

Invincible Colliery

MP 07_0127 Modification 6

Prepared for Castlereagh Coal

January 2025

Invincible Colliery

MP 07_0127 Modification 6

Castlereagh Coal

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Approved by



Nicole Armit
Director
21 January 2025

Level 3 175 Scott Street
Newcastle NSW 2300
ABN: 28 141 736 558

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Executive Summary

The Invincible Colliery is an existing underground and open cut coal mine located approximately 25 kilometres (km) north-west of Lithgow in New South Wales (NSW) and within the Lithgow local government area (LGA).

The Invincible Colliery operates in accordance with Project Approval MP07_0127 granted by the then Minister for Planning on 4 December 2008, which authorises, amongst other things:

- opencut mining operations up until 31 December 2025
- extraction and transport of up to 1.2 million tonnes (Mt) of product coal per calendar year from the site
- transportation of coal by road to the Shoalhaven Starches plant near Nowra and to Mount Piper Power Station (MPPS)
- continued use of existing coal processing and surface infrastructure
- rehabilitation of the site.

Mining operations at Invincible Colliery were placed into in care and maintenance in 2012 and recommenced in July 2023.

Castlereagh Coal is seeking a modification (Mod 6) to MP07_0127 under section 4.55(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to:

- extend the life of mining at Invincible Colliery from 31 December 2025 for a further five years until 31 December 2030
- modify Schedule 2, Condition 7(c) of MP07_0127 to enable flexibility for coal to be transported to other domestic customers in addition to the Shoalhaven Starches plant and MPPS
- increase the approved full time equivalent (FTE) workforce from 35 personnel to 50 personnel.

The modification, if approved, will enable continued open cut mining of remaining coal reserves currently approved to be extracted for a further five years from within the Southern Extension Area which was assessed and approved by Mod 5 to MP07_0127.

Other than as set out above, no further changes are proposed to what is approved under MP07_0127, including no changes to mining methods, annual coal extraction rates, coal processing and handling activities, surface infrastructure and hours of operation. The proposed modification does not require any additional surface disturbance activities beyond those currently assessed and approved to be disturbed.

An assessment of potential impacts associated with the continuation of mining operations has been undertaken, which included but was not limited to traffic, noise and vibration, greenhouse gas (GHG), air quality, surface water, groundwater and aboriginal heritage. As all approved activities will remain largely consistent under the Modification, in particular mining methods, approved annual coal extraction rates, coal processing and handling activities, the assessments have determined that the Modification will result in no or negligible change to previously assessed and approved impacts. GHG emissions were estimated for future projected operations under the modification. There were no years where the *NSW EPA Guide for Large Emitters'* threshold of 25,000 t CO₂-e/year was exceeded and therefore the modification was not considered a large emitter under the guide.

The operations at Invincible Colliery will continue to be carried out in accordance with the existing and approved management plans and monitoring programmes and associated management and mitigation measures. The Modification, if approved, will secure employment for the existing workforce of approximately 50 FTE employees across Invincible Colliery for a further 5 years.

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1 Introduction

1.1 Background

The Invincible Colliery is an existing underground and open cut coal mine located approximately 25 kilometres (km) north-west of Lithgow in New South Wales (NSW) and within the Lithgow local government area (LGA) (refer to Figure 1.1 and Figure 1.2).

The Invincible Colliery operates in accordance with Project Approval MP07_0127 granted by the then Minister for Planning on 4 December 2008. The Project Approval has been subsequently modified on five occasions, with the last modification (Mod 5) approved on 2 February 2018. The Project Approval, as modified, authorises, amongst other things:

- opencut mining operations up until 31 December 2025
- extraction and transport of up to 1.2 million tonnes (Mt) of product coal per calendar year from the site
- transportation of coal by road to the Shoalhaven Starches plant near Nowra and to Mount Piper Power Station (MPPS)
- continued use of existing coal processing and surface infrastructure
- rehabilitation of the site.

Mining operations at Invincible Colliery were placed into in care and maintenance in 2012 and recommenced in July 2023.

1.2 Proposed modification

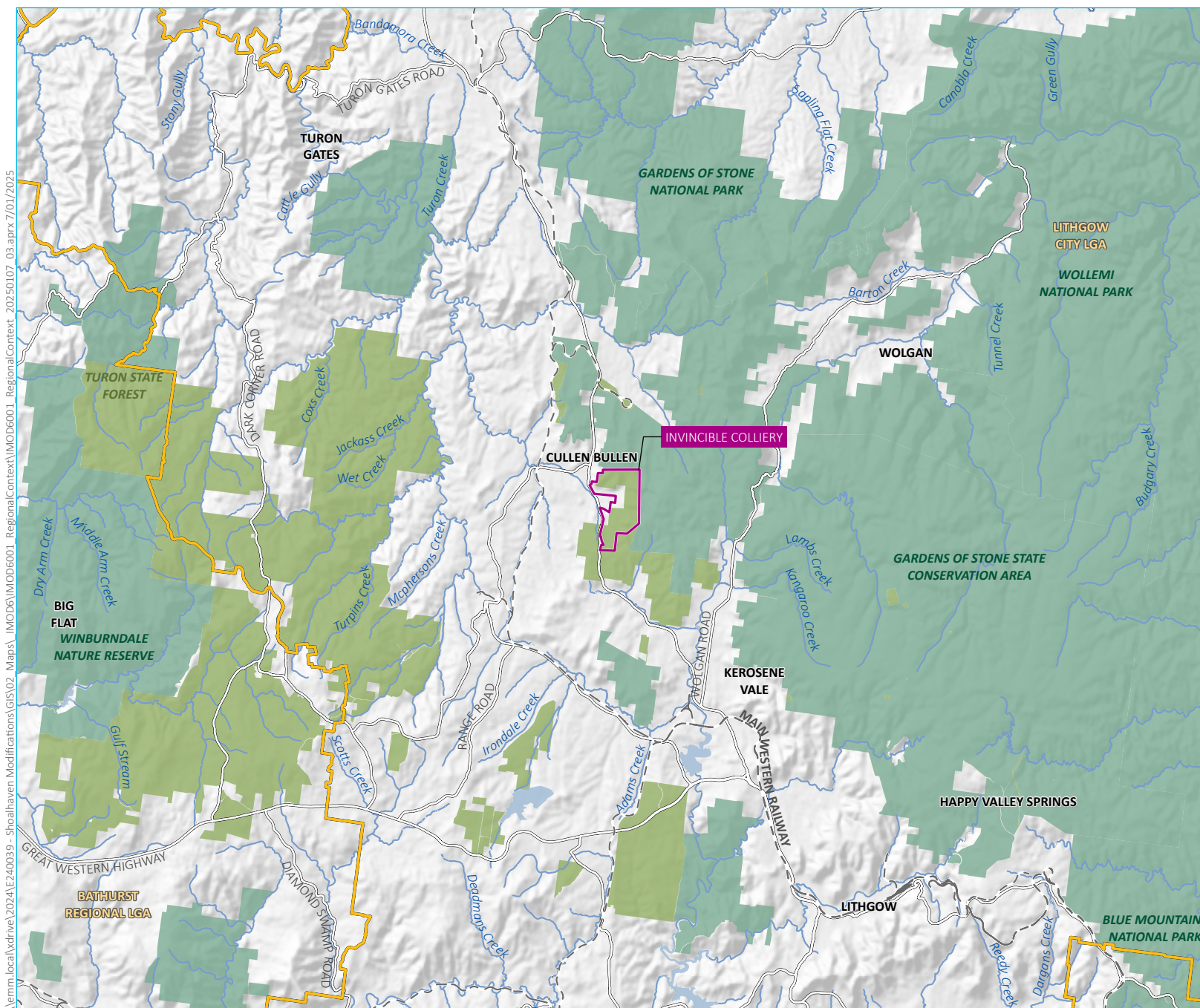
Castlereagh Coal is seeking a modification (Mod 6) to MP07_0127 under section 4.55(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to:

- extend the life of mining at Invincible Colliery from 31 December 2025 for a further five years until 31 December 2030
- modify Schedule 2, Condition 7(c) of MP07_0127 to enable flexibility for coal to be transported to other domestic customers in addition to the Shoalhaven Starches plant and MPPS
- increase the approved full time equivalent (FTE) workforce from 35 personnel to 50 personnel.

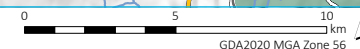
The modification, if approved, will enable continued open cut mining of remaining coal reserves currently approved to be extracted for a further five years from within the Southern Extension Area which was assessed and approved by Mod 5 to MP07_0127.

Other than as set out above, no further changes are proposed to what is approved under MP07_0127, including no changes to mining methods, annual coal extraction rates, coal processing and handling activities, surface infrastructure and hours of operation. The proposed modification does not require any additional surface disturbance activities beyond those currently assessed and approved to be disturbed. Further details on the current approved operations and proposed modification are presented in Chapter 2 and Chapter 3 of this report, respectively.

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Source: EMM (2025); ABS (2021); DCSSS (2024); GA (2009)



KEY

 Invincible Colliery project approval boundary (MP07_0127)

Existing environment

- Rail line
- Major road
- Named watercourse
- Named waterbody
- NPWS reserve
- State forest
- Local government area

INSET KEY

- Major road
- NPWS reserve
- State forest

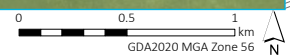
Regional context

Invincible Mine Mod 6
Modification Report
Figure 1.1





Source: EMM (2025); DCSSS (2024); ESRI (2025); GA (2009)



KEY

 Invincible Colliery project approval boundary (MP07_0127)

Existing environment

— Rail line

— Major road

— Minor road

..... Vehicular track

— Named watercourse

NPWS reserve

State forest

Local setting

Invincible Mine Mod 6
Modification Report
Figure 1.2

1.3 Alternatives

The proposed extension of time is considered the most suitable option to ensure an already approved resource is successfully extracted and a supplementary supply of coal for domestic consumers is maintained. The proposed extension would not result in any additional disturbance outside of that which has been previously assessed and approved and would not introduce any additional material environmental risks.

If operations discontinue before the existing approved resource has been mined the following benefits would be forgone:

- direct employment of approximately 50 FTE personnel over the next five-year period
- indirect employment in related supply-chain industries
- continued supply of coal to domestic markets, including the Shoalhaven Starches plant near Nowra and to the MPPS
- successful rehabilitation of existing disturbance areas in accordance with the approved Rehabilitation Management Plan.

1.4 Purpose of this report

This modification report has been prepared by EMM Consulting Pty Limited (EMM) on behalf of Castlereagh Coal. It describes the proposed modification, the statutory and strategic context to the proposal, assesses the impacts of the proposed modification and recommends, where necessary, mitigation measures to address residual impacts.

This modification report has been prepared in accordance with *State significant development guidelines – preparing a modification report* (DPIE 2022) and the requirements of the Environmental Planning and Assessment Regulation 2021 (EP&A Regulation).

1.5 Applicant

Invincible Colliery is operated by Castlereagh Coal. Castlereagh Coal is the trading name of Shoalhaven Coal. Shoalhaven Coal is an Australian mining company primarily engaged in the extraction and production of both thermal and metallurgical coal.

Castlereagh Coal is the applicant for the modification, as detailed in Table 1.1.

Table 1.1 **Applicant details**

Aspect	Detail
Proponent	Castlereagh Coal
Postal address	Castlereagh Highway, Cullen Bullen NSW 2790
ABN	91 070 863 893
Nominated contact	William Olson – Environmental Superintendent
Contact details	0477 115 523

2 Existing operations

2.1 Mining operations

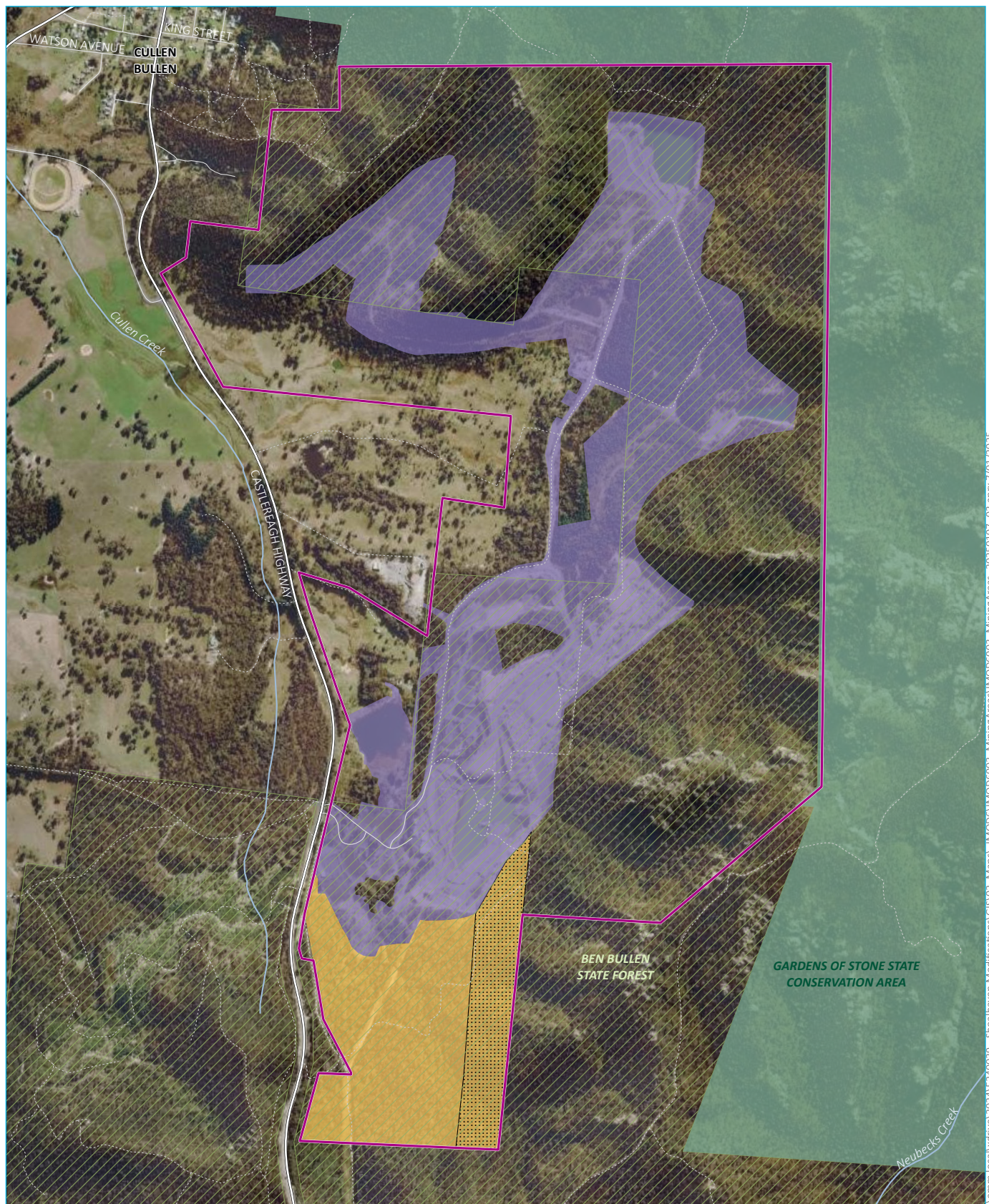
Invincible Colliery is an approved highwall and open cut operation. Mining operations comprise the extraction of coal from the Irondale, Lidsdale and Lithgow coal seams within the Illawarra Coal Measures. Project Approval MP07_0127 authorises mining operations to be carried out at Invincible Colliery until 31 December 2025.

The current open cut is a multi-seam strip mining operation with all coal meeting the quality specifications of the MPPS and Shoalhaven Starches plant. Typical open cut mining operations generally involve:

- removal of vegetation
- collection of topsoil and vegetation, and placement in a rehabilitation area or designated stockpile
- where possible, removal of top layer of overburden using dozers
- drill and blast the overburden as required
- removal of overburden and disposal in emplacement facilities
- removal of coal from each economic coal seam using either blasting techniques or ripping using dozers
- haulage of coal to the Run-of-Mine (ROM) stockpile located at the Invincible Colliery mine infrastructure area.

The areas approved for disturbance by open cut and ancillary mining activities are illustrated on Figure 2.1.

Current open cut mining operations are focused on the Southern Extension Area (Figure 2.1) and include extraction of coal from all seams down to and including the Lithgow Seam. No highwall mining is currently undertaken at Invincible Colliery.



Source: EMM (2025); DCSSS (2024); ESRI (2025); GA (2009)

KEY

 Invincible Colliery project approval boundary (MP07_0127)

 Existing mine disturbance area

 Southern extension area

 Mining restriction area

Existing environment

 Major road

 Minor road

 Vehicular track

 Named watercourse

 NPWS reserve

 State forest

Approved mining area

Invincible Mine Mod 6
Modification Report
Figure 2.1

2.2 Coal handling

ROM coal is transported by truck via internal haul roads to the ROM coal stockpile at the Invincible Colliery mine infrastructure area. ROM coal is crushed to the size requirements of different products. Product coal is stored on the 5,000 tonne (t) capacity conical stockpile and is then transported off-site by truck to the Shoalhaven Starches plant or MPPS.

2.3 Mine infrastructure

Existing and approved mine infrastructure at Invincible Colliery includes:

- administration offices
- car park
- workshop
- coal stockpile areas
- mobile crusher
- warehouse
- laydown area
- fuel and lubrication storages
- refuelling facilities
- wash down facilities
- internal access roads
- septic tank system power reticulation and infrastructure (currently not in use)
- automated weather station (AWS).

A coal wash plant was previously approved and operated on site; however, this has been decommissioned and is no longer operated at the site.

2.4 Coal transport

Up to 1.2 Mt of product coal is approved to be transported to domestic markets, including the Shoalhaven Starches plant near Nowra NSW and to MPPS. Product coal leaves the site via the access road onto the Castlereagh Highway where it is then transported to the receiving facility via public road. The immediate coal haulage road network is illustrated in Figure 2.2.

The operation is currently approved to permit no more than:

- 146 laden coal truck movements from the site per day, averaged over a week, with a maximum of 16 laden coal truck movements per hour
- 10 laden coal truck movements to the Shoalhaven Starches plant per day, averaged over a week.

2.5 Waste

Overburden material is loaded onto trucks by excavators and hauled to emplacement areas located onsite. Waste rock is transported by truck to designated dumping areas or emplaced directly to facilitate final landform development and rehabilitation. Coarse reject material from screening and crushing process is co-disposed with overburden and emplaced within the final landform.

As there is no washery on site, no coarse coal reject material or tailings is produced. There are two historical tailings storage facilities on site that will be decommissioned in accordance with the approved Rehabilitation Management Plan and High Risk Activity approval from the Resources Regulator.

2.6 Water management system

The water management strategy at Invincible Colliery is focused on the separation of clean, dirty and mine water streams by interception and diversion of stormwater runoff from operational and non-operational areas. The water management system (WMS) was designed as a closed loop system, with all water entering the site via rainfall or runoff being managed in a series of dams within the WMS.

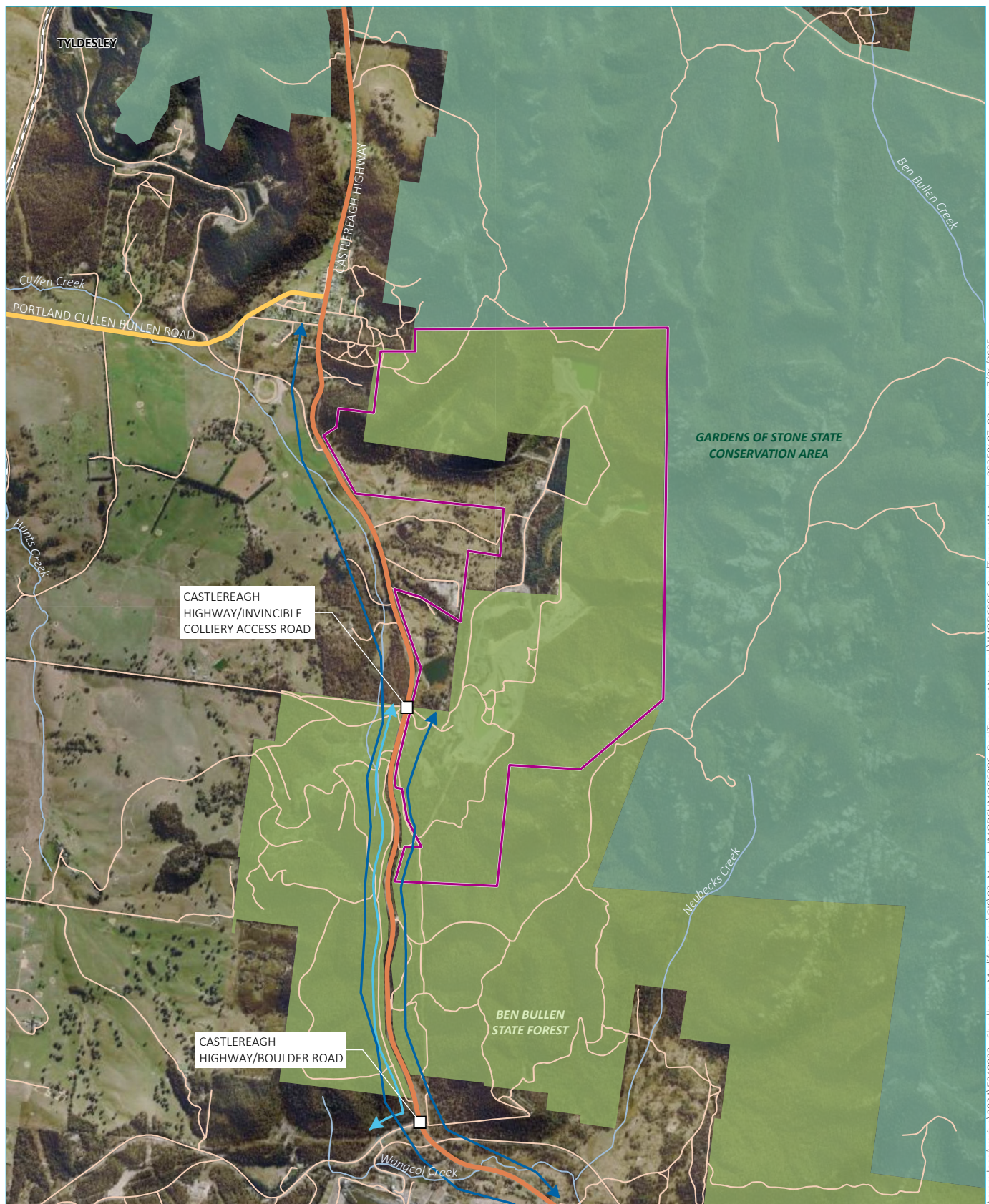
Runoff from undisturbed catchments upslope of the former open cut pits cannot presently be diverted as clean water due to the difficult terrain. When adequate quantities of backfill have been emplaced in the open cut voids, catch drains will be constructed in the backfill to divert clean water runoff from upslope undisturbed catchment. The catch drains will be lined with a suitable material to prevent erosion within the drain as runoff is directed off-site. These clean water diversions will be installed as a priority following the backfilling of site voids.

Dirty water is utilised preferentially to meet water needs for coal processing and dust suppression, or if water quality meets required guidelines, would be released to downstream waterways. Clean water is currently captured and managed in accordance with the WMS. Surplus mine water will be contained and where needed diverted to the existing Main Water Storage Dam, where it is diluted by a series of bunds, culverts and diversion drains prior to reuse.

The Invincible Colliery operates in accordance with an environment protection licence (EPL 1095). Under EPL 1095, the site is authorised for wet weather discharges into an unnamed tributary of Cullen Creek from the Main Water Storage Dam. This discharge point is referred to as EPA Identification no. 2, or licensed discharge point 2 (LDP 002). Any surplus water within the WMS is discharged during wet weather as specified by EPL 1095.

A schematic of the existing WMS is illustrated in Figure 2.3.

The primary source of water for Invincible Colliery is from the old mine underground workings. Potable water is currently sourced by truck. Wastewater is managed on site using a septic tank system which is periodically maintained by licensed contractors.



Source: EMM (2025); DCSSS (2024); ESRI (2025); GA (2009)

KEY

Invincible Colliery project approval boundary (MP07_0127)

Key intersection

NSW classified road

State road

Regional road

Local road

Truck haulage route

↔ Invincible Colliery to Mt Piper Power Station

↔ Invincible Colliery to other domestic customers

Existing environment

--- Rail line

--- Named watercourse

NPWS reserve

State forest

Coal transport network

Invincible Mine Mod 6
Modification Report
Figure 2.2

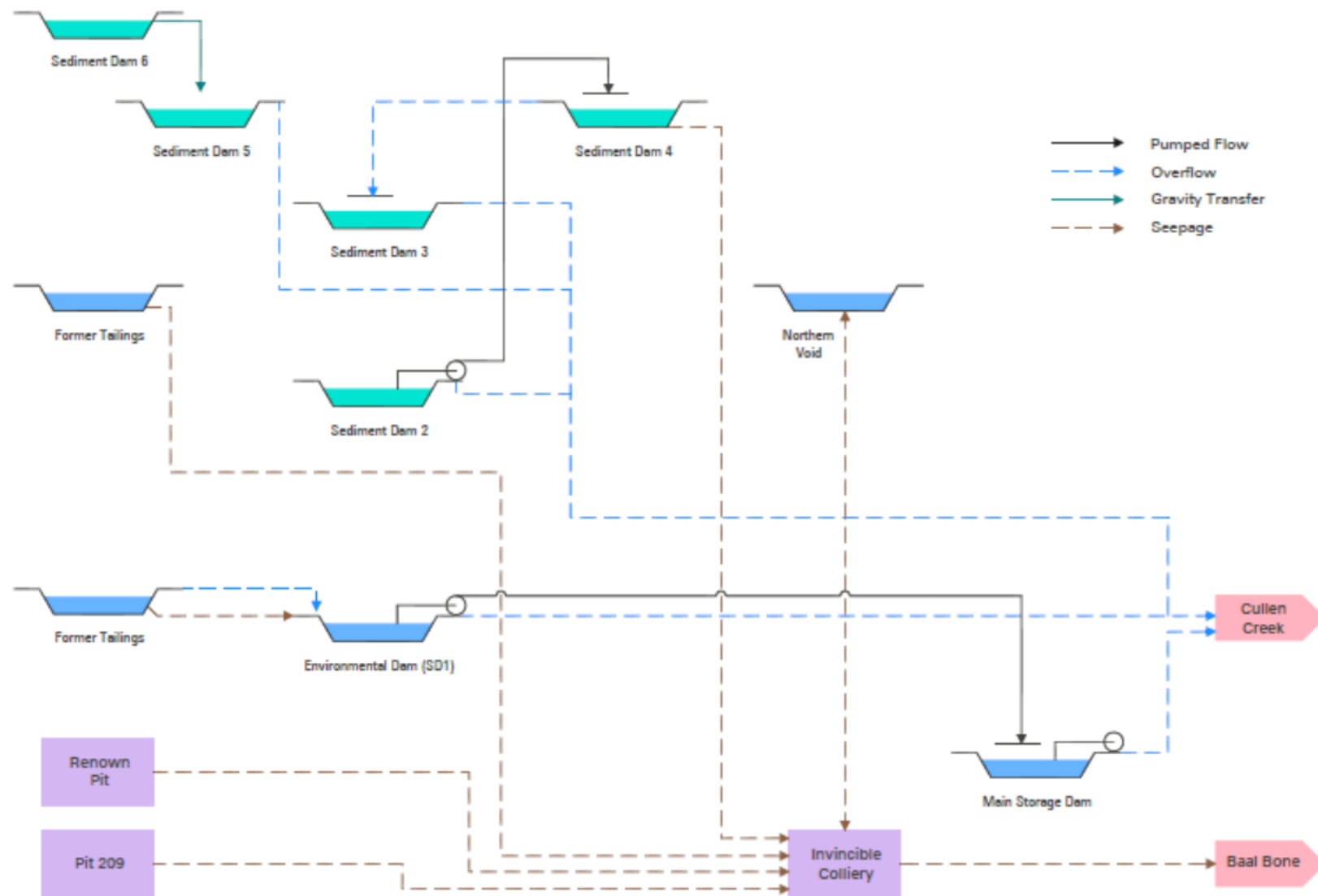


Figure 2.3 Existing water management system schematic

2.7 Workforce and hours of operation

The Invincible Colliery has been assessed and approved to operate with up to approximately 35 FTE personnel.

Hours of operation are approved as follows:

- Removal and emplacement of overburden and extraction of coal between 7:00 am to 6:00 pm on Monday to Saturday, and 8:00 am to 6:00 pm on Sundays and public holidays.
- Coal processing and transport coal from the site between 7:00 am to 10:00 pm on Monday to Saturday, and 8:00 am to 10:00 pm on Sundays and public holidays.
- All other maintenance activities and safety procedures at any time or as directed by the Resources regulator.

Blasting is only permitted to occur between 9:00 am and 5:00 pm, Monday to Saturday. No blasting is allowed on Sundays or public holidays, or at any other time without the written approval of the Planning Secretary. Blasting activities are approved to be undertaken at a maximum of one blast per day and five blasts per week, averaged over a calendar year.

2.8 Rehabilitation and final landform

The final land use for the Invincible Colliery is detailed in the approved Rehabilitation Management Plan (RMP) and illustrated on Figure 2.4. Rehabilitation will establish native woodland and forest generally consistent with ecological communities that would have historically occurred in the area. Infrastructure that is not able to be utilised by subsequent approved land uses will be removed. Soils within and surrounding former infrastructure areas will be assessed and any areas of contamination would be remediated or disposed of at an appropriately licensed facility. Dams forming part of the mine water management system will be removed unless utilised for habitat purposes or subsequent land uses.



Source: EMM (2025); DCSSS (2024); ESRI (2025); GA (2009)

KEY

 Invincible Colliery project approval boundary (MP07_0127)

 Southern extension area

Final landform contour (10 m)

Final land use domain

Infrastructure

Native ecosystem

Existing environment

Major road

Minor road

Vehicular track

Named watercourse

Final land use domains

Invincible Mine Mod 6
Modification Report
Figure 2.4

3 Description of modification

3.1 Overview

Despite significant coal reserves remaining, Invincible Colliery was placed into care and maintenance in 2012. Mining operations to extract remnant coal from approved open cut mining areas recommenced at Invincible Colliery in July 2023. Approximately 2.3 Mt of approved coal reserves remain to be extracted from the Southern Extension Area illustrated in Figure 2.1.

Castlereagh Coal is seeking to modify MP07_0127 under section 4.55(2) of the EP&A Act to:

- extend the life of mining from 31 December 2025 for a further five years until 31 December 2030
- modify Schedule 2, Condition 7(c) of MP07_0127 to enable flexibility for coal to be transported to other domestic customers in addition to the Shoalhaven Starches plant and MPPS
- increase the approved FTE workforce from 35 FTEs to 50 FTEs.

The modification, if approved will enable continued open cut mining of remaining coal reserves currently approved to be extracted from within the Southern Extension Area.

The key aspects at the Invincible Colliery and changes as a result of the proposed modification are summarised in Table 3.1 and described in the sections below. Other than as set out in the table, all activities that are currently approved under MP07_0127 are intended to continue and will remain the same under the modification, including mining methods, annual coal extraction rates, coal processing and handling activities, surface infrastructure and hours of operation. The proposed modification does not require any additional surface disturbance activities beyond those currently assessed and approved to be disturbed.

Table 3.1 Summary of modification

Project component	Approved components	Proposed modification
Project area	As shown on Figure 1.2	No change
Mining method	Open cut and highwall mining	Open cut mining only
Mine life	31 December 2025	31 December 2030
Annual coal production	Up to 1.2 Mtpa	No change
Coal handling and processing	Coal crushing and screening. 15,000 t ROM coal stockpile and 10,000 t product coal stockpile. Washery and 5,000 t capacity conical stockpile for product coal.	No change. The coal wash plant has been decommissioned and no longer operates on site. The coal wash plant will not be recommissioned during the proposed modification period.
Coal transport	Up to 1.2 Mtpa of product coal transported by truck to Shoalhaven Starches plant and MPPS. No more than 146 laden coal truck movements from the site per day, averaged over a week, with a maximum of 16 laden coal truck movements per hour. No more than 10 laden coal truck movements to the Shoalhaven Starches plant per day, averaged over a week.	Enable flexibility for coal to be transported to other domestic customers in addition to the Shoalhaven Starches plant and MPPS.

Project component	Approved components	Proposed modification
Waste management	Waste rock is either temporarily stockpiled within designated stockpile areas or directly emplaced to facilitate final landform development and rehabilitation. Coarse reject material from crusher to be co-disposed with overburden and emplaced within the final landform. Coarse reject material from crusher, or future de-shaling plant operations should it be constructed and operated, emplaced within the final landform. Fine tailings and rejects to be temporarily placed in drying ponds prior to excavation for blending or co-disposal with overburden.	No changes. No coarse coal reject or tailings produced on site.
Water management system	Separate clean, dirty and mine water. Clean water diversion drains. Sediment and water storage dams. Discharges from LD002 in accordance with EPL 1095.	No change
Workforce	Approximately 35 full time personnel.	Increase to up to 50 FTE personnel.
Hours of operation	General hours of operation are 7:00 am to 10:00 pm, Monday to Saturday, and 8:00 am to 6:00 pm on Sunday and public holidays. Removal and emplacement of overburden and extraction of coal between 7:00 am to 6:00 pm on Monday to Saturday, and 8:00 am to 6:00 pm on Sundays and public holidays. Coal processing and/or transport of coal from the site on Monday to Saturday, between 7:00 am to 10:00 pm and on Sundays and public holidays between 8:00 pm to 10:00 pm. Blasting between 9:00 am and 5:00 pm Monday to Saturday.	No change. While no changes to approved conditions are proposed, blasting is not intended to be carried out to support the open cut mining activities proposed for the extraction of coal in the Southern Extension Area.
Final landform and rehabilitation	Land returned to native woodland and forest.	No change

3.2 Mining operations

The proposed modification involves the continuation of open cut mining operations within the Southern Extension Area (Figure 2.1) and includes extraction of coal from all seams down to and including the Lithgow Seam. The mining method will remain as currently approved and detailed in Section 2.1. No highwall mining will be carried out during the period proposed by the modification. No blasting will be carried out to facilitate coal extraction from within the Southern Extension Area.

3.3 Coal handling

ROM coal will continue to be transported by truck via internal haul roads and handled and processed as currently authorised and detailed in Section 2.2.

3.4 Coal transport

Up to 1.2 Mt/year of product coal will continue to be transported off-site by truck to domestic markets utilising the public road network. Customers include the Shoalhaven Starches plant near Nowra and the EnergyAustralia owned and operated MPPS. The modification seeks to also send product coal to alternative domestic customers east of the mine site should coal supply contracts be negotiated. The current restrictions on off-site coal transport will remain as currently approved with truck movements limited to a maximum of 16 laden coal truck movements per hour and no more than 10 laden coal truck movements per day to the Shoalhaven Starches plant or other domestic customers.

3.5 Mine infrastructure

Existing and approved ancillary infrastructure necessary to support the mining operation, as detailed in Section 2.3, will continue to be utilised by the continued mining activities proposed by the modification. No additional infrastructure is required to support the continuation of mining activities proposed by the modification. The coal washery will not be recommissioned or operated during the life of the proposed modification.

3.6 Waste

Overburden material will continue to be loaded onto trucks by excavators and hauled to emplacement areas located onsite as detailed in Section 2.5. Coarse reject material from screening and crushing process will continue to be co-disposed with overburden and emplaced within the final landform.

No coarse coal reject material or tailings will be produced as the coal washery will not be recommissioned during the period of mining proposed by the modification.

3.7 Water management

Water management across the site will continue to be managed in accordance with the existing approved water management system as described in Section 2.6 and detailed within the approved Water Management Plan. Water pumped from the Southern Extension Area will be transferred to either surface storages (dams or open cut voids) or the historical Invincible Colliery underground workings to facilitate mixing with other water.

Discharges from the site will continue in accordance with EPL 1095.

3.8 Workforce and hours of operation

Castlereagh Coal seek to increase the number of FTE personnel operating at the Invincible Colliery from 35 personnel to 50 personnel. The increase in the number of personnel at Invincible Colliery is required to meet production targets as nightshift would no longer continue. As no blasting is proposed to be undertaken, additional resources are required to facilitate removal of overburden and achieve rehabilitation targets in accordance with the approved Rehabilitation Management Plan.

The hours of operations will remain consistent with those currently assessed and approved and as detailed in Section 2.7.

3.9 Rehabilitation and final landform

The proposed modification will not change the approved rehabilitation goals and objectives for the Invincible Colliery as detailed in Section 2.8. Rehabilitation will continue to be undertaken in accordance with the approved Rehabilitation Management Plan.

4 Strategic context

4.1 Regional context

Invincible Colliery is located on the western slopes of the Great Dividing Range, approximately 25 km north-west of Lithgow, NSW. The township of Cullen Bullen is approximately 3 km north-west of the Invincible Colliery mine infrastructure area.

The Invincible Colliery is within a mining and power generation precinct with the MPPS located to the south and Cullen Valley Mine immediately north of the Invincible Colliery Project Approval area.

Much of the Invincible Colliery operations are within Ben Bullen State Forest. The Invincible Colliery Project area adjoins the Gardens of Stone State Conservation Area.

4.2 Project context

Mining has been undertaken in the areas around Cullen Bullen since the late 1800s. Invincible Colliery began operating around 1901 and operations have continued to develop since that time through a series of expansions and acquisitions. Invincible Colliery continues to be an important contributor to the local, regional and NSW economy, producing thermal coal suitable for use in domestic markets.

The modification involves the continuation of an existing mine in an area that is an established coal mining and power generation precinct, providing ongoing employment and other socio-economic contributions to the local and regional community. In the Lithgow LGA, coal mining is the largest employment industry equating to 6.9% of the population (ABS 2021) and the largest contributor at 23% (\$241M) to the Lithgow economy (Lithgow City Council 2020).

The strategic planning framework for the area is also well established, and mining projects are permissible with development consent on the land within the site. The modification involves an extension of time for mining activities to be carried out and to enable flexibility for coal to be transported to other domestic customers in addition to the Shoalhaven Starches plant and MPPS. All other activities in Table 5.1 that are currently approved under Project Approval MP07_0127, are intended to continue under the modification. The modification is therefore substantially the same as the development last modified. Further discussion on the relevant planning framework is provided in the Chapter 3.

4.2.1 Mount Piper Power Station

The MPPS is comprised of two 700 megawatt (MW) coal-fired steam turbine generators which have the capacity to meet the energy needs of approximately 1.18 million homes across NSW. EnergyAustralia has expressed its interest in Castlereagh Coal maintaining its ability to continue to deliver supplementary coal to the MPPS from both the Invincible Colliery and Cullen Valley Mine. The proposed modification will enable Castlereagh Coal to continue to provide remaining and previously approved open-cut coal resources to MPPS for a further five years.

4.3 Key strategic planning documents

4.3.1 NSW strategic statement on coal exploration and mining in NSW

The NSW Government's strategic statement was released in 2020 and describes its position on the use of coal to 2050, and the approach to a global transition to a low carbon future. The strategic statement outlines how important the coal mining industry is for the economy of NSW, particularly the regional and local economies where mining occurs. The strategic statement notes that the coal mining industry is a significant source of employment, directly and indirectly employing over 110,000 people, and underpins prosperity in many local economies.

The strategic statement notes that over the coming decades, the coal mining industry will be directly affected by the global transition to different forms of energy generation. However, it is noted that this transition will occur over an extended period of time. During the transition, the NSW Government commits to continue to support the local economy and the responsible development of the state's abundant, high quality coal resources for the benefit of the state. The strategic statement makes it clear that the NSW Government seeks to recognise existing industry investment by continuing to consider responsible applications to extend the life of current coal mines, such as the Invincible Colliery.

4.3.2 Central West and Orana Regional Plan 2041

The *Central west and Orana Regional Plan 2041* (CWORP) acknowledge the significant role that coal mining has historically played in the region's economy, particularly in areas like Lithgow. However, the CWORP emphasises a strategic transition towards a more diversified and sustainable economic base. The CWORP promotes economic diversification, supporting affected communities, ensuring environmental rehabilitation, and advancing renewable energy projects to build a sustainable and resilient regional economy.

The proposed modification aligns with the objectives of the CWORP as it provides for continuity of employment and maintains economic contributions to the region as the region continues its transition to a post coal mining economy.

4.3.3 Lithgow 2040 Local Strategic Planning Statement

The *Lithgow 2040 Local Strategic Planning Statement* (Lithgow LSPS) provides an overarching strategic direction of how Lithgow City Council is planning for the present and the future. It outlines Lithgow City Council's vision for transitioning from a coal-dependent economy to a more diversified and sustainable one while recognising the historical significance of coal mining and coal-fired power generation in the region. The Lithgow LSPS states that coal mining operations are expected to continue for the life of the plan. A key objective of the Lithgow LSPS is to ensure the existing economic values of the rural areas within the Lithgow LGA are protected and potential conflicts are mitigated through local planning instruments.

The proposed modification aligns with the objectives of the Lithgow LSPS and represents a continuation of an existing coal mine within existing approved mining areas. The proposed modification will provide for continuity of employment and maintain economic contributions to the region as the region continues its transition to a post coal mining economy.

5 Statutory context

This section outlines the statutory context applicable to assessing the modification. As required by *State significant development guidelines – preparing a modification report* (DPIE 2022), a statutory compliance table has been prepared and is attached as Appendix A.

5.1 Environmental Planning and Assessment Act 1979

The EP&A Act and EP&A Regulation set the framework for planning and environmental assessment in NSW.

5.1.1 Applicability of section 4.55(2) of the EP&A Act

Invincible Colliery was approved under Part 4 of the EP&A Act and is considered State significant development (SSD). Castlereagh Coal are seeking to modify MP 07_0127 pursuant to section 4.55(2) of the EP&A Act.

In accordance with section 4.55(2) of the EP&A Act, a consent authority may modify the consent if it is satisfied that the development, as modified, remains substantially the same development as originally approved.

Section 4.55(2) of the EP&A Act states:

(2) Other modifications A consent authority may, on application being made by the applicant or any other person entitled to act on a consent granted by the consent authority and subject to and in accordance with the regulations, modify the consent if—

(a) it is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which consent was originally granted and before that consent as originally granted was modified (if at all).

Schedule 2, section 3BA(6) of the Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017 provides:

3BA Winding-up of transitional Part 3A modification provisions on cut-off date of 1 March 2018 and other provisions relating to modifications

(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 and whose approval was modified under section 75W.

Mod 5 to MP07_0127 was granted under the since repealed section 75W of the EP&A Act. As such, the consent authority needs only be satisfied that the proposed modification is substantially the same development as last modified on 2 February 2018.

The proposed extension of timing for mining activities at Invincible Colliery for up to five years will not alter other aspects of the approved development beyond what has previously been assessed and approved. As such, the proposed modification satisfies the pre-requirements for an application under section 4.55(2) of the EP&A Act, namely that the modified development would be substantially the same development as last modified.

5.2 Other NSW legislation

In addition to the EP&A Act, the following other NSW legislation is potentially relevant to the modification:

- *Biodiversity Conservation Act 2016* (BC Act)
- Biodiversity Conservation Regulation 2017
- *Protection of the Environment Operations Act 1997* (POEO Act)
- *Water Management Act 2000* (WM Act)
- *Mining Act 1992*
- *National Parks and Wildlife Act 1974* (NPW Act).

Castlereagh Coal would continue to obtain the necessary licences and approvals under these Acts, as required, including revisions to relevant plans, licences or agreements to incorporate the modification.

5.2.1 Biodiversity Conservation Act 2016

The BC Act outlines the approach for conducting an assessment of a project's impacts on endangered/threatened ecological communities and species.

Under the Biodiversity Conservation (Savings and Transitional) Regulation 2017, a biodiversity development assessment report (BDAR) is not required to be submitted for the modification if the determining authority is satisfied that the modification will not increase the impact on biodiversity values (section 30A(2c)).

The modification does not seek to change the approved existing operations or clear additional land, therefore, would not increase the impact on biodiversity values.

5.2.2 Biodiversity Conservation Regulation 2017

As no additional disturbance beyond what has previously been assessed and approved is proposed, the proposed modification will not exceed the thresholds that trigger the requirement for a BDAR, as outlined in section 7.1 of the Biodiversity Conservation Regulation 2017 (BC Regulation) including:

- a) the clearing of native vegetation of an area declared by section 7.2 as exceeding the threshold
- b) the clearing of native vegetation, or other action prescribed by section 6.1, on land included on the Biodiversity Values Map published under section 7.3.

Table 5.1 summarises the thresholds for which a BDAR is required. Based on the information presented in Table 5.1, no BDAR is considered necessary to support the proposed modification.

