

TRANSPORT FOR NSW

JULY 2021

LOWER HUNTER FREIGHT CORRIDOR DRAFT STRATEGIC ENVIRONMENTAL ASSESSMENT

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Lower Hunter Freight Corridor Draft Strategic Environmental Assessment

Transport for NSW

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GLOSSARY

Term	Definition
AEP	Annual Exceedance Probability. It is the chance of a flood of a given or larger size occurring in any one year. A flood event with a 20% AEP means there is a 20% chance (i.e., a one in five chance) of a flood of that size or larger occurring in any one year. This is preferable to describing the event as a one in five-year event because, whilst a 20% AEP flood will recur on average every five years, such events can occur much closer together or much further apart than that time period.
AHD	Australian Height Datum
CO	Carbon monoxide
Down Main	A term used to describe a specific track on the rail network. The Down Main is used to describe the rail track primarily used for trains heading away from a major location (i.e. Sydney)
EPA	Environment Protection Authority (EPA)
Hunter Valley Rail Network	A term used to refer to the rail lines between Islington (Newcastle) and Maitland including both the Up and Down Main lines and the Up and Down Coal lines.
LEP	Local Environmental Plan
Main North Rail Line	The rail line running from Strathfield (Sydney) to NSW Queensland border, via Armidale. References in this document refer to the Main North Rail Line between Sydney and Newcastle, with the section of line through the Hexham to Beresfield referred to as being part of the Hunter Valley Rail Network.
MCA	Multi-criteria analysis
MIC SEPP	State Environmental Planning Policy (Major Infrastructure Corridors)
NO ₂	Nitrogen dioxide
PM	Particulate matter, being a term that describes very small solid particles and liquid droplets suspended in air. Particulate matter can be made up of a variety of components including nitrates, sulfates, organic chemicals, metals, soil or dust particles, and allergens (such as fragments of pollen or mould spores). Particle pollution mainly comes from motor vehicles, wood burning heaters and industry. During bushfires or dust storms, particle pollution can reach extremely high concentrations
PM _{2.5}	Particles with a diameter of 2.5 micrometres or less
PM ₁₀	Particles with a diameter of 10 micrometres or less
SEPP	State Environmental Planning Policy
Up Main	A term used to describe a specific track on the rail network. The Up Main is used to describe the rail track primarily used by trains heading to a major location (i.e. Sydney)

EXECUTIVE SUMMARY

The Lower Hunter Freight Corridor project aims to identify and protect land for a future freight rail line that would bypass Newcastle between Fassifern and Hexham. The future freight rail line will help meet the long-term freight needs of NSW and support the growth of Greater Newcastle as a globally acknowledged emerging economic and lifestyle city.

The strategic need for the project has been established in numerous Government policies, such as the Greater Newcastle Metropolitan Plan (Department of Planning and Environment (DPE), 2018), Future Transport Strategy 2056 (Transport for NSW, 2018a), Hunter Regional Plan 2036 (DPE, 2016), and NSW Freight and Ports Plan 2018 – 2023 (Transport for NSW, 2018b).

A key driver for early protection of the corridor is the encroachment of urban development on the limited land available for use as a future freight rail line.

The benefits of protecting the Lower Hunter Freight Corridor are to:

- Ensure that the future infrastructure corridor is taken into consideration in strategic land use planning
- Provide greater certainty about the future freight network
- Reduce future construction costs and disruption for communities and businesses
- Support broader Government initiatives aimed at improving the passenger rail network.

The benefits to be delivered by future infrastructure within the Lower Hunter Freight Corridor include:

- Increased rail capacity for passenger and freight train growth across the broader rail network
- Increased efficiency and reliability of the rail network by separating the majority of the freight and passenger rail services on the congested Main North Rail Line between Fassifern and Newcastle
- Reducing freight service travel times by 15 to 20 minutes
- Improvements to urban amenity and liveability in the Newcastle urban region by removing most of the freight trains within the urban area
- Relieving some congestion at level crossings at the Adamstown and Islington level crossings
- Relieving pressure on regional roads to accommodate the growth in the freight task
- Supporting the investment in the freight rail industry in the region.

This draft Strategic Environmental Assessment brings together the strategic justification for the identification and protection of land for the Lower Hunter Freight Corridor, the process of identifying the alignment, and an analysis of how potential impacts will be mitigated at future design and construction stages.

CORRIDOR IDENTIFICATION PROCESS

The Lower Hunter Freight Corridor project aims to protect land for a rail corridor in accordance with the process outlined in the Planning guideline for Major Infrastructure Corridors (Department of Planning and Environment, undated). The process to identify the recommended corridor alignment included:

- Review of the Government policy context, including the Future Transport Strategy 2056 (Transport for NSW, 2018a), NSW Freight and Port Plan 2018 – 2023 (Transport for NSW, 2018b), Greater Newcastle Metropolitan Plan 2056 (DPE, 2018), and Greater Newcastle Future Transport Plan (Transport for NSW, 2018c).
- A constraints and opportunities analysis, which was informed by engagement with key Government agency stakeholders to understand the context of the study area.
- Identification of a number of alternative route alignments that could potentially avoid major constraints and meet project objectives.

- Assessment of the alternative route alignments to identify the recommended corridor against a range of criteria. These criteria considered a range of environmental and socio-economic factors and expanded upon the objectives and operational requirements for the Lower Hunter Freight Corridor.

RECOMMENDED CORRIDOR

The recommended corridor avoids and where impacts are unavoidable minimises impacts on land uses, through:

- Maximising the separation between the corridor and residential properties and sensitive receivers in order to reduce potential impacts such as noise, severance, visual impacts and direct property impacts.
- Utilising Government land where available to avoid impacts on private land holdings.
- Avoiding areas of high ecological significance, such as the Hunter Wetlands National Park, Tank Paddock, and Pambalong Nature Reserve, and minimising impacts on ecological connectivity.
- Avoiding severance of local communities.
- Utilising existing and planned infrastructure corridors where available, such as the M1 Pacific Motorway and future M1 Pacific Motorway extension to Raymond Terrace, to assist in reducing impacts on property, biodiversity and visual amenity. However, it is acknowledged that this would also result in some cumulative impacts (such as noise).

The recommended corridor, shown in Figure ES1, has the following characteristics running from south to north:

- The recommended corridor leaves the Main North Rail Line approximately one and a half kilometre to the north of Fassifern Railway Station.
- Where the recommended corridor leaves the Main North Rail Line, it would require a tunnel for the future freight rail line around 1.6 kilometres in length to respond to the steeper terrain. This tunnel would minimise impacts on the Fassifern community.
- The recommended corridor continues above ground in the vicinity of operational and historic mine workings, such as the Metromix Teralba Quarry, Teralba Colliery, and Westside Coal Mine. The exact alignment of the corridor in relation to these operations would be finalised following engagement with key stakeholders and the community. Further geotechnical investigations would form part of any future design and the environmental impact assessment for infrastructure within the recommended corridor.
- The recommended corridor avoids the township of Killingworth and the Killingworth substation. The corridor crosses a series of high voltage transmission lines, which would be considered further and assessed as part of the next phase of project development.
- Land west of West Wallsend is predominately government owned and would provide a green buffer between the future freight rail and the communities of Barnsley, Holmesville and West Wallsend.
- North of West Wallsend, the recommended corridor travels north-east alongside the existing M1 Pacific Motorway reservation. Aligning these two infrastructure corridors reduces the overall infrastructure footprint and will assist in minimising future visual impacts.
- The recommended corridor utilises some land at the rear of properties within the Cameron Park industrial area where the M1 Pacific Motorway reservation is more constrained. Further design development would ultimately determine the extent of the impact on these properties.
- The recommended corridor crosses under the Newcastle Link Road and passes over the M1 Pacific Motorway near the M1 Pacific Motorway and Hunter Expressway interchange. It would avoid the Minmi urban release area.
- The recommended corridor is located between the motorway and the Stockrington Conservation Area and Pambalong Nature Reserve. The design of the rail infrastructure would need to consider solutions to minimise impacts on the wetlands associated with the Pambalong Nature Reserve (such as being on a viaduct). Any solution would also need to retain access to Stockrington Road and Cedar Hill Drive for rural residential properties.

- The recommended corridor would avoid the Tank Paddock, located to the east of the M1 Pacific Motorway, which has been dedicated to the NSW Government for biodiversity offsets and holds important community significance.
- At Black Hill, the corridor continues alongside the M1 Pacific Motorway, and crosses Black Hill Road. The rail corridor has been positioned to be located close to the current Black Hill Road interchange with the M1 Pacific Motorway. This has required the corridor to be located within large lot residential properties, and alternative property access would need to be identified in the next phase of project development.
- The recommended corridor passes over the M1 Pacific Motorway at the future M1 Pacific Motorway Black Hill interchange and travels to the west towards the Hunter River. The recommended corridor has been located to the south of the M1 Pacific Motorway extension to Raymond Terrace to improve constructability of the project and to increase the separation from Beresfield and Tarro. The recommended corridor has also been located to avoid interaction with high voltage powerlines which would necessitate their relocation at the time of infrastructure delivery.
- For the northern junction to the existing Hunter Valley Rail Network at Tarro, the recommended corridor would cross over the Pacific Highway (Maitland Road) and Woodberry Road. For the southern junction at Hexham, the recommended corridor would be located to the west of the Pacific Highway (Maitland Road) and adjacent to the Aurizon Train Support Facility.
- The northern and southern junctions of the recommended corridor would be located on sections of private property.

ADDITIONAL INVESTIGATIONS AND POTENTIAL IMPACT MITIGATION

This report outlines the process undertaken to ensure that the location of the recommended corridor avoids, and where avoidance is not possible, minimises the potential impacts from a future freight rail line on the surrounding environment and community.

The future freight rail line is anticipated to be required in the next 10 to 20 years. At that time, the detailed design of the infrastructure will appropriately address and manage identified impacts, such as noise and vegetation clearing.

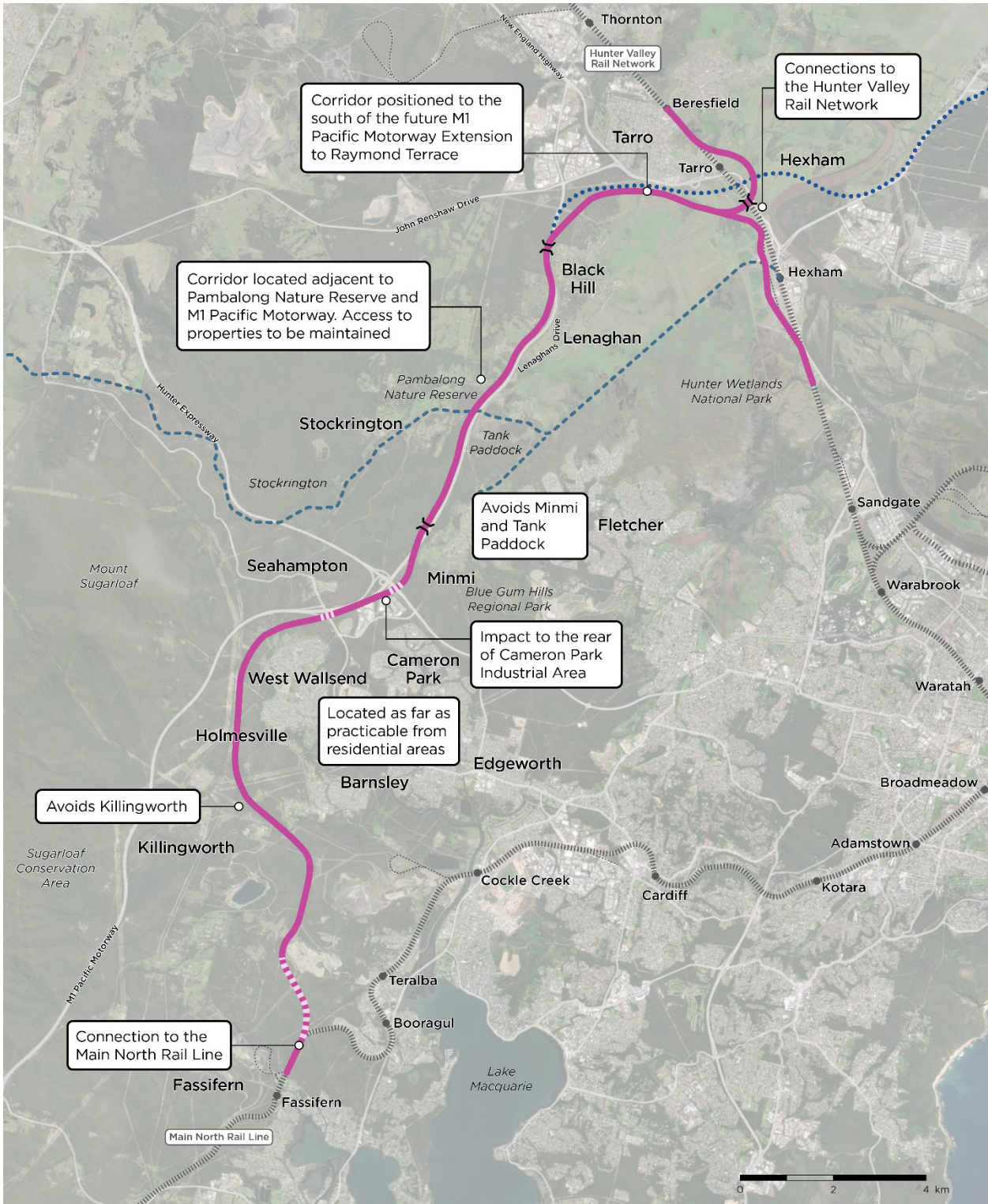
Additional investigations to identify potential future impacts are outlined in this report and will be undertaken as part of a future environmental approval process over the next 10 to 20 years.

CORRIDOR PROTECTION AND NEXT STEPS

The recommended corridor has been identified following a comprehensive process, ensuring that an efficient route alignment is balanced with the needs of the community and environment.

Transport for NSW will take into consideration feedback from the community and stakeholder engagement process and refine the recommended corridor where appropriate.

The Department of Planning, Industry and Environment have prepared an Explanation of Intended Effects, which details how the corridor is proposed to be protected under an amendment to the State Environmental Planning Policy (Major Infrastructure Corridors) 2020. The Explanation of Intended Effects is on exhibition alongside this draft Strategic Environmental Assessment for the recommended corridor alignment. After considering submissions and making any refinements to the final corridor alignment, Transport for NSW will request that the Minister for Planning and Public Spaces protect the corridor under *State Environmental Planning Policy (Major Infrastructure Corridors) 2020*.



KEY

- Recommended Corridor**
- Recommended Corridor
 - Tunnel / Underpass

- Infrastructure**
- Existing Rail Network
 - Freight Sidings
 - Major Road Network
 - Major Road Crossings (Bridges)
 - ⋯ Proposed M1 Pacific Motorway extension to Raymond Terrace
 - ⋯ Disused Richmond Vale Railway

Note: Stylised representation, corridor widths may not be to scale

Figure ES.1 The recommended Lower Hunter Freight Corridor

1 OVERVIEW

1.1 INTRODUCTION

The NSW freight and ports network is fundamental to the economy of NSW, and the Hunter Region plays an important role in supporting freight that is moved within the region, and between Greater Sydney to Northern NSW and Queensland. The NSW regional freight task for all commodities is forecast to rise by approximately 25 per cent over the next 40 years (Transport for NSW, 2018b). Investment in the freight transport network will be required to address the growing freight task and to support continued economic growth.

Parts of the existing Main North Rail Line are operating very close to capacity in times of peak demand and the line serves both freight and passenger rail services. Over the next 20 years, Transport for NSW expects that forecast demand for rail freight services will place increasing pressure on the Main North Rail Line between Sydney and Newcastle and has estimated that an additional 66 freight services per week in each direction will be required by 2056. The transport of freight is constrained by the priority given to passenger services, and urban growth will exacerbate this issue (Transport for NSW, 2018). The Future Transport Strategy 2056 (Transport for NSW, 2018a) and the NSW Freight and Ports Plan 2018-2023 (Transport for NSW, 2018b) highlights the need to provide greater separation of these services, and to identify land and protect freight corridors.

To alleviate pressure on the Main North Rail Line, Transport for NSW has identified the need for a new dedicated freight rail line between Fassifern and Hexham to bypass the existing shared rail network through the inner suburbs of Newcastle. This would also help to reduce freight services through Newcastle's urban area, improving amenity for local communities and enabling both freight and passenger networks to grow.

