 (LCO, 2022)

Figure 2 Location of Compliance Air Quality and Meteorological Monitors

### 2.3.1 Local Setting

The area surrounding Liddell is dominated by power generation and mining activities, with some agricultural activities and scattered residential settlements. Neighbouring operations include Ravensworth Surface Operations and Hunter Valley Operations to the south, Ravensworth Coal Terminal and Ravensworth Underground Mine to the southwest, the Mt. Owen Complex to the east, and Liddell and Bayswater power stations to the west. A number of other mining operations are situated in the Upper Hunter region.

There are fifteen nearby private dwellings, with the closest dwellings located at least 3 km from Target areas. The remaining private dwellings are situated within the Bowmans Creek valley to the northeast of Liddell.

### 2.3.2 Meteorology

Meteorological conditions are important for determining the transport of emissions, and the potential influences on air quality. In addition, meteorological data are often used with concurrent air quality data to determine potential contributions from sources of interest. This section provides an analysis of the local meteorological conditions.

The EPA prescribes the minimum requirements for meteorological data that are to be used for air quality assessments (EPA, 2022). These requirements include data capture rates, siting and operation, and data preparation. Meteorological stations that are used for the purposes of air quality assessments can be classified (EPA, 2022) as either "site specific" or "site representative". Data from site specific meteorological stations are preferred however site representative data are also acceptable where site specific meteorological data are not available provided that the data adequately describe the expected meteorological conditions at the site of interest. Air quality assessments that involve modelling are usually carried out using at least one year of site specific meteorological data that is over 90% complete.

LCO has been monitoring meteorological conditions around Liddell since at least 2000. An automatic weather station (AWS) is located near the administration building (Figure 2). This station collects continuous records of temperature, wind speed, wind direction, and rainfall, among other parameters.

The Liddell AWS was installed in accordance with the applicable Australian Standard (AS 3580.14) and specifically for collecting data to assist with understanding the local wind conditions on a continuous basis. This station can be considered as "site specific" for the purposes of air quality assessment and would have collected data that can be classified as specific to conditions at and around Liddell.

Figure 3 shows wind-roses from data collected at the Liddell AWS between 2020 and 2024. The wind-roses show the frequency of wind speeds and wind directions based on hourly records. The circular format of the wind rose shows the direction from which the wind blew and the length of each "spoke" around the circle shows how often the wind blew from that direction. The different colours of each spoke provide details on the speed of the wind from each direction.

The wind-roses (Figure 3) show very little variability in wind patterns from year-to-year. Prevailing winds are from the northwest and southeast, a pattern which is driven by the northwest-southeast alignment of the Hunter Valley.

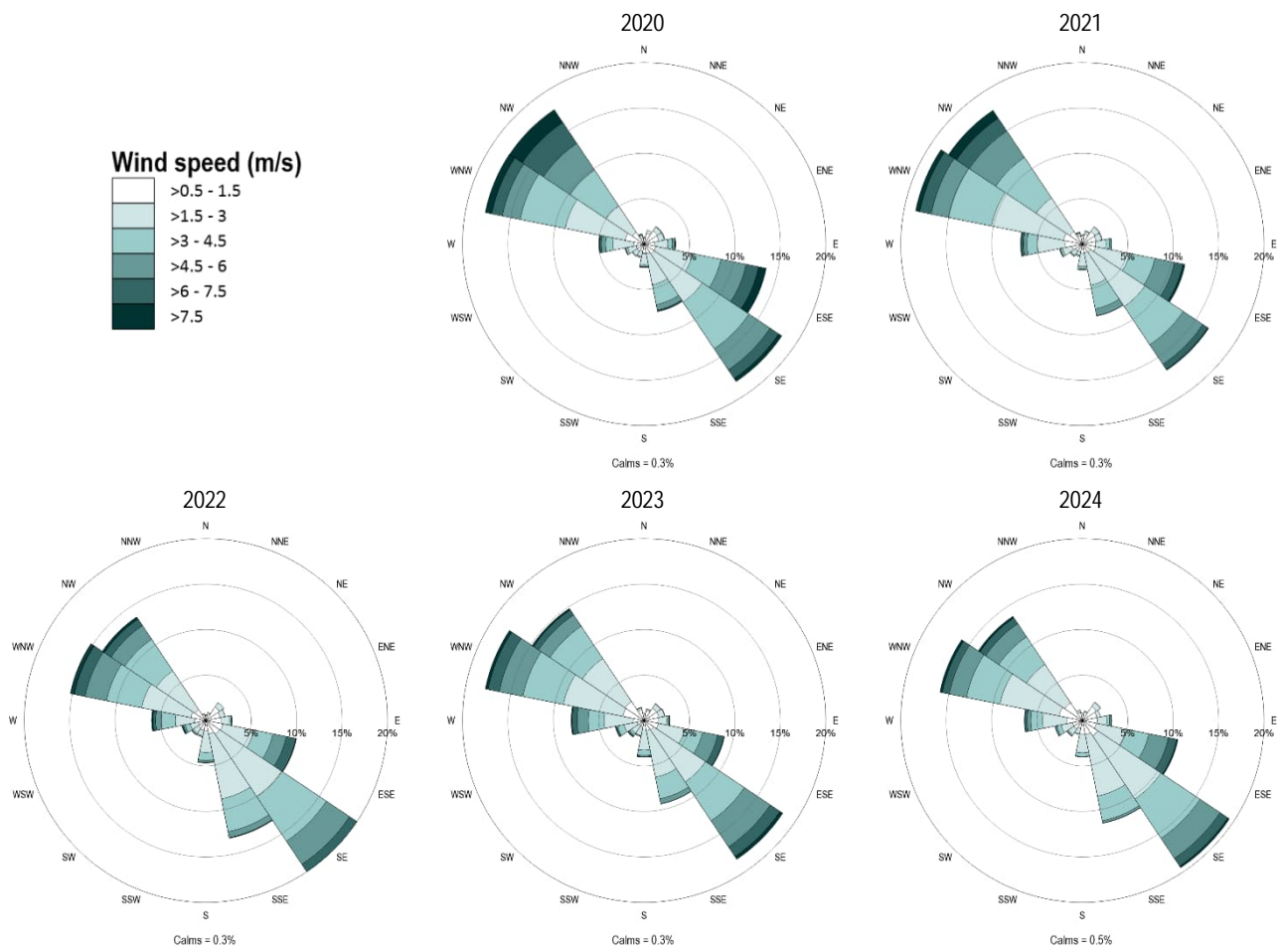


Figure 3 Wind Roses from Data Collected at the Liddell AWS

### 2.3.3 Air Quality

LCO monitors PM<sub>10</sub> around Liddell and Table 3 provides a summary of the measurement data since 2020. These data show that higher average PM<sub>10</sub> concentrations occurred in 2020. This coincided with drought conditions and lower than average rainfall. The DPHI noted multiple extraordinary events from 2017 to 2020 and indicated that conditions were not representative of typical air quality (DPE, 2020). The increases in PM<sub>10</sub> concentrations were observed across many locations in NSW and were not unique to the Hunter region. Annual average PM<sub>10</sub> concentration have not exceeded the DA 305-11-01 criterion. Maximum 24-hour average PM<sub>10</sub> concentrations and site contributions have been assessed in Annual Reviews, with compliance demonstrated.

Table 3 Summary of measured PM<sub>10</sub> concentrations

Year	D1 (TEOM)	D2 (TEOM)	Scriven (12) (HVAS)	Antiene (21) (HVAS)	DA 305-11-01 criteria
Annual average (µg/m <sup>3</sup> )					
2020	16	20	15	18	30
2021	13	18	9	12	30
2022	12	16	8	12	30
2023	15	18	10	13	30
2024	14	17	11	13	30

LCO does not monitor PM<sub>2.5</sub>. Concentrations of PM<sub>2.5</sub> have been estimated from the PM<sub>10</sub> data on the (conservative) assumption that 50% of the PM<sub>10</sub> is PM<sub>2.5</sub>. Table 4 shows the estimated PM<sub>2.5</sub> concentrations. DA 305-11-01 does not prescribe any criteria for PM<sub>2.5</sub>.

Table 4 Summary of estimated PM<sub>2.5</sub> concentrations

Year	D1 (TEOM)	D2 (TEOM)	EPA criteria
Annual average (µg/m <sup>3</sup> )			
2020	8.1	10.2	8
2021	6.7	8.8	8
2022	6.1	7.8	8
2023	7.4	9.1	8
2024	7.1	8.3	8

LCO monitors TSP at two locations (Figure 2). Table 5 shows the annual average TSP concentrations from data collected in the most recent five-year period. These data show that TSP concentrations have not exceeded 90 µg/m<sup>3</sup>.

Table 5 Summary of measured TSP concentrations

Year	Scriven (11) (HVAS)	Antiene (2) (HVAS)	DA 305-11-01 criteria
Annual average (µg/m <sup>3</sup> )			
2020	36	47	90
2021	24	33	90
2022	21	31	90
2023	29	36	90
2024	29	29	90

Deposited dust is monitored at 2 compliance locations (Figure 2). Table 6 shows the measured annual average deposited dust levels. The monitored dust levels have not exceeded the DA 305-11-01 air quality criteria in the most recent five-year period.

Table 6 Summary of measured deposited dust levels

Year	D55	D62	DA 305-11-01 criteria
Annual average (g/m <sup>2</sup> /month)			
2020	1.8	1.5	4
2021	2.6	2.1	4
2022	2.8	1.4	4
2023	2.5	0.9	4
2024	1.2	1.1	4

## 2.4 Potential Impacts

Potential air quality impacts of MOD 9 would be influenced by the nature and intensity of the activities taking place, the prevailing meteorological conditions, and proximity of sensitive receptors. Dust emissions are expected to be the key air quality issue and the total amount of dust generated would depend on the types of operations being carried out, exposed areas, frequency of water spraying and speed of vehicles and machinery operating on unpaved roads and areas. A more detailed review of the activities proposed for MOD 9 is outlined below.

Construction and operation of a grout batching compound for each Target Area is expected to include:

- Hardstand compound within predominantly existing hardstand areas already cleared and compacted;
- Grout batching plant (batch plant will be relocated between Target areas);
- Temporary office and ablution buildings;
- Cement storage silos and water storage tanks;
- Material stockpile areas (e.g. fly ash);
- Water pipeline from Liddell water source to water tanks;
- Pipelines from the batching plant to the boreholes; and
- Other ancillary infrastructure as required to support the grout batching activities.

All infrastructure will be temporary in nature and will be fully removed at the end of grouting works with the disturbed areas rehabilitated in accordance with the Liddell Rehabilitation Management Plan.

The proposed works require the drilling of approximately 70 boreholes to undertake and monitor the filling of the remnant underground workings. The final number of boreholes may change depending on the performance of the backfilling activities. To avoid disturbance of areas outside of the approved disturbance area at Liddell, LCO will drill angled holes (where required) to reach targeted workings underneath the MNRL rail corridor and other public infrastructure;

- The boreholes will generally be up to approximately 200 mm in diameter. The approximate depths of the holes in Target Area 1 would range from 110 to 170 m, whereas the holes in Target Area 2 range from 45 to 55 m.
- Nominal drill pad sizes will be 20 m x 20 m, however these will change, as required, depending on slope and vegetation clearing requirements. All holes will be drilled using above ground sumps / tanks for storage of drill cuttings. At the completion of grouting works, casing will be removed to 1.5 m below surface, holes will be grouted to surface with drill pads and associated access tracks rehabilitated in accordance with the Liddell Rehabilitation Management Plan.

Additional boreholes may also be drilled if required for backfilling of additional areas of remnant underground workings, with any disturbance to remain within the approved disturbance area at Liddell.

There will be approximately 40 truck deliveries (i.e. approximately 80 truck movements) per day supplying materials used for the activities (including those required for batching grout on-site) to Liddell. Fly ash will be sourced and hauled from Power Stations within the region (with source options including Earing Power Station or the nearby Bayswater Power Station). Cement will be hauled in via a powder tanker. Pre-mixed concrete for use in plug construction will be delivered via agitator trucks from regional suppliers or mixed on-site at the batch plant.

All operations will be limited to Monday to Friday, between the hours of 7:00 am and 5:30 pm. No works are planned for weekends or public holidays.

Based on the above, the most significant dust generating activities would be:

- Drilling of holes for grouting works
- Wheel generated dust from vehicles delivering materials (such as fly ash and cement)
- Wind erosion from fly ash stockpiles and exposed areas

The potential air quality impacts of these activities have been determined by quantifying the emissions and comparing these emissions to historical operational emissions from Liddell, with reference to past air quality monitoring and compliance outcomes.

Table 7 shows the estimated fugitive dust emissions (as PM<sub>10</sub>) from historical operations at Liddell, as reported for Modification 5 (Pacific Environment, 2013). Annual PM<sub>10</sub> emissions were estimated to be up to 1,230,525 kg/y. With these emissions, and from the historical air quality monitoring (Section 2.3.3), LCO complied with the air quality criteria from DA 305-11-01 at nearest sensitive receptors.

In addition, data reported to the National Pollutant Inventory (NPI) show that the estimated annual PM<sub>10</sub> emissions from Liddell have significantly decreased in recent years. For example, annual PM<sub>10</sub> emissions in FY 24/25 were in the order of 80% lower than the PM<sub>10</sub> emissions in FY 20/21. This downward trend reflects the significant reduction in site activities as mining ceased.

Table 7 Estimated fugitive dust emissions from historical operations at Liddell

Operational year	ROM coal mined (Mtpa)	Annual emissions (kilograms per year (kg/y))		
		TSP	PM <sub>10</sub>	PM <sub>2.5</sub>
Operations in Year 2*	7.1	Not available	1,122,564	Not available
Operations in Year 4*	7.2	Not available	1,230,525	Not available
Operations in Year 5*	7.0	Not available	1,147,421	Not available

\* Source: Pacific Environment (2013)

Dust emissions from the activities associated with MOD 9 have been estimated using the emission factors from "Emission Estimation Technique Manual for Mining" (NPI, 2012). Table 8 shows the estimated TSP, PM<sub>10</sub> and PM<sub>2.5</sub> emissions from MOD 9. Appendix A provides details of the emission calculations.

Table 8 Estimated fugitive dust emissions from MOD 9

MOD 9 activities during closure and rehabilitation	Annual emissions (kilograms per year (kg/y))		
	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>
Drilling holes for grouting	12	6	1
Wheel generated dust	58,448	17,252	1,725
Wind erosion from fly ash stockpiles and exposed areas	9,697	4,849	727
Total	68,158	22,107	2,453

The data from Table 7 and Table 8 show that emissions from activities associated with MOD 9 would represent a very small fraction of historical emissions at Liddell (as per Table 7). Specifically, PM<sub>10</sub> emissions from MOD 9 would be less than 2% of historical operational emissions. Given that historical air quality monitoring (Section 2.3.3) and Annual Reviews have shown that LCO complied with the air quality criteria from DA 305-11-01, it can be inferred that MOD 9 would not result in any additional exceedances of the relevant air quality impact assessment criteria.

## 2.5 Air Quality Management

The approved Air Quality Management and Monitoring Plan (LCO, 2022) describes the key sources of emissions, relevant air quality criteria, air quality management measures, air quality monitoring, and a contingency plan to manage any unpredicted impacts and their consequences.

MOD 9 would represent a relatively low air quality risk (compared with historical operations) and an appropriate air quality management strategy would include standard mitigation measures such as:

- 
- Minimising the area of disturbed land at any one time
  - Adopting controls for unsealed haul road dust emissions
  - Use of water sprays when drilling if / as required
  - Use of water sprays on stockpile areas if / as required
  - Storing cement in silos to minimise dust
  - Visual monitoring to identify excessive dust generation

## 3 Greenhouse Gas Assessment

### 3.1 Background

GHG is a collective term for a range of gases that are known to trap radiation in the upper atmosphere, where they have the potential to contribute to the greenhouse effect (global warming). GHGs include:

- Carbon dioxide (CO<sub>2</sub>); by far the most abundant GHG, primarily released during fuel combustion.
- Methane (CH<sub>4</sub>); generated from the anaerobic decomposition of carbon-based material (including enteric fermentation and waste disposal in landfills).
- Nitrous oxide (N<sub>2</sub>O); generated from industrial activity, fertiliser use and production.
- Hydrofluorocarbons (HFCs); commonly used as refrigerant gases in cooling systems.
- Perfluorocarbons (PFCs); used in a range of applications including solvents, medical treatments and insulators.
- Sulphur hexafluoride (SF<sub>6</sub>); used as a cover gas in magnesium smelting and as an insulator in heavy duty switch gear.

It is common practice to aggregate the emissions of these gases to the equivalent emission of carbon dioxide. This provides a simple figure for comparison of emissions against targets. Aggregation is based on the potential of each gas to contribute to global warming relative to carbon dioxide and is known as the global warming potential (GWP). The resulting number is expressed as carbon dioxide equivalents (or CO<sub>2</sub>-e).

GHG emissions that form an inventory can be split into three categories known as “Scopes”. Scopes 1, 2 and 3 are defined by the Greenhouse Gas Protocol (WRI, 2004) and can be summarised as follows:

- Scope 1 – Direct emissions from sources that are owned or operated by the organisation (examples include combustion of diesel in company owned vehicles or used in on-site generators).
- Scope 2 – Indirect emissions associated with the import of energy from another source (examples include importation of electricity or heat).
- Scope 3 – Other indirect emissions (other than Scope 2 energy imports) which are a direct result of the operations of the organisation but from sources not owned or operated by them (examples include business travel, by air or rail, and product usage).

The purpose of differentiating between the scopes of emissions is to avoid the potential for double counting, where two or more organisations assume responsibility for the same emissions.

### 3.2 Federal Policy

The 21<sup>st</sup> yearly session of the Conference of Parties (COP), held in Paris in 2015, was pivotal for developing an international treaty on climate change. It resulted in “The Paris Agreement”, an agreement “to achieve a balance between anthropogenic (human induced) emissions by sources and removals by sinks of greenhouse in the second half of this century”. Subsequent COPs have sought to develop policy architecture to deliver on the commitments of COP21. In particular, following COP21, international agreements were made to:

- Keep global warming well below 2.0 degrees Celsius, with an aspirational goal of 1.5 degrees Celsius (based on temperature pre-industrial levels).
- From 2018, countries are to submit revised emission reduction targets every five years, with the first being effective from 2020, and goals set to 2050.
- Define a pathway to improve transparency and disclosure of emissions.
- Make provisions for financing the commitments.

The *Climate Change Act 2022* operates as umbrella legislation to implement Australia’s net-zero commitments. It codifies Australia’s net 2030 and 2050 GHG emissions reduction targets under the Paris Agreement including targets to cut emissions by 43% by 2030 from 2005 levels and achieve net zero emissions by 2050. The Federal Government more recently (September 2025) set a national target to reduce emissions by 62 to 70% below 2005 levels by 2035.

The Federal Government uses the *National Greenhouse and Energy Reporting Act 2007* (NGER Act) legislation for the measurement, reporting and verification of GHG emissions in Australia. This legislation is used for a range of purposes, including international GHG reporting. Under the NGER Act, constitutional corporations in Australia which exceed thresholds for GHG emissions or energy production or consumption are required to measure and report data to the Clean Energy Regulator (CER) on an annual basis.

The NGER Act defines facility and corporate group emission thresholds. The facility thresholds are:

- 25,000 t or more CO<sub>2</sub>-e (scope 1 and scope 2 emissions);
- production of 100 terajoules (TJ) or more of energy; or
- consumption of 100 TJ or more of energy.

LCO reports both Group and Facility greenhouse gas emissions under the NGER Act.

The *National Greenhouse and Energy Reporting (Measurement) Determination 2008* (Measurement Determination) identifies several methodologies to account for GHGs from specific sources relevant to Liddell. This includes emissions of GHGs from direct fuel combustion (fuels for transport energy purposes), emissions associated with consumption of power from direct combustion of fuel (e.g. diesel generators), and from consumption of electricity from the grid.

The Measurement Determination provides methods, criteria, and measurement standards for calculating and reporting greenhouse gas emissions and energy data under the NGER Act. It covers Scope 1 and Scope 2 emissions and energy production and consumption. The calculation methodologies have been based primarily on the National Greenhouse Accounts (NGA) Factors as these are used for the purposes of project assessment in NSW. The NGA Factors provide methods for the estimation of GHG emissions. Whilst drawing on the Measurement Determination, the NGA factors can be applied to a broader range of emissions estimates.

The Safeguard Mechanism has been in place since 1 July 2016 and is a legislated framework that applies to all facilities that emit more than 100,000 tonnes of CO<sub>2</sub>-e of Scope 1 emissions (emissions produced on-site) in a year. The Safeguard Mechanism places a limit on the amount of greenhouse gases Australia's largest industrial facilities can emit by assigning each facility covered by the Mechanism a 'baseline'. Each year, every large facility within the Safeguard Mechanism reports their emissions to the CER. Any facility that emits more greenhouse gases than allowed by their baseline has to take actions to reduce their emissions, for example, through purchasing Australian Carbon Credit Units.

Reforms to the Safeguard Mechanism took effect from 1 July 2023. Under these reforms, new baseline emissions numbers ('baselines') for designated large facilities are set on a declining trajectory aligned with achieving Australia's emissions reduction targets set out in the *Climate Change Act 2022* and its Nationally Determined Contribution (NDC) under the Paris Agreement. The decline rate for Safeguard baselines is currently 4.9% per year to 2030, followed by 3.285% per year thereafter. Liddell ceased operations in 2023 and no longer emits more than 100,000 tonnes of CO<sub>2</sub>-e of Scope 1 emissions (direct emissions produced on-site) in a year as it did during active mining operations. As such, it is not considered to be a Safeguard facility.

### 3.3 State Policy

Table 9 summarises the relevant NSW Government legislation and policy documents that are relevant to MOD 9, including policy documents from the EPA, the primary environmental regulator for NSW.

Table 9 Relevant NSW Government legislation and policy

Title	Description
NSW Guide for Large Emitters	The Guide outlines the EPA's assessment requirements for new projects likely to have large emissions and proposed modifications of existing facilities likely to significantly increase their emissions.
Climate Change Licensee Requirements	<p>The EPA is proposing new requirements for NSW's large greenhouse gas emitters. The requirements are detailed in the following documents:</p> <ul style="list-style-type: none"> <li>- Proposed Climate Change Licensee Requirements - Consultation Draft - July 2025</li> <li>- Climate Change Mitigation and Adaptation Plans: Proposed Mitigation Requirements – Consultation Draft - July 2025</li> <li>- Proposed Greenhouse Gas Mitigation Guide for NSW Coal Mines – Consultation Draft - July 2025</li> </ul> <p>These documents have been published for consultation and public feedback is currently being sought. However none of the measures in the "Proposed Greenhouse Gas Mitigation Guide for NSW Coal Mines" apply to MOD 9.</p>
<i>Climate Change (Net Zero Future) Act 2023</i>	Legislates NSW target reductions in GHG emissions of 50% of 2005 levels by 30 June 2030, 70% of 2005 levels by 30 June 2035, and net zero emissions by 2050. The Act does not impose any direct obligations on companies or facilities.

Title	Description
NSW Climate Change Policy Framework	Sets out the NSW Government's long-term goals of achieving net-zero emissions by 2050, and making NSW more resilient and better adapted to a changing climate.
Net Zero Plan Stage1: 2020-2030	Foundation for NSW's action on climate change. It outlines the NSW Government's plan to grow the economy, create jobs and reduce emissions during the 2020s.
Net Zero Plan Stage 1: 2020-2030 Implementation Update Net Zero Plan Implementation Update 2022	These provide updates on the key achievements of NSW Government under the Net Zero Plan and commit NSW to reducing emissions by 50% below 2005 levels by 2030, and 70% below 2005 levels by 2035.
NSW Climate Change Adaptation Strategy	Sets out the NSW Government's strategic approach for managing the impacts of climate change on the State.
NSW Waste and Sustainable Materials Strategy 2041	Sets out how NSW will transition to a circular economy over the next 20 years, including key reforms for reducing GHG emissions from materials (embedded carbon) and the waste sector.
<i>Protection of the Environment Administration Act 1991</i>	<p>Outlines the EPA's statutory objectives and duty to address climate change. Section 6 of the Act outlines the EPA's statutory objectives to protect the environment and human health. The key elements are:</p> <ul style="list-style-type: none"> <li>- to protect, restore and enhance the quality of the environment in NSW, having regard to the need to maintain ecologically sustainable development</li> <li>- to reduce the risks to human health and prevent the degradation of the environment, including by taking action in relation to climate change.</li> </ul> <p>Section 9 of the Act imposes a statutory duty on the EPA to develop environmental quality objectives, guidelines and policies to ensure environment protection. This includes protection of the environment from climate change.</p>
<i>Protection of the Environment Operations Act 1997</i>	Sets out EPA's statutory powers and regulatory tools, including environment protection licensing. Schedule 1 of the Act sets out the types of activities that need a licence. The EPA is required to consider its statutory objectives (above) when exercising its licensing functions.
Climate Change Policy	<p>Supports and builds upon NSW Government's climate change policies and initiatives. The main purpose is to address:</p> <ul style="list-style-type: none"> <li>- the EPA's statutory objectives to protect, restore and enhance the quality of the environment in NSW, and to reduce the risks to human health and prevent the degradation of the environment</li> <li>- the EPA's statutory duty to develop environmental quality objectives, guidelines and policies to ensure environment protection from climate change.</li> </ul>
Climate Change Action Plan 2023-26	<p>Designed to deliver the Climate Change Policy. The Action Plan sets out:</p> <ul style="list-style-type: none"> <li>- the specific actions the EPA will take over the three years that it covers</li> <li>- the regulatory action the EPA will consider over the medium to longer term, where an increased regulatory response may be required to support the NSW Government's climate change commitments and policies, including achieving net-zero emissions in NSW by 2050.</li> </ul>
Strategic Plan 2024–29	<p>Describes how the EPA will deliver stewardship for the environment to protect, restore and enhance the environment and human health. It sets out commitments to effective regulation and a focus on high quality environmental outcomes across all of EPA's work. The plan details objectives and outcomes for three key areas:</p> <ul style="list-style-type: none"> <li>- caring for country</li> <li>- driving action on climate change</li> <li>- enabling a safe circular economy.</li> </ul>
Waste Delivery Plan	Outlines the actions the EPA take to reduce the harmful impact of waste and drive behaviours that create a circular economy. The Waste Delivery Plan includes actions to reduce carbon emissions and building the resilience of the waste sector to climate change.