Table 5.1 BC Regulation thresholds and modification impacts

Section of Regulation	Regulation threshold	Impact from proposed modification												
Part 7, section 7.2	Clearing of area of land that exceeds threshold Clearing of native vegetation exceeds areas for minimum lot size applicable to the land. <table><tr><th>Column 1</th><th>Column 2</th></tr><tr><th>Minimum lot size of land</th><th>Area of clearing</th></tr><tr><td>Less than 1 hectare</td><td>0.25 hectare or more</td></tr><tr><td>Less than 40 hectares but not less than 1 hectare</td><td>0.5 hectare or more</td></tr><tr><td>Less than 1,000 hectares but not less than 40 hectares</td><td>1 hectare or more</td></tr><tr><td>1,000 hectares or more</td><td>2 hectares or more</td></tr></table>	Column 1	Column 2	Minimum lot size of land	Area of clearing	Less than 1 hectare	0.25 hectare or more	Less than 40 hectares but not less than 1 hectare	0.5 hectare or more	Less than 1,000 hectares but not less than 40 hectares	1 hectare or more	1,000 hectares or more	2 hectares or more	All vegetation clearing required during the modification period will be undertaken on land previously assessed and approved to be cleared. No additional vegetation clearing exceeding the minimum lot size threshold.
Column 1	Column 2													
Minimum lot size of land	Area of clearing													
Less than 1 hectare	0.25 hectare or more													
Less than 40 hectares but not less than 1 hectare	0.5 hectare or more													
Less than 1,000 hectares but not less than 40 hectares	1 hectare or more													
1,000 hectares or more	2 hectares or more													
Part 7, section 7.3	Clearing on land within Biodiversity Values Map exceeds threshold Clearing of native vegetation on land included on the Biodiversity Values Map.	All vegetation clearing required during the modification period will be undertaken on land previously assessed and approved to be cleared and will have no additional impacts on areas included on the Biodiversity Values Map beyond what has previously been considered.												
Part 6, section 6.1	Impacts on the following habitat of threatened species or ecological communities— (i) karst, caves, crevices, cliffs and other geological features of significance (ii) rocks (iii) human made structures (iv) non-native vegetation.	All impacts (direct and indirect) will remain within the performance criteria of the development consent and have no greater impact on threatened species, ecological communities or their habitats beyond those previously assessed and approved.												
Part 6, section 6.1	Impacts on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range.	All vegetation clearing required during the modification period will be undertaken on land previously assessed and approved to be cleared and will have no additional impacts on habitat connectivity beyond those previously assessed and approved.												
Part 6, section 6.1	Impacts on movement of threatened species that maintains their lifecycle.	All impacts during the modification period will be undertaken on land previously assessed and approved for impact on the movement of threatened species or habitat that maintains their lifecycle beyond those previously assessed and approved.												
Part 6, section 6.1	Impacts on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities.	All impacts to water quality and water resources will remain within previously assessed and approved impacts. Mine water discharges will be undertaken in accordance with the existing EPL.												
Part 6, section 6.1	Impacts of wind turbine strikes on protected animals.	N/A												
Part 6, section 6.1	Impacts of vehicle strikes on threatened species of animals or on animals that are part of a threatened ecological community.	Management of activities will be undertaken in accordance with existing approved management plans and will not increase the risk or impact from vehicle strikes on threatened species or part of a threatened ecological community beyond those previously assessed and approved.												

5.2.3 Protection of the Environment Operations Act 1997

The POEO Act and the Protection of the Environment Operations (General) Regulation 2021 define the general obligations for environmental protection for development in NSW and is administered by the NSW Environment Protection Authority (EPA).

Invincible Colliery currently holds EPL 1095 to conduct “coal works” and “mining for coal”, as defined in Schedule 1 of the POEO Act.

No variation to EPL 1095 would be required as a result of the modification. The current EPL would be required to remain in effect for the additional period of time proposed by the modification.

5.2.4 Water Management Act 2000

The WM Act regulates the licensing, allocation, capture and use of water resources. Under the WM Act, water sharing plans establish rules for sharing water between different users and between the various rivers or aquifers.

Invincible Colliery holds two water access licences (WALs) under the WM Act as detailed in Table 5.2. No new WALs will be required for the modification.

Table 5.2 Invincible Colliery water access licenses

License ID	Date granted	Expiry date	Water Sharing Plan	Water source	Allocation
WAL 36485	1 July 2013	18 February 2028	<i>Greater Metropolitan Region Groundwater Sources 2023</i>	Sydney Basin Coxs River Groundwater Source (now Sydney Basin West Groundwater Source)	26 Units
WAL 35978	24 December 2012	23 December 2027	<i>NSW Murray Darling Basin Porous Rock Groundwater Sources 2020</i>	Sydney Basin Murray-Darling Basin Groundwater Source	120 Units

5.2.5 Mining Act 1992

The objects of the *Mining Act 1992* are to encourage and facilitate the discovery and development of mineral resources in NSW, having regard to the need to encourage ecologically sustainable development.

The *Mining Act 1992* regulates environmental protection and rehabilitation of all mining tenements. A summary of mining tenements relevant to the Invincible Colliery operations is provided in Table 5.3 and illustrated on Figure 5.1.

Table 5.3 Invincible Colliery mining leases, licenses and authorisations

Authority ID	Date granted	Expiry date	Description
ML 1635	10 September 2009	10 September 2030	Extends to the surface and covers the open cut mining areas at Invincible
ML 1638	6 November 2009	6 November 2030	Extends to the surface and covers the open cut mining areas at Invincible
ML 1844	21 February 2023	21 February 2044	Surface to 15.24 m
ML 1860	7 September 2023	7 September 2044	Ancillary mining activities
ML 1859	15 May 2024	28 June 2027	Extends from 15.24 m to a depth of 900 m
CCL 702	26 November 1990	28 June 2027	Variable depth
EL 7517	16 April 2010	16 April 2025	Variable depth

All mining within the Southern Extension Areas is undertaken within ML 1854 and ML 1638.

There are no proposed changes to mining tenements or additional mining tenements required as a result of the modification.

5.2.6 National Parks and Wildlife Act 1974

The objects of the NPW Act are to conserve nature, places or features (including biological diversity) of cultural value within the landscape, foster public appreciation, understanding and enjoyment of nature and cultural heritage and their conservation, and provide for the management of land reserved under the Act in accordance with the management principles applicable for each type of reservation.

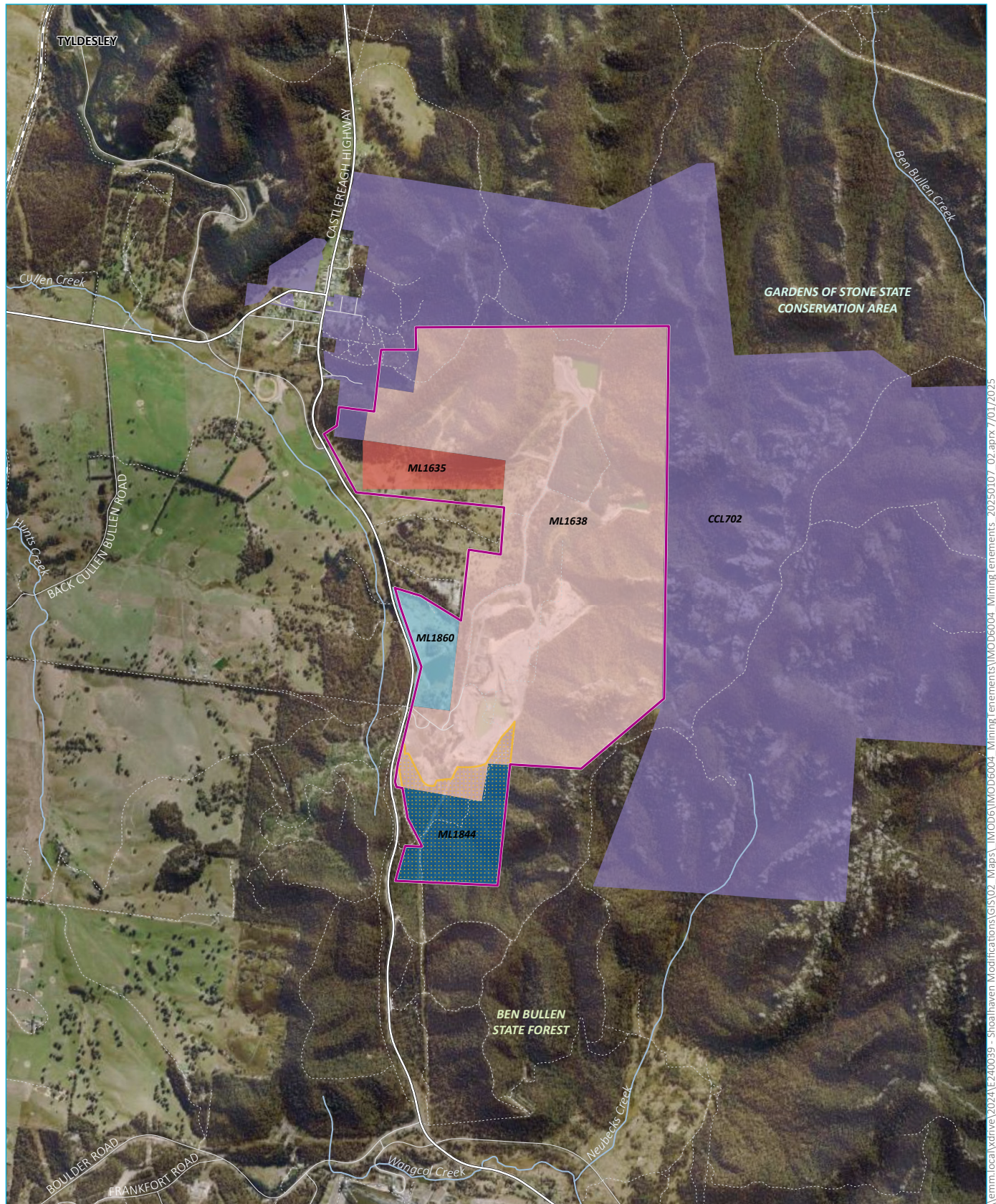
Any Aboriginal objects within the Project Approval area are afforded legislative protection under the NPW Act. However, the provisions of the EP&A Act provide an exemption from the requirement for an Aboriginal Heritage Impact Permit (AHIP) under the NPW Act for activities approved under Part 3A of the EP&A Act, as is the case with the Invincible Colliery. No new areas are proposed to be disturbed as a result of the modification, and all sites identified within the approved disturbance have already been salvaged (refer Section 7.7).

5.2.7 Climate Change (Net Zero Future) Act 2023

The *Climate Change (Net Zero Future) Act 2023* legislates the NSW approach to addressing climate change and delivering net zero greenhouse gas (GHG) emissions by 2050. The *Climate Change (Net Zero Future) Act 2023* sets a path to 2050 with emissions reduction targets and legislates:

- guiding principles for action to address climate change that consider the impacts, opportunities and need for action in NSW
- net emissions reduction targets for NSW (50% reduction on 2005 levels by 2030, 70% reduction on 2005 levels by 2035, and net zero by 2050)
- an objective for NSW to be more resilient to a changing climate
- establishing an independent, expert Net Zero Commission to monitor, review, report on and advise on progress towards these targets.

In May 2024, the EPA issued a draft policy on climate change assessment requirements for large emitters (EPA 2024a) (draft CCARs) and a draft *Guide for Large Emitters* (EPA 2024b). The draft CCARs outline the requirements for “new projects likely to have large emissions and proposed modifications of existing facilities likely to significantly increase their GHG emissions”. The GHG emissions associated with the Modification have been quantified to determine whether the modification would represent a significant modification to an existing facility. The GHG assessment is provided in Appendix D, with the findings summarised in Section 7.3 of this report.



Source: EMM (2025); DPE (2024); DCSSS (2024); ESRI (2025); GA (2009)

KEY

 Invincible Colliery project approval boundary (MP07_0127)

 Southern extension area

Existing environment

— Rail line

— Major road

— Minor road

— Vehicular track

— Named watercourse

Mining lease title

CCL702

ML1635

ML1638

ML1844

ML1860

Mining tenements

Invincible Mine Mod 6
Modification Report
Figure 5.1

5.3 Commonwealth legislation

5.3.1 Environment Protection and Biodiversity Conservation Act 2000

Under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), approval from the Commonwealth Minister for the Environment is required for any action that may have a significant impact on matters of national environmental significance (MNES). If an 'activity' is likely to have a significant impact on a matter of national environmental significance, then it may be a 'controlled action' and should be referred to the Commonwealth Minister for Environment for consideration.

Modification 4 (Mod 4) to the Invincible Colliery Project Approval was referred to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) which included the Southern Extension Area in which continued mining is proposed (EPBC 2014/7147). The proposed action was determined on 30 March 2014 to not be a controlled action. Mod 4 was ultimately refused under the NSW EP&A Act and did not proceed. The Southern Extension Area was subsequently approved under the EP&A Act (Mod 5) and was determined to not have a significant impact on MNES. As the proposed modification is within areas previously assessed and approved for disturbance, and in an area previously referred under the EPBC Act and determined not to be a controlled action, the proposed modification is unlikely to have any significant impact to MNES and no further referral under the EPBC Act is considered necessary.

5.3.2 Native Title Act 1993

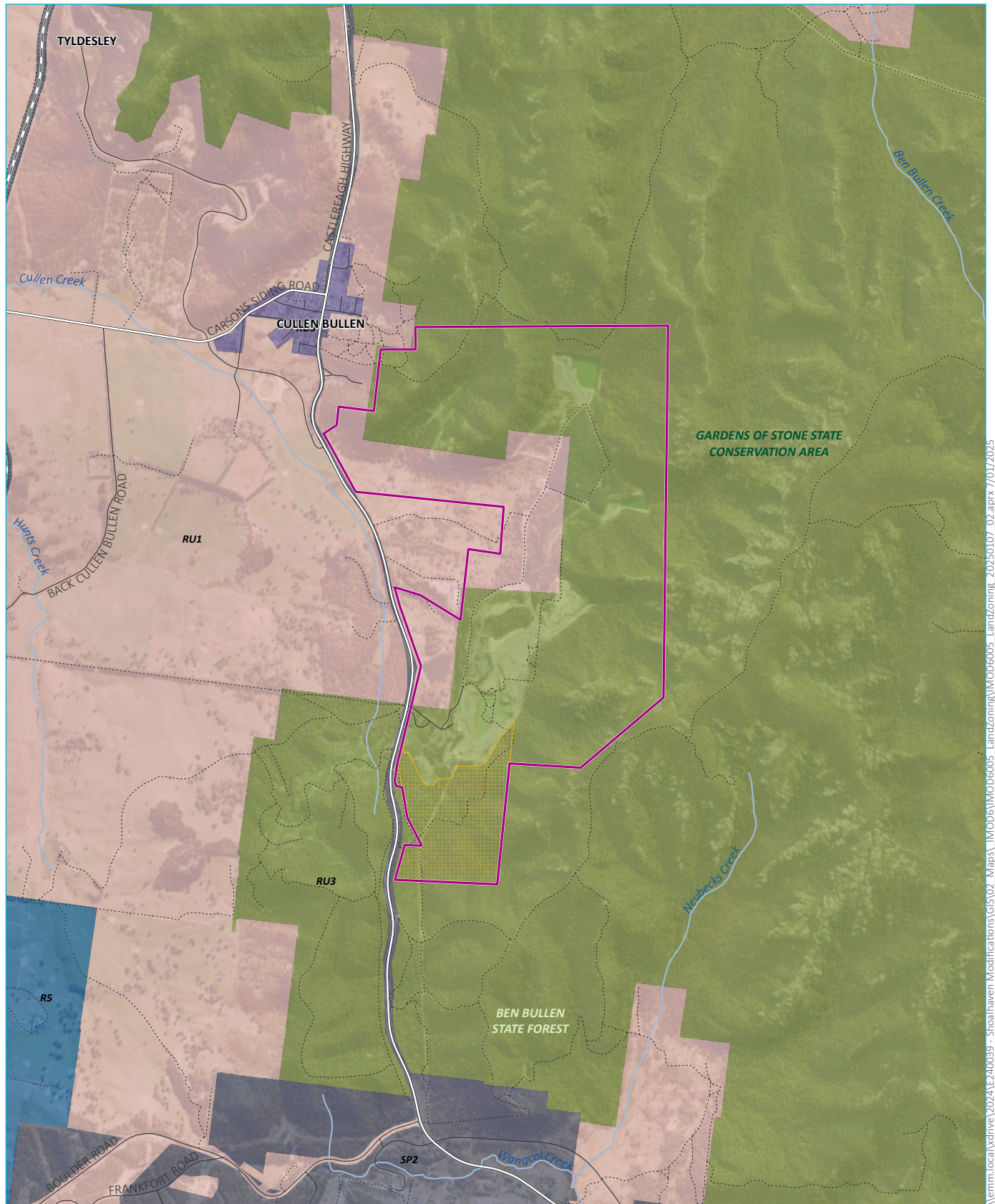
The Project Approval area is within an area of land subject to a registered Native Title claim (Warrabinga Wiradjuri #7, NC2018/002) that was accepted for registration on 22 November 2018. The Project Approval area is also subject to an ancillary deed of agreement for which the joint signatories are the Warrabinga Native Title Claimants Aboriginal Corporation, the Gundungurra Tribal Council Aboriginal Corporation, and Coalpac.

5.4 Environmental planning instruments

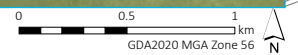
5.4.1 Lithgow Local Environmental Plan 2014

The *Lithgow Local Environmental Plan 2014* (Lithgow LEP) presents local environmental planning provisions for land within the Lithgow LGA, and outlines permissibility of various land uses within individual land use zones.

The Invincible Colliery is on land zoned RU1 – Primary Production and RU3 – Forestry as illustrated on Figure 5.2. Open cut mining is permissible with development consent in the RU1 and RU3 zones.



Source: EMM (2025); DCSSS (2024); DPIE (2022); ESRI (2025); GA (2009)



KEY

 Invincible Colliery project approval boundary (MP07_0127)

 Southern extension area

Existing environment

— Rail line

— Major road

— Minor road

..... Vehicular track

— Named watercourse

Land zoning

R5 | Large Lot residential

RU1 | Primary production

RU3 | Forestry

RU5 | Village

SP2 | Infrastructure

Land zoning

Invincible Mine Mod 6
Modification Report
Figure 5.2

6 Stakeholder engagement

6.1 NSW Government agencies and local council

Consultation undertaken with NSW government agencies and Lithgow City Council in relation to the proposed modification is summarised in Table 6.1.

Table 6.1 Agency consultation

Agency	Date	Method	Purpose and matters discussed
Department of Planning, Housing and Infrastructure (DPHI) - Resource Assessments	16 July 2024	Letter	Introduction provided to modification and outline of proposed approval pathway and assessment approach.
	23 August 2024	Letter	Confirm appropriate approval pathway and assessment requirements.
EPA	7 November 2024	Email/Letter	Introduction provided to modification and outline of modification need and proposed scope.
	5 December 2024	Site visit	Overview of site operations and water management system.
DCCEEW – Biodiversity, Conservation and Science (BCS)	7 November 2024	Email/Letter	Introduction provided to modification and outline of modification need and proposed scope.
	12 November 2024	Letter	Response from BCS noting no biodiversity development assessment report is required provided the consent authority is satisfied that the modification will not increase the impact on biodiversity values.
Department of Primary Industries and Regional Development - Industry Advisory and Mining Concierge	7 November 2024	Email/Letter	Introduction provided to modification and outline of modification need and proposed scope.
	8 November 2024	Email	Advised meeting to be scheduled with the Mine Development Panel (MDP) and advises a Resource and Economic Assessment would be conducted.
	10 December 2024	Meeting	Meeting with the MDP providing overview of proposed modification, production schedules and modification timeframes. JORC statement and economic assumptions to be provided to MDP for consideration.
Lithgow City Council	7 November 2024	Email/Letter	Introduction provided to modification and outline of modification need and proposed scope. No concerns raised by Lithgow City Council in regard to the proposed modification.

6.2 Community and Aboriginal party consultation

Community consultation and consultation undertaken with the Invincible Colliery’s registered Aboriginal parties (RAPs) in relation to the proposed modification is summarised in Table 6.2.

Table 6.2 Community consultation

Stakeholder	Date	Method	Consultation description and matters raised
Community Consultation Committee (CCC)	29 October 2024	Meeting	Overview of proposed modification. No feedback has been received from the CCC to date.
RAPs including: • Ann Glassenbury • Bathurst Local Aboriginal Land Council (BLALC) • Booral Maliyan • Mingaan Aboriginal Corporation • Wellington Valley Wiradjuri Aboriginal Corporation (WVWAC) • Wiray-duraa Maing-gu • Warrabinga Native Title Claimants Aboriginal Corporation (WNTCAC)	29 November 2024	Letter/Email	Overview of proposed modification. No feedback has been received from the RAPs to date.

6.3 EnergyAustralia

Castlereagh Coal has undertaken consultation with EnergyAustralia regarding the proposed modification. EnergyAustralia are supportive of the proposed modification as they provide an ongoing supplementary coal supply to MPPS.

7 Assessment of potential impacts

7.1 Traffic

A Traffic Impact Assessment (TIA) (EMM 2024a) has been prepared to support the modification and provided as Appendix C. The TIA was completed to assess the potential impact of the proposed modification on the local road network and to determine whether any road upgrade or maintenance would be required. The TIA was prepared with consideration to:

- *Road Traffic Authority (RTA) Guide to Traffic Generating Developments, October 2002* (RTA, 2002)
- *Austrroads Guide to Road Design Part 4a: Unsignalised & Signalised Intersections, October 2010* (Austrroads, 2023)
- *Austrroads Guide to Traffic Management Part 12: Integrated Transport Assessments for Developments, April 2020* (Austrroads, 2020)

The outcomes from the TIA are summarised in the sections below.

7.1.1 Existing environment

The principal road network that provides access to Invincible Colliery is Castlereagh Highway. The key roads of relevance to the proposed modification include:

- Castlereagh Highway, which provides the main access to the site
- Boulder Road, which passes MPPS and leads to the township of Portland.

The key intersections of relevance to the modification are:

- Castlereagh Highway/Invincible Colliery Access Road/Ivanhoe Mine Access Road
- Castlereagh Highway/Boulder Road.

The existing road networks are shown on Figure 2.2.

Currently, product coal is transported from the Invincible Colliery to domestic markets, including the Shoalhaven Starches plant near Nowra and to the MPPS. Product coal leaves the site via the access road onto the Castlereagh Highway where it is then transported to the receiving facility via public road. The modification seeks to send up to 250,000 t of product coal a year to domestic markets in addition to the MPPS and the Shoalhaven Starches plant. The coal sent to other domestic customers would be a diversion of coal otherwise sent to the Shoalhaven Starches plant and would not increase total coal transport off site beyond currently approved.

The key intersections were surveyed on Tuesday, 30 July 2024 between 6:00 am to 9:00 am and 3:00 pm to 6:00 pm during a non-school holiday period. The peak hours for the key intersections are summarised in Table 7.1.

Table 7.1 Intersection peak hours

Intersection	AM peak hour	PM peak hour
Castlereagh Highway/Invincible Colliery Access Road/ Ivanhoe Mine Access Road	7:15 am to 8:15 am	3:00 pm to 4:00 pm
Castlereagh Highway/Boulder Road	6:00 am to 7:00 am	3:00 pm to 4:00 pm

7.1.2 Impact assessment

i Methodology

The TIA methodology involved:

- collection of traffic volumes to allow assessment against the baseline (existing and scaled to 2030) condition and to provide a detailed assessment for the section of Castlereagh Highway between Carsons Siding Road (north) and Boulder Road (south) which is the main travel route for Invincible Colliery
- consideration of traffic of Invincible Colliery running until the year 2030
- assessment of key intersections along the Castlereagh Highway, specifically, where it intersects with Carson Siding Road, Cullen Valley Mine Access Road, Invincible Colliery Access Road, Ivanhoe Mine Access Road and Boulder Road.

ii Traffic generation

There will be no operational changes to Invincible Colliery as part of the modification and traffic generation will remain below the previously assessed and approved truck movements from the site.

iii Intersection performance

SIDRA modelling for the key intersections was conducted for the haulage route for the following scenarios:

- Forecast baseline traffic – based on 2030 traffic volumes.
- Forecast baseline + project traffic – includes baseline 2030 traffic volumes combined with the project traffic volumes.

The results of the SIDRA modelling for the Castlereagh Highway/Invincible Colliery Access Road intersection and the Castlereagh Highway/Boulder Road intersection is presented in Table 7.2 and Table 7.3 respectively.

The SIDRA modelling demonstrates that all key intersections will remain at Level of Service (LOS) A with the projected production traffic volumes in all scenarios. The intersections will not be adversely affected by the modification.

Table 7.2 **SIDRA modelling result for Castlereagh Highway/Invincible Colliery Access Road/Ivanhoe Mine Access Road intersection**

Control: Priority controlled (Give way)		AM Peak					PM Peak					
Scenarios	Intersection volume	DEL (s)	LOS	DOS	Q95 (m)	Q95 direction and approach	Intersection volume	DEL (s)	LOS	DOS	Q95 (m)	Q95 direction and approach
2030 Baseline (without project)	199	11.4	A	0.054	0.4	RT from south	257	12.0	A	0.067	0.4	RT from south
2030 (Baseline + project)	295	9.7	A	0.072	1.2	RT from south	357	12.3	A	0.085	0.4	RT from south

Table 7.3 **SIDRA modelling result for Castlereagh Highway/Boulder Road intersection**

Control: Priority controlled (Give way)		AM Peak					PM Peak					
Scenarios	Intersection volume	DEL (s)	LOS	DOS	Q95 (m)	Q95 direction and approach	Intersection volume	DEL (s)	LOS	DOS	Q95 (m)	Q95 direction and approach
2030 Baseline (without project)	312	8.5	A	0.063	0.2	RT from north	424	10.0	A	0.137	0.3	RT from north
2030 (Baseline + project)	412	10.1	A	0.079	0.8	RT from north	524	10.8	A	0.155	0.9	RT from north

iv Sight distances

Castlereagh Highway near the Invincible Colliery Access Road has a sign posted speed limit of 100 kilometres per hour (km/h). Based on the sight distance analysis, the sight distances to the left meets the minimum requirement 300 m as stipulated in the *Austroads Guide to Road Design*. However, the sight distance to the right does not meet the minimum requirement of 300 m. Existing turning traffic safety mitigation measures have been implemented near the intersection including truck warning signs in place on both approaches to the intersection. These mitigation measures are considered appropriate.

Castlereagh Highway near Boulder Road has a sign posted speed limit of 100 km/h. Based on the sight distance analysis, the sight distances to the left and right do not meet the minimum requirement 300 m as stipulated in the *Austroads Guide to Road Design*. However, existing turning traffic safety mitigation measures have been implemented at the intersection. The left turn features a dedicated slip lane, enabling traffic to merge safely onto the highway. The right turn has a dedicated approach lane that allows traffic to queue safely before turning from Boulder Road.

v Public transport, pedestrians and cyclists

There is minimal existing pedestrian activity and no dedicated cycle paths along the Castlereagh Highway on the traffic route. Therefore, the proposed modification is not expected to have any impact on active transport users.

vi Parking provision

Sufficient parking will be provided on site for the staff members and visitors that will be driving to the site.

No parking will be required on public roads. Therefore, there will not be any parking impacts to the road network.

7.1.3 Management, mitigation and monitoring

Invincible Colliery has an approved transport management plan that identifies a range of traffic management and mitigation measures plus performance and compliance indicators utilised to measure effectiveness and monitor compliance associated with transport safety and potential impacts as a result of traffic movements associated with the Invincible operations. Should the modification be approved, Castlereagh Coal will review, and update where necessary, the Transport Management Plan to take into consideration the outcomes from the TIA.

In addition to the continued implementation of the transport management plan, and to mitigate the risk of inadequate sight distances at the Castlereagh Highway near Boulder Road, it is recommended advanced intersection warning signs be installed for both northbound and southbound traffic on Castlereagh Highway.

7.1.4 Conclusion

The associated traffic impacts for the project and potential cumulative traffic impacts as a result of the modification have been assessed as follows:

- There will be no operational changes to Invincible Colliery as part of the modification and traffic generation will remain below the previously assessed and approved truck movements from the site.
- All key intersections will remain at LOS A with the projected production traffic volumes in all scenarios. The intersections will not be adversely affected by the modification.
- The sight distance requirements to the right at the Castlereagh Highway/Carsons Siding Road intersection are not met due to the road's curvature and elevation changes. To address this, the installation of an advanced intersection warning sign is recommended to alert approaching traffic. All associated costs for the signage will be covered by the applicant.

- The sight distance requirements to the left and right at the Castlereagh Highway/Boulder Road intersection are also not met due to the road's curvature. It is recommended that advanced intersection warning signs be installed to warn oncoming traffic, with all costs for the signage borne by the applicant.
- The modification is not expected to impact public transport, pedestrians or cyclist activity in the locality.
- Car parking will be provided on-site during operation. Cars will not be parked on public roads.

The forecast truck movements from Invincible Colliery over the next five years are below those previously approved and detailed in the development consent, and as such, impacts will largely remain consistent with what has previously been assessed and approved.

7.2 Noise and vibration

A detailed Noise Impact Assessment (NIA) (Umwelt 2016a) was prepared for Castlereagh Coal in support of Mod 5 to MP07_0127 to assess the potential noise impacts of mining in the Southern Extension Area. The key outcomes of the NIA and consideration of continued noise impacts from the proposed modification are summarised in the sections below.

7.2.1 Existing environment

Sensitive receiver locations surrounding the Invincible Colliery are illustrated on Figure 5.2 and include scattered privately owned rural residences to the west of Invincible Colliery and those within the township of Cullen Bullen, which is approximately 3 km to the north north-west of the Invincible Colliery mine infrastructure area.

Noise criteria for Invincible Colliery are established by Condition 2 Schedule 3 of the Project Approval and Condition L4.1 of the EPL. The relevant noise criteria are summarised in Table 7.4.

Table 7.4 Noise criteria (MP07_0127 and EPL 1095)

Location	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)	
	L _{Aeq} (15 minute)	L _{Aeq} (15 minute)	L _{Aeq} (15 minute)	L _{A1} (1 minute)
393 (Billabong)	40	40	35	45
394 (Hillview)	43	43	35	45
All other receivers	35	35	35	45

Mining activities proposed to continue under this modification will be within the Southern Extension Area assessed and approved by Mod 5 to MP07_0127. The typical mobile equipment and numbers operating at the Invincible Colliery is summarised in Table 7.5. It is noted that no blasting activities are proposed to be carried out to facilitate the continuation of mining in the Southern Extension Area.

Table 7.5 Typical mobile operating fleet

Equipment type	Number
Excavator (Overburden)	2
Excavator (Coal)	2
Small Excavator	2
Dozers	3
Rear dump truck (Overburden)	7
Rear dump truck (Coal)	4
Grader	1
Water cart	1
Loaders (at Coal stockpiles)	1

7.2.2 Impact assessment

The NIA prepared for Mod 5 to MP07_0127 (Umwelt 2016a) predicted operational noise levels for the various daytime and evening periods at the sensitive receptor locations surrounding the Invincible Colliery. The NIA determined that noise would comply with the relevant noise criteria at all locations except for Residence Hillview. At this location, the modelling showed a potential minor exceedance of the noise criteria presented in Table 7.4 under the maximum operational and production scenarios. Hillview was acquired by the previous owners to Shoalhaven Coal and is therefore no longer a privately owned receptor.

It is also noted that as no changes to the approved ROM coal production are proposed by the modification, the impacts from noise at the sensitive receivers surrounding Invincible Colliery are anticipated to continue to comply with the relevant noise criteria within the Project Approval conditions and the EPL.

No blasting activities are proposed to support mining in the Southern Extension Area, so vibration impacts are not considered a risk.

7.2.3 Management, mitigation and monitoring

Invincible Colliery monitor and manage noise in accordance with an approved Noise Management Plan. A range of noise management and mitigation measures are utilised at Invincible Colliery to limit the generation of noise and mitigate noise impacts which are detailed in the Noise Management Plan and include:

- utilising meteorological data and forecasts to provide site personnel with information on daily environmental risks associated with noise
- managing mobile machines during adverse weather conditions when wind conditions enhance the noise propagation towards sensitive receiver locations
- conducting regular inspections and maintenance of existing noise attenuation systems via maintenance inspections
- considering noise minimisation when selecting new plant and equipment
- maintaining product stockpiles in strategic locations, where practical, to shield product trucks and product loading equipment from receivers
- implementation of broad band reversing alarms instead of beeper style alarms on all mobile equipment.

Castlereagh Coal will continue to implement the monitoring and management measures detailed within the approved Noise Management Plan for the life of the proposed modification.

7.2.4 Conclusion

All approved activities will remain consistent under the modification, in particular mining methods and coal processing and handling activities. Therefore, the changes due to the modification are unlikely to result in exceedances of the applicable noise criteria outlined within the Project Approval and the EPL. All impacts will remain consistent with those presented in Mod 5 to MP07_0127 and will continue to be managed and monitored in accordance with the Invincible Colliery approved noise management plan.

7.3 Greenhouse gas

A Greenhouse Gas (GHG) Assessment (EMM 2024b) has been prepared to support the modification and is provided as Appendix D. The assessment has been conducted following the draft *NSW EPA Guide for Large Emitters* guidance document and the *National Greenhouse Accounts Factors Workbook* (NGAF) (DCCEW 2024). The assessment includes estimates of scope 1 and 3 GHG emissions for continued operations at the colliery as a result of the proposed modification.

The outcomes from the GHG Assessment are summarised in the sections below.

7.3.1 Existing environment

GHG emissions are predominantly comprised of the following:

- Scope 1 – direct emissions associated with the combustion of diesel and release of fugitive emissions.
- Scope 2 – emissions by the consumption of electricity.
- Scope 3 – emissions generated by third parties during product transport and consumption activities.

7.3.2 Impact assessment

i GHG assessment boundary and emission sources

The GHG assessment boundary for the modification is treated *conceptually*, as shown in Figure 7.1. The figure shows the scope 1 and 3 emission sources that are included and excluded. The sources that were included represented the most significant sources associated with the project. Where a particular emission source was excluded from the assessment, this was either because it was not relevant, or because emissions were likely to be negligible.

The following emissions sources included in the assessment were:

- **Scope 1** – on-site diesel combustion, fugitive emissions from open cut mining, on-site consumption of oils and on-site consumption of greases.
- **Scope 2** – there are no scope 2 emissions for the project as diesel generators will continue to power the colliery.
- **Scope 3** – these have been separated into upstream (extraction, production and transport of liquid fuels, oils and greases) and downstream sources (combustion and transport of coal at the MPPS and Shoalhaven Starches plant).

ii Identification of the project as a large emitter

The modification is not considered to be a large emitter as annual scope 1 emissions are below the *NSW EPA Guide for Large Emitters* threshold for large emitters of 25,000 t CO₂-e during the operational life of the project. The annual scope 1 emissions are provided in Table 7.6.

Table 7.6 Annual scope 1 emissions for project operation

Financial year	Scope 1 emissions (t CO ₂ -e/year)
FY26	13,478.0
FY27	18,689.0
FY28	10,422.0
FY29	9,520.8
FY30	5,798.7
FY31	1,805.2
TOTAL	59,713.7

Notes:

1. Financial year = 1 July to 30 June the following year.
2. As the project's operations are proposed for 1 January 2026 to 31 December 2030, there are no emissions for the first half of FY26 and the second half of FY31.

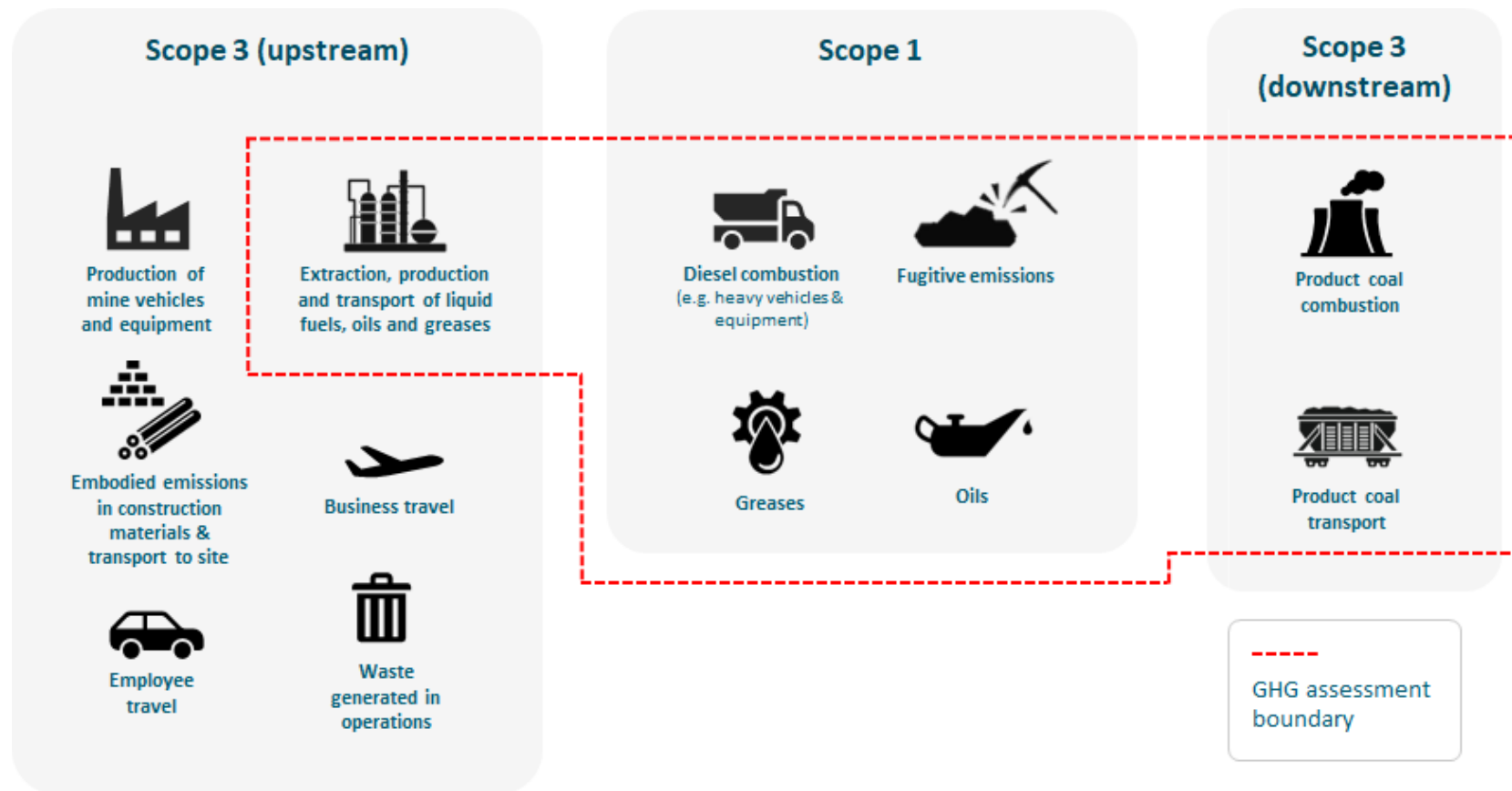


Figure 7.1 GHG assessment boundary and emission sources

iii Assessment methodology

The estimation of GHG emissions for the modification was generally based primarily on the *National Greenhouse Accounts Factors Workbook* (NGAF) (DCCEW 2024). The methodologies in the NGAF workbook follow a simplified approach, equivalent to the 'Method 1' approach outlined in the *National Greenhouse and Energy Reporting (Measurement) Technical Guidelines* (DoE 2014). The Technical Guidelines are used for the purpose of reporting under the Commonwealth *National Greenhouse and Energy Reporting Act 2007* (the NGER Act).

The most significant emission-generating activities were considered in the assessment as mentioned in the preceding sections. There are also no emissions associated with post-closure of the colliery as these are not stated in the Measurement Determination for open-cut coal mines.

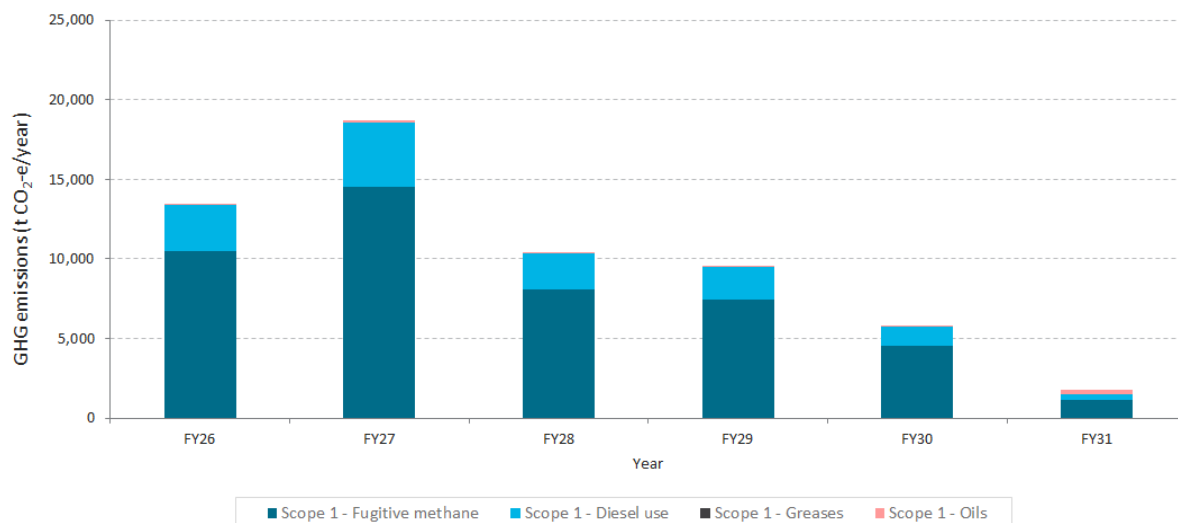
iv Emissions estimates

The estimated GHG emissions for every year of the project are presented in Figure 7.2. The following points are noted:

- estimated scope 1 GHG emissions are below the *NSW EPA Guide for Large Emitters* threshold of 25,000 tonnes of CO₂-e per year for every operational year of the project
- the year with the highest scope 1 emissions is FY27 at 18,689.0 tonnes of CO₂-e
- emissions from fugitive methane make up 77.4% of total scope 1 emissions
- fuel combustion from on-site diesel use makes up 21.5% of total scope 1 emissions
- emissions from the combustion of coal by the end user makes up 99.6% of total scope 3 emissions
- scope 1 emissions make up 4.0% of total emissions and scope 3 emissions make up 96.0% of total emissions.

Overall, the modification is not considered to be a large emitter as emissions will remain below the *NSW EPA Guide for Large Emitters* threshold of 25,000 t CO₂-e per year.

Scope 1 emissions



Scope 3 emissions



Figure 7.2 Graphical representation of estimated GHG emissions for the modification

7.3.3 Management, mitigation and monitoring

Castlereagh Coal is committed to the ongoing management and reduction of GHG emissions generated as a result of the modification. Castlereagh Coal also reports GHG emissions and energy use under the National Greenhouse and Energy Reporting (NGER) scheme.

GHG emissions as a result of the modification are principally associated with fugitive emissions from open-cut mining, and on-site fuel consumption (specifically diesel combustion). It is noted that scope 1 emissions account for 4.0% of total GHG emissions (i.e. all scopes) from the project. The majority of emissions are scope 3, and 96.0% of these are due to coal combustion by the end user. Mitigation measures discussed in this section are focused on the project's direct (scope 1) emissions.

The proposed GHG management measures to reduce Scope 1 and 2 emissions include:

- all adits are sealed thus restricting fugitive methane and carbon dioxide emissions
- ensure that all equipment will be serviced and maintained according to manufacturers' specifications
- perform pre-start inspections at each shift on mobile plant and vehicles to confirm they are operating efficiently
- idling of diesel equipment will be minimised wherever feasible
- haul route distances are minimised
- fuel use is tracked daily
- revegetation plan in place
- daily gas samples conducted
- induction process includes training on best practices to reduce GHG emissions.

Safeguard Mechanism reporting under the *National Greenhouse and Energy Reporting Act 2007* will not be required as the modification will not emit about the threshold of 100,000 t of CO₂-e per year throughout its lifetime.

7.3.4 Conclusion

GHG emissions were estimated for future projected operations under the modification. There were no years where the *NSW EPA Guide for Large Emitters'* threshold of 25,000 t CO₂-e/year was exceeded and therefore the modification was not considered a large emitter under the guide.