The pressure of urban development in the region will constrain and limit opportunities in the future to secure land for the corridor. As such, it is important to identify a suitable corridor in advance of delivering the infrastructure. The purpose of corridor protection is to safeguard land so that infrastructure can be delivered in the optimal location in the future.

This draft Strategic Environmental Assessment has been prepared to support the community and stakeholder engagement process for the identification of the recommended Lower Hunter Freight Corridor between Fassifern and Hexham. This report brings together the strategic justification for the Lower Hunter Freight Corridor and the process undertaken to identify the recommended corridor alignment against project objectives.

Following consideration of feedback from the current engagement process and the refinement of the recommended corridor where necessary, Transport for NSW will seek the protection of the corridor from the Minister of Planning and Public Spaces.

1.2 CORRIDOR PLANNING PHASES

1.2.1 OVERVIEW

The corridor protection process is outlined within the Department of Planning, Industry and Environment's Planning Guideline for Major Infrastructure Corridors (the 'Guideline') (Department of Planning and Environment, undated). The approach used to define a corridor is shown in Figure 1.1.

The guideline also provides requirements to ensure an appropriate recommended corridor is identified for planning protection that can adequately address relevant social, environmental and economic matters. These requirements are included in the template included as part of the guidelines.

The corridor investigation process discussed in Chapter 2 involves consideration of feedback based on consultation with government agencies, landowners and other stakeholders during the investigation phase.

Corridor Protection Phases

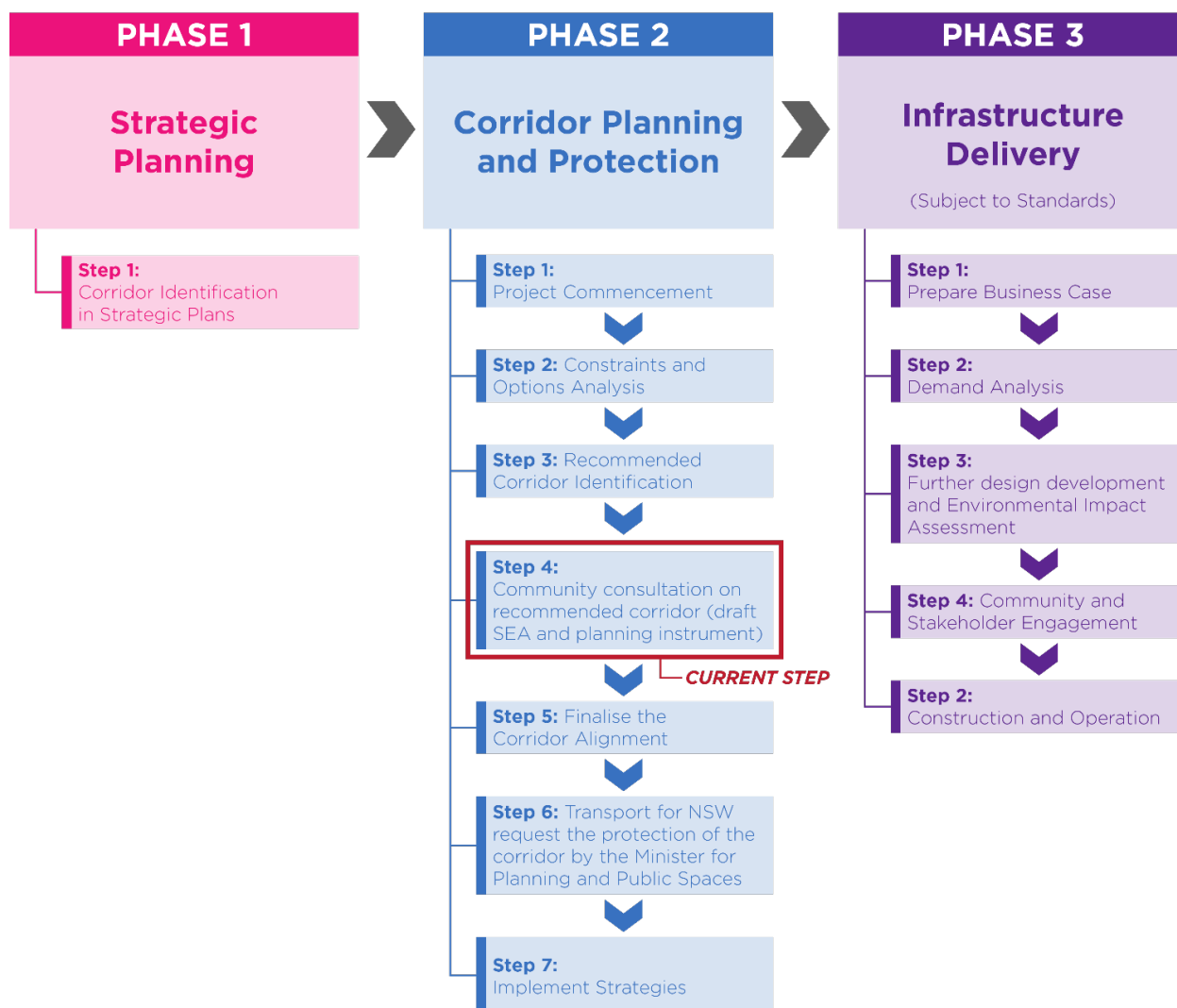


Figure 1.1 Corridor protection process

Specific stages in the corridor protection process identified in the guideline are further described in the following sub-sections.

1.2.2 PHASE 1: STRATEGIC PLANNING PHASE

The aim of the strategic planning phase is to justify and include the proposed future transport corridor in strategic planning strategies.

The Strategic Planning Phase for the Lower Hunter Freight Corridor is complete, with the project identified in a number of government strategic documents such as the Future Transport Strategy 2056 (Transport for NSW, 2018a), Hunter Regional Plan 2036 (DPE, 2016), Greater Newcastle Metropolitan Plan (DPE, 2018), and NSW Freight and Ports Plan 2018 – 2023 (Transport for NSW, 2018b).

1.2.3 PHASE 2: CORRIDOR PLANNING AND PROTECTION

The objective of this phase is to identify and recommend a corridor alignment and create the necessary statutory protections to protect the alignment, enabling project delivery at a later stage.

This phase includes the investigation and assessment of corridor alignments and design issues to inform the identification of land requirements for any potential future infrastructure.

This is the current phase of the corridor protection process for the Lower Hunter Freight Corridor project and is discussed further in Chapter 2.

1.2.4 PHASE 3: DELIVERY OF INFRASTRUCTURE

It is anticipated that a future freight rail line utilising the Lower Hunter Freight Corridor would be needed sometime in the next 10 to 20 years, when there is sufficient demand for improved freight infrastructure, or a need to separate freight and passenger services through Newcastle.

An application for the construction and operation of future infrastructure would be subject to an environmental impact assessment and approval under the *Environmental Planning and Assessment Act 1979* (or the applicable approval processes at that time). This would include additional community and stakeholder engagement, focused on the design of infrastructure and more detailed analysis of mitigation measures, to minimise any potential impacts on the surrounding environment or community.

1.3 PROJECT OBJECTIVES

The objectives of the Lower Hunter Freight Corridor are to:

- Protect a corridor of land needed for future freight rail infrastructure that would bypass Newcastle
- Provide certainty over the future Lower Hunter Freight Corridor location to assist with the strategic and land use planning of the surrounding area
- Enable strategic protection of corridor land to reduce long term infrastructure cost and community disturbance.

The key objectives for the future rail infrastructure are to:

- Provide an efficient flow of goods by separating freight and passenger services
- Support economic growth and productivity by increasing freight transport capacity and improving travel times
- Increase capacity for passenger rail services in suburban Newcastle
- Support urban growth in the region and to deliver amenity benefits for communities along the Main North Line and improve community impacts associated with delays at level crossings.

1.4 PROJECT BENEFITS

The key benefits of identifying and protecting the Lower Hunter Freight Corridor include:

- Reduced land use impacts by protecting the corridor from future development and later disruption when the future rail infrastructure is delivered: Protecting the corridor will ensure that land is available when it is required in the future while enabling continued existing uses of the land.
- Certainty for long-term land use planning in the region: The protection of the corridor will reduce future land use conflicts as residential and employment areas in the region continue to expand, while also providing increased certainty for the ongoing urban renewal of inner Newcastle.

- Certainty for future network efficiency by securing a corridor that bypasses inner Newcastle: This in turn would provide certainty to industry for continued investment in the region.
- Minimising cost in the delivery of future infrastructure by securing a corridor that best meets the operational requirements for the future rail infrastructure: This will avoid more costly engineering solutions to address environmental constraints (such as steep terrain) or amenity impacts to surrounding communities.

When built, the benefits of the future rail infrastructure include:

- Increased rail capacity for passenger and freight train growth across the broader rail network
- Increased efficiency and reliability of the rail network by separating the majority of the freight and passenger rail services on the congested Main North Rail Line between Fassifern and Newcastle
- Reducing freight service travel times by 15 to 20 minutes
- Improvements to urban amenity and liveability in the Newcastle urban region by removing most of the freight trains within the urban area
- Relieving some congestion at level crossings at the Adamstown and Islington level crossings
- Relieving pressure on regional roads to accommodate the growth in the freight task
- Supporting the investment in the freight rail industry in the region.

1.5 INVESTIGATION AREA

The investigation area, shown in Figure 1.2, includes the area between Fassifern on the Main North Rail Line and the Hunter Coal Network at Hexham. It comprises the local government areas of Cessnock, Lake Macquarie, Maitland and Newcastle, and the townships of Fassifern, Teralba, Barnsley, Holmesville, West Wallsend, Cameron Park, Minmi, Seahampton, Stockrington, Lenaghan, Black Hill, Tarro, Beresfield and Hexham.

Planning for the Lower Hunter Freight Corridor and broad area for investigation was identified in Transport for NSW's Future Transport Strategy 2056.

Key features of the investigation area are:

- Areas of environmental significance (such as the Hunter Wetlands National Park, Pambalong Nature Reserve, Mount Sugarloaf, Stockrington and Tank Paddock) and high community value (including major parks, open space and schools)
- A significant National Park estate, located to the west of the M1 Pacific Motorway and the Hexham Wetlands National Park
- Areas of significant cultural landscape features and sites, and Aboriginal heritage items
- Areas of existing and planned residential development, such as the Minmi urban release area
- Areas of heritage value, including existing and historical mining
- Mining related activities and existing industrial areas at Cameron Park and Hexham, and proposed industrial development at Black Hill
- Transport and utilities infrastructure, including freight related infrastructure (such as the Hunter Valley Rail Network, the Aurizon Train Support Facilities and Australian Rail Track Corporation's Hexham Relief Roads) and the M1 Pacific Motorway. The latter runs the length of the investigation area with the Hunter Expressway extending north-west of the M1 Pacific Motorway Newcastle Interchange. The proposed M1 Pacific Motorway extension to Raymond Terrace project is also located in the northern extent of the investigation area. Major electricity

transmission lines are located around West Wallsend and Killingworth including a major electrical substation. Other power, gas and water utilities are located between Black Hill and Beresfield

- Steep terrain in the south, around Fassifern and west of the M1 Pacific Motorway
- Wetlands and floodplain in the north-east around Hexham and Tarro
- Past mining activity near Mount Sugarloaf, which has resulted in large areas of geological instability west of the M1 Pacific Motorway.

1.6 PURPOSE OF THIS REPORT

This draft Strategic Environmental Assessment has been prepared to describe the Lower Hunter Freight Corridor, to provide a strategic assessment and to justify the protection of a recommended corridor. It has been prepared to address the Department of Planning, Industry and Environment's scope requirements issued for this draft strategic assessment (refer to Appendix A).

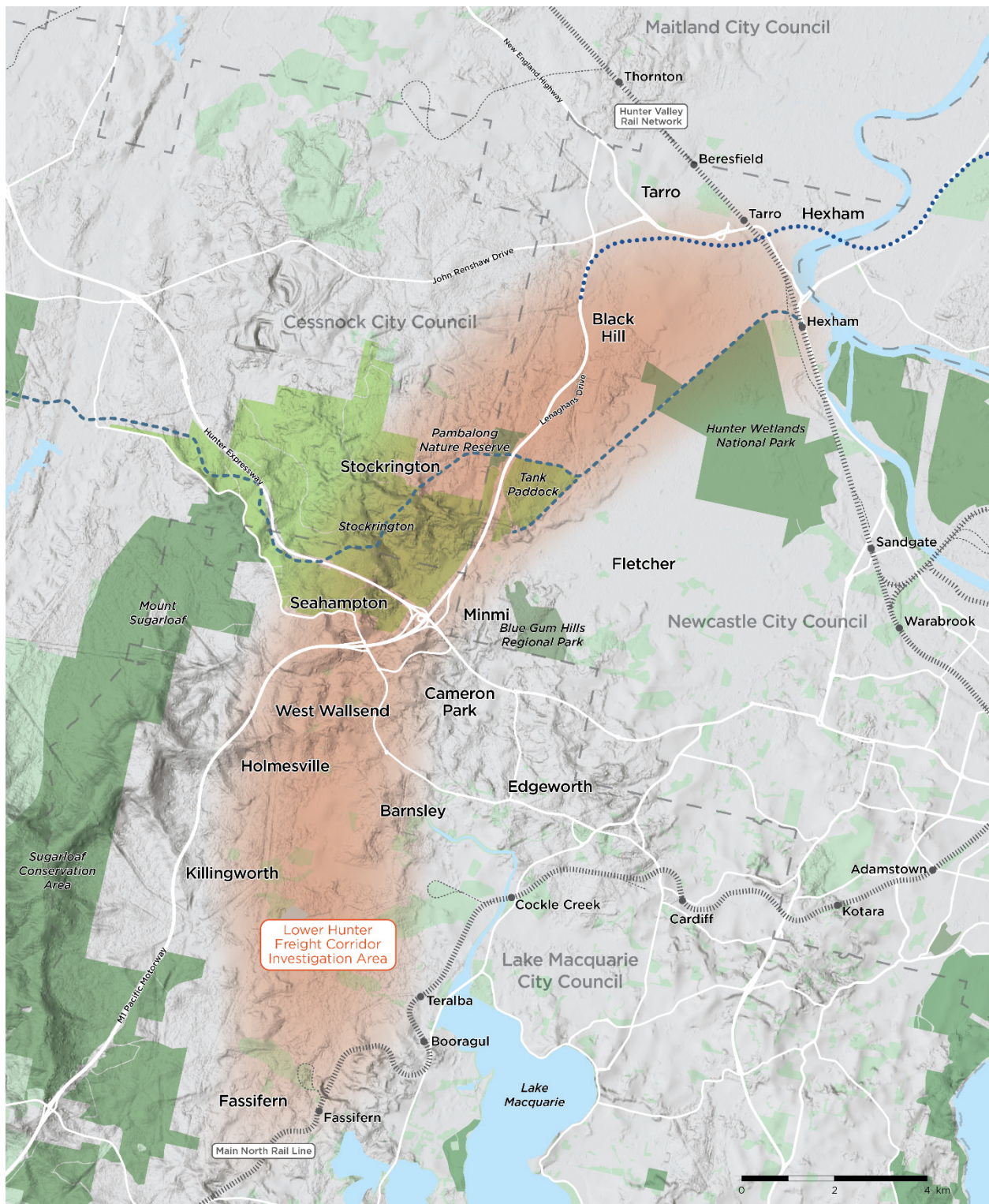
The key objectives of the draft Strategic Environmental Assessment are to:

- Outline the strategic justification and need for the corridor and its protection
- Clarify the process undertaken to identify a recommended corridor, including both constraints and opportunities, and options analysis
- Identify key environmental, community and operational matters for consideration, and possible mitigation measures minimising potential future impacts
- Identify measures required to protect the corridor in relevant Environmental Planning Instruments.

This draft Strategic Environmental Assessment forms part of the corridor protection process to support the protection of the recommended corridor. The Department of Planning, Industry and Environment have prepared an Explanation of Intended Effects, which has been released for community engagement. The Explanation of Intended Effects describes how the corridor is proposed to be protected under an amendment to the State Environmental Planning Policy (Major Infrastructure Corridors) 2020. The Explanation of Intended Effects describes the proposed zoning and development controls that would apply to the final corridor alignment to facilitate the protection of the land. Before making an amendment to the State Environmental Planning Policy (Major Infrastructure Corridors) 2020 to protect the corridor, the Department of Planning, Industry and Environment will consider feedback from the community on the proposed protection mechanisms, as well as considering the Strategic Environmental Assessment finalised by Transport for NSW. To finalise the Strategic Environmental Assessment, Transport for NSW is required to consider and respond to any feedback received on the recommended alignment and draft Strategic Environmental Assessment.