In January 2025, the EPA finalised their GHG assessment requirements in the "NSW Guide for Large Emitters" (EPA, 2025) (the Guide). The Guide outlines the assessment requirements for new projects likely to have large emissions and proposed modifications of existing facilities likely to significantly increase their emissions. There are two main tests to determine the applicability of the Guide. These consider whether the project (or modification) is a large emitter, and if these emissions will be "significant" based on the development type. The potential applicability and requirements of the Guide are discussed in Section 3.4.

### 3.4 Assessment Boundary and Scenarios

The level of assessment of MOD 9 has been informed by the "NSW Guide for Large Emitters" (EPA, 2025). The assessment requirements of the Guide are applicable to a project if it meets the following three criteria:

- The project proposal requires development assessment and approval, or a change to an approval, under the *Environmental Planning and Assessment Act 1979*.
- The project involves one or more scheduled activities under Schedule 1 of the *Protection of the Environment Operations Act* (POEO Act) and / or will be carried out at an existing licensed premises.

- The project is likely to emit 25,000 tonnes or more of scope 1 and 2 emissions CO<sub>2</sub>-e in any financial year during the operational life of the project (based on planned operational throughput and as designed).

Emissions have been calculated to determine whether MOD 9 is likely to result in more than 25,000 tonnes of CO<sub>2</sub>-e of scope 1 and 2 emissions in any financial year during the operational life of the project (incremental to the emissions from the existing approved development).

The assessment boundary was developed to include all significant Scope 1, 2 and 3 emissions. The completeness principle states that all relevant emission sources within the chosen inventory boundary need to be accounted for so that a comprehensive and meaningful inventory is compiled (WRI, 2004).

Emission sources include the dominant sources at mining operations that are often targeted by mitigation measures and of interest to stakeholders. Table 10 lists the sources that have been included and excluded from the assessment. The source exclusions represent sources that are unlikely to generate sufficient emissions to materially change impacts or influence the decision-making outcomes of stakeholders. Emissions for the excluded sources are also not included in the National Greenhouse and Energy Reporting Scheme (except for emissions from industrial processes).

Table 10 GHG source inclusions and exclusions

Activity	Description	Scope
Included sources		
Diesel usage (vehicles)	Combustion of diesel fuel from on-site mobile equipment	1
Diesel usage (generators)	Combustion of diesel fuel from on-site generators	1
Vegetation removal	Loss of carbon sink from vegetation removal	1
Electricity	Electricity usage from on-site activities	2
Diesel transport	Combustion of diesel fuel from transporting materials to site	3
Grout manufacture	Embodied energy in cement for grouting product manufacture	3
Excluded sources		
Industrial processes	Sulphur hexafluoride (high voltage switch gear) Hydrofluorocarbon (commercial and industrial refrigeration)	1
Wastewater handling (industrial)	Methane emissions from wastewater management	1
Solid waste	Solid waste to landfill	3
Business travel	Employees travelling for business purposes	3
Employee travel	Employees travelling between their place of residence and Liddell	3

Emissions have been considered for the operational life of MOD 9 which is expected to be 12 months. The components of MOD 9 are related to the mine closure and rehabilitation activities and do not seek to extend the life of current approved mining operations.

### 3.5 Estimated Emissions

The GHG inventory in this document has been calculated in accordance with the principles of the GHG Protocol. The initial actions for a GHG inventory are to determine the sources of GHG emissions, assess their likely significance and set a boundary for the assessment. Creating an inventory of the likely GHG emissions has the benefit of determining the scale of the emissions and providing a baseline from which to assess options that may be reasonable and feasible for GHG reduction. The results of this assessment are presented in terms of the previously mentioned 'Scopes' to help understand the direct and indirect impacts of MOD 9.

The GHG Protocol (and similar reporting schemes) dictates that reporting Scope 1 and 2 sources is mandatory, whilst reporting Scope 3 sources is optional. Reporting significant Scope 3 sources is recommended. Scope 3 emissions are a consequence of the activities of the company, although occur from sources not owned or controlled by the company. Some examples of Scope 3 activities include the extraction and production of purchased materials, transportation of purchased fuels, and (whilst no longer relevant to LCO) the use of sold products and services. The inventory for this assessment includes all significant sources of GHGs (Scopes 1, 2 and 3) associated as per Table 10.

Future projections of fuel usage, land clearing, electricity usage and vehicle movements (from LCO) were used to determine the GHG emissions from MOD 9. Table 11 shows the emission estimation methodologies for the key emission sources.

Table 11 GHG emission estimation methodologies for MOD 9

Activity	Description	Scope(s)	Emission estimation methodology
Diesel usage (vehicles)	Combustion of diesel fuel from on-site mobile equipment	1, 3	Emission factors from NGA Factors (Department of Climate Change, Energy, the Environment and Water [DCCEEW], 2024a).
Diesel usage (generators)	Combustion of diesel fuel from on-site generators	1, 3	Emission factors from NGA Factors (DCCEEW, 2024a).
Vegetation removal	Loss of carbon sink from vegetation removal	1	Calculated using "Carbon Gauge" developed by the Transport Authorities Greenhouse Group (Transport Authorities Greenhouse Group, 2013). Vegetation of "Class I Grasslands". Biomass class set to "Class 3:100-150 (tonnes of dry matter per hectare [t dry matter/ha])" based on site location.
Electricity	Electricity usage from on-site activities	2, 3	Emission factor projections from DCCEEW (2024b).
Diesel transport	Combustion of diesel fuel from transporting materials to site	3	Emission factors from NGA Factors (DCCEEW, 2024a).
Grout manufacture	Embodied energy in cement for grouting product manufacture	3	Emission factors from the Infrastructure Sustainability Materials Calculator Version 2.0, developed by the ISCA (ISCA, 2019) including life cycle inventories and weighting factors.

Table 12 shows the estimated emissions due to all identified GHG generating activities associated with MOD 9. Emissions from MOD 9 would not exceed 25,000 tonnes of scope 1 and 2 emissions CO<sub>2</sub>-e in any financial year, from the Guide. Therefore, the assessment requirements of the Guide are not applicable, and no further assessment is required. The GHG management measures included in the Air Quality Management and Monitoring Plan (LCO, 2022) would continue to be applicable.

Table 12 Estimated GHG emissions from MOD 9

Activity	Usage	Units	Emission factor (kg CO <sub>2</sub> -e/unit)			Emission (t CO <sub>2</sub> -e)			Total
			Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	
Diesel (on-site)	301*	kL	2709.72	0	667.78	817	-	201	1,018
Land clearing	8 <sup>#</sup>	ha	311625	0.00	0.00	2,493	-	-	2,493
Electricity usage	-	kWh	0	0.47	0.03	-	-	-	-
Diesel (material transport)	957**	kL	0	0	2717.44	-	-	2,600	2,600
Grout manufacture	11,500	t	0	0	161.59	-	-	1,858	1,858
Total	-	-	-	-	-	3,310	-	4,660	7,970

<sup>#</sup> Land clearing relates to disturbance of previously disturbed areas which have since been rehabilitated. Emissions from this activity will therefore be conservatively high.

\* Calculated from LCO estimates of equipment fuel burn, and hours per day usage.

\*\* Calculated from 40 truck deliveries per day, 5 days per week, 230 km return site distance, and fuel consumption of 40 L/100 km.

GHG emissions from Liddell have historically been calculated using the Measurement Determination and reported in accordance with the NGER Act. Table 13 shows the reported GHG emissions for recent years. The decrease in reported emissions in recent years reflects the decrease in site activities due to the cessation of active mining and the undertaking of rehabilitation and mine closure activities.

Table 13 Reported GHG emissions from Liddell

Reporting year	Emission (t CO <sub>2</sub> -e)	
	Scope 1	Scope 2
FY 21/22*	168,363	20,728
FY 22/23*	166,197	20,234
FY 23/24*	20,057	4,050

\* Source: Liddell Annual Reviews (LCO 2023, LCO 2024, LCO 2025)

## 4 Conclusions

This report has provided an assessment of potential air quality and GHG impacts associated with MOD 9 to DA 305-11-01. The assessment considered historical operations, historical air quality compliance and proposed activities to determine potential air quality risks. GHG emissions were estimated in accordance with recognised methodologies.

The following key conclusions were made in relation to air quality impacts:

- Annual dust emissions from MOD 9 (as PM<sub>10</sub>) would be less than 2% of historical operational emissions. Given that historical air quality monitoring and Annual Reviews have shown that LCO complied with the air quality criteria from DA 305-11-01, it can be inferred that MOD 9 will continue to meet the relevant air quality impact assessment criteria.
- Measures described within the existing Air Quality Management and Monitoring Plan (LCO, 2022) would be appropriate for controlling dust from drilling, unsealed roads, cementitious products, and exposed areas for MOD 9.

The following key conclusions were made in relation to GHG emissions:

- MOD 9 would not generate “significant” emissions as per the EPA definition of a “large” emitter, and the detailed assessment steps of the “NSW Guide for Large Emitters” (EPA, 2025) are not applicable.
- The GHG management measures included in the existing Air Quality Management and Monitoring Plan (LCO, 2022) would continue to be applicable.

## 5 References

- DCCEEW (2024a) "National Greenhouse Accounts Factors 2024". Department of Climate Change, Energy, the Environment and Water.
- DCCEEW (2024b) "Australia's emissions projections 2024". Department of Climate Change, Energy, the Environment and Water. November 2024.
- DCCEEW (2024c) "Safeguard Mechanism" document July 2021 republished October 2023, April 2024 and September 2024. Last updated 24 September 2024. Department of Climate Change, Energy, the Environment and Water.
- DPE (2020) "Annual Air Quality Statement 2019". Available from <https://www.environment.nsw.gov.au/>. Department of Planning and Environment now known as Department of Planning, Housing and Infrastructure.
- DPIE (2020) "Net Zero Plan Stage 1: 2020–2030". Department of Planning, Industry and the Environment. March 2020.
- EPA (2022) "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW". August 2022. Published by the Environment Protection Authority.
- EPA (2025) "NSW Guide for Large Emitters – guidance on how to prepare a greenhouse gas assessment as part of NSW environmental planning processes". January 2025. Environment Protection Authority.
- ISCA (2019) Infrastructure Sustainability Materials Calculator Version 2.0, Release date 31/05/2019, Infrastructure Sustainability Council of Australia.
- Liddell Coal Operations (2023) "Liddell Annual Review 2022". March 2023.
- Liddell Coal Operations (2024) "Liddell Annual Review 2023". March 2024.
- Liddell Coal Operations (2025) "Liddell Annual Review 2024". March 2025.
- Liddell Coal Operations (2022) "Liddell Air Quality Management and Monitoring Plan". Effective 21/09/2022. NEPC (1998 and updates to 2021) "Ambient Air – National Environment Protection Measure for Ambient Air Quality", National Environment Protection Council, Canberra.
- Pacific Environment (2013) "Air Quality and Greenhouse Gas Assessment – Liddell Coal Operations Modification 5". Job number 5347. Report dated 20 February 2013.
- WRI (2004). "Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard - REVISED EDITION". The Greenhouse Gas Protocol is a collaboration between the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). The Protocol provides guidance on the calculation and reporting of carbon footprints.

## Appendix A. Dust emission calculations

Table A1 details the emission factors for the calculations.

Table A1 Emission factors

Activity	Emission factors	Units	Source
Drilling	$E_{TSP} = 0.59$ $E_{PM10} = 0.52 \times E_{TSP}$ $E_{PM2.5} = 0.03 \times E_{TSP}$	kg/hole	US EPA / NPI (2012)
Hauling on unsealed roads	$E_{F_{SP}} = \frac{0.4536}{1.6093} \times 4.9 \times \left(\frac{s}{12}\right)^{0.7} \times \left(\frac{W \times 1.1023}{3}\right)^{0.45}$ $E_{F_{PM_{10}}} = \frac{0.4536}{1.6093} \times 1.5 \times \left(\frac{s}{12}\right)^{0.9} \times \left(\frac{W \times 1.1023}{3}\right)^{0.45}$ $E_{PM2.5} = 0.03 \times E_{TSP}$	kg/VKT	US EPA / NPI (2012)
Wind erosion from fly ash stockpiles and exposed areas	$E_{TSP} = 0.1$ $E_{PM10} = 0.5 \times E_{TSP}$ $E_{PM2.5} = 0.075 \times E_{TSP}$	kg/ha/h	US EPA

W = vehicle gross mass. A value of 30 t has been used.

S = silt content (%). A default value of 10% has been used.

### Emission calculations

Activity	Annual emissions (kg/y)				Control (%)	Intensity	Units	TSP		PM10		PM2.5	
	TSP	PM10	PM2.5					Factor	Units	Factor	Units	Factor	Units
Drilling rock	12	6	1	70	69 holes/y		0.59 kg/hole		0.31 kg/hole		0.030 kg/hole		
Wheel generated dust	58448	17252	1725	75	65312 km/y		3.58 kg/km		1.06 kg/km		0.11 kg/km		
Wind erosion from exposed areas	9697	4849	727	0	11 ha		876.0 kg/ha/y		438.0 kg/ha/y		65.7 kg/ha/y		
	68158	22107	2453										



# **Appendix B Acoustic Assessment**

17 December 2025  
Ref: J0254-30-L3

Xenith Consulting Pty Ltd  
Shops 4-6 Mezzanine Level  
157-159 John Street  
SINGLETON NSW 2330

**Attn: Mr Nathan Cooper**

Dear Nathan,

**RE: LIDDELL COAL OPERATIONS –  
MODIFICATION 9 ACOUSTIC ASSESSMENT**

## **1. INTRODUCTION**

Liddell Coal Operations Pty. Limited (LCO), a subsidiary of Glencore Coal Pty Limited (Glencore), operates Liddell Coal Operations (Liddell), a combined underground and open cut coal mine located approximately 25 km north-west of Singleton in the NSW Hunter Valley region. Liddell operates according to Development Consent DA 305-11-01. Mining operations at Liddell have ceased and LCO is currently progressing mine closure and rehabilitation activities.

LCO proposes a Modification to DA 305-11-01 to permit the works required to backfill select underground workings to provide long term stability (the Modification).

This assessment and report have been commissioned by Xenith Consulting Pty Ltd on behalf of LCO to identify any acoustic impacts associated with the Modification (MOD 9) and, if required, to recommend mitigation measures to avoid or minimise such impacts.

## **2. MODIFICATION DESCRIPTION**

LCO seeks to modify DA 305-11-01 to facilitate the backfilling of targeted underground workings situated beneath the Main Northern Rail Line (MNRL) and other public infrastructure to provide long term stability. This includes the use of grout [a cementitious mix of either coal ash or blended coal ash (i.e. materials which comply with the Coal Ash Exemption 2014, and are referred to as “fly ash” in this assessment) mixed with general purpose cement]. Grout will be batched onsite at Liddell and pumped into the targeted underground workings via a series of boreholes.

The core modification activity is the backfilling of the remnant underground workings across two target areas (Target Area 1 and Target Area 2). This will be achieved through a combination of the following proposed activities:

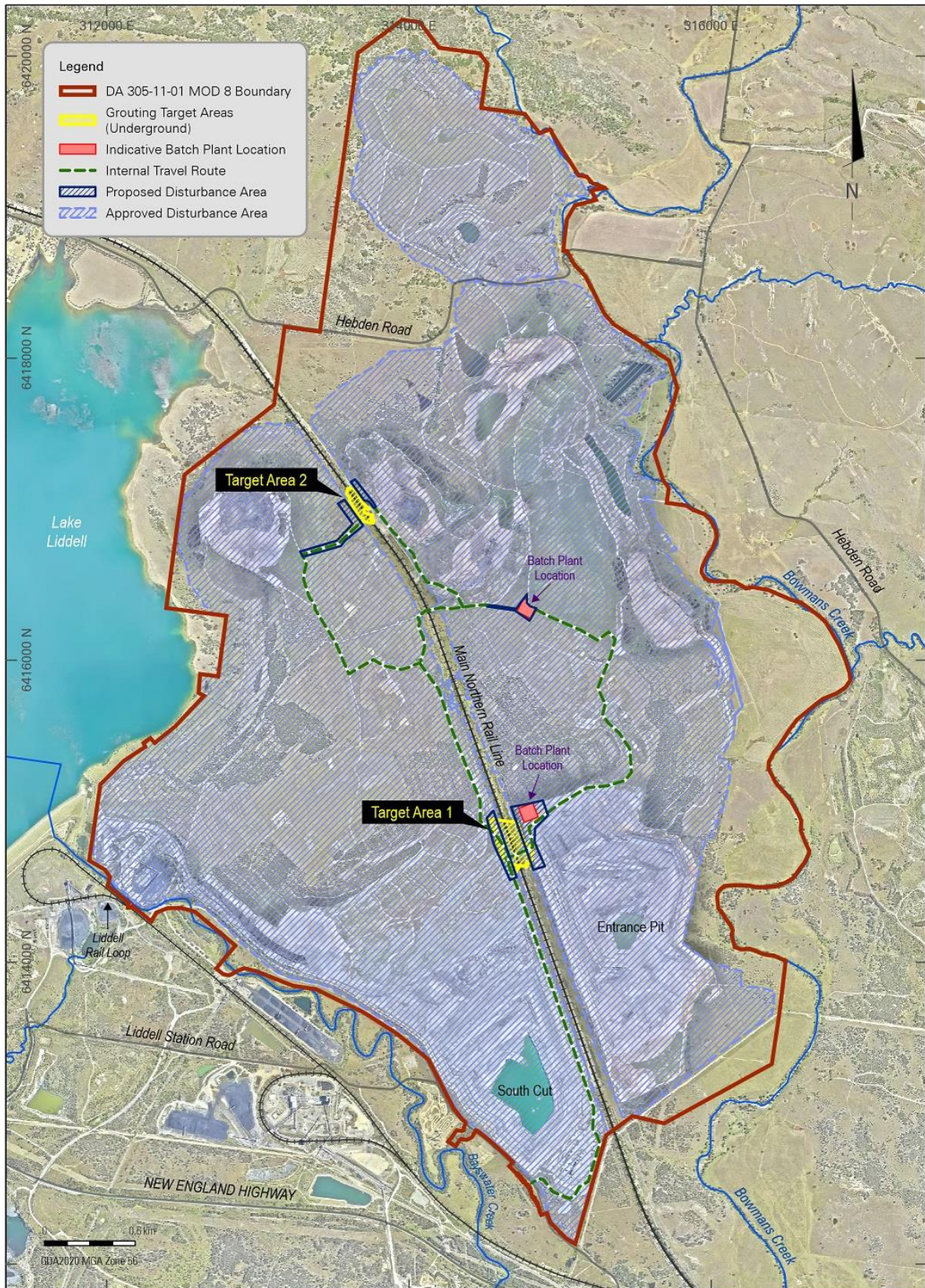
- Construction and operation of a batching compound and minor ancillary infrastructure on predominantly existing hardstand areas that have already been cleared and compacted. The batching compound will be constructed in locations that will support the backfilling works associated with the two Target Areas. General details of required infrastructure include:
  - Hardstand compound within predominantly existing hardstand areas already cleared and compacted;
  - Batching plant (batch plant will be relocated between Target Areas);

- 
- Cement storage silos and water storage tanks;
  - Material stockpile areas;
  - Temporary office and ablution buildings;
  - Water pipeline from site water source to water tanks;
  - Pipelines from the batching plant to the boreholes; and
  - Other ancillary infrastructure as required to support the grout batching activities.
- Drilling of boreholes to access the former underground workings within the two Target Areas. Approximately 70 boreholes will be required to undertake and monitor the filling of the underground workings. However, the final number of boreholes may change depending on the performance of backfilling activities. To avoid disturbance of areas outside the approved disturbance areas at Liddell, LCO will drill angled holes where required to reach targeted workings underneath the MNRL corridor and other public infrastructure;
  - Pumping and emplacement of grout into the targeted underground workings;
  - Transportation of materials used for the activities, including materials required for onsite batching, via approximately 40 truck deliveries (approximately 80 truck movements) per day generally transported to Liddell via highway routes; and
  - Decommissioning and rehabilitation of disturbed areas following the completion of works including sealing of boreholes, decommission and removal of temporary infrastructure from the site, releveling and rehabilitation of drill pads and access tracks in accordance with Liddell's Rehabilitation Management Plan.

The proposed works are expected to take approximately 12 months to complete with an estimated contractor workforce of around 10 to 20 personnel.

A conceptual layout of surface components of MOD 9 is shown in Figure 1.

**Figure 1: Conceptual Modification Layout**



### 3. ASSESSMENT

#### 3.1 Nearest Receptors and Noise Criteria

Nearest noise sensitive receptors to Liddell are located generally to the north-east and north-west. Receptor locations are shown on the figure in Appendix A attached to this report which was obtained from DA 305-11-01 Appendix 5. DA 305-11-01 Schedule 3 Condition 1 provides relevant noise criteria for this assessment and is reproduced below.

##### *Impact Assessment Criteria*

1. *The Applicant must ensure that the noise generated by the development does not exceed the noise impact assessment criteria in Table 1 at any residence.*

*Table 1: Noise impact assessment criteria dB(A)*

<i>Assigned residential location number</i>	<i>Day LAeq 15min</i>	<i>Evening LAeq 15min</i>	<i>Night LAeq 15min</i>	<i>Night LA 1min</i>
<i>1,5,6,7,8,9,10,11,12,14</i>	<i>35</i>	<i>35</i>	<i>35</i>	<i>45</i>
<i>2</i>	<i>35</i>	<i>35</i>	<i>36</i>	<i>45</i>
<i>3</i>	<i>36</i>	<i>35</i>	<i>37</i>	<i>45</i>
<i>4</i>	<i>36</i>	<i>35</i>	<i>36</i>	<i>45</i>
<i>All other privately-owned land</i>	<i>35</i>	<i>35</i>	<i>35</i>	<i>45</i>

*Note: To interpret the locations referred to in Table 1, see Appendix 5*

*Noise generated at the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 6 sets out the meteorological conditions under which these criteria apply and the requirements for evaluating compliance with these criteria.*

*However, these criteria do not apply if the Applicant has an agreement with the owner(s) of the relevant residence or land to generate higher noise levels, and the Applicant has advised the Department in writing of the terms of this agreement.*

Nearest receptors in each direction, distance from each MOD 9 component and noise criteria for each time period are summarised in Table 1 below.

**Table 1: Nearest Privately-Owned Receptors and Noise Criteria**

Parameter	Receptor 1	Receptor 14
Distance from closest Target Area	3,480 m	4,600 m
Distance from closest grout batching plant	3,420 m	5,930 m
Noise criteria day / evening / night / night LA1	35 / 35 / 35 / 45	35 / 35 / 35 / 45

There are no nearby sensitive receptors in other directions from Liddell as a number of other mining developments exist in these directions. While Table 1 presents noise criteria for all time periods, works associated with MOD 9 are not proposed to occur during the evening and night therefore only the daytime criteria apply.

### 3.2 Proposed Noise Sources

The grout batching plant would initially be constructed at the southern location and used to pump grout into all boreholes in Target Area 1. The drill rigs would then be moved to the northern target area and the batch plant disassembled and reconstructed at the northern location. Grout would be transported from the plant to each borehole via a pump and pipeline, resulting in few noise sources operating at the borehole during the grouting phase. All work would occur during the day (7:00 am – 5:30 pm) excluding weekends and public holidays.

Exact machines and noise sources associated with MOD 9 will depend on the contractor engaged for the work, the machines available to that contractor and the project stage and location. Indicative major noise sources for each location and stage and estimated combined sound power levels for standard machines with no specific noise mitigation measures are summarised below:

- Grout Batching Plant:
  - Pad construction (excavator, dozer) – 114 LAeq,15min;
  - Batch plant construction (truck, crane, excavator, hand tools) – 114 LAeq,15min;
  - Batch plant operation (plant, loader, water cart, truck, slurry pump, generator) – 120 LAeq,15min
- Borehole Target Area:
  - Pad construction (backhoe, excavator, truck and skid steer) – 112 LAeq,15min;
  - Drilling (drill rig x3) – 120 LAeq,15min; and
  - Grouting (backhoe or excavator to occasionally relocate grout pipeline) – 106 LAeq,15min.

Worst case estimated sound power levels at each work site are 120 LAeq,15min during operation of the grout batching plant and a similar level at each target area during borehole drilling.

An estimated 40 trucks (80 movements) per day would be required to transport materials such as fly ash and cement to the batch plant. These trucks will travel within Liddell along the haul routes indicated in Figure 1.