The significance of emission sources to GHG emissions was analysed. Emissions from fugitive methane and combustion from diesel used on-site contributed approximately 77.4% and 21.5% of total scope 1 GHG emissions respectively. Total scope 1 emissions for the life of the project were 59,713 t CO₂-e and scope 3 emissions were 1,501,518 t CO₂-e. Combustion of coal by the end user made up 99.6% of scope 3 emissions.

Castlereagh Coal will employ a range of best practice mitigation measures at the colliery to minimise its GHG emissions. These measures include ensuring that all adits are sealed, tracking of fuel use, daily gas sampling, and training processes for staff.

7.4 Air quality

An Air Quality Impact Assessment (AQIA) (Jacobs 2016) was prepared for Castlereagh Coal in support of Mod 5 to MP07_0127 to assess the potential air quality impacts of mining in the Southern Extension Area. The key outcomes of the AQIA and consideration of continued air quality impacts from the proposed modification are summarised in the sections below.

7.4.1 Existing environment

Invincible Colliery is located in an area of historical mining operations associated with the western coalfield of NSW. Sensitive receiver locations (Figure 5.2) include scattered privately owned rural residences to the west of Invincible Colliery and those within the township of Cullen Bullen, approximately 3 km to the north north-west of the Invincible Colliery mine infrastructure area.

Air quality criteria relevant to Invincible Colliery are detailed in Schedule 3, Condition 16 of the Project Approval and are specified in Table 7.7.

Table 7.7 Project Approval air quality criteria

Pollutant	Averaging period	Criterion
Total suspended particulate (TSP) matter	Annual	90 µg/m ³
Particulate matter (PM ₁₀)	Annual	30 µg/m ³
	24 hour	50 µg/m ³
Deposited dust	Annual (maximum increase)	2 g/m ² /month
	Annual (maximum total)	4 g/m ² /month

In addition to the air quality criteria outlined within the Project Approval conditions, the EPA has developed assessment criteria for a range of air quality indicators including particulate matter. These criteria are outlined in the EPA's *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 the Approved Methods 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 (NEPMs) (NEPC, 1998 and updates to 2021). The relevant air quality assessment criteria outlined within the Approved Methods for PM₁₀ and PM_{2.5} are summarised in Table 7.8.

Table 7.8 Air quality assessment criteria (Approved Methods)

Pollutant	Averaging period	Criterion
Particulate matter (PM ₁₀)	Annual	25 µg/m ³
	24 hour	50 µg/m ³
Particulate matter (PM _{2.5})	Annual	8 µg/m ³
	24-hour	25 µg/m ³

This modification has considered the potential impacts of the proposed modification against the Project Approval criteria (Table 7.7) and the relevant assessment criteria outlined within the Approved Methods (Table 7.8).

7.4.2 Impact assessment

A comprehensive assessment of the potential air quality impacts for the Southern Extension Area was prepared in support of Mod 5 to MP07_0127 (Jacobs 2016). The AQIA identified that air quality impacts associated with mining in the Southern Extension Area would be well below adopted impact assessment criteria at surrounding private residences, as follows:

- No privately owned residences were expected to experience PM₁₀ concentrations above EPA annual criteria of 30 micrograms per cubic metre (µg/m³) or 24-hour criteria of 50 µg/m³.
- Compliance would also be achieved with the more stringent annual average standard for PM₁₀ of 25 µg/m³ outlined within the Approved Methods.
- Maximum 24-hour average PM_{2.5} concentrations due to mining in the Southern Extension Area would not exceed the NEPM criteria of 25 µg/m³.
- There are no private residences that are predicted to experience annual average TSP or dust deposition levels above the air quality assessment criteria.

Invincible Colliery report air quality monitoring results against relevant criteria in an Annual Review. Annual reviews for the past three years indicate that Invincible Colliery has maintained compliance consistently well below the assessment criteria with no exceedances reported in relation to air quality. Given that all approved activities will remain largely consistent with those previously assessed and approved, the proposed modification is predicted to comply with the existing air quality criteria and the relevant criteria outlined within the Approved Methods, and remain consistent with those previously assessed and approved by Mod 5 to MP07_0127.

7.4.3 Management, mitigation and monitoring

Castlereagh Coal is committed to effectively managing the air quality impacts associated with Invincible Colliery, including the minimisation of any visible off-site air pollution generated by the operations which include the implementation of predictive and proactive management measures including:

- use of forecast weather conditions to inform on site activities
- development of a mine plan that allows for progressive rehabilitation of the Southern Extension Area and the previously mined areas
- minimising the length of haul roads (where practicable) and adopting controls for haul road dust emissions
- minimising the area of disturbed land at any one time as much as practicable
- using temporary rehabilitation and stabilisation measures on disturbed land.

In addition, reactive management measures will be implemented in response to identified triggers, as a contingency to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible. These include:

- following a complaint, appropriate action will be taken within one working day to determine the cause of the complaint and identify appropriate actions to remediate the complaint source
- if air quality monitoring indicates that the air quality criteria has been exceeded, an investigation would be completed and action plan developed to reduce the exceedance to acceptable levels as soon as possible

- during times when extraordinary events are forecast or observed, it is the Mine Manager's responsibility to limit or modify operations as required to ensure that air quality impacts are limited as much as practically possible.

Air quality monitoring is completed at Invincible Colliery and surrounding areas on a regular basis to confirm that dust emissions are within the acceptable criteria at sensitive receivers. Air quality monitoring is undertaken in accordance with Invincible Colliery's Air Quality Management Plan and includes monitoring of particulate matter (PM₁₀ and TSP) and deposited dust.

7.4.4 Conclusion

All approved activities will remain consistent under the modification, in particular mining methods, and coal processing and handling activities. Therefore, the changes due to the modification are unlikely to result in an increase in the currently approved air quality impacts of Invincible Colliery. All impacts will remain consistent with those presented in Mod 5 to MP07_0127 and will continue to be managed and monitored in accordance with the approved Air Quality Management Plan.

7.5 Surface water

A Surface Water Assessment (SWA) (Umwelt 2016b) was prepared for Castlereagh Coal in support of Mod 5 to MP07_0127 to assess the potential impacts of mining in the Southern Extension Area. The key outcomes of the SWA and consideration of continued surface water impacts from the proposed modification are summarised in the sections below.

7.5.1 Existing environment

Invincible is located within the catchment of Cullen Creek, a tributary in the upper reaches of the Turon River (refer to Figure 7.3). Cullen Creek, and its tributaries are ephemeral watercourses. Cullen Creek is a fourth order watercourse based on the Strahler stream ordering system. Cullen Creek flows in a north-westerly direction before joining Dulhuntys Creek approximately 4 km downstream of the Invincible Colliery.

The existing WMS at the Invincible Colliery allows for three categories of water:

- Clean: comprising runoff from undisturbed and fully rehabilitated areas.
- Dirty: comprising runoff from any area disturbed by mining operations.
- Mine water: comprising water exposed to coal or used in coal processing and runoff within mining areas.

Under the existing Invincible Colliery EPL, the site is authorised for wet weather discharges into an unnamed tributary of Cullen Creek from the Main Water Storage Dam. This discharge point is referred to as LDP 002. Concentration limits for this discharge point (expressed as 100 percentile concentration limits) are:

- oil and grease; 10 milligrams per litre (mg/L)
- pH; within the range 6.5 to 8.5
- total suspended solids; 30 mg/L.

Castlereagh Coal is required to monitor the concentrations of each of the above on a monthly basis (during discharge).



Source: EMM (2025); DCSSS (2024); ESRI (2025); GA (2009)

KEY

- | | |
|---|---|
| Invincible Colliery project approval boundary (MP07_0127) | Existing mine disturbance area |
| Southern extension area | Mining restriction area |
| | Major road |
| | Minor road |
| | Named watercourse |
| | Watercourse/drainage line |

Watercourses

Invincible Mine Mod 6
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Figure 7.3

7.5.2 Impact assessment

Continued mining in the Southern Extension Area has the potential to impact on surface water systems including:

- impacts to catchment areas and downstream watercourses
- impacts to flooding, including flow rates, velocities and depths
- impacts to water quality in downstream watercourses.

As detailed in Section 3.7, water pumped from the Southern Extension Area will be transferred to either surface storages (dams or open cut voids) or the existing Invincible Colliery underground workings to facilitate mixing with other water.

The SWIA (Umwelt 2016b) prepared to support Mod 5 to MP07_0127 determined that mining in the Southern Extension Area would not result in changes to the current catchment area of Cullen Creek relative to the existing WMS, and that there would be no reduction in annual flow volumes, relative to the currently approved impacts, in Cullen Creek. As there would be no change to the current catchment area during the operational life of mining in the Southern Extension Area, it is considered that there will be no impacts on downstream flooding during the life of the Southern Extension Project.

The SWIA further determined that through management of dirty water and mine water within the WMS over the life of mining in the Southern Extension Area, it is not anticipated that water quality in downstream watercourses will be adversely impacted by mining continuing in the Southern Extension Area.

Water discharges from Invincible Colliery will continue to be managed in accordance with EPL requirements.

7.5.3 Management mitigation and monitoring

The key management measures for Invincible Colliery in regard to surface water includes the existing WMS and associated erosion and sediment control measures as detailed within the Invincible Colliery Water Management Plan (WMP). Invincible Colliery will continue to manage surface water and groundwater in accordance with the objectives of the WMP and requirements of the EPL.

Water take will continue under existing WAL entitlements. All results will continue to be reported in the Annual Review.

7.5.4 Conclusion

As the modification is only proposing an extension of time in which mining operations are undertaken, the potential impacts on water resources are consistent with that already assessed and approved by Mod 5 to MP07_0127. As there will be no changes to the WMS, approved disturbance area, and mining depth or extent, the direct and indirect surface water and groundwater take is expected to be consistent with current reported take. Invincible Colliery will continue to manage water resources in accordance with the objectives of the approved WMP and requirements of the EPL.

7.6 Groundwater

7.6.1 Existing Environment

The Invincible Colliery is located within the Illawarra Coal Measures. The majority of the Illawarra Coal Measures comprise very low yielding, to essentially dry interbedded strata of sandstone, siltstone, and mudstone. Groundwater within the Southern Extension Area and Invincible Colliery workings is found within the:

- Lithgow Seam (largely depressurised from historical mining operations targeting this seam including within the Southern Extension Area)
- historical underground mine workings in the Lithgow Seam
- saturated areas of spoil in the Invincible open cut workings
- Marrangaroo (sandstone / conglomerate) Formation.

The site is also situated on and adjacent to land that has been impacted by extensive underground mining activity with the Invincible Underground below and to the east, the Old Tyldesley Colliery to the north-west, Baal Bone Colliery to the north-east, Ivanhoe #2 Colliery to the south and Wallerawang No.3 Colliery to the south-west. All these mines targeted the Lithgow coal seam due to its continuity and thickness, resulting in connective cracking to the surface, which has facilitated rainfall infiltration into the abandoned workings via points of high permeability.

As a result of historical mining operations, the Lithgow Seam has been completely depressurised in the vicinity of Invincible Colliery. The abandoned underground workings have re-saturated to an extent, primarily through surface water infiltration rather than groundwater processes.

7.6.2 Impact Assessment

A groundwater impact assessment (AGE 2016) was prepared in support of Mod 5 to MP07_0127 to assess the potential impacts on the groundwater system resulting from the Southern Extension Project. The key water related issue for the Southern Extension Area is managing the water stored within flooded former underground workings.

Potential impacts associated with the modification and results of the assessment are provided in Table 7.9.

Table 7.9 Potential groundwater impacts associated with the modification

Potential Impact	Assessment Result / Mitigation Measures
Potential impacts on the flooded underground workings from surface runoff	• During the life of mining there may be a slight increase in the amount of surface water flows captured and diverted into the former Ivanhoe No. 2 workings. • Pit dewatering activities and slope of the Lithgow Seam bedding plane north towards the existing Invincible open cut void will minimise extent of any inflows. • Water falling into disturbed areas of the open cut as either rainfall or inflows from upstream catchment will be diverted first into the open cut and then into the former Invincible underground workings. • Rehabilitation of former open cut areas and Southern Extension Area will reduce inflows into the former Invincible and Ivanhoe underground workings as this runoff is diverted into Cullen Creek.
Groundwater seepage to the open cut from the underground workings	• There is potential for water to discharge into the corner of the Invincible open cut area due to flooding of the Ivanhoe No. 2 workings. • Discharges from the Invincible water management system will be managed in accordance with the Invincible EPL to remove any risk of decant.

Potential Impact	Assessment Result / Mitigation Measures
Potential aquifer depressurisation due to dewatering within the Southern Extension Area	Depressurisation of the Lithgow Seam due to dewatering within the Southern Extension Area will likely be minimal and is assumed to generate a localised zone of depressurisation.
Potential impact on other groundwater users	- The closest bore potentially used for productive purposes is located approximately 3.5 km to the west of the Southern Extension Area. - Dewatering of the Southern Extension Area is not anticipated to impact the water level in this bore.
Potential impact on groundwater dependent ecosystems (GDEs)	- No high priority GDEs are located within the footprint of the Southern Extension Area. - The absence of any groundwater seepage and aquifer depressurisation will ensure that no GDEs will be impacted.
Assessment against Aquifer Interference Policy	- An assessment was completed comparing the predicted impacts against the Aquifer Interference Policy Level 1 minimal impact considerations for less productive groundwater of the Permian coal measures. - The assessment confirms that the predicted groundwater impacts are within the minimal impact considerations under the Aquifer Interference Policy.

The proposed modification is requesting an extension of time only, with all other aspects of the operations, including groundwater management, to remain consistent with approved operations.

7.6.3 Management, mitigation and monitoring

The key management measures for Invincible Colliery in regard to groundwater includes the existing WMS and associated dewatering strategies as mentioned above.

Invincible Colliery will continue to monitor and manage groundwater in accordance with the objectives of the Invincible Colliery WMP.

7.6.4 Conclusion

As the modification is only proposing an extension of time, the potential impacts on water resources are consistent with that already approved and assessed as part of Mod 5 to MP07_0127. As there will be no changes to the WMS, approved disturbance area, and mining depth or extent, the direct and indirect surface water and groundwater take is expected to be consistent with current reported take. Invincible Colliery will continue to manage water resources in accordance with the objectives of the WMP.

7.7 Aboriginal heritage

7.7.1 Existing environment

An Aboriginal Cultural Heritage and Archaeological Assessment (ACHAA) (Umwelt 2016c) was prepared in support of Mod 5 to MP07_0127 to assess the potential impacts of mining in the Southern Extension Area to Aboriginal cultural heritage. The ACHAA identified six Aboriginal heritage sites within the Southern Extension Area that were to be impacted by mining activities (consisting of three artefact scatters and three isolated finds), and a potential birthing tree with potential archaeological deposit (PAD). This tree was destroyed in the 2019/2020 bushfires and is not included in the list of valid sites. Aboriginal cultural heritage sites within the Southern Extension Area and their assessed archaeological significance are summarised in Table 7.10. The location of Aboriginal heritage sites identified within the Southern Extension Area are illustrated on Figure 7.4.

Table 7.10 Aboriginal cultural heritage sites within the Southern Extension Area

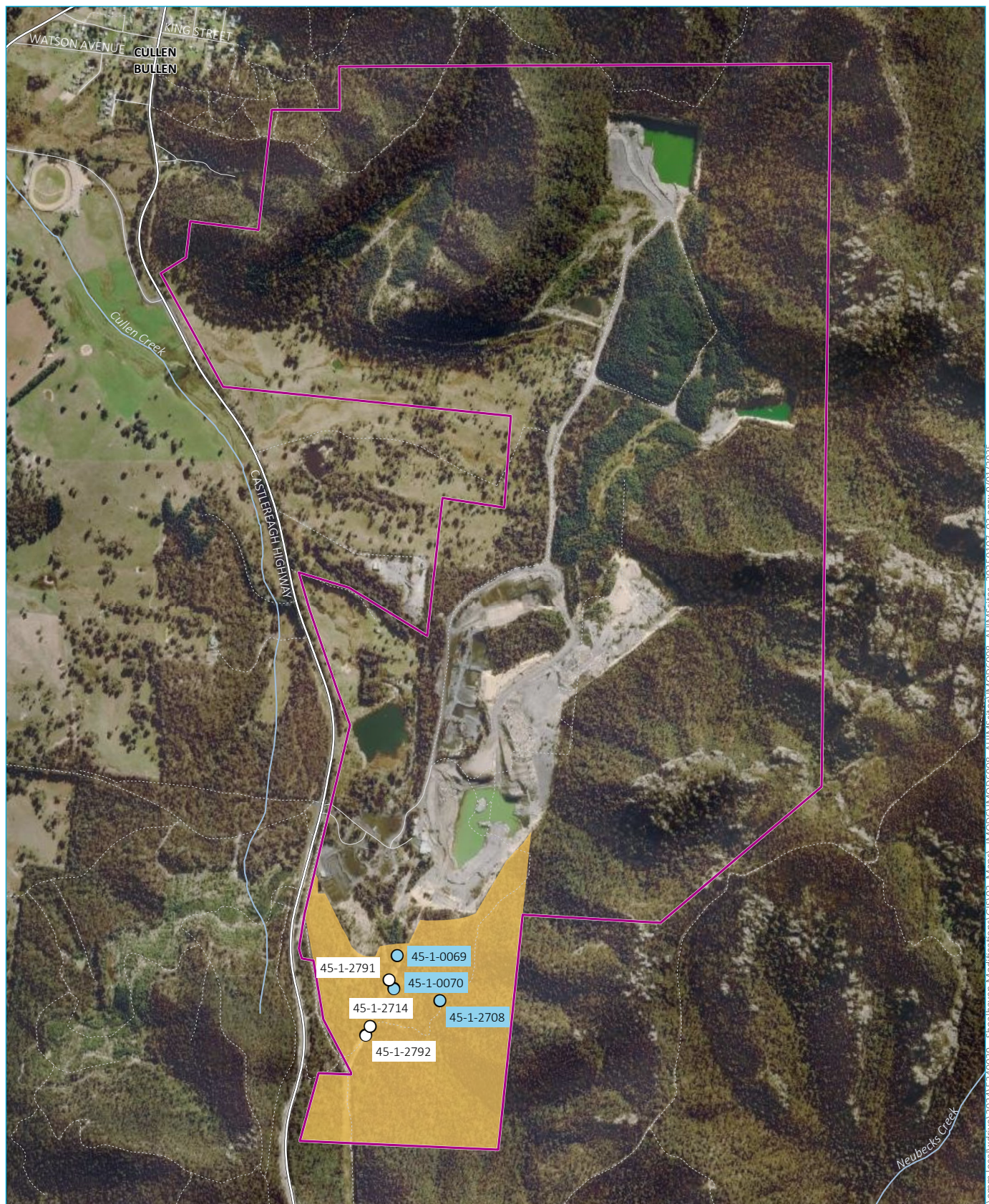
Site ID	Type	Overall archaeological significance
45-1-2791	Isolated Find	Low
45-1-2792	Isolated Find	Low
45-1-0069	Artefact Scatter	Low
45-1-0070	Artefact Scatter	Low
45-1-2708	Artefact Scatter	Low
45-1-2714	Isolated Find	Low
45-1-2797*	Modified tree and PAD	

* Not included in the list of valid sites.

A surface salvage program was completed in May 2023 to collect these sites prior to being impacted by mining activities in accordance with the approved Aboriginal Cultural Heritage Management Plan (ACHMP).

7.7.2 Impact assessment

All Aboriginal cultural heritage sites within the Southern Extension Area potentially impacted by future mining activities have been salvaged. No sites of Aboriginal cultural heritage remain within the area potentially impacted by the ongoing mining activities as a result of the proposed modification. There is a possibility for further previously unidentified sites are within the Southern Extension Area; however, due to the sloping nature of the landforms and level of previous disturbance, it is likely any further sites would be small in number and of a similar nature to the currently identified sites. That is, small artefact scatters and isolated finds with low potential for subsurface archaeological deposits as a result of the erosion and subsidence within the Southern Extension Area.



Source: EMM (2025); DCSSS (2024); OEH (2024); ESRI (2025); GA (2009)

KEY

Invincible Colliery project approval boundary (MP07_0127)

Southern extension area

AHIMS (by site type)

Artefact scatter (salvaged)

Isolated find (salvaged)

Existing environment

Major road

Minor road

Vehicular track

Named watercourse

Aboriginal cultural heritage sites

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Figure 7.4

7.7.3 Management, mitigation and monitoring

Management of Aboriginal cultural heritage at Invincible Colliery is undertaken in accordance with an approved ACHMP. As there will be no additional disturbance associated with the modification beyond those previously assessed and approved for disturbance, there will be no additional impacts to Aboriginal cultural heritage items beyond those previously considered.

Any previously un-identified Aboriginal cultural heritage sites discovered during mining in the Southern Extension Area will be managed in accordance with the procedures outlined within the approved ACHMP.

7.7.4 Conclusion

There will be no additional disturbance associated with the modification outside of the approved disturbance area, the modification will therefore not result in any additional impacts to Aboriginal cultural heritage items beyond those previously assessed and approved. Management of Aboriginal heritage sites will continue to be undertaken in accordance with the Invincible Colliery ACHMP.

7.8 Other matters

The following environmental aspects have been considered as part of the modification:

- historic heritage
- biodiversity
- visual
- rehabilitation and final land use.

Consideration of these environmental aspects as previously assessed with consideration to the proposed modification are summarised in Table 7.11.

Table 7.11 **Assessment of other environmental aspects**

Aspect	Assessed impact	Applicability to the modification
Historic heritage	No items of historic heritage are located within the Southern Extension Area.	The proposed modification will not have any impact on historic heritage items.
Biodiversity	Mod 5 to MP07_0127 identified approximately 50 hectares of vegetation would be cleared to facilitate the extension of mining in the Southern Extension Area with no impact to any threatened ecological communities. Biodiversity impacts are to be offset in accordance with the requirements of the Project Approval conditions. Work is being completed to update the Biodiversity Offset Strategy and a modification to the development consent would be required to align the development consent conditions with the proposed Biodiversity Offset Strategy. Castlereagh Coal is targeting submission of the revised Biodiversity Offset Strategy in Q1 2025.	There will be no additional disturbance associated with the modification beyond those previously assessed and approved. Biodiversity impacts will continue to be managed in accordance with the approved.
Visual	Views of mining in the Southern Extension Area will be possible from a number of vantage points along the Castlereagh Highway and elevated areas to the east of Invincible in the Gardens of Stone State Conservation Area. The locations within Ben Bullen State Forest where mining in the Southern Extension Area would be visible are not readily accessible. The existing Invincible operations are currently visible from these locations and views of mining in the Southern Extension Area will be similar to those of the existing operations. Vegetation and topography will screen views of the Southern Extension Area from most locations to the west of the Castlereagh Highway and there is unlikely to be any views of the Southern Extension Area from any residences. The Southern Extension Project includes the progressive rehabilitation of both the existing Invincible open cut mining area and the Southern Extension Area. This rehabilitation will reduce the visual impacts associated with mining at Invincible.	The modification will not result in any changes to visual impacts on the surrounding area than those previously assessed and approved. Rehabilitation of the site will continue to be carried out in accordance with the approved Rehabilitation Management Plan (RMP).
Rehabilitation and final land use	Rehabilitation would continue to be completed in accordance with the existing approved RMP. Castlereagh Coal will adopt a progressive approach to rehabilitation to ensure that completed areas are shaped and vegetated to provide a stable landform. The created landforms will blend with the surrounding landscape. No voids will remain in the rehabilitated final landform. Rehabilitation will return the majority of Invincible Colliery site to native woodland and forest generally consistent with ecological communities that would have historically occurred in the area.	There will be no additional disturbance associated with the modification outside of the approved disturbance area. As such, rehabilitation will continue to be undertaken in accordance with the previously approved RMP.

8 Justification and conclusion

The Invincible Colliery is an existing underground and open cut coal mine approximately 25 km north-west of Lithgow in the Lithgow LGA. The Invincible Colliery operates in accordance with Project Approval (MP07_0127) granted by the then Minister for Planning on 4 December 2008.

Castlereagh Coal is seeking a modification (Mod 6) to Invincible Colliery's project approval to modify Schedule 2, Condition 5 of MP07_0127 to extend the life of mine from 31 December 2025 for a further five years until 31 December 2030. The modification, if approved, will enable continued mining of remaining open cut coal reserves currently approved to be extracted. No highwall or underground mining is proposed to be undertaken during the additional period of time sought by the modification. In addition, Castlereagh Coal is seeking to modify Schedule 2, Condition 7(c) of MP07_0127 to enable flexibility for coal to be transported to other domestic customers in addition to the Shoalhaven Starches plant and MPPS.

Other than as set out above, all activities that are currently approved under MP07_0127 are intended to continue and will remain the same under the modification, including mining methods, annual coal extraction rates, coal processing and handling activities, surface infrastructure and hours of operation. The proposed modification does not require any additional surface disturbance activities beyond those currently assessed and approved to be disturbed.

The modification will enable operations to continue mining to the approved final footprint and secure employment for approximately 50 personnel across Invincible Colliery for a further five years.

The proposed modification is being sought under section 4.55(2) of the EP&A Act on the basis that the development to which the consent as modified relates is substantially the same development. Based on the assessment of environmental impacts presented in Chapter 7 of this report, the modification would result in no or negligible change to previously assessed and approved impacts. GHG emissions were estimated for future projected operations under the modification. There were no years where the *NSW EPA Guide for Large Emitters'* threshold of 25,000 t CO₂-e/year was exceeded and therefore the modification was not considered a large emitter under the guide. The operations at Invincible Colliery will continue to be carried out in accordance with the existing and approved management plans and monitoring programmes in place. On this basis, it is considered that the modification would be in the public interest.

Abbreviations

Aboriginal Cultural Heritage and Archaeological Assessment	ACHAA
Aboriginal Cultural Heritage Management Plan	ACHMP
Air Quality Impact Assessment	AQIA
Bathurst Local Aboriginal Land Council	BLALC
<i>Biodiversity Conservation Act 2016</i>	BC Act
Biodiversity, Conservation and Science	BCS
<i>Central West and Orana Regional Plan 2041</i>	CWORP
Department of Climate Change, Energy, the Environment and Water	DCCEEW
Department of Planning, Housing and Infrastructure	DPHI
EMM Consulting Pty Limited	EMM
<i>Environment Protection and Biodiversity Conservation Act 1999</i>	EPBC Act
Environment Protection Authority	EPA
environment protection licence	EPL
<i>Environmental Planning and Assessment Act 1979</i>	EP&A Act
Environmental Planning and Assessment Regulation 2021	EP&A Regulation
full time equivalent	FTE
groundwater dependent ecosystems	GDEs
kilometres	km
Level of Service	LoS
licensed discharge point	LDP
<i>Lithgow Local Environmental Plan 2014</i>	Lithgow LEP
local government area	LGA
Local Strategic Planning Statement	LSPS
million tonnes	Mt
Mine Development Panel	MDP
Mount Piper Power Station	MPPS
<i>National Parks and Wildlife Act 1974</i>	NPW Act
National Environmental Protection Council of Australia	NEPC
National Environment Protection Measures	NEPM
New South Wales	NSW
Noise Impact Assessment	NIA
potential archaeological deposit	PAD
<i>Protection of the Environment Operations Act 1997</i>	POEO Act

registered Aboriginal party	RAP
Rehabilitation Management Plan	RMP
Run-of-Mine	ROM
Surface Water Assessment	SWA
Traffic Impact Assessment	TIA
tonne	t
Warrabinga Native Title Claimants Aboriginal Corporation	WNTCAC
water access licences	WAL
<i>Water Management Act 2000</i>	WM Act
Water Management Plan	WMP
Water Management System	WMS
Wellington Valley Wiradjuri Aboriginal Corporation	WVWAC

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Umwelt 2016c, *Invincible Southern Extension Project: Aboriginal Cultural Heritage and Archaeological Assessment*

Appendix A

Statutory compliance

Table A.1 **Statutory compliance**

Relevant legislation or instrument	Mandatory consideration	Relevant section in report
<i>Environmental Planning and Assessment Act 1979</i>		
Section 1.3	Objects of Act The objects of this Act are as follows— (a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources, (b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment, (c) to promote the orderly and economic use and development of land, (d) to promote the delivery and maintenance of affordable housing, (e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats, (f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage), (g) to promote good design and amenity of the built environment, (h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants, (i) to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State, (j) to provide increased opportunity for community participation in environmental planning and assessment.	Chapter 5 Chapter 7 Chapter 8

Relevant legislation or instrument	Mandatory consideration	Relevant section in report
Section 4.15	Evaluation (1) Matters for consideration—general In determining a development application, a consent authority is to take into consideration such of the following matters as are of relevance to the development the subject of the development application— (a) the provisions of— (i) any environmental planning instrument, and (ii) any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Planning Secretary has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and (iii) any development control plan, and (iiia) any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4, and (iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph), (v) (Repealed) that apply to the land to which the development application relates, (b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality, (c) the suitability of the site for the development, (d) any submissions made in accordance with this Act or the regulations, (e) the public interest.	Chapter 4 Chapter 5 Chapter 7 Chapter 8

Relevant legislation or instrument	Mandatory consideration	Relevant section in report
Environmental Planning and Assessment Regulation 2021		
Section 98	Modification applications for development (1) A modification application may be made by— (a) the owner of the land to which the modification application relates, or (b) another person, with the consent of the owner of the land. (2) The consent of the owner is not required if the original development application was made, or could have been made, without the consent of the owner. (3) The consent of the owner of the land is not required for a modification application made by a public authority, or a modification application for public notification development, if the applicant complies with subsections (4) and (5). (4) The applicant must give notice of the modification application— (a) to the owner of the land before the modification application is made, or (b) by publishing, no later than 14 days after the modification application is made, a notice in a newspaper circulating in the area in which the development will be carried out.	The modification will be public notification development
Section 99	Making a modification application (1) A modification application must— (a) be in the approved form, and (b) contain all the information and documents required by— (i) the approved form, and (ii) the Act or this Regulation, and (c) be submitted on the NSW planning portal. (2) If the modification application is for State significant development— (a) the application must also include particulars of the nature of the modification, and (b) the applicant must have regard to <i>the State Significant Development Guidelines in preparing the application</i>.	This report

Relevant legislation or instrument	Mandatory consideration	Relevant section in report
Section 100	Content of modification application (1) A modification application must contain the following information— (a) the name and address of the applicant, (b) a description of the development that will be carried out under the development consent, (c) the address and folio identifier of the land on which the development will be carried out, (d) a description of the modification to the development consent, including the name, number and date of plans that have changed, to enable the consent authority to compare the development with the development originally approved, (e) whether the modification is intended to— (i) merely correct a minor error, misdescription or miscalculation, or (ii) have another effect specified in the modification application, (f) a description of the expected impacts of the modification, (g) an undertaking that the modified development will remain substantially the same as the development originally approved, (h) for a modification application that is accompanied by a biodiversity development assessment report—the biodiversity credits information, (i) if the applicant is not the owner of the land—a statement that the owner consents to the making of the modification application, (j) whether the modification application is being made to— (i) the Court under the Act, section 4.55, or (ii) the consent authority under the Act, section 4.56.	This report
Section 103	Modification applications for mining and petroleum development consents (1) This section applies to an application under the Act, section 4.55(2), to modify a development consent that relates to mining or petroleum development on land— (a) shown on the Strategic Agricultural Land Map, or (b) subject to a site verification certificate. (2) The application must be accompanied by— (a) for development on land shown on the Strategic Agricultural Land Map as critical industry cluster land—a current gateway certificate that applies to the development to be carried out under the modified consent, or (b) for development on other land— (i) a current gateway certificate that applies to the development to be carried out under the modified consent, or (ii) a site verification certificate certifying that the land on which the development will be carried out is not biophysical strategic agricultural land. (3) To avoid doubt, <i>State Environmental Planning Policy (Resources and Energy) 2021</i>, Part 2.4, other than Divisions 2 and 5, applies, with necessary modifications, to an application to modify a development consent as if it were a development application.	A Strategic Agricultural Land Map is not required as the proposed modification is within an already approved mining lease area

Relevant legislation or instrument	Mandatory consideration	Relevant section in report
Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017		
Schedule 2, Section 3BA	Winding-up of transitional Part 3A modification provisions on cut-off date of 1 March 2018 and other provisions relating to modifications (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 and whose approval was modified under section 75W.	Chapter 3
Mining Act 1992		
Section 380AA	Restrictions on planning applications for coal mining (1) An application for development consent, or for the modification of a development consent, to mine for coal cannot be made or determined unless (at the time it is made or determined) the applicant is the holder of an authority that is in force in respect of coal and the land where mining for coal is proposed to be carried out, or the applicant has the written consent of the holder of such an authority to make the application. Note— In this Act, development consent means a development consent under <i>the Environmental Planning and Assessment Act 1979</i>, Part 4 or an approval under that Act, Part 3A or Division 5.2. (2) For that purpose, an authority in respect of coal need not be in force in respect of the whole of the land to which the application for development consent relates but must be in force for the land where mining for coal is proposed. (3) For the purposes of this section, an authority that is a mining lease is considered to be in force in respect of the land on which it authorises prospecting or mining for coal, and not in respect of land on which it only authorises the carrying out of ancillary mining activities (and not prospecting or mining for coal). A mining lease is not an authority for the purposes of this section if it is for ancillary mining activities only.	Chapter 5
Protection of the Environment Operations Act 1997		
Section 43	Types of licences Environment protection licences may be issued for the following purposes— (a) to authorise the carrying out of scheduled development work at any premises, as required under section 47, (b) to authorise the carrying out of scheduled activities at any premises, as required under section 48, (c) to authorise the carrying out of scheduled activities not related to premises, as required under section 49, (d) to control the carrying out of non-scheduled activities for the purpose of regulating water pollution resulting from any such activity, as referred to in section 122.	Chapter 5

Relevant legislation or instrument	Mandatory consideration	Relevant section in report
Water Management Act 2000		
Section 89	Water use approvals (1) A water use approval confers a right on its holder to use water for a particular purpose at a particular location. (2) A water use approval may authorise the use within New South Wales of water taken from a water source outside New South Wales.	Chapter 5
Section 90	Water management work approvals (1) There are three kinds of water management work approvals, namely, water supply work approvals, drainage work approvals and flood work approvals. (2) A water supply work approval authorises its holder to construct and use a specified water supply work at a specified location. (3) A drainage work approval confers a right on its holder to construct and use a specified drainage work at a specified location. (4) A flood work approval confers a right on its holder to construct and use a specified flood work at a specified location.	Chapter 5
Section 91	Activity approvals (1) There are two kinds of activity approvals, namely, controlled activity approvals and aquifer interference approvals. (2) A controlled activity approval confers a right on its holder to carry out a specified controlled activity at a specified location in, on or under waterfront land. (3) An aquifer interference approval confers a right on its holder to carry out one or more specified aquifer interference activities at a specified location, or in a specified area, in the course of carrying out specified activities.	Chapter 5
State Environmental Planning Policy (Planning Systems) 2021		
Section 2.1	Aims of Chapter The aims of this Chapter are as follows— (a) to identify development that is State significant development, (b) to identify development that is State significant infrastructure and critical State significant infrastructure, (c) to identify development that is regionally significant development.	Chapter 5

Relevant legislation or instrument	Mandatory consideration	Relevant section in report
State Environmental Planning Policy (Resources and Energy) 2021		
Section 2.1	Aims of Chapter The aims of this Chapter are, in recognition of the importance to New South Wales of mining, petroleum production and extractive industries— (a) to provide for the proper management and development of mineral, petroleum and extractive material resources for the purpose of promoting the social and economic welfare of the State, and (b) to facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources, and (c) to promote the development of significant mineral resources, and (d) to establish appropriate planning controls to encourage ecologically sustainable development through the environmental assessment, and sustainable management, of development of mineral, petroleum and extractive material resources, and (e) to establish a gateway assessment process for certain mining and petroleum (oil and gas) development— (i) to recognise the importance of agricultural resources, and (ii) to ensure protection of strategic agricultural land and water resources, and (iii) to ensure a balanced use of land by potentially competing industries, and (iv) to provide for the sustainable growth of mining, petroleum and agricultural industries.	Chapter 4 Chapter 5 Chapter 7 Chapter 8
Section 2.9	Development permissible with consent (1) Mining Development for any of the following purposes may be carried out only with development consent— (a) underground mining carried out on any land, (b) mining carried out— (i) on land where development for the purposes of agriculture or industry may be carried out (with or without development consent), or (ii) on land that is, immediately before the commencement of this section, the subject of a mining lease under the <i>Mining Act 1992</i> or a mining licence under the <i>Offshore Minerals Act 1999</i>, (c) mining in any part of a waterway, an estuary in the coastal zone or coastal waters of the State that is not in an environmental conservation zone, (d) facilities for the processing or transportation of minerals or mineral bearing ores on land on which mining may be carried out (with or without development consent), but only if they were mined from that land or adjoining land, (e) mining on land that is reserved as a state conservation area under the <i>National Parks and Wildlife Act 1974</i>, (f) extracting a bulk sample as part of resource appraisal of more than 20,000 tonnes of coal or of any mineral ore.	Chapter 5

Relevant legislation or instrument	Mandatory consideration	Relevant section in report
Section 2.16	Non-discretionary development standards for mining (1) The object of this section is to identify development standards on particular matters relating to mining that, if complied with, prevents the consent authority from requiring more onerous standards for those matters (but that does not prevent the consent authority granting consent even though any such standard is not complied with). (2) The matters set out in this section are identified as non-discretionary development standards for the purposes of section 4.15(2) and (3) of the Act in relation to the carrying out of development for the purposes of mining. Note— The development standards do not prevent a consent authority from imposing conditions to regulate project-related noise, air quality, blasting or ground vibration impacts that are not the subject of the development standards.	Chapter 5
Section 2.17	Compatibility of proposed mine, petroleum production or extractive industry with other land uses Before determining an application for consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must— (a) consider— (i) the existing uses and approved uses of land in the vicinity of the development, and (ii) whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to land use trends, are likely to be the preferred uses of land in the vicinity of the development, and (iii) any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses, and (b) evaluate and compare the respective public benefits of the development and the land uses referred to in paragraph (a)(i) and (ii), and (c) evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a)(iii).	Chapter 2 Chapter 4 Chapter 7 Chapter 8

Relevant legislation or instrument	Mandatory consideration	Relevant section in report
Section 2.19	Compatibility of proposed development with mining, petroleum production or extractive industry (1) This section applies to an application for consent for development on land that is, immediately before the application is determined— (a) in the vicinity of an existing mine, petroleum production facility or extractive industry, or (c) identified by an environmental planning instrument as being the location of significant resources of minerals, petroleum or extractive materials. (2) Before determining an application to which this section applies, the consent authority must— (a) consider— (i) the existing uses and approved uses of land in the vicinity of the development, and (ii) whether or not the development is likely to have a significant impact on current or future extraction or recovery of minerals, petroleum or extractive materials (including by limiting access to, or impeding assessment of, those resources), and (iii) any ways in which the development may be incompatible with any of those existing or approved uses or that current or future extraction or recovery, and (b) evaluate and compare the respective public benefits of the development and the uses, extraction and recovery referred to in paragraph (a)(i) and (ii), and (c) evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a)(iii).	Chapter 2 Chapter 4 Chapter 5
Section 2.20	Natural resource management and environmental management (1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring that the development is undertaken in an environmentally responsible manner, including conditions to ensure the following— (a) that impacts on significant water resources, including surface and groundwater resources, are avoided, or are minimised to the greatest extent practicable, (b) that impacts on threatened species and biodiversity, are avoided, or are minimised to the greatest extent practicable, (c) that greenhouse gas emissions are minimised to the greatest extent practicable. (2) Without limiting subsection (1), in determining a development application for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider an assessment of the greenhouse gas emissions (including downstream emissions) of the development, and must do so having regard to any applicable State or national policies, programs or guidelines concerning greenhouse gas emissions.	Chapter 7
Section 2.21	Resource recovery (1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider the efficiency or otherwise of the development in terms of resource recovery. (2) Before granting consent for the development, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at optimising the efficiency of resource recovery and the reuse or recycling of material. (3) The consent authority may refuse to grant consent to development if it is not satisfied that the development will be carried out in such a way as to optimise the efficiency of recovery of minerals, petroleum or extractive materials and to minimise the creation of waste in association with the extraction, recovery or processing of minerals, petroleum or extractive materials.	Chapter 7 Chapter 8

Relevant legislation or instrument	Mandatory consideration	Relevant section in report
Section 2.22	Transport (1) Before granting consent for development for the purposes of mining or extractive industry that involves the transport of materials, the consent authority must consider whether or not the consent should be issued subject to conditions that do any one or more of the following— (a) require that some or all of the transport of materials in connection with the development is not to be by public road, (b) limit or preclude truck movements, in connection with the development, that occur on roads in residential areas or on roads near to schools, (c) require the preparation and implementation, in relation to the development, of a code of conduct relating to the transport of materials on public roads. (2) If the consent authority considers that the development involves the transport of materials on a public road, the consent authority must, within 7 days after receiving the development application, provide a copy of the application to— (a) each roads authority for the road, and (b) the Roads and Traffic Authority (if it is not a roads authority for the road). Note— Section 7 of the <i>Roads Act 1993</i> specifies who the roads authority is for different types of roads. Some roads have more than one roads authority. (3) The consent authority— (a) must not determine the application until it has taken into consideration any submissions that it receives in response from any roads authority or the Roads and Traffic Authority within 21 days after they were provided with a copy of the application, and (b) must provide them with a copy of the determination. (4) In circumstances where the consent authority is a roads authority for a public road to which subsection (2) applies, the references in subsections (2) and (3) to a roads authority for that road do not include the consent authority.	Chapter 7
Section 2.23	Rehabilitation (1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring the rehabilitation of land that will be affected by the development. (2) In particular, the consent authority must consider whether conditions of the consent should— (a) require the preparation of a plan that identifies the proposed end use and landform of the land once rehabilitated, or (b) require waste generated by the development or the rehabilitation to be dealt with appropriately, or (c) require any soil contaminated as a result of the development to be remediated in accordance with relevant guidelines (including guidelines under section 3 of Schedule 6 to the Act and the <i>Contaminated Land Management Act 1997</i>), or (d) require steps to be taken to ensure that the state of the land, while being rehabilitated and at the completion of the rehabilitation, does not jeopardize public safety.	Chapter 7

Relevant legislation or instrument	Mandatory consideration	Relevant section in report
Lithgow LEP		
Section 2.3	Zone objectives and Land Use Table (2) The consent authority must have regard to the objectives for development in a zone when determining a development application in respect of land within the zone.	Chapter 5
Section 7.10	Essential services Development consent must not be granted to development unless the consent authority is satisfied that any of the following services that are essential for the development are available or that adequate arrangements have been made to make them available when required— (a) the supply of water, (b) the supply of electricity, (c) the disposal and management of sewage, (d) stormwater drainage or on-site conservation, (e) suitable vehicular access.	The modification is requesting an extension of time only and no other changes to critical infrastructure. Supply of water and electricity is considered to be secure for the duration of the proposed extension

Appendix B

Mitigation measures

B.1 Summary of mitigation measures

Table B.1 provides a summary of mitigation measures relevant to this modification.

Table B.1 Summary of mitigation measures

Updated mitigation measures
Traffic Management
Traffic would continue to be carried out in accordance with its transport management plan that identified a range of traffic management and mitigation measures plus performance and compliance indicators utilised to measure effectiveness and monitor compliance associated with transport safety. The existing transport management plan would be updated to take into consideration the outcomes from the TIA. Additionally, advanced intersection warning signs would be installed for both northbound and southbound traffic on Castlereagh Highway.
Noise and Vibration
A range of noise management and mitigation measures would continue to be implemented at Invincible Colliery in accordance with the Noise Management Plan, which includes the following: • Utilising meteorological data and forecasts to provide site personnel with information on daily environmental risks associated with noise. • Managing mobile machines during adverse weather conditions when wind conditions enhance the noise propagation towards sensitive receiver locations. • Conducting regular inspections and maintenance of existing noise attenuation systems via maintenance inspections. • Considering noise minimisation when selecting new plant and equipment. • Maintaining product stockpiles in strategic locations, where practical, to shield product trucks and product loading equipment from receivers. • Implementation of broad band reversing alarms instead of beeper style alarms on all mobile equipment.
Greenhouse Gas
The proposed GHG management measures to reduce Scope 1 and 2 emissions include the following: • All adits are sealed thus restricting fugitive methane and carbon dioxide emissions. • Ensure that all equipment will be serviced and maintained according to manufacturers' specifications. • Perform pre-start inspections at each shift on mobile plant and vehicles to confirm they are operating efficiently. • Idling of diesel equipment will be minimised wherever feasible. • Haul route distances are minimised. • Fuel use is tracked daily. • Revegetation plan in place. • Daily gas samples conducted. • Induction process includes training on best practices to reduce GHG emissions.