This draft Strategic Environmental Assessment was informed by a number of strategic technical analyses provided by Transport for NSW including engineering, noise and vibration, heritage, ecology and biodiversity and a hydrological review.

The draft Strategic Environmental Assessment does not support an application for environmental approval for construction of infrastructure. In seeking future approvals for the project, a detailed environmental assessment of the existing conditions, potential impacts and required mitigations would be carried out. It is anticipated that environmental approval would be sought over the next 10 to 20 years and would include an environmental impact assessment. Further community and stakeholder engagement would also be carried out during this phase.



KEY

- Lower Hunter Freight Corridor Investigation Area
- Local Government Area Boundaries

- Environment**
- NSW National Park and Wildlife Service Estate
 - Lands acquired under National Parks and Wildlife Act
 - Other Parks

- Infrastructure**
- Existing Rail Network
 - Freight Sidings
 - Major Road Network
 - Proposed M1 Pacific Motorway extension to Raymond Terrace
 - Disused Richmond Vale Railway

Figure 1.2 The Lower Hunter Freight Corridor investigation area (Source TfNSW)

2 CORRIDOR INVESTIGATION PROCESS

2.1 OVERVIEW

Based on the project objectives as detailed in Section 1.3, a systematic approach was followed to develop and assess the options presented in this report. The approach is consistent with the requirements of the Planning Guideline for Major Infrastructure Corridors (Department of Planning and Environment, undated), and the NSW Government’s Practitioner’s Guide to Movement and Place. This process is summarised in Figure 2.1.

Community and stakeholder engagement is a vital element of the corridor planning and investigation process. Stakeholders, landowners and the broader community will be able to provide feedback on the identified recommended corridor. Submissions received during the consultation process will help refine the corridor. This will enable the project team to identify a suitable corridor for future transport use.



Figure 2.1 Corridor investigation process

The key stages of the process in Figure 2.1 are addressed in detail in the following sections of the report.

2.2 STAGES IN THE CORRIDOR INVESTIGATION PROCESS

2.2.1 *DEFINE THE BROAD STUDY AREA*

A broad geographical area for investigation between the Main North Rail Line and Hexham on the Hunter Valley Rail Network was considered prior to identifying the potential options for the Lower Hunter Freight Corridor. This area is set out in strategic policies discussed in Chapter 4, such as the Hunter Regional Plan 2036 (DPE, 2016), Future Transport Strategy 2056 (Transport for NSW, 2018a) and the Greater Newcastle Future Transport Plan (Transport for NSW, 2018c).

The broad study area reflects the objectives of the project, the operational and business requirements (as provided in Chapter 3, and Appendix B) and an initial constraints analysis. As such, the broad study area comprised of a geographic area large enough to enable the freight line to avoid urban areas between Newcastle and Fassifern, while ensuring the route can deliver critical time savings. Further detail on the establishment and subsequent refinement of the broad study area is provided in Chapter 5.

2.2.2 *CONSTRAINTS AND OPPORTUNITIES ANALYSIS*

A constraints and opportunities analysis was undertaken to identify key community, environmental and operational factors to inform corridor identification and performance assessment. The constraints and opportunities analysis is based on technical investigations which are detailed in Chapter 5 of this report. This analysis was also used to further refine the study area to exclude areas that were unsuitable for a future corridor.

2.2.3 *CORRIDOR ALIGNMENT IDENTIFICATION*

A number of potential corridor alignments within the refined study area were measured against the key project objectives and environmental, community, and operational criteria. The recommended corridor alignment is the option that best meets those key objectives and criteria. This is discussed in Chapter 6.

2.2.4 *COMMUNITY ENGAGEMENT*

The recommended corridor will be exhibited for consultative purposes and will be supported by the draft Strategic Environmental Assessment and Explanation of Intended Effect for a proposed amendment to the State Environmental Planning Policy (Major Infrastructure Corridors) 2020 to protect the final corridor alignment. This process will enable further refinements to the recommended corridor alignment to minimise and mitigate potential impacts, where possible. This is the current stage of the corridor identification process.

2.2.5 *FINALISE THE CORRIDOR ALIGNMENT*

Transport for NSW will consider the feedback received during the community consultation and propose to seek finalisation of the recommended corridor alignment in late 2021 to early 2022.

2.2.6 *PROTECTION OF THE CORRIDOR*

Once a corridor is confirmed, Transport for NSW will request the Minister for Planning and Public Spaces to approve draft legislative changes to statutorily protect the recommended corridor under State Environmental Planning Policy (Major Infrastructure Corridors) 2020.

In support of this step, Transport for NSW will prepare additional implementation and management strategies such as an Ecological Offset Strategy as necessary.

3 DESIGN AND OPERATIONAL REQUIREMENTS

3.1 REQUIREMENTS

A future Lower Hunter Freight Line would be built in the short to medium term – around 10 to 20 years – when the forecasted demand for the freight bypass of Newcastle requires construction of the infrastructure. Transport for NSW will continue to monitor the rate of demand for infrastructure provision taking into consideration the growth of services and broader industry measures such as the growth of the Port of Newcastle.

To meet the objectives, the line would need to connect the Main North Rail Line at Fassifern and the Hunter Valley Rail Network at Hexham, and to satisfy the design and operational requirements outlined in Table 3.1. These requirements have been developed so that any future infrastructure would meet current industry and rail design standards for operational efficiency, rail safety and to minimise emissions (noise and air). These requirements would be developed further as part of the future design of the infrastructure.

It is the objective of the Lower Hunter Freight Corridor is to separate passenger and freight rail services through Greater Newcastle. As such, the route has been designed to provide a rail freight bypass of Newcastle for freight, avoiding communities where practicable. This means stations have not been actively considered in the design of the alignment. If passenger services bypassing Newcastle were to be considered in the future, the final design of the infrastructure would need to consider systems (including fire and life safety requirements) at the time of delivery. The proposed corridor does not preclude the delivery of a corridor for use by passenger rail.

The recommended corridor width of 60 metres would provide for the future infrastructure project footprint while considering constraints, environmental impacts and constructability challenges identified during the delivery phase of the project. The formation width would future proof the provision of double tracks. The decision to proceed with double track, or single track with passing loops would be made at the time of investment and prior to the delivery of the future infrastructure.

It is expected that the future rail infrastructure would operate over a 24-hour period, seven days a week. A future environmental approval process for rail infrastructure would address in greater detail the number, frequency and composition of trains expected to use the rail line.

Table 3.1 Lower Hunter Freight Corridor design and operational requirements

PARAMETER	REQUIREMENT	DESCRIPTION
Formation width	To be suitable for double tracks	This will allow for freight trains to pass each other without having to wait for another train to pass.
Maximum corridor width	Maximum corridor width to be 60 metres to allow for double-track formation, access roads and supporting structures and enable construction.	This will allow for the track and supporting infrastructure to have an efficient alignment and also provide other infrastructure (such as noise walls and cuttings) where required.
Speed	Minimum speed of 80 kilometres per hour	Design will allow for a minimum of 80 kilometres per hour main line operation except at junctions.
Curve Radii	Flat or larger curves (greater than 600 metres in radius)	Small radius curves (less than 400 metres) should be avoided where possible and generally greater than 800 metres to maintain a minimum 80 kilometres per hour speed, avoid increased noise profiles and operational constraints (such as lower speeds).
Noise	The Rail Industry Noise Guideline (RING) will apply.	Ensuring that communities are not unduly affected by noise.
Minimum corridor clearance	Provide for electrification and enable double stack vertical clearance where possible.	This will enable electrification of the line, if required, and provide future proofing for double stacked container trains subject to modifications to the existing rail network.
Train length	Allow for trains up to 1,800 metres in length.	Current interstate freight trains operating through Newcastle operate at up 1,500 metres and trains on other corridors up to 1,800 metres.

4 STRATEGIC CORRIDOR JUSTIFICATION

This section provides the strategic need and justification of the project and provides a consideration of relevant Government policies. This aligns with Phase 1 of the Planning Guideline for Major Infrastructure Corridors (undated).

4.1 OVERVIEW

The Lower Hunter Freight Corridor is identified in key NSW and Australian Government policies and strategic documents. It is identified in, or supported by, Australian Government policy in the Australian Infrastructure Plan (2016), National Ports Strategy (2011) and National Freight and Supply Chain Strategy (2019). It is additionally identified in the Future Transport Strategy 2056 (Transport for NSW, 2018a), NSW Freight and Ports Plan 2018 – 2023 (Transport for NSW, 2018b), Greater Newcastle Metropolitan Plan (DPE, 2018), Greater Newcastle Future Transport Plan (Transport for NSW, 2018c) and the Hunter Regional Plan (DPE, 2016).

The demand for a future Lower Hunter Freight Line, and the role that protection of the corridor would provide in meeting this demand, is summarised as follows:

- Over the next 20 years, Transport for NSW expects forecast demand for rail freight services will place increasing pressure on the Main North Rail Line between Sydney and Newcastle. Preserving the Lower Hunter Freight Corridor is the first step in delivering this additional freight capacity.
- Reducing freight services through Newcastle would improve amenity for existing communities and enable both freight and passenger networks to grow.
- The key driver for the protection of the Lower Hunter Freight Corridor in advance of the need for the future infrastructure is that encroaching urban development would limit opportunities in the future to secure land for the corridor.
- The alternatives to the Lower Hunter Freight Corridor would have significant impacts for communities in Newcastle. A ‘Do Nothing’ option is not feasible given the importance of the existing East Coast rail network for passenger and freight services between Newcastle and Sydney.

The Lower Hunter Freight Corridor would also enable various social, environmental and economic benefits from future infrastructure provision that are also summarised in this section.

4.2 POLICY CONTEXT

4.2.1 AUSTRALIAN GOVERNMENT POLICIES AND STRATEGIES

CORRIDOR PROTECTION: PLANNING AND INVESTING FOR THE LONG TERM, 2017

Corridor Protection: Planning and investing for the long term (Infrastructure Australia, 2017) is the third paper of Infrastructure Australia’s Reform Series advising Australian governments to take urgent action in the next five years to protect vital infrastructure corridors, to avoid cost overruns, delays and community disruption when delivering new infrastructure. The paper shows that protection and early acquisition of just seven corridors identified as national priorities on the Infrastructure Priority List could save Australian taxpayers close to \$11 billion in land purchase and construction costs.

The paper identifies a Hunter Valley freight line between Fassifern and Hexham as one of seven key projects on which the economic case is made.

AUSTRALIAN INFRASTRUCTURE PLAN, 2016

The 2016 Australian Infrastructure Plan (Infrastructure Australia, 2016) sets out Australia's infrastructure challenges and opportunities for the next 15 years.

The plan identifies the protection of a corridor for the Lower Hunter Freight Corridor as a high priority. The plan notes that the efficiency and cost effectiveness of freight movement in the Hunter region is impacted by 'line congestion, and the priority given to passenger trains on shared parts of the network, mean that efficiency and cost effectiveness of freight movement is reduced'.

The Lower Hunter Freight Corridor project, aimed to identify and protect a bypass freight rail line, would ultimately allow passenger services and freight trains to run concurrently on separate lines, improving efficiency and making rail more competitive.

The Australian Infrastructure Plan is updated at least every five years, with the next plan due to be released in 2021.

NATIONAL PORTS STRATEGY, 2011

The objective of the National Ports Strategy (Infrastructure Australia, 2011) is to facilitate trade growth and improve the efficiency of port-related freight movement across infrastructure network, via a commitment to the application of best practice policy making and planning.

The national ports strategy works towards identifying:

- The most effective regulatory and governance frameworks
- Ways to improve land planning and corridor protection
- The future infrastructure requirements of Australia's ports, including road and rail links.

The report concludes that urban encroachment is seen by the freight community as one of the most important issues the sector faces and notes that land planning and corridor protection has the potential to help balance the freight requirement against community and traffic amenity. The protection of the Lower Hunter Freight Corridor would therefore provide certainty and predictability for decision-making within the freight transport sector.

NATIONAL FREIGHT AND SUPPLY CHAIN STRATEGY, 2019

To position Australia to meet its emerging freight and supply chain challenges the Transport and Infrastructure Council endorsed the National Freight and Supply Chain Strategy (Department of Infrastructure, Transport, Cities and Regional Development, 2019a) and National Action Plan (Department of Infrastructure, Transport, Cities and Regional Development, 2019b) on 2 August 2019. The Strategy and Action Plan set an agenda for integrated national action across all freight modes over the next 20 years and beyond.

Developed by all Australian governments with extensive input from industry, the Strategy commits to national action in four critical areas:

- Smarter and targeted infrastructure
- Enable improved supply chain efficiency
- Better planning, coordination and regulation
- Better freight location and performance data.

As part of the agenda under the Strategy and Action, draft Urban Freight Planning Principles have been developed to guide actions and strengthen consideration of freight in planning and decision-making. The principles are:

- 1 Understand the value, needs and characteristics of freight movement and incorporate in strategic and statutory land use planning.
- 2 Safeguarding the resilience of all major freight handling facilities and corridors within and between neighbouring jurisdictions, including local government areas.
- 3 Identify and plan areas for new freight facilities and freight-intensive land uses.
- 4 Plan for efficient freight movements and complementary land uses around intermodal freight facilities.
- 5 Promote building and precinct design that considers freight needs.
- 6 Realise the importance of rest and fuel facilities.
- 7 Respond to changes in freight movements, including smaller scale freight movement and emerging technologies.

4.2.2 NSW POLICIES AND STRATEGIES

BUILDING MOMENTUM – STATE INFRASTRUCTURE STRATEGY 2018-2038, 2018

The Building Momentum – State Infrastructure Strategy (Infrastructure NSW, 2018) aims to ensure new government investment is consistent with infrastructure priorities. The strategy recognises the need for long term planning to manage growth and support the efficient delivery of future infrastructure projects, highlighting the reservation of the Lower Hunter Freight Corridor as a priority.

Strong growth is forecast over the next 20 years across NSW’s major freight regions, including the Hunter. Coal production, generally moved by rail to port, is projected to drive this growth, with new capacity requirements on the rail network largely met through Commonwealth and private investment.

The Lower Hunter Freight Corridor provides an opportunity to improve the planning, delivery and use of infrastructure, and ensure projects have a strategic underpinning and result from high quality long-term plans.

FUTURE TRANSPORT STRATEGY 2056, 2018

The Future Transport Strategy 2056 (Transport for NSW, 2018a) and the suite of supporting plans provides the basis for planning of the Lower Hunter Freight Corridor, as part of the NSW Government’s commitment to investigate improvements in rail freight capacity in areas currently depending on the shared rail network. The investigation will seek to identify ‘a freight rail line separating the majority of freight and passenger rail services on the congested area between Fassifern and Newcastle and improving amenity by removing most of the freight trains from within urban area’.

The Lower Hunter Freight Corridor is identified as a committed initiative for corridor protection within 10 years and for investigation for potential commitment within 10-20 years.

The Lower Hunter Freight Corridor would also complement and help to maximise the benefits of a number of other projects being planned and delivered by the Australian Government, NSW Government and Local Government, such as:

- Inland Rail - Some freight currently transported through Sydney would be diverted onto Inland Rail to avoid passing through the Sydney rail network, relieving pressure on north-south freight movements between Sydney and the Lower Hunter. Inland Rail could extend the timing before rail infrastructure in the Lower Hunter Freight Corridor is needed.
- Fast Rail - A Fast Rail Program is being planned by NSW Government to improve passenger travel times on the existing network between Sydney and Newcastle. The Lower Hunter Freight Corridor complements this program by removing rail freight from the Main North Rail Line, allowing an increase in services that would be more reliable, faster and capable of meeting future demand. A ‘Faster Rail Plan’ has also been released by the Australian Government setting out the commitments of the Australian Government to a faster rail network that, in common with Fast Rail, includes the objective of improving travel times between Sydney and Newcastle.
- The M1 Pacific Motorway extension linking the M1 Pacific Motorway to the Pacific Highway at Raymond Terrace.