### 3.3 Prevailing Weather Conditions

Wind speeds in the range 0.5 to 3 m/s measured at the standard height of 10 m above the ground can significantly affect noise levels at a remote receptor. Higher wind speeds tend to cause turbulence which does not enhance noise propagation. Winds generally from the south-west would result in higher noise levels to Receptor 1 and other nearby receptors, while winds from the south-east would enhance noise levels to Receptor 14.

Data from Liddell weather station for the period January 2020 to August 2025 were supplied by LCO for analysis to determine prevailing weather conditions. Data analysis was completed by:

- Sorting the data by season and time period (day, evening and night) then discarding data for the evening and night periods;
- For each season, separating the data into 16 compass directions; and
- For each compass direction, summing the hours in which vector wind speeds remain in the range 0.5 to 3 m/s, considering winds up to 45° from the compass direction, and expressing these hours as a percentage of the total day time in that season.

The result of this process is the percentage occurrence of potentially noise enhancing winds during the day in each season and direction, as presented in Table 2.

**Table 2: Analysis of Prevailing Winds, Day Period.**

Wind Direction	Occurrence of Daytime Noise Enhancing Winds, % of Time per Season			
	Summer	Autumn	Winter	Spring
N	1	4	5	2
NNE	1	3	2	1
NE	3	4	3	2
ENE	8	9	6	6
E	17	18	12	13
ESE	24	25	16	17
SE	25	27	17	19
SSE	24	26	17	20
S	20	20	13	16
SSW	11	12	10	11
SW	10	11	11	11
WSW	12	14	19	14
W	14	23	31	18
WNW	11	20	29	15
NW	9	17	26	13
NNW	6	13	20	9

Winds from any direction occurring for at least 30% of the time in any season are shaded in Table 2 and considered significant according to the *NSW Industrial Noise Policy* referred to in Condition 1 of DA 305-11-01 and in the later *NSW Noise Policy for Industry (NPI)*.

Table 2 indicates prevailing winds occur more than 30% of the time from the west in winter. Such winds would cause a moderate increase in noise levels to Receptor 1 and other nearby receptors. Winds from other directions occur for less than 30% of the time and are therefore not considered significant according to the NPI, although winds from the south-east occur for up to 27% of the time in autumn which is close to the 30% threshold. South-easterly winds, when they occur, would significantly enhance noise levels to Receptor 14.

### 3.4 Receptor Noise Levels

Calculated noise levels to closest receptors assume the following activities may occur simultaneously to present a worst case assessment, resulting in an assumed sound power level of up to 120 LAeq,15min at both locations:

- Batch plant operation at the northern location; and
- Grouting of some boreholes and drilling of other nearby boreholes at the northern target area.

Noise levels were calculated using the Harmonoise Engineering Method developed by working groups engaged by the European Union (EU) to be the most accurate and reliable noise propagation calculation method currently available for general use. Input data to the method included:

- Approximate topography between the source and receptor guided by terrain shown in Figure 3 of the *Environmental Noise and Blasting Assessment* prepared by Global Acoustics for Modification 5 to DA 305-11-01 (Global Acoustics, 2013), previous experience with this area and previous visits to these specific receptors while completing quarterly environmental noise surveys for LCO;
- A typical spectral shape for a diesel powered machine totalling 120 LAeq,15min, as shown in Figures 2 to 5;
- No vertical sound speed gradient reflecting calm wind conditions for both receptors and a 3 m/s wind from each source to Receptor 14; and
- Atmospheric absorption and distance attenuation based on spherical spreading added to the Harmonoise results, as the Harmonoise Engineering Method does not include these attenuation effects.

Noise levels were calculated separately from the northern batch plant location and from drilling at the northern boreholes to each of Receptors 1 and 14, as shown in Figures 2 to 5 below and summarised in Table 3. Each figure shows an A-weighted 1/3 octave spectrum for the assumed sound power and the received level under calm and noise enhancing conditions, rather than the more usual unweighted spectra, to better illustrate received noise levels.

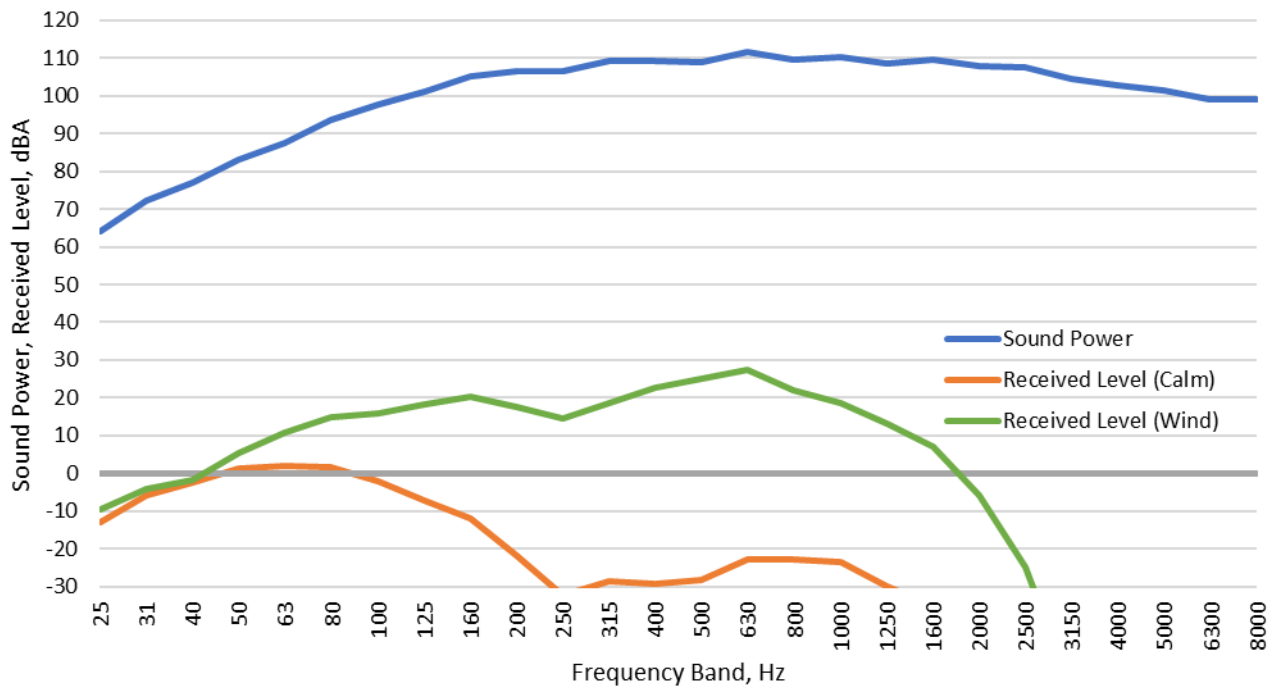
**Table 3: Calculated Noise Levels to Receptors, LAeq,15min**

Receptor	Receptor 1		Receptor 14	
Atmospheric Conditions	Calm wind	3 m/s W wind	Calm wind	3 m/s SE wind
Received Level, Drilling, LAeq,15min	8	19	4	28
Received Level, Batch Plant, LAeq,15min	9	31	-1	23
Combined Received Level, LAeq,15min	12	31	5	29
DA 305-11-01 Noise Criteria, LAeq,15min	35			

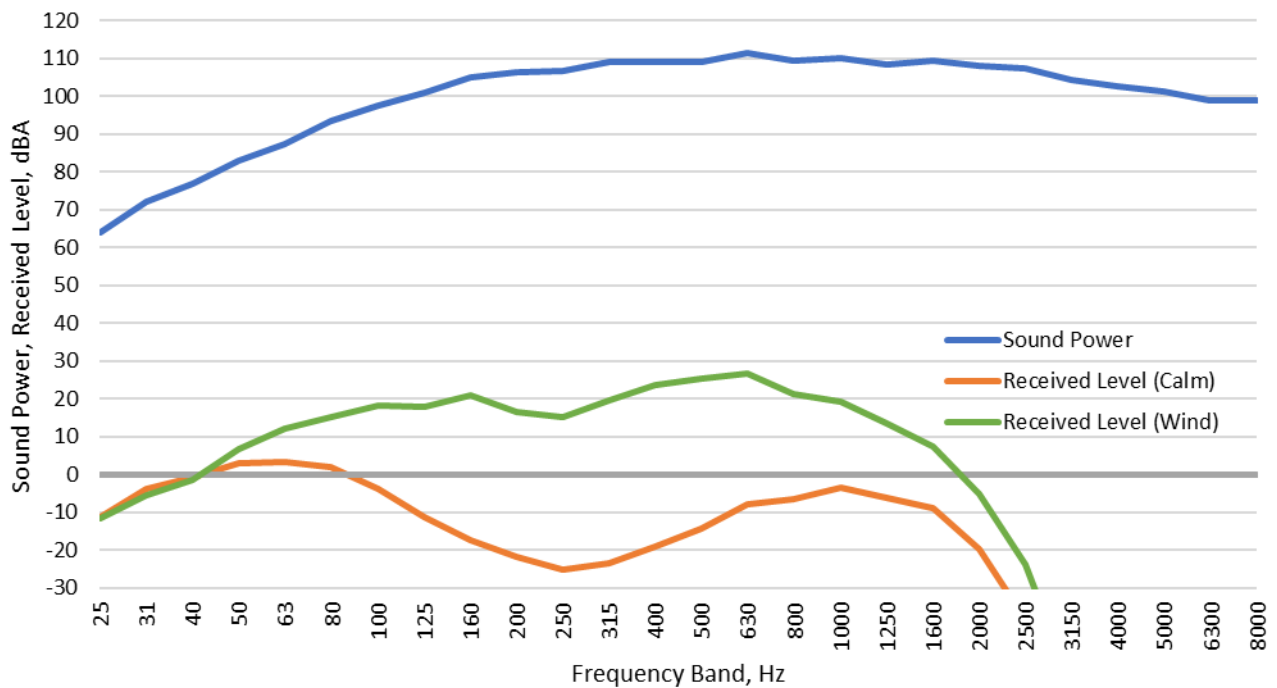
Table 3 indicates calculated worst case noise levels, with both batching and drilling activities occurring simultaneously, are expected to reach 12 LAeq,15min at Receptor 1 and 5 LAeq,15min at Receptor 14 under calm wind conditions. Noise levels up to 31 LAeq,15min at Receptor 1 and 29 LAeq,15min at Receptor 14 are predicted if a 3 m/s wind occurs from the west or south-east under worst case operating conditions.

Calculated noise levels are expected to meet the DA 305-11-01 noise criteria at closest assessed receptors and therefore at all receptors. Noise levels for much of the time, with either but not both of these drilling and batching activities occurring or with less noise enhancement due to winds, will be significantly lower.

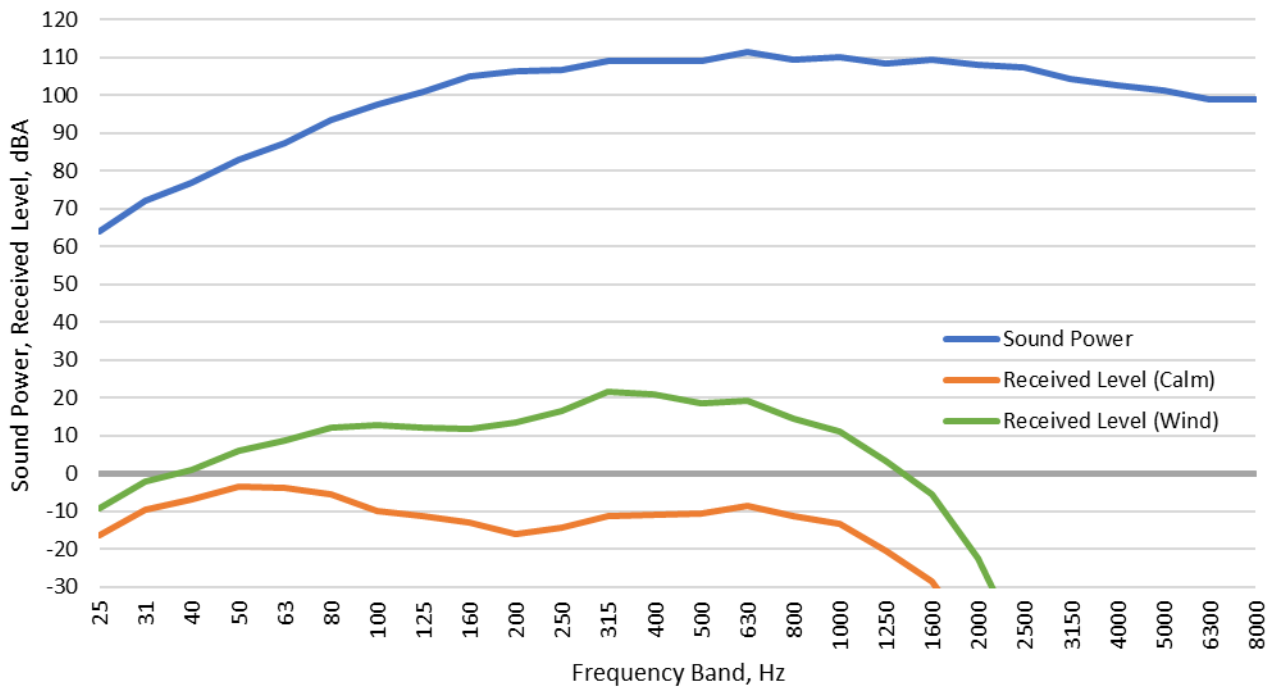
**Figure 2: Calculated Noise Levels, Drilling to Receptor 1, Calm and Wind Conditions, LAeq,15min**



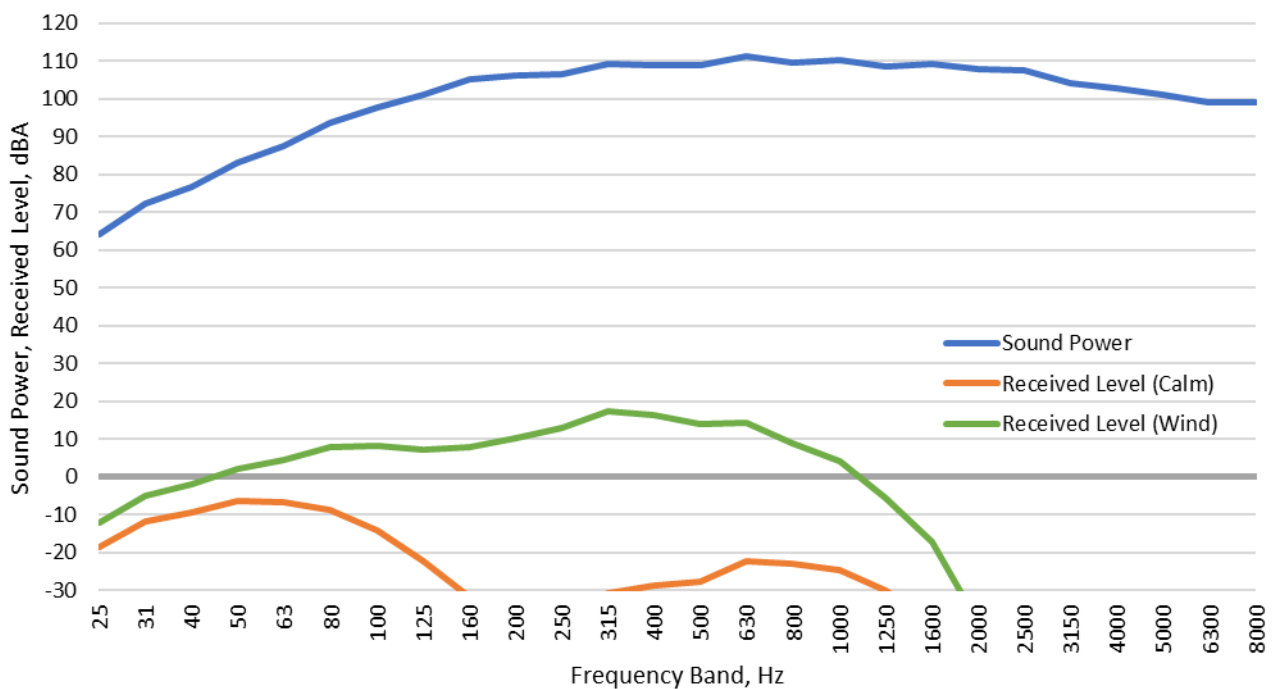
**Figure 3: Calculated Noise Levels, Batching to Receptor 1, Calm and Wind Conditions, LAeq,15min**



**Figure 4: Calculated Noise Levels, Drilling to Receptor 14, Calm and Wind Conditions, LAeq,15min**



**Figure 5: Calculated Noise Levels, Batching to Receptor 14, Calm and Wind Conditions, LAeq,15min**



### 3.5 Trucks and Other Vehicle Movements

Noise from mobile machines such as trucks, loaders and water carts operating within the batching plant and drilling sites has been included in the reported noise levels in Table 2. Noise from delivery trucks and other vehicles travelling on the haul road from the Liddell entrance on the Old New England Highway to each work site requires separate assessment.

An estimated 40 delivery trucks (80 truck movements) per day to the batching plant, over a 10.5 hour working day from 7:00 am to 5:30 pm, averages just under two movements per 15 minute period. The following reasonable worst case assumptions have been made to calculate noise from truck movements:

- Up to 4 movements concentrated in a worst case 15 minute period;
- Truck speed of 40 km/hr over the 5.5 km haul route from the Liddell entrance to the northern batch plant site, resulting in each truck movement taking 8 minutes 15 seconds or 55% of a 15 minute period; and
- A sound power level of 108 dBA for each truck.

Correcting the 108 dBA truck sound power for number of trucks and duration of each movement along the route results in a reasonable worst case sound power level of 111 LAeq,15min from the haul route. This sound power level is 9 dBA lower than the drilling and batch plant site sound power levels assumed in Section 3.2.

Noise from truck movements along the haul route would therefore remain at least 9 dBA lower than the predicted noise levels in Table 3, would be inaudible at all receptors and would not significantly contribute to cumulative noise levels from MOD 9.

### 3.6 Cumulative Noise Levels

LCO has programmed a series of currently approved mine closure and rehabilitation works that are likely to coincide with MOD 9. Closest such works to receptors include:

- Durham TSF Capping;
- Reservoir West TSF Capping; and
- Reservoir South TSF Capping.

Each of these works is expected to require up to 3 dozers to complete, for a total of 9 dozers operating simultaneously. Other activities such as the Entrance North Rehab Works are significantly more remote from receptors or are unlikely to coincide with MOD 9.

As mine closure and rehabilitation works are currently approved, such works are assumed to meet the DA 305-11-01 noise criterion of 35 LAeq,15min at closest receptors. Table 4 presents calculated cumulative noise levels assuming currently approved activities produce a noise level of 33 LAeq,15min, just 2 dBA under the criterion, and MOD 9 produces the worst case noise levels reported in Table 3.

**Table 4: Calculated Cumulative Noise Levels to Receptors, LAeq,15min**

Receptor	Receptor 1		Receptor 14	
	Calm wind	3 m/s W wind	Calm wind	3 m/s SE wind
MOD 9, LAeq,15min	12	31	5	29
Approved Rehabilitation, LAeq,15min	33	33	33	33
Cumulative Level, LAeq,15min	33	35	33	34
DA 305-11-01 Noise Criteria, LAeq,15min	35			

Table 4 indicates MOD 9 is expected to increase existing noise levels from currently approved rehabilitation activities by less than 1 LAeq,15min under calm wind conditions and less than 2 LAeq,15min under prevailing weather conditions. Predicted minor noise level increases due to MOD 9 are insignificant and unlikely to be noticeable at any receptor.

### 3.7 Tonal Noise

Calculated noise levels in Tables 3 and 4 assume noise sources associated with MOD 9 do not produce tonal noise. Diesel powered machines do not typically produce tonal noise unless they are fitted with reverse alarms. As tonal noise is assessed at the receptor rather than at the source, a machine fitted with a reverse alarm may not necessarily produce tonal noise at a receptor. However, it is appropriate to consider the possible effect of tonal sources such as reverse alarms on receptor noise levels.

LCO is currently managing noise from mine closure and rehabilitation works via the Liddell noise Monitoring Program. Works associated with MOD 9 are assumed to be subject to the recommendations and procedures in these plans and will therefore be managed in conjunction with other concurrent activities at Liddell. No additional measures beyond those currently described within the existing management plans are recommended for works associated with MOD 9.

## 4. CONCLUSION

An assessment of environmental noise from the proposed Liddell MOD 9 to nearest receptors has indicated no appreciable changes in currently approved noise levels are likely to occur at any receptor. Predicted noise levels from MOD 9 alone are expected to remain at least 4 dBA below relevant DA 305-11-01 noise criteria under simultaneous worst case operating and prevailing weather conditions.

Based on the results of this assessment, no additional noise mitigation or management measures are required or have been recommended.

We trust this assessment provides sufficient information regarding acoustic issues associated with MOD 9. Please contact the undersigned for any further information or discussion.

### BRIDGES ACOUSTICS

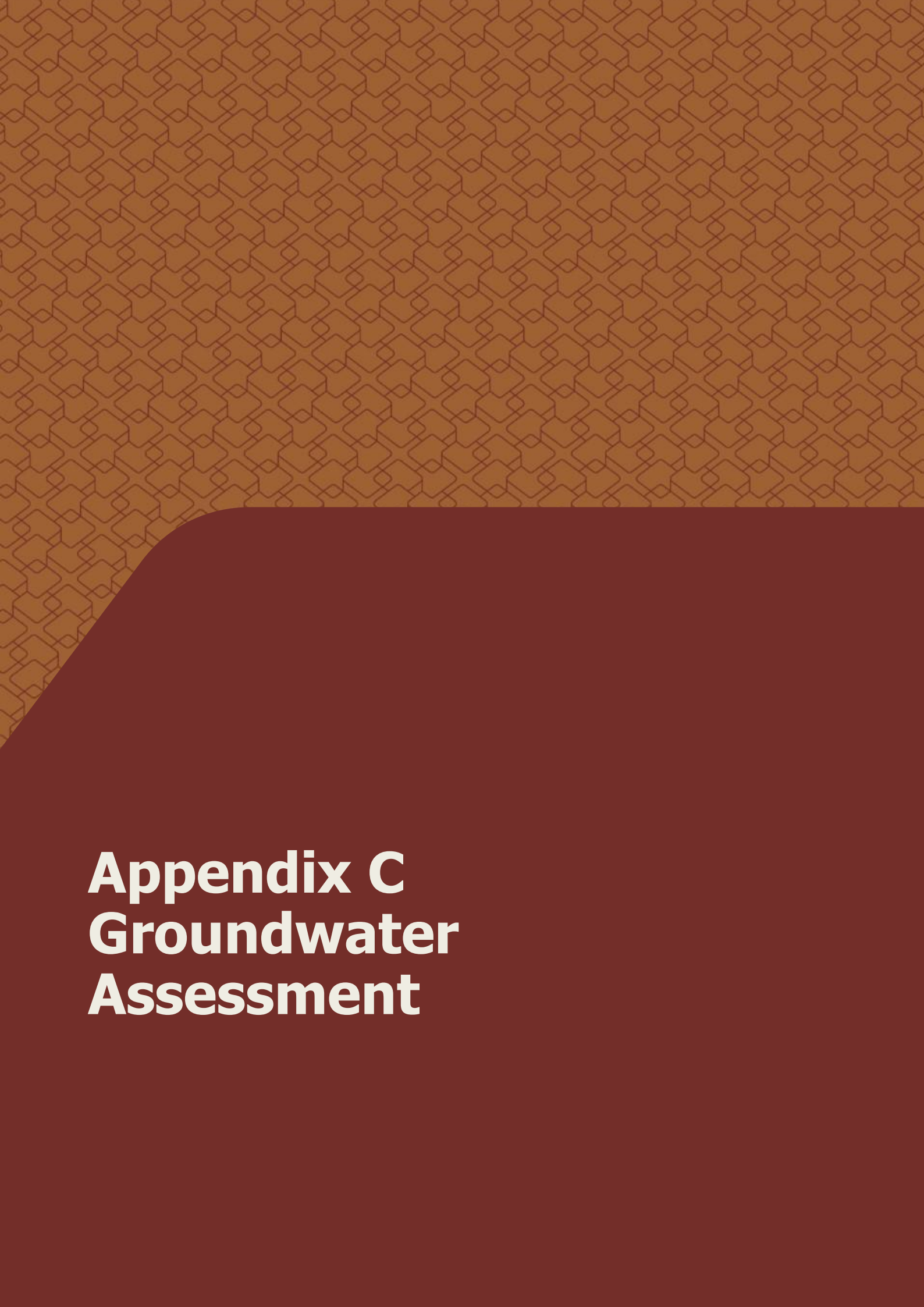


**MARK BRIDGES BE (Mech) (Hons) MAAS**  
**Principal Consultant**

**APPENDIX A: SENSITIVE RECEPTORS (FROM DA 305-11-01 APPENDIX 5)**



LIDDELL COAL OPERATIONS



# **Appendix C Groundwater Assessment**

17 December 2025  
Xenith Consulting Pty Ltd  
PO Box 550  
Singleton NSW 2330

Attention: Eiko Fuimaono  
Environmental Scientist  
[eiko.fuimaono@xenith.com.au](mailto:eiko.fuimaono@xenith.com.au)

## LIDDELL MOD9 - GROUNDWATER ASSESSMENT

### 1. Introduction

Liddell Coal Operations Pty. Limited (LCO), a subsidiary of Glencore Coal Pty Limited operates the Liddell Coal Operations (Liddell) which is located approximately 25 kilometres (km) north-west of Singleton and 26 km south-east of Muswellbrook in the Upper Hunter Valley, New South Wales. Mining operations at Liddell have ceased and LCO is currently progressing mine closure and rehabilitation works.