Updated mitigation measures

Air Quality

Predictive and proactive management measures include the following:

- Use of forecast weather conditions to inform on site activities.
- Development of a mine plan that allows for progressive rehabilitation of the Southern Extension Area and the previously mined areas.
- Minimising the length of haul roads (where practicable) and adopting controls for haul road dust emissions.
- Minimising the area of disturbed land at any one time as much as practicable.
- Using temporary rehabilitation and stabilisation measures on disturbed land.

Reactive management measures include:

- Following a complaint, appropriate action will be taken within one working day to determine the cause of the complaint and identify appropriate actions to remediate the complaint source.
- If air quality monitoring indicates that the air quality criteria has been exceeded, an investigation would be completed and action plan developed to reduce the exceedance to acceptable levels as soon as possible.
- During times when extraordinary events are forecast or observed, it is the Mine Manager's responsibility to limit or modify operations as required to ensure that air quality impacts are limited as much as practically possible.

Surface Water

Surface water will continue to be managed in accordance with the existing approved WMS and associated erosion and sediment control measures as detailed within the Invincible Colliery Water Management Plan and requirements of the EPL.

Water take will continue under existing WAL entitlements. All results will continue to be reported in the Annual Review.

Groundwater

Surface water will continue to be managed in accordance with the existing approved WMS and associated dewatering strategies as mentioned in Section 7.5.

Invincible Colliery will continue to monitor and manage groundwater in accordance with the objectives of the Invincible Colliery WMP.

Aboriginal Heritage

Management of Aboriginal cultural heritage will continue to be undertaken in accordance with the existing approved Aboriginal Cultural Heritage Management Plan. Any previously un-identified Aboriginal cultural heritage sites discovered during mining in the Southern Extension Area will be managed in accordance with the procedures outlined within the approved Aboriginal Cultural Heritage Management Plan.

Historic Heritage

There are no items of historic heritage located within the Southern Extension Area; therefore, no mitigation measures are considered required for this aspect.

Biodiversity

Biodiversity impacts are to be offset in accordance with the requirements of the Project Approval conditions.

Visual

Progressive rehabilitation of both the existing Invincible open cut mining area and the Southern Extension Area will continue to reduce potential visual impacts associated with mining at Invincible Colliery.

Rehabilitation and final land use

Rehabilitation would continue to be completed in accordance with the existing approved Rehabilitation Management Plan.

A progressive rehabilitation approach would continue to ensure that completed areas are shaped and vegetated to provide a stable landform. No voids will remain in the rehabilitated final landform. Rehabilitation will return the majority of Invincible Colliery to native woodland and forest generally consistent with ecological communities that would have historically occurred in the area.

Appendix C

Traffic impact assessment

Cullen Valley Mine Mod 5 and Invincible Colliery Mod 6

Traffic Impact Assessment

Prepared for Castlereagh Coal

January 2025

Cullen Valley Mine Mod 5 and Invincible Colliery Mod 6

Traffic Impact Assessment

Castlereagh Coal

E240039 RP1

January 2025

Version	Date	Prepared by	Reviewed by	Comments
V0.1	21/11/2024	Fan Fang	Abdullah Uddin	

Approved by



Abdullah Uddin

Associate Traffic

7 January 2025

Ground floor 20 Chandos Street

St Leonards NSW 2065

ABN: 28 141 736 558

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Executive Summary

Castlereagh Coal is seeking to modify the development consent for Cullen Valley Mine (DA 200-5-2003) and the Invincible Colliery (MP07_0127). These modifications are referred to as Cullen Valley Mine Mod 5 and Invincible Colliery Mod 6. This report presents a traffic impact assessment (TIA) for the proposed modifications.

The current approvals for both Cullen Valley Mine and Invincible Colliery are provided in Table ES1 whilst the modifications that are being sought are provided in Table ES2.

Table ES1 **Current Approved Operations**

Site	Approval	Approved operations
Cullen Valley Mine	DA 200-5-2003	- open cut and underground mining operations up until 19 August 2025 - production of up to 1 million tonnes (Mt) of product coal per calendar year from the site - transportation of no more than 250,000 tonnes (t) of product coal a year by road to domestic destinations other than the Mount Piper Power Station.
Invincible Colliery	MP 07-0127	- open cut mining operations up until 31 December 2025 - extraction and transport of up to 1.2 Mt of product coal per calendar year from the site - transportation of coal by road to the Shoalhaven Starches plant near Nowra and to Mount Piper Power Station - continued use of existing coal processing and surface infrastructure - rehabilitation of site.

Table ES2 **Proposed modifications**

Site	Proposed modification
Cullen Valley Mine	- Extend the Life-of-Mine for a further five years, from 19 August 2025 until 19 August 2030. - Amend current development consent area to include water management infrastructure that are currently outside development consent boundary.
Invincible Colliery	- Extend the Life-of-Mine for a further five years, from 31 December 2025 until 31 December 2030. - Enable flexibility for coal to be transported to other domestic customers in addition to the Shoalhaven Starches Plant and Mount Piper Power Station. - Increase the approved full time equivalent (FTE) workforce from 35 personnel to 50 personnel.

This TIA was prepared in accordance with the requirements of the following relevant guidelines:

- *Transport for NSW's Guide to Transport Impact Assessment (2024).*
- *Austroads Guide to Road Design Part 4a: Unsignalised & Signalised Intersections, October 2010 (Austroads, 2023).*
- *Austroads Guide to Traffic Management Part 12: Integrated Transport Assessments for Developments, April 2020 (Austroads, 2020).*

The methodology for the TIA involved the following:

- Collection of traffic volumes to allow assessment against the baseline (existing and scaled to 2030) condition and to provide a detailed assessment for the section of Castlereagh Highway between Carsons Siding Road (north) and Boulder Road (south) which is the main travel route for both Invincible Colliery and Cullen Valley Mine.
- Consideration of traffic of both mines running concurrently in the year 2030.
- Assessment of key intersections along the Castlereagh Highway, specifically, where it intersects with Carson Sliding Road, Cullen Valley Mine Access Road, Invincible Colliery Access Road, Ivanhoe Mine Access Road and Boulder Road.

This modification application does not seek any increase in production of these mines nor any associated increase in coal transport traffic volumes. The TIA also considered the potential impacts of coal being transported to other domestic customers to support the proposed modification for Invincible Colliery.

The outcomes of the assessment are as follows:

- All key intersections will remain at Level of Service (LOS) A with the projected production traffic volumes in all scenarios. The intersections will not be adversely affected by these modifications.
- The Castlereagh Highway and Carsons Siding Road intersection has sufficient shoulder width which acts as a defacto BAR treatment. Therefore, it is recommended that 'No Parking' signs are to be installed on the eastern side of Castlereagh Highway, opposite to Carsons Siding Road to ensure a southbound through vehicle can pass through this intersection while there is another vehicle waiting to turn right from Castlereagh Highway to Carsons Siding Road. It is important to note that this is an existing deficiency which is not caused by the proposed modifications.
- The sight distance requirement to the right from Carsons Siding Road to Castlereagh Highway is limited due to the road's curvature and elevation changes. It is recommended that an intersection warning sign be installed on the western side of Castlereagh Highway, on approach to the Carsons Siding Road intersection to alert motorists about the presence of this intersection. It is important to note that this is an existing deficiency which is not caused by the proposed modifications.
- The project is not expected to impact public transport, pedestrians or cyclists activity in the locality.
- Car parking will be provided on-site during operation. Cars will not be parked on any public roads.

Based on our assessment, it can be concluded that the proposed modifications will not significantly impact the adjoining road networks or existing traffic flow conditions.

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Abbreviations

Abbreviation	Full name
AUL	Auxiliary left turn
AUL(s)	Auxiliary left turn (shortened)
AUR	Auxiliary right turn
BAL	Basic left turn
BAR	Basic right turn
CHL	Channelised left turn
CHR	Channelised right turn
CHR(s)	Channelised right turn (shortened)
DCC	Drivers Code of Conduct
DOS	Degree of Saturation
DEL	Average Delay
EIS	Environmental Impact Statement
EP&A	Environmental Planning and Assessment
HV	Heavy vehicles
LGA	Local government area
LOS	Level of Service
LV	Light vehicles
MOD	Modification
NSW	New South Wales
OSOM	Oversize over mass (vehicle)
Q95	95% queue lengths
RTA	(NSW) Roads and Traffic Authority (now TfNSW)
SIDRA	Signalised and unsignalised Intersection Design and Research Aid (traffic engineering software)
SISD	Safe intersection sight distance
SSI	State significant Infrastructure
TIA	Traffic Impact Assessment
TfNSW	Transport for New South Wales
TMP	Traffic Management Plan

1 Introduction

1.1 Background

Castlereagh Coal is seeking to modify the development consent for Cullen Valley Mine (DA 200-5-2003) and the Project Approval for Invincible Colliery (MP07_0127). These modifications are referred to as Cullen Valley Mine Mod 5 and Invincible Colliery Mod 6.

The proposed modification for Cullen Valley Mine aims to extend its operational life from 19 August 2025 to 19 August 2030, facilitating the extraction of remaining open-cut coal reserves currently approved. No changes are proposed to the mining methods, annual coal extraction rates, coal processing and handling activities, surface infrastructure, or operating hours. Additionally, the modification does not involve any new surface disturbance beyond the areas already assessed and approved. Underground mining activities are not proposed during the modification period but may be subject to future feasibility reviews and approvals if required.

For Invincible Colliery, Castlereagh Coal seeks to extend its operational life from 31 December 2025 to 31 December 2030 (Schedule 2, Condition 5 of MP07_0127). The modification would also allow for increased flexibility in coal transportation, enabling delivery to additional domestic customers beyond the Shoalhaven Starches Plant and Mount Piper Power Station (Schedule 2, Condition 7(c) of MP07_0127). All other approved activities, including mining methods, coal extraction rates, processing, handling, infrastructure, and operating hours, will remain unchanged. The modification does not require any additional surface disturbance beyond what is already approved.

The proposed modifications for both mines are provided in Table 1.1 below.

Table 1.1 **Proposed modifications**

Site	Proposed modification
Cullen Valley Operation	• Extend the Life-of-Mine for a further five years, from 19 August 2025 until 19 August 2030. • Amend current development consent area to include water management infrastructure that are currently outside development consent boundary.
Invincible Colliery	• Extend the Life-of-Mine for a further five years, from 31 December 2025 until 31 December 2030. • Enable flexibility for coal to be transported to other domestic customers in addition to the Shoalhaven Starches Plant and Mount Piper Power Station. • Increase the approved full time equivalent (FTE) workforce from 35 personnel to 50 personnel.

1.2 Purpose and scope

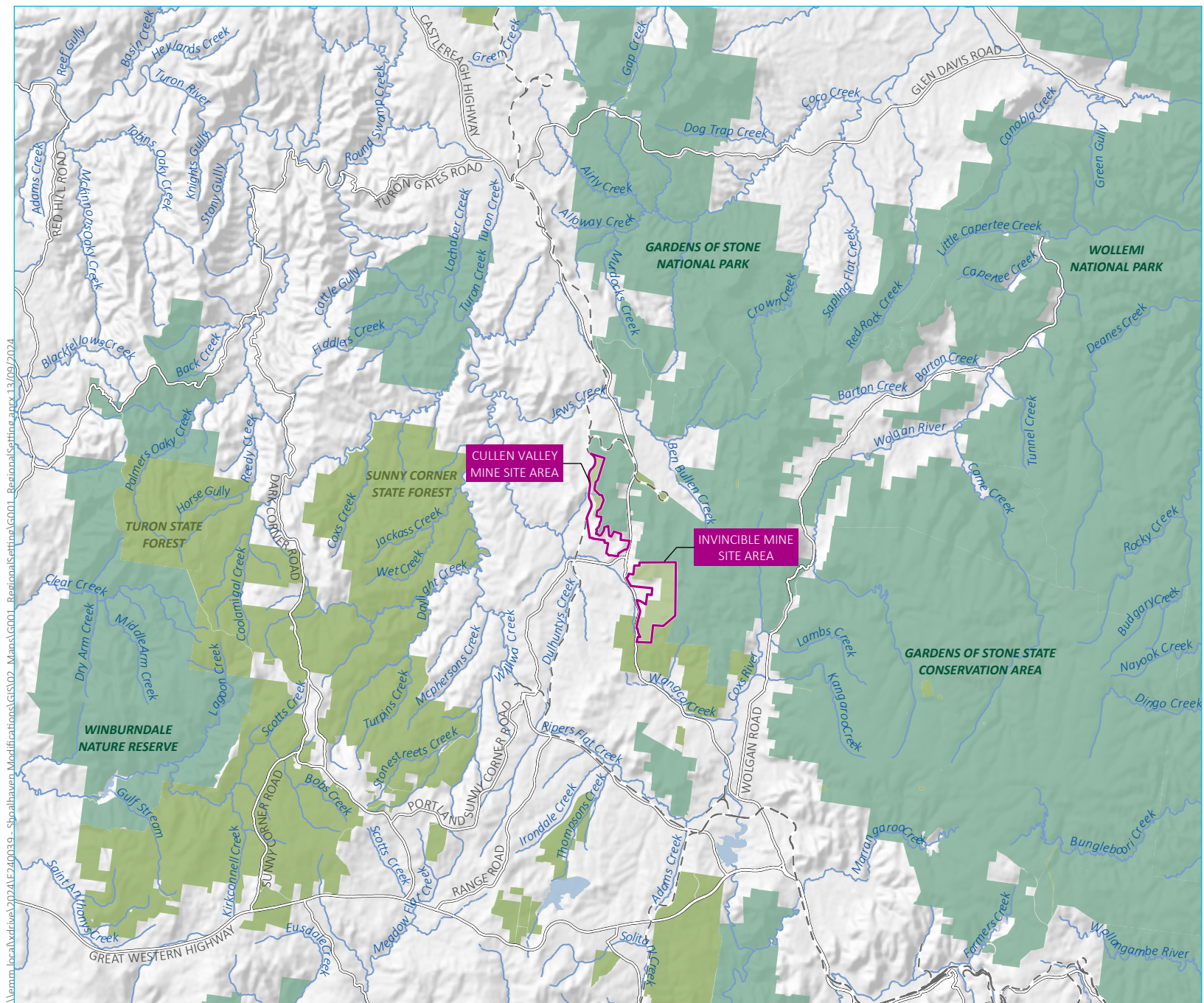
This Traffic Impact Assessment (TIA) is an appendix to the Project's modification report and should be read in conjunction with it. The TIA addresses the requirements of Section 100 of the *Environmental Planning and Assessment Regulation 2021* (EP&A Regulation).

This TIA has been prepared in accordance with:

- *Transport for NSW's Guide to Transport Impact Assessment* (2024).
- *Austroads Guide to Road Design Part 4a: Unsignalised & Signalised Intersections*, (Austroads, 2023).
- *Austroads Guide to Traffic Management Part 12: Integrated Transport Assessments for Developments, April 2020* (Austroads, 2020).

This report comprises the following sections:

- a description of the project, local setting and surrounds
- consideration of existing traffic volumes and results of traffic surveys
- description of project and operational activities and estimates of associated project traffic volumes
- identification and consideration of nearby developments and cumulative traffic
- consideration of future intersection and road upgrade requirements and maintenance impacts.

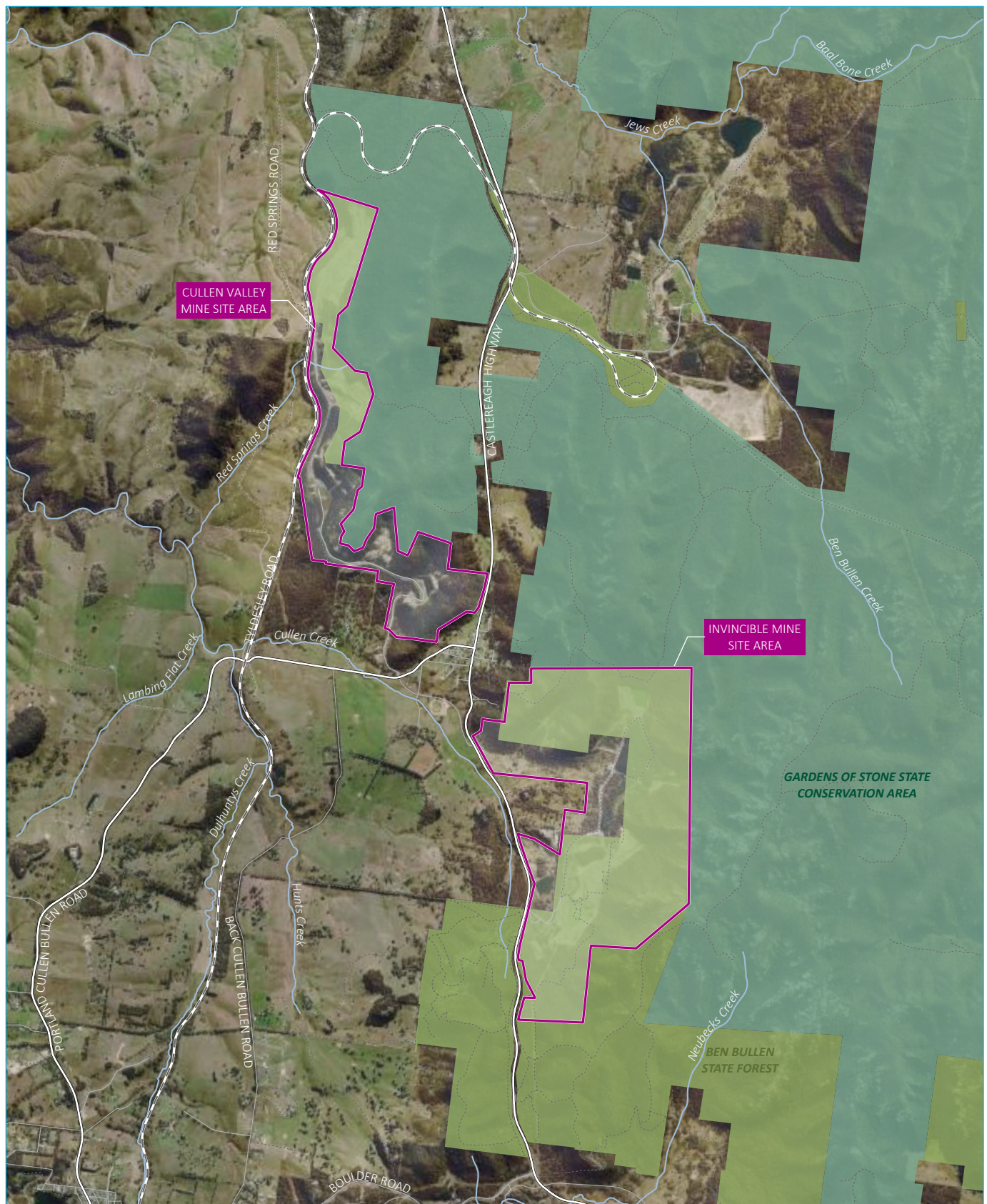


KEY

- Project area
 - Existing environment
 - Rail line
 - Major road
 - Named watercourse
 - Named waterbody
 - NPWS reserve
 - State forest
- #### INSET KEY
- NPWS reserve
 - State forest

Regional setting

Shoalhaven Modification
Traffic Impact Assessment
Figure 1.1



KEY

- | | |
|--|---|
| Project area | Vehicular track |
| Existing environment | Named watercourse |
| Rail line | State forest |
| Major road | NPWS reserve |
| Minor road | |

Local setting

Shoalhaven Modification
Traffic Impact Assessment
Figure 1.2

2 Current approval

2.1 Cullen Valley mine

The Cullen Valley Mine is an existing underground and open cut coal mine located approximately 30 kilometres (km) north-west of Lithgow in New South Wales (NSW). Cullen Valley Mine operates in accordance with development consent (DA 200-5-2003) granted by the then Department of Infrastructure and Planning (now the Department of Planning, Housing and Infrastructure) in August 2004. The development consent has been modified on one occasion (Mod 1) in December 2004, which authorised the transportation of product coal from the Cullen Valley Mine by truck to domestic destinations other than the Mount Piper Power Station.

The development consent as modified, authorises, amongst other things:

- open cut and underground mining operations up until 19 August 2025
- production of up to 1 million tonnes (Mt) of product coal per calendar year from the site
- transportation of no more than 250,000 tonnes (t) of product coal a year by road to domestic destinations other than the Mount Piper Power Station.

Despite significant coal reserves remaining, the Cullen Valley Mine was placed into care and maintenance in 2013. Mining operations to extract remnant coal from approved open cut mining areas recommenced at the Cullen Valley Mine in May 2022. Approximately 700,000 t of remnant open cut coal reserves remain to be extracted from the approved open cut mining areas. No extraction of coal in the approved underground mining area (authorised by DA 200-5-2003) has commenced.

2.2 Invincible colliery

The Invincible Colliery (Invincible) is an existing open cut coal mine located approximately 25 km north-west of Lithgow in NSW. Invincible operates in accordance with Project Approval MP 07_0127 granted by the then Minister for Planning, on 4 December 2008. The Project Approval has been subsequently modified on five occasions, with the last modification (Mod 5) approved by the then NSW Planning and Assessment Commission (PAC) on 2 February 2018. Mining operations at Invincible recommenced in accordance with Project Approval MP 07_0127 in July 2023 after being in care and maintenance since 2012.

The Project Approval, as modified, authorises, amongst other things:

- open cut mining operations up until 31 December 2025
- extraction and transport of up to 1.2 Mt of product coal per calendar year from the site
- transportation of coal by road to the Shoalhaven Starches plant near Nowra and to Mount Piper Power Station
- continued use of existing coal processing and surface infrastructure
- rehabilitation of site.

3 Existing conditions

3.1 Site locations and accesses

The site access points for Cullen Valley Mine and Invincible Colliery from Castlereagh Highway are detailed in Figure 3.1, Plate 3.4 and Plate 3.5. The Cullen Valley Mine Access Road is publicly accessible up to the Carsons Siding Road/Cullen Valley Mine intersection, while the Invincible Colliery Access Road remains private.

3.2 Road network

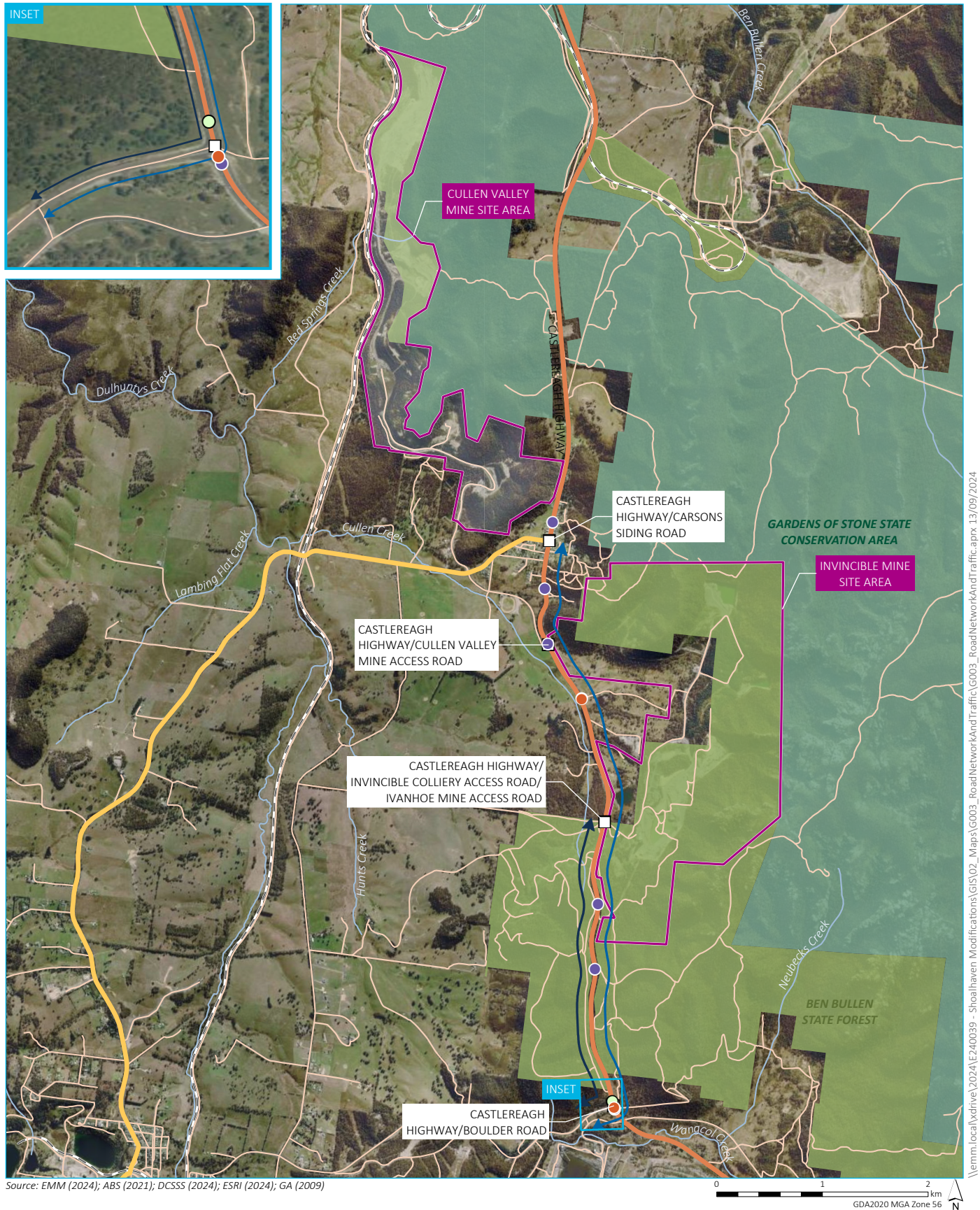
The NSW administrative road hierarchy comprises the following road classifications, which align with the generic road hierarchy as follows:

- state roads – freeways and primary arterials (TfNSW managed)
- regional roads – secondary or sub arterials (council managed and part funded by the State)
- local roads – collector and local access roads (council managed).

The key roads in the vicinity of the project and their administrative hierarchy are shown in Figure 3.1 and the subsequent tables.

The proposed coal transport route is also shown in Figure 3.1 and is approved for use by OSOM vehicles and 26 m long B-double trucks.

The key roads of relevance to the proposed modification works and their traffic characteristics are described in Table 3.1 and Table 3.2 and shown in Plate 3.1 and Plate 3.2.



KEY

 Project area	Degree of crash (site vicinity only)
 Key intersection	● Serious
Existing environment	● Moderate
 Rail line	○ Non-casualty
— Named watercourse	NSW classified road
 State forest	— State road
 NPWS reserve	— Regional road
	— Local road

Truck haulage route

- ↔ Cullen Valley Mine to Mt Piper Power Station
- ↔ Invincible Colliery to Mt Piper Power Station

Road network and traffic characteristics

Shoalhaven Modification
Traffic Impact Assessment
Figure 3.1

Table 3.1 **Castlereagh Highway (B55)**

Aspect	Description
Road classification and connectivity	State road which passes a few local and regional towns such as Cullen Bullen, Capertee, Mudgee, Gulgong.
Alignment	Generally north – south
Number of lanes	One lane each way, excluding near the intersections
Carriageway type	Sealed road
Carriageway width	Approximately 6.3 to 7.0 metres wide (measured on metromap)
Posted speed limit	100 km/hr general speed
Heavy vehicle access	Approved route for up to 26 m B-doubles Approved OSOM vehicle route
Traffic function	Provides connection between townships, acts as an urban local road within towns.



Source: Metromap

Plate 3.1 **Castlereagh Highway (looking north from between Boulder Road and Invincible Colliery Access Road)**

Table 3.2 **Boulder Road**

Aspect	Description
Road classification and connectivity	Local road which passes Mount Piper Power Station and leads to the township of Portland.
Alignment	Generally east – west
Number of lanes	<u>Between Castlereagh Highway & Frankfort Road</u> • One lane heading west • Two lanes heading east <u>Between Frankfort Road and western end</u> • One lane each way
Carriageway type	Sealed road
Carriageway width	<u>Between Castlereagh Highway & Frankfort Road</u> • Approximately 10.5 m wide (measured on metromap) <u>Between Frankfort Road and western end</u> • Approximately 7.0 m wide (measured on metromap)
Posted speed limit	<u>Between Castlereagh Highway & Frankfort Road</u> • 60 km/hr general speed <u>Between Frankfort Road and western end</u> • 80 km/hr general speed
Heavy vehicle access	Access for vehicles up to 19 m long and over 50 tonnes
Traffic function	Provides connection between townships Provides access to Mount Piper Power Station



Source: Metromap

Plate 3.2 **Boulder Road (looking west near Castlereagh Highway/Boulder Road intersection)**

3.3 Key intersections

The following four intersections are of relevance due to project traffic generated from the modifications (from north to south):

1. Castlereagh Highway/Carsons Siding Road
2. Castlereagh Highway/Cullen Valley Mine Access Road
3. Castlereagh Highway/Invincible Colliery Access Road/Ivanhoe Mine Access Road
4. Castlereagh Highway/Boulder Road.

A description and layout of each intersection is provided in the following tables and its associated plate.

Table 3.3 **Castlereagh Highway/Carsons Siding Road intersection**

Aspect	Description
Location from the site	Approximately 6 km north of the Mount Piper Power Station. Approximately 1 km east of the Cullen Valley Mine.
Intersection control	Priority controlled T-intersection (give way)
Major Road	Castlereagh Highway
North approach	One approach and one departure lane plus sealed shoulder for parking
South approach	One approach and one departure lane plus sealed shoulder for parking
West approach	One approach and one departure lane
Pedestrian connectivity	There is no pedestrian connectivity between the footpaths at the approach roads to this intersection.
Traffic function	Predominantly carries regional traffic Provides light vehicle access to Cullen Valley Mine and access to Cullen Bullen township
Speed limit	50 km/h on Castlereagh Highway (40 km/h during school hours) 50 km/h on Carsons Siding Road (40 km/h during school hours)
Additional comments	Lies adjacent to Cullen Bullen Public School, a service road on the western side of the Highway, provides separate vehicle access to the school



Source: Metromap

Plate 3.3 **Castlereagh Highway/Carsons Siding Road intersection**

Table 3.4 **Castlereagh Highway/Cullen Valley Mine Access Road intersection**

Aspect	Description
Location from the site	Approximately 5 km north of the Mount Piper Power Station. Approximately 1.2 km south of the Cullen Valley Mine.
Intersection control	Priority controlled T-intersection (give way)
Major Road	Castlereagh Highway
North approach	On approach one right turning lane and one through lane On departure one through lane
South approach	On approach one left turning lane and one through lane On departure one merging lane and one through lane
West approach	One approach and one departure lane
Pedestrian connectivity	There is no pedestrian connectivity at this intersection
Traffic function	Predominantly carries regional traffic Provides heavy vehicle access to Cullen Valley Mine
Speed limit	50 km/h on Castlereagh Highway heading north 100 km/h on Castlereagh Highway heading south 60 km/h on Cullen Valley Mine Access Road
Additional comments	This seagull intersection is constructed primarily to provide heavy vehicle access to the mines located west of Castlereagh Highway.



Source: Metromap

Plate 3.4 **Castlereagh Highway/Cullen Valley Mine Access Road intersection**

Table 3.5 **Castlereagh Highway/Invincible Colliery Access Road/Ivanhoe Mine Access Road intersection**

Aspect	Description
Location from the site	Approximately 3.5 km north of the Mount Piper Power Station. Adjacent to the Invincible Colliery.
Intersection control	Priority controlled T-intersection (give way)
Major Road	Castlereagh Highway
North approach	One approach and one departure lane
East approach	One approach and one departure lane
South approach	On approach one right turning lane and one through lane On departure two through lanes
Pedestrian connectivity	There is no pedestrian connectivity at this intersection.
Traffic function	Predominantly carries regional traffic Provides heavy vehicle access to the Invincible Colliery
Speed limit	100 km/h on Castlereagh Highway 50 km/h on Invincible Colliery Access Road (assumed) 50 km/h on Ivanhoe Mine Access Road (assumed)



Source: Metromap

Plate 3.5 **Castlereagh Highway/Invincible Colliery Access Road/Ivanhoe Mine Access Road intersection**

Table 3.6 **Castlereagh Highway/Boulder Road intersection**

Aspect	Description
Location from the site	Approximately 5.7 km south of the Cullen Valley Mine. Approximately 2.7 km south of the Invincible Colliery. Adjacent to Mount Piper Power Station.
Intersection control	Priority controlled T-intersection (give way)
Major Road	Castlereagh Highway
North approach	On approach one right turning lane and one through lane On departure one left turning lane and one through lane
South approach	On approach one left turning lane and one through lane On departure one through lane
West approach	On approach one left turning lane and one right turning lane On departure one lane
Pedestrian connectivity	There is no pedestrian connectivity at this intersection.
Traffic function	Predominantly carries regional traffic Provides vehicular access to the Mount Piper Power Station
Speed limit	100 km/h on Castlereagh Highway 60 km/h on Boulder Road



Source: Metromap

Plate 3.6 **Castlereagh Highway/Boulder Road intersection**

3.4 Existing traffic volumes

The key intersections (refer Section 3.3) were surveyed on Tuesday, 30 July 2024 between 6:00 am to 9:00 am and 3:00 pm to 6:00 pm during a non-school holiday period. The peak hours for the four intersections are summarised in Table 3.7.

The surveyed intersection traffic volumes during the AM and PM peak hours are summarised in Figure 3.2.

Table 3.7 Intersection peak hours

Intersection	AM peak hour	PM peak hour
Castlereagh Highway/Carsons Siding Road	7:00 am to 8:00 am	3:00 pm to 4:00 pm
Castlereagh Highway/Cullen Valley Mine Access Road	7:30 am to 8:30 am	3:00 pm to 4:00 pm
Castlereagh Highway/Invincible Colliery Access Road/Ivanhoe Mine Access Road	7:15 am to 8:15 am	3:00 pm to 4:00 pm
Castlereagh Highway/Boulder Road	6:00 am to 7:00 am	3:00 pm to 4:00 pm

The traffic count data are attached in Appendix A.

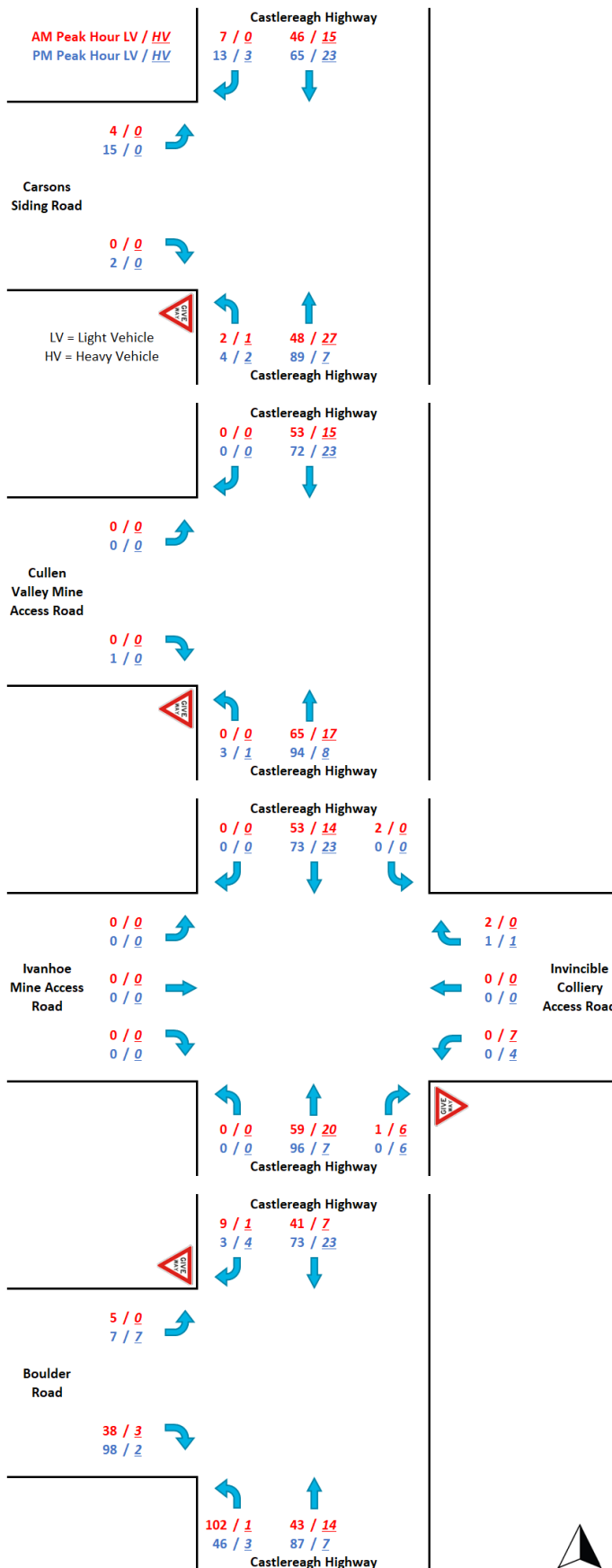


Figure 3.2 2024 existing peak hour intersection volumes

The above figure shows that in Castlereagh Highway, traffic is generally balanced during the AM peak hour but there is dominant northbound flow during the PM peak hour.

3.5 Crash data analysis

Crash data in the vicinity of the site is available from TfNSW Centre for Road Safety website (TfNSW 2024) in the five-year period from 2018 to 2022 (inclusive).

The crashes are categorised based on the severity of the crashes:

- fatal
- serious injury
- moderate injury
- minor/other injury
- non-casualty (towaway).

A total of 9 crashes were found to have occurred on the road network. The distribution of the crashes is presented in Figure 3.1 and summarised in Table 3.8.

Table 3.8 Crash data summary on the road network

Type of crash	Severity of injury				
	Non-casualty	Minor	Moderate	Serious	Fatal
Castlereagh Highway					
Overtake turning			1		
Run off road			1		
Run off road into object				2	
Head on			2		
Out of control			2		
Lane sideswipe	1				
Total	1	0	6	2	0

The 9 crashes identified resulted in two serious injuries, six moderate injuries and one crashes that did not cause any injuries. There were no fatalities recorded.

There were no crashes at any of the key intersections mentioned in Section 3.3. Hence, the road network adjacent to the site can generally be considered safe.

3.6 Public transport

3.6.1 Trains

There is no nearby train station within the proximity of the project area.

3.6.2 Buses

i Regional coach services

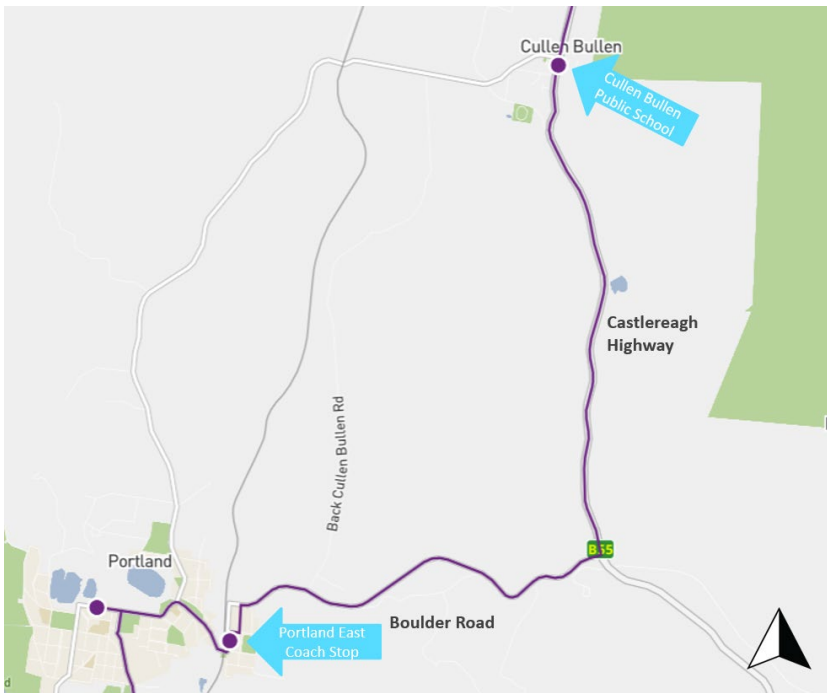
Regional coach services are available within the project area, beginning at Lithgow train station and extending to townships such as Gulgong, Coonabarabran, and Baradine, with stops in towns along the route including Wallerawang, Portland, Cullen Bullen, Ben Bullen, and Mudgee. Coach services must be booked in advance and operate on specific days of the week.

The coach routes that travel along Castlereagh Highway are listed below:

- 539 Lithgow to Coonabarabran
- 540 Coonabarabran to Lithgow
- 541 Lithgow to Gulgong
- 543 Lithgow to Gulgong
- 544 Gulgong to Lithgow
- 545 Lithgow to Coonabarabran
- 546 Coonabarabran to Lithgow
- 547 Lithgow to Coonabarabran
- 549 Lithgow to Coonabarabran
- 573 Lithgow to Baradine
- 574 Baradine to Lithgow
- 575 Lithgow to Gulgong
- 576 Gulgong to Lithgow

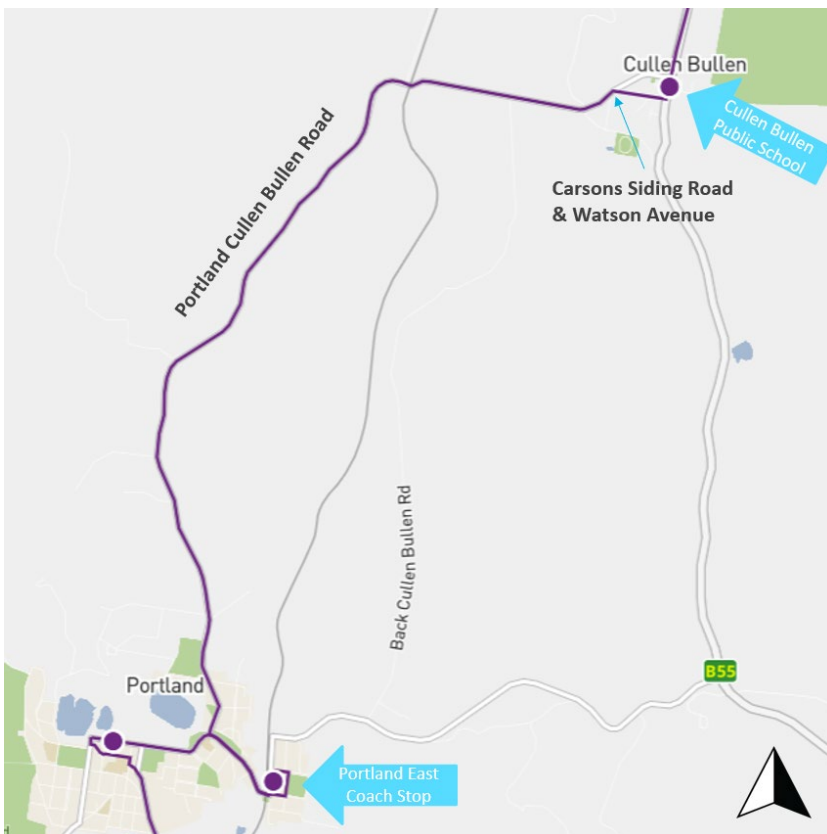
Services travelling northbound from Portland to Cullen Bullen follow Boulder Road and Castlereagh Highway (see Figure 3.3). Southbound services from Cullen Bullen to Portland use Castlereagh Highway, Watson Avenue, and Carsons Siding Road (see Figure 3.4).

These routes are serviced by TfNSW. The regional map for the routes (updated 1 July 2023) is shown in Figure 3.5.



Source: TfNSW

Figure 3.3 Northbound route from Portland to Cullen Bullen



Source: TfNSW

Figure 3.4 Southbound route from Cullen Bullen to Portland



Source: TfNSW

Figure 3.5 Regional coach service map

3.6.3 School buses

School bus services provided by TfNSW are available within the project area, beginning at Lithgow train station and extending to Capertee with stops in towns along the route including Wallerawang, Portland, Cullen Bullen and Ben Bullen.

The bus routes that travel along Castlereagh Highway are listed below:

- S358 Zebra Bus – Hampton Public to Rydal via Jenolan Caves Road
- S358 Zebra Bus – Rydal to Hampton Public via Jenolan Caves Road
- S366 Hippo Bus – Lithgow Schools to Capertee via Lidsdale
- S366 Hippo Bus – Capertee to Lithgow Schools via Lidsdale

Similarly to the regional coach services, services travelling northbound from Portland to Cullen Bullen follow Boulder Road and Castlereagh Highway (see Figure 3.3). Southbound services from Cullen Bullen to Portland use Castlereagh Highway, Watson Avenue, and Carsons Siding Road (see Figure 3.4).