- The Richmond Vale Rail Trail, a 32-kilometre walking/cycling track proposed by Cessnock, Newcastle and Lake Macquarie Councils.
- Future upgrades to the Hunter Valley Rail Network, at either Tarro or Hexham.

NSW FREIGHT AND PORTS PLAN 2018–2023, 2018

The NSW Freight and Ports Plan 2018 – 2023 (Transport for NSW, 2018b) is a supporting plan to the Future Transport Strategy 2056. It identifies a program of initiatives to address key transport links as well as network enhancements and rail freight alignments across the Lower Hunter.

The report recognises the Lower Hunter Freight Corridor as an initiative for investigation, noting that it would help deliver new infrastructure to increase rail freight capacity and to accommodate growth.

REGIONAL NSW SERVICES AND INFRASTRUCTURE PLAN, 2018

As a supporting document to the Future Transport Strategy 2056, the Regional NSW Services and Infrastructure Plan (Transport for NSW, 2018d) sets a 40-year vision for transport in Regional New South Wales to support liveable communities and productive economies. The plan aims to assist Regional NSW to maximise its potential, recognising the diversity between regions and their natural assets, strong communities, local skills and globally competitive industries.

The Lower Hunter Freight Corridor is identified in the report as an initiative for investigation for potential commitment over the next 20 years, subject to Business Case development.

GREATER NEWCASTLE FUTURE TRANSPORT PLAN, 2018

The Greater Newcastle Future Transport Plan (Transport for NSW, 2018c) is a supporting plan to the Future Transport Strategy 2056. It considers the importance of enhancing freight connections to cater for changing freight demand to enable improved market access and support the efficient movement of freight through the region. Strategies include the identification and development of the Lower Hunter Freight Corridor, improvements to the Main North Rail Line to address freight pinch points, and implementation of the ‘Port Efficiency, Access and Integration Package’.

The plan identifies the Lower Hunter Freight Corridor as an initiative for investigation for potential commitment over the next 20 years, subject to Business Case development. New or upgraded freight rail corridors are highlighted in the Plan, including the Lower Hunter Freight Corridor. These are shown on Figure 4.1.

PORT MASTER PLAN 2040 – PORT OF NEWCASTLE, 2018

The Port Master Plan 2040 (Port of Newcastle, 2018) provides a broad and strategic approach to identifying future development and opportunities for the Port of Newcastle. The plan focuses on demonstrating the connectivity and capacity of the Port and its supporting transport networks to accommodate, attract and grow trade, and assist in addressing the freight task in an efficient, sustainable, profitable and innovative manner. The plan recognises the Lower Hunter Freight Corridor as a key project that would enhance the existing transport networks and enable improved utilisation of existing transport networks to accommodate the current and future freight task. The plan supports the initiative of corridor protection for the Lower Hunter Freight Corridor, noting that delivery of the infrastructure would provide improvements in capacity on the existing rail network which would have overall positive impacts in terms of network efficiency.

GREATER NEWCASTLE METROPOLITAN PLAN 2056, 2018

The Greater Newcastle Metropolitan Plan 2056 (DPE, 2018) delivers a collaborative framework, strategies and actions for the implementation of the Hunter Regional Plan (DPE, 2016). The plan identifies areas for renewal and revitalisation along major transport corridors into the city core. This would integrate economic and knowledge centres with renewal opportunities at rail stations such as Adamstown, Waratah and Broadmeadow. The plan notes that the proposed Lower Hunter Freight Corridor would improve amenity around some rail stations (by diverting freight), supporting further revitalisation of employment and new housing.

Greater Newcastle Freight Network

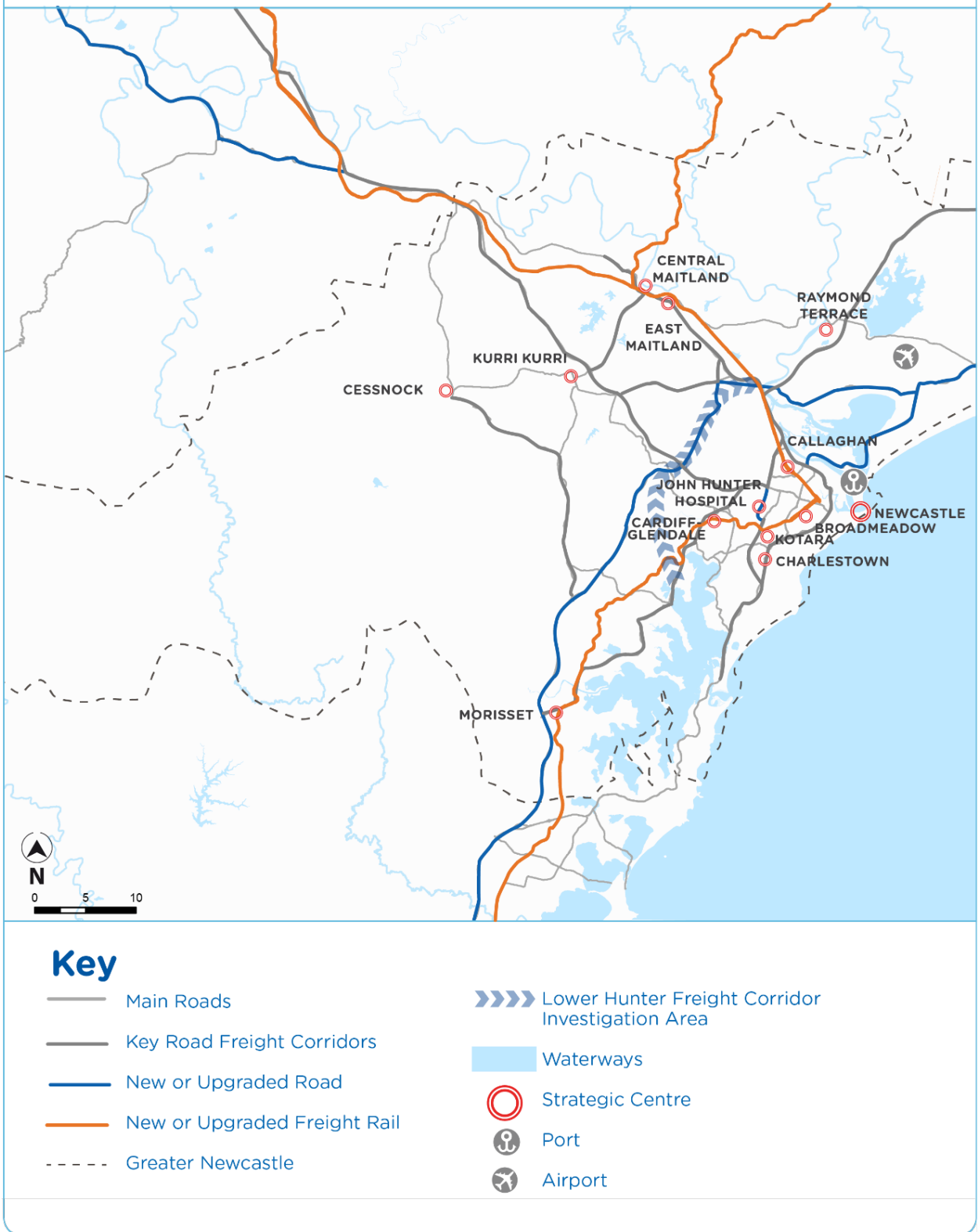


Figure 4.1 Greater Newcastle Future Transport Plan – Freight Network (Adapted from Transport for NSW, 2018c)

The plan recognises opportunities to better connect trade movements across NSW and nationally via major road and rail infrastructure, including the proposed Lower Hunter Freight Corridor. It highlights land around trading hubs as having potential for freight and logistics, capturing the opportunity provided by improved connectivity, as well as enabling trade and exports to adapt to changing global demands through the protection of infrastructure corridors including the Lower Hunter Freight Corridor.

Strategies and actions from the plan which support the delivery of the Lower Hunter Freight Corridor or which would be supported by the delivery of the Lower Hunter Freight Corridor include:

- Strategy 3 – Increase domestic and global trade capabilities at Newcastle Port: The Department of Planning, Industry and Environment, working with local councils, will amend the Three Ports State Environmental Planning Policy to facilitate the diversification of activities at Newcastle Port to adapt to changing global demand for trade and tourism.
- Strategy 7 – Respond to the changing land use needs of the new economy: Greater Newcastle councils will align local plans to focus heavy industries in the employment precincts of Tomago and Beresfield-Black Hill. The Department of Planning, Industry and Environment, working with local councils, will encourage the relocation of heavy industries away from urban areas.
- Strategy 23 – Protect major freight corridors: Greater Newcastle councils to align their local Environmental Planning Instruments to protect future freight corridors between the Port, Airport, Beresfield-Black Hill and interchanges on the National Road Freight Network, and ensure incompatible uses do not encroach on the Lower Hunter Freight Corridor.

HUNTER REGIONAL TRANSPORT PLAN, 2014

The Hunter Regional Transport Plan (Transport for NSW, 2014) (and updated in 2016) was developed to support the Future Transport 2056 Masterplan by outlining specific actions to address transport challenges of the Hunter region. The Plan contains actions to:

- Protect existing and planned major infrastructure corridors and sites, including inter-regional transport routes like the M1 Pacific Motorway and the railway, port and airport, to support their intended functions.
- Protect and plan for the construction of the strategic rail freight corridor at Fassifern and the Hexham rail bypass.
- Invest in freight rail infrastructure to support efficient movement of rail-based freight through the Hunter region, lend weight to the reservation and protection of the Lower Hunter Freight Corridor, and support the reservation and protection of a corridor for freight movements through the Lower Hunter.

THE HUNTER REGIONAL PLAN 2036, 2016

The Hunter Regional Plan 2036 (DPE, 2016) guides the NSW Government's land use planning priorities and decisions over the next 20 years, providing a framework for the development of detailed land use plans, development proposals and infrastructure funding decisions.

The Lower Hunter Freight Corridor's bypass of Newcastle's inner suburbs is identified as a regional priority. It is seen as being critical to the efficient movement of freight and to allow for the region's growth. The Plan lists a number of Actions that relate to the Lower Hunter Freight Corridor:

- Action 4.1 Enhance inter-regional transport connections to support economic growth.
- Action 4.5 Plan for multimodal freight facilities that support economic development of the region and respond to the location of the proposed Freight Rail Bypass.
- Action 4.7 Enhance the efficiency of existing nationally significant transport corridors and protect their intended use from inappropriate surrounding land uses.

The Lower Hunter Freight Corridor would assist in both separating future freight from sensitive land uses and communities and improve transport efficiencies to support the economic growth of the region.

NEWCASTLE – LAKE MACQUARIE WESTERN CORRIDOR PLANNING STRATEGY, 2011

The Newcastle – Lake Macquarie Western Corridor Planning Strategy (Department of Planning, 2011) identifies known infrastructure requirements that would guide future urban expansion and conservation in the western corridor of Lake Macquarie and Newcastle local government areas.

The strategy aimed to ensure future planning in the area considered existing residential areas and employment lands, site constraints, major transport linkages, and regional and local conservation corridors. The proposal to construct a freight corridor to the west of Newcastle was identified in this Strategy and was to be considered through Council land use planning strategies.

4.2.3 LOCAL POLICIES AND STRATEGIES

NEWCASTLE 2030, 2013

Newcastle 2030 (Newcastle City Council, 2013) is a shared community vision developed by Newcastle City Council as a guide to inform policies and actions throughout the city for the next twenty years. This includes actions to support the implementation of the regional transport strategy and to advocate improvements to public transport to achieve Council's strategic integrated and accessible transport direction.

PLANNING NEWCASTLE 2040: GLOBAL CITY, LOCAL CHARACTER, 2020

The Local Strategic Planning Statement – Planning Newcastle 2040: Global City, Local Character (City of Newcastle Council, 2020) outlines its plan to guide land use planning within the local government area over the next 20 years. It also gives effect to the Hunter Regional Plan 2036 (DPE, 2016) and the Greater Newcastle Metropolitan Plan 2036 (DPE, 2018), and implements the priorities outlined in Newcastle 2030 and other adopted strategies.

This statement identifies the need to protect freight movement from incompatible land uses as a planning priority, in recognition of the importance of freight transport in supporting the economic prosperity and employment opportunities in NSW. The City of Newcastle Council has identified the need to work with Transport for NSW to identify potential strategic road and rail freight corridors as identified in the Newcastle Transport Strategy, and to ensure appropriate land uses controls are considered to ensure compatible land uses along strategic corridors.

IMAGINE LAKE MAC, 2019

Imagine Lake Mac (Lake Macquarie City Council, 2019a) provides strategic direction for the land use and land management of the city for the next 30 years. The strategy acknowledges the Lower Hunter Freight Rail Corridor as a project in its early investigation stages that would complement other transport links in the region including the Main North Rail Line, M1 Pacific Motorway and the Hunter Expressway. The conceptual route for the Lower Hunter Freight Corridor is recognised in the strategy's 'City Structure and Opportunity' map.

LOCAL STRATEGIC PLANNING STATEMENT – SHAPING THE FUTURE

The Local Strategic Planning Statement – Shaping the Future (Lake Macquarie City Council, 2019b) outlines its plan to guide land use planning within the local government area. Similar to Imagine Lake Mac, Lake Macquarie City Council has identified the need to protect major freight corridors and identified the Lower Hunter Freight Corridor.

4.3 THE CASE FOR A LOWER HUNTER FREIGHT CORRIDOR

4.3.1 NEED FOR A NEW FREIGHT LINE

ACCOMMODATING GROWTH IN FREIGHT DEMAND

The NSW regional freight task for all commodities is forecast to rise by approximately 25 per cent over the next 40 years, placing increasing pressure on the Main North Rail Line between Sydney and Newcastle. It is predicted that the capacity of the current rail network will be reached by 2036, meaning growth in freight demand would not be met over time. The strain on network capacity would likely lead to freight being forced to travel via other modes such as roads. This could have wider impacts on production levels, employment, road congestion and investment occurring in the region.

Whilst there has been significant investment in the North-South Interstate Rail Corridor between Melbourne and Brisbane, improving capacity, reliability and transit times, the rail line between Sydney and Newcastle remains a constraint. This corridor provides access to some Australia's largest markets and most important trade gateways.

Planning for a future freight bypass of Newcastle is the first step in delivering essential rail capacity for future freight. The development of the design and the environmental approval would need to be completed over the next 10 to 20 years to enable timely construction and delivery to meet expected forecast demand. Transport for NSW will continue to monitor the growth in demand and plan accordingly, subject to available funding.

REDUCING PASSENGER RAIL CAPACITY CONSTRAINTS

Capacity for rail freight may be impacted by growth in passenger services, which is a legislative priority over freight services. Transport for NSW advises that the Lower Hunter Region is expected to generate around 3 million more passenger train journeys per year by 2031 further constraining rail freight growth. Separating freight and passenger services north of Fassifern would ease congestion and would encourage growth across both networks.

A dedicated freight line would address reliability and servicing impacts to both freight and passenger networks associated with shared infrastructure. Passengers would benefit from transit time savings, reliability, service delay reductions and additional capacity through an increase in train services. Freight would have the ability to run increased services due to availability of an alternate route and on time running would improve service reliability.

TIME TRAVEL IMPACTS ON INDUSTRY

If future rail freight is limited to ongoing use of the existing shared passenger and freight rail network, there would be significant adverse impacts on the freight industry, and productivity impacts. Conversely, a new rail line would deliver benefits to industry in terms of travel time savings and increased reliability. Industry would likely benefit from a reduction in operating costs as a direct benefit, which could lead to indirect benefits in terms of lower cost for services and products. It is also likely to lead to improved productivity, particular in global markets relevant to the Hunter Region, such as mining and agriculture.

The economic benefits are generally derived from travel time savings of between 15-20 minutes for an average trip in comparison with the current rail network. Travel time savings are a key measure of the operational justification of the project. Without travel time savings, the likelihood of attracting industry support and government funding for the project is diminished.

REDUCING FREIGHT TRAVELLING VIA NEWCASTLE

Freight trains passing through inner Newcastle cause liveability impacts for existing residents. Removing or decreasing the number of freight trains passing through the existing urban areas of Newcastle would see an immediate improvement in the local urban amenity adjoining the rail line. This improved amenity is an important contributor to the achievement of urban renewal (transit-oriented development) in areas already identified by the Department of Planning, Industry and Environment and City of Newcastle.