LCO is proposing the targeted backfilling of select areas of remnant underground mine workings at Liddell to provide long term stability. This includes the use of grout delivered through a series of boreholes into the targeted underground mining areas. LCO commissioned Xenith Consulting Pty Ltd (Xenith) to coordinate environmental approvals for a proposed modification to Development Consent DA 305-11-01 (MOD 9).

Xenith engaged James Tomlin Consulting Pty Ltd (JTC) to assess the groundwater impacts of MOD 9 and prepare a report. This report describes the outcomes of the groundwater assessment.

### 2. Objectives and scope of work

The objective of this assessment was to determine risks to the groundwater regime associated with grouting activities within two target areas (Target Area 1 and Target Area 2), and the need for management or mitigation measures. The scope of work to achieve this objective comprised:

- review of all available background information,

- 
- qualitative assessment of potential impacts to the groundwater regime,
  - assessment of risks, and the need for management or mitigation measures,
  - assessment of impacts against the Aquifer Interference Policy (AIP), and
  - documentation of the outcomes in this report.

The existing conceptual model developed for Liddell and a MOD 9 specific source-pathway-receptor model was used to assess impacts on the groundwater regime. Numerical modelling was not necessary as the source-pathway-receptor model allowed a qualitative assessment of risk.


### 3. Project description

Mining operations at Liddell commenced in the 1920s utilising the bord and pillar method to extract coal from the Middle Liddell seam. In the 1960's, open cut operations commenced targeting the Lemington, Pikes Gully, Arties, Liddell, Barrett seams, and later the Hebden seam. During the final phase of operations, open cut mining occurred in two pits known as South Cut (including the South Pit Extension) and the Entrance Block (including Entrance Pit Extension) which progressed in a generally north to south direction, with two approved open voids (South Cut and Entrance Pit) now remaining.

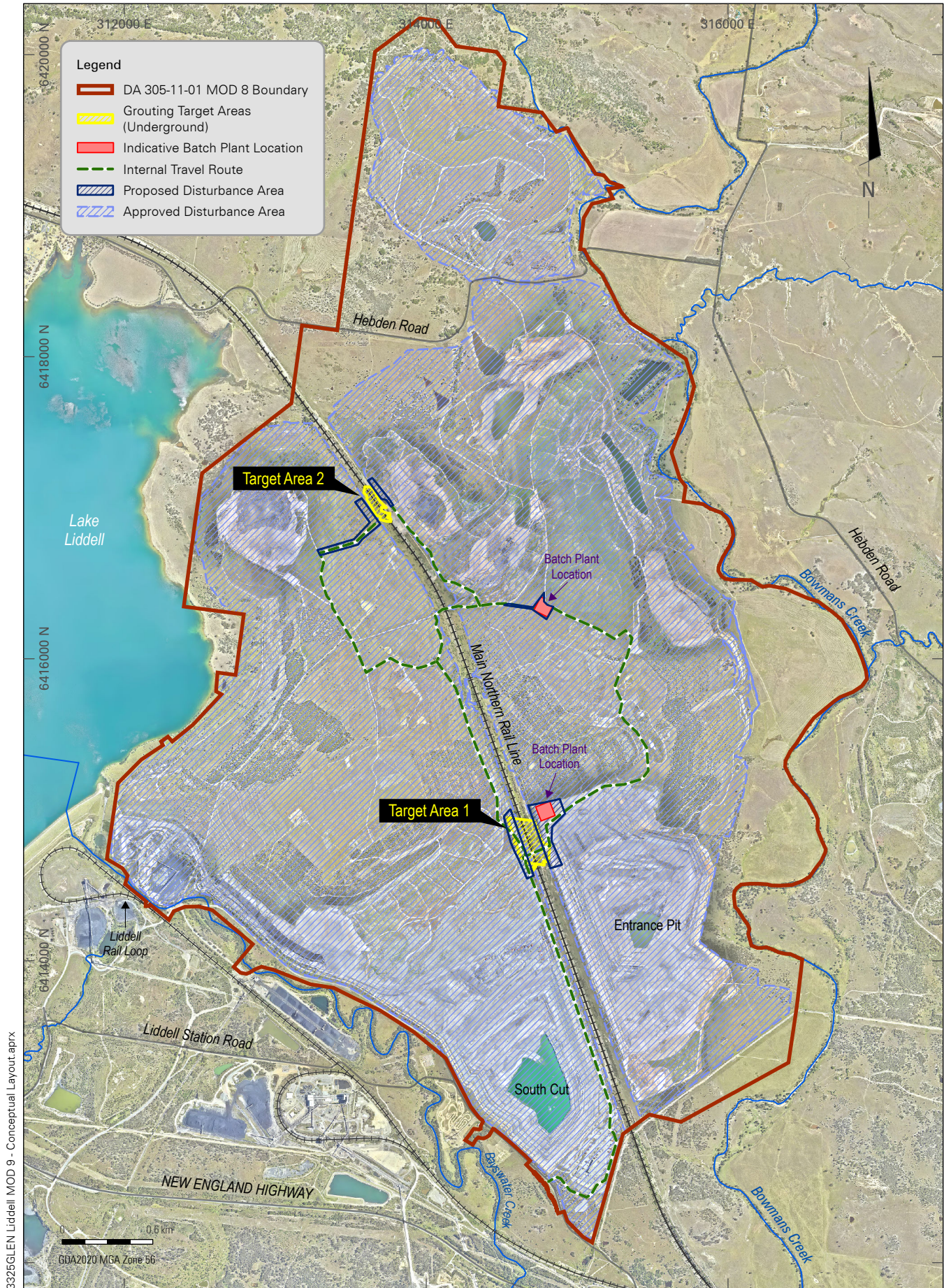
LCO is approved to utilise the South Cut as a tailings emplacement, with the Entrance Pit used for mine water storage. Former workings associated with the historical Liddell underground operations were progressively removed by the open cut mining operations as they progressed from north to south.

Areas of underground workings remain today, located outside the footprint of open cut mining, including below the Main Northern Rail Line (MNRL) that runs in a north-south direction between the South Cut and Entrance Pit. LCO is proposing the targeted backfilling of the underground workings across two Target Areas. This includes the use of grout (a cementitious mix of either coal ash or blended coal ash (i.e. materials which comply with the Coal Ash Exemption 2014, and are referred to as “fly ash” in this assessment) mixed with general purpose cement). The purpose of the backfilling is to provide buttressing to coal pillars thereby enabling long-term structural support to the overlying strata and infrastructure. Additionally backfilling displaces oxygen from within the targeted underground workings which helps mitigate the risk of external influences such as spontaneous combustion. The sealing and stabilisation process will also assist in achieving the rehabilitation objectives for Liddell such as ensuring the “*Mine site (as a whole) to be safe, stable and non-polluting*”. Elements of the proposed works relevant to groundwater include:

- clearing and levelling of drill pad areas (nominally 20 m x 20 m) and associated access tracks;

- 
- drilling of an initial series of boreholes referred to as ‘plug holes’ into the underground workings around the perimeter of each target area. LCO is currently investigating the feasibility of using existing goafed areas around Target Area 2 as a barrier, in lieu of using plug holes for this area;
  - placement of concrete or other inert material (such as sand or gravel) to seal the perimeter of each target area;
  - drilling of a second series of boreholes referred to as ‘fill holes’ within each target area and injection of a highly flowable infill grout into the underground workings; and
  - rehabilitation of disturbed areas following completion of works including sealing of boreholes and access tracks.

The overall program is expected to require approximately 12 months to complete. Figure 1 shows the two grouting target areas along the MNRL and the location of remnant underground mine workings. The boreholes in each target area will be located within the proposed disturbance areas shown on Figure 2, which also illustrates the former open cut pit shell, that is now partially backfilled with spoil from open cut mining.



3325GLENLiddell MOD 9 - Conceptual Layout.aprx



**LEGEND**

- Disturbance areas
- Railway
- Remaining Liddell underground workings
- Pit shell void excluding backfilled spoils (mAHD)

Figure 2 - Proposed disturbance areas and remnant underground workings

Scale 1: 25,000

Date: 15 December 2025

Project: LID001



Figure 3 and Figure 4 show sections through the two areas targeted for stabilisation and grouting. The alignment of the sections are shown on Figure 2. The figures illustrate the proposed drilling areas, the Liddell seam underground targeted for grouting, the South Cut pit shell and the backfilled spoils. The purpose of the sections is to illustrate the potential pathways for any waters that contact the cement grout proposed for emplacement within the Liddell underground workings.

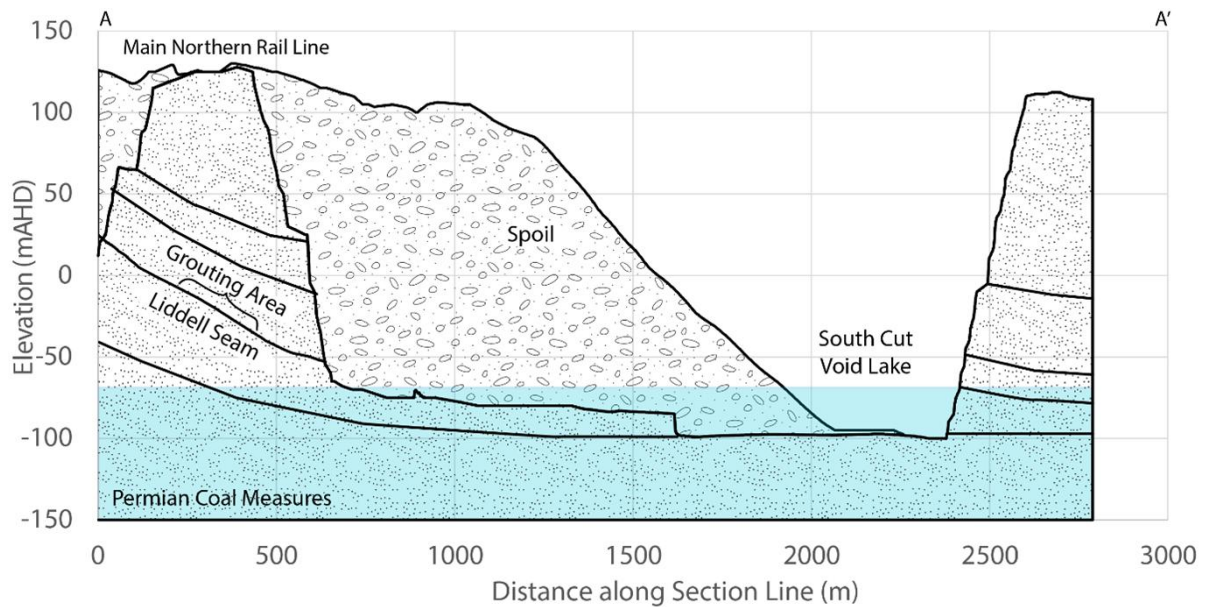


Figure 3 – Section A – A'

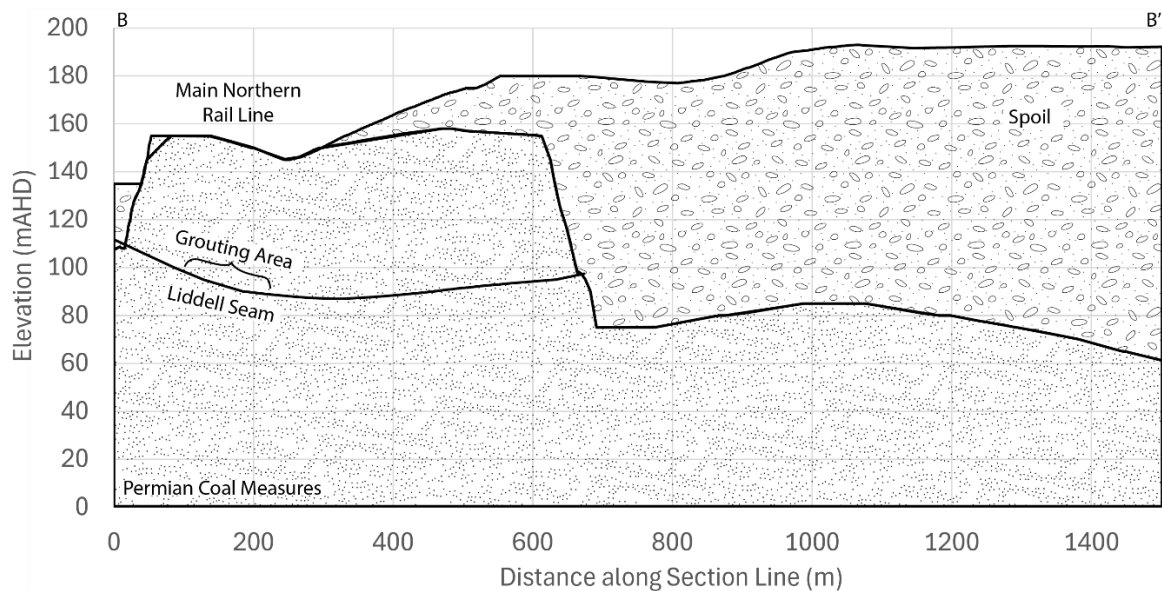


Figure 4 – Section B – B'



## 4. Groundwater regime

The groundwater regime at Liddell and in the surrounding region has been described in detail by SKM (2013), AGE (2022) and Umwelt (2025). Given the localised scale of the grouting activities proposed as part of MOD 9, this review focuses on the groundwater regime in the immediate vicinity of each grout injection area.

The groundwater regime is highly disturbed in the two areas where the injection is proposed. The middle Liddell coal seam has been partially removed by bord and pillar mining, with Vane sub-group target seams removed in the adjacent backfilled open cuts at South Cut and Entrance Pit. This is illustrated in Figure 2, Figure 3 and Figure 4.

The Permian strata can be divided into the non-coal interburden that forms aquitards; and low to moderately permeable coal seams that act as the most transmissive strata within the Permian sequence. The coal seams were dewatered when underground and open cut mining activities were active. Drilling undertaken by LCO indicates that the Middle Liddell seam at both target areas is currently dry.


Outside of the footprint of open cut mining at Liddell, the Permian sediments are unconformably overlain by thin Quaternary alluvial sediments deposited along drainage line flood plains. These deposits comprise clay, silt, sand, and gravel along the present-day alignments of Bowmans Creek and Bayswater Creek that form a shallow aquifer system with connectivity to the creeks.

## 5. Potential hazards

The main potential hazard associated with MOD 9 is the potential for the cement grout to influence the alkalinity of any waters it contacts. Freshly mixed cement is highly alkaline, and when it interacts with water, it can raise alkalinity significantly. The leaching of alkalinity reduces as the concrete cures over a period of about 30 days as the concrete compounds become less soluble and less permeable (Setunge 2009).

The fly ash which will be blended with cement to form the cementitious grout is also a potential hazard depending on its trace metal composition and mobility following mixing with cement. NSW EPA stipulates maximum allowable concentrations of trace metal in fly ash that suppliers must adhere with to limit environmental risk (NSW EPA Coal Ash Order 2014).

The other potential hazard is the changes in permeability associated with the cement grouting of the underground workings. The open workings have a very high permeability readily allowing water movement through the Liddell seam. The proposed grouting will reduce the permeability, and therefore influence groundwater flow locally around the northern and southern grouting areas.



The risks associated with these potential hazards are considered further in Section 6 below.

## 6. Impact assessment

A source-pathway-receptor model is a tool used in impact assessments to determine if a hazard can lead to risk and harm. The ‘source’ is the origin of the hazard, the ‘pathway’ is the mechanism the hazard travels by, and the ‘receptor’ is the entity that could be harmed by the hazard.

In the case of MOD\_9, the ‘source’ is the grouted areas within the Liddell seam. The ‘pathways’ are the directions water could move by gravity from the source. The contours for the pit floor shown on Figure 2, Figure 3 and Figure 4 illustrate that the ‘pathway’ for water is through the remaining Liddell seam underground mine workings, then moving through backfilled spoils along the pit floor of the South Cut pit, discharging into the South Cut final void. Flow towards the Entrance Pit will not occur as the slope on the Liddell seam floor is towards the South Cut in both proposed grouting areas.

The pit floor contours indicate the ‘receptor’ is the water body that has formed within the South Cut void. LCO has been monitoring water levels within the South Cut and Entrance Pit since open cut mining ceased in 2023. Figure 5 shows the water level recovery within each of the final voids as of September 2025. Figure 5 also shows the crest level of the South Cut, which is about 110 mAHD, and the range of groundwater levels recorded within the Bowmans Creek alluvium and shallow bedrock monitoring bores. Figure 5 illustrates the water levels within the final voids are recovering relatively slowly, and the voids are currently a sink within the groundwater regime, rather than a source.

Numerical modelling for previous applications (AGE 2022) indicated water levels within the final voids are predicted to remain well below the level of the adjacent alluvial aquifers, meaning waters in the voids will not interact with the alluvial systems.

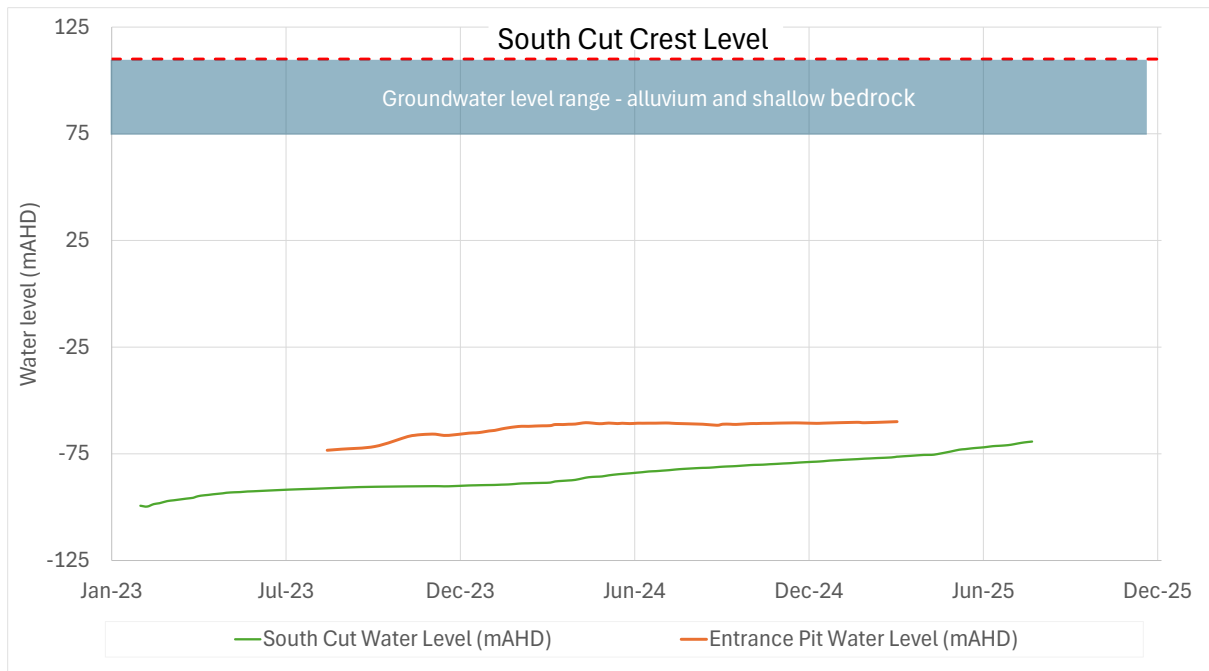


Figure 5 – Water Levels - South Cut and Entrance Pit

Water quality within the final voids has been measured by LCO on a number of occasions since cessation of mining. Figure 6 shows the range in pH measurements, and water quality categories. The data indicates a moderately alkaline water body has formed within both the South Cut and Entrance Pit. Total dissolved solids (TDS) measurements range between about 3,500 mg/L and 5,000 mg/L, indicating a brackish salinity typical of coal mining waters.

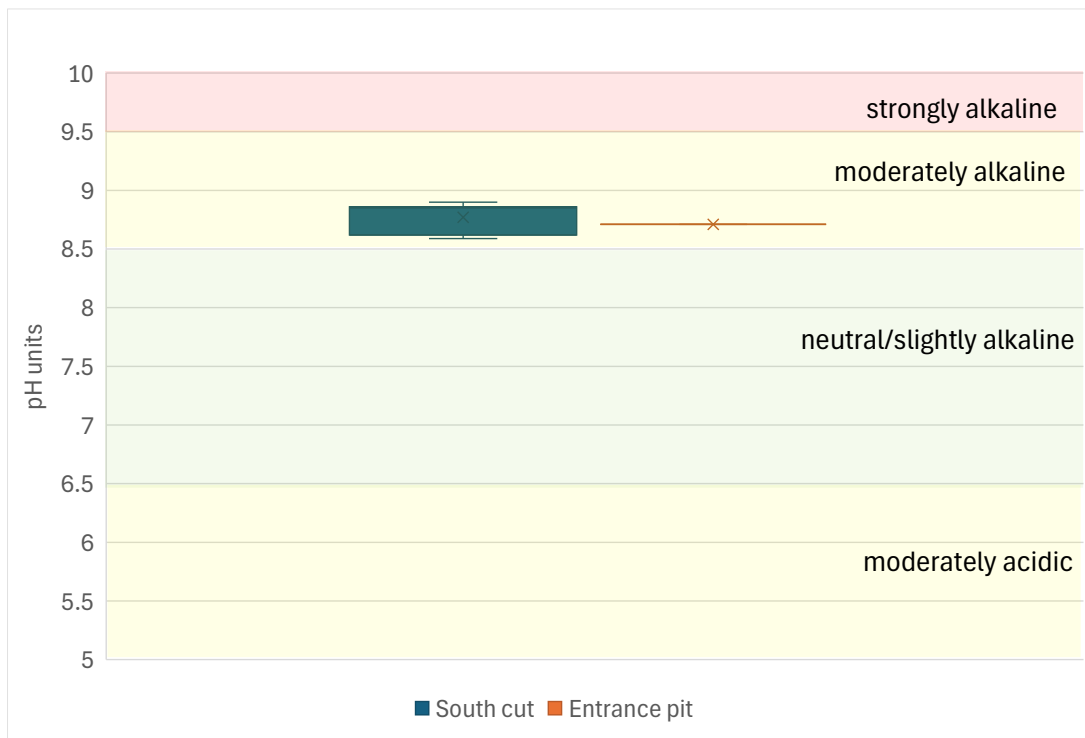


Figure 6 –Box and Whisker Plot for pH - South Cut and Entrance Pit

## 7. Risk assessment

### 7.1 Water quality

The potential for the identified hazards to pose a significant risk depends on the likelihood of the hazard occurring, and the associated consequences. Section 6 established that there is a pathway for water movement from the ‘source’ grouting areas to the South Cut final void. At the northern grouting area (Target Area 2), Figure 2 and Figure 4 indicate there are a number of sumps within the South Cut floor that would first need to fill with water and overtop before flow to the South Cut void would occur, but the final void is the ultimate ‘receptor’.

The potential for the cement grout to influence the alkalinity of underground waters depends on if the target injection areas are flooded or dry. As both target areas are currently dry, the injected cementitious grout will cure over a period of some months greatly reducing the potential for release of alkalinity.

The potential for fly ash to pose a risk depends on the presence and mobility of trace metals following blending with cement. The supplier of the fly ash under the Coal Ash Order 2014 is required to ensure allowable concentrations of trace metals in the fly ash are below stipulated thresholds to limit environmental risk (NSW EPA Coal Ash Order 2014). The Coal Ash Exemption Order 2014 exempts consumers of fly ash from further testing of the fly ash where this testing is undertaken by the supplier, and the fly ash is used in cementitious mixes (NSW EPA Coal Ash Exemption Order 2014).

When the fly ash is mixed with cement the alkalinity of the grout mixture will reduce the solubility of trace metals. This chemical process, followed by a physical reduction in permeability of the grout material as it sets hard over-time, limit the leaching of trace metals from the grout mixture. These processes combined with the limits on metals in the source fly ash material will limit the leaching risk.

It is possible that depending on the level of tailings within South Cut, the target cement grouting areas will flood in the future. However, by this time the cement grout will be fully cured with a very low permeability, meaning the potential for leaching of alkalinity will be limited.

Water within the target areas of the workings would ultimately report to the South Cut open void which already contains a slightly alkaline water body. The source-pathway-receptor model indicates there is no connectivity between the South Cut void and the surrounding groundwater regime indicating the proposed grouting activity does not pose a consequential risk. The South Cut open void also contains a substantial volume of water and would significantly dilute any seepage.

## 7.2 Groundwater flow

The other potential hazard is the changes in permeability associated with the cement grouting of the underground workings. The grouting areas are relatively small, when compared to the scale of the open cut and underground mining footprint. The grouted areas will influence groundwater flow locally in the grouted areas, however it is expected groundwater will simply move around the grouted areas through the remaining areas of the Middle Liddell seam and residual underground workings. The influence on the long-term recovery of the groundwater regime and associated risk is expected to be negligible.

## 8. Aquifer interference policy


The NSW Aquifer Interference Policy (AIP) requires proponent's "...ensure that the necessary licences are held with sufficient share component and water allocation to account for all water taken from a groundwater or surface water source as a result of an aquifer interference activity, both for the life of the activity and after the activity has ceased." MOD 9 does not require the extraction or usage of groundwater. No groundwater will be removed from the mining area or the groundwater regime by the proposed activity, and therefore there is no need to account for any water take with water licences.