Furthermore, Lithgow Buslines provides special school bus services, offering transportation to schools from the Portland to the Capertee area.

It should be noted that services traveling to the Cullen Bullen Public School coach stop via Castlereagh Highway may be impacted by project-related traffic.

3.7 Active transport

Footpaths are located on the southern side of Carsons Siding Road, providing access to residences, the playground, and the school.

No other active transport is available within the vicinity of the site.

3.8 Onsite parking

Due to the rural nature of the area, there is no on street parking demand. Hence, no on street parking is provided along Castlereagh Highway or any of the adjoining public roads.

3.9 Existing operation of the mines

A traffic survey of the project area was conducted on Tuesday, 30 July 2024. During the survey, the Cullen Valley Mine was closed. Despite this, some heavy vehicle movements were observed at the Castlereagh Highway/Cullen Valley Mine Access Road intersection. As this intersection is open to public use, it is assumed that these vehicles were accessing Portland Cullen Bullen Road rather than the mine itself.

The Invincible Colliery was operational on the day of the survey. According to weighbridge data provided by Castlereagh Coal, the colliery had a production rate of 45 loads per day, totalling 1,489.94 t of coal.

4 The proposal

The proposal is to extend the mines' operations for an additional five years as summarised below:

- Cullen Valley Mine - from 19 August 2025 until 19 August 2030.
- Invincible Colliery – from 31 December 2025 until 31 December 2030.

Cullen Valley Mine is predicted to produce 700,000 t over 5 years while Invincible Colliery is expected to produce 2,300,000 t over the same time period. The production limit is restraint by the maximum resources available to these mines.

Table 4.1 **Estimated Production**

Mine	Peak per annum production (t)	Predicted 5-year production (t)
Cullen Valley Mine	240,000	700,000
Invincible Colliery	600,000	2,300,000

4.1 Operational workforce

The peak workforce will be approximately 70 full-time equivalent (FTE) workers at Cullen Valley Mine and 50 FTE workers at Invincible Colliery.

4.2 Hours of operation

General operating hours will be unchanged from the existing approval and would occur from 7:00 am – 10:00 pm Monday to Saturday (excluding public holidays).

4.3 Traffic generation

The daily and peak hour traffic generation of both mines is calculated from the maximum annual production and workforce information provided by Castlereaigh Coal.

4.3.1 Heavy vehicles

Heavy vehicles will include outbound semi-trailers, maintenance and delivery trucks. The proposed heavy vehicle traffic calculations for each location are shown below in Table 4.2.

Table 4.2 **Estimated heavy vehicle generation**

Heavy vehicle movements	Units	Cullen Valley Mine	Invincible Colliery
All vehicle movements	5-year production (t)	700,000	2,300,000
	Peak per annum production (t)	240,000	600,000
	Workdays per annum	300	300
	Average per day production (t)	800	2,000
	Average semi-trailer capacity (t)	30	30

Heavy vehicle movements	Units	Cullen Valley Mine	Invincible Colliery
	Average per day external movement	27	67
To Mount Piper Power Station (90% of the trips)	Average per day movement to Mount Piper Power Station	24	60
	Maintenance and delivery trucks per day	5	5
	Total one-way movements per day	29	65
	Total peak hour movements	3	7
	Total peak hours trips	6	13
Via Lithgow (10% of the trips)	Average per day movement	3	7
	Total peak hour movements	0.3	0.7
	Total peak hours trips	0.6 (rounded up to 1)	1.4 (rounded up to 2)

4.3.2 Light vehicles

Light vehicles will include those of the workforce, visitors, and contractors, see Table 4.3. All light vehicles will be travelling during the AM and PM peak hours.

Table 4.3 Light vehicle generation (one-way)

Mine	Workforce	Visitors	Contractors
Cullen Valley Mine	30	5	4
Invincible Colliery	50	5	4

4.4 Traffic distribution

The distribution of vehicles is determined by information provided by Castlereagh Coal and estimations based on existing data. The following assumptions have been made:

- For semi-trailers, 90% of the average per day external movements will be travelling to/from the Mount Piper Power Station (Table 4.2)
- For semi-trailers, 10% of the average per day external movements will be travelling via Lithgow. They are assumed to depart during the AM peak and arrive during the PM peak (Table 4.2).
- For maintenance and delivery trucks, 100% of the daily movements will be travelling to/from the Mount Piper Power Station (Table 4.2)
- For all light vehicles, 75% will be travelling from/to the south (Lithgow) and the remaining 25% will be travelling from/to the north (Mudgee)
- Light vehicles are assumed to arrive during the AM peak hour and leave during the PM peak hour
- From Mudgee, light vehicles travelling to/from Cullen Valley Mine will use Carsons Siding Road rather than the Cullen Valley Mine Access Road

The baseline traffic distribution for light and heavy vehicles is shown in Figure 4.1. The proposed project traffic volumes are shown in Figure 4.2.

By adding the baseline volumes (Figure 4.1) to the proposed project volumes (Figure 4.2), the baseline and Baseline + project traffic volumes for Cullen Valley Mine can be estimated as shown in Figure 4.3.

It should be noted that Invincible Colliery was operational on the day of the traffic survey (Section 3.9). Therefore, the baseline volumes associated with the colliery will not be added to the proposed project traffic volumes to ensure an accurate representation of the future traffic scenario.

4.5 Vehicle type

Coal transport will be using 19 m long semi-trailers for product transport with 30 t of capacity per truck.

4.6 Growth of background traffic

A 2% per annum of linear traffic growth has been applied to the 2024 existing traffic volumes (Figure 3.2) to obtain the future 2030 baseline traffic volumes (Figure 4.3). This value is typical for regional traffic growth for rural highways in NSW.

4.7 Cumulative traffic impact assessment

As there is no known development along the haulage route, no cumulative traffic impact assessment is required for the Castlereagh Highway intersections other than the inclusion of regional traffic growth, as stated above.

4.8 Projected traffic volumes

The estimated future traffic volumes are provided in the following three figures.

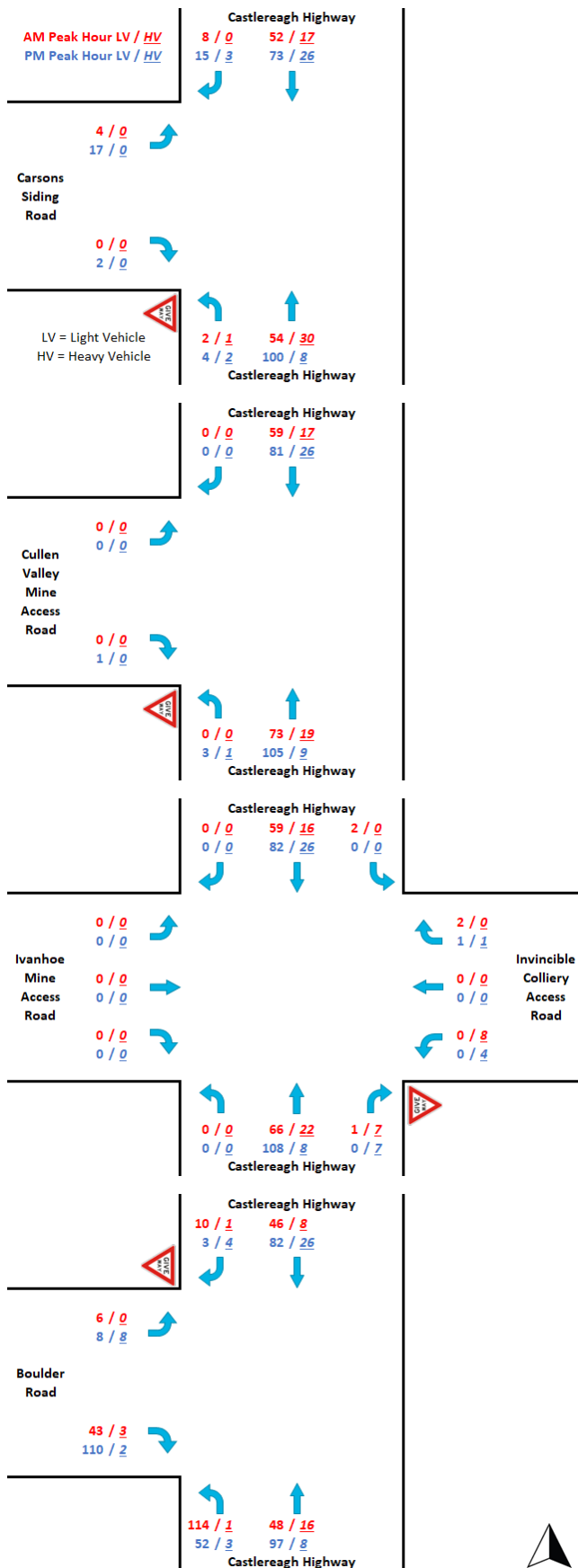


Figure 4.1 2030 projected baseline peak hour intersection volumes

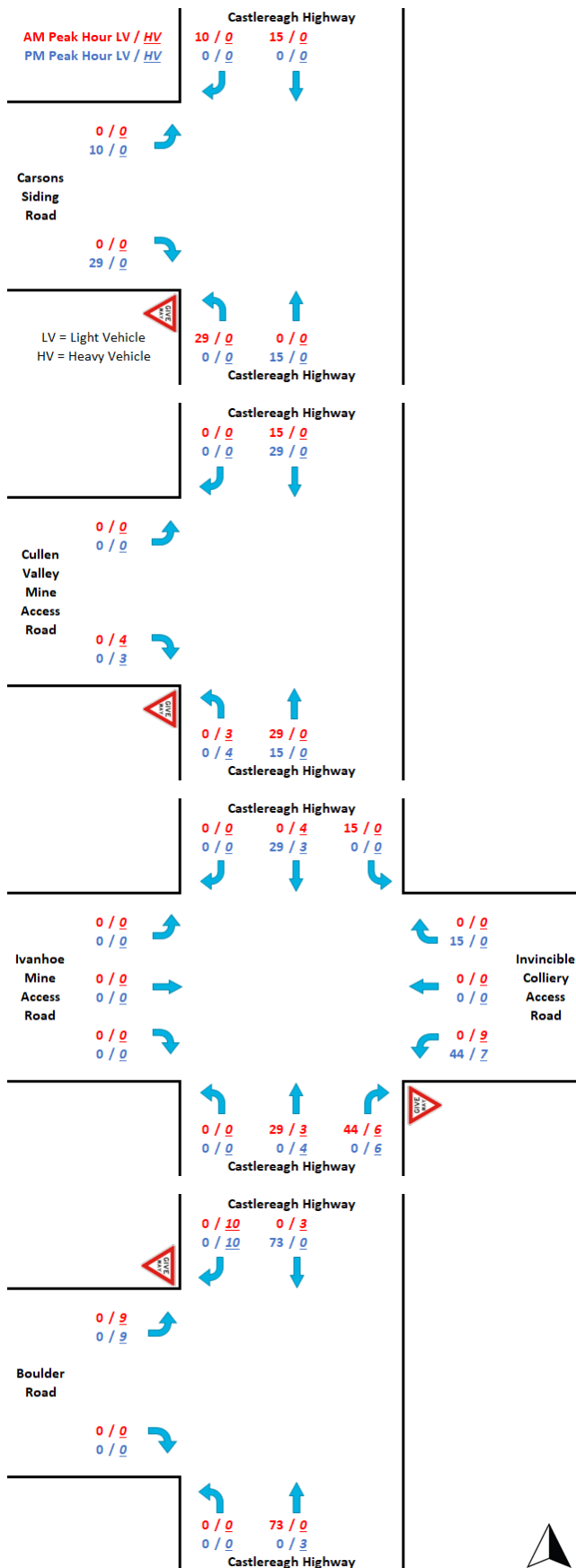


Figure 4.2 2030 development peak hour intersection volumes

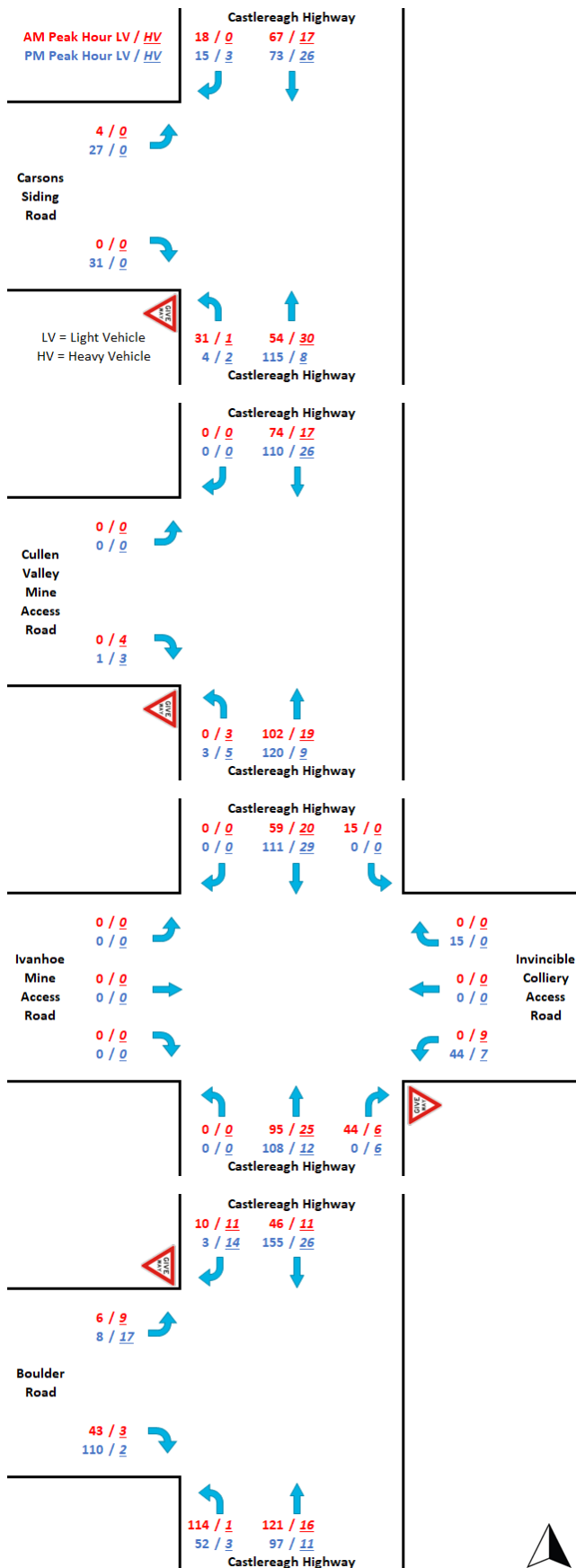


Figure 4.3 2030 projected baseline +development peak hour intersection volumes

5 Impact assessment

5.1 Intersection performance

The key intersections have been modelled with the SIDRA Intersection 9.1 software, a micro-analytical tool for individual intersections and linked intersection-network modelling. The modelling is based on the 2030 projected traffic volumes detailed in Section 4.8. SIDRA provides the following performance indicators:

- Degree of saturation (DOS) – the total usage of the intersection expressed as a factor of 1 with 1 representing 100% use/saturation (e.g. 0.8 = 80% saturation). In practice, the target degrees of saturation of 0.90 for signals, 0.85 for roundabouts and 0.80 for unsignalised intersections are generally agreed to. These are usually called ‘practical degrees of saturation’.
- Average delay (DEL) – for a signalised or roundabout intersection, this is the average delay in seconds encountered by all vehicles passing through the intersection. For a priority-controlled intersection, this is the average delay experienced by the worst approach and turning movement. It is often important to review the average delay of each approach as a side road could have a long delay time, while the large free flowing major traffic will provide an overall low average delay.
- Level of service (LOS) – this is a categorisation of average delay, intended for simple reference. For a priority-controlled intersection, this is the categorisation of the average delay experienced by the worst approach and turning movement.
- 95% queue lengths (Q95) – is defined to be the queue length in metres that has only a 5% probability of being exceeded during the analysed time period. It transforms the average delay into measurable distance units.

The LOS is a good indicator of overall performance for individual intersections, with each level summarised in Table 5.1.

Table 5.1 Intersection LOS standards

Level of service	Average delay (seconds per vehicle)	Traffic signals, roundabout	Priority intersection (‘Stop’ and ‘Give Way’)
A	<14	Good operation	Good operations
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity. At traffic signals, incidents will cause extensive delays. Roundabouts require other control mode.	At capacity, required other control mode
F	>71	Unsatisfactory with excessive queuing	Unsatisfactory with excessive queuing; required other control mode

Source: RTA Guide to Traffic Generating Developments (RTA 2002)

SIDRA modelling for all key intersections (Section 3.3) has been conducted for the haulage route. The following details have been included:

- Forecast Baseline traffic – based on 2030 traffic volumes (Figure 4.1).
- Forecast Baseline + project traffic – includes baseline 2030 traffic volumes (Figure 4.1) combined with the project traffic volumes (Figure 4.3), where relevant i.e. excluding the 2024 Baseline Invincible Colliery Access Road traffic.

The following abbreviations are used for the turn movements:

- TH: through
- LT: left turn
- RT: right turn.

The SIDRA results for the key intersections are presented in Section 5.2. Detailed SIDRA results can be found in Appendix B.

5.2 SIDRA modelling results

5.2.1 Castlereagh Highway/Carsons Siding Road

Table 5.2 SIDRA modelling result for Castlereagh Highway/Carsons Siding Road

Control: Priority controlled (Give way)	AM Peak						PM Peak						
	Scenarios	Intersection volume	DEL (s)	LOS	DOS	Q95 (m)	Q95 direction and approach	Intersection volume	DEL (s)	LOS	DOS	Q95 (m)	Q95 direction and approach
	2030 Baseline (without project)	178	6.1	A	0.058	0.4	RT from north	263	6.7	A	0.075	1.3	RT from north
	2030 (Baseline + project)	235	6.4	A	0.074	0.9	RT from north	320	6.8	A	0.076	1.1	RT from north

Key findings:

- In the AM and PM, the intersection performs well within capacity with a LOS A (good operation) for all scenarios.
- The intersection can easily accommodate the project related traffic volumes without significantly affecting its operation.

5.2.2 Castlereagh Highway/Cullen Valley Mine Access Road intersection

Table 5.3 SIDRA modelling result for Castlereagh Highway/Cullen Valley Mine Access Road intersection

Control: Priority controlled (Give way)	AM Peak						PM Peak						
	Scenarios	Intersection volume	DEL (s)	LOS	DOS	Q95 (m)	Q95 direction and approach	Intersection volume	DEL (s)	LOS	DOS	Q95 (m)	Q95 direction and approach
	2030 Baseline (without project)	181	8.5	A	0.055	0.0	N/A	240	8.6	A	0.066	0.0	N/A
	2030 (Baseline + project)	233	8.6	A	0.071	0.0	N/A	294	8.7	A	0.081	0.0	N/A

Key findings:

- In the AM and PM, the intersection performs well within capacity with a LOS A (good operation) for all scenarios.
- The intersection can easily accommodate the project related traffic volumes without significantly affecting its operation.

5.2.3 Castlereagh Highway/Invincible Colliery Access Road/Ivanhoe Mine Access Road intersection

Table 5.4 SIDRA modelling result for Castlereagh Highway/Invincible Colliery Access Road/Ivanhoe Mine Access Road intersection

Control: Priority controlled (Give way)	AM Peak						PM Peak						
	Scenarios	Intersection volume	DEL (s)	LOS	DOS	Q95 (m)	Q95 direction and approach	Intersection volume	DEL (s)	LOS	DOS	Q95 (m)	Q95 direction and approach
	2030 Baseline (without project)	199	11.4	A	0.054	0.4	RT from south	257	12.0	A	0.067	0.4	RT from south
	2030 (Baseline + project)	295	9.7	A	0.072	1.2	RT from south	357	12.3	A	0.085	0.4	RT from south

Key findings for:

- In the AM and PM, the intersection performs well within capacity with a LOS A (good operation) for all scenarios.

- The intersection can easily accommodate the project related traffic volumes without significantly affecting its operation.

5.2.4 Castlereagh Highway/Boulder Road intersection

Table 5.5 SIDRA modelling result for Castlereagh Highway/Boulder Road intersection

Control: Priority controlled (Give way)	AM Peak						PM Peak					
Scenarios	Intersection volume	DEL (s)	LOS	DOS	Q95 (m)	Q95 direction and approach	Intersection volume	DEL (s)	LOS	DOS	Q95 (m)	Q95 direction and approach
2030 Baseline (without project)	312	8.5	A	0.063	0.2	RT from north	424	10.0	A	0.137	0.3	RT from north
2030 (Baseline + project)	412	10.1	A	0.079	0.8	RT from north	524	10.8	A	0.155	0.9	RT from north

Key findings for:

- In the AM and PM, the intersection performs well within capacity with a LOS A (good operation) for all scenarios.
- The intersection can easily accommodate the project related traffic volumes without significantly affecting its operation.

5.3 Austroads turn warrant assessments

Intersection operations are assessed from a combination of the peak hourly through and turning traffic movements that occur at each intersection. This determines the need for additional intersection turning lanes (e.g. basic, auxiliary lane and channelised) in accordance with the current intersection design standards (Austroads 2023) *Guide to Road Design Part 4a, Unsignalised and Signalised Intersections* (Figure 5.1 and Figure 5.2), where:

- Curve 1 (red line) represents the boundary between a basic right turn (BAR) and a channelised short right turn (CHR(S)) turn treatment and between a basic left turn (BAL) and an auxiliary short left turn (AUL(S)) turn treatment.
- Curve 2 (blue line) represents the boundary between a CHR(S) and a full length CHR treatment and between an AUL(S) and a full length AUL or CHL treatment. The choice of CHL over an AUL will depend on factors such as the need to change the give way rule in favour of other manoeuvres at the intersection and the need to define more appropriately the driving path by reducing the area of bitumen surfacing.

Figure 5.1 contains two graphs for the selection of turn treatments on roads with a design speed less than or equal to 70 km/h, which is appropriate for low-speed urban roads.

Figure 5.2 contains two graphs for the selection of turn treatments on roads with a design speed greater than or equal to 100 km/h, which is appropriate for high-speed rural roads.

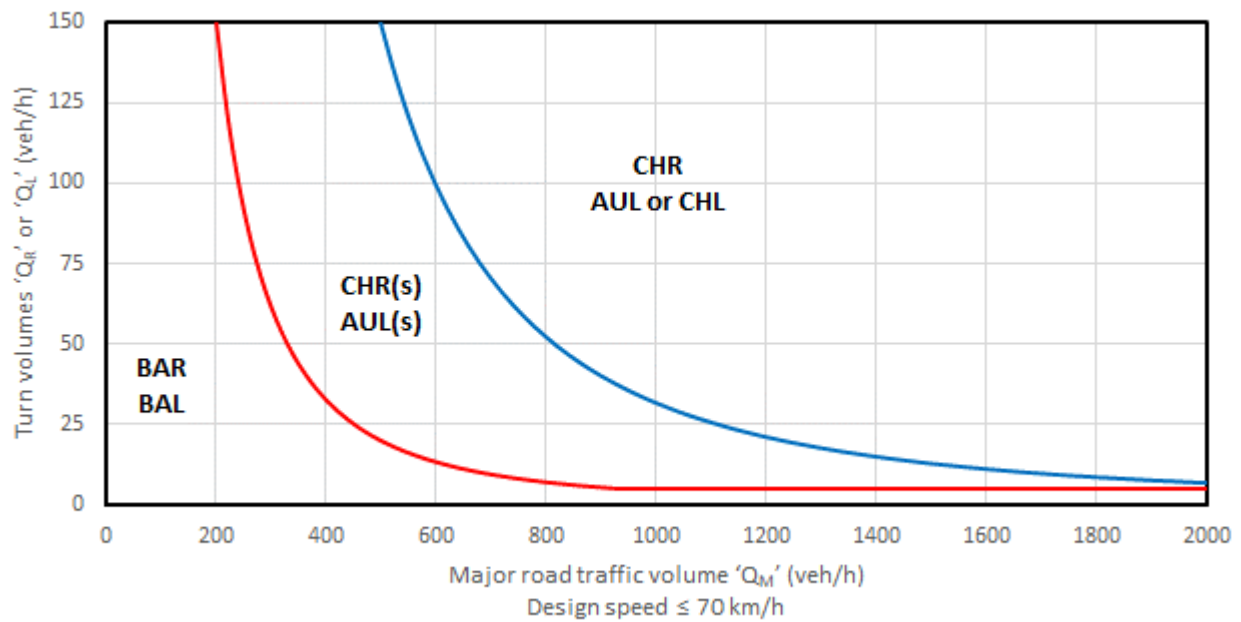


Figure 5.1 Austroads warrant design charts for low-speed urban intersection turning lanes

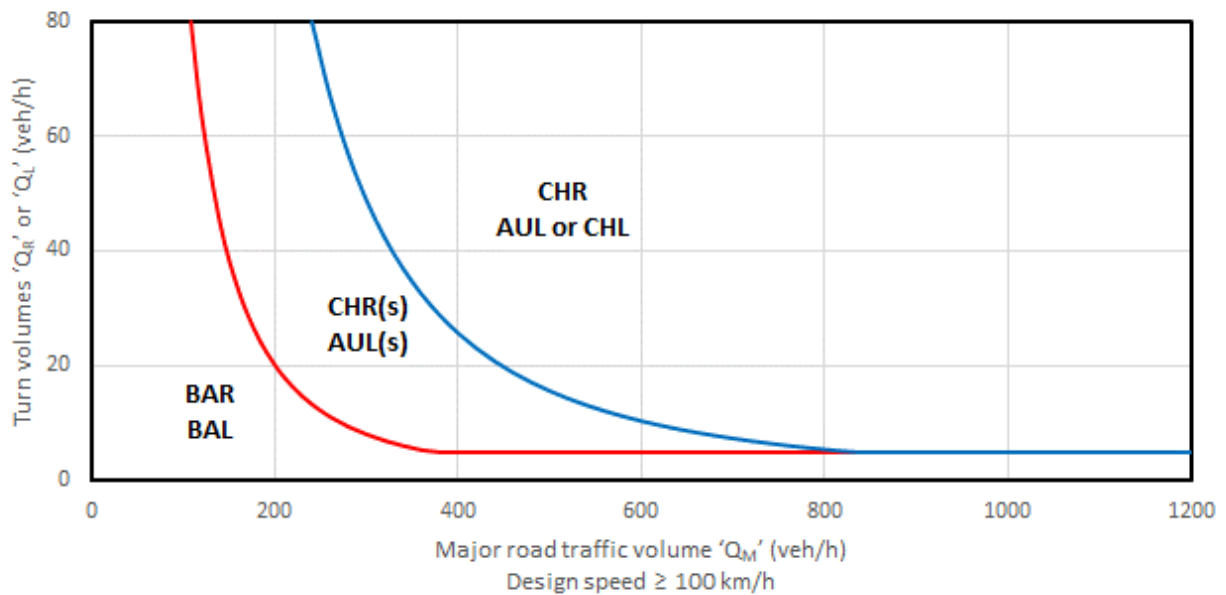


Figure 5.2 Austroads warrant design charts for high-speed rural intersection turning lanes

TfNSW recommends intersections should be designed for a travel speed 10 km/h greater than the posted speed limit.

To provide conservative results, the warrant for turn treatments has been assessed based on the combination of baseline and project traffic. It should be noted that the worst-case scenario traffic volumes have been used for all intersections.

5.3.1 Castlereagh Highway/Carsons Siding Road intersection

LVs are assumed to be coming from both directions on Castlereagh Highway. Therefore, assessments are required for a possible left or right turn bay from Castlereagh Highway. Castlereagh Highway near Carsons Siding Road has a speed limit of 50 km/h (40 km/h during school peak hours), therefore a design speed of 60 km/h is considered. The left and right turn treatment warrant design charts for Castlereagh Highway/Carsons Siding Road during the proposed production period are shown in Figure 5.3 and Figure 5.4.

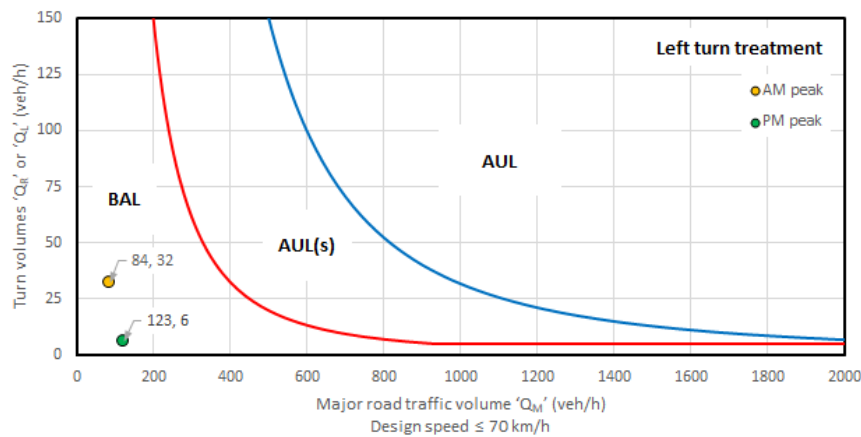


Figure 5.3 Austroads warrant design chart for urban intersection left turning lane to Carsons Siding Road

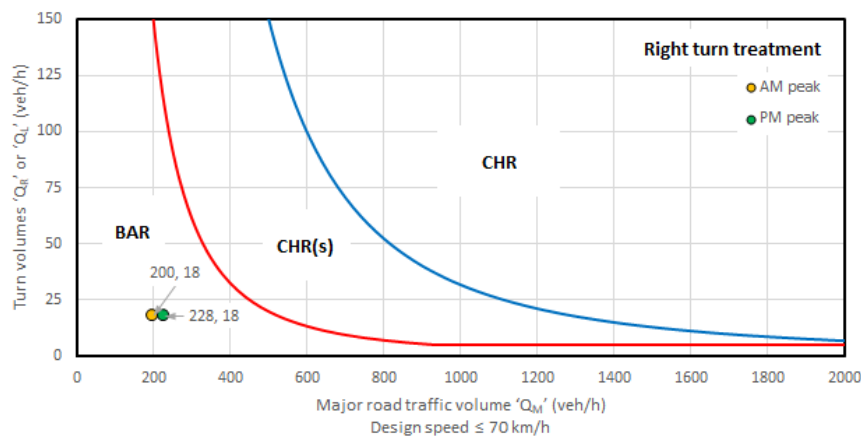


Figure 5.4 Austroads warrant design chart for urban intersection right turning lane to Carsons Siding Road

For 32 left turning vehicles and 84 northbound vehicles on Castlereagh Highway, a BAL treatment is the minimum requirement. The existing intersection adopts a BAL treatment which meets the minimum requirement.

For 18 light right turning vehicles and 228 major road vehicles on Castlereagh Highway, a BAR treatment is the minimum requirement. The existing intersection does not currently have a BAR treatment, but there is sufficient sealed shoulder width to implement one without requiring road widening. To ensure no vehicle is parked at the shoulder at this intersection, 'No Parking' signs on the eastern side of Castlereagh Highway, opposite to Carsons Siding Road will assist near the intersection for uninterrupted southbound flow at this intersection.

5.3.2 Castlereagh Highway/Cullen Valley Mine Access Road intersection

HVs are assumed to approach from the south of Castlereagh Highway. However, since Cullen Valley Mine Access Road is open to the public, assessments are necessary to evaluate the need for a potential right-turn bay. Hence, assessments for both left and right-turn bays from Castlereagh Highway are required.

Castlereagh Highway near Cullen Valley Mine Access Road has a speed limit of 50 km/h heading north and a speed limit of 100 km/h heading south. Therefore, a design speed of 60 km/h will be considered for the left turn treatment and a design speed of 110 km/h will be considered for the right turn treatment.

The left and right turn treatment warrant design charts for Castlereagh Highway/Cullen Valley Mine Access Road during the proposed production period are shown in Figure 5.5 and Figure 5.6.

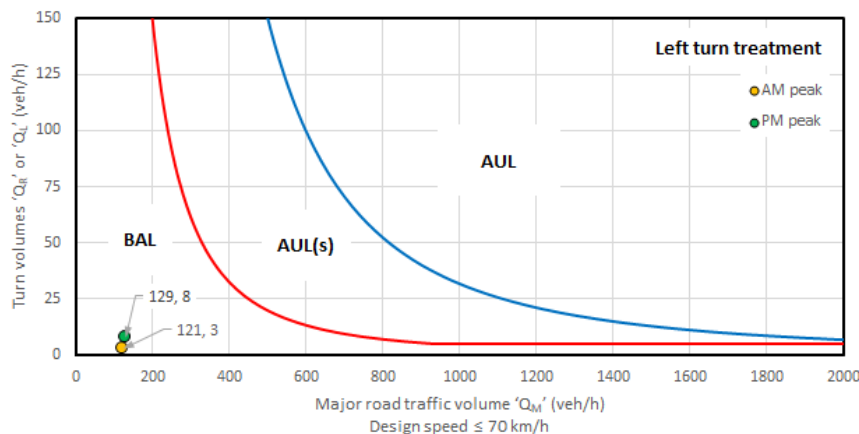


Figure 5.5 Austroads warrant design chart for urban intersection left turning lane to Cullen Valley Mine Access Road

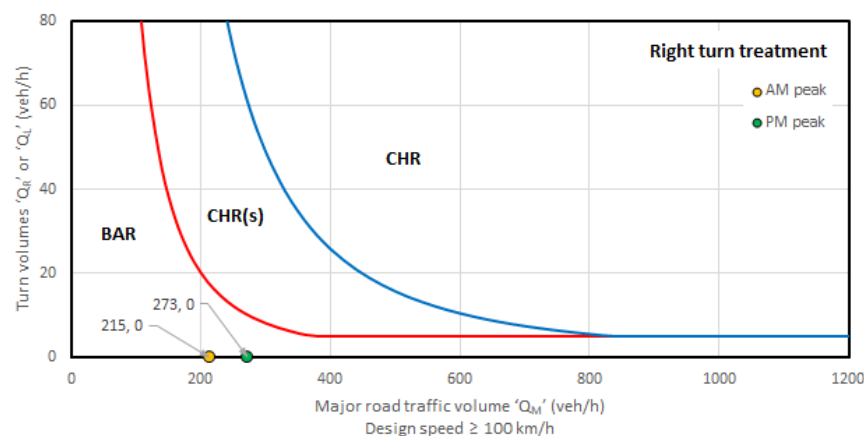


Figure 5.6 Austroads warrant design chart for rural intersection right turning lane to Cullen Valley Mine Access Road

For 8 left turning vehicles and 129 northbound vehicles on Castlereagh Highway, a BAL treatment is the minimum requirement. The existing intersection adopts an AUL treatment which exceeds the minimum requirement.

For 0 right turning vehicles and 273 major road vehicles on Castlereagh Highway, a BAR treatment is the minimum requirement. The existing intersection adopts a CHR(s) treatment which exceeds the minimum requirement.

The existing intersection does not require any further upgrade.

5.3.3 Castlereagh Highway/Invincible Colliery Access Road/Ivanhoe Mine Access Road intersection

LVs are assumed to be coming from both directions on Castlereagh Highway. HVs are also assumed to be coming from both directions on Castlereagh Highway. Hence, assessments are required for a possible left or right turn bay from Castlereagh Highway. Castlereagh Highway near Invincible Colliery Access Road has a speed limit of 100 km/h, therefore a design speed of 110 km/h is considered. The left and right turn treatment warrant design charts for this intersection during the proposed production period are shown in Figure 5.7 and Figure 5.8.

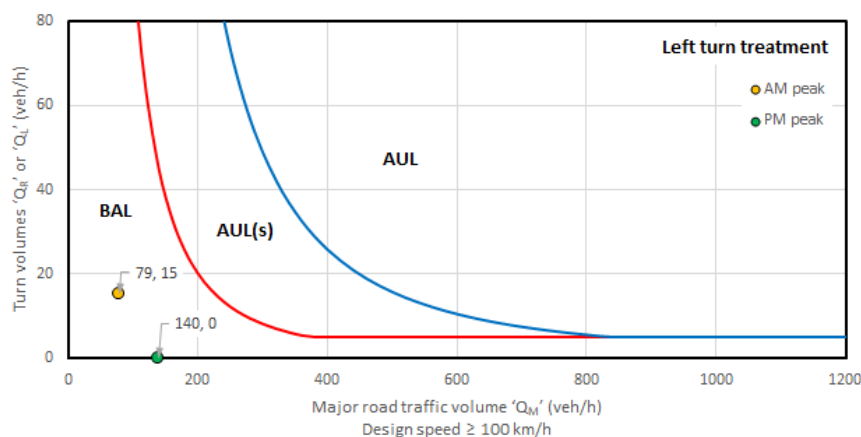


Figure 5.7 Austroads warrant design charts for rural intersection left turning lane to Invincible Colliery Access Road

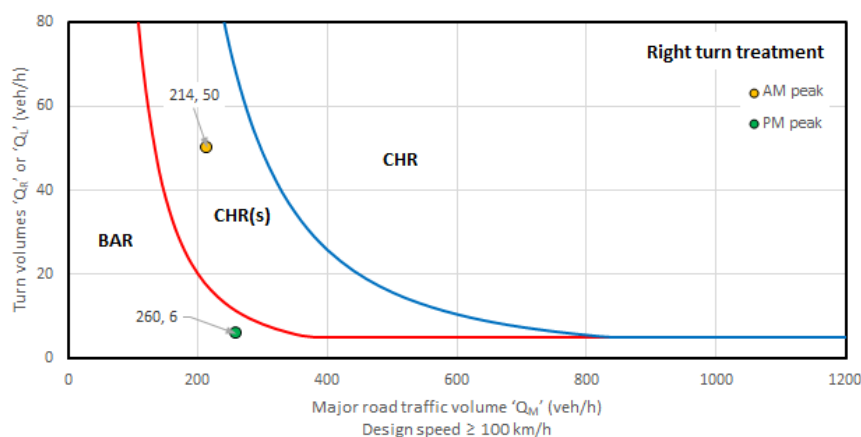


Figure 5.8 Austroads warrant design charts for rural intersection right turning lane to Invincible Colliery Access Road

For 15 left turning vehicles and 79 southbound vehicles on Castlereagh Highway, a BAL treatment is the minimum requirement. The existing intersection adopts a BAL treatment which meets the minimum requirement.

For 50 right turning vehicles and 214 major road vehicles on Castlereagh Highway, a CHR(s) treatment is the minimum requirement. The existing intersection adopts a CHR treatment which exceeds the minimum requirement.

The existing intersection does not require any further upgrade.

5.3.4 Castlereagh Highway/Boulder Road intersection

Project-related LVs and HVs are expected to approach from the north on Castlereagh Highway, while a significant portion of baseline light vehicles originates from the south. Hence, assessments are required for a possible left or right turn bay from Castlereagh Highway. Castlereagh Highway near Boulder Road has a speed limit of 100 km/h, therefore a design speed of 110 km/h is considered. The left and right turn treatment warrant design charts for this intersection during the proposed production period are shown in Figure 5.9 and Figure 5.10.

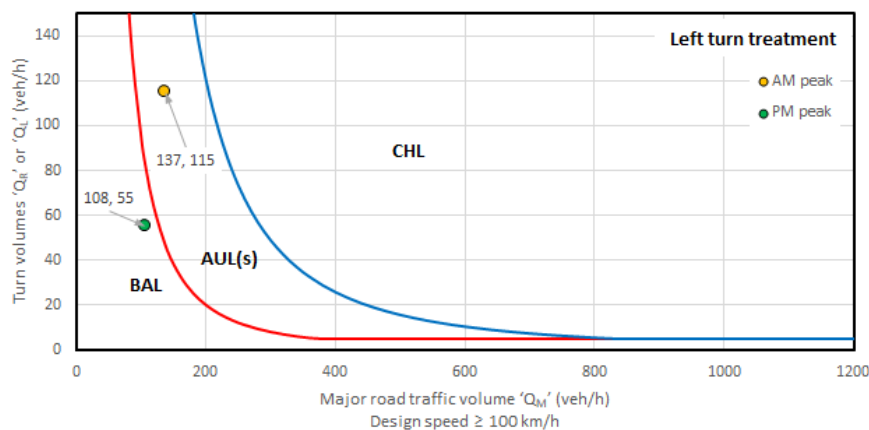


Figure 5.9 Austroads warrant design chart for rural intersection left turning lane to Boulder Road

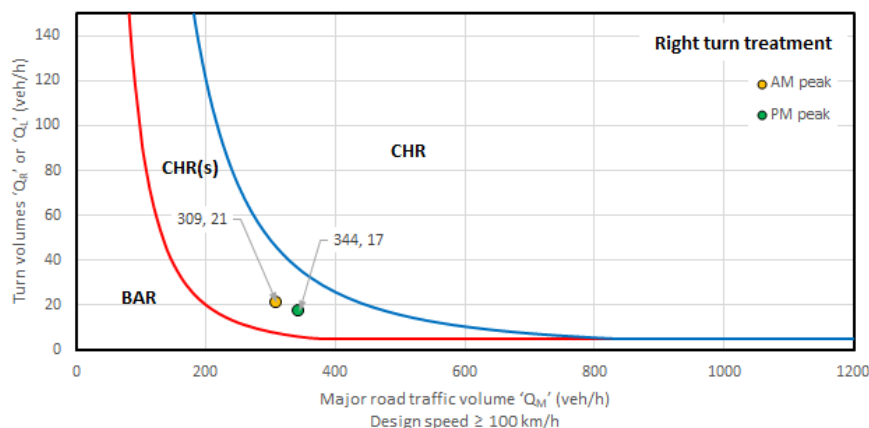


Figure 5.10 Austroads warrant design chart for rural intersection right turning lane to Boulder Road

For 115 left turning vehicles and 137 northbound vehicles on Castlereagh Highway, an AUL(s) treatment is the minimum requirement. The existing intersection adopts an CHL treatment with a high entry angle, which exceeds the minimum requirement.

For 17 right turning vehicles and 344 major road vehicles on Castlereagh Highway, a CHR(s) treatment is the minimum requirement. The existing intersection adopts a CHR treatment which exceeds the minimum requirement.

The existing intersection does not require any further upgrade.

5.4 Road safety assessment at the project site accesses

In the vicinity of the key intersection points, Castlereagh Highway has relatively large geometry with generally flat elevation along its entire length with a few winding sections. Castlereagh Highway has varying speed limits from 50 km/h – 100 km/h.

- For a posted speed limit of 100 km/h, the road safety assessment should be assessed at a 110 km/h design speed, which is 10 km/h above the posted speed limit.
- Similarly, for a posted speed limit of 50 km/h, the road safety assessment should be assessed at a 60 km/h design speed, which is 10 km/h above the posted speed limit.

In accordance with Austroads Guide to Road Design Part 4A (Unsignalised and Signalised Intersections) (Austroads, 2017), Table 3.2.

- for a road with a 110 km/h design speed, the minimum safe intersection sight distance (SISD) required for a general 2.5 second driver's reaction time is 300 m.
- for a road with a 60 km/h design speed, the SISD required for a general 2.0 second driver's reaction time is 123 m.

5.4.1 Castlereagh Highway/Carsons Siding Road sight distance assessment

Castlereagh Highway near Carsons Siding Road has a sign posted speed limit of 50 km/h. The sight distances on Castlereagh Highway at Carsons Siding Road have been estimated based on the line of sight and observation, as shown in Figure 5.11.

Based on the sight distance analysis, the sight distance to the left meets the minimum requirement (123 m) as stipulated in the *Austroads Guide to Road Design*.

The sight distance to the right falls short of the minimum requirement due to a crest adjacent to the intersection that obstructs visibility. To mitigate the risk, an advanced intersection warning sign could be installed for northbound vehicles on Castlereagh Highway, just north of Watson Avenue (Figure 5.1).