RELIEVING CONGESTION AT LEVEL CROSSINGS

Road level crossings on the rail network, particularly at St James Road, Adamstown and Clyde Street, Islington, can cause significant traffic delays while waiting for consecutive freight and passenger services to clear.

The length and procedures for freight trains to pass through level crossings means it takes significantly longer than a passenger train to cross through level crossings. Commuters regularly experience long delays at rail level crossings (up to ten minutes), especially when freight trains are travelling in both directions through the level crossing.

Should freight continue on the current corridor, the forecasted increase in volume will result in boom gates closing more frequently over the course of a day and would result in more congestion at level crossings, increased community severance and amenity impacts as well as increased costs attributed to a loss of time savings.

Enabling freight trains to bypass Newcastle would relieve some congestion and delays to road users and active transport at these level crossings.

RELIEVING PRESSURE ON REGIONAL ROADS

Improved reliability and efficiency of the rail network, aside from passenger benefits, would reduce pressure on regional roads. Without further freight infrastructure development, demand for rail freight could exceed capacity as early as 2026.

This would result in some rail freight being diverted to road, resulting in significant increases in vehicle movements through the Hunter region, and would result in increased congestion and safety risks to Newcastle residents, particularly on the Newcastle bypass and M1 Pacific Motorway. Transport for NSW estimates that as a result of future rail freight infrastructure, approximately 62,000 heavy vehicle road trips per year on the road network would be avoided.

MAINTAINING VIABLE BULK FREIGHT INDUSTRIES

For some freight, including bulk commodities that may use the Lower Hunter Freight Corridor in the future, road transport might not be a cost-effective alternative due to the weight of the goods, or may not be operationally viable due to specific restrictions, for example operational restrictions for transporting coal from mines. Therefore, if the current rail network in the region reaches capacity and these goods are unable to obtain the required rail freight paths, they may stop being produced and transported.

Overall, Transport for NSW expects substantial cost advantages to using rail compared with road transport.

4.3.2 *DISADVANTAGES OF UPGRADING THE EXISTING NETWORK (ALTERNATIVE SCENARIO)*

The alternative to constructing a dedicated freight bypass would be to upgrade the existing rail network, which would be the minimum 'do nothing' approach to alleviating future network capacity issues brought on by the expected growth in freight demand.

There are currently no alternatives for rail freight services to bypass Newcastle, even if they are travelling through the region. With all rail traffic forced to travel through the inner suburbs of Newcastle, trains that do not have destination in Newcastle are contributing to congestion, extended transit times and unreliable services. This includes impacts on passenger services.

Any upgrade of the existing network would therefore ultimately be an inferior option to a future freight bypass in terms of operation and efficiency and would likely raise the intensity of existing land use conflicts.

The upgrade of the existing freight line between Fassifern and Broadmeadow would be limited to the single line largely within the existing corridor along its western edge. Transport for NSW has advised that this option would require upgrades to numerous existing bridges, and potential modifications to Fassifern and Adamstown stations. Upgrading the existing railway network through these built up urban areas would likely have significant and direct property impacts and expose a larger number of existing homes to higher amenity impacts due to the increased freight services and proximity

to the expanded rail corridor. It would also further exacerbate the congestion issues caused at the level crossings in Adamstown and Islington.

The main impact of expanding the existing rail corridor would be noise from trains negotiating 4.5 kilometres of tight radius curves, including through the townships of Cardiff and Teralba. The areas around the existing railway are also undergoing residential development and urban renewal, meaning additional homes would significantly reduce the viability of expanding the existing rail corridor to accommodate dedicated freight lines. Figure 4.2 shows the proximity of the existing network to residential communities that would be impacted as a result of upgrading the existing network.

For these reasons, planning for a dedicated freight bypass is a much more viable scenario over upgrading the existing rail network, and protecting the Lower Hunter Freight Corridor is the first step in delivering essential rail capacity for future freight.

4.3.3 *BENEFITS OF EARLY CORRIDOR PROTECTION*

THE IMPORTANCE OF ALIGNMENT SELECTION IN REALISING CORRIDOR PROTECTION BENEFITS

Finding a direct connection between Fassifern and Hexham which saves travel time, whilst limiting community and environmental impacts, has been a major challenge in the corridor planning process. Early into the investigation it was determined that alignments further west of the M1 Pacific Motorway were unlikely to deliver viable travel time savings due to length of journey and steep topography. Further west of the M1 Pacific Motorway corridor, the steep and often unstable topography would require extensive use of costly tunnelling to provide a connection. For these reasons, route alignments west of the M1 Pacific Motorway corridor were discounted early in the planning process.

PROVIDING CERTAINTY FOR INDUSTRY FOR THE FUTURE OF FREIGHT RAIL THROUGH THE REGION

The freight industry and other key stakeholders need to see that the NSW Government is committed to delivering the necessary future capacity. Protecting the corridor would provide a signal to industry of the NSW Government's intent to ensure freight rail capacity is being met, both now and in the future. This in turn would encourage continued investment in the rail freight industry.

AVOIDING CONFLICTS WITH FUTURE URBAN DEVELOPMENT

The Greater Newcastle Metropolitan Area and Hunter Region are growing rapidly. Population projections for Newcastle City Council estimate growth of 39,000 people between 2016 and 2041, putting pressure on demand for housing and land resources suitable for large-scale projects.

Long-term planning is needed to ensure that this infrastructure is delivered in a manner that is efficient and cost-effective. The Department of Planning, Industry and Environment, City of Newcastle and Lake Macquarie Council have been undertaking strategic planning to ensure orderly and efficient land use planning for the region. Additionally, individual landowners and developers have begun submitting specific planning applications for new residential and employment areas in the region.

The rapid pace of housing development in the region, particularly around Minmi and Fletcher, as well as employment development in Cameron Park and Black Hill, highlights the urgent need to protect the recommended corridor.

As urban expansion results in higher order land uses, such as homes and businesses, new communities would become established. It would then be more difficult for Government to acquire land without impacting new developments and established communities may be impacted and potentially displaced if the corridor has not been preserved. It is therefore prudent to protect the corridor early before urban development impacts on the viability of the corridor in terms of suitable land uses.



Figure 4.2 The existing rail network within urban areas

MINIMISING COSTS OF DELIVERY

Corridor protection would provide significant financial benefits such as savings in infrastructure construction costs and property acquisition costs, as well as avoiding future disruption and stress for property owners and other stakeholders in and around the corridor.

In July 2017, Infrastructure Australia released a report entitled Corridor Protection – Planning and Investing for the Long Term. The report examines the potential for cost savings associated with protecting seven priority long term infrastructure corridors, including the Lower Hunter Freight Corridor.

To identify opportunities for cost savings through corridor protection, Infrastructure Australia modelled three different scenarios:

- 1 Do not protect now and acquire at time of construction (2 years prior).
- 2 Protect and acquire now (2017-2019).
- 3 Do not protect now and tunnel in the future – any acquisition two years prior to construction.

Based on the result of the modelling, the report found:

'Done well, corridor protection reduces the future financial costs of delivering infrastructure, while minimising the social costs of acquiring homes and businesses, and disrupting existing communities. It minimises the chance that infrastructure will need to be delivered in expensive tunnels; it protects against a scenario where critical infrastructure goes undelivered as a result of prohibitive costs' (Infrastructure Australia, 2017).

The specific report findings for the Lower Hunter Freight Corridor were that under the 'protect and acquire now' scenario, there are potential savings of \$33 million and potential revenue of \$5 million (\$2016 at seven per cent discount rate).

Included within these potential savings is the avoidance of construction costs associated with increased tunnelling of rail infrastructure. The Infrastructure Australia report notes that tunnelling costs are on average three times the cost of surface (at-grade) construction. Early protection of the recommended corridor can therefore avoid significant tunnelling and associated construction costs. Similarly, planning for a surface alignment in a developed area can result in the need for deviation of a route to avoid constraints, adding to both construction and long-term operational costs associated with a longer, less direct alignment.

Whilst the above cost saving are based on a scenario of immediate acquisition of corridor land, the potential for staged acquisition over a longer time period still offers potential and substantial cost savings in terms of avoiding land improvements associated with subdivision, urban development and escalation in property prices overtime.

It is important to note that around 65 per cent of the recommended Lower Hunter Freight Corridor is already in Government ownership, which represents a substantial advantage compared with other potential alignments that would require much more private land acquisition. Much of the Government land identified within the recommended corridor either supports existing infrastructure or has limited development potential.

Government owned land adjacent to West Wallsend may offer an opportunity for biodiversity offsets, which would likely reduce the future costs associated with meeting the requirements of the environmental approval process of the future rail infrastructure in the Lower Hunter Freight Corridor, thus improving the overall viability of the project.

4.3.4 **BALANCING INFRASTRUCTURE NEED WITH LANDOWNER CONSIDERATIONS**

As described in the Explanation of Intended Effects, the corridor is proposed to be rezoned to SP2 Infrastructure to retain a viable corridor for future infrastructure delivery. Under the State Environmental Planning Policy (Major Infrastructure Corridors) 2020, landowners will maintain the ability to lodge development applications for uses that were previously permissible under the former zoning, facilitating the continued use of the land prior to infrastructure delivery. Zoning the corridor to SP2 Infrastructure also provides the ability for landowners to initiate acquisition requests under the *Land Acquisition (Just Terms Compensation) Act 1991*.

5 CONSTRAINTS AND OPPORTUNITIES

This section summarises the broad study area constraints and opportunities analysis that was used to identify the refined investigation area in which options for corridor alignment were identified. The analysis was informed by a number of technical studies undertaken by Transport for NSW.

The analysis of corridor alignment options and the selection of the recommended corridor alignment is provided in Chapter 6. The assessment of this alignment is provided in Chapter 7.

5.1 CONSTRAINTS AND OPPORTUNITIES WITHIN THE STUDY AREA

This section has been informed by a number of technical studies carried out by Transport for NSW and meets the purposes of a strategic assessment.

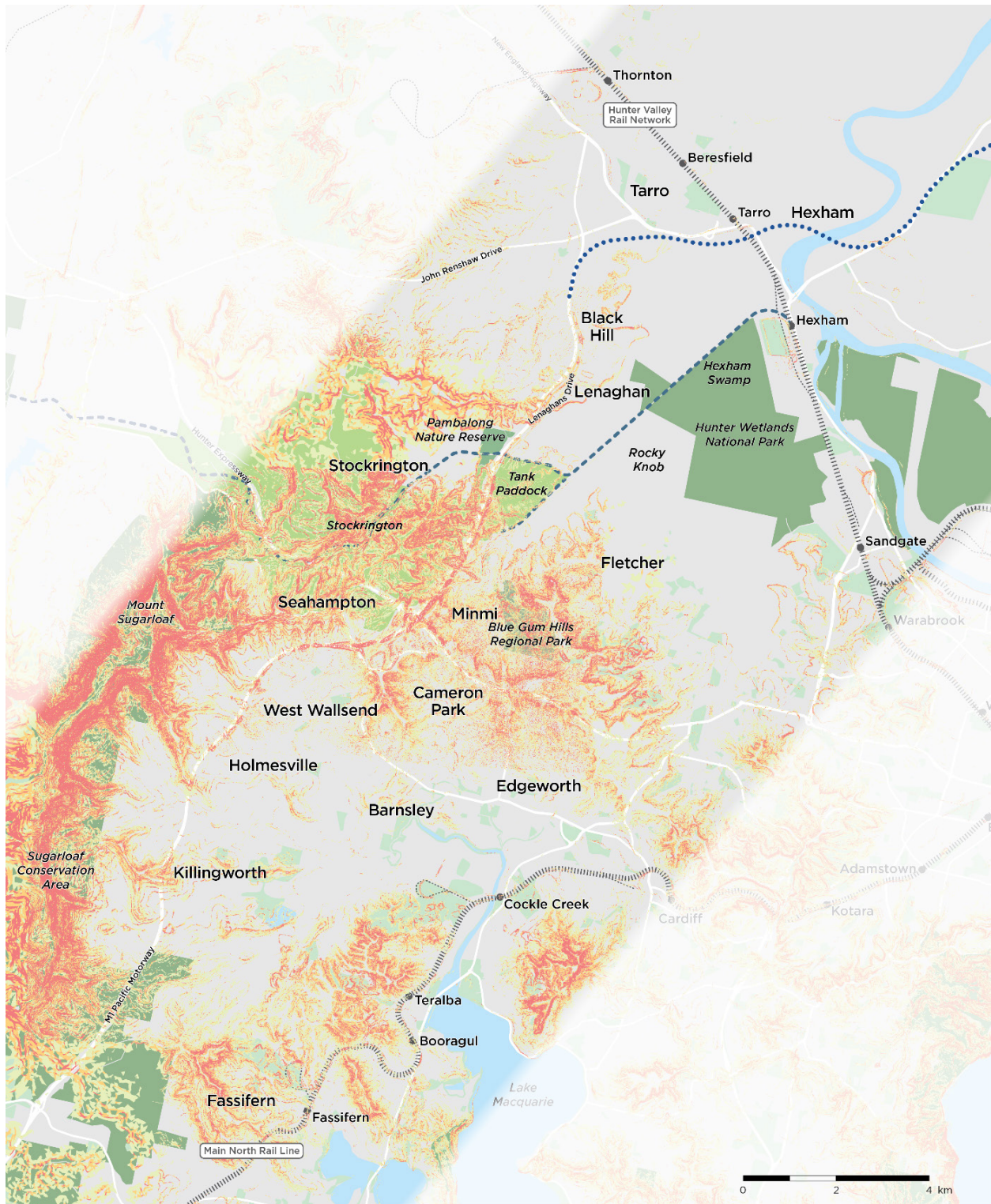
5.1.1 TOPOGRAPHY

The study area topography is highly varied, with low lying coastal floodplains and undulating terrain with steep gradients (refer to Figure 5.1), as well as areas with potential subsidence due to previous mining activity. The floodplains are bisected by numerous creek lines in areas to the north of Awaba and Fassifern. The Sugarloaf Range extends north-south on the western side of the M1 Pacific Motorway. The Sugarloaf Range includes very steep terrain and has been subject to mining activity in the past, particularly around the Stockrington area.

The desirable gradient for a future freight line is one per cent, with steeper gradients limited to short sections if required. This is to ensure operational efficiency for the future rail line in terms of transit time (train speeds) and operator costs as well as minimising air and noise emissions from freight trains.

For this reason, steep terrain in the study area is considered a notable constraint to the rail corridor. To achieve desirable rail gradients in steep terrain, tunnelling solutions would be required that can result in increased cost and construction complexity. Tunnels beyond 1.5 kilometres are considered impractical for operational reasons and would require more complex in-tunnel air quality infrastructure. Historical mine workings and the inherent instability further increases the construction complexity of tunnel solutions in this region.

Low lying areas (such as the Hexham Swamp) are also a general constraint to the future corridor, due to flooding risk to future rail infrastructure as well as changes that future infrastructure could have on flood behaviour and nearby wetland systems. Alternative engineering solutions (such as viaducts) would need to be considered to minimise such impacts.



KEY

- Slope (Degrees)**
- 6 - 12
 - 12.01 - 20
 - >20

- Environment**
- NSW National Park and Wildlife Service Estate
 - Lands acquired under National Parks and Wildlife Act
 - Other Parks

- Infrastructure**
- Existing Rail Network
 - Freight Sidings
 - Major Road Network
 - Proposed M1 Pacific Motorway extension to Raymond Terrace
 - Disused Richmond Vale Railway

Figure 5.1 Topographical features

5.1.2 LAND USE

The study area is a mix of rural and forested lands, and wetlands, some of which are environmentally significant (e.g. Tank Paddock, Hexham Swamp). Farmland, several residential communities, infrastructure corridors (e.g. power lines, road corridors) and pockets of industrial and employment lands are also present (refer to Figure 5.2). The land use zones (refer to Figure 5.3). are generally consistent with the land uses within the study area

Existing residential communities are generally located at the northern end and along the eastern border of the study area, with other smaller residential areas scattered throughout. Some residential communities are identified for further growth, particularly around Minmi, Fassifern and Fletcher.