The AIP also provides the "Minimal Impact Considerations" which are a set of thresholds and criteria used to assess whether aquifer interference activities will have no more than minimal impact on water sources and water-dependent assets. There are two levels of impact consideration, Level 1 where impacts are considered acceptable if these thresholds are not exceeded. Where Level 1 impacts are exceeded then further studies can be required to assess impacts. Thresholds for water table drawdown, water pressure decline and water quality changes are provided as part Level 1 "Minimal Impact Considerations".

The proposed activity does not involve water take and therefore the thresholds for water table drawdown and water pressure decline are not relevant to the activity. The Level 1 water quality threshold is "any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40m from the activity". The water within the final voids is currently slightly alkaline and brackish. Its beneficial use is only for mining purposes as required, and the proposed grouting will not influence the current beneficial use of the void waters.

## 9. Mitigation and management

Liddell operates under a Water Management Plan (WMP) last updated in July 2024. Whilst the risk to groundwater is low, it is recommended the WMP be updated to ensure the South Cut void waters are monitored for pH on a monthly basis during the grouting period



and for a period of 12 months following completion. A trigger action response plan should be included in the WMP that triggers an investigation if three successive samples exceed the 95<sup>th</sup> percentile of the baseline void water quality.

## 10. Summary and conclusions

The potential risks associated with cement grouting of underground workings was considered, focusing on water quality and groundwater flow. The risk of cement grout affecting groundwater alkalinity and trace metal concentrations is low, as the target areas are currently dry and the grout will have time to cure before possible future flooding, thereby limiting potential leaching.

The flow of any water that contacts both grouting areas is towards the South Cut open void. The grouting areas are within the Liddell dirty water catchment, and within the final void catchment which are designed and approved as long term sinks.


There is no direct connectivity between the South Cut void and the surrounding groundwater regime in the short term, so the activity is not considered to pose a consequential risk to local groundwater quality.

The potential for changes in groundwater flow resulting from grouting were also considered, concluding that the localised nature of the works means any impact will be minimal. Groundwater is expected to circumvent the grouted areas, with negligible effect on the broader groundwater regime or long-term recovery.

The proposed grouting does not result in impacts that exceed the Level 1 Minimal Impact thresholds provided in the NSW Aquifer Interference Policy. Water quality thresholds will not be breached and beneficial use of water in the final voids, which is limited to mining purposes, will remain unchanged. The proposed grouting does not require extraction of groundwater and therefore accounting for water take with licensing is not required.

In summary the proposed grouting represents a low risk to both water quality and groundwater flow, complies with relevant policy requirements, and will not alter the established beneficial use of affected waters.

Whilst the risk to groundwater is low, it is recommended the existing WMP be updated to ensure the South Cut void waters are monitored during and after completion of the grouting activity.



Yours sincerely



James Tomlin

Principal/Director



## 11. References

AGE (2022). Groundwater Impact Assessment, GRAWTS Stage 2, Prepared for Liddell Coal Operations, June 2022

NSW Department of Primary Industries (2012) NSW Aquifer Interference Policy: NSW Government policy for the licensing and assessment of aquifer interference activities, September 2012

NSW EPA (2014a) Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014. The coal ash order 2014 <https://www.epa.nsw.gov.au/sites/default/files/rro14-coal-ash.pdf>

NSW EPA (2014b) Resource Recovery Exemption under Part 9, Clauses 91 and 92 of the Protection of the Environment Operations (Waste) Regulation 2014, The coal ash exemption 2014 <https://www.epa.nsw.gov.au/sites/default/files/rre14-coal-ash.pdf>

SKM (2013). Liddell Coal Operations, Modification 5 to Development Consent DA305-1101, April 2013

Umwelt (2025). Liddell Coal Operations, Groundwater Model Updates, DRAFT, Prepared by Umwelt (Australia) Pty Limited on behalf of Liddell Coal Operations February 2025

Setunge, S., Nguyen, N., Alexander, B.L. et al. (2009). Leaching of Alkali from Concrete in Contact with Waterways. *Water Air Soil Pollut: Focus* 9, 381–391 (2009). <https://doi.org/10.1007/s11267-009-9234-x>



# **Appendix D Transport Impact Assessment**



# TRANSPORT IMPACT ASSESSMENT

Liddell Coal Operations – Modification 9

**PREPARED FOR:**  
Xenith Consulting Pty Ltd

**REFERENCE:**  
25.195r01v07

**DATE:**  
17/12/2025



# TRANSPORT IMPACT ASSESSMENT

## Liddell Coal Operations – Modification 9

Prepared for: Xenith Consulting Pty Ltd

ABN: 73 112 994 715

Reference: 25.195r01v07

Date: 17/12/2025

© 2025 PDC Consultants (Aust) Pty Limited. The concepts and information contained in this document are the property of PDC Consultants (Aust) Pty Ltd (PDC Consultants). PDC Consultants has prepared this document for the sole use of whom it was prepared for, for the express purpose agreed between, and in accordance with the provisions of the contract between the two parties. PDC Consultants accepts no liability or responsibility whatsoever to any third-party use of or reliance upon this document. Some information used by PDC Consultants received by whom this document was prepared for, and third parties, may not have been verified. Use or copying of this document in whole or in part without the written permission of PDC Consultants constitutes an infringement of copyright.

### Revision History

VERSION	DATE	PREPARED	REVIEWED	APPROVED	SIGNED
04	27/11/2025	Rohan Jain	Hayden Calvey	Hayden Calvey	Original Signed
05	05/12/2025	Rohan Jain	Hayden Calvey	Hayden Calvey	Original Signed
06	12/12/2025	Rohan Jain	Hayden Calvey	Hayden Calvey	Original Signed
07	17/12/2025	Rohan Jain	Hayden Calvey	Hayden Calvey	

PDC Consultants

info@pdcconsultants.com.au | www.pdcconsultants.com.au

+61 2 7900 6514 | Level 14, 100 William Street, Woolloomooloo NSW 2011



## Table of Contents

<b>1. Introduction</b>	<b>3</b>
1.1. Overview	3
1.2. Structure of this Report	3
1.3. References	4
<b>2. Existing Conditions</b>	<b>5</b>
2.1. Location and Site	5
2.2. Road Network	5
2.3. Public Transport	8
2.4. Active Transport	8
2.5. Traffic Volumes	8
2.6. Existing Traffic Generation & Impact	9
2.7. Crash History	9
<b>3. Parking Assessment</b>	<b>12</b>
3.1. Parking Requirement	12
3.2. Design Aspects	12
<b>4. Traffic Impacts</b>	<b>13</b>
4.1. Traffic Generation & Impacts	13
4.2. Mitigation and Management Measures for Traffic Impacts	14
<b>5. Conclusions</b>	<b>15</b>

## List of Figures

Figure 1: Site Plan	6
Figure 2: Location and Road Hierarchy Plan	7
Figure 3: Crash History Map	11

## List of Tables

Table 1: NEH Traffic Volume Summary	9
Table 1: Crash History Summary	10

## Appendices

Appendix A	Concept Modification Layout
------------	-----------------------------



# 1. Introduction

---

## 1.1. Overview

PDC Consultants has been commissioned by Xenith Consulting Pty Ltd (Xenith) on behalf of Liddell Coal Operations Pty. Limited (LCO) to prepare a Transport Impact Assessment (TIA) in support of a proposed modification to Development Consent DA 305-11-01 (MOD 9) for the Liddell Coal Operations (Liddell). A detailed description of MOD 9 for which approval is sought, is outlined in the main Modification Report prepared separately and in which this TIA serves as an addendum. Specifically, MOD 9 consists of activities associated with the backfilling of targeted remnant underground workings at Liddell to provide long term stability. This includes the use of grout [a cementitious mix of either coal ash or blended coal ash (i.e. materials which comply with the Coal Ash Exemption 2014, and are referred to as “fly ash” in this assessment) mixed with general purpose cement]. Elements of MOD 9 relevant to the TIA include:

- Transportation of materials used for the activities (including those required for batching grout onsite) via approximately 40 truck deliveries (i.e. approximately 80 truck movements) per day generally transported to Liddell via highway routes.
- Rehabilitation of disturbed areas following the completion of works including sealing of boreholes and revegetation of drill pads and access tracks.
- 10 – 20 contractor workforce.
- All operations will be limited to Monday to Friday, between the hours of 7:00am and 5:30pm. No operations associated with MOD 9 are planned for weekends or public holidays.

A Concept Modification Layout is included as **Appendix A**.

Having regard for the above, the development is of a scale that requires referral of the Modification Application for MOD 9 to Transport for New South Wales (TfNSW), under Clause 2.122 of the State Environmental Planning Policy (Transport and Infrastructure) 2021.

The site is located within boundaries of both the Singleton and Muswellbrook local government area (LGA).

## 1.2. Structure of this Report

This report documents the findings of our investigations in relation to the anticipated traffic and parking impacts of the proposed development and should be read in the context of the Modification Report, prepared separately. The remainder of this report is structured as follows:

- Section 2: Describes the site and existing traffic and parking conditions in the locality.
- Section 3: Assesses the parking requirements of the development.
- Section 4: Assesses the traffic impacts of the development.



- Section 5: Presents the overall study conclusions.

### 1.3. References

In preparing this report, reference has been made to the following guidelines / standards:

- Singleton Development Control Plan 2014 (SDCP 2014).
- Singleton Local Environmental Plan 2013 (SLEP 2013).
- Muswellbrook Development Control Plan 2009 (MDCP 2009).
- Muswellbrook Local Environmental Plan 2009 (MLEP 2009).
- Guide to Transport Impact Assessment 2024 (GTIA).
- Public Transport Service Planning Guideline, Rural and Regional NSW, Transport for NSW 2015 (Public Transport Service Planning Guideline).
- State Environmental Planning Policy (Transport and Infrastructure) 2021 (SEPP T&I 2021).
- Umwelt Environmental Consultants, Liddell Colliery Modification to Development Consent, Environmental Assessment, 2006 (Umwelt EA 2006).
- Parsons Brinckerhoff, Liddell Coal Operations Modification to DA 305-11-01 Traffic Impact Assessment, 2013 (PB 2013).
- Parsons Brinckerhoff, Traffic Impact Assessment Intersection of Old New England Highway and the New England Highway: Liddell Coal Operations, 2006 (PB 2006).



## 2. Existing Conditions

---

### 2.1. Location and Site

Liddell is located within the Hunter Coalfields, part of the broader Sydney-Gunnedah Basin, approximately 25 km north-west of Singleton and 26 km south-east of Muswellbrook in the Upper Hunter Valley, New South Wales. Mining operations at Liddell largely concluded in 2023 and the mine site is now in the mine closure and rehabilitation phase.

The existing site is set within a heavily mined and industrialised region. The Hunter Coalfields hosts a number of large-scale mining operations, and the site is surrounded by several active coal mines within a 10 km radius, including Mt Owen Complex and Ravensworth Open Cut Operations as well as the operational Bayswater Power Station and the site of the former Liddell Power Station. This industrial activity influences both the local traffic patterns and the regional transport infrastructure demands.

Liddell's primary access currently connects to Old New England Highway (ONEH) which intersects with the New England Highway (NEH), a key regional freight and passenger corridor. The NEH serves as the main route for coal transport, employee movements, and delivery of equipment and supplies. The road is of national significance and accommodates high volumes of heavy vehicles, particularly in mining precincts. In the vicinity of Liddell, this route experiences regular coal haulage traffic and general regional traffic associated with Singleton and surrounding rural settlements. Scattered private residences are present to the north-west, and north-east of Liddell. While the area has a rural character, transport movements reflect an industrial profile due to the proximity and density of active mines.

**Figure 1** and **Figure 2** provide an appreciation of the site's location in both a local and broader context, respectively.

### 2.2. Road Network

The road hierarchy in the vicinity of the site is shown by **Figure 2**, with the following roads considered noteworthy:

- **NEH:** a classified state road (HW 9), that generally runs in a north-west to south-east direction between Queensland border at Wallangarra in the north-west to Hexham in the south-east. Near the site, it is subject to 100 km/h speed zoning restrictions and accommodates a single lane of traffic in each direction.
- **ONEH:** a local road that runs in a north-west to south-east direction between Pikes Gully Road (same road) in the north-west and the NEH in the south-east. Near the site, it is subject to 80 km/h speed zoning restrictions and accommodates a single lane of traffic in each direction.



Figure 1: Site Plan

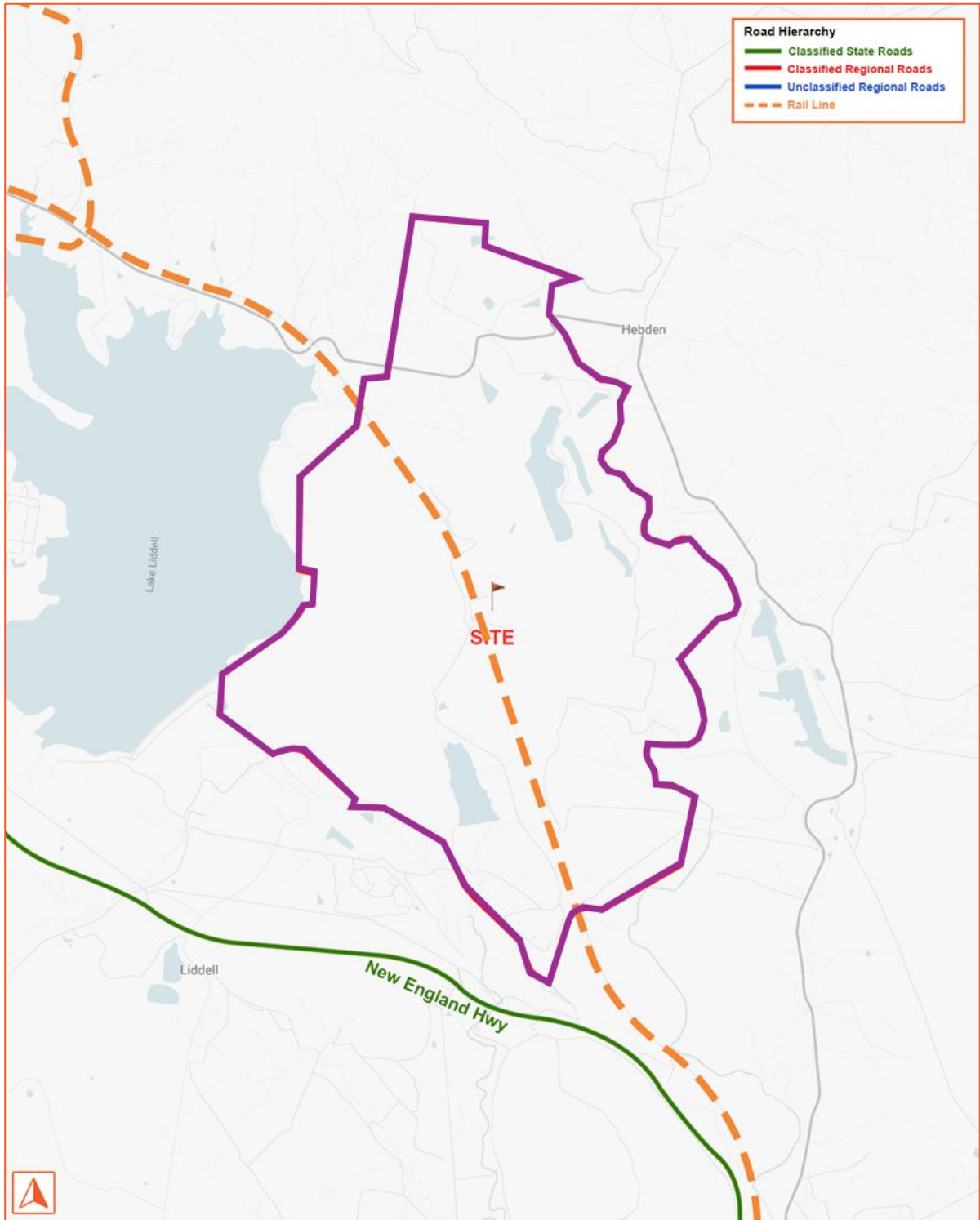


Figure 2: Location and Road Hierarchy Plan



## 2.3. Public Transport

### 2.3.1. Bus Services

The Public Transport Service Planning Guideline states that the walking catchment for rural and regional bus services includes all areas within an 800-metre radius of a bus stop. From review of publicly available bus service data<sup>1</sup>, there are no nearby bus services which operate near the site. It is assumed all workers arrive to the site by private vehicle and accordingly, there is little to no demand for the use of bus services by workers for journeys to and from the site, remaining consistent for the project.

### 2.3.2. Rail Services

#### Public Rail Services

**Figure 2** illustrates that the rail line, the Hunter Line (referred to as “Rail Line” on the figure), runs through Liddell. The mine rail loop within Liddell connects with the Hunter Line and was used to transfer product coal via rail to the Port of Newcastle during mining operations. Singleton Railway Station is the nearest station to Liddell being approximately 22 km away. Similar to bus services, all workers arrive to the site by private vehicle and accordingly, there is no demand for the use of rail services by Liddell workers for journeys to and from the site. MOD 9 does not propose to utilise rail services and therefore there will be no impacts on rail capacity.

#### Australian Rail Track Corporation

The Australian Rail Track Corporation (ARTC) manages the Hunter Valley rail network through its annual Hunter Valley Corridor Capacity Strategy (HVCCS), aiming to ensure that rail corridor capacity aligns with coal demand. Since active mining operations at Liddell ceased in 2023 and MOD 9 does not propose to utilise rail services, the HVCCS requirements therefore does not apply.

## 2.4. Active Transport

Given the remote location and scale of Liddell, demand for cycling and walking is expected to be negligible. Workers at Liddell consequently rely on private transport to travel to and from the site.

## 2.5. Traffic Volumes

The NEH carries some 14,000 to 15,000 daily vehicles with peak hour volumes of some 1,500 and 1,400 two-way vehicles occurring from 5:00 – 6:00am and 4:00 – 5:00pm period respectively (TfNSW Count Station, ID 6153, 200-metres north of Rix Creek Lane and ID T6156S, 272-metres north of Rix Creek Lane). The vehicle classification along the NEH is approximately 77% light vehicles, and 23% heavy vehicles, based on the TfNSW Count Station data. The average daily profile is summarised in **Table 1**.

---

<sup>1</sup> <https://transportnsw.info/> and <https://anytrip.com.au/region/nsw>



**Table 1: NEH Traffic Volume Summary**

YEAR	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	DAILY AVERAGE
2022	14,465	13,572	15,362	17,003	14,539	10,591	10,685	13,745
2023	14,497	16,236	16,882	17,573	16,477	10,281	10,635	14,654
2024	15,788	16,670	16,674	16,894	17,040	11,170	11,145	15,054

## 2.6. Existing Traffic Generation & Impact

The site accommodates a mine administration area which under DA 305-11-01 (as modified), is approved for a maximum workforce of 460 workers shared between 360 full time personnel and approximately 100 contractors as required. Since active mining operations ceased, the activity on-site is predominantly associated with mine closure and rehabilitation works resulting in a significantly reduced workforce on-site, well below the peak operation of Liddell while active mining operations were underway. Given this substantial reduction in on-site workers compared to during the operational phase, it is reasonable to expect a corresponding reduction in light-vehicle movements to and from Liddell. The distribution of trips associated with these 460 workers is 78% to the east, towards Singleton (equivalent to some 359 vehicles in one direction, or 718 two-way movements), and 22% to the west (equivalent to 101 vehicles in one direction, or 202 two-way movements), towards Muswellbrook (PB 2006).

The existing workers involved in mine closure and rehabilitation activities have been assumed to generate in the order of 101 two-way vehicle movements towards Singleton and 29 two-way vehicle movements towards Muswellbrook, based on the same workforce distribution.

The intersection of the ONEH / NEH was assessed in 2011 when Liddell was fully operational with the workforce of 460 workers. The intersection performance was further assessed as part of Modification 5 (MOD 5) to DA 305-11-01 within the PB 2013 TIA. The intersection captured 85 to 159 two-way vehicles (PB, 2013) turning to / from the ONEH with operation assessed to be Level of Service (LOS) 'B' which is reflective of good operation with acceptable delays and spare capacity. It is reasonable to expect a reduction in light-vehicle traffic volumes associated with reduced workforce for rehabilitation activities, and therefore a similar, or improved level of intersection performance at the ONEH / NEH intersection compared to when Liddell was operating at peak workforce capacity.

Liddell is currently approved to transport 'old tailings' to power stations within the locality using a maximum of 114 truck movements per day (i.e. 57 loaded trucks) along the New England Highway, 5 days per week. This approval was granted as part of MOD 3 (Umwelt, 2006). In addition, MOD 3 TIA (PB 2006) found that there would be eight additional heavy vehicle movements per hour at the ONEH / NEH intersection. The MOD 5 TIA (PB 2013) stated that there was no change in heavy vehicles associated with the operation of the mine, given there was no proposed change to coal production at the time. Although not explicitly stated, it is inferred by the PB 2006 TIA that as a minimum, the intersection was assessed as generating eight heavy vehicles during the peak hour.

## 2.7. Crash History

An assessment of the crash history near the site has been conducted to identify any potential existing crash trends which might be affected by the proposed development. The analysis was conducted on data available from the NSW Centre for Road Safety for roads and intersections near the site. The details of reported crashes are available for the five-year period between 2019 and 2023. The information provided for each crash includes the crash type, location, year, conditions, and contributing factors.



There was a total of seven crashes recorded in the study area for the most recent five-year period, averaging just above one crash per year. Crash locations are illustrated by **Figure 3** and further information is provided in **Table 2**.

**Table 2: Crash History Summary**

NO.	YEAR	INJURY	DCA <sup>(1)</sup>	DCA DESCRIPTION	LIGHTING
1	2021	Fatal	81	Off left/rt bnd => obj	Daylight
2	2023	Fatal	20	Head on	Dawn
3	2020	Serious injury	88	Out of cont on bend	Darkness
4	2023	Serious injury	20	Head on	Darkness
5	2019	Moderate injury	73	Off rd right => obj	Daylight
6	2019	Moderate injury	20	Head on	Daylight
7	2019	Moderate injury	20	Head on	Daylight

Notes: (1) Definition for Coding Accidents

Two of the crashes resulted in fatalities in 2021 and 2023 respectively. One of the fatal incidents involved a motorcycle leaving the carriageway travelling southbound along the ONEH and into an object during daylight (refer to crash number one in **Figure 3**). The remaining fatal incident involved a head on collision between two vehicles on the ONEH during dawn (refer to crash number two in **Figure 3**) located to the west of the ONEH intersection.

Two of the crashes resulted in serious injuries in 2020 and 2023 respectively. One incident involved a vehicle veering off the carriageway while travelling eastbound along the NEH on the left bend during darkness conditions (refer to crash number three in **Figure 3**). The remaining incident involved a head on collision between two vehicles along the NEH during darkness conditions (refer to crash number four in **Figure 3**).

Three of the crashes resulted in moderate injuries in 2019 of which one is located to the east of the ONEH intersection (refer to seven in **Figure 3**).

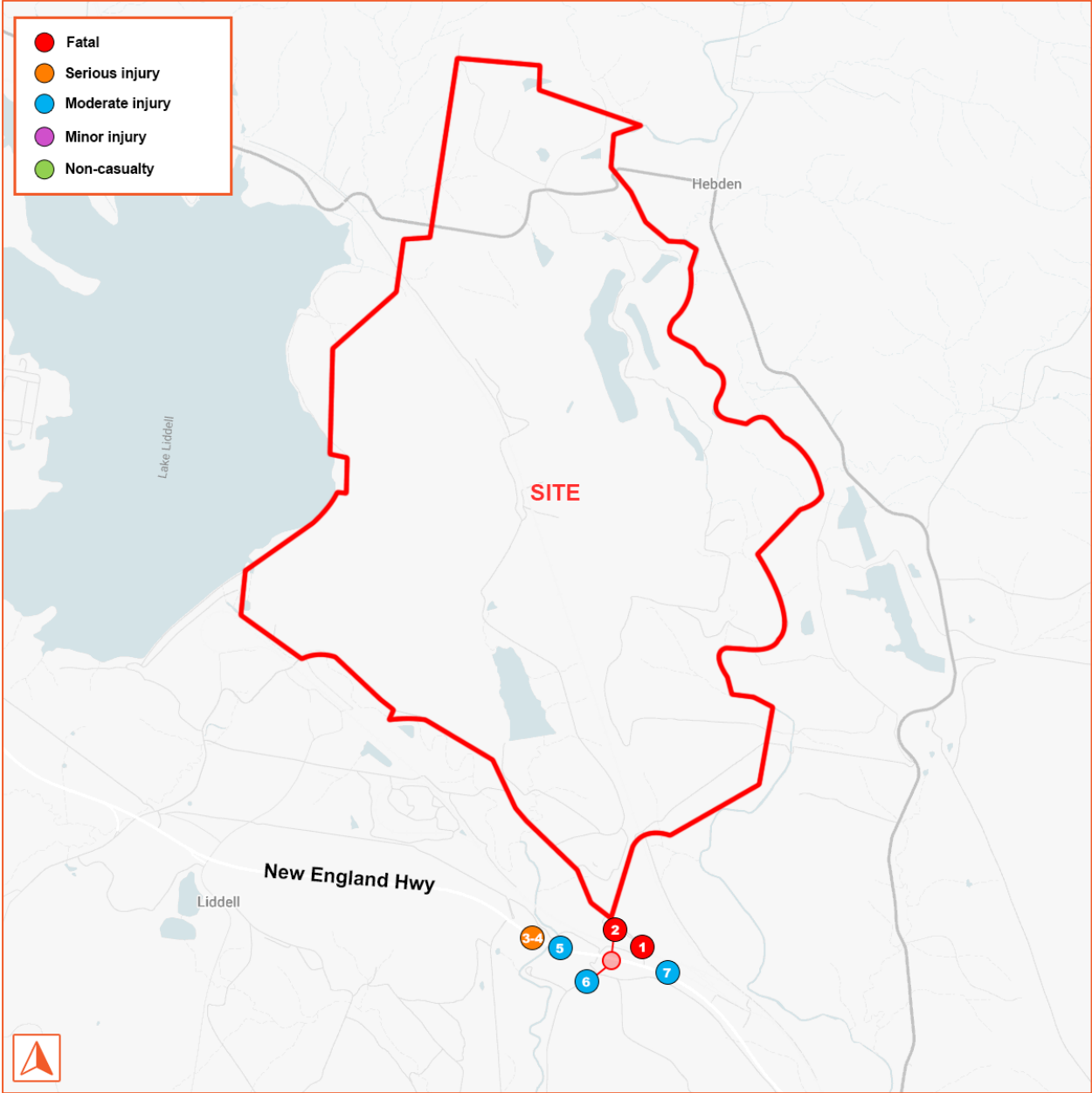


Figure 3: Crash History Map



## 3. Parking Assessment

---

### 3.1. Parking Requirement

DA 305-11-01 (as modified) provides Liddell approval to accommodate 360 full time personnel and 100 contractors within the confines of the site. Given that active mining operations at Liddell concluded in 2023, the workforce has significantly reduced. As a result, the existing car parking near the Administration Building and informal car parking area near the batching plant/s will readily accommodate the estimated 10 – 20 person workforce associated with MOD 9.