Sight distance to the left (~335 m)



Sight distance to the right (~80 m)

Source: MetroMap

Figure 5.11 Sight distance to the left and right of Carsons Siding Road



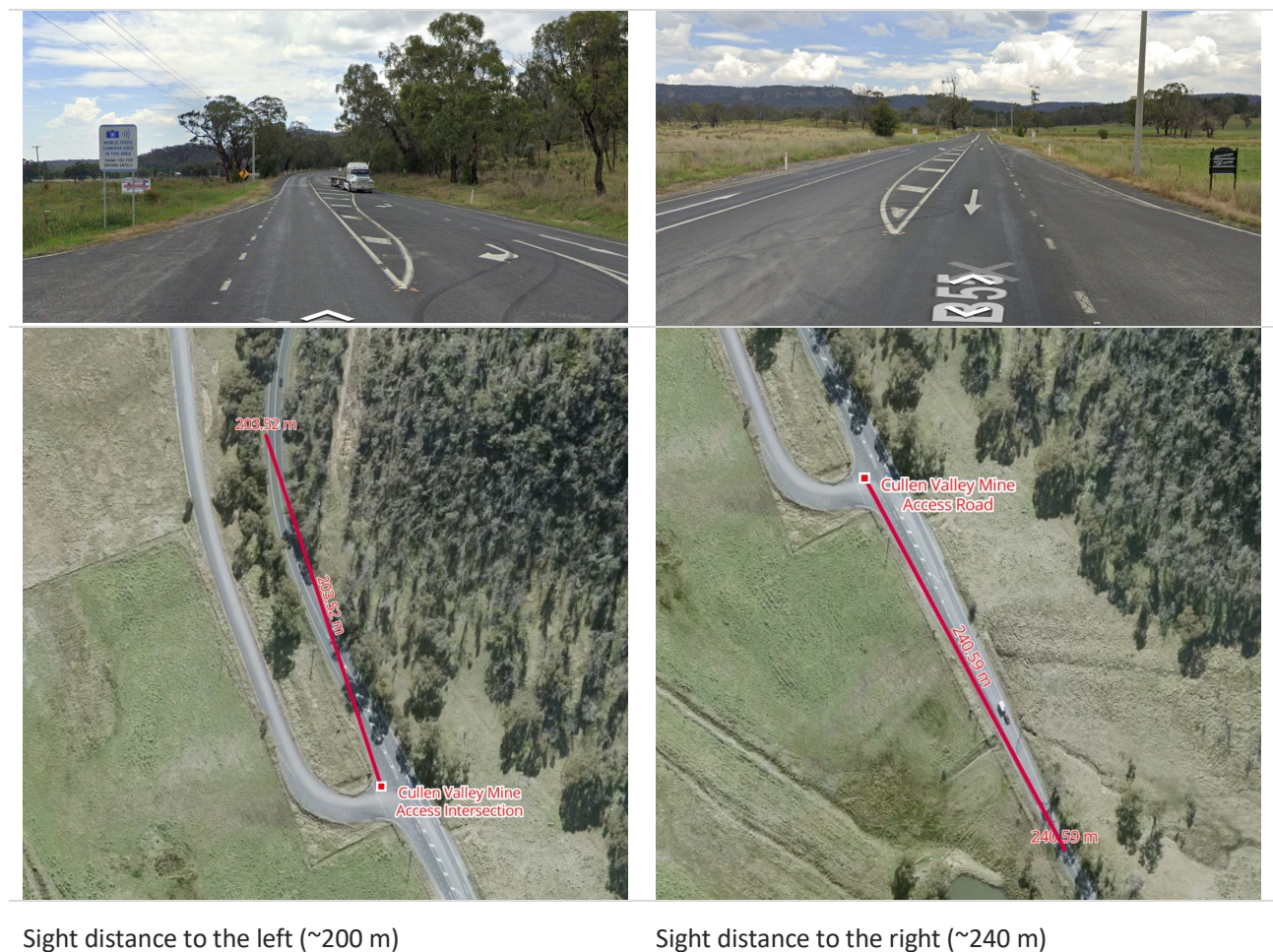
Source: TfNSW

Figure 5.12 Recommended advance intersection warning signage

5.4.2 Castlereagh Highway/Cullen Valley Mine Access Road intersection site access sight distance assessment

Castlereagh Highway near Cullen Valley Mine Access Road has a sign posted speed limit of 100 km/h heading south and a sign posted speed limit of 50 km/h going north. The sight distances on Castlereagh Highway at the Cullen Valley Mine Access Road intersection have been estimated based on the line of sight and observation, as shown in Figure 5.13.

Based on the sight distance analysis, the sight distance to the left meets the minimum requirement of 123 m. However, the sight distance to the right does not meet the minimum requirement of 300 m. Existing turning traffic safety mitigation measures have been implemented at the intersection. Advance Intersection warning signs (Plate 5.1 and Plate 5.2) are in place on both approaches to the intersection and a dedicated right-turn merge lane from the access road southbound allows oncoming traffic to maintain its flow. Additionally, a merge warning sign (Plate 5.3) and a 'Form One Lane' sign (Plate 5.4) are present to guide drivers at the merge point, south of the intersection. These mitigation measures are considered appropriate.



Source: MetroMap

Figure 5.13 Sight distance to the left and right of the Cullen Valley Mine Access Road intersection



Source: Google Maps

Plate 5.1 Existing advance intersection warning signage south of Castlereagh Highway/Cullen Valley Mine Access Road intersection



Source: Google Maps

Plate 5.2 Existing advance intersection warning signage north of Castlereagh Highway/Cullen Valley Mine Access Road intersection



Source: Google Maps

Plate 5.3 Existing merge warning signage at Castlereagh Highway/Cullen Valley Mine Access Road intersection



Source: Google Maps

Plate 5.4 Existing ‘form 1 lane’ signage south of Castlereagh Highway/Cullen Valley Mine Access Road intersection

5.4.3 Castlereagh Highway/Invincible Colliery Access Road/Ivanhoe Mine Access Road intersection sight distance assessment

Castlereagh Highway near Invincible Colliery Access Road has a sign posted speed limit of 100 km/h. The sight distances on Castlereagh Highway at the Invincible Colliery Access Road intersection have been estimated based on the line of sight and observation, as shown in Figure 5.14.

Based on the sight distance analysis, the sight distances to the left meets the minimum requirement 300 m as stipulated in the *Austroads Guide to Road Design*. However, the sight distance to the right does not meet the minimum requirement of 300 m. Existing turning traffic safety mitigation measures have been implemented near the intersection. Truck warning signs (Plate 5.5 and Plate 5.6) are in place on both approaches to the intersection. These mitigation measures are considered appropriate





Sight distance to the left (~400 m)



Sight distance to the right (~250 m)

Source: MetroMap

Figure 5.14 Sight distance to the left and right of the Invincible Colliery Access Road intersection



Plate 5.5 Existing truck warning signage north of Castlereagh Highway/Invincible Colliery Access Road/Ivanhoe Mine Access Road intersection



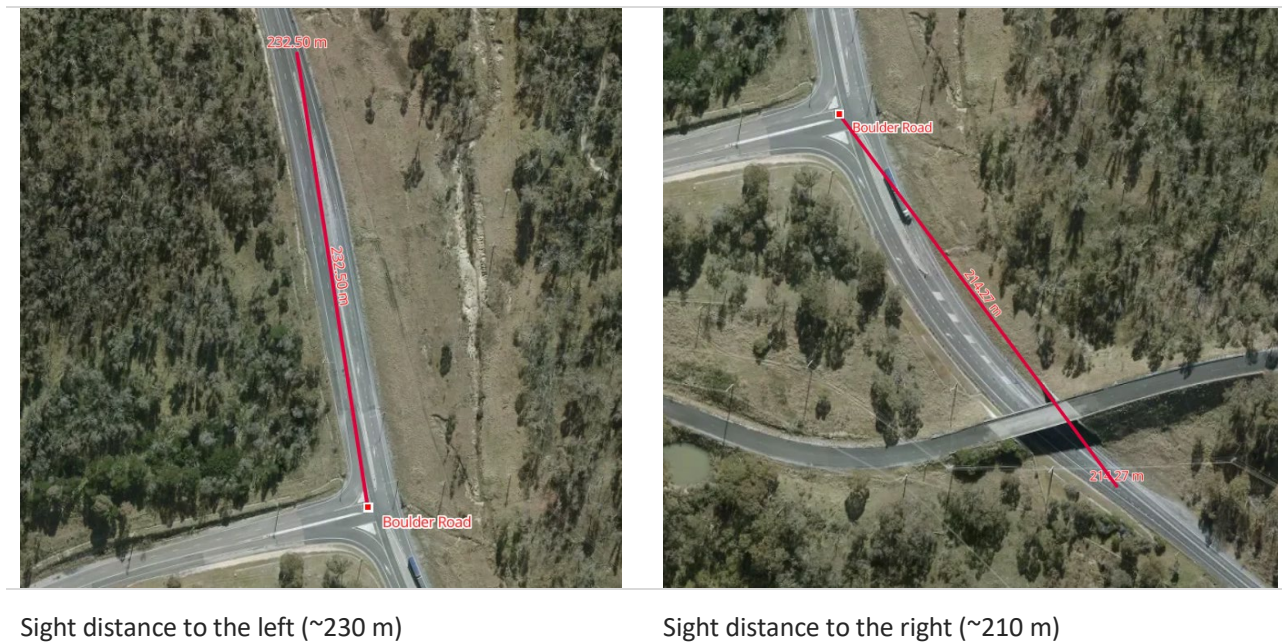
Plate 5.6 Existing truck warning signage south of Castlereagh Highway/Invincible Colliery Access Road/Ivanhoe Mine Access Road intersection

5.4.4 Castlereagh Highway/Boulder Road intersection sight distance assessment

Castlereagh Highway near Boulder Road has a sign posted speed limit of 100 km/h. The sight distances on Castlereagh Highway at Boulder Road have been estimated based on the line of sight and observation, as shown in Figure 5.15.

Based on the sight distance analysis, the sight distances to the left and right do not meet the minimum requirement 300 m as stipulated in the *Austroads Guide to Road Design*. However, existing turning traffic safety mitigation measures have been implemented at the intersection. The left turn features a dedicated slip lane, enabling traffic to merge safely onto the highway. The right turn has a dedicated approach lane that allows traffic to queue safely before turning from Boulder Road. Although to further mitigate risks, it is recommended for advanced intersection warning signs to be installed for both northbound and southbound traffic on Castlereagh Highway (Figure 5.12).





Source: MetroMap

Figure 5.15 Sight distance to the left and right of the Boulder Road intersection

5.5 Impacts on public transport, pedestrians and cyclists

Public transport services, including school buses and regional coach routes operating along the Castlereagh Highway and Boulder Road between Lithgow and Cullen Bullen, will share the same route as project traffic. However, project heavy vehicle traffic will have only limited interaction with public transport due to the relatively short length of the Castlereagh Highway which is affected (less than 6 km in total), the infrequency of public transport services and the low overall daily volume of project heavy vehicles, resulting in minimal traffic impact to these facilities and services. Additionally, the Castlereagh Highway provides frequent opportunities for light vehicles to overtake heavy vehicles through the availability of extra lanes on the Castlereagh Highway at multiple locations.

There is minimal existing pedestrian activity and no dedicated cycle paths along the Castlereagh Highway on the project traffic route. Therefore, the proposed modifications are not expected to have any impact on active transport users.

5.6 Traffic management within the site

The internal site roads in the existing mines are adequate for use for the proposed transport operation.

5.7 Parking provision

Sufficient parking is expected to be provided on site for the staff members and visitors that will be driving to the site.

No parking will be required on public roads. Therefore, there will not be any parking impacts to the road network.

5.8 Over Size Over Mass (OSOM) deliveries

As there will be no use of OSOM vehicles for this project, an OSOM assessment is not required for the modification applications.

6 Conclusions and summary

Cullen Valley Mine DA 200-5-2003 Mod 5 and Invincible Colliery MP07_0127 Mod 6 are anticipated to take place over a five-year future period. The modification application seeks continuation of these mines for additional five years. However, no increase in light or heavy vehicle is predicted as part of the proposal.

The traffic generated by the project will be consistent throughout its operation. There are expected to be approximately 100 loaded trucks per day operating via the Castlereagh Highway from the combined operations of both mines and approximately 70 FTE employees for Cullen Valley Mine and 50 FTE employees for Invincible Mine travelling to and from work each day.

The associated traffic impacts for the project and potential cumulative traffic impacts as a result of the project have been assessed as follows:

- All key intersections will remain at LOS A with the projected production traffic volumes in all scenarios. The intersections will not be adversely affected by these modifications.
- The Castlereagh Highway and Carsons Siding Road intersection requires upgrading to a BAR treatment. There is sufficient shoulder width to implement this without the need for road widening. Additionally, 'No Parking' signs could be installed near the intersection to ensure uninterrupted southbound flow at this intersection.
- The sight distance requirements to the right at the Castlereagh Highway/Carsons Siding Road intersection are not met due to the road's curvature and elevation changes. To address this, the installation of an advanced intersection warning sign is recommended to alert approaching traffic. All associated costs for the signage will be covered by the proponent.
- The sight distance requirements to the left and right at the Castlereagh Highway/Boulder Road intersection are also not met due to the road's curvature. It is recommended that advanced intersection warning signs be installed to warn oncoming traffic, with all costs for the signage borne by the proponent.
- The project is not expected to impact public transport, pedestrians or cyclists activity in the locality.
- Car parking will be provided on-site during operation. Cars will not be parked on public roads.

In summary, the forecast truck movements from both collieries over the next 5 years are below those previously approved and detailed in the development consent, and as such, impacts will largely remain consistent with what has previously been assessed and approved.

7 References

Austroads 2020, *Guide to Traffic Management Part 12: Integrated Transport Assessments for Developments*

Austroads 2023, *Guide to Road Design Part 4A: Unsignalised and Signalised Intersections*

Google Maps 2024, *Online Mapping Service*, Google

Lithgow Buslines 2024, *School Services – Student Travel Planner*

TfNSW 2024, *Guide to Transport Impact Assessment*

TfNSW 2024, *Interactive crash statistics – NSW Centre for Road Safety*, Transport for New South Wales

TfNSW 2024, *Routes and timetables (Cullen Bullen Coach Stop)*, Transport for New South Wales

TfNSW 2024, *W2-4L Side Road Intersection on Straight Left (Symbolic)*, Transport for New South Wales.

Appendix A

Traffic count data

TRANS TRAFFIC SURVEY

TURNING MOVEMENT SURVEY

Intersection of Carsons Sliding Rd and Castlereagh Hwy, Cullen Bn

City: Adelaide

Date: 10/05/2019

Surveyor: JAM

Observer: JAM

Location: Carsons Sliding Rd

Countdown: 10

Approach: Castlereagh Hwy

From: North

To: South

Survey: JAM

Observer: JAM

Location: Carsons Sliding Rd

Countdown: 10

Survey: JAM

Observer: JAM

Location: Carsons Sliding Rd

Countdown: 10

Survey: JAM

Observer: JAM

Location: Carsons Sliding Rd

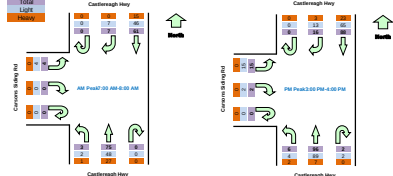
Countdown: 10

Peak Time		North Approach			Castlereagh Hwy			South Approach			Castlereagh Hwy			West Approach			Carsons Sliding Rd			Hourly Total	
Period Start	Period End	U	R	SB	U	R	SB	L	U	R	SB	L	U	R	SB	L	U	R	L	Hourly Total	Peak
6:00	6:15	0	1	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	155	
6:15	6:30	0	1	14	0	0	11	0	0	0	0	0	0	0	0	0	0	0	2	127	
6:30	6:45	0	3	14	0	0	12	0	0	0	0	0	0	0	0	0	0	0	2	121	
6:45	7:00	0	2	10	0	0	8	1	0	0	1	0	0	0	0	1	0	0	1	146	
7:00	7:15	0	2	12	0	0	10	1	0	0	1	0	0	0	0	1	0	0	1	140	Peak
7:15	7:30	0	1	14	0	0	14	1	0	0	0	0	0	0	0	2	0	0	1	151	Peak
7:30	7:45	0	4	16	0	0	26	0	0	0	0	0	0	0	0	2	0	0	0	148	
7:45	8:00	0	0	10	0	0	13	1	0	0	0	0	0	0	0	0	0	0	0	136	
8:00	8:15	0	2	13	0	0	18	1	0	0	0	0	0	0	0	1	0	0	0	139	
8:15	8:30	0	2	12	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	139	
8:30	8:45	0	4	13	0	0	14	2	0	0	0	0	0	0	0	0	0	0	0	139	
8:45	9:00	0	4	9	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	139	
9:00	9:15	0	5	28	0	0	25	1	0	0	2	0	0	0	0	0	0	0	0	235	Peak
9:15	9:30	0	3	20	0	0	27	4	0	0	0	0	0	0	0	0	0	0	0	235	
9:30	9:45	0	3	20	0	0	24	0	0	0	1	1	0	0	0	1	3	0	0	233	
9:45	10:00	0	5	20	2	0	23	0	0	0	0	1	1	0	0	0	1	7	0	208	
10:00	10:15	0	6	18	1	0	20	1	0	0	1	1	1	0	0	0	4	0	0	199	
10:15	10:30	0	1	28	0	0	30	2	0	0	0	0	0	0	0	0	0	0	0	199	
10:30	10:45	0	6	22	0	0	14	0	0	0	0	1	1	0	0	1	3	0	0	189	
10:45	11:00	0	7	20	2	0	17	0	0	0	0	0	0	0	0	0	4	0	0	189	
11:00	11:15	0	3	12	0	0	16	1	0	0	0	0	0	0	0	0	2	0	0	142	
11:15	11:30	0	0	13	0	0	18	2	0	0	0	0	0	0	0	0	0	0	0	143	
11:30	11:45	0	3	10	0	0	11	1	0	0	0	0	0	0	0	0	0	0	0	143	
11:45	12:00	0	3	10	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	143	

Peak Time		North Approach Castlereagh Hwy			South Approach Castlereagh Hwy			West Approach Carsons Sliding Rd			Peak
Period Start	Period End	U	R	SB	U	SB	L	U	R	L	total
7:00	8:00	0	7	61	0	75	3	0	0	4	150
15:00	16:00	0	16	88	2	96	6	0	2	15	225

Note: Site sketch is for illustrative traffic flows. Direction is indicative only. Diagram is not to scale and not an exact streets configuration.

Graphic:



Peak Vehicle Counts									
Period Start	Period End	North Approach	Castlereagh Hwy	South Approach	Castlereagh Hwy	West Approach	Carsons Sliding Rd	Peak	Time
6:00	6:15	0	1	6	0	0	0	0	2
6:15	6:30	0	1	13	0	0	0	0	2
6:30	6:45	0	3	10	0	0	0	0	2
6:45	7:00	0	2	17	0	4	0	0	1
7:00	7:15	0	2	10	0	11	1	0	0
7:15	7:30	0	1	11	0	8	0	0	2
7:30	7:45	0	4	11	0	18	0	0	2
7:45	8:00	0	0	14	0	10	1	0	2
8:00	8:15	0	2	11	0	13	1	0	1
8:15	8:30	0	1	10	0	12	0	0	1
8:30	8:45	0	2	11	0	14	1	0	3
8:45	9:00	0	2	8	0	16	0	0	4
9:00	9:15	0	5	22	0	23	0	0	2
9:15	9:30	0	3	19	0	26	3	0	3
9:30	9:45	0	2	17	0	20	0	0	3
9:45	10:00	0	3	13	2	21	1	0	1
10:00	10:15	0	6	16	1	18	1	0	1
10:15	10:30	0	1	16	0	16	0	0	2
10:30	10:45	0	6	18	0	14	0	0	3
10:45	11:00	0	6	12	2	16	0	0	4
11:00	11:15	0	3	8	0	20	1	0	2
11:15	11:30	0	0	13	0	18	0	0	2
11:30	11:45	0	3	17	0	20	1	0	2
11:45	12:00	0	3	0	0	9	0	0	0

Peak Time		North Approach Castlereagh Hwy			South Approach Castlereagh Hwy			West Approach Carsons Sliding Rd			Peak
Period Start	Period End	U	R	SB	U	NB	L	U	R	L	total
7:00	8:00	0	7	46	0	48	2	0	0	4	207
15:00	16:00	0	13	65	2	89	4	0	2	15	190

Peak Volume													
Peak Time		North Approach		Castlereagh Hwy		South Approach		Castlereagh Hwy		West Approach		Carsons Sliding Rd	
Period Start	Period End	U	R	SB	L	U	R	SB	L	U	R	SB	L
6:00	6:15	0	0	2	0	0	0	0	0	0	0	0	0
6:15	6:30	0	0	0	1	0	3	0	0	0	0	0	0
6:30	6:45	0	0	4	0	0	0	0	0	0	0	0	0
6:45	7:00	0	0	2	0	0	4	1	0	0	0	0	0
7:00	7:15	0	0	2	0	11	0	0	0	0	0	0	0
7:15	7:30	0	0	3	0	6	1	0	0	0	0	0	0
7:30	7:45	0	0	5	0	7	0	0	0	0	0	0	0
7:45	8:00	0	0	0	0	3	0	0	0	0	0	0	0
8:00	8:15	0	0	2	0	5	0	0	0	0	0	0	1
8:15	8:30	0	1	2	0	3	0	0	0	0	0	0	0
8:30	8:45	0	2	2	0	0	0	1	0	0	0	0	0
8:45	9:00	0	2	0	0	3	0	0	0	0	0	0	0
9:00	9:15	0	0	6	0	2	1	0	0	0	0	0	0
9:15	9:30	0	0	7	0	2	1	0	0	0	0	0	0
9:30	9:45	0	1	3	0	1	0	0	0	0	0	0	0
9:45	10:00	0	2	7	0	2	0	0	0	0	0	0	0
10:00	10:15	0	0	2	0	2	0	0	0	0	0	0	0
10:15	10:30	0	0	2	0	2	0	0	0	0	0	0	0
10:30	10:45	0	0	4	0	0	0	0	0	0	0	0	0
10:45	11:00	0	1	6	0	1	0	0	0	0	0	0	0
11:00	11:15	0	0	4	0	1	0	0	0	0	0	0	0
11:15	11:30	0	0	2	0	0	0	0	0	0	0	0	0
11:30	11:45	0	0	2	0	1	0	0	0	0	0	0	0
11:45	12:00	0	0	1	0	0	0	0	0	0	0	0	0

0.0	0.0	0	0	0	0	0	0	0	0	0	
Peak Time		North Approach Castlereagh Hwy			South Approach Castlereagh Hwy			West Approach Carsons Sliding Rd			Peak
Period Start	Period End	U	R	SB	U	NB	L	U	R	L	total
7:00	8:00	0	0	15	0	27	1	0	0	0	43
17:00	18:00	0	0	20	0	20	0	0	0	0	40

Peaks	06:00-06:15	06:15-06:30	06:30-06:45	06:45-07:00	07:00-07:15	07:15-07:30	07:30-07:45	07:45-08:00	08:00-08:15
Period	Period Start	Period End	U	R	SB	L	SB	L	Period End
06:00	06:00	06:15	0	0	0	0	0	0	06:15
06:15	06:15	06:30	0	0	0	0	0	0	06:30
06:30	06:30	06:45	0	0	0	0	0	0	06:45
06:45	06:45	07:00	0	0	0	0	0	0	07:00
07:00	07:00	07:15	0	0	0	0	0	0	07:15
07:15	07:15	07:30	0	0	0	0	0	0	07:30
07:30	07:30	07:45	0	0	0	0	0	0	07:45
07:45	07:45	08:00	0	0	0	0	0	0	08:00
08:00	08:00	08:15	0	0	0	0	0	0	08:15
08:15	08:15	08:30	0	0	0	0	0	0	08:30
08:30	08:30	08:45	0	0	0	0	0	0	08:45
08:45	08:45	09:00	0	0	0	0	0	0	09:00
09:00	09:00	09:15	0	0	0	0	0	0	09:15
09:15	09:15	09:30	0	0	0	0	0	0	09:30
09:30	09:30	09:45	0	0	0	0	0	0	09:45
09:45	09:45	10:00	0	0	0	0	0	0	10:00
10:00	10:00	10:15	0	0	0	0	0	0	10:15
10:15	10:15	10:30	0	0	0	0	0	0	10:30
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10:45	10:45	11:00	0	0	0	0	0	0	11:00
11:00	11:00	11:15	0	0	0	0	0	0	11:15
11:15	11:15	11:30	0	0	0	0	0	0	11:30
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11:45	11:45	12:00	0	0	0	0	0	0	12:00

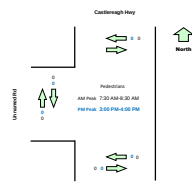
Peaktime Chart																	
Period Start		Period End		North Approach		Castlereagh Hwy		South Approach		Castlereagh Hwy		West Approach		Carsons Sliding Rd		Peak Time	
U	R	U	R	U	R	U	R	U	R	U	R	U	R	U	R	U	R
6:00	6:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:15	6:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:30	6:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:45	7:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:00	7:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15	7:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
7:30	7:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
7:45	8:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
8:00	8:15	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
8:15	8:30	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
8:30	8:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45	9:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00	9:15	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	5
9:15	9:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:30	9:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:45	10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15	10:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30	10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45	11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	11:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15	11:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30	11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45	12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Peak Time	North Approach	Castlere
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Intersection of Unnamed Rd and Castlereagh Hwy, Cullen Bullen

Survey Period	AM	6:00 AM-9:00 AM
	PM	3:00 PM-6:00 PM
Traffic Peak	AM	7:30 AM-8:30 AM
	PM	3:00 PM-4:00 PM

Periods duration		Catching				Application				Entry 7
Period start	Period end	Herbivore	Carnivore	Grasshopper	Antlion	Antlion	Antlion	Antlion		
6:00	6:35	0	0	0	0	0	0	0	0	
6:35	6:50	0	0	0	0	0	0	0	0	
6:50	7:05	0	0	0	0	0	0	0	0	
6:55	7:05	0	0	0	0	0	0	0	0	
6:45	7:00	0	0	0	0	0	0	0	0	
7:00	7:35	0	0	0	0	0	0	0	0	
7:15	7:30	0	0	0	0	0	0	0	0	
7:30	7:45	0	0	0	0	0	0	0	0	
7:45	8:00	0	0	0	0	0	0	0	0	
8:00	8:35	0	0	0	0	0	0	0	0	
8:15	8:30	0	0	0	0	0	0	0	0	
8:30	8:45	0	0	0	0	0	0	0	0	
8:45	9:00	0	0	0	0	0	0	0	0	
15:00	15:15	0	0	0	0	0	0	0	0	
15:15	15:30	0	0	0	0	0	0	0	0	
15:30	15:45	0	0	0	0	0	0	0	0	
15:45	16:00	0	0	0	0	0	0	0	0	
16:00	16:15	0	0	0	0	0	0	0	0	
16:15	16:30	0	0	0	0	0	0	0	0	
16:30	16:45	0	0	0	0	0	0	0	0	
16:45	17:00	0	0	0	0	0	0	0	0	
17:00	17:15	0	0	0	0	0	0	0	0	
17:15	17:30	0	0	0	0	0	0	0	0	
17:30	17:45	0	0	0	0	0	0	0	0	

[illegible]

TRANS TRAFFIC SURVEY

TURNING MOVEMENT SURVEY

Intersection of Invercailley Colliery Access and Castlerough Way, Cullen (Built)

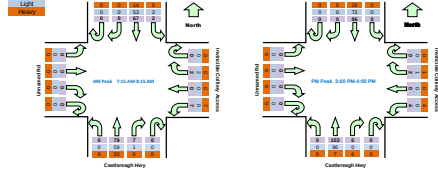
Date:	17/07/2014	North:	Castlerough Way	Survey Period:	17/07/2014 08:00 AM
Prepared:	Colin Wilson	East:	Invercailley Colliery Access	End:	17/07/2014 05:00 PM
Checked:	Colin Wilson	West:	Castlerough Way	Peak:	17/07/2014 08:00 AM
Customer:	TRF	South:	Unimodel Rd	Time:	17/07/2014 08:00 PM

All Vehicles		North Approach Castlerough Way				East Approach Invercailley Colliery Access				South Approach Castlerough Way				West Approach Unimodel Rd				Hourly Total
Period Start	Period End	U	R	SB	L	U	R	SB	L	U	R	SB	L	U	R	SB	L	Peak
6:00	6:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	122
6:15	6:30	0	0	11	2	0	1	0	0	0	0	6	11	0	0	0	0	155
6:30	6:45	0	0	20	0	0	0	0	0	0	0	6	23	0	0	0	0	134
6:45	7:00	0	0	17	1	0	0	0	0	0	0	12	0	0	0	0	0	152
7:00	7:15	0	0	28	3	0	0	0	0	0	0	10	0	0	0	0	0	159
7:15	7:30	0	0	11	1	0	1	0	3	0	0	16	0	0	0	0	0	244 Peak
7:30	7:45	0	0	26	0	0	1	0	0	0	3	26	0	0	0	0	0	243
7:45	8:00	0	0	18	1	0	0	0	3	0	0	15	0	0	0	0	0	154
8:00	8:15	0	0	18	0	0	0	0	1	0	4	22	0	0	0	0	0	154
8:15	8:30	0	0	11	0	0	0	0	2	0	1	17	0	0	0	0	0	
8:30	8:45	0	0	18	0	0	0	0	2	0	3	18	0	0	0	0	0	
8:45	9:00	0	0	15	0	0	0	0	2	0	2	18	0	0	0	0	0	30
9:00	9:15	0	0	23	0	0	1	0	2	0	2	22	0	0	0	0	0	211 Peak
9:15	9:30	0	0	35	0	0	0	0	0	0	2	36	0	0	0	0	0	205
9:30	9:45	0	0	22	0	0	0	0	1	0	0	24	0	0	0	0	0	151
9:45	10:00	0	0	20	0	0	1	0	1	0	2	21	0	0	0	0	0	191
10:00	10:15	0	0	16	0	0	0	1	0	3	0	21	0	0	0	0	0	103
10:15	10:30	0	0	29	0	0	0	0	2	0	2	22	0	0	0	0	0	199
10:30	10:45	0	0	26	0	0	0	0	1	0	0	20	0	0	0	0	0	206
10:45	11:00	0	0	25	0	0	1	0	5	0	0	20	0	0	0	0	0	175
11:00	11:15	0	0	16	1	0	2	0	11	0	0	30	0	0	0	0	0	155
11:15	11:30	0	0	13	0	0	1	0	2	0	0	28	0	0	0	0	0	
11:30	11:45	0	0	17	0	0	0	0	0	0	0	17	0	0	0	0	0	
11:45	12:00	0	0	14	0	0	0	0	0	0	0	13	0	0	0	0	0	

Peak Time		North Approach Castlerough Way				East Approach Invercailley Colliery Access				South Approach Castlerough Way				West Approach Unnamed Rd				Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	total
7:15	8:15	0	0	67	2	0	2	0	7	0	7	79	0	0	0	0	0	164
15:00	16:00	0	0	96	0	0	2	0	4	0	6	103	0	0	0	0	0	211

Note: One sketch is for illustrating traffic flow. Direction is indicative only, drawing is not to scale and not an exact street configuration.

Graphic:



Light Vehicles		North Approach Castlerough Way				East Approach Invercailley Colliery Access				South Approach Castlerough Way				West Approach Unimodel Rd				Hourly Total
Period Start	Period End	U	R	SB	L	U	R	SB	L	U	R	SB	L	U	R	SB	L	Peak
6:00	6:15	0	0	0	0	0	0	0	0	0	0	6	6	0	0	0	0	12
6:15	6:30	0	0	10	2	0	1	0	0	0	0	6	9	0	0	0	0	28
6:30	6:45	0	0	20	0	0	0	0	0	0	0	6	15	0	0	0	0	41
6:45	7:00	0	0	25	1	0	0	0	0	0	0	6	0	0	0	0	0	32
7:00	7:15	0	0	18	0	0	0	0	0	0	0	10	0	0	0	0	0	28
7:15	7:30	0	0	16	1	0	1	0	0	0	0	9	0	0	0	0	0	27
7:30	7:45	0	0	15	0	0	0	0	0	0	0	12	0	0	0	0	0	27
7:45	8:00	0	0	12	1	0	0	0	0	0	0	12	0	0	0	0	0	25
8:00	8:15	0	0	18	0	0	0	0	0	0	1	16	0	0	0	0	0	35
8:15	8:30	0	0	14	0	0	0	0	0	0	0	14	0	0	0	0	0	28
8:30	8:45	0	0	18	0	0	0	0	0	0	0	17	0	0	0	0	0	35
8:45	9:00	0	0	15	0	0	0	0	0	0	0	14	0	0	0	0	0	29
9:00	9:15	0	0	20	0	0	0	0	0	0	0	21	0	0	0	0	0	41
9:15	9:30	0	0	23	0	0	0	0	0	0	0	21	0	0	0	0	0	44
9:30	9:45	0	0	21	0	0	0	0	0	0	0	20	0	0	0	0	0	41
9:45	10:00	0	0	18	0	0	0	0	0	0	0	22	0	0	0	0	0	40
10:00	10:15	0	0	17	0	0	1	0	1	0	0	10	0	0	0	0	0	29
10:15	10:30	0	0	27	0	0	0	1	1	0	0	10	0	0	0	0	0	39
10:30	10:45	0	0	25	0	0	0	0	0	0	0	10	0	0	0	0	0	35
10:45	11:00	0	0	14	0	0	0	0	4	0	0	16	0	0	0	0	0	30
11:00	11:15	0	0	11	1	0	2	0	11	0	0	20	0	0	0	0	0	34
11:15	11:30	0	0	12	0	0	0	0	0	0	0	16	0	0	0	0	0	28
11:30	11:45	0	0	17	0	0	0	0	0	0	0	16	0	0	0	0	0	33
11:45	12:00	0	0	12	0	0	0	0	0	0	0	11	0	0	0	0	0	23

Peak Time		North Approach Castlerough Way				East Approach Invercailley Colliery Access				South Approach Castlerough Way				West Approach Unimodel Rd				Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NS	L	U	R	EB	L	Total
7:15	8:15	0	0	53	2	0	2	0	0	0	1	59	0	0	0	0	0	117
15:00	16:00	0	0	75	0	0	1	0	0	0	0	96	0	0	0	0	0	170

Heavy Vehicles		North Approach Castlerough Way				East Approach Invercailley Colliery Access				South Approach Castlerough Way				West Approach Unimodel Rd				Hourly Total
Period Start	Period End	U	R	SB	L	U	R	SB	L	U	R	SB	L	U	R	SB	L	Peak
6:00	6:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:15	6:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:30	6:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:45	7:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:00	7:15	0	0	2	1	0	0	0	0	0	0	9	0	0	0	0	0	12
7:15	7:30	0	0	1	0	0	0	0	0	0	0	7	0	0	0	0	0	7
7:30	7:45	0	0	5	0	0	0	0	0	0	0	4	0	0	0	0	0	9
7:45	8:00	0	0	3	0	0	0	0	0	0	0	3	0	0	0	0	0	6
8:00	8:15	0	0	2	0	0	0	0	0	1	0	6	0	0	0	0	0	9
8:15	8:30	0	0	2	0	0	0	0	0	2	0	3	0	0	0	0	0	5
8:30	8:45	0	0	2	0	0	0	0	0	2	0	1	0	0	0	0	0	5
8:45	9:00	0	0	2	0	0	0	0	0	2	0	2	0	0	0	0	0	6
9:00	9:15	0	0	3	0	0	0	0	0	2	0	1	0	0	0	0	0	6
9:15	9:30	0	0	10	0	0	0	0	0	0	0	2	0	0	0	0	0	12
9:30	9:45	0	0	3	0	0	0	0	0	0	0	2	0	0	0	0	0	5
9:45	10:00	0	0	7	0	0	0	0	0	1	0	2	0	0	0	0	0	10
10:00	10:15	0	0	3	0	0	0	0	0	1	0	0	1	0	0	0	0	5
10:15	10:30	0	0	2	0	0	0	0	0	1	0	2	0	0	0	0	0	5
10:30	10:45	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	5
10:45	11:00	0	0	7	0	0	0	0	0	1	0	2	0	0	0	0	0	10
11:00	11:15	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	5
11:15	11:30	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
11:30	11:45	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	3
11:45	12:00	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	4

27/03	28/03	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	
Peak Time		North Approach Castlerough Way				East Approach Invercailley Colliery Access				South Approach Castlerough Way				West Approach Unimodel Rd				Peak total
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	
7:15	8:15	0	0	34	0	0	0	0	2	0	6	20	0	0	0	0	0	
15:00	16:00	0	0	29	0	0	1	0	0	0	6	7	0	0	0	0	0	

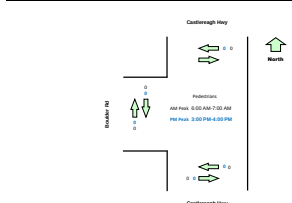
Peak Time		North Approach Castlereagh Hwy			South Approach Castlereagh Hwy			West Approach Boulder Rd			Peak
Period Start	Period End	U	R	SB	U	NB	L	U	R	L	Total
6:00	7:00	0	10	48	0	57	103	0	41	5	204
15:00	16:00	0	7	95	0	94	49	0	100	14	360

Peak Time		North Approach Castlemeigh Hwy			South Approach Castlemeigh Hwy			West Approach Boulder Rd			Peak
Period Start	Period End	U	R	SB	U	NB	L	U	R	L	Total
6:00	7:00	0	0	41	0	43	102	0	38	5	238
15:00	16:00	0	3	73	0	87	46	0	98	7	314

Peak Time		North Approach Castreign Hwy				South Approach Castreign Hwy				West Approach Boulder Rd				Total
Period Start	Period End	U	R	SB	U	MB	L	U	R	L	U	R	L	
6:00	7:00	0	1	7	0	14	1	0	3	0	0	0	0	20
7:00	7:30	0	1	7	0	14	0	0	3	0	0	0	0	20

[illegible]

Peak Time		Approach Castlere		Approach Castlere		Approach Bould		Peak total
Period Start	Period End	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound	
6:00	7:00	0	0	0	0	0	0	0
15:00	16:00	0	0	0	0	0	0	0



Peak Time		Approach Castlere		Approach Castlere		Approach Bould		Peak total
Period Start	Period End	Westbound	Eastbound	Westbound	Eastbound	Southbound	Northbound	
6:00	7:00	0	0	0	0	0	0	0
15:00	16:00	0	0	0	0	0	0	0

Peak hour Traffic at various intersections

Intersection	AM Peak	PM Peak
Castlereagh/Carsons Siding	7 to 8 & 7.15 to 8.15	3 to 4
Castlereagh/Invincible	7.30 to 8.30	3 to 4
Castlereagh/Cullen Access	7.15 to 8.15	3 to 4
Castlereagh/Boulder	6 to 7	3 to 4

Appendix B

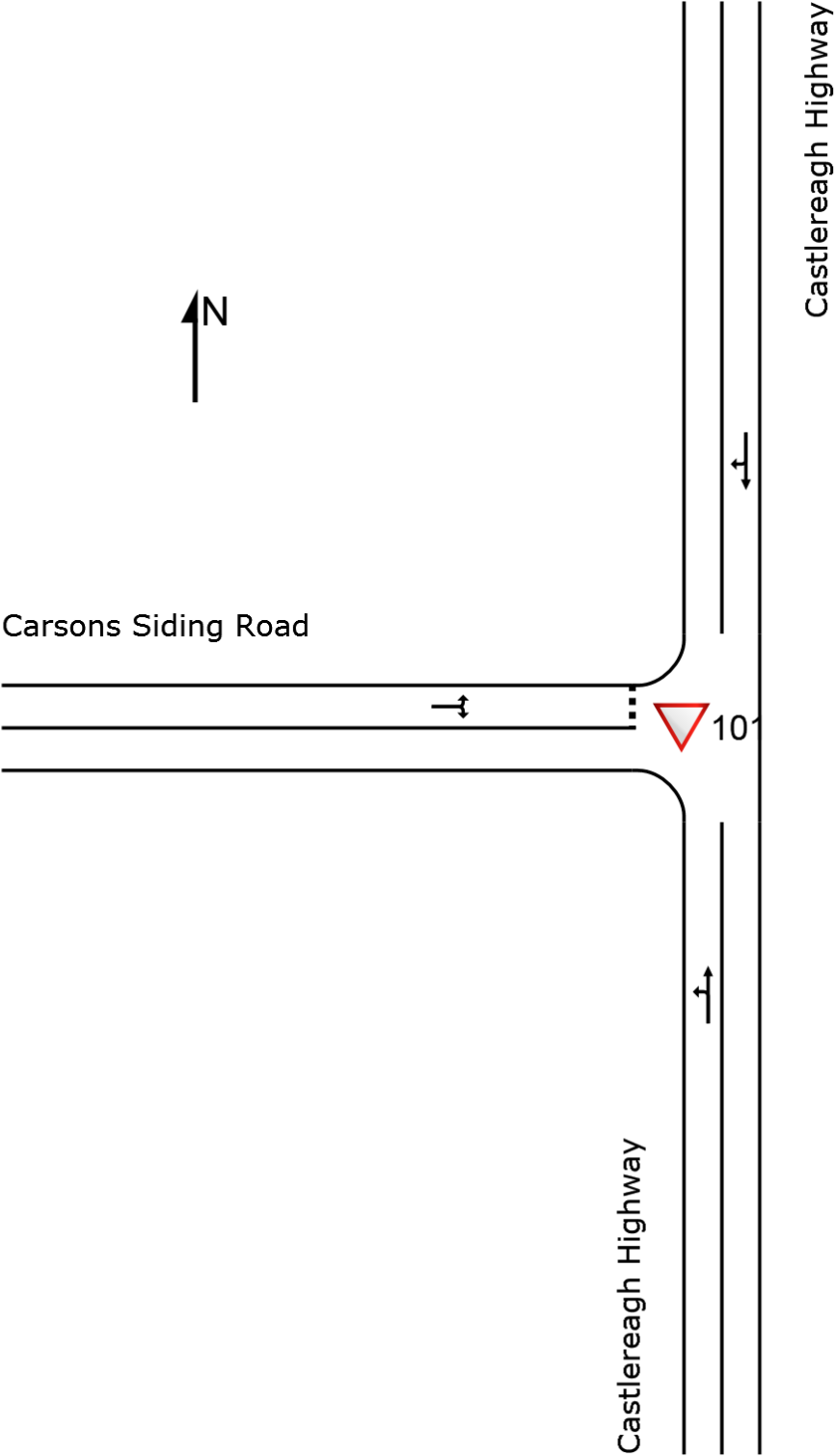
SIDRA modelling results

SITE LAYOUT

▼ Site: 101 [Castlereagh Highway/Carsons Siding Road (Site Folder: 2030 Baseline scenario AM peak)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



SITE LAYOUT

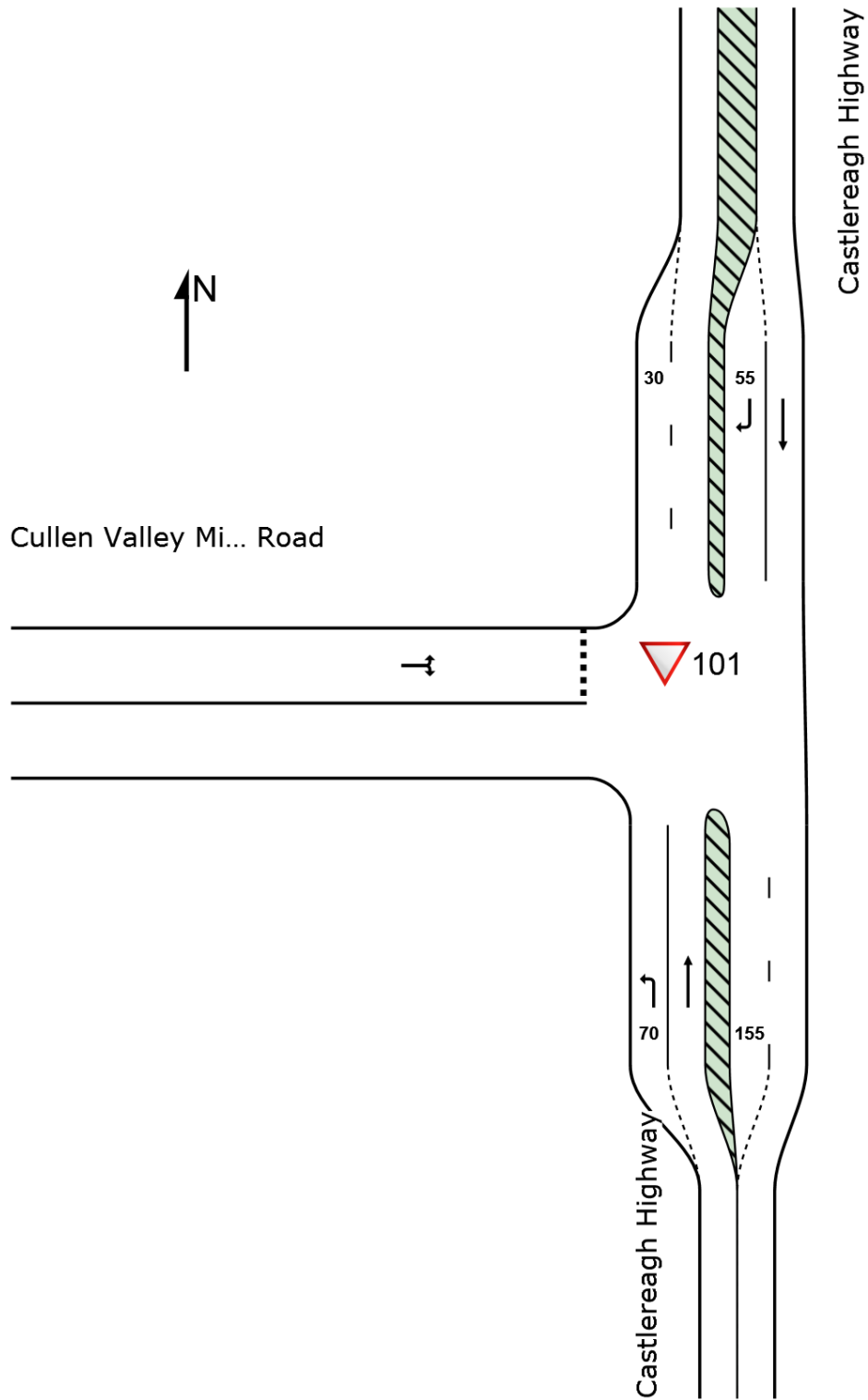
▽ Site: 101 [Castlereagh Highway/Cullen Valley Mine Access Road (Site Folder: 2030 Baseline scenario AM peak)]

New Site

Site Category: (None)

Give-Way (Two-Way)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.