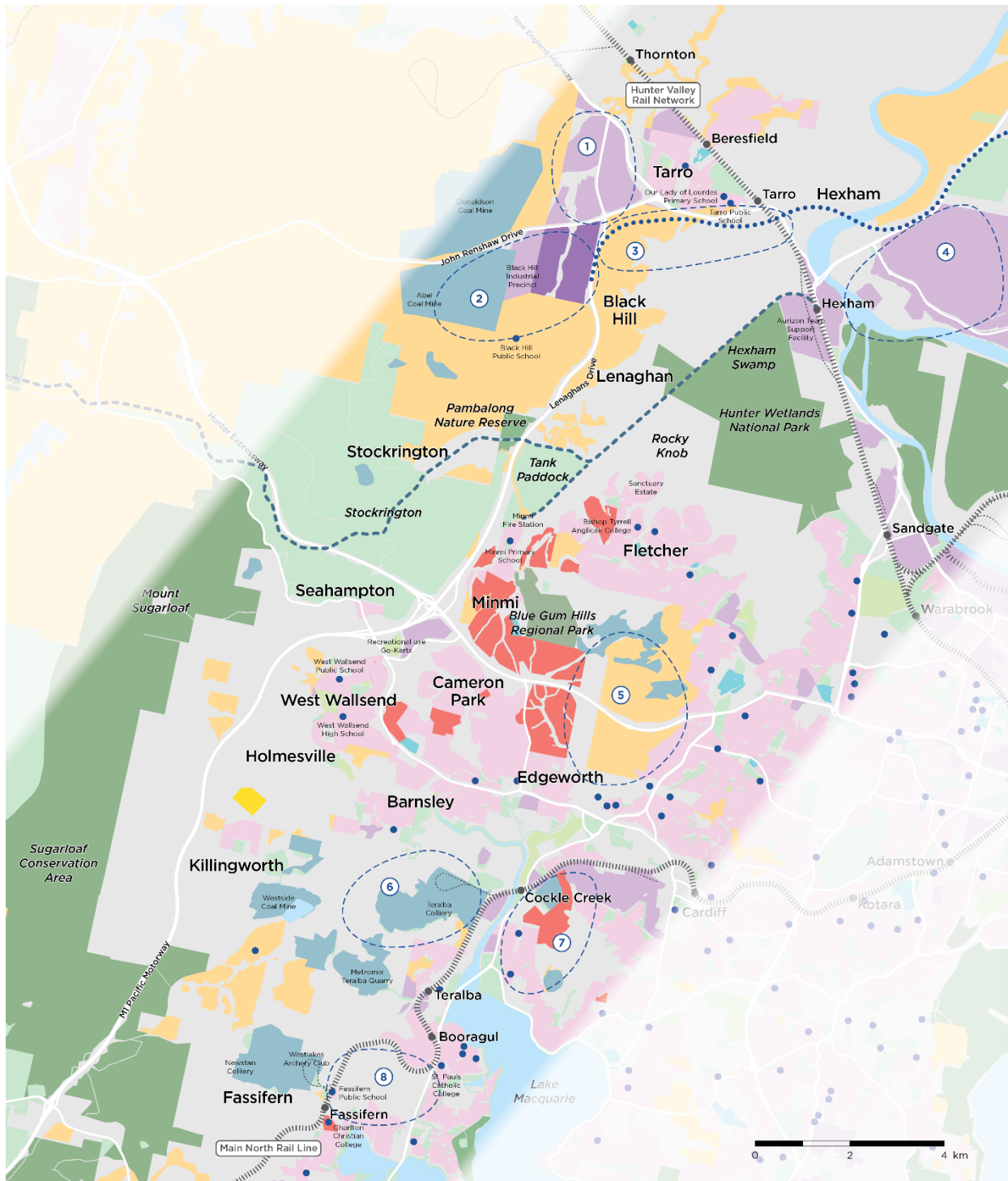
Several community facilities are also distributed through the study area, such as:

- Education facilities – Minmi Primary School, Barnsley Primary School, Fassifern Primary School, and Charlton Christian College.
- Recreational facilities such as Johnston Park, West Wallsend (also known as the ‘West Wallsend Football Ground’), ‘Go Karts Go’ in Cameron Park, the Driver Training Centre (approved) at Rhondda Colliery, Fassifern Oval and Tarro Recreation Area.
- Other key community facilities including Hawkins Masonic Village Nursing Home in Edgeworth; Sugar Valley Lifestyle Estate retirement and golf course in West Wallsend, West Wallsend Cemetery, Council depot near Barnsley and Minmi Fire Station.

The study area includes a cluster of existing and closed coal mines, collieries, coal railways and a quarry including West Wallsend Colliery, Westside Coal Mine, Teralba Colliery, Metromix Quarries, and Newstan Colliery. Further industrial and/or employment areas are located in Black Hill, Cameron Park, and West Wallsend, with smaller industrial and business uses distributed throughout the study area.

Industrial land uses are more compatible with the future rail infrastructure as these uses are less sensitive to amenity impacts in comparison to residential or community land uses. The proximity of the future rail infrastructure to these lands is not considered to be a major constraint.

Notwithstanding, a key driver of this project is to secure a corridor for future freight movement in the Lower Hunter, and to minimise the impacts it may have on encroaching urban development, particularly around Minmi and the proposed Black Hill industrial area. Large areas of land are currently owned by Federal, State and Local Government and this has assisted in the development of the options.



KEY

Land Zoning

- Existing Residential
- Rezoned Residential Land
- Rural Residential
- Town Centres
- Community and Recreational Facilities
- Schools
- Existing Industrial
- Rezoned Industrial
- Existing Mines & Quarries
- Substation
- Major Parks and Open Space

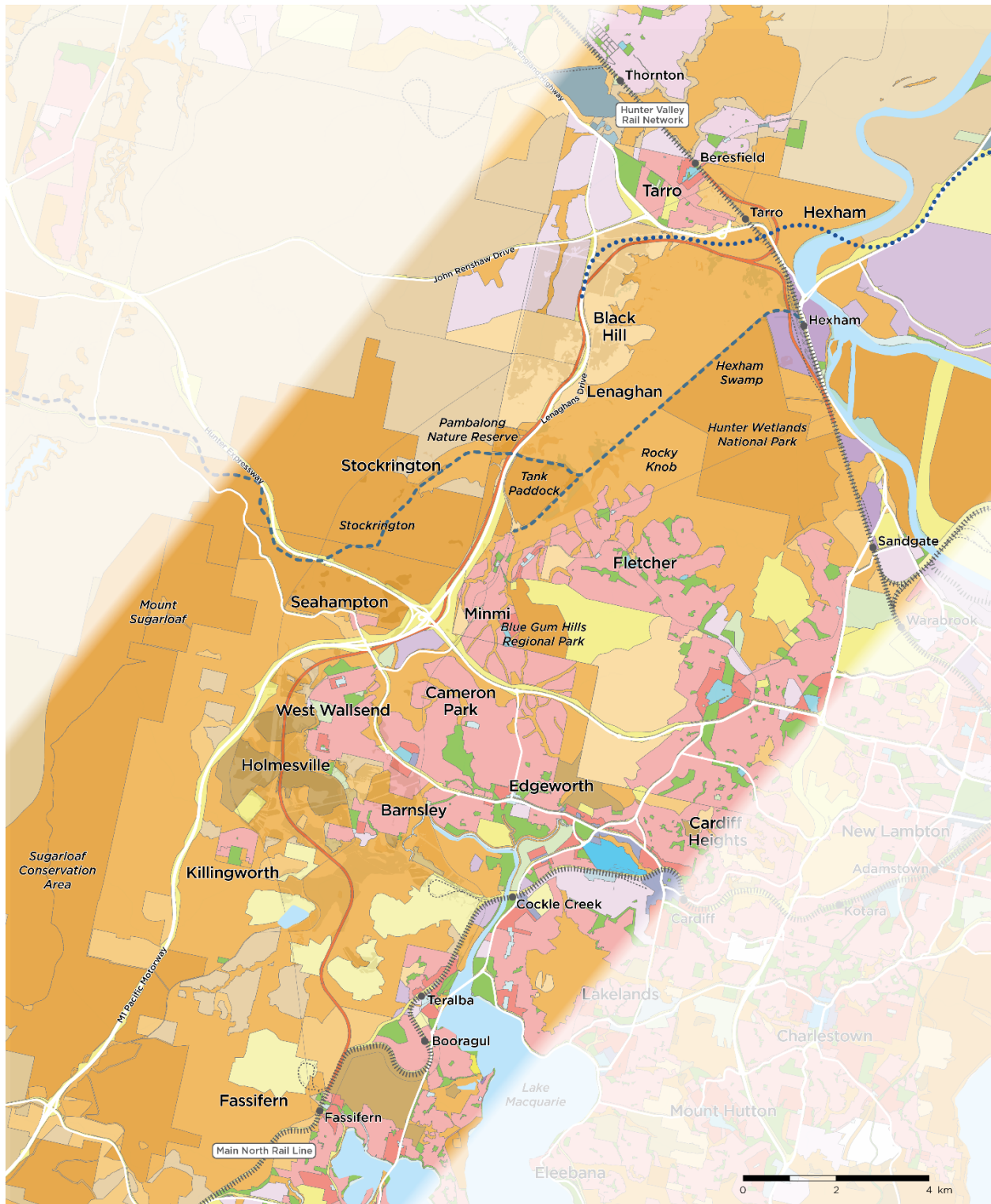
Infrastructure

- Existing Rail Network
- Freight Sidings
- Major Road Network
- Substation
- Proposed M1 Pacific Motorway extension to Raymond Terrace
- Disused Richmond Vale Railway

Future Growth Areas

- 1 Beresfield freight and logistics precinct
- 2 Blackhill freight and logistics precinct
- 3 Potential Beresfield expansion precinct
- 4 Tomago industrial precinct
- 5 Newcastle housing release area
- 6 Teralba industrial precinct
- 7 Murrumbidgee urban renewal precinct
- 8 Fennell Bay major residential development site

Figure 5.2 Land use characteristics and community facilities



KEY			
Land Zoning	E2 Environmental Conservation	R5 Large Lot Residential	SP3 Tourist
B1 Neighbourhood Centre	E3 Environmental Management	RE1 Public Recreation	W1 Natural Waterways
B2 Local Centre	E4 Environmental Living	RE2 Private Recreation	W2 Recreational Waterways
B3 Commercial Core	IN1 General Industrial	RU1 Primary Production	UL Unzoned Land
B4 Mixed Use	IN2 Light Industrial	RU2 Rural Landscape	DM Deferred Matter
B5 Business Development	IN3 Heavy Industrial	RU3 Forestry	
B6 Enterprise Corridor	IN4 Working Waterfront	RU4 Primary Production Small Lots	
B7 Business Park	R1 General Residential	RU5 Village	
E1 National Parks and Nature Reserves	R2 Low Density Residential	RU6 Transition	
	R3 Medium Density Residential	SP1 Special Activities	
	R4 High Density Residential	SP2 Infrastructure	

Figure 5.3 Land use zones

5.1.3 BIODIVERSITY

The majority of the study area has been impacted by agriculture post-European settlement. However, areas of significant remnant native vegetation remain. Aquatic systems are also present including ecologically sensitive wetlands areas such as Pambalong Nature Reserve, Hunter Wetlands National Park, RAMSAR Wetlands and farm dams. A number of databases and reports were reviewed to gain an understanding of the sector’s biodiversity values including the:

- BioNet Atlas of NSW Wildlife for Biodiversity Conservation Act 2016 (BC Act) listed threatened species and communities.
- Protected Matters Search Tool for Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) matters of national environmental significance.
- PlantNet.
- Fisheries Database.
- Fishing and Aquaculture spatial database.

The matters outlined in this section have been identified as sensitive and are to be avoided as far as possible.

Future infrastructure delivery within the corridor would need to undertake further detailed environmental assessment ahead of obtaining approval for construction.

THREATENED ECOLOGICAL COMMUNITIES (TECS)

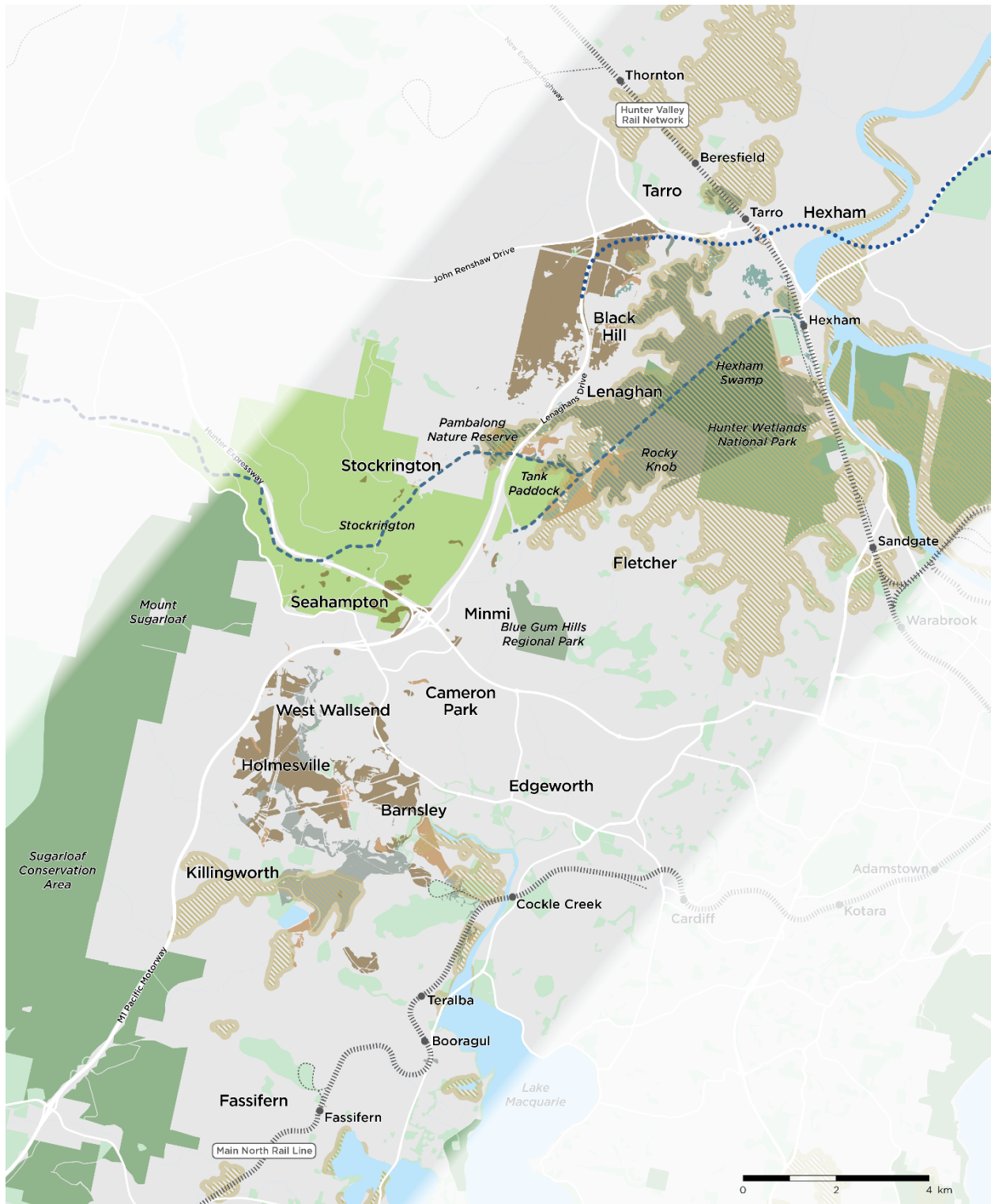
An ‘ecological community’ is defined under the *Biodiversity Conservation Act 2016* as ‘an assemblage of species occupying a particular area’. Ecological communities are not limited to assemblages of plant species, although the majority of ecological communities listed under State (BC Act) and Commonwealth (EPBC Act) legislation are based on and defined by vegetation types.

State and Commonwealth legislation recognise different categories of Threatened Ecological Communities (TECs) of conservation significance: Vulnerable (V), Endangered (E), and Critically Endangered (CE). The listing of ecological communities as TECs takes into consideration the natural rarity of different ecological communities, current and historical reductions in their extent and threats to their continued existence. Table 5.1 below outlines the TECs identified in the study area. The location of TECs is shown in Figure 5.4.