The administration area has some 200 car parking spaces available to workers. When considering the existing workforce associated with closure works, and the addition of up to 20 workers associated with MOD 9 in comparison with those associated with peak operations, there will be ample on-site car parking to accommodate the 20 additional workers on-site.

The car parking demand outlined above reflects a worst-case scenario, assuming all additional employees travel to and from the site by private vehicle. In practice, mine workers typically carpool, meaning actual parking demand is likely to be lower than the assumed rate of 1.0 car space per employee.

### 3.2. Design Aspects

MOD 9 proposes the retention of the existing car park and vehicle access arrangements, which has been approved by the original development consent and subsequent modifications. This is reflective of the peak mining conditions prior to the 2023 cessation of active mining operations.

The exact infrastructure to be provided for MOD 9, specifically the batching plant and arrangements, will differ depending on construction contractors / suppliers. However, all infrastructure will generally be temporary in nature and will be fully removed at the end of the grouting works proposed under MOD 9.

Given no changes would be made to the car park design as part of MOD 9, retention of the existing arrangements is considered satisfactory and does not require reassessment.

## 4. Traffic Impacts

---

### 4.1. Traffic Generation & Impacts

The proposed traffic generation for MOD 9 will be based on the 80 daily truck movements and the associated worker trip generation from the 10-20 contractors, with truck and contractor vehicles primarily accessing the site via the ONEH from the NEH. It is reiterated that since the cessation of active mining operations in 2023, the workforce has substantially reduced to numbers well below the workforce Liddell is currently approved for (noting that mining operations are approved until 31 December 2028).

The traffic generation associated with the proposed 20 workers under MOD 9, in combination with the existing workers on-site associated with mine closure activities, remains well below the 460 workers that were employed when Liddell was fully operational. It has been previously established, from the Traffic Impact Assessment completed for MOD 3, that some 78% of the workforce travelled to / from the east, towards Singleton, and 22% towards the west, to Muswellbrook. Based on the 460 workers when Liddell was fully operational, this would be up to 920 daily vehicle trips of which 718 daily vehicle trips would be towards Singleton and 202 daily vehicle trips towards Muswellbrook, via the NEH.

The 20 workers under MOD 9, in combination with the existing mine closure and rehabilitation workers on-site, would generate considerably lower vehicle trips than the estimated 920 daily trips at peak operation of Liddell. Thus, the volume of worker and contractor traffic associated with MOD 9, as calculated above, noting mining operations at Liddell are approved until 31 December 2028, remains well within those approved for peak operations at Liddell

The generation of some 80 truck movements and 20 – 40 daily light vehicle movements associated with the 10 – 20 contractors, is less than one percent of the average daily traffic along NEH. Based on the current vehicle classification along NEH, there is in the order of 77% light vehicles and 23% heavy vehicles. The increase of 80 daily heavy vehicle trips would have a negligible increase on the overall total number of heavy vehicles and is also below the previously approved 114 truck movements noted in Section 2.6. It is also reasonable to conclude that the traffic volumes generated under MOD 9 are within the daily fluctuation along the NEH, noting that volumes shown in **Table 1** vary depending on the day of the week.

Consequently, it is reasonable to also conclude that the performance of the ONEH / NEH intersection which serves as the primary access point for MOD 9 vehicles, would remain unchanged from the previously assessed LOS 'B' when Liddell was at its peak.

Fly ash will be sourced and hauled from Power Stations within the region (including the Eraring Power Station). Cement will be hauled via powder tanker and pre-mixed concrete for use in plug construction will be delivered via agitator trucks or mixed on-site at the batch plant. The generation of up to 80 truck movements per day will be spread across the day, where it is estimated that up to eight truck movements would occur in a peak hour. This is generally consistent with MOD 3 assessment at the time when Liddell was fully operational.

Liddell is also currently approved for up to 114 daily truck movements for transporting 'old tailings' along the NEH, indicating that the truck movements proposed under MOD 9 remain well within the existing approval.



In summary, the traffic generation associated with MOD 9 is below peak activities approved at Liddell and will result in traffic impacts no worse than what was previously considered and approved, in conjunction with existing mine closure and rehabilitation activities.

#### 4.2. Mitigation and Management Measures for Traffic Impacts

LCO will continue to manage impacts on traffic in accordance with existing measures implemented at Liddell. These include management measures such as heavy vehicles complying with the Heavy Vehicle National Law (HVNL) and its associated Chain of Responsibility (COR) requirements.



## 5. Conclusions

---

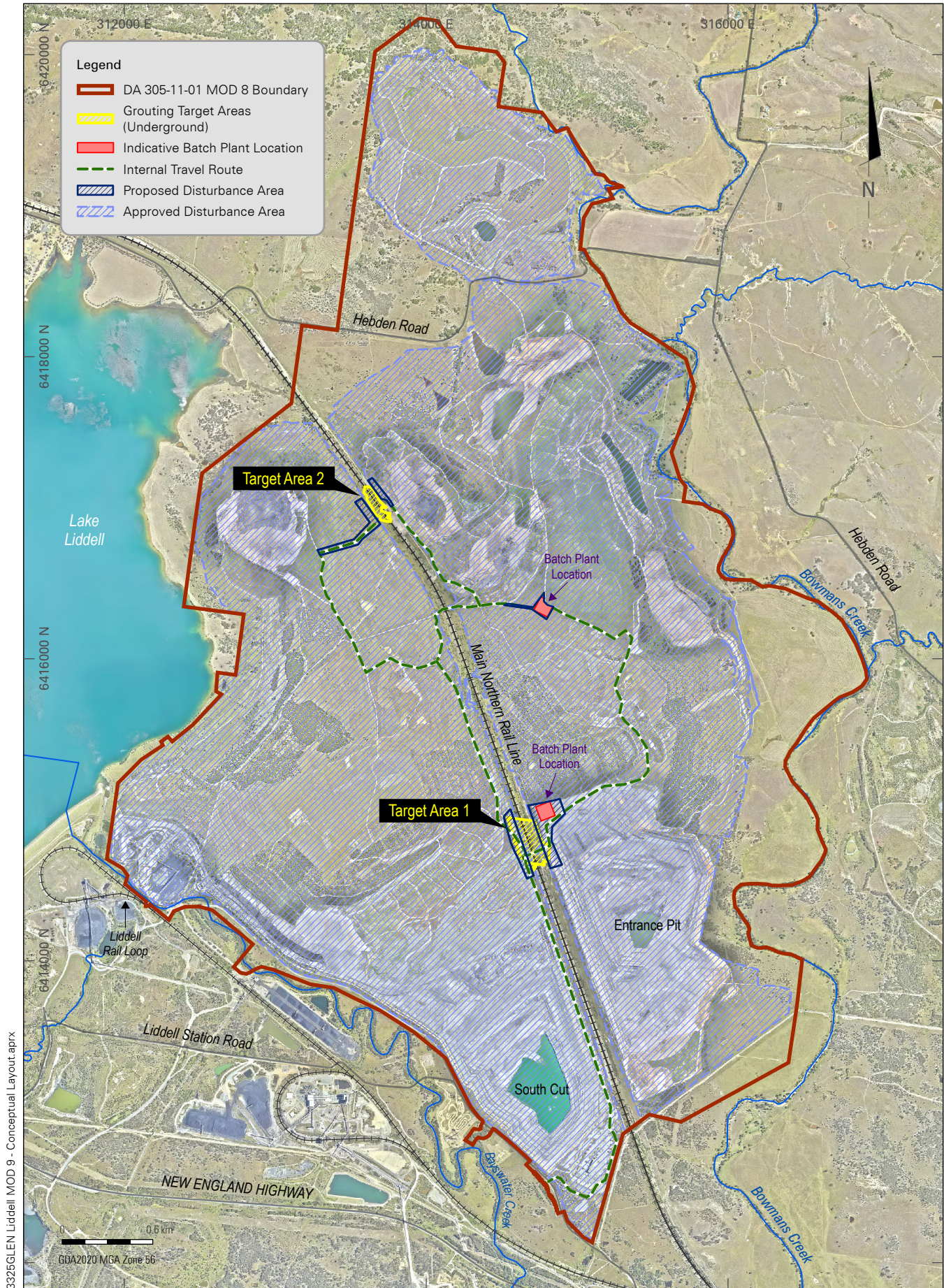
In summary:

- The traffic generation assessment confirms that MOD 9 traffic, in conjunction with mine closure and rehabilitation activities, is significantly below the peak traffic generation previously generated during peak operations at Liddell.
- The resulting traffic movements generated to the east towards Singleton, and the west towards Muswellbrook, will remain well within those previously assessed and approved for peak mining operations.
- The cumulative traffic impacts of MOD 9 and the current mine closure activities will be below the approved existing conditions with the LOS of the ONEH / NEH intersection expected to remain unchanged.
- The approved existing parking provision is suitable to accommodate the proposed 10 – 20 contractor workforce, with parking being provided formally at the existing Administration Building and informally around the batching plants and grouting works area. The Administration Building has over 200 car parking spaces in close proximity.

It is therefore concluded that the proposed development is supportable on transport planning grounds.



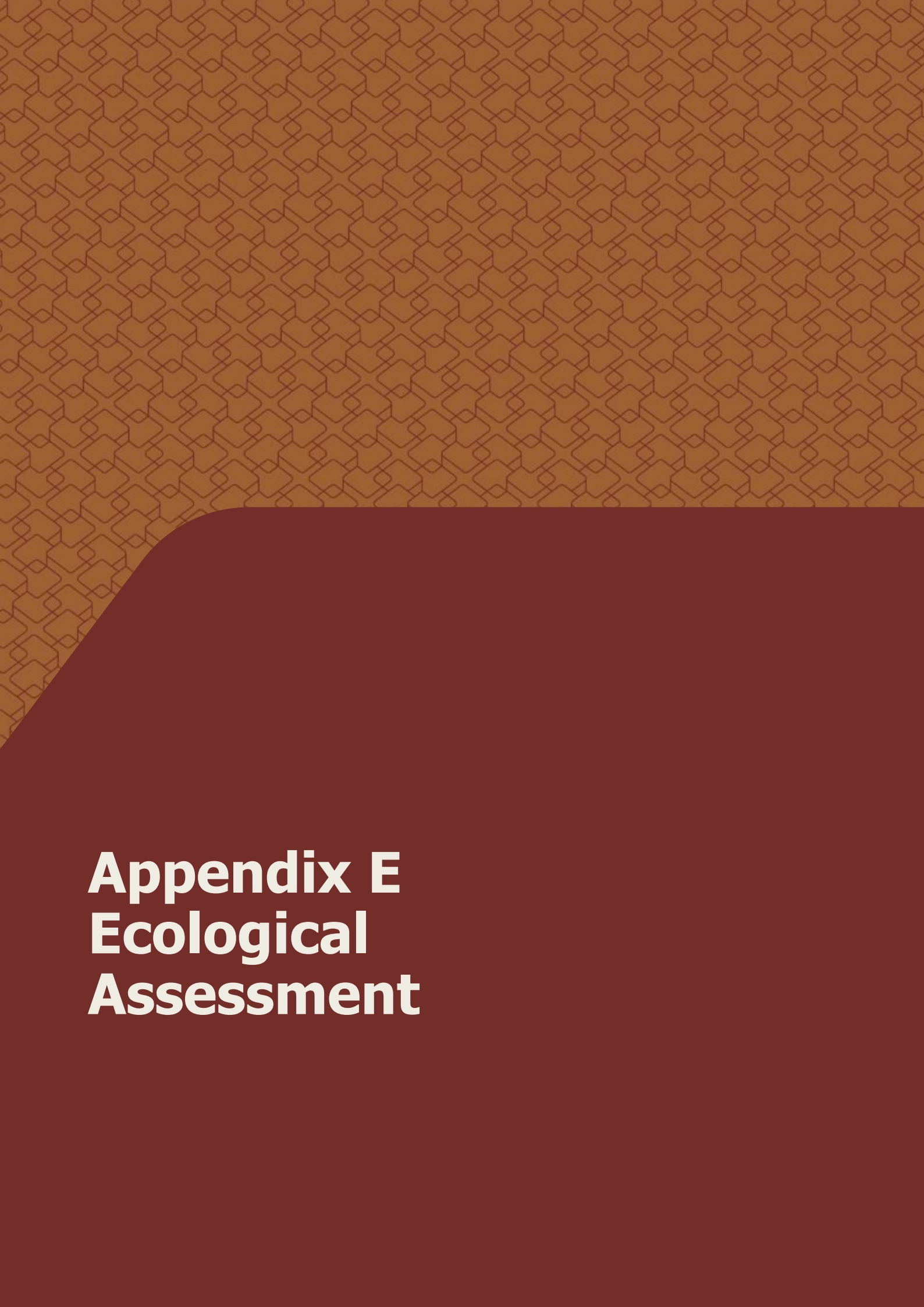
## Appendix A



3325GLEN Liddell MOD 9 - Conceptual Layout.aprx

**PDC CONSULTANTS**  
+61 2 7900 6514 | [pdcconsultants.com.au](http://pdcconsultants.com.au)





# **Appendix E Ecological Assessment**

## Briefing Note

To	Sean Pigott
E	Sean.Pigott@glencore.com.au
From	Adam Cavallaro
Date	17 December 2025
<b>Subject</b>	<b>Liddell Coal Operations Modification 9: Ecological Assessment</b>

## 1.0 Introduction

Umwelt (Australia) Pty Ltd (Umwelt) was engaged by Liddell Coal Operations Pty Limited (LCO) to undertake an ecological assessment for the proposed Liddell Coal Operations (Liddell) Modification 9 (MOD9) works which will entail backfilling of remnant underground mine workings with grout via boreholes (the Modification). The proposed works will occur entirely within areas of existing and areas of approved disturbance at Liddell (Approved Disturbance Area) in accordance with the development consent DA 305-11-01 as modified.

### 1.1 The Proposed Modification

LCO is currently undertaking mine closure and rehabilitation works in accordance with the development consent and Rehabilitation Management Plan (RMP). One of the objectives of the consent requires rehabilitation to be “safe stable and non-polluting”. The proposed works for the Modification requires a targeted grouting program to be carried out in historic underground mining specifically remnant first workings situated beneath the Main Northern Rail line (MNRL) and other public infrastructure. An assessment of these workings indicates that the current pillar geometry is long-term stable. However, pillar area reduction may occur overtime as a result of external influences such as spontaneous combustion.

In order to alleviate any pillar failure risk beneath the MNRL and other public infrastructure, LCO is proposing a targeted backfill program using grout (a cementitious mix of either coal ash or blended coal ash (i.e. materials which comply with the Coal Ash Exemption 2014, and are referred to as “fly ash” in this assessment) mixed with general purpose cement) to provide long-term stability.

LCO seeks to modify DA 305-11-01 to permit the works required to backfill select underground workings with grout. The Modification will require the following actions:

- Construction and operation of a grout batching compound and ancillary infrastructure on predominantly existing hardstand areas that have already been cleared and compacted. The grout

batching compound will be constructed in locations that will support the backfilling works of select underground workings.

- Drilling of approximately 70 boreholes (The final location and number of boreholes may change depending on the performance of backfilling activities)
- Pumping and emplacement of grout into the targeted underground workings
- Transportation of grout materials (fly ash, cement and other materials) to site via approximately 40 truck deliveries (i.e. 80 truck movements) per day generally transported to Liddell via highway routes
- Other ancillary infrastructure as required to support the grout batching activities
- Rehabilitation of disturbed areas following the completion of works, including sealing of boreholes, decommission and removal of temporary infrastructure from the site and revegetation of drill pads and access tracks.

There are two target grouting locations (refer to **Figure 1.1**) which are located within the Study Area identified by LCO. The Study Area is made up of five locations where grouting works (approximately 70 boreholes), some haul roads and proposed infrastructure will be located. These five areas are entirely located within the Approved Disturbance Area at Liddell. The five areas are displayed on **Figure 1.1** and **Table 1.1** provides a summary of the location name and extent of each area.

**Table 1.1 Study Area Extent**

<b>Study Area</b>	<b>Area (ha)</b>
North-1	2.79
North-2	0.72
East-1	1.29
South-1	2.8
South-2	5.32
<b>Total Area</b>	<b>12.92</b>

## 1.2 Objective

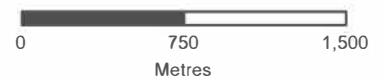
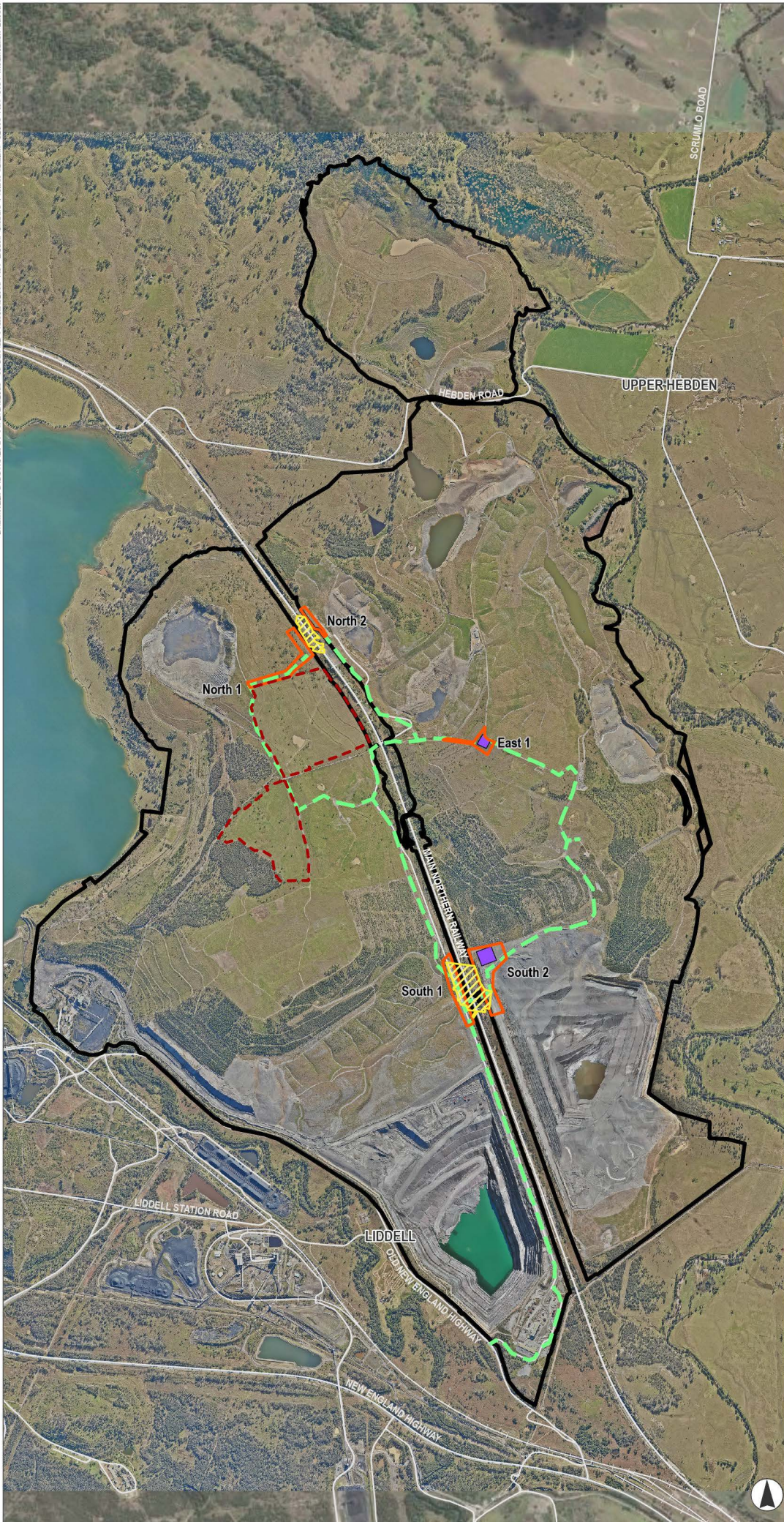
The objective of the ecological assessment was to undertake a desktop and field assessment of the Study Area to determine if the proposed works would result in additional impacts to biodiversity above those approved for DA 305-11-01 as modified.

The Study Area is located within the Approved Disturbance Area. As the Modification will see the re-disturbance of areas previously mined and rehabilitated that have not been relinquished, certified or meet completion criteria, a modified ecological assessment was carried out to assess whether the Modification would have additional impacts on biodiversity values beyond those already approved.

This ecological assessment was developed to provide a general understanding of biodiversity values that may occur and determine whether the impacts associated with the Modification are inconsistent with those approved under DA 305-11-01. The Modification is unlikely to increase impacts to biodiversity above that approved under DA 305-11-01, therefore a Biodiversity Development Assessment Report (BDAR) is not applicable due to impacts already addressed under previous approvals.

**FIGURE 1.1**  
**Modification Layout**

- Legend**
- Approved Disturbance Area
  - MOD 9 Proposed Disturbance Area
  - Grouting Target Areas
  - Certified Land
  - Internal Travel Route
  - Proposed Batch Plant Location
  - Road
  - Railway



Scale 1:35,000 at A4  
 GDA2020 MGA Zone 56



This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.

APPROVED FOR AND ON BEHALF OF Umwelt

## 2.0 Methodology

The following methodology was used to describe the biodiversity values relating to the proposed works area at Liddell and is a combination of a desktop analysis and field assessments.

### 2.1 Desktop Assessment

A review of relevant public databases and literature was undertaken to identify threatened and migratory species, endangered populations, Threatened Ecological Communities (TECs) and their habitats that have previously been recorded within the locality (a 10-kilometre (km) radius around the Study Area). Threatened species, endangered populations and TECs (listed under the NSW *Biodiversity Conservation Act 2016* (BC Act), and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)) that have the potential to occur within the locality were also considered based on the type of habitat present and the Interim Biogeographic Regionalisation for Australia (IBRA) subregion within which the Study Area is located.

The desktop included a review of the following documentation and databases:

- Liddell Coal Operations Extension Project – Ecological Assessment Report (Umwelt 2013)
- Liddell Coal Operations Rehabilitation Management Plan (RMP) (LCO 2025)
- NSW BioNet Atlas
- Commonwealth Department of Climate Change Energy Environment and Water (DCCEE) EPBC Act Protected Matters Search Tool (PMST)
- NSW Draft Native Vegetation Regulatory Map (NVR Map)

### 2.2 Land Categorisation Desktop Review

To validate Category -1 Exempt Land, an initial desktop review was carried out to determine if lands within the Study Area were cleared at January 1990 or lawfully cleared after this date.

A review of the following historic aerials and overlaid with the NSW Draft NVR Map was undertaken to assess when clearing had occurred across the Study Area:

- Historic aerial imagery from 1989 and 1993.
- Historic Google Earth satellite imagery between 2007, 2009 and 2013.
- ESRI Wayback Historic Images 2010.

**Appendix A** provides a summary of the land category definitions in accordance with the *Local Land Services Act 2013* (LLS Act) and its reference within the BC Act.

## 2.3 Field Assessment

A site visit of an early version of the Study Area (>25 hectares (ha)) was undertaken by an Umwelt Ecologist on the 8 May 2025 and a follow up field assessment was carried out over the final Study Area on the 17 September 2025. The fieldworks consisted of:

- High-level constraints mapping of the original Study Area. This included over fence assessment of the rail corridor land which is no longer part of the Modification
- Ecological field assessment of the Study Area included general site observations, random meander through vegetation areas and rapid vegetation data point collection
- Collection of formal floristic data by collecting:
  - A single floristic plot in accordance with the BAM
  - Three transects in accordance with the Interim Grass and Groundcover Assessment Method (IGGAM) in areas of pasture
    - This method involves conducting a 100-metre transect survey, where the assessor records the presence of either exotic perennial or native species at each metre along the transect. The results are used to determine whether the area qualifies as low conservation value grassland and therefore supports the classification of the Category 1 – exempt land classification.
    - Conservation value of grassland is determined by two methods:
      - Importing the field data from the IGGAM transects into the IGGAM Calculator (Version 1.2.2.00) where there is a native cover of 50% or less.
      - Where >50% exotic cover is present it is automatically assigned to the low conservation value grassland category.