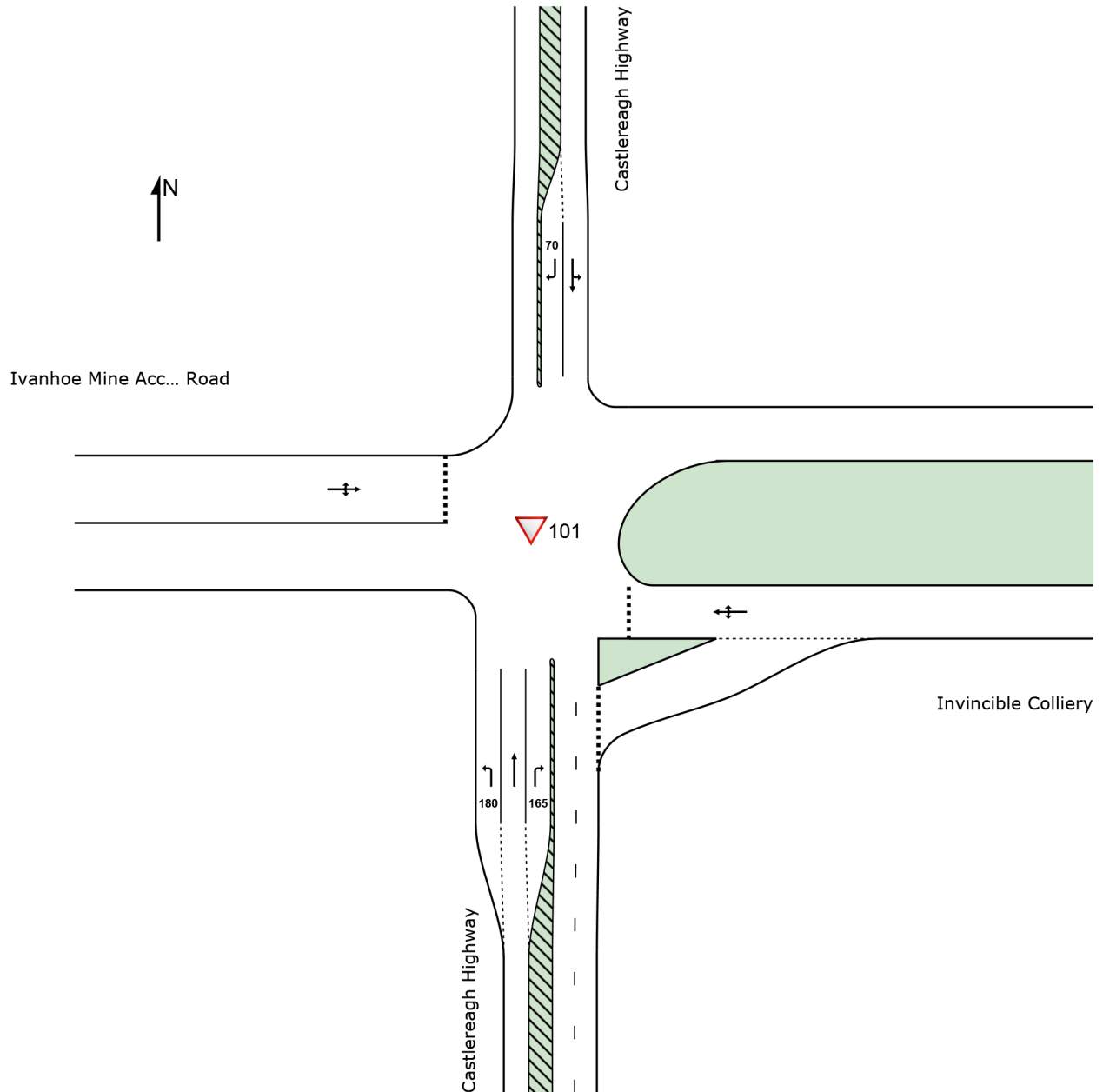


SITE LAYOUT

▽ Site: 101 [Castlereagh Highway/Invincible Colliery/Ivanhoe Mine Access Road (Site Folder: 2030 Baseline scenario AM peak)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



SITE LAYOUT

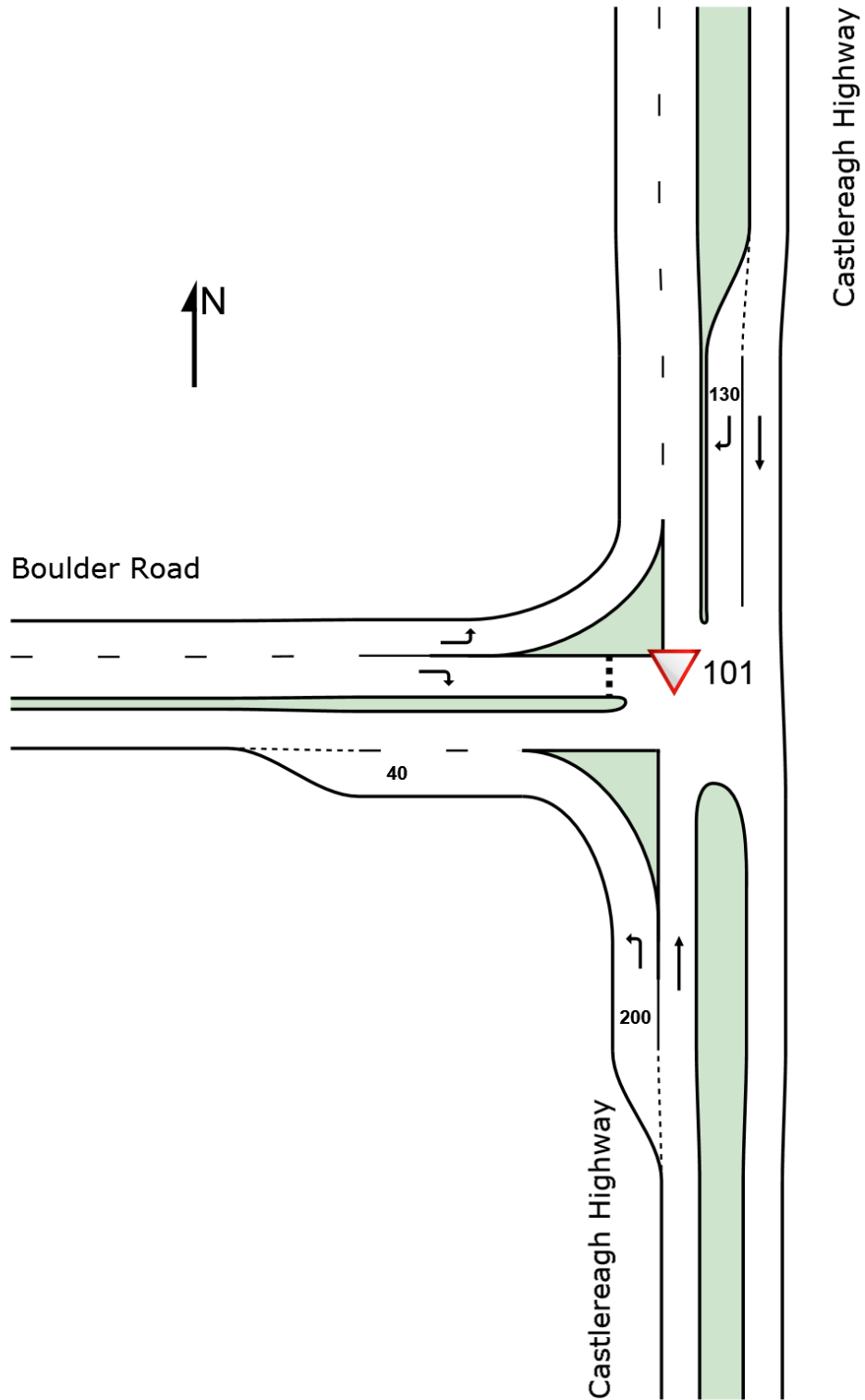
▼ Site: 101 [Castlereagh Highway/Boulder Road (Site Folder: 2030 Baseline scenario AM peak)]

New Site

Site Category: (None)

Give-Way (Two-Way)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



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Organisation: EMM CONSULTING | Licence: NETWORK / 1PC | Created: Wednesday, 11 September 2024 12:05:03 PM

Project: C:\Users\ffang\Desktop\sidra models\Shoalhaven\E240039_SIDRA_v2_11 September 2024.sip9

MOVEMENT SUMMARY

Site: 101 [Castlereagh Highway/Carsons Siding Road (Site Folder: 2030 Baseline scenario AM peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %		Arrival Flows [Total HV] veh/h %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. Dist] veh m		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Castlereagh Highway															
1	L2	All MCs	3	33.3	3	33.3	0.058	4.9	LOS A	0.0	0.0	0.00	0.02	0.00	48.1
2	T1	All MCs	88	35.7	88	35.7	0.058	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	49.9
Approach			92	35.6	92	35.6	0.058	0.2	NA	0.0	0.0	0.00	0.02	0.00	49.8
North: Castlereagh Highway															
8	T1	All MCs	73	24.6	73	24.6	0.048	0.0	LOS A	0.1	0.4	0.05	0.08	0.05	59.1
9	R2	All MCs	8	0.0	8	0.0	0.048	6.1	LOS A	0.1	0.4	0.05	0.08	0.05	56.4
Approach			81	22.1	81	22.1	0.048	0.6	NA	0.1	0.4	0.05	0.08	0.05	58.8
West: Carsons Siding Road															
10	L2	All MCs	4	0.0	4	0.0	0.004	5.8	LOS A	0.0	0.1	0.20	0.53	0.20	52.3
12	R2	All MCs	1	0.0	1	0.0	0.004	6.1	LOS A	0.0	0.1	0.20	0.53	0.20	52.1
Approach			5	0.0	5	0.0	0.004	5.9	LOS A	0.0	0.1	0.20	0.53	0.20	52.3
All Vehicles			178	28.4	178	28.4	0.058	0.6	NA	0.1	0.4	0.03	0.06	0.03	53.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Castlereagh Highway/Cullen Valley Mine Access Road (Site Folder: 2030 Baseline scenario AM peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %		Arrival Flows [Total HV] veh/h %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. Dist] veh m		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Castlereagh Highway															
1	L2	All MCs	1	0.0	1	0.0	0.001	4.6	LOS A	0.0	0.0	0.00	0.53	0.00	46.0
2	T1	All MCs	97	20.7	97	20.7	0.055	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
Approach			98	20.4	98	20.4	0.055	0.1	NA	0.0	0.0	0.00	0.01	0.00	49.9
North: Castlereagh Highway															
8	T1	All MCs	80	22.4	80	22.4	0.046	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
9	R2	All MCs	1	0.0	1	0.0	0.001	8.5	LOS A	0.0	0.0	0.20	0.58	0.20	61.0
Approach			81	22.1	81	22.1	0.046	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.2
West: Cullen Valley Mine Access Road															
10	L2	All MCs	1	0.0	1	0.0	0.002	5.5	LOS A	0.0	0.0	0.00	0.56	0.00	49.2
12	R2	All MCs	1	0.0	1	0.0	0.002	5.6	LOS A	0.0	0.0	0.00	0.56	0.00	61.8
Approach			2	0.0	2	0.0	0.002	5.6	LOS A	0.0	0.0	0.00	0.56	0.00	54.8
All Vehicles			181	20.9	181	20.9	0.055	0.2	NA	0.0	0.0	0.00	0.01	0.00	64.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Castlereagh Highway/Invincible Colliery/Ivanhoe Mine Access Road (Site Folder: 2030 Baseline scenario AM peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %		Arrival Flows [Total HV] veh/h %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. Dist] veh m		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Castlereagh Highway															
1	L2	All MCs	1	0.0	1	0.0	0.001	7.8	LOS A	0.0	0.0	0.00	0.66	0.00	74.4
2	T1	All MCs	93	25.0	93	25.0	0.054	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
3	R2	All MCs	8	87.5	8	87.5	0.008	11.4	LOS A	0.0	0.4	0.23	0.53	0.23	55.1
Approach			102	29.9	102	29.9	0.054	1.0	NA	0.0	0.4	0.02	0.05	0.02	93.4
East: Invincible Colliery															
4	L2	All MCs	8	100.0	8	100.0	0.015	6.0	LOS A	0.1	0.6	0.25	0.45	0.25	44.3
5	T1	All MCs	1	0.0	1	0.0	0.015	5.6	LOS A	0.1	0.6	0.25	0.45	0.25	45.2
6	R2	All MCs	2	0.0	2	0.0	0.015	6.1	LOS A	0.1	0.6	0.25	0.45	0.25	54.7
Approach			12	72.7	12	72.7	0.015	6.0	LOS A	0.1	0.6	0.25	0.45	0.25	46.0
North: Castlereagh Highway															
7	L2	All MCs	2	0.0	2	0.0	0.046	7.8	LOS A	0.0	0.0	0.00	0.02	0.00	87.2
8	T1	All MCs	79	21.3	79	21.3	0.046	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	99.3
9	R2	All MCs	1	0.0	1	0.0	0.001	8.4	LOS A	0.0	0.0	0.20	0.58	0.20	56.2
Approach			82	20.5	82	20.5	0.046	0.3	NA	0.0	0.0	0.00	0.02	0.00	98.0
West: Ivanhoe Mine Access Road															
10	L2	All MCs	1	0.0	1	0.0	0.004	4.9	LOS A	0.0	0.1	0.30	0.48	0.30	55.8
11	T1	All MCs	1	0.0	1	0.0	0.004	5.6	LOS A	0.0	0.1	0.30	0.48	0.30	45.6
12	R2	All MCs	1	0.0	1	0.0	0.004	6.3	LOS A	0.0	0.1	0.30	0.48	0.30	55.9
Approach			3	0.0	3	0.0	0.004	5.6	LOS A	0.0	0.1	0.30	0.48	0.30	52.0
All Vehicles			199	28.0	199	28.0	0.054	1.1	NA	0.1	0.6	0.03	0.07	0.03	88.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Castlereagh Highway/Boulder Road (Site Folder: 2030 Baseline scenario AM peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist] m				km/h
South: Castlereagh Highway															
1	L2	All MCs	121	0.9	121	0.9	0.063	8.8	LOS A	0.0	0.0	0.00	0.64	0.00	72.5
2	T1	All MCs	67	25.0	67	25.0	0.040	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
Approach			188	9.5	188	9.5	0.063	5.6	NA	0.0	0.0	0.00	0.41	0.00	80.3
North: Castlereagh Highway															
8	T1	All MCs	57	14.8	57	14.8	0.032	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
9	R2	All MCs	12	9.1	12	9.1	0.007	8.5	LOS A	0.0	0.2	0.17	0.59	0.17	60.7
Approach			68	13.8	68	13.8	0.032	1.4	NA	0.0	0.2	0.03	0.10	0.03	90.1
West: Boulder Road															
10	L2	All MCs	6	0.0	6	0.0	0.003	5.6	LOS A	0.0	0.0	0.00	0.53	0.00	53.5
12	R2	All MCs	48	6.5	48	6.5	0.053	6.9	LOS A	0.2	1.5	0.34	0.57	0.34	58.2
Approach			55	5.8	55	5.8	0.053	6.8	LOS A	0.2	1.5	0.30	0.56	0.30	57.6
All Vehicles			312	9.8	312	9.8	0.063	4.9	NA	0.2	1.5	0.06	0.37	0.06	76.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Castlereagh Highway/Carsons Siding Road (Site Folder: 2030 Baseline scenario PM peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %		Arrival Flows [Total HV] veh/h %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. Dist] veh m		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Castlereagh Highway															
1	L2	All MCs	6	33.3	6	33.3	0.065	3.6	LOS A	0.0	0.0	0.00	0.02	0.00	39.3
2	T1	All MCs	114	7.4	114	7.4	0.065	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	39.9
Approach			120	8.8	120	8.8	0.065	0.2	NA	0.0	0.0	0.00	0.02	0.00	39.9
North: Castlereagh Highway															
8	T1	All MCs	104	26.3	104	26.3	0.075	0.0	LOS A	0.1	1.1	0.08	0.12	0.08	58.7
9	R2	All MCs	19	16.7	19	16.7	0.075	6.7	LOS A	0.1	1.1	0.08	0.12	0.08	55.2
Approach			123	24.8	123	24.8	0.075	1.0	NA	0.1	1.1	0.08	0.12	0.08	58.2
West: Carsons Siding Road															
10	L2	All MCs	18	0.0	18	0.0	0.014	5.9	LOS A	0.1	0.4	0.21	0.54	0.21	52.3
12	R2	All MCs	2	0.0	2	0.0	0.014	6.4	LOS A	0.1	0.4	0.21	0.54	0.21	52.0
Approach			20	0.0	20	0.0	0.014	5.9	LOS A	0.1	0.4	0.21	0.54	0.21	52.2
All Vehicles			263	15.6	263	15.6	0.075	1.0	NA	0.1	1.1	0.06	0.11	0.06	47.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Castlereagh Highway/Cullen Valley Mine Access Road (Site Folder: 2030 Baseline scenario PM peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist] m				km/h
South: Castlereagh Highway															
1	L2	All MCs	4	25.0	4	25.0	0.003	4.8	LOS A	0.0	0.0	0.00	0.52	0.00	45.6
2	T1	All MCs	120	7.9	120	7.9	0.064	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
Approach			124	8.5	124	8.5	0.064	0.2	NA	0.0	0.0	0.00	0.02	0.00	49.8
North: Castlereagh Highway															
8	T1	All MCs	113	24.3	113	24.3	0.066	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
9	R2	All MCs	1	0.0	1	0.0	0.001	8.6	LOS A	0.0	0.0	0.23	0.57	0.23	60.9
Approach			114	24.1	114	24.1	0.066	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.4
West: Cullen Valley Mine Access Road															
10	L2	All MCs	1	0.0	1	0.0	0.002	5.5	LOS A	0.0	0.0	0.00	0.56	0.00	49.2
12	R2	All MCs	1	0.0	1	0.0	0.002	5.6	LOS A	0.0	0.0	0.00	0.56	0.00	61.8
Approach			2	0.0	2	0.0	0.002	5.6	LOS A	0.0	0.0	0.00	0.56	0.00	54.8
All Vehicles			240	15.8	240	15.8	0.066	0.2	NA	0.0	0.0	0.00	0.02	0.00	65.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Castlereagh Highway/Invincible Colliery/Ivanhoe Mine Access Road (Site Folder: 2030 Baseline scenario PM peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %		Arrival Flows [Total HV] veh/h %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. Dist] veh m		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Castlereagh Highway															
1	L2	All MCs	1	0.0	1	0.0	0.001	7.8	LOS A	0.0	0.0	0.00	0.66	0.00	74.4
2	T1	All MCs	122	6.9	122	6.9	0.064	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
3	R2	All MCs	7	100.0	7	100.0	0.007	12.0	LOS A	0.0	0.4	0.29	0.53	0.29	52.5
Approach			131	12.1	131	12.1	0.064	0.7	NA	0.0	0.4	0.02	0.04	0.02	94.9
East: Invincible Colliery															
4	L2	All MCs	4	100.0	4	100.0	0.012	6.3	LOS A	0.0	0.5	0.34	0.48	0.34	43.9
5	T1	All MCs	1	0.0	1	0.0	0.012	6.2	LOS A	0.0	0.5	0.34	0.48	0.34	44.9
6	R2	All MCs	2	50.0	2	50.0	0.012	9.1	LOS A	0.0	0.5	0.34	0.48	0.34	47.0
Approach			7	71.4	7	71.4	0.012	7.1	LOS A	0.0	0.5	0.34	0.48	0.34	44.9
North: Castlereagh Highway															
7	L2	All MCs	1	0.0	1	0.0	0.067	7.8	LOS A	0.0	0.0	0.00	0.01	0.00	87.5
8	T1	All MCs	114	24.1	114	24.1	0.067	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	99.7
9	R2	All MCs	1	0.0	1	0.0	0.001	8.5	LOS A	0.0	0.0	0.22	0.57	0.22	56.1
Approach			116	23.6	116	23.6	0.067	0.2	NA	0.0	0.0	0.00	0.01	0.00	98.9
West: Ivanhoe Mine Access Road															
10	L2	All MCs	1	0.0	1	0.0	0.004	5.0	LOS A	0.0	0.1	0.34	0.49	0.34	55.5
11	T1	All MCs	1	0.0	1	0.0	0.004	6.1	LOS A	0.0	0.1	0.34	0.49	0.34	45.4
12	R2	All MCs	1	0.0	1	0.0	0.004	7.0	LOS A	0.0	0.1	0.34	0.49	0.34	55.6
Approach			3	0.0	3	0.0	0.004	6.0	LOS A	0.0	0.1	0.34	0.49	0.34	51.7
All Vehicles			257	18.9	257	18.9	0.067	0.7	NA	0.0	0.5	0.02	0.04	0.02	92.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Castlereagh Highway/Boulder Road (Site Folder: 2030 Baseline scenario PM peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist] m				km/h
South: Castlereagh Highway															
1	L2	All MCs	58	5.5	58	5.5	0.031	8.9	LOS A	0.0	0.0	0.00	0.63	0.00	71.1
2	T1	All MCs	111	7.6	111	7.6	0.059	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
Approach			168	6.9	168	6.9	0.059	3.0	NA	0.0	0.0	0.00	0.22	0.00	87.6
North: Castlereagh Highway															
8	T1	All MCs	114	24.1	114	24.1	0.067	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
9	R2	All MCs	7	57.1	7	57.1	0.006	10.0	LOS A	0.0	0.3	0.25	0.58	0.25	58.0
Approach			121	26.1	121	26.1	0.067	0.6	NA	0.0	0.3	0.02	0.04	0.02	95.7
West: Boulder Road															
10	L2	All MCs	17	50.0	17	50.0	0.012	6.1	LOS A	0.0	0.0	0.00	0.50	0.00	51.8
12	R2	All MCs	118	1.8	118	1.8	0.137	7.4	LOS A	0.6	4.0	0.41	0.63	0.41	58.9
Approach			135	7.8	135	7.8	0.137	7.3	LOS A	0.6	4.0	0.36	0.61	0.36	57.9
All Vehicles			424	12.7	424	12.7	0.137	3.7	NA	0.6	4.0	0.12	0.29	0.12	76.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Castlereagh Highway/Carsons Siding Road (Site Folder: 2030 Baseline + Project scenario AM peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %		Arrival Flows [Total HV] veh/h %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. Dist] veh m		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Castlereagh Highway															
1	L2	All MCs	34	3.1	34	3.1	0.074	4.6	LOS A	0.0	0.0	0.00	0.15	0.00	47.6
2	T1	All MCs	88	35.7	88	35.7	0.074	0.0	LOS A	0.0	0.0	0.00	0.15	0.00	48.9
Approach			122	26.7	122	26.7	0.074	1.3	NA	0.0	0.0	0.00	0.15	0.00	48.5
North: Castlereagh Highway															
8	T1	All MCs	88	20.2	88	20.2	0.063	0.0	LOS A	0.1	0.9	0.09	0.13	0.09	58.5
9	R2	All MCs	19	0.0	19	0.0	0.063	6.4	LOS A	0.1	0.9	0.09	0.13	0.09	55.9
Approach			107	16.7	107	16.7	0.063	1.1	NA	0.1	0.9	0.09	0.13	0.09	58.0
West: Carsons Siding Road															
10	L2	All MCs	4	0.0	4	0.0	0.004	5.8	LOS A	0.0	0.1	0.20	0.53	0.20	52.3
12	R2	All MCs	1	0.0	1	0.0	0.004	6.2	LOS A	0.0	0.1	0.20	0.53	0.20	52.1
Approach			5	0.0	5	0.0	0.004	5.9	LOS A	0.0	0.1	0.20	0.53	0.20	52.2
All Vehicles			235	21.5	235	21.5	0.074	1.3	NA	0.1	0.9	0.05	0.15	0.05	52.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Castlereagh Highway/Cullen Valley Mine Access Road (Site Folder: 2030 Baseline + Project scenario AM peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %		Arrival Flows [Total HV] veh/h %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. Dist] veh m		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Castlereagh Highway															
1	L2	All MCs	3	100.0	3	100.0	0.003	5.4	LOS A	0.0	0.0	0.00	0.51	0.00	44.1
2	T1	All MCs	127	15.7	127	15.7	0.071	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
Approach			131	17.7	131	17.7	0.071	0.2	NA	0.0	0.0	0.00	0.01	0.00	49.8
North: Castlereagh Highway															
8	T1	All MCs	96	18.7	96	18.7	0.054	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
9	R2	All MCs	1	0.0	1	0.0	0.001	8.6	LOS A	0.0	0.0	0.24	0.57	0.24	60.9
Approach			97	18.5	97	18.5	0.054	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.3
West: Cullen Valley Mine Access Road															
10	L2	All MCs	1	0.0	1	0.0	0.010	5.5	LOS A	0.0	0.4	0.02	0.53	0.02	48.5
12	R2	All MCs	4	100.0	4	100.0	0.010	7.2	LOS A	0.0	0.4	0.02	0.53	0.02	47.5
Approach			5	80.0	5	80.0	0.010	6.9	LOS A	0.0	0.4	0.02	0.53	0.02	47.7
All Vehicles			233	19.5	233	19.5	0.071	0.3	NA	0.0	0.4	0.00	0.02	0.00	62.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Castlereagh Highway/Invincible Colliery/Ivanhoe Mine Access Road (Site Folder: 2030 Baseline + Project scenario AM peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %		Arrival Flows [Total HV] veh/h %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. Dist] veh m		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Castlereagh Highway															
1	L2	All MCs	1	0.0	1	0.0	0.001	7.8	LOS A	0.0	0.0	0.00	0.66	0.00	74.4
2	T1	All MCs	126	20.8	126	20.8	0.072	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
3	R2	All MCs	53	12.0	53	12.0	0.034	9.7	LOS A	0.2	1.2	0.22	0.57	0.22	56.0
Approach			180	18.1	180	18.1	0.072	2.9	NA	0.2	1.2	0.06	0.17	0.06	81.2
East: Invincible Colliery															
4	L2	All MCs	9	100.0	9	100.0	0.016	6.0	LOS A	0.1	0.7	0.25	0.46	0.25	44.2
5	T1	All MCs	1	0.0	1	0.0	0.016	6.5	LOS A	0.1	0.7	0.25	0.46	0.25	45.1
6	R2	All MCs	1	0.0	1	0.0	0.016	7.2	LOS A	0.1	0.7	0.25	0.46	0.25	54.6
Approach			12	81.8	12	81.8	0.016	6.2	LOS A	0.1	0.7	0.25	0.46	0.25	45.1
North: Castlereagh Highway															
7	L2	All MCs	16	0.0	16	0.0	0.057	7.8	LOS A	0.0	0.0	0.00	0.11	0.00	84.5
8	T1	All MCs	83	25.3	83	25.3	0.057	0.0	LOS A	0.0	0.0	0.00	0.11	0.00	95.9
9	R2	All MCs	1	0.0	1	0.0	0.001	8.6	LOS A	0.0	0.0	0.24	0.57	0.24	56.0
Approach			100	21.1	100	21.1	0.057	1.3	NA	0.0	0.0	0.00	0.11	0.00	93.2
West: Ivanhoe Mine Access Road															
10	L2	All MCs	1	0.0	1	0.0	0.004	5.0	LOS A	0.0	0.1	0.36	0.50	0.36	55.3
11	T1	All MCs	1	0.0	1	0.0	0.004	6.5	LOS A	0.0	0.1	0.36	0.50	0.36	45.3
12	R2	All MCs	1	0.0	1	0.0	0.004	7.3	LOS A	0.0	0.1	0.36	0.50	0.36	55.4
Approach			3	0.0	3	0.0	0.004	6.3	LOS A	0.0	0.1	0.36	0.50	0.36	51.5
All Vehicles			295	21.4	295	21.4	0.072	2.5	NA	0.2	1.2	0.05	0.17	0.05	81.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Castlereagh Highway/Boulder Road (Site Folder: 2030 Baseline + Project scenario AM peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist] m				km/h
South: Castlereagh Highway															
1	L2	All MCs	121	0.9	121	0.9	0.063	8.8	LOS A	0.0	0.0	0.00	0.64	0.00	72.5
2	T1	All MCs	144	11.7	144	11.7	0.079	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
Approach			265	6.7	265	6.7	0.079	4.0	NA	0.0	0.0	0.00	0.29	0.00	85.1
North: Castlereagh Highway															
8	T1	All MCs	60	19.3	60	19.3	0.034	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
9	R2	All MCs	22	52.4	22	52.4	0.019	10.1	LOS A	0.1	0.8	0.29	0.59	0.29	58.0
Approach			82	28.2	82	28.2	0.034	2.7	NA	0.1	0.8	0.08	0.16	0.08	83.7
West: Boulder Road															
10	L2	All MCs	16	60.0	16	60.0	0.012	6.2	LOS A	0.0	0.0	0.00	0.50	0.00	51.5
12	R2	All MCs	48	6.5	48	6.5	0.060	7.6	LOS A	0.2	1.7	0.41	0.62	0.41	57.8
Approach			64	19.7	64	19.7	0.060	7.3	LOS A	0.2	1.7	0.31	0.59	0.31	56.1
All Vehicles			412	13.0	412	13.0	0.079	4.3	NA	0.2	1.7	0.06	0.31	0.06	78.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Castlereagh Highway/Carsons Siding Road (Site Folder: 2030 Baseline + Project scenario PM peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %		Arrival Flows [Total HV] veh/h %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. Dist] veh m		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Castlereagh Highway															
1	L2	All MCs	6	33.3	6	33.3	0.073	3.6	LOS A	0.0	0.0	0.00	0.02	0.00	39.4
2	T1	All MCs	129	6.5	129	6.5	0.073	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	39.9
Approach			136	7.8	136	7.8	0.073	0.2	NA	0.0	0.0	0.00	0.02	0.00	39.9
North: Castlereagh Highway															
8	T1	All MCs	104	26.3	104	26.3	0.076	0.0	LOS A	0.1	1.1	0.09	0.13	0.09	58.7
9	R2	All MCs	19	16.7	19	16.7	0.076	6.8	LOS A	0.1	1.1	0.09	0.13	0.09	55.2
Approach			123	24.8	123	24.8	0.076	1.1	NA	0.1	1.1	0.09	0.13	0.09	58.2
West: Carsons Siding Road															
10	L2	All MCs	28	0.0	28	0.0	0.052	5.9	LOS A	0.2	1.3	0.27	0.57	0.27	52.1
12	R2	All MCs	33	0.0	33	0.0	0.052	6.5	LOS A	0.2	1.3	0.27	0.57	0.27	51.9
Approach			61	0.0	61	0.0	0.052	6.2	LOS A	0.2	1.3	0.27	0.57	0.27	52.0
All Vehicles			320	12.8	320	12.8	0.076	1.7	NA	0.2	1.3	0.09	0.17	0.09	47.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Castlereagh Highway/Cullen Valley Mine Access Road (Site Folder: 2030 Baseline + Project scenario PM peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist] m				km/h
South: Castlereagh Highway															
1	L2	All MCs	8	62.5	8	62.5	0.006	5.1	LOS A	0.0	0.0	0.00	0.52	0.00	45.1
2	T1	All MCs	136	7.0	136	7.0	0.072	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
Approach			144	10.2	144	10.2	0.072	0.3	NA	0.0	0.0	0.00	0.03	0.00	49.7
North: Castlereagh Highway															
8	T1	All MCs	143	19.1	143	19.1	0.081	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
9	R2	All MCs	1	0.0	1	0.0	0.001	8.7	LOS A	0.0	0.0	0.25	0.57	0.25	60.8
Approach			144	19.0	144	19.0	0.081	0.1	NA	0.0	0.0	0.00	0.00	0.00	99.5
West: Cullen Valley Mine Access Road															
10	L2	All MCs	1	0.0	1	0.0	0.010	5.5	LOS A	0.0	0.3	0.02	0.53	0.02	49.1
12	R2	All MCs	4	75.0	4	75.0	0.010	7.1	LOS A	0.0	0.3	0.02	0.53	0.02	47.1
Approach			5	60.0	5	60.0	0.010	6.8	LOS A	0.0	0.3	0.02	0.53	0.02	47.5
All Vehicles			294	15.4	294	15.4	0.081	0.3	NA	0.0	0.3	0.00	0.03	0.00	65.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Castlereagh Highway/Invincible Colliery/Ivanhoe Mine Access Road (Site Folder: 2030 Baseline + Project scenario PM peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %		Arrival Flows [Total HV] veh/h %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. Dist] veh m		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Castlereagh Highway															
1	L2	All MCs	1	0.0	1	0.0	0.001	7.8	LOS A	0.0	0.0	0.00	0.66	0.00	74.4
2	T1	All MCs	126	10.0	126	10.0	0.068	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
3	R2	All MCs	6	100.0	6	100.0	0.007	12.3	LOS A	0.0	0.4	0.33	0.54	0.33	52.2
Approach			134	14.2	134	14.2	0.068	0.6	NA	0.0	0.4	0.02	0.03	0.02	95.6
East: Invincible Colliery															
4	L2	All MCs	54	13.7	54	13.7	0.082	5.4	LOS A	0.3	2.3	0.32	0.52	0.32	52.6
5	T1	All MCs	1	0.0	1	0.0	0.082	6.9	LOS A	0.3	2.3	0.32	0.52	0.32	45.5
6	R2	All MCs	16	0.0	16	0.0	0.082	7.7	LOS A	0.3	2.3	0.32	0.52	0.32	55.1
Approach			71	10.4	71	10.4	0.082	5.9	LOS A	0.3	2.3	0.32	0.52	0.32	53.0
North: Castlereagh Highway															
7	L2	All MCs	1	0.0	1	0.0	0.085	7.8	LOS A	0.0	0.0	0.00	0.00	0.00	87.5
8	T1	All MCs	147	20.7	147	20.7	0.085	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.8
9	R2	All MCs	1	0.0	1	0.0	0.001	8.5	LOS A	0.0	0.0	0.23	0.57	0.23	56.1
Approach			149	20.4	149	20.4	0.085	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.1
West: Ivanhoe Mine Access Road															
10	L2	All MCs	1	0.0	1	0.0	0.004	5.0	LOS A	0.0	0.1	0.36	0.50	0.36	55.2
11	T1	All MCs	1	0.0	1	0.0	0.004	6.5	LOS A	0.0	0.1	0.36	0.50	0.36	45.3
12	R2	All MCs	1	0.0	1	0.0	0.004	7.5	LOS A	0.0	0.1	0.36	0.50	0.36	55.3
Approach			3	0.0	3	0.0	0.004	6.4	LOS A	0.0	0.1	0.36	0.50	0.36	51.5
All Vehicles			357	15.9	357	15.9	0.085	1.5	NA	0.3	2.3	0.07	0.12	0.07	83.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Castlereagh Highway/Boulder Road (Site Folder: 2030 Baseline + Project scenario PM peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist] m				km/h
South: Castlereagh Highway															
1	L2	All MCs	58	5.5	58	5.5	0.031	8.9	LOS A	0.0	0.0	0.00	0.63	0.00	71.1
2	T1	All MCs	114	10.2	114	10.2	0.062	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
Approach			172	8.6	172	8.6	0.062	3.0	NA	0.0	0.0	0.00	0.21	0.00	87.8
North: Castlereagh Highway															
8	T1	All MCs	191	14.4	191	14.4	0.106	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
9	R2	All MCs	18	82.4	18	82.4	0.016	10.8	LOS A	0.1	0.9	0.27	0.59	0.27	56.7
Approach			208	20.2	208	20.2	0.106	0.9	NA	0.1	0.9	0.02	0.05	0.02	93.8
West: Boulder Road															
10	L2	All MCs	26	68.0	26	68.0	0.021	6.3	LOS A	0.0	0.0	0.00	0.49	0.00	51.2
12	R2	All MCs	118	1.8	118	1.8	0.155	8.3	LOS A	0.6	4.4	0.48	0.68	0.48	58.2
Approach			144	13.9	144	13.9	0.155	7.9	LOS A	0.6	4.4	0.39	0.65	0.39	56.8
All Vehicles			524	14.7	524	14.7	0.155	3.5	NA	0.6	4.4	0.12	0.27	0.12	78.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Australia

SYDNEY

Ground floor 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500

NEWCASTLE

Level 3 175 Scott Street
Newcastle NSW 2300
T 02 4907 4800

BRISBANE

Level 1 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

CANBERRA

Suite 2.04 Level 2
15 London Circuit
Canberra City ACT 2601

ADELAIDE

Level 4 74 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE

Suite 9.01 Level 9
454 Collins Street
Melbourne VIC 3000
T 03 9993 1900

PERTH

Suite 3.03
111 St Georges Terrace
Perth WA 6000
T 08 6430 4800

Canada

TORONTO

2345 Yonge Street Suite 300
Toronto ON M4P 2E5
T 647 467 1605

VANCOUVER

422 Richards Street Unit 170
Vancouver BC V6B 2Z4
T 604 999 8297

CALGARY

606 4th Street SW 11 Floor
Calgary Alberta T2P 1T1



[linkedin.com/company/emm-consulting-pty-limited](https://www.linkedin.com/company/emm-consulting-pty-limited)



emmconsulting.com.au

Appendix D

Greenhouse gas assessment

Invincible Colliery Modification 6

Greenhouse gas assessment

Prepared for Castlereagh Coal

January 2025

Invincible Colliery Modification 6

Greenhouse gas assessment

Castlereagh Coal

E240039 RP3

January 2025

Version	Date	Prepared by	Reviewed by	Comments
V1	20 December 2024	F Manansala	Paul Boulter	Draft report
V2	15 January 2025	F Manansala	Paul Boulter	Final

Approved by



Dr Paul Boulter
Associate Director and Technical Lead – Air Quality and Climate
15 January 2025

Level 10 201 Pacific Highway
St Leonards NSW 2065
ABN: 28 141 736 558

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ABN: 28 141 736 558

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1 Introduction

1.1 Project overview

Castlereagh Coal owns and operates the Invincible Colliery (the colliery), an open-cut coal mine located approximately 30 kilometres (km) north-west of Lithgow, New South Wales (NSW). The colliery is located in the Lithgow City Council local government area (LGA).

The colliery's project approval (07_0127) was granted on 4 December 2008 and modified on 2 February 2018. Project approval 07_0127 permits extraction and transport of up to 1.2 million tonnes per annum (tpa) of run-of-mine (RoM) coal until 31 December 2025. The approval includes transportation of coal by road to the Mount Piper Power Station and the Shoalhaven Starches Plant in Nowra.

The colliery was in care and maintenance from April 2013 to July 2023, when mining recommenced in the Southern Extension area.

Castlereagh Coal is seeking a modification to:

- modify Schedule 2 Condition 5 of MP07_0127 to extend the life of mine from 31 December 2025 for a further five years (until 31 December 2030), to enable continued mining of the remaining coal reserves that are currently approved to be extracted
- modify Schedule 2 Condition 7(c) of MP07_0127 to enable flexibility for coal to be transported to other domestic customers in addition to the Mount Piper Power Station and the Shoalhaven Starches Plant.

The modification known as 'Modification 6' is hereafter referred to as the 'project'.

1.2 Purpose of this report

EMM Consulting Pty Ltd (EMM) has been engaged by Castlereagh Coal to produce this greenhouse gas (GHG) assessment to support the project application.

The GHG assessment has been compiled in accordance with the draft *NSW EPA Guide for Large Emitters* (NSW EPA 2024a) and the *National Greenhouse Accounts Factors Workbook* (NGAF) (DCCEW 2024). Chapter 3 of this report outlines the assessment approach.

Section 2 of the draft *NSW EPA Guide for Large Emitters* describes the process for identifying whether a project is a large emitter of GHGs. EMM followed this process and concluded that the project would not be a large emitter. Further details of this are provided in Chapter 3 of this report.

The purpose of this GHG assessment is to estimate emissions from the project and provide context of emissions against State and Federal legislation, policies, and national emissions inventories.

2 Legislative and policy context

2.1 Overview of chapter

This chapter introduces the main GHGs that are the focus of legislation and policy and --explains the concept of emission ‘scopes’. The chapter also summarises the legislative and policy context as it relates to GHG emissions assessment, mitigation and reporting.

2.2 Greenhouse gases and emission scopes

2.2.1 Greenhouse gases

The gases addressed under the *National Greenhouse and Energy Reporting Act 2007* (NGER Act – see section 2.4.3) are summarised in Table 2.1. The most important gases in relation to coal mining are carbon dioxide (CO₂) and methane (CH₄). Emissions of nitrous oxide (N₂O) were also considered.

Table 2.1 Greenhouse gases and characteristics

Greenhouse gas	Global warming potential (GWP) ^(a)	Atmospheric lifetime (years) ^(a)
Carbon dioxide (CO ₂)	1	N/A ^(b)
Methane (CH ₄)	28	12
Nitrous oxide (N ₂ O)	265	121
Sulfur hexafluoride (SF ₆)	23,500	3,200
Hydrofluorocarbons (HFCs)	Dependent on HFC type	Dependent on HFC type
Perfluorocarbons (PFCs)	Dependent on PFC type	Dependent on PFC type

(a) From Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5).

(b) No single lifetime can be given for carbon dioxide because it moves throughout the earth system at differing rates.

Given that the various GHGs have different global warming potentials, it is convenient to express emissions using a common unit. For this purpose, the term ‘carbon dioxide equivalent’ (CO₂-e) has been defined. For any quantity and type of GHG, CO₂-e signifies the amount of CO₂ which would have the equivalent global warming impact. CO₂-e emissions are calculated based on the global warming potentials (GWPs) of specific gases adopted by the Parties to the UNFCCC and its Kyoto Protocol. In this assessment, GHG emissions are presented by gas, and for all gases combined, in terms of CO₂-e.

2.2.2 Emission scopes

For accounting and reporting purposes, GHG emissions are referred to as ‘direct’ or ‘indirect’, and defined according to three ‘scopes’ (1, 2 and 3). Examples of Scope 1, 2 and 3 emissions are provided in Figure 2.1.

The three scopes are defined as follows:

- Scope 1 relates to direct emissions from sources within the boundary of an organisation (or project), and as a result of the organisation’s activities. Scope 1 emissions are determined for the point of release (on-site). They include, for example, emissions from solid and liquid fuel combustion, fugitive emissions of methane, and leaks of SF₆.

- Scope 2 relates to indirect emissions associated with the purchase of electricity, steam, heat or cooling at a site. Scope 2 emissions are physically generated outside an organisation's boundaries, such as an external power station in the case of electricity, but they are included in an organisation's emissions inventory because they are a result of the organisation's energy use.
- Scope 3 relates to all other indirect emissions (i.e. other than scope 2) which occur outside the boundary of an organisation but as a result of actions by the organisation and are generated in the wider economy. Scope 3 emissions may occur upstream, such as during the extraction and production of fossil fuels, or downstream, such as from the transport of an organisation's product to customers, or the emissions from outsourced activities.

This GHG assessment is mainly concerned with scope 1 and scope 2 emissions, as defined under the NGER Act, but also considers scope 3 emissions, as defined within Australia's National Greenhouse Accounts for facility reporting (DCCEEW 2024).