Table 5.1 Threatened ecological communities

THREATENED ECOLOGICAL COMMUNITY	STATUS
Coastal Swamp Oak Forest	EPBC Act – E
River-flat Eucalypt Forest	EPBC Act – CE
Freshwater Wetlands	BC Act – E
Lower Hunter Spotted Gum Ironbark Forest	BC Act – E
Swamp Sclerophyll Forest	BC Act – E
Swamp Oak Floodplain Forest	BC Act – E
River Flat Eucalypt Forest	BC Act – E

The Tank Paddock and land in Stockrington has been acquired under the *National Parks and Wildlife Act 1974* as biodiversity offset lands associated with the Minmi Link Road, residential development and the Black Hill Employment Lands rezoning. Lands acquired for offsets are protected due to their high ecological value and local significance. It is expected that the National Parks and Wildlife Service will place the land on the 2021-22 reservation program which will then classify these areas as National Park Estate.



KEY

Threatened Ecological Communities

- Freshwater Wetlands
- Lower Hunter Spotted Gum - Ironbark Forest
- River Flat Eucalypt Forest
- Swamp Oak Forest
- Swamp Sclerophyll Forest

Only TEC's within the Investigation Area are displayed

Environment

- Coastal Wetlands
- Coastal Wetlands Proximity Area
- NSW National Park and Wildlife Service Estate
- Lands acquired under National Parks and Wildlife Act
- Other Parks

Infrastructure

- Existing Rail Network
- Freight Sidings
- Major Road Network
- Proposed M1 Pacific Motorway extension to Raymond Terrace
- Disused Richmond Vale Railway

Figure 5.4 Ecological features (Source: TfNSW)

Avoiding areas of high ecological value and threatened ecological communities is an important consideration in the option development process. Any requirement for areas to be cleared would need to be investigated as part of future design and environmental approval process.

FAUNA AND FLORA

Individual fauna and flora species were also considered using database searches and field inspections to record or predict the likelihood of habitat for threatened species in the study area.

A total of 133 threatened species of animal under State and Commonwealth legislation have been recorded or are predicted to have habitat in the study area. Seventy-two of the threatened species are also considered to have a low likelihood of occurrence in the study area with the remaining 61 likely to have habitat with a moderate or higher likelihood of occurrence. No threatened aquatic species listed are likely to be impacted by potential corridor alignments in the study area.

Two species of bird listed as migratory under Commonwealth legislation were recorded during field inspections. However, habitat within the study area is considered marginal for these species given the abundance of similar or greater quality habitat elsewhere in the region.

The biodiversity assessment also determined that the corridor included a high likelihood of koalas occurring at a sparse density within the study area (which comprised the area covered by the four shortlisted options – refer Section 6.2 – and a buffer of between 200 metres and one kilometre). This finding was based on the species being occasionally previously recorded in the study area in the BioNet database.

It is not likely that all the threatened species identified would be affected by all corridor options being considered. Any potential impact on fauna and flora would need to be investigated as part of future design and environmental approval processes.

RAMSAR WETLANDS

The Hunter Estuary Wetlands is a ‘declared RAMSAR wetland’ due to its significance to international migratory birds, these wetlands also support mangrove and saltmarsh communities. Two areas of wetland fall within the study area, the Shortland wetland, and the Kooragang Nature Reserve. RAMSAR wetlands are considered to be Matters of National Environmental Significance under the EPBC Act.

The western portion of the Hunter Wetlands National Park covers part of Hexham Swamp. Hexham Swamp is considered a matter of national importance, as it is the largest remaining waterfowl habitat on the lower north coast of NSW, containing approximately 37 per cent of the remaining non-tidal wetland habitat on the lower Hunter floodplain.

Any potential impact on these wetlands would need to be investigated as part of future design and environmental approval process.

BIODIVERSITY CORRIDORS

A number of connectivity and green corridors are located in the study area, including the Watagan Stockton and Wallarah green corridor as identified in the Lower Hunter Regional Strategy (Department of Planning, 2006). The green corridor mapped by the Lower Hunter Regional strategy has conservation important in maintaining connectivity from the western bushland at Seahampton further north east across Hexham Swamp and Tarro through to the Hunter River and further east to Ash Island and Raymond Terrace. A key fauna habitat corridor in the southern area of the study area was also mapped by the National Parks and Wildlife Service in 2001. This corridor extends to the north and provides connectivity to native bushland at West Wallsend and further west to Heaton State Forest. Lake Macquarie City Council has also identified green corridors throughout the study area.

Using previously disturbed areas where possible, such as existing easements or infrastructure corridors would assist in reducing further fragmentation of biodiversity corridors and introducing additional barriers to fauna movement. Mitigation, such as fauna crossings, would be required where additional barriers to fauna connectivity would result. The requirement and location of these would be investigated as part of future design and environmental approval processes.

5.1.4 GEOTECHNICAL AND MINING

GEOLOGICAL ENVIRONMENT

The basic geology of the study area overlies Newcastle coal measures comprising sandstone, shale, conglomerate, coal and tuff at Fassifern to Minmi. Near Stockrington, the study area overlies Tomago coal measures comprising shale, mudstone, sandstone, coal, tuff and clays. Tomago coal measures are also present to the east of Lenaghan, east of Woods Gully and East of Tarro. In the southern portion of the study area, the Narrabeen group comprising lithic sandstone, shale and siltstone is evident.

To the west of Lenaghan and in the vicinity of Rocky Knob, Hexham Swamp, Hexham and south of Tarro, silts, clay and estuarine sediments are dominant and are associated with Hexham Swamp, Hunter River and Cockle Creek.

North west to south east trending dykes cross Rhondda Road in the south portion of the study area and at the M1 Pacific Motorway, south west of Minmi.

MINE SUBSIDENCE

Subsidence has occurred at and near Mount Sugarloaf. This demonstrates the geological instability west of the M1 Pacific Motorway. The extent of old mine workings with open cut mine/quarry, active mines and historic mine workings cover a large portion of the study area shown in Figure 5.5. This represents a potential risk to the construction of infrastructure particularly where structures such as tunnels, bridges, viaducts and significant earthworks are required.

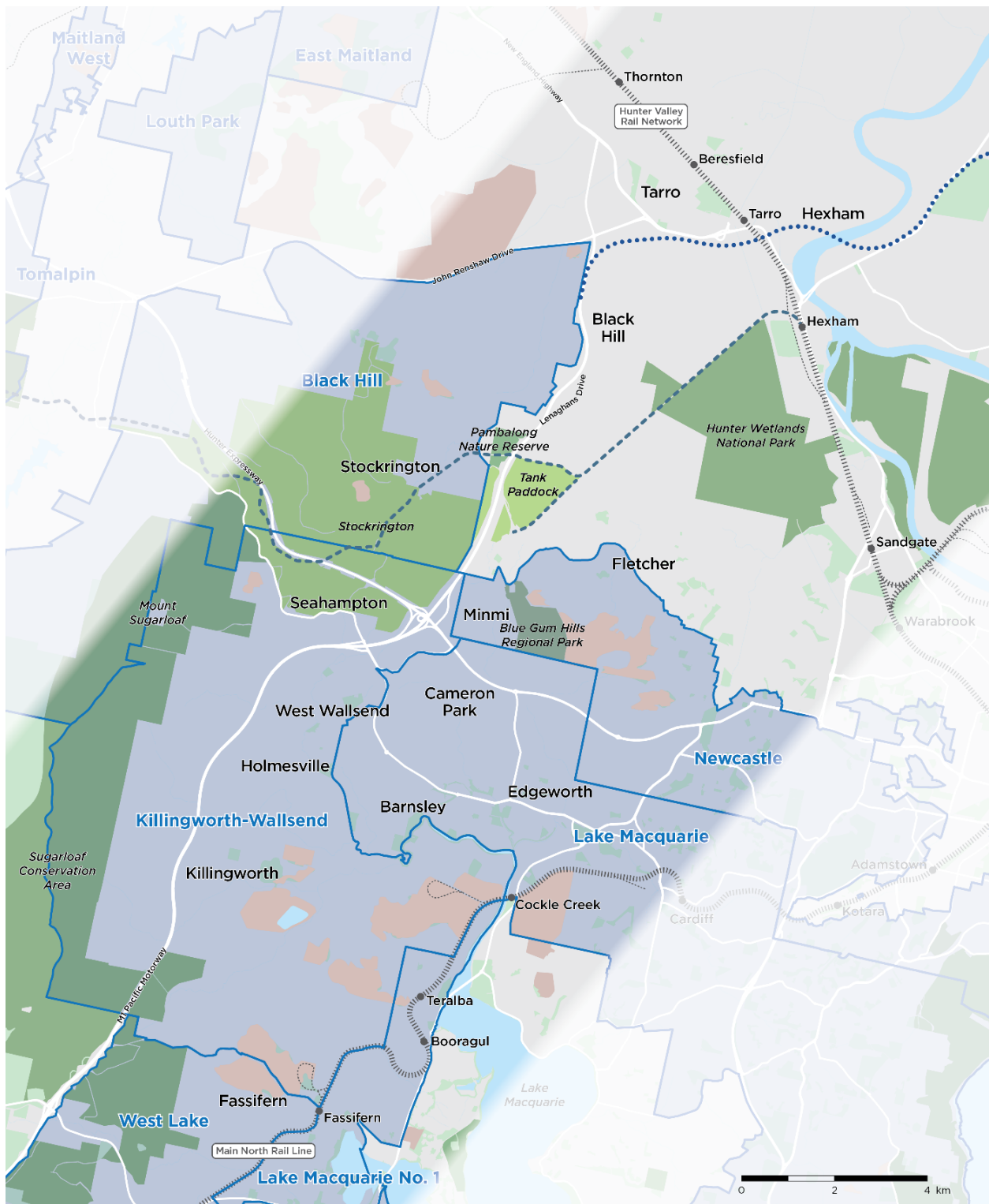
The study area traverses eight existing mine sites predominantly in the southern portion with one mine site north of Black Hill. Mitigation measures used on recent infrastructure projects including the Hunter Expressway included grouting of mine voids and structural design of bridges and viaducts to accommodate movement.

Future ongoing liaison with Subsidence Advisory NSW is needed to support future designs for the rail infrastructure within the corridor.

CONTAMINATION

The presence of mining and other industrial activity is likely to result in the presence of contamination within the study area. Four registered contaminated sites are located within the study area:

- Green Acres Farm located at 1 Woodland Close, Tarro and is approximately 83,900m². A notice under Section 35 of the *Environmentally Hazardous Chemicals Act 1985* sets out restrictions applying to the site which is affected by asbestos.
- Trojay Pty Ltd located at 64 Old Maitland Road, Hexham (approximately 32,400 m²), located approximately 450 metres east of Hexham Station and impacted by asbestos.
- Former Forgacs Site at 21 Sparke Street, Hexham (approximately 84,700 m²), located near Ironbark Creek. The site was under a voluntary agreement with NSW EPA to conduct investigations regarding contamination of sediments from hydrocarbons, cyanide, copper, zinc and lead.
- Metal Salvage Newcastle Pty Ltd located at 21 Racecourse Road, Teralba is impacted by hydrocarbons, heavy metals, phenols and cyanide.



KEY

Areas of Mining Activity

- Mine Subsidence District
- Existing and Historic Mines and Quarries

Environment

- NSW National Park and Wildlife Service Estate
- Lands acquired under National Parks and Wildlife Act
- Other Parks

Infrastructure

- Existing Rail Network
- Freight Sidings
- Major Road Network
- Proposed M1 Pacific Motorway extension to Raymond Terrace
- Disused Richmond Vale Railway

Figure 5.5 Historical mine workings and areas of subsidence (Source: TfNSW)

ACID SULFATE SOIL

Acid sulfate soils are widespread along the margins of the NSW coast within estuarine floodplains and coastal lowlands. The primary concern surrounding acid sulfate soils is for the potential estuarine acidification to occur. This reduces soil fertility, kills vegetation and has the potential to impact on threatened species.

Changes to the water table and/or the extent of inundation experienced in low lying areas are potential threats to estuarine ecology. The two key concerns for rail construction related to acid sulfate soils risk are:

- The change to water table and/or the extent of inundation through modified drainage /flow regime
- Exposure of potential acid sulfate soils through excavation during construction.

The first risk can be effectively managed through maintaining existing flow patterns by incorporating drainage works into the future rail design. The exposure of acid sulfate soils during construction would be specifically addressed through the development of an Acid Sulfate Soil Management Plan as part of the future design and construction phase. This would set out ways to avoid and manage the disturbance of acid sulfate soils to avoid harm to the surrounding environment.

Acid sulfate soils are not considered a constraint to the identification of the corridor alignments and would be considered, where necessary, in the design and construction management stages.

5.1.5 ABORIGINAL HERITAGE

The study area includes the traditional lands of the Awabakal, Wonnaruah and Mindaribba Aboriginal people. The Awabakal are the Traditional Owners of the floodplains of the lower Hunter Valley south of the Hunter River through Lake Macquarie. The Wonnaruah are the Traditional Owners of the valley lands of the upper and central Hunter Valley. The Mindaribba are the Traditional Owners of land to the west of Hexham, including Tarro, Black Hill and Stockrington. The study area contains the boundary between the three tribes.

Traditionally tribal boundaries were overlapping and could change depending on the season, making difficult a definitive ownership of lands difficult. Further traditional hunting grounds often extended well into the lands of neighbouring tribes.

The geology, landform, climate and plant and animal communities of the lower Hunter have determined how the Aboriginal people of the area has utilised the land. A review of the environmental context of the study area suggests that the lower Hunter Valley could have been very comfortably inhabited by Aboriginal populations in the past during all times of the year. Prior to European settlement, the floodplain, alluvial landscape and swamps, such as Hexham Swamp, would have been exploited for its natural resources and it is likely that the high ground adjacent to the swamps were also utilised by Aboriginal people as living space. Important trade and pathways linked the Hexham Swamp and Sugarloaf Range, and some of these paths now form roads.

A search of the National Native Title Register was conducted in June 2019. There are several Aboriginal Land Claims (Aboriginal Land Rights Act 1983) in the study area. The study area contains several archaeological sites as recorded on the NSW Government Aboriginal Heritage Information Management System (AHIMS) database. This database is not definitive and should be used as an indicator of potential site finds. AHIMS data indicates a high potential for discovery of Aboriginal heritage sites during future site works. Significant artefact numbers have been discovered in the past as development of infrastructure and urban development has taken place. Sections of the study area that have not had similar levels of development could also reveal heritage sites.

A search of the State Heritage Inventory (NSW) was also conducted in June 2019 to identify sites in the study area that have been recognised for their Aboriginal heritage value. Two are included; the Butterfly Cave and the Lake Macquarie Resting Place. These are culturally sensitive sites and the exact location is not public information.

An Aboriginal cultural values assessment was also carried out in early 2020 to inform option investigation through the Lower Hunter Valley between Fassifern and Hexham. This included review of previous studies as well as engagement with Aboriginal Land Councils and Aboriginal elders. The investigation sought to identify and preserve values important to Aboriginal people. An integrated Transport for NSW team worked with local Aboriginal people to develop and

deliver an innovative approach to an Aboriginal Cultural Values Assessment (CVA). The work ensured that cultural values are assessed and considered early in the corridor selection process. Aboriginal people lead the CVA process and its outputs are culturally relevant, inclusive and tailored to further engagement of Aboriginal customers. A number of highly significant ceremonial sites were identified in the study area.

These include:

- Tokol (Doghole); an initiation and marriage ceremony site located in the vicinity of Stockrington.
- The foothills of Mt Sugarloaf; significant in the context of social discipline and used to reinforce the importance of lore and ceremony.
- Links and pathways between Mount Sugarloaf and the head of Hexham Swamp; connecting the living areas, resources and water sites associated with the lowlands and swamps and the ceremonial areas and vantage points associated with Mount Sugarloaf and foothills.
- The headwaters of Cockle Creek; an important area that has meaning for female initiation ceremony.

The development of corridors options considered the presence of these Aboriginal cultural heritage values, with the view to minimising impacts where avoidance is not practicable. The significance of Aboriginal heritage and potential for discovery of sites and artefacts will require on-going investigation. This will be undertaken as part of the future design and impact assessment phase.

5.1.6 NON-ABORIGINAL HERITAGE

The non-Aboriginal history of the study area is linked closely to the themes of early exploration, settlement, coal mining, industry, transport and towns. Areas and items of non-Aboriginal heritage significance are shown in Figure 5.6.

Government databases were searched in June 2019 to identify sites in the study area that have been recognised for their non-Aboriginal heritage value, and include:

- Items listed on the Australian Heritage Database
- Items listed on the State Heritage Inventory (NSW) which includes:
 - State Heritage Register
 - Interim Heritage Orders
 - State Agency Heritage Registers
 - Local Environmental Plans
- Register of the National Estate (non-statutory).