## 3.0 Results

### 3.1 Study Area Description

The Study Area has been defined into areas of similar condition and/or land use. The wider mine site is still operational to facilitate the completion of rehabilitation works and closure of the mine. The Study Area contains areas that include:

- Operational areas - this includes roads, and other non-rehabilitated areas of the former open cut mine
- Early-stage rehabilitation works
- Exotic pasture areas
- Exotic vegetation with native shrubs
- Native canopy with exotic understorey.

All the above areas are within the Approved Disturbance Area at Liddell. **Table 3.1** provides a breakdown of the extent of each land use and vegetation type within the Study Area. **Figures 3.1-3.3** display the extent of each land use and vegetation type within the Study Area.

**Table 3.1 Study Area Vegetation Extent**

Area Description	North-1 Area (ha)	North-2 Area (ha)	East-1 Area (ha)	South-1 Area (ha)	South-2 Area (ha)	Total Area (ha)
Exotic Pasture	2.79	0.61	0.91	0.1	0.21	<b>4.62</b>
Exotic with mixed shrub	-	-	-	0.35	0.54	<b>0.89</b>
Native Canopy	-	-	-	-	0.10	<b>0.10</b>
Rehabilitation	-	-	-	1.06	-	<b>1.06</b>
Operational Area	-	0.11	0.38	1.29	4.47	<b>6.25</b>
<b>Total Area (ha)</b>	<b>2.79</b>	<b>0.72</b>	<b>1.29</b>	<b>2.8</b>	<b>5.32</b>	<b>12.92</b>

#### 3.1.1 Exotic Pasture

The Study Area has a total of 4.62 ha of exotic pasture across the five locations. The exotic pasture generally consists of exotic grass species intermixed with the very scattered common native groundcover and a very scattered shrub layer of *Acacia salicina* (Cooba) and exotic or non-endemic native shrubs including *Acacia saligna* (Golden wreath wattle) and *Olea europaea* subsp. *cuspidata* (African olive). The final land use of these areas is generally for pasture with all areas in various conditions where rehabilitation works have occurred. Vegetation is developing on these disturbed areas where exotic grasses were observed to be dominant and native species relatively sparse and often suppressed by the pasture species.

The groundlayer is primarily exotic species with *Chloris gayana* (Rhodes grass) being the dominant exotic grass species along with patches of Coolatai grass (*Hyparrhenia hirta*), Guinea grass

(*Megathyrus maximus*) and forb species *Galenia pubescens*, *Cirsium vulgare* (Scotch thistle), fireweed (*Senecio madagascariensis*) and Medic (*Medicago* spp.). Common native species that often persist amongst exotic pasture were also present at very low density. These species included *Dichondra repens* (Kidney weed), *Geranium solandri* and scattered patches of the cosmopolitan species *Cynodon dactylon* (Couch grass) a species often used in rehabilitation to provide cover and stability.

The substrates in these areas were observed to be a mixed spoil and subsoils that have been applied post mining. Topsoil was only present as a thin patch layer with the spoil mix being the dominant substrate in these areas.

A total of three IGGAM transects were undertaken across the areas with exotic cover estimated to be between 83-96%, native cover 3-7% and bare soil 5-15% cover. In **Photos 3.1-3.4**, examples of exotic pasture across the five areas have been provided to show the extent of exotic cover and condition of the vegetation.



**Photo 3.1 Exotic Pasture area North -1**



**Photo 3.2 Exotic Pasture area East -1**



**Photo 3.3 Exotic Pasture area North -2**



**Photo 3.4 Exotic Pasture area South -2**

### 3.1.2 Exotic with Mixed Shrub

The exotic with mixed shrub vegetation extent is approximately 0.89 ha of the Study Area. This vegetation is often found on the edges of operational areas, where infrastructure has previously been located and a small area of early-stage rehabilitation. The vegetation is often dominated by exotic grasses and forbs with a mixed shrub layer of regenerating native and exotic species. The substrate is a mix of spoil, over burden and pushed up spoil piles. Topsoil is present as very thin patchy layers amongst the rock spoil.

The groundlayer is primarily exotic species with *Chloris gayana* (Rhodes grass) being the dominant exotic grass species along with patches of Coolatai grass (*Hyparrhenia hirta*), Guinea grass (*Megathyrsus maximus*) and forb species *Galenia pubescens*, *Cirsium vulgare* (Scotch thistle), fireweed (*Senecio madagascariensis*) and *Gomphocarpus fruticosus* (Cotton bush). Common native species that often persist amongst exotic pasture were also present at very low density. These species included *Dichondra repens* (Kidney weed), *Geranium solandri* and scattered patches of the cosmopolitan species *Cynodon dactylon* (Couch grass) a species often used in rehabilitation to provide cover and stability. The shrub layer consists of young tree and shrub species that include *Acacia salicina* (Cooba) and exotic or non-endemic native shrubs *Acacia saligna* (Golden wreath wattle), *Cestrum nocturnum* (Night Cestrum), *Olea europaea* subsp. *cuspidata* (African olive) and the occasional *Eucalyptus crebra* (Narrow-leaved ironbark) and *Allocasuarina luehmannii* (Buloke). These areas currently described as exotic with mixed shrubs in South -1 and South – 2 were previously described as disturbed vegetation in the LCO MOD 5 Ecological Assessment (Umwelt 2013). **Photo 3.5-3.8** show examples of the exotic with mixed shrub vegetation.



Photo 3.5 Area South -2



Photo 3.6 Area South -2



Photo 3.7 Area South -2



Photo 3.8 Area South -1

### 3.1.3 Native Canopy

There is a small area of vegetation in area South -2 where the native canopy has not been cleared as part of the MOD 5 approval. The removal of this area of vegetation was approved and accounted for as part of the offset package in MOD 5.

These very small patches are approximately 0.1 ha in area and consist of a canopy with *Eucalyptus moluccana* (Grey box), *E. crebra* (Narrow-leaved ironbark) and *Allocasuarina luehmannii* (Buloke). These trees have a primarily exotic understory with the occasional native grass and forb species observed. These trees appeared to have been retained as they are located on the western side of a secure fence. The groundlayer contains *Chloris gayana* (Rhodes grass), *Cynodon dactylon* (Couch grass), *Solanum cinereum* (Narrawa Burr) and *Enchylaena tomentosa* (Ruby saltbush) and *Dichondra repens* (Kidney weed).

The ages of trees range from 10-20 years and do not provide any habitat value in the form of hollows or deep fissures. These trees are contiguous with a patch of similar condition vegetation outside the Study Area.

The vegetation in this area was part of a larger extent of native vegetation prior to 2013 and described in the LCO MOD 5 Ecological Assessment (Umwelt 2013) as Central Hunter Box- Ironbark Woodland. The canopy species still present in these minor patches are indicative of the woodland that was previously described in this area.

The minor area of this vegetation did not allow the collection of floristic data to confirm the best fit Plant Community Type (PCT) as all patches are <1,000 m<sup>2</sup> the standard size of a BAM floristic plot. Based on experience and canopy species present the vegetation would most likely align with PCT 3431 Central Hunter Ironbark Grassy Woodland which is associated with the BC Act endangered ecological community (EEC) *Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions*. **Photo 3.9 and 3.10** show examples of the native canopy vegetation



Photo 3.9 Area South 2



Photo 3.10 Area South 2

### 3.1.4 Rehabilitation

There is approximately 1.06 ha of area within the Study Area that has been assigned to very early-stage rehabilitation works. These areas have recently (past 12 -18 months) undergone landform redesign which includes the redistribution of substrates such as overburden and a mix of topsoil and spoil. Some areas have been seeded and there is evidence of recruitment of the native shrub and tree species layer. There was also a moderate cover of exotic species in these areas. Shrub and tree species included *Eucalyptus moluccana* (Grey box), *E. crebra* (Narrow-leaved ironbark), *Corymbia maculata* (Spotted gum), *Allocasuarina luehmannii* (Buloke), *Acacia salicina* (Cooba), *A. paradoxa* (Kangaroo thorn), *A. implexa* (Hickory wood) and *Dodonaea viscosa* (Hop bush). All native tree and shrubs were generally <1m with the very occasional individual >1m. Coverage was sparse with open bare spoil areas to small patches of dense exotic and native cover. The vegetation is in the very early establishment phase and does not provide habitat features that would support threatened flora or fauna species.

Vegetation in these areas do not conform to any PCT in their current conditions therefore cannot be assigned to a best fit PCT. **Photos 3.11 and 3.12** shows examples of the rehabilitation areas.

A single IGGAM transect was placed in Area South -1 and a total of 92% of the transect is exotic with 6% bare soil and 2% native.



**Photo 3.11 Area South -2**



**Photo 3.12 Area South -2**

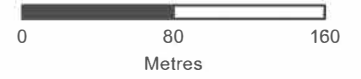
### 3.1.5 Operational Area

Vegetation was generally absent from operational areas with only the occasional exotic grass recorded along active haul roads. A total of 6.25 ha of operational area is present within the Study Area.



**FIGURE 3.1**  
**Northern Study Area -**  
**Vegetation**

- Legend**
- Approved Disturbance Area
  - MOD 9 Proposed Disturbance Area
  - BAM Plot
  - IGGAM
  - Exotic Pasture
  - Operational Area
  - Road
  - Railway



Scale 1:4,000 at A4  
 GDA2020 MGA Zone 56

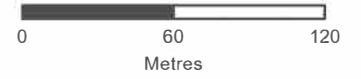


This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.  
 APPROVED FOR AND ON BEHALF OF Umwelt



**FIGURE 3.2**  
**Eastern Study Area -**  
**Vegetation**

- Legend**
- Approved Disturbance Area
  - MOD 9 Proposed Disturbance Area
  - IGGAM
  - Exotic Pasture
  - Operational Area



Scale 1:3,000 at A4  
GDA2020 MGA Zone 56







This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.  
APPROVED FOR AND ON BEHALF OF Umwelt

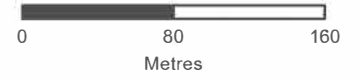




**FIGURE 3.3**  
**Southern Study Area -**  
**Vegetation**

**Legend**

-  Approved Disturbance Area
-  MOD 9 Proposed Disturbance Area
-  IGGAM
-  Exotic Pasture
-  Exotic with mixed shrubs
-  Native Canopy
-  Rehabilitation
-  Operational Area
-  Road
-  Railway



Scale 1:4,000 at A4  
 GDA2020 MGA Zone 56



This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt"). Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.  
 APPROVED FOR AND ON BEHALF OF Umwelt



## 3.2 Threatened Species

As part of the desktop analysis a 10 km NSW BioNet Atlas and PMST database search was conducted to determine the number of threatened species that have been recorded in the locality. The results of these searches are provided in Table 3.2. The table shows the number of species that have been recorded and MNES species likely to be present. The number of species with no records from the State BioNet search has been shown in parentheses under the number of species identified by the PMST search.

**Table 3.2 BioNet Wildlife Atlas and PMST database search results**

Species Group	Number of species recorded (BioNet)	Number of Species (PMST)	Total threatened entities
Flora	9	14 (10)	19
Amphibians	1	2 (1)	2
Avifauna	29	19 (5)	34
Mammals	16	11 (4)	20
Reptiles	0	2 (2)	2
Total	55	48 (22)	77

A likelihood of occurrence table has been provided in **Appendix B**. All threatened entities were considered to have a low likelihood to occur in the Study Area predominantly due to the disturbed nature and limited connectivity to any surrounding large remnants.

No threatened flora or fauna species were observed within areas containing vegetation during the May site visit and September 2025 field assessment. In addition, no stick nests, hollow-bearing trees or decortivating bark were observed.

## 3.3 Land Categorisation

The ecological assessment sought to validate Category 1 – exempt land across the Study Area.

A two-fold method was used in the field:

- a species list was compiled by meandering through the areas and an inspection of the substrate to record conditions and evidence of past land use and disturbance. This information has informed the vegetation descriptions in Section 3.1.
- the IGGAM (OEH 2017) was applied to determine the conservation value of the grassland areas.

All areas that have been identified as Category 1- Exempt land on the Draft NVR map are consistent with the definition *Land cleared of native vegetation as at 1 January 1990 or lawfully cleared after 1 January 1990 (but before 25 August 2017)*. The majority of the Study Area has been disturbed by historical mining operations within the Approved Disturbance Area, therefore resulting in the clearing of land consistent with the definition. A full definition of land categories is provided in **Appendix A**.

Umwelt has reviewed the land categorisations across the Study Area presented within the Draft NVR Map. The Study Area encompasses (11.37 ha) Category 1 land (includes operational land), and (1.55

ha) of Category 2 – Regulated land. Figure 3.4 displays the current Draft NVR Mapping and IGGAM locations.

There is 1.55ha of exotic pasture in North-1 that is currently assigned to Category 2-Regulated Land. During the site visit, vegetation in this area was observed to be consistent with adjacent areas that have been mapped as Category 1 – Exempt Land. A review of aerial imagery from 2007 (refer to **Photo 3.13**) also demonstrates that the area was undergoing rehabilitation works including landform re-establishment (see below). The current condition and obvious substrate disturbances of the past should result in this area being recategorized as Category 1- Exempt Land.



**Photo 3.13 Google Maps Image (3/5/07) showing Category 2 land early -stage rehabilitation**

To support the categorisation of land, three of the four IGGAM transects were located in areas of Category 1- Exempt Land and resulted in all being considered low conservation value grassland after entering the data collected into the IGGAM Calculator. The fourth IGGAM (IGGAM\_01) transect was located in the area of Category 2- Regulated Land and this area is also considered low conservation value grassland. Table 3.3 provides a summary of the IGGAM calculator results.

**Table 3.3 IGGAM Vegetation Integrity Scores**

IGGAM Transect	Exotic perennial/ Native cover	Composition Condition Score	Structure Condition Score	Vegetation Integrity Score	Conservation Value
IGGAM_01	1	0	0	0	Low
IGGAM_02	1	0.7	0.5	0.6	Low
IGGAM_03	0.9	1.7	10.4	4.2	Low
IGGAM_04	1	0.4	0	0.1	Low

The single BAM floristic plot was also located in the Category 2-Regulated Lands on the Draft NVR map. The plot data indicates the 20x50m plot was dominated by exotic species with very poor native

diversity and cover. In Table 3.4 a summary of the plot data has been provided. Function attributes have been summarised and only attributes that have a result were included. The very low diversity and cover with a lack of structure and habitat features supports the very poor condition of the vegetation and the lack of detail to determine the best fit PCT for this area.

**Table 3.4 Floristic BAM Plot Summary**

Attribute	Tree	Shrub	Grass/ grass like	Forb	Fern	Other
Composition	1	1	0	2	0	0
Structure	2	0.1	0	0.2	0	0

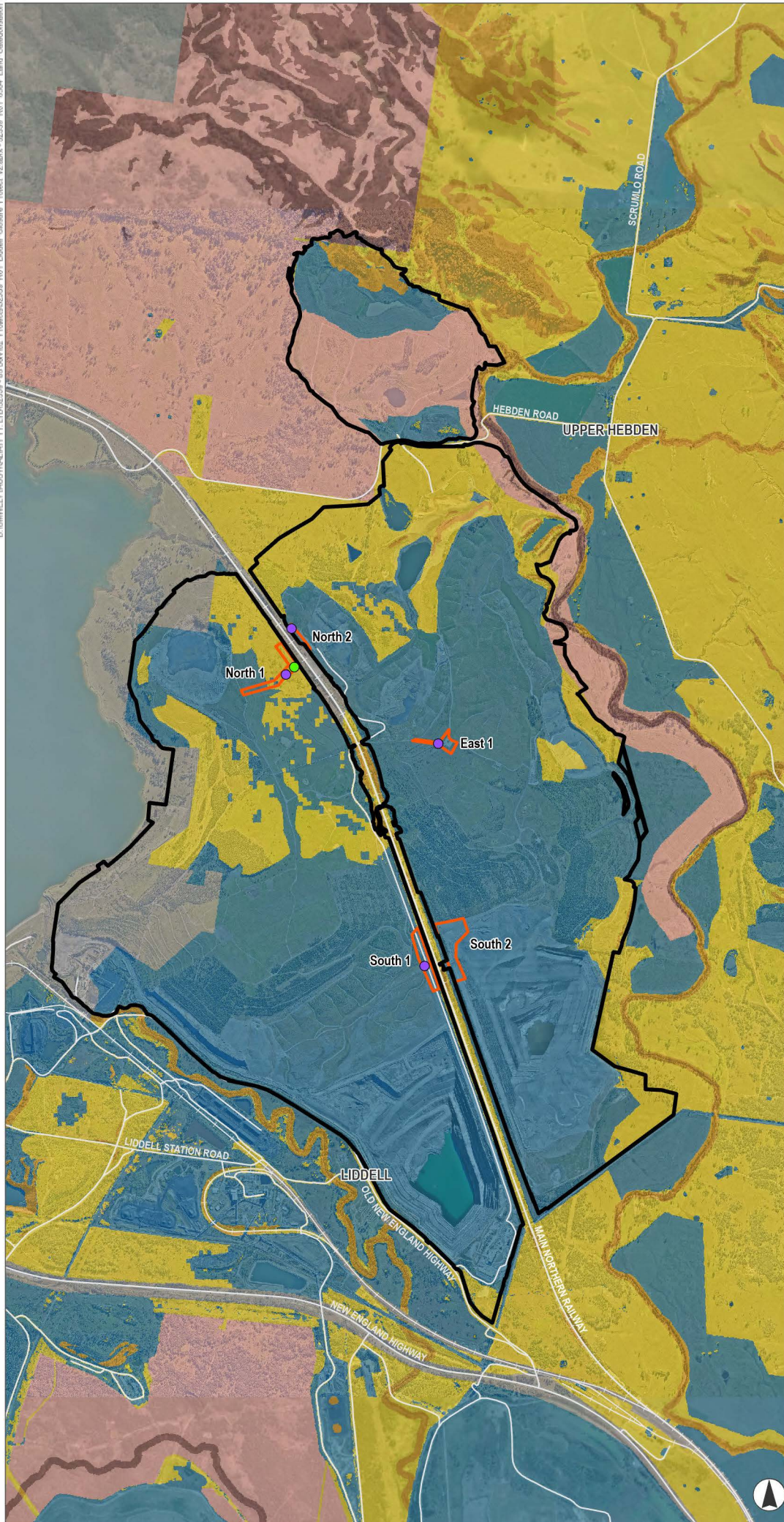
Attribute	Litter	Logs	Tree Regen <5cm	Tree 5-9cm	Tree 9-19 cm	Tree 20-29 cm	Tree 30-49 cm	Tree 50-79 cm	Large Old Tree	High Threat Weeds
Function	9.2	0	1	0	0	0	0	0	0	82.5

Table 3.5 is a summary of the vegetation integrity score when entering the floristic plot data into the BAM-Calculator. This exercise was undertaken to provide an example of the very poor condition the vegetation within this area and the lack of biodiversity values present. This low biodiversity value would also support the recategorization of the land from Category 2 – Regulated Land to Category 1- Exempt Land.

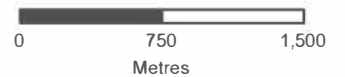
**Table 3.5 BAM-C Vegetation Integrity Summary**

Plot	Composition	Structure	Function	VI Score
Plot_001	2.6	0.1	4	2.2

**FIGURE 3.4**  
**Land Categorisation**



- Legend**
- Approved Disturbance Area
  - MOD 9 Proposed Disturbance Area
  - Road
  - Railway
  - BAM Plot
  - IGGAM
  - Category 1 - exempt land (draft)
  - Category 2 - regulated land (draft)
  - Category 2 - vulnerable regulated land (in-force)
  - Category 2 - sensitive regulated land (in-force)
  - Category 2 - sensitive and vulnerable regulated lands areas of overlap (in-force)
  - Land excluded from the LLS Act



Scale 1:40,000 at A4  
GDA2020 MGA Zone 56



This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.

APPROVED FOR AND ON BEHALF OF Umwelt

## 4.0 Assessment of Impacts

The following section provides an assessment of the Modification and potential impacts to biodiversity within the Study Area.

### 4.1 Modification Impact Summary

The Study Area accounts for approximately 12.9 ha of land within the Approved Disturbance Area at Liddell. The entire Study Area is not expected to be impacted by the Modification. Instead, a larger area has been identified to provide flexibility in selecting final drilling pad locations, access tracks, ensuring efficient access to grouting target zones and facilitating effective grouting operations. It is expected that the final design of the works will reduce the area of impact and where possible co-locate all areas of impact within existing operational areas.

### 4.2 Previous Land Use and Final Land Use

Areas within the Study Area have been subject to mining activities or associated works which has resulted in the progressive rehabilitation of some areas or in some instances overburden, spoil piles and site infrastructure left in situ. LCO is progressively rehabilitating the wider disturbance area in preparation for final mine closure. The Study Area will become part of the wider rehabilitation of the mine site, therefore under current approvals, LCO may be required to disturb areas in the Study Area to ensure any proposed final land use results in the restoration and rehabilitation of landform and vegetation in accordance with the approved LCO RMP (2025).

In the LCO RMP (2025) all areas within the Study Area are shown in the conceptual final land use plan to be restored to pasture and/or native woodlands.

All areas in the Study Area have been approved for disturbance under the current consent and no area within the Study Area has been certified, relinquished or met completion criteria, therefore LCO may be required to disturb these areas to ensure the final land use target is achieved.

The current RMP identifies Schedule 3 Condition 38 of the development consent and acknowledges that it is accepted that parts of the site that are progressively rehabilitated may be subject to further disturbance in the future. This acknowledgement provides LCO the opportunity to re-disturb lands to ensure the final rehabilitation of the land is safe, stable and non-polluting in accordance with the consent.

### 4.3 Avoidance and Mitigation Measures

The Study Area includes a small area 0.1 ha of vegetation with a native canopy *Eucalyptus moluccana* (Grey box), *E. crebra* (Narrow-leaved ironbark), and *Allocasuarina luehmannii* (Buloke). This vegetation is most likely to align with PCT 3431 Central Hunter Ironbark Grassy Woodland which is associated with the BC Act listed EEC *Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions*.

Although currently approved for disturbance, LCO will avoid or minimise impacts to patches of trees associated with this woodland vegetation where possible through the design and planning of the borehole locations.

It is acknowledged that these areas do not provide significant habitat value in the locality, though would benefit the wider rehabilitation program of the mine by providing a minor seed resource and long-term larger trees within a patchwork of varying aged native woodlands (rehabilitation).

In addition, the initial plans to drill boreholes within the MNRL corridor was revised to relocate boreholes within the Approved Disturbance Area and resulted in the avoidance of potential biodiversity impacts above that approved under DA 305-11-01.

At the completion of the grouting program all areas which works are proposed will be rehabilitated in accordance with LCO RMP (2025). The requirement to rehabilitate these areas mitigates the loss of vegetation cover (noting its exotic dominance) as the final land use will see the reestablishment of pasture and native woodlands across the Study Area.

## 4.4 Biodiversity Impacts

The overall biodiversity impacts associated with the Modification are not expected to exceed those already approved under the development consent DA 305-11-01 as modified. All works will involve the re-disturbance of rehabilitation that has been identified as primarily exotic dominated vegetation types.

The Study Area encompasses approximately 6.67 ha of vegetation. Of this, impact to 0.1 ha of woodland vegetation will be avoided or minimised where possible and would only be disturbed if additional flexibility within the Study Area is required for clearing to carry out grouting works. This vegetation still contains native canopy species present at the time of the MOD5 approval. The remaining 6.57 ha primarily consists of exotic vegetation that does not align with any recognised PCT in the Hunter Valley. This vegetation is generally dominated by aggressive exotic grass species that suppress the establishment of native flora, except for a few hardy, common native groundcover species.

In the southern portion of the Study Area, a mixed shrub layer has recruited over exotic grasses, particularly in areas of spoil, overburden and established bunds. These areas are likely to be disturbed during future stages of landform restoration and native vegetation rehabilitation under the RMP. Habitat value in these zones is limited due to their proximity to managed transmission lines, operational areas, and early-stage rehabilitation.

The shrub layer is relatively young and predominantly composed of species that readily recruit in the Hunter Valley, such as Buloke, which can form monocultures that inhibit broader native species establishment. Connectivity to larger remnant vegetation is currently limited, reducing the likelihood of use by highly mobile species such as avifauna. Fragmentation also restricts the potential for threatened mammal species to utilise these areas for denning or breeding.

The disturbance of the substrate from mining activities is unlikely to sustain or support threatened flora species and not only would the post mining soil conditions limit the likelihood of these species occurring, the historic agricultural land use prior to mining, would contribute to the very low likelihood of these species persisting in the wider disturbance area.

The exotic pasture found in the northern and eastern areas are currently in a condition that is in accordance with the current approved final landform requirements.

The threatened avifauna and mammal species are all considered highly mobile species which would require woodland and forest vegetation types to forage in combinations with exotic pastures, and most species would require these vegetation types to roost or den. The location of the Study Area within a mine site where closure works are occurring would limit the use of the vegetation by these species as they are likely to be resource poor and unlikely to provide connection across the landscape to facilitate movement due to the majority of the Study Area being exotic pasture with at best young trees and shrubs.

The Study Area does not contain habitat that would be suitable for amphibian species as water resources were not identified, so it would be highly unlikely these species would occur in such a highly modified environment that is still currently operational.