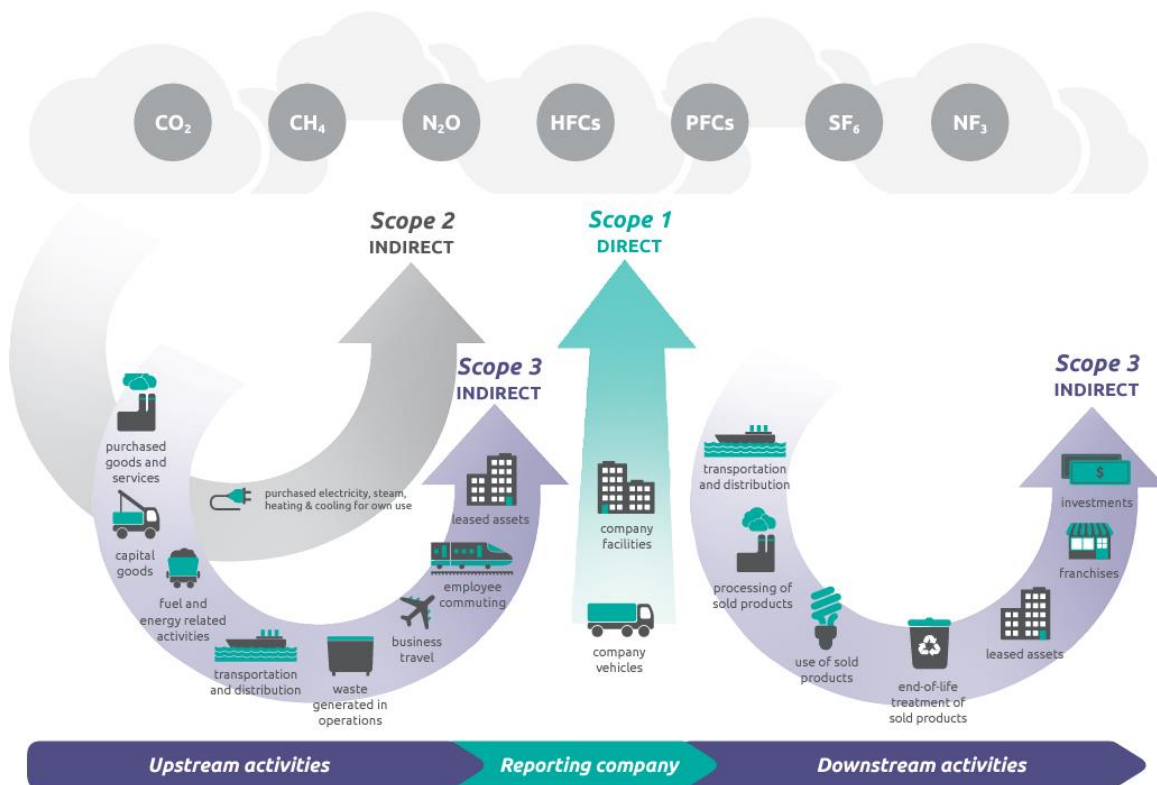


Figure 2.1 Overview of GHG emission scopes (WRI & WBCSD 2013)

2.3 International context

2.3.1 Intergovernmental Panel on Climate Change (IPCC)

The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science in relation to climate change. The IPCC prepares comprehensive Assessment Reports about the state scientific, technical and socio-economic knowledge on climate change, its impacts and future risks, and options for reducing the rate at which climate change is taking place. This first assessment report of the IPCC served as the basis for negotiating the United Nations Framework Convention on Climate Change (UNFCCC). The IPCC released its Sixth Assessment Report (AR6) in 2022/2023. The IPCC also produces a variety of guidance documents and recommendation methodologies for GHG emissions inventories.

2.3.2 United Nations Framework Convention on Climate Change (UNFCCC)

The UNFCCC entered into force in March 2004 and provides the basis for concerted international action to mitigate climate change and to adapt to its impacts. With 198 Parties, the Convention has nearly universal membership. The Conference of the Parties to the Convention (COP) are used to advance the implementation of the Convention.

The objective of the Convention is to stabilise GHG emissions 'at a level that would prevent dangerous anthropogenic interference with the climate system'. It states that 'such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner'¹.

The UNFCCC:

- puts the onus on developed countries to lead the way in reducing GHG emissions
- directs funds to climate change activities in developing countries
- receives regular reports from developed countries on climate change policies and measures
- recognises adaptation to climate change.

2.3.3 Paris Agreement

The Paris Agreement, which the Australian Government has signed, is a legally binding international treaty on climate change. It was adopted by the (then) 196 Parties to the UNFCCC at the 21st United Nations Climate Change Conference (COP21) in Paris, France in December 2015, and entered into force in November 2016. Its overarching goal is to hold the increase in the global average temperature to well below 2°C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels.

Under the Paris Agreements, all Parties are required to put forward GHG emissions reduction targets through Nationally Determined Contributions (NDCs). All Parties are required to report on national emissions, with a review of targets set to occur every five years from 2020.

¹ <https://unfccc.int/process-and-meetings/the-convention/what-is-the-united-nations-framework-convention-on-climate-change>

2.4 Australian Context

2.4.1 Climate Change Act 2022

The *Climate Change Act 2022* provides the legislative framework for implementing Australia's net-zero commitments under the Paris Agreement and sets out Australia's GHG emission-reduction targets. Australia has committed to reducing its GHG emissions by 43% below 2005 levels by 2030 and achieving net-zero emissions by 2050. The *Climate Change Act 2022* also introduced a requirement for an annual climate change statement to parliament, supported by independent advice from the Climate Change Authority (CCA). The *Climate Change Act 2022* does not impose any direct obligations on companies or facilities.

2.4.2 Global Methane Pledge

The Australian Government has also signed the Global Methane Pledge (GMP). The GMP was launched at the 26th United Nations Climate Change Conference (COP26) by the European Union and the United States. It is a voluntary commitment, with 122 signatories working collectively to reduce global CH₄ emissions across all sectors by at least 30% below 2020 levels by 2030.

2.4.3 The National Greenhouse and Energy Reporting Act and Scheme

The *National Greenhouse and Energy Reporting Act 2007 (Cwth)* (NGER Act), administered by the Commonwealth Government, establishes a national framework (the NGER Scheme) for corporations to report GHG emissions, energy consumption and energy production. Companies that exceed the NGER Scheme thresholds² of 25,000 tonnes CO₂-e per year for a facility, or 50,000 tonnes CO₂-e per year for a corporation, are required to register and report annually on their scope 1 and scope 2 emissions.

Castlreagh Coal currently reports annual GHG emissions under the NGER Scheme.

The NGER Act is underpinned by the *National Greenhouse and Energy Reporting Regulations 2008* and the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*. The Measurement Determination provides methods, criteria and measurement standard for calculating GHG emissions and energy data and covers Scope 1 and Scope 2 emissions, energy production and consumption.

2.4.4 The Safeguard Mechanism

The NGER Act also provides a framework for Australia's highest emitting facilities to manage and report on their GHG emissions. This framework is the Safeguard Mechanism³. The Safeguard Mechanism was first legislated in 2014 and has been in place since 2016. It was reformed in 2023 to ensure that the facilities it covers will contribute to meeting Australia's GHG emission-reduction targets.

In general terms, the Safeguard Mechanism applies to facilities⁴ with scope 1 emissions⁵ of more than 100,000 tonnes of CO₂-e per year. It sets legislated limits — known as baselines — on the GHG emissions of these facilities. These baselines decrease on a trajectory that is consistent with achieving Australia's GHG emission-reduction targets of 43% below 2005 levels by 2030, and net zero by 2050. The baselines will decrease at 4.9% per year from 2023 to 2030. If a Safeguard facility exceeds its baseline, it must surrender Australian Carbon Credit Units or Safeguard Mechanism Credits (SMCs) equal to their excess emissions. Facilities that 'beat' their baselines may apply to receive SMCs.

² The thresholds are also stated in terms of energy production/consumption.

³ <https://www.dcccew.gov.au/climate-change/emissions-reporting/national-greenhouse-energy-reporting-scheme/safeguard-mechanism>

⁴ Grid-connected electricity generators are treated separately.

⁵ The threshold applies to actual (gross) emissions from a facility and does not take into account any offset or displaced emissions.

There are currently around 220 Safeguard Facilities across the mining, manufacturing, transport, oil, gas and waste sectors. These facilities produce around 28% of Australia’s GHG emissions.

It is acknowledged that the Safeguard Mechanism provides minimum requirements for the highest emitting facilities but does not preclude the need for NSW EPA and the consent authority to properly understand the potential GHG impacts of proposed new or significantly modified developments, and to ensure that all proponents are adequately avoiding, minimising and managing their GHG emissions over all stages of the development.

It is noted that the mine is not a Safeguard Facility.

2.5 NSW context

2.5.1 NSW Government

The overarching NSW Government legislation and policy documents that are broadly relevant to this assessment are summarised in Table 2.2. Of these, only the Net Zero Plan refers directly to coal mining.

Table 2.2 Overarching NSW Government legislation and policy

Title	Description	Reference
<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.	-
<i>NSW Climate Change Policy Framework</i>	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.	OEI (2016)
<i>Net Zero Plan Stage1: 2020–2030</i>	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.	DPIE (2020)
<i>Net Zero Plan Stage 1: 2020–2030 Implementation Update</i> <i>Net Zero Plan Implementation Update 2022</i>	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.	DPIE (2021a) OECC (2022)
<i>NSW Climate Change Adaptation Strategy</i>	Sets out the NSW Government’s strategic approach for managing the impacts of climate change on the State.	NSW Government (2022)
<i>NSW Waste and Sustainable Materials Strategy 2041</i>	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.	DPIE (2021b)

The EPA is the primary environmental regulator for NSW. Although it has historically regulated some GHGs, the EPA has traditionally focussed on local and regional impacts on health and the environment. It has recently expanded its focus to more explicitly regulate the causes and consequences of climate change in NSW. The key EPA policy documents that are broadly relevant to this assessment are summarised in Table 2.3.

Table 2.3 **Key NSW EPA legislation and policy**

Title	Description	Reference
<i>Protection of the Environment Administration Act 1991</i>	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: • to protect, restore and enhance the quality of the environment in NSW, having regard to the need to maintain ecologically sustainable development • to reduce the risks to human health and prevent the degradation of the environment, including by taking action in relation to climate change. 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.	-
<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.	-
<i>Climate Change Policy</i>	Supports and builds upon NSW Government’s climate change policies and initiatives. The main purpose is to address: • 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 • the EPA’s statutory duty to develop environmental quality objectives, guidelines and policies to ensure environment protection from climate change.	NSW EPA (2023a)
<i>Climate Change Action Plan 2023–26</i>	Designed to deliver the Climate Change Policy. The Action Plan sets out: • the specific actions the EPA will take over the three years that it covers • 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.	NSW EPA (2023b)
<i>Strategic Plan 2024–29</i>	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: • caring for country • driving action on climate change • enabling a safe circular economy.	NSW EPA (2024)
<i>Waste Delivery Plan</i>	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.	NSW EPA (2021)

3 GHG emissions assessment

3.1 Scope of GHG assessment

3.1.1 GHG assessment boundary and emission sources

Step 1 in the draft *NSW EPA Guide for Large Emitters* involves defining the GHG assessment boundary for a project. This helps the proponent and the EPA to understand whether the climate change requirements for large emitters apply. In this report, the GHG assessment boundary for the project is treated *conceptually*, as shown in Figure 3.1. The figure shows the scope 1 and 3 emission sources that are included and excluded. The sources that were included represented the most significant sources associated with the project. Where a particular emission source was excluded from the assessment, this was either because it was not relevant, or because emissions were likely to be negligible.

The project features conventional open-cut mining techniques, which are largely dependent of the use of diesel-powered equipment. Underground mining is not proposed.

For **scope 1** emissions, the sources included were:

- on-site diesel combustion
- fugitive emissions from open-cut mining (released from coal seams, overburden, etc.)
- on-site consumption of oils
- on-site consumption of greases.

The project will continue to use diesel generators to power the colliery and therefore, there are no **scope 2** emissions for the project.

For **upstream scope 3** emissions, the sources included were:

- the extraction, production and transport of liquid fuels, oils and greases.

For **downstream scope 3** emissions, the sources included were:

- combustion of coal at the Mount Piper Power Station and the Shoalhaven Starches Plant
- the transport of RoM coal from the colliery to the Mount Piper Power Station and the Shoalhaven Starches Plant via road.

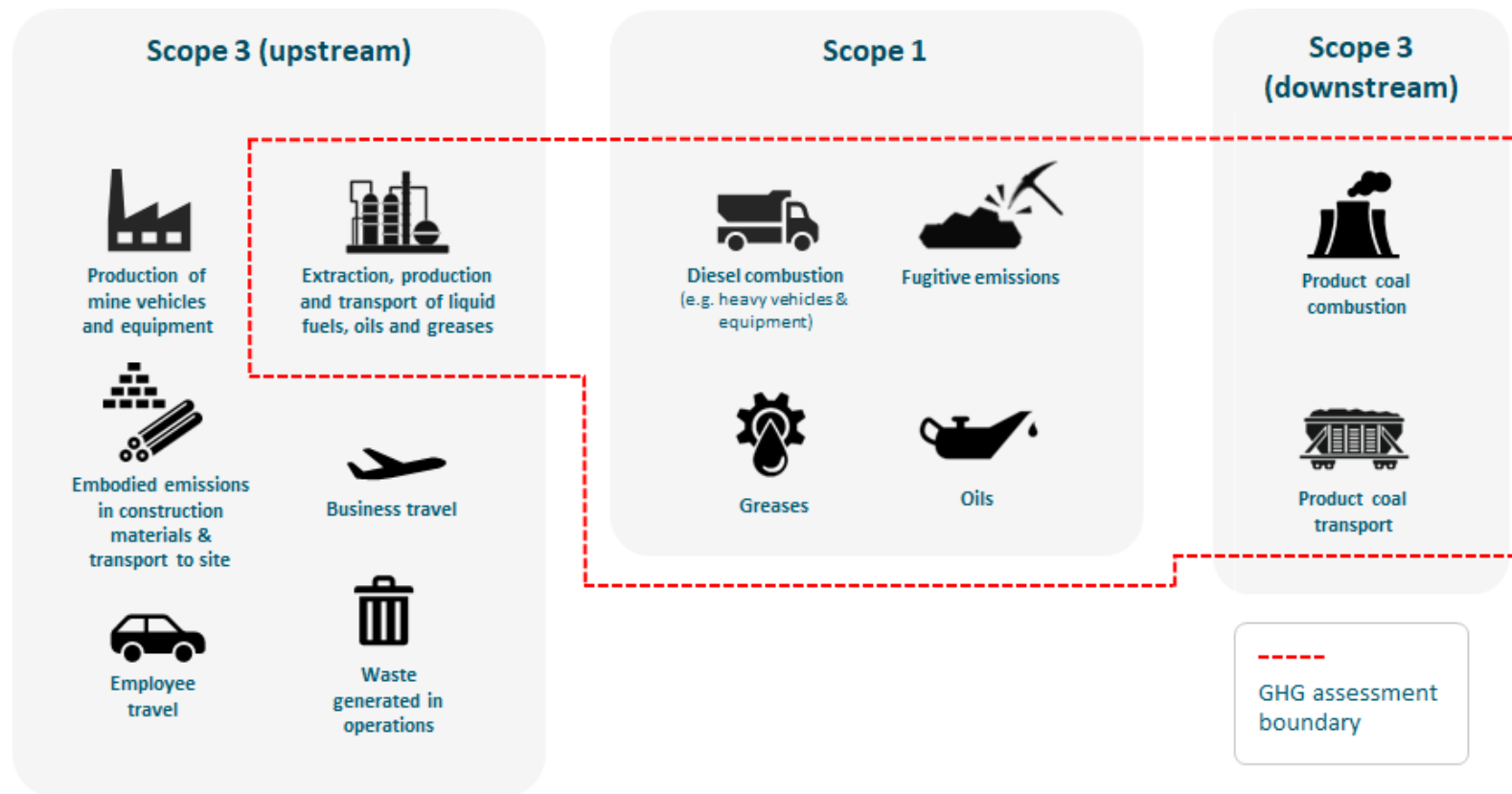


Figure 3.1 GHG assessment boundary and emission sources

3.1.2 Identification of the project as a large emitter

The EPA considers a project to be a large emitter if it meets three criteria. The application of these criteria to the project is shown in Table 3.1. For the third criterion, the supporting calculations are given in Table 3.2.

Table 3.1 Criteria for identifying large emitters

Criterion	Applicability to project
Does the project require development assessments and approvals under the <i>Environmental Planning and Assessment Act 1979</i> ?	Yes
Does the project involve one or more scheduled activities under Schedule 1 of the Protection of the Environment Operations (POEO) Act and/or will be carried out at an existing licensed premises?	Yes
Is the project likely to emit (within the GHG assessment boundary) 25,000 tonnes or more of scope 1 and 2 emissions (CO ₂ -e) in any financial year during the operational life of the project?	No (see calculations in Table 3.2)

The emissions are based on the results for the assessment presented in Section 3.3 and Appendix A, and exclude any carbon offsets. It can be seen that the threshold for large emitters of 25,000 t CO₂-e is not projected to be exceeded by the project in any operational years.

Table 3.2 Annual scope 1 emissions for project operation

Financial year	Scope 1 emissions (t CO ₂ -e/year)
FY26	13,478.0
FY27	18,689.0
FY28	10,422.0
FY29	9,520.8
FY30	5,798.7
FY31	1,805.2
TOTAL	59,713.7

Notes:

1. Financial year = 1 July to 30 June the following year.
2. As the project's operations are proposed for 1 January 2026 to 31 December 2030, there are no emissions for the first half of FY26 and the second half of FY31.

3.2 Assessment methodology

3.2.1 Calculation approach

Details of the GHG emission calculation methodology are provided in Appendix A. The supporting activity data (e.g. fuel consumption) are given in Appendix B.

The estimation of GHG emissions for the project was based primarily on the *National Greenhouse Accounts Factors Workbook* (NGAF) (DCCEW 2024). The methodologies in the NGAF workbook follow a simplified approach, equivalent to the 'Method 1' approach outlined in the *National Greenhouse and Energy Reporting (Measurement) Technical Guidelines* (DoE 2014). The Technical Guidelines are used for the purpose of reporting under the Commonwealth *National Greenhouse and Energy Reporting Act 2007* (the NGER Act).

The most significant emission-generating activities were considered in the assessment. Table 3.3 summarises the GHG emission sources for the project's operations, along with their corresponding emission scopes. It is noted that, as the project is a continuation of mining, there would be no construction activities. Post-closure fugitive emissions from the mine have not been included as these are not stated in the Measurement Determination for open-cut coal mines. Emissions from post-closure for open-cut coal mines are likely to be a small component of the overall emissions.

Table 3.3 Scope 1, 2 and 3 emission sources included in assessment

Activity	Scope 1	Scope 2	Scope 3
Fuel combustion from on-site diesel use	Yes Direct emissions from diesel combustion in on-site plant and equipment (e.g. haul trucks and processing equipment).	No	Yes Indirect emissions from extraction, production and supply.
Fugitive methane	Yes Fugitive emissions from open-cut mining.	No	No
Combustion of oils	Yes Direct emissions from oil combustion in on-site plant and equipment (e.g. operating heavy equipment).	No	Yes Indirect emissions from extraction, production and supply.
Combustion of greases	Yes Direct emissions from grease combustion in on-site plant and equipment (e.g. operating heavy equipment).	No	Yes Indirect emissions from extraction, production and supply.
Combustion of coal by end user	No	No	Yes Indirect emissions from the combustion of coal by end users.
Transport of coal to end user	No	No	Yes Indirect emissions from diesel combustion in trucks used to transport coal to end users.

3.3 Emission estimates

The estimated GHG emissions for every year of the project are presented in Table 3.4. Activity data and details of the calculations are provided in Appendix A and Appendix B. A graphical representation of the GHG emissions by year is presented in Figure 3.2

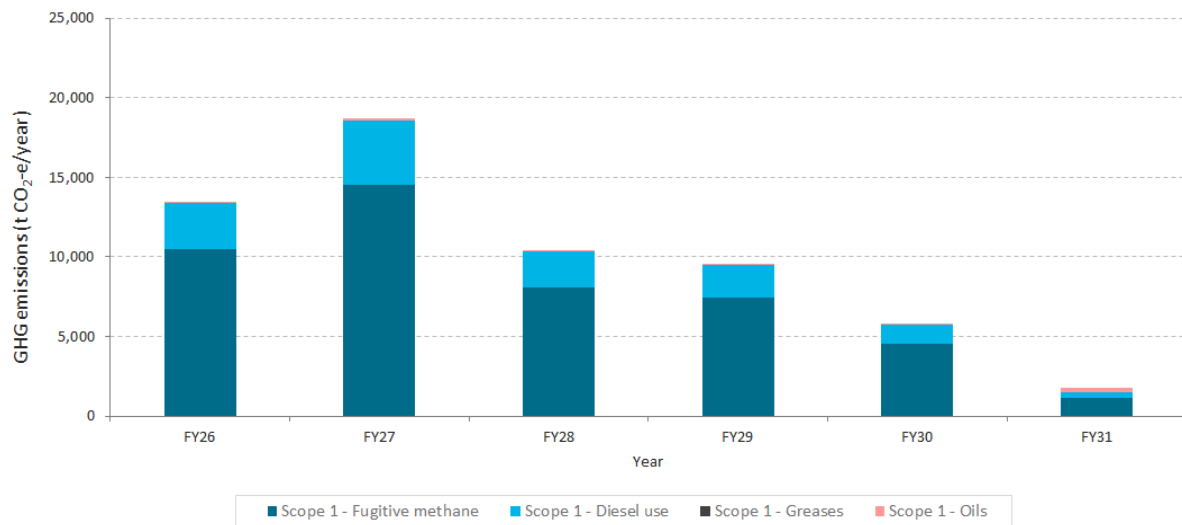
The following points are noted:

- estimated scope 1 GHG emissions are below the *NSW EPA Guide for Large Emitters* threshold of 25,000 tonnes of CO₂-e per year for every operational year of the project
- the year with the highest scope 1 emissions is FY27, at 18,689.0 tonnes of CO₂-e
- emissions from fugitive methane make up 77.4% of total scope 1 emissions
- fuel combustion from on-site diesel use makes up 21.5% of total scope 1 emissions
- emissions from the combustion of coal by the end user makes up 99.6% of total scope 3 emissions
- scope 1 emissions make up 4.0% of total emissions and scope 3 emissions make up 96.0% of total emissions.

Table 3.4 **Estimated GHG emissions for the project**

Year	Scope 1 emissions (CO ₂ -e)					Scope 3 (CO ₂ -e)				Totals (CO ₂ -e)		
	Fuel combustion from on-site diesel use	Fugitive methane	Oils	Greases	On-site diesel use	Oils	Greases	Combustion of coal by end user	Transport of coal to end user	Scope 1	Scope 3	All scopes
FY26	2,912.4	10,492.0	71.3	2.3	717.7	92.3	12.0	325,946.9	258.6	13,478.0	327,027.6	340,505.6
FY27	4,038.4	14,548.5	98.9	3.2	995.2	128.0	16.7	451,967.0	129.3	18,689.0	453,236.3	471,925.3
FY28	2,252.0	8,113.0	55.1	1.8	555.0	71.4	9.3	252,040.3	258.6	10,422.0	252,934.6	263,356.5
FY29	2,057.3	7,411.5	50.4	1.7	507.0	65.2	8.5	230,247.4	258.6	9,520.8	231,086.7	240,607.5
FY30	1,253.0	4,514.0	30.7	1.0	308.8	39.7	5.2	140,233.0	258.6	5,798.7	140,845.2	146,643.9
FY31	321.7	1,159.0	314.2	10.3	79.3	406.9	53.1	36,005.8	129.3	1,805.2	36,674.3	38,479.5
TOTAL	12,834.8	46,238.0	620.5	20.4	3,163.0	803.5	104.8	1,436,440.3	1,293.0	59,713.7	1,441,804.6	1,501,518.2

Scope 1 emissions



Scope 3 emissions



Figure 3.2 Graphical representation of estimated GHG emissions for the project

4 Management of emissions

Castlereaugh Coal is committed to the ongoing management and reduction of GHG emissions generated by the project. Castlereaugh Coal also reports GHG emissions and energy use under the National Greenhouse and Energy Reporting (NGER) scheme.

GHG emissions from the project are principally associated with fugitive emissions from open-cut mining, and on-site fuel consumption (specifically diesel combustion).

Table 4.1 provides an overview of best practice GHG management measures that can be applied at open-cut coal mines such as the colliery. The table also indicates whether a mitigation measure is proposed for implementation for the project.

It is noted that scope 1 emissions account for 4.0% of total GHG emissions (i.e. all scopes) from the project. The majority of emissions are scope 3, and 96.0% of these are due to coal combustion by the end user. Mitigation measures discussed in this section are focused on the project's direct (scope 1) emissions.

The proposed GHG management measures to reduce Scope 1 and 2 emissions include:

- all mine adits will be sealed thus restricting fugitive methane and carbon dioxide emissions
- all equipment will be serviced and maintained according to manufacturers' specifications
- pre-start inspections will be performed at each shift on mobile plant and vehicles to confirm they are operating efficiently
- idling of diesel equipment will be minimised wherever feasible
- haul route distances will be minimised
- fuel use will be tracked daily
- a revegetation plan will be in place
- daily gas samples will be conducted
- induction process will include training on best practices to reduce GHG emissions.

Table 4.1 Best practice GHG mitigation measures for open-cut coal mines

Measure	Detail	Proposed for the project	Comment or justification
Methane management			
Methane capture and utilisation	Capture and utilisation of methane as an energy source.	N/A	Low methane present in the coal.
Methane drainage	Extraction of methane from coal seams prior to mining, including underreaming, cavitation, surface to in-seam drilling, and tight-radius drilling.	N/A	Low methane present in the coal.
Sealing	Sealing off abandoned or inactive areas, thus preventing methane and other gases from entering active mining areas	Yes	All adits have and will remain to be sealed.
Methane monitoring and detection	Monitoring used to detect high methane concentrations early enabling measures to be implemented to prevent prolonged releases.	N/A	Low methane present in the coal.
Fuel use and fleet			
Electric mining equipment	Investigate use of electricity-powered mining equipment.	No	No power to site. All power is run from diesel generators.
Equipment maintenance	Equipment is serviced and maintained according to manufacturers' specifications.	Yes	Detailed in the Mechanical Engineering Control Plan.
Equipment checks	Performing pre-start inspections at each shift on mobile plant and vehicles.	Yes	Pre-start inspections regularly completed.
Engine upgrades	Investing in diesel engine technology with higher fuel efficiency (up to Tier 4 emission standards).	No	Maintain existing fleet. Upgrades not planned but may occur.
Low-carbon fuels	Investigate the use of alternative fuels (e.g. biodiesel or renewable diesel).	No	Existing fleet will be used however there will be consideration for the purchase or replacement of new equipment.
Vehicle idling	Minimise idling of vehicles.	Yes	Minimised as far as possible.
Haul route optimisation	Design haul routes to minimise distances travelled by trucks.	Yes	Haul route distances are minimised for both emission reduction and economic benefits. Ramp gradients will also be optimised.

Measure	Detail	Proposed for the project	Comment or justification
Energy use			
Use of renewable electricity	Investigate sourcing all purchased electricity from certified renewable electricity providers.	No	No power to site. All power is run from diesel generators.
On-site renewable energy source	Installation of renewable energy source (eg solar farm or solar panels) on-site to generate electricity required for operations.	No	No current or investigated renewable energy sources for site to date.
Energy and fuel use	Tracking fuel usage.	Yes	Fuel usage tracked daily.
Mine closure and rehabilitation			
Closure plan	Implementation of a mine closure plan including actions such as rehabilitation, ecosystem restoration etc.	Possibly	Detailed in the Rehabilitation Strategy and Rehabilitation Management Plan.
Revegetation	Revegetation plan including use of natives etc.	Yes	Detailed in the Rehabilitation Management Plan.
Monitoring and reporting			
GHG monitoring	Implementation of a system to monitor GHG emissions to identify trends and opportunities for emission reductions.	Yes	Daily gas samples conducted showing nil results.
Other assessment	Conduct other studies to understand GHG emissions (e.g. Life Cycle Analysis).	No	Low gas emissions present in the coal.
Other			
Employee training and awareness	Training programs for employees on best practices to reduce GHG emissions. May include incentive programs.	Yes	Induction process in place.
Research and development	Research innovations in methane capture and emission-reduction, including collaboration with the industry, universities and other operations.	No	Low methane present in the coal.
Energy efficient technology	Investigate the feasibility of installing and utilising energy efficient technologies, such as the use of LED lights on fixed plant and buildings.	Yes	LED lights installed on outside of buildings noting that it runs off a diesel generator.
Company targets	Set internal GHG emissions targets.	No	Not to date.

N/A = not applicable

5 Reporting and emission targets

5.1 Reporting obligations

5.1.1 Safeguard Mechanism

The project will not emit GHGs above the Safeguard Mechanism threshold of 100,000 t of CO₂-e per year throughout its lifetime and therefore will not be subject to reporting under the Safeguard Mechanism.

5.2 State emission targets

The Net Zero Emissions Dashboard ('the Dashboard') presents past and projected future GHG emissions for NSW (NSW EPA 2024b). The Dashboard shows emission trends and the progress being made towards the state's emission-reduction objectives.

The Dashboard provides emissions for the following four cases (in bold):

- An historical **actual** emissions scenario up to 2020, based on the NSW Greenhouse Gas Inventory and the National Greenhouse Accounts compiled by the Australian Government.
- A future **business as usual (BAU)** projection. The BAU scenario accounts for major factors impacting NSW emissions including past state policies but excludes the impact of actions under the Net Zero Plan and related Government policies and programs.
- Two future **current policy** emissions projections up to 2050:
 - **As designed** scenario. This takes the BAU scenario and adjusts the emissions trajectory based on the designed abatement and timelines in existing NSW and Commonwealth policies and programs.
 - **As tracking** scenario. This adjusts the as designed scenario to reflect increased uncertainties in expected emissions reductions under certain programs and policies.

The current policy emission estimates consider:

- Current policies and programs under Stage 1 of the Net Zero Plan.
- Future initiatives related to reducing emissions supported by the NSW Climate Change Fund (CCF) under Stages 2 and 3 of the Plan.
- Related policies including NSW Environment Protection Authority (EPA) Climate Change Policy and Action Plan and the Commonwealth's Safeguard Mechanism.

In Table 5.1 the projected annual scope 1 emissions for the project are compared against the projected emissions for NSW from the NSW Net Zero Emissions Dashboard. Table 5.1 shows that, depending on the year, the project emissions are up to 0.02% of NSW BAU emissions, and up to 0.02% of the current policy emissions.

In a given year in NSW, the reduction in emissions from the BAU case to the current policy (as tracking) case ranges from 6 Mt CO₂-e to 16 Mt CO₂-e. When summed over all years from FY26 to FY31, the total reduction is 64 Mt CO₂-e. The total emissions of the project over this period are 0.06 Mt CO₂-e. In other words, the project would increase the required emission reduction in NSW over the project's operational period by 0.1%.

Table 5.1 Comparison with NSW Net Zero Emissions Dashboard (scope 1 emissions)

Financial year	NSW (Mt CO ₂ -e/year)			Project (Mt CO ₂ -e/year)	Project as % of NSW		
	BAU	Current policy – as designed	Current policy – as tracking		BAU	Current policy – as designed	Current policy – as tracking
2025-26	118.16	110.29	112.03	0.01	0.01%	0.01%	0.01%
2026-27	115.50	104.31	108.57	0.02	0.02%	0.02%	0.02%
2027-28	110.35	94.86	100.15	0.01	0.01%	0.01%	0.01%
2028-29	106.79	87.16	94.49	0.01	0.01%	0.01%	0.01%
2029-30	102.42	81.31	89.81	0.01	0.01%	0.01%	0.01%
2030-31	99.32	73.79	83.05	0.01	0.01%	0.01%	0.01%

5.2.1 National emissions targets

Australia's GHG emissions reduction targets are presented in the Commonwealth Department of Climate Change, Energy, the Environment and Water's (DCCEEW) document *Australia's Emissions Projections 2024*⁶. Under the updated Nationally Determined Contributions (NDC), Australia has committed to the following:

- a single-year commitment of reducing GHG emissions to 43% below 2005 levels by 2030
- a multi-year emissions budget for the period (financial years) 2021-2030 of 4,377 Mt CO₂-e.

The DCCEEW report notes that under a 'with additional measures' scenario, Australia is projected to achieve a 42.7% reduction on 2005 levels in 2030. In other words, Australia would fail to meet the single-year target. The report, however, predicts that Australia would meet the multi-year emissions budget by 147 Mt.

As shown in Table 5.1, between 2021 and 2030, the project is expected to contribute 0.06 Mt CO₂-e of scope 1 emissions. This equates to 0.001% of the 2021-2030 emissions budget.

Under the 'with additional measures scenario', Australia is projected to be 3.358% below the multi-year emissions budget target. With the contribution of the project, Australia would be 3.357% above the multi-year emissions budget target under the assumption that the project was not included in the projections.

⁶ <https://www.dcceew.gov.au/sites/default/files/documents/australias-emissions-projections-2024.pdf>

6 Conclusions

EMM was engaged by Castlereagh Coal to produce this GHG assessment to support the Modification 6 application for the Invincible Colliery. The assessment has been conducted following the draft *NSW EPA Guide for Large Emitters* guidance document and the *National Greenhouse Accounts Factors Workbook* (NGAF). The assessment includes estimates of scope 1 and 3 GHG emissions for continued operations at the colliery with the proposed modification. As the project will not use electricity from the grid, there are no Scope 2 emissions.

Emission from the project were estimated for future projected operations under the modification. There were no project years in which the *NSW EPA Guide for Large Emitters'* threshold of 25,000 t CO₂-e/year was exceeded, and therefore the project was not considered to be a large emitter.

Emissions from fugitive methane and the combustion of diesel on-site contributed approximately 77.4% and 21.5% of total scope 1 GHG emissions, respectively. Total scope 1 emissions for the life of the project were 59,713 t CO₂-e and scope 3 emissions were 1,501,518 t CO₂-e. Combustion of coal by the end user made up 99.6% of scope 3 emissions.

Castlereagh Coal will employ a range of best practice mitigation measures at the colliery to minimise its GHG emissions. These measures include ensuring that all mine adits are sealed, tracking of fuel use, daily gas sampling, and training of staff.

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Appendix A

GHG emission calculation methods

A.1 Scope 1 emissions

A.1.1 Fugitive emissions

Emissions of fugitive methane were estimated using the following equation:

$$E = Q \times EF$$

Equation A.1

where:

- E

=

GHG emissions of methane

(t CO₂-e/year)

Q

=

coal extracted

(t/year)

EF

=

emission factor for fugitive methane

(t CO₂-e/t of RoM coal)

The GHG emission factor for fugitive methane is presented in Table A.1. The quantity of coal (t) used in the assessment is given in Appendix B.

Table A.1 Scope 1 emission factors – fugitive methane

Activity/source	Scope 1 emission factors for CH ₄ (t CO ₂ -e/t of RoM coal)	Reference
Fugitive methane	0.061	NGERs Measurement Determination 2024 (Section 3.20, NSW, Method 1)

A.1.2 Diesel fuel consumption

For each greenhouse gas *i* (CO₂, CH₄ and N₂O), annual scope 1 emissions from the on-site consumption of diesel fuels were estimated using the following equation:

$$E_i = \frac{Q \times EC \times EF_i}{1,000}$$

Equation A.2

where:

- E_i

=

GHG emission for gas *i*

(t CO₂-e/year)

Q

=

quantity of fuel

(kL/year)

EC

=

energy content of fuel

(GJ/kL)⁷

EF_i

=

emission factor for gas *i*

(kg CO₂-e/GJ)⁸

The energy content and GHG emission factors for each fuel are presented in Table A.2. The quantities of fuel (kL) used in the assessment are given in Appendix B.

⁷

GJ = gigajoules

⁸

kg CO₂-e/GJ = kilograms of carbon dioxide equivalents per gigajoule

Table A.2 Energy content and scope 1 emission factors – diesel fuel consumption

Activity/source	Energy content (GJ/kL)	Scope 1 emission factors (kg CO ₂ -e/GJ)			Reference
		CO ₂	CH ₄	N ₂ O	
Diesel – stationary fuel	38.6	69.9	0.1	0.2	DCCEEW (2024) (Table 8, diesel oil)

A.1.3 Oils consumption

For each greenhouse gas *i* (CO₂, CH₄ and N₂O), annual scope 1 emissions from the on-site consumption of oils were estimated using the following equation:

$$E_i = \frac{Q \times EC \times EF_i}{1,000}$$

Equation A.2

where:

- E_i

=

GHG emission for gas *i*

(t CO₂-e/year)

Q

=

quantity of oil

(kL/year)

EC

=

energy content of oil

(GJ/kL)

EF_i

=

emission factor for gas *i*

(kg CO₂-e/GJ)

The energy content and GHG emission factors for oils are presented in Table A.3. The quantities of oils (kL) used in the assessment are given in Appendix B.

Table A.3 Energy content and scope 1 emission factors – oils consumption

Activity/source	Energy content (GJ/kL)	Scope 1 emission factors (kg CO ₂ -e/GJ)			Reference
		CO ₂	CH ₄	N ₂ O	
Oils	38.8	13.9	0.0	0.0	DCCEEW (2024) (Table 8, other than petroleum-based oil used as fuel), e.g. lubricants)

A.1.4 Greases consumption

For each greenhouse gas i (CO_2 , CH_4 and N_2O), annual scope 1 emissions from the on-site consumption of greases were estimated using the following equation:

$$E_i = \frac{Q \times EC \times EF_i}{1,000} \quad \text{Equation A.2}$$

where:

- E_i = GHG emission for gas i (t CO_2 -e/year)
- Q = quantity of oil (kL/year)
- EC = energy content of greases (GJ/kL)
- EF_i = emission factor for gas i (kg CO_2 -e/GJ)

The energy content and GHG emission factors for greases are presented in Table A.4. The quantities of greases (kL) used in the assessment are given in Appendix B.

Table A.4 Energy content and scope 1 emission factors – greases consumption

Activity/source	Energy content (GJ/kL)	Scope 1 emission factors (kg CO_2 -e/GJ)			Reference
		CO_2	CH_4	N_2O	
Greases	38.8	3.5	0.0	0.0	DCCEEW (2024) (Table 8, petroleum-based greases)

A.2 Scope 3 emissions (upstream)

A.2.1 Extraction, production and transport of liquid fuels, oils and greases

Upstream scope 3 emissions for diesel consumption, oils, and greases were calculated using Equation A.2. The energy content and scope 3 GHG emission factors for each fuel are presented in Table A.5. The quantities of fuel (kL) used in the assessment are given in Appendix B.

Table A.5 Energy content and scope 3 emission factors – diesel, oils and greases consumption

Fuel	Energy content (GJ/kL)	Scope 3 emission factor (kg CO_2 -e/GJ)	Reference
Diesel – stationary fuel	38.6	17.3	DCCEEW (2024) (Table 8, diesel oil)
Diesel – transport fuel	38.6	17.3	DCCEEW (2024) (Table 9, diesel oil)
Oils	38.8	18.0	DCCEEW (2024) (Table 8, other than petroleum-based oil used as fuel), e.g. lubricants)
Greases	38.8	18.0	DCCEEW (2024) (Table 8, petroleum-based greases)

A.3 Scope 3 emissions (downstream)

A.3.1 Coal combustion

Coal would be transported from the colliery to the Mount Piper Power Station and/or to the Shoalhaven Starches Plant for combustion.

For each greenhouse gas *i* (CO₂, CH₄ and N₂O), annual scope 3 emissions for coal combustion were estimated using the following equation:

$$E_i = \frac{Q \times EC \times EF_i}{1,000}$$

Equation A.2

where:

- E_i

=

GHG emission for gas *i*

(t CO₂-e/year)

Q

=

quantity of coal

(t/year)

EC

=

energy content of coal

(GJ/t)⁹

EF_i

=

emission factor for gas *i*

(kg CO₂-e/GJ)

The energy content and GHG emission factors for coal combustion are presented in Table A.6. Although the combustion of the coal would be a scope 3 process, the scope 1 emission factors were used to represent the actual emissions associated with the process.

The quantities of coal (tonnes) used in the assessment are given in Appendix B.

Table A.6 Energy content and scope 1 emission factors – coal consumption

Activity/source	Energy content (GJ/kL)	Scope 1 emission factors (kg CO ₂ -e/GJ)			Reference
		CO ₂	CH ₄	N ₂ O	
Combustion of coal	21.0	90.0	0.04	0.2	DCCEEW (2024) (Table 4, sub-bituminous coal)

⁹ GJ = gigajoules

A.3.2 Coal transport

For each greenhouse gas i (CO₂, CH₄ and N₂O), annual scope 1 emissions from the combustion of diesel fuels during coal transport by road were estimated using the following equation:

$$E_i = \frac{Q \times EC \times EF_i}{1,000}$$

Equation A.2

where:

- E_i = GHG emission for gas i (t CO₂-e/year)
- Q = quantity of fuel (kL/year)
- EC = energy content of fuel (GJ/kL)¹⁰
- EF_i = emission factor for gas i (kg CO₂-e/GJ)¹¹

The energy content and GHG emission factors for each fuel are presented in Table A.7. The quantities of fuel (kL) used in the assessment are given in Appendix B. Although the off-site transportation of the coal would be a scope 3 process, the scope 1 emission factors were used to represent the actual emissions. The calculations assume that coal will be transported to Mount Piper Power Station and Shoalhaven Starches as information on alternative destinations is not yet available.

Table A.7 Energy content and scope 1 emission factors – diesel fuel consumption

Activity/source	Energy content (GJ/kL)	Scope 1 emission factors (kg CO ₂ -e/GJ)			Reference
		CO ₂	CH ₄	N ₂ O	
Diesel – transport fuel (Euro iv or higher)	38.6	69.9	0.07	0.4	DCCEEW (2024) (Table 9, diesel oil)

¹⁰ GJ = gigajoules

¹¹ kg CO₂-e/GJ = kilograms of carbon dioxide equivalents per gigajoule

Appendix B

Activity data

B.1 On-site activity

The on-site activity parameters used in the GHG calculations were:

- coal extracted
- on-site diesel consumption
- on-site oil consumption
- on-site grease consumption.

Activity data used to calculate the GHG emissions are presented in Table B.1. These data were supplied by Castlereaigh Coal.

Table B.1 Activity data used in the emission estimates

Financial year	RoM coal extracted (t)	Diesel use on-site (stationary) (kL)	Diesel use (transport of coal off-site) (kL)	Oils (kL)	Greases (kL)
FY26	172,000	1,075	95	132	17
FY27	238,500	1,490	48	183	24
FY28	133,000	831	95	102	13
FY29	121,500	759	95	93	12
FY30	74,000	462	95	57	7
FY31	19,000	119	48	15	2
TOTALS	758,000	4,737	476	583	76

Australia

SYDNEY

Ground floor 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500

NEWCASTLE

Level 3 175 Scott Street
Newcastle NSW 2300
T 02 4907 4800

BRISBANE

Level 1 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

CANBERRA

Suite 2.04 Level 2
15 London Circuit
Canberra City ACT 2601

ADELAIDE

Level 4 74 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE

Suite 9.01 Level 9
454 Collins Street
Melbourne VIC 3000
T 03 9993 1900

PERTH

Suite 3.03
111 St Georges Terrace
Perth WA 6000
T 08 6430 4800

Canada

TORONTO

2345 Yonge Street Suite 300
Toronto ON M4P 2E5
T 647 467 1605

VANCOUVER

422 Richards Street Unit 170
Vancouver BC V6B 2Z4
T 604 999 8297

CALGARY

700 2nd Street SW Floor 19
Calgary AB T2P 2W2



[linkedin.com/company/emm-consulting-pty-limited](https://www.linkedin.com/company/emm-consulting-pty-limited)



emmconsulting.com.au

Australia

SYDNEY

Ground floor 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500

NEWCASTLE

Level 3 175 Scott Street
Newcastle NSW 2300
T 02 4907 4800

BRISBANE

Level 1 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

CANBERRA

Suite 2.04 Level 2
15 London Circuit
Canberra City ACT 2601

ADELAIDE

Level 4 74 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE

Suite 9.01 Level 9
454 Collins Street
Melbourne VIC 3000
T 03 9993 1900

PERTH

Suite 3.03
111 St Georges Terrace
Perth WA 6000
T 08 6430 4800

Canada

TORONTO

2345 Yonge Street Suite 300
Toronto ON M4P 2E5
T 647 467 1605

VANCOUVER

422 Richards Street Unit 170
Vancouver BC V6B 2Z4
T 604 999 8297

CALGARY

606 4th Street SW 11 Floor
Calgary Alberta T2P 1T1



[linkedin.com/company/emm-consulting-pty-limited](https://www.linkedin.com/company/emm-consulting-pty-limited)



emmconsulting.com.au