There are no items listed on the Australian Heritage Database within the study area. Three items listed on the Register of National Estate (non-statutory archive) are located within the study area: the Tarro Pumping Station (which is also listed on the NSW State Heritage Inventory), the Tarro Telephone Exchange (Anderson Street Tarro), and The Five Islands & Adjacent Land, Five Islands Road, Teralba.

There are 125 local heritage items within the study area, and two local conservation areas (West Wallsend and Teralba). There are no items within the study area that are listed as a State heritage item, however, some sites have been listed in the local environmental plan as having state significance values. This includes the Minmi to Hexham Railway and former railway cuttings at Minmi.

Listed heritage items in the study area largely consist of residences, churches, schools, cemeteries, former mining sites and rail infrastructure, railways and associated buildings, utilities (e.g. water reservoirs, pumping stations, and substations, bridges).



KEY

Non-Aboriginal Heritage Features

- State
- Local

Environment

- NSW National Park and Wildlife Service Estate
- Lands acquired under National Parks and Wildlife Act
- Other Parks

Infrastructure

- Existing Rail Network
- Freight Sidings
- Major Road Network
- Proposed M1 Pacific Motorway extension to Raymond Terrace
- Disused Richmond Vale Railway

Figure 5.6 Areas and items of non-Aboriginal heritage

Of note are:

- Various former collieries and infrastructure, including Newstan Colliery, Colliery Relics (Fassifern), Rhondda Colliery and railway, West Wallsend Colliery, Mount Sugarloaf Colliery and the Seaham, West Wallsend, Fairley and Killingworth railway.
- The Minmi to Hexham Railway, and the Richmond Vale Railway, which passes through the study area. The Minmi to Hexham Railway has been identified in the Lake Macquarie LEP as having State significance but is not a State heritage item.
- The Great North Line, which is operational.
- The John Brown's Model Farm in Minmi.
- Winston Court residence in Minmi.

A list of local heritage items is provided in Appendix C.

The development of corridors options would consider the presence of previously recorded heritage sites, with the view of minimising impacts where avoidance is not practicable.

5.1.7 FLOODING AND HYDROLOGY

Several flood studies have been undertaken for the Hunter region that have included flood modelling and the mapping of flood behaviour within the Hunter River floodplain. These studies were used as a principal source of information for the analysis of existing hydrological features and constraints within the study area.

A review of the hydrological features of the study area by Transport for NSW identified two major flooding catchments, the Hexham Swamp (as identified in Figure 5.7) and the LT Creek catchment. Flood prone areas (as identified in Figure 5.8) are a general constraint which would require additional engineering responses to minimise impacts to flood behaviour.

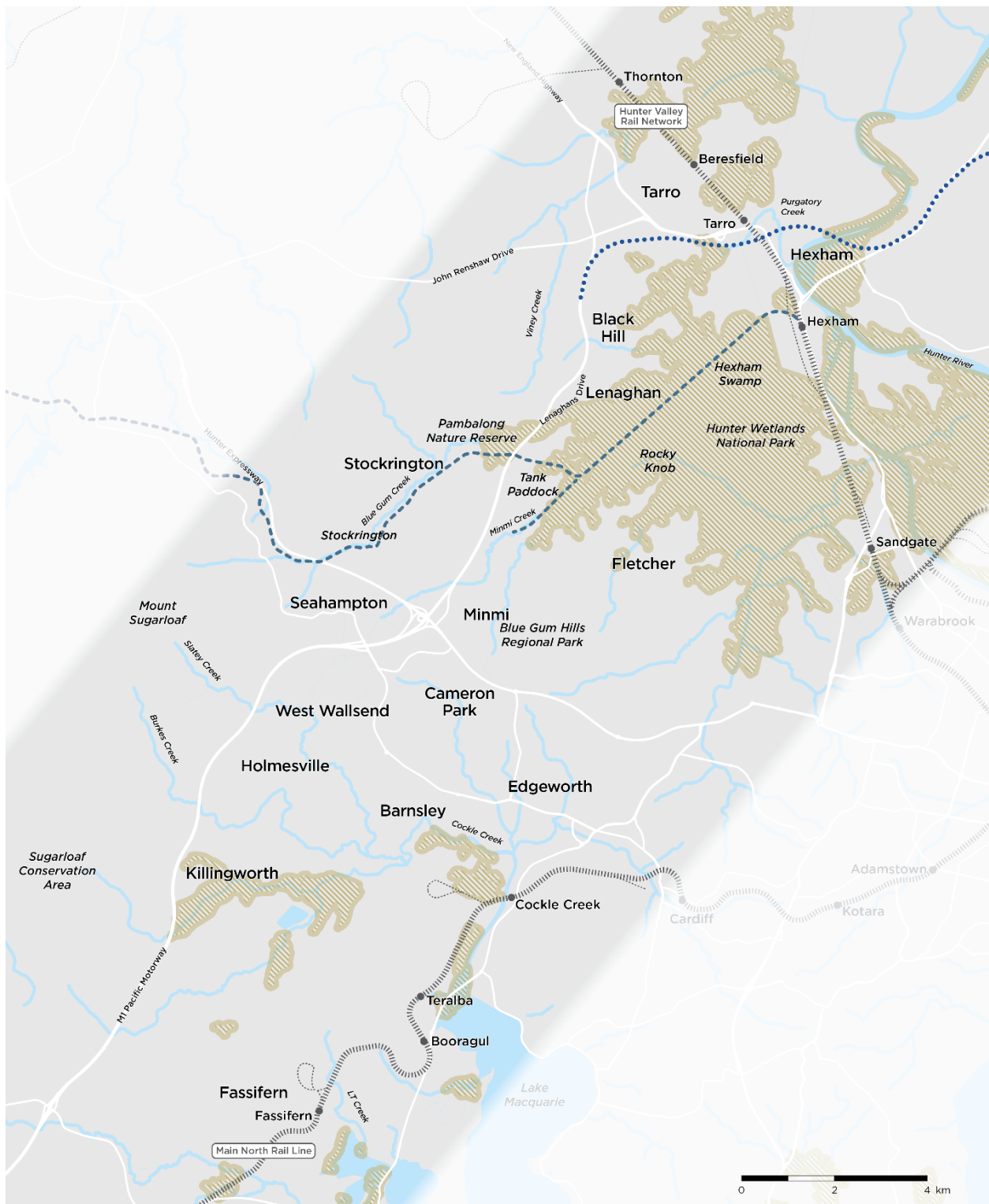
HEXHAM SWAMP

Hexham Swamp, which includes the Hunter Wetlands National Park, stretches from the area north of the Tank Paddock to Hexham to the Hexham Train Support Facility. Major catchment flooding of the Hunter River system dominates flooding events near Hexham Swamp. The swamp is a major flood storage on the south bank of the Hunter River. The majority of the swamp is drained by Ironbark Creek, but a small section of the northern corner is drained by Purgatory Creek which discharges underneath the Great Northern Railway and New England Highway into the Hunter River through floodgates just upstream of the Hexham Road Bridge.

Flood levels in the vicinity of the swamp are influenced by ocean water levels (e.g. storm surge and the tide), which have an effect on flood levels within the lower estuary. Once the flood level in the Hunter River rises above the New England Highway at Hexham, the swamp can fill up to a level of 2m AHD within a few hours. During flood events in the order of 5% Annual Exceedance Probability (AEP) or greater, extensive spilling of flood waters occurs and over top the New England Highway and the existing railway through Hexham Swamp, which is intended. Larger magnitude flooding events inundate parts of the existing rail infrastructure and the swamp may also become inundated. At a 1% AEP magnitude event, parts of Hexham Swamp may be inundated for a period of three to four days.


The progression of flood waters through Hexham Swamp is controlled by a number of topographical features, including:

- The disused Richmond Vale Railway embankment
- The Chichester Water Pipeline
- A set of eight flood gates located on Ironbark Creek near the confluence with the Hunter River South Arm control flows in and out of Hexham Swamp for lower order flood events, but these are overtopped for more significant flood events (above 5% AEP).



KEY

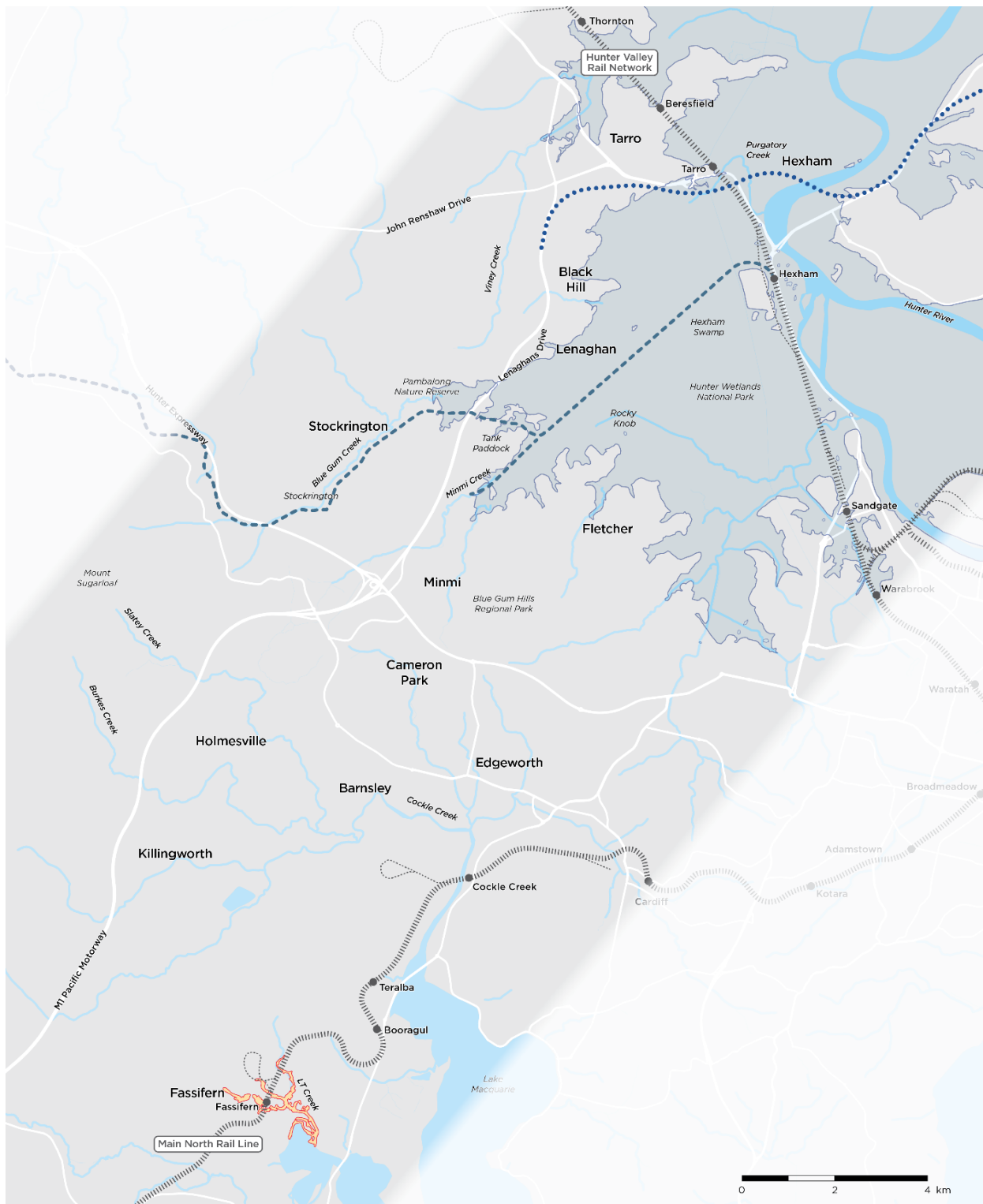
Environment

-  Coastal Wetlands (Coastal Wetlands SEPP)

Infrastructure

-  Existing Rail Network
-  Freight Sidings
-  Major Road Network
-  Proposed M1 Pacific Motorway extension to Raymond Terrace
-  Disused Richmond Vale Railway

Figure 5.7 Coastal Wetlands



KEY

Environment

- Existing 1% AEP Modelled Peak Flood Conditions
- LT Creek Catchment, 0.5% AEP Flood Extent

Infrastructure

- Existing Rail Network
- Freight Sidings
- Major Road Network
- Proposed M1 Pacific Motorway extension to Raymond Terrace
- Disused Richmond Vale Railway

Figure 5.8 Flooding

In less intense flood events (of around 10% AEP magnitude), Hexham Swamp acts as a flood storage facility. On occasions when the capacity of the swamp is exceeded due to more significant flooding (around 5% AEP), the abandoned rail embankment acts as a local flood control mechanism resulting in a drop in flood levels between the north and south sections of the swamp as flood waters pass over the embankment due to the limited cross drainage capacity.

During major flood events (around 2% AEP), Hexham Swamp exceeds its storage capacity and the disused rail embankment becomes drowned and flood waters return to the Hunter River by spilling over the Pacific Highway, becoming the dominant flood control mechanism for flood levels within Hexham Swamp.

LT CREEK CATCHMENT

The LT Creek catchment is located in the southern part of the study area around Fassifern. There is a high flood risk exposure to the Fassifern community at the lower end of LT Creek. Several flood events and property inundation have occurred in this catchment. The risk to flood exposure is higher at downstream properties along the low-lying reaches of LT Creek that joins with Fennell Bay rather than at Fassifern.

COASTAL MANAGEMENT SEPP

NSW State Environmental Planning Policy (Coastal Management) 2018 (Coastal Management SEPP) promotes a coordinated and integrated approach to the land use planning of coastal areas. Several Coastal Wetlands identified under the Coastal Management SEPP are located within the study area. These are predominately associated with the Hexham floodplain, including the Hexham Swamp and Pambalong Nature Reserve north of Stockrington.

The hydrological features in these wetland areas are influenced by existing infrastructure:

- Hexham Swamp flood gates at Ironbark Creek.
- Tidal flaps on local drainage channels discharging to the Hunter River (Purgatory Creek/Mid Site Creek at Hexham).
- Road/rail embankments and associated culverts including the M1 Pacific Motorway, Lenaghans Drive and Cedar Hill (for Pambalong) and the disused Richmond Vale Railway embankment, Hunter Valley Rail Network, New England Highway, Pacific Highway/Maitland Road (for Hexham Swamp).

5.1.8 NOISE-SENSITIVE RECEIVERS

Noise from rail freight operations includes but is not limited to noise from locomotives (engine, brake and exhaust noise) and noise from the wheel-rail interface (such as curve squeal).

Noise sensitive receivers are located across the study area and range from residential areas (including rural-residential), schools, hospitals, places of worship and recreational areas. Existing and future clusters of residential areas within the study area are largely located east of the M1 Pacific Motorway or north of the New England Highway, such as Fassifern, Killingworth, Holmesville, Barnsley, Cameron Park, West Wallsend, Seahampton, Minmi, Tarro and Beresfield. Rural residential areas are also located in the study area, including Stockrington, Lenaghan and Black Hill.

The location of noise sensitive receivers is an important consideration in the identification of corridor options, in terms of avoiding residential areas, or maximising distances to residential receivers where practicable to minimise future land use conflicts and/or requirements for noise mitigation (such as property treatment or noise barriers). For example, corridor options in the southern part of the study area could be located in existing bushland to provide a buffer to any potential noise affecting communities at Barnsley, Killingworth and West Wallsend.

The identification of the corridor options considered corridors that can provide optimal gradients and curve radii to minimise future rail noise contributions (such as wheel squeal).

Noise mitigation, such as noise walls or acoustic treatment to properties, may be required where future infrastructure is in proximity to sensitive receivers. The type of noise mitigation required would be more appropriately quantified as part of the environmental approval process.

5.1.9 VISUAL AND LANDSCAPE

Landscape characteristics within the study area consist of undulating hills, large tracts of woodland and environmentally sensitive floodplains. These elements contribute strongly to the spatial quality of the area and its scenic nature. Built form within the study area includes major and minor transport corridors as well as low-density residential development and rural-residential areas, and areas of open space (existing and proposed). Areas such as the Sugarloaf Range and corridors to Hexham Swamp also hold cultural values for the Aboriginal community (refer to Section 5.1.6), and non-Aboriginal heritage sites are located throughout the study area.

There would be varying levels of landscape sensitivity across the study area, and the ability for a landscape to accommodate change