The threatened flora species are also unlikely to occur due to the highly disturbed nature of the Study Area and only one threatened flora species has been recorded during biodiversity assessment for previous modifications of the LCO development consent. Only one threatened flora species assessed in the likelihood of occurrence table (refer to **Appendix B**) was recorded in MOD 5, being *Cymbidium canaliculatum* (Tiger Orchid). This species requires mature trees to persist therefore is unlikely to occur in the Study Area and was not recorded during the site visit.

## 5.0 Conclusion

The biodiversity impacts associated with the Modification are not expected to exceed those already approved under the existing development consent (DA 305-11-01 as modified). The proposed works will re-disturb vegetation that is predominantly exotic in nature, with limited ecological value and minimal presence of native species. Of the 6.67 ha within the Study Area, impact to 0.1 ha of woodland vegetation will be avoided or minimised where practicable due to the presence of native canopy species (approved to be cleared under MOD5), while the remaining 6.57 ha comprises vegetation that does not correspond to any recognised PCT in the Hunter Valley.

Habitat quality across the Study Area is low, with limited connectivity to remnant vegetation and minimal suitability for threatened flora and fauna species. The presence of young shrub layers and exotic pastures further restricts ecological function, and the operational nature of the site reduces its potential to support amphibians or provide viable habitat for denning or breeding. The likelihood of threatened flora species occurring is very low due to historical land use and current soil conditions. Overall, the Modification is unlikely to result in any additional biodiversity impacts beyond those already assessed and approved as part of the LCO development consent.

## 6.0 References

Liddell Coal Operations (2025) Rehabilitation Management Plan July 2025

NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW 2024)

BioNet Vegetation Classification. NSW: Environment, Energy and Science

NSW Office of Environment and Heritage (OEH) (2025) Threatened Biodiversity Profile

Search <https://threatenedspecies.bionet.nsw.gov.au/>

Umwelt (2013) Liddell Coal Operations Extension Project – Ecological Assessment Report

Appendix A

# Land Category Map Definition



## A.1 Land Category Map Definitions

Section 6.12 of the Biodiversity Conservation Act 2016 (BC Act) requires a Biodiversity Development Assessment Report (BDAR) for a proposed development or activity that would be authorised by a planning approval, to be prepared in accordance with the Biodiversity Assessment Method (BAM) which is established under Section 6.8 of the BC Act.

Relevantly, section 6.8(3) of the BC Act provides:

The BAM is to exclude the assessment of the impacts of any clearing of native vegetation and loss of habitat on category 1-exempt land (within the meaning of Part 5A of the Local Land Services Act 2013), other than any impacts prescribed by the regulations under section 6.3.

The following definitions from the Local Land Services Act 2013 (LLS Act) are relevant to the reading of section 6.8(3) of the BC Act:

**category 1-exempt land** means areas of the State to which this Part applies designated as category 1-exempt land on the native vegetation regulatory map.

**category 2-regulated land** means areas of the State to which this Part applies designated as category 2-regulated land on the native vegetation regulatory map (including category 2-vulnerable regulated land that is so designated).

### 60E Purpose of native vegetation regulatory map

The purpose of the native vegetation regulatory map is to designate areas of the State to which this Part applies—

- a. where the clearing of native vegetation is not regulated under this Part (category 1-exempt land), and
- b. where the clearing of native vegetation is regulated under this Part (category 2-regulated land), and
- c. where the clearing of native vegetation is regulated under this Part but (because of its vulnerability) is subject to additional restrictions and extended to the clearing of dead and non-native plants (category 2-vulnerable regulated land).

The Draft Native Vegetation Regulatory (NVR) Map is available for all areas of NSW including the land on which the Modification is proposed. The draft NVR map has been published to enable landholders to review the accuracy of the map of their land before the map is finalised. Although still a draft at this stage, landholders can utilise the draft NVR map when making decisions about native vegetation management including whether clearing of vegetation would require the preparation of a BDAR.

## Definition Category 1- Exempt Land

Category 1-exempt land is defined in Part 5A, Division 2 of the LLS Act. Subject to certain exceptions,

Category 1-exempt land is broadly defined as being:

- a. Land cleared of native vegetation as at 1 January 1990 or lawfully cleared after 1 January 1990 (but before 25 August 2017).
- b. Low conservation grasslands.
- c. Land containing only low conservation groundcover (not being grasslands).
- d. Native vegetation identified as regrowth in a Property Vegetation Plan under the repealed Native Vegetation Act 2003.
- e. Land bio-certified under the BC Act.

Land meeting the above criteria is not considered to be Category 1-exempt land if certain exceptions apply.

## Definition Category 2 – Regulated Land

Category 2 – Regulated land is defined in Part 5A, Division 2 of the LLS Act. Category 2 – Regulated Land is broadly defined as being:

- f. Land not cleared of native vegetation as at 1 January 1990 or unlawfully cleared after 1 January 1990
- g. the land contains native vegetation that was grown or preserved with the assistance of public funds (other than funds for forestry purposes)
- h. the land is eligible for designation as category 2-vulnerable regulated land
- i. the land is subject to a private land conservation agreement under the Biodiversity Conservation Act 2016,
- j. the land is subject to be set aside under a requirement made in accordance with a land management (native vegetation) code under this Part, or
- k. the land contains grasslands that are not low conservation value grasslands, or
- l. the land is or was subject to a requirement to take remedial action to restore or protect the biodiversity values of the land under this Part or the Biodiversity Conservation Act 2016 or under the Native Vegetation Act 2003 or the National Parks and Wildlife Act 1974, or
- m. the land is subject to an approved conservation measure that was the basis for other land being biodiversity certified under Part 8 of the Biodiversity Conservation Act 2016 or under any Act repealed by that Act, or
- n. the land is an offset under a property vegetation plan under the Native Vegetation Act 2003 or is a set aside under a Ministerial order under Division 3 of Part 6 of the Native Vegetation Regulation 2013, or
- o. the land is in the coastal wetlands and littoral rainforests area of the coastal zone referred to in the Coastal Management Act 2016, or

- p. the land is identified as koala habitat (of a kind prescribed by the regulations) in a plan of management made under State Environmental Planning Policy No 44—Koala Habitat Protection, or
- q. the land is a declared Ramsar wetland within the meaning of the Environment Protection and Biodiversity Conservation Act 1999 of the Commonwealth, or
- r. the land has (subject to the regulations) been mapped by the Environment Agency Head as land containing critically endangered species of plants under the Biodiversity Conservation Act 2016, or
- s. the land has been mapped by the Environment Agency Head as land containing a critically endangered ecological community under the Biodiversity Conservation Act 2016, or the land is of a kind prescribed by the regulations as category 2-regulated land.

Appendix B

# Likelihood of Occurrence Table



TEC/Species	BC Act	EPBC Act	BioNet Records <=10km	PMST	Source	Habitat and Justification for likelihood	Likelihood to occur in Study Area
<i>Acacia pendula</i> population in the Hunter catchment	E	-	363	-	BioNet	The species is very distinctive, and no individuals were observed during the site visit.	Low
<i>Androcalva procumbens</i>	V	V	-	May	PMST	No records occur within 10km. This species is unlikely to occur in disturbed post mining areas within the Study Area as there is no suitable habitat.	Low
<i>Asperula asthenes</i> (Trailing Woodruff)	V	V	1	May	BioNet PMST	This species is unlikely to occur in disturbed post mining areas within the Study Area as there is no suitable habitat	Low
<i>Cymbidium canaliculatum</i> population in the Hunter Catchment	E	-	12	-	BioNet	All mature trees occurring within the Study Area have been surveyed for this species. No individuals were observed	Low
<i>Cynanchum elegans</i> (White-flowered Wax Plant)	E	E	-	May	PMST	No records occur within 10km. This species is unlikely to occur in disturbed post mining areas within the Study Area as there is no suitable habitat	Low
<i>Dichanthium setosum</i> (Bluegrass)	V	V	-	Likely	PMST	No records occur within 10km. This species is unlikely to occur in disturbed post mining areas within the Study Area as there is no suitable habitat	Low
<i>Diuris tricolor</i> (Pine Donkey Orchid)	V	V	164	-	BioNet	Although there are multiple records within 10km this species is unlikely to persist in disturbed post mining areas within the Study Area as there is no suitable habitat.	Low

TEC/Species	BC Act	EPBC Act	BioNet Records <=10km	PMST	Source	Habitat and Justification for likelihood	Likelihood to occur in Study Area
<i>Eucalyptus camaldulensis</i> population in the Hunter catchment	E	-	35	-	BioNet	Population occurs on the major floodplains of the Hunter and Goulburn Rivers, in areas where water impoundment occurs after flood. Unlikely to persist in disturbed post mining areas within the Study Area as there is no suitable habitat.	Low
<i>Eucalyptus glaucina</i> (Slaty Red Gum)	V	V	10	Known	BioNet, PMST	<i>Eucalyptus glaucina</i> is recorded within the locality, however, all eucalypts occurring within the Study Area have been identified as other Eucalypt species	Low
<i>Eucalyptus nicholii</i> (Narrow-leaved Black Peppermint)	V	V	-	-	BioNet	Naturally occurs only in New England Tablelands from Nundle to north of Tenterfield.	Low
<i>Euphrasia arguta</i> ( <i>Euphrasia arguta</i> )	CE	CE	-	May	PMST	No record occurs within 10km. The closest occurrence is a rediscovered population in the Nundle State Forest.	Low
<i>Lepidium aschersonii</i> (Spiny Peppergrass)	V	V	-	May	PMST	No record occurs within 10km.	Low
<i>Ozothamnus tessellatus</i> ( <i>Ozothamnus tessellatus</i> )	V	V	5	Known	BioNet, PMST	Known to occur within the area, however, all records occur within moderate condition woodland. This species would not persist in disturbed post mining areas within the Study Area as there is no suitable habitat.	Low
<i>Picris evae</i> (Hawkweed)	V	V	-	May	PMST	No record occurs within 10km.	Low
<i>Pomaderris brunnea</i> (Brown Pomaderris)	E	E	-	May	PMST	No record occurs within 10km.	Low
<i>Prasophyllum petilum</i> (Tarengo Leek Orchid)	E	E	2	May	BioNet, PMST	The closest record is over 8km north. This species would not persist in disturbed post mining areas within the Study Area as there is no suitable habitat.	Low

TEC/Species	BC Act	EPBC Act	BioNet Records <=10km	PMST	Source	Habitat and Justification for likelihood	Likelihood to occur in Study Area
<i>Pterostylis gibbosa</i> (Illawarra Greenhood)	E	E	-	May	PMST	No record occurs within 10km.	Low
<i>Rhodamnia rubescens</i> (Scrub Turpentine)	CE	CE	2	Known	BioNet, PMST	The Study Area does not contain suitable habitat for this species.	Low
<i>Thesium australe</i> (Austral Toadflax)	V	V		Likely	PMST	No record occurs within 10km of the Study Area and it does not contain suitable habitat	Low
<b>Amphibians</b>							
<i>Litoria aurea</i> (Green and Golden Bell Frog)	E	V	9	Known	BioNet, PMST	5 records occur within 10km of the Study Area, however, the species has not been recorded within the locality in approximately 20 years. The historical records largely occur in what is now the open cut pit top of a neighbouring mine. The study area does not contain suitable habitat.	Low
<i>Litoria booroolongensis</i> (Booroolong Frog)	E	E	-	May	PMST	No record occurs within 10km of the Study Area and it does not contain suitable habitat.	Low
<b>Avifauna</b>							
<i>Anthochaera phrygia</i> (Regent Honeyeater)	CE	CE	-	Likely	PMST	The Study Area does not overlap with mapped Important Habitat. No records occur within 10km of Study Area	Low
<i>Aphelocephala leucopsis</i> (Southern Whiteface)	V	V	1	Known	BioNet, PMST	This species is unlikely to occur in disturbed post mining areas within the Study Area as there is no suitable habitat.	Low
<i>Artamus cyanopterus cyanopterus</i> (Dusky Woodswallow)	V	-	39	-	BioNet,	This species is unlikely to utilise disturbed post mining areas within the Study Area as there is no suitable habitat.	Low

TEC/Species	BC Act	EPBC Act	BioNet Records <=10km	PMST	Source	Habitat and Justification for likelihood	Likelihood to occur in Study Area
<i>Botaurus poiciloptilus</i> (Australasian Bittern)	E	E	-	May	PMST	No record occurs within 10km. This species is unlikely to utilise disturbed post mining areas within the Study Area as there is no suitable habitat.	Low
<i>Burhinus grallarius</i> (Bush Stone-curlew)	E	-	1	-	BioNet	This species is unlikely to utilise disturbed post mining areas within the Study Area as there is no suitable habitat.	Low
<i>Callocephalon fimbriatum</i> (Gang-gang Cockatoo)	E	E	-	May	PMST	This species requires tree hollows for breeding. No hollow bearing trees were identified within the Study Area. No records occur within 10km.	Low
<i>Calyptorhynchus lathami lathami</i> (South-eastern Glossy Black Cockatoo)	V	V	3	Known	BioNet, PMST	This species requires tree hollows for breeding. No hollow bearing trees were identified within the Study Area.	Low
<i>Certhionyx variegatus</i> (Pied Honeyeater)	V	-	1	-	BioNet	A single record of a pied honeyeater, recorded 10 years ago. This species would not occur in disturbed post mining areas within the Study Area as there is no suitable habitat.	Low
<i>Circus assimilis</i> (Spotted Harrier)	V	-	26	-	BioNet	Although the species is known within the locality there is no breeding habitat (large trees) within the Study Area that would support this species.	Low
<i>Climacteris picumnus victoriae</i> (Brown Treecreeper (eastern subspecies))	V	-	60	Known	BioNet, PMST	Although the species is known within the locality it is unlikely that this species would utilise the highly degraded vegetation within the Study Area.	Low
<i>Erythrotriorchis radiatus</i> (Red Goshawk)	E	E	-	May	PMST	No records occur within 10km. This species is not known to occur as far south as the Hunter Valley.	Low

TEC/Species	BC Act	EPBC Act	BioNet Records <=10km	PMST	Source	Habitat and Justification for likelihood	Likelihood to occur in Study Area
<i>Falco hypoleucos</i> (Grey Falcon)	V	V	-	Likely	PMST	No record occurs within 10km. This species is unlikely to occur since mining activities commenced within the Study Area. The Study Area would only provide very minor foraging opportunities that would still be presence adjacent to the Study Area.	Low
<i>Falco subniger</i> (Black Falcon)	V	-	1	Likely	BioNet, PMST	Although the species is known within the locality there is no breeding habitat (large trees) within the Study Area that would support this species.	Moderate
<i>Gallinago hardwickii</i> (Latham's Snipe)	V	V, Migratory	-	Likely	PMST	No record occurs within 10km. No suitable habitat in the Study Area.	Low
<i>Grantiella picta</i> (Painted Honeyeater)	V	V	-	Known	PMST	This species is unlikely to occur since mining activities commenced within the Study Area.	Low
<i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle)	V	-	34	-	BioNet	Although this species is known to occur within the locality, this species utilises large bodies of water to hunt, and builds large conspicuous stick nests for breeding. The Study Area does not contain suitable habitat, and no stick nests were observed during the site visit.	Low
<i>Hieraaetus morphnoides</i> (Little Eagle)	V	-	3	-	BioNet	The species is known to utilise grasslands for hunting. It is unlikely the species would utilise the Study Area for breeding as there are no large trees for establishing stick nests and no stick nests were observed during the site visit.	Low
<i>Hirundapus caudacutus</i> (White-throated Needletail)	V	V	20	Known	BioNet, PMST	This species is predominantly aerial and may occur in the air space above the Study Area. However, this species would be very unlikely to utilise the disturbed vegetation since mining activities commenced within the Study Area.	Low

TEC/Species	BC Act	EPBC Act	BioNet Records <=10km	PMST	Source	Habitat and Justification for likelihood	Likelihood to occur in Study Area
<i>Lathamus discolor</i> (Swift Parrot)	E	CE	13		BioNet	The Study Area does not occur within the mapped Important Habitat Layer for the Swift Parrot. This species is unlikely to utilise disturbed post mining areas within the Study Area as there is no suitable foraging habitat	Low
<i>Lophoictinia isura</i> (Square-tailed Kite)	V	-	1	-	BioNet	The species is known to utilise grasslands for hunting. It is unlikely the species would utilise the Study Area for breeding as there are no large trees for establishing stick nests and no stick nests were observed during the site visit.	Low
<i>Melanodryas cucullata cucullata</i> (South-eastern Hooded Robin)	E	E	15	Known	BioNet, PMST	This species is unlikely to utilise disturbed post mining areas within the Study Area as there is no suitable foraging or roosting habitat.	Low
<i>Melithreptus gularis gularis</i> (Black-chinned Honeyeater (eastern subspecies))	E	-	4	-	BioNet	This species is unlikely to utilise disturbed post mining areas within the Study Area as there is no suitable foraging or roosting habitat	Low
<i>Neophema chrysostoma</i> (Blue-winged Parrot)	V	V	-	May	PMST	This species is unlikely to utilise disturbed post mining areas within the Study Area as there is no suitable foraging or breeding habitat	Low
<i>Neophema pulchella</i> (Turquoise Parrot)	V	-	2	-	BioNet	This species is unlikely to utilise disturbed post mining areas within the Study Area as there is no suitable foraging or breeding habitat	Low
<i>Ninox strenua</i> (Powerful Owl)	V	-	1	-	BioNet	The species requires large hollows to breed. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation. The Study Area does not provide suitable habitat.	Low

TEC/Species	BC Act	EPBC Act	BioNet Records <=10km	PMST	Source	Habitat and Justification for likelihood	Likelihood to occur in Study Area
<i>Oxyura australis</i> (Blue-billed Duck)	V	-	4	-	BioNet	Study Area does not contain suitable habitat to support this species.	Low
<i>Petroica boodang</i> (Scarlet Robin)	V	-	12	-	BioNet	The species habitat usually contains abundant logs and fallen timber, and they generally occur in dry eucalypt forests and woodlands. It is unlikely that the site would provide significant habitat.	Low
<i>Petroica phoenicea</i> (Flame Robin)	V	-	4	-	BioNet	The species is known to prefer clearings and areas with open understories, The species migrates to the lowlands in the winter, and moves to upland tall eucalypt forests. Breeding habitat is dominated by native grasses. It is possible that the species may infrequently use the habitat as foraging, but it would not be suitable breeding habitat.	Low
<i>Pomatostomus temporalis</i> <i>temporalis</i> (Grey-crowned Babbler (eastern subspecies))	V	-	360	-	BioNet,	It is possible that the species infrequently pass through the degraded vegetation to get to large remnants in the locality. No nests created by this species were observed during the site visit.	Low
<i>Rostratula australis</i> (Australian Painted Snipe)	E	E	-	Likely	PMST	Study Area does not contain suitable habitat to support this species.	Low
<i>Stagonopleura guttata</i> (Diamond Firetail)	V	V	8	Known	BioNet, PMST	Known in the locality and often found in grassy eucalypt woodlands, and preferably around riparian area. Not likely to occur within the highly degraded vegetation and exotic grassland found in the Study Area.	Low
<i>Stictonetta naevosa</i> (Freckled Duck)	V	-	13	-	BioNet	Study Area does not have suitable habitat to support this species.	Low

TEC/Species	BC Act	EPBC Act	BioNet Records <=10km	PMST	Source	Habitat and Justification for likelihood	Likelihood to occur in Study Area
<i>Tyto longimembris</i> (Eastern Grass Owl)	V	-	1	-	BioNet	Eastern Grass Owls are found in areas of tall grass, including grass tussocks, in swampy areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains. This species is unlikely to utilise disturbed post mining areas within the Study Area as there is no suitable habitat.	Low
<i>Tyto novaehollandiae</i> (Masked Owl)	V	-	1	-	BioNet	The species requires large hollows to breed. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation. The Study Area does not provide suitable habitat.	Low
<b>Mammals</b>							
<i>Chalinolobus dwyeri</i> (Large-eared Pied Bat)	E	E	9	Known	BioNet, PMST,	Roosts in caves (near their entrances), crevices in cliffs, old mine workings. The site does not have the required habitat features.	Low
<i>Dasyurus maculatus</i> (Spotted-tailed Quoll)	V	E	115	Known	BioNet, PMST	The species is known within the locality. Quolls use hollow-bearing trees, fallen logs, other animal burrows, small caves and rock outcrops as den sites. They occupy very large home ranges, utilising creeklines to traverse the landscape. It is possible that species infrequently utilises the habitat within the site to travel throughout its home range. No den sites, or suitable habitat for den sites, were observed while on site.	Moderate
<i>Falsistrellus tasmaniensis</i> (Eastern False Pipistrelle)	V	-	7	-	BioNet	Generally roosts in eucalypt hollows but has also been found under loose bark on trees or in buildings. The site does not contain suitable habitat.	Low

TEC/Species	BC Act	EPBC Act	BioNet Records <=10km	PMST	Source	Habitat and Justification for likelihood	Likelihood to occur in Study Area
<i>Miniopterus australis</i> (Little Bent-winged Bat)	V	-	176	-	BioNet	The species roosts in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. The site does not contain suitable habitat	Low
<i>Miniopterus orianae oceanensis</i> (Large Bent-winged Bat)	V	-	3	-	BioNet	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Hunt in forested areas, catching moths and other flying insects above the tree tops. The site does not contain the required habitat.	Low
<i>Myotis macropus</i> (Southern Myotis)	V	-	15	-	BioNet	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, wharves, bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface. The site does not contain the required habitat.	Low
<i>Notamacropus parma</i> (Parma wallaby)	V	V	-	May	PMST	No record occurs within 10km	Low
<i>Nyctophilus corbeni</i> (Corben's Long-eared Bat)	V	V	-	Known	PMST	No record within 10km of the site. Roosts in tree hollows, crevices, and under loose bark. No suitable habitat on site.	Low
<i>Petauroides volans</i> (Southern Greater Glider)	E	E	-	May	BioNet	No record occurs within 10km of the Study Area. This species is hollow dependant, and would be unlikely to occur in the degraded habitat within the Study Area.	Low

TEC/Species	BC Act	EPBC Act	BioNet Records <=10km	PMST	Source	Habitat and Justification for likelihood	Likelihood to occur in Study Area
<i>Petaurus australis australis</i> (Yellow-bellied Glider (south-eastern))	-	-	1	Likely	BioNet, PMST	This species is unlikely to utilise disturbed post mining areas within the Study Area as there is no suitable habitat (foraging or denning).	Low
<i>Petaurus norfolcensis</i> (Squirrel Glider)	V	-	92	-	BioNet	The species is known within the locality though, this species is unlikely to utilise disturbed post mining areas within the Study Area as there is no suitable habitat (denning or foraging).	Low
<i>Petrogale penicillata</i> (Brush-tailed Rock-wallaby)	E	V	1	May	BioNet, PMST	Study Area does not have the required habitat constraints to support this species.	None
<i>Phascogale tapoatafa</i> (Brush-tailed Phascogale)	V	-	8	-	BioNet	The species is known within the locality though, this species is unlikely to utilise disturbed post mining areas within the Study Area as there is no suitable habitat.	Low
<i>Phascolarctos cinereus</i> (Koala)	E	E	5	Known	BioNet, PMST	The closest koala record occurs over 5 km away. This species is unlikely to utilise disturbed post mining areas within the Study Area as there is no suitable habitat.	Low
<i>Potorous tridactylus tridactylus</i> (Long-nosed Potoroo (northern))	-	-	-	May	PMST	No record occurs within 10km. This species is unlikely to utilise disturbed post mining areas within the Study Area as there is no suitable habitat.	Low
<i>Pseudomys novaehollandiae</i> (New Holland Mouse)	V	V	18	May	BioNet, PMST	This species is unlikely to utilise disturbed post mining areas within the Study Area as there is no suitable habitat.	Low
<i>Pteropus poliocephalus</i> (Grey-headed Flying-fox)	V	V	15	Known	BioNet, PMST	This species is unlikely to occur within disturbed post mining areas within the Study Area as there is no roosting or foraging habitat present.	Low

TEC/Species	BC Act	EPBC Act	BioNet Records <=10km	PMST	Source	Habitat and Justification for likelihood	Likelihood to occur in Study Area
<i>Saccolaimus flaviventris</i> (Yellow-bellied Sheath-tail-bat)	V	-	5	-	BioNet	Known to roost in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. No suitable habitat occurs within the Study Area.	Low
<i>Scoteanax rueppellii</i> (Greater Broad-nosed Bat)	V	-	10	-	BioNet	Known to roost in tree hollows and buildings and utilise creek and river corridors to forage. No suitable habitat occurs within the Study Area.	Low
<i>Vespadelus troughtoni</i> (Eastern Cave Bat)	V	-	18	-	BioNet	A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings (underground). No suitable habitat occurs on site.	Low
<b>Reptile</b>							
<i>Aprasia parapulchella</i> (Pink-tailed Legless Lizard)	V	V	-	Known	PMST	Inhabits sloping, open woodland areas with predominantly native grassy groundlayers. This species is unlikely to occur post mining disturbance within the Study Area.	Low
<i>Delma vescolineata</i> (Hunter Valley delma)	V	V	-	Known	PMST	This species has been found mainly in Natural Temperate Grassland but has also been captured in grasslands that have a high exotic component. This species is unlikely to utilise disturbed post mining areas within the Study Area.	Low



**xenith**

**Hunter Valley**

Shops 4-6, The Singleton Centre  
157-159 John Street  
Singleton NSW 2330  
P 02 6536 2999

[xenith.com.au](http://xenith.com.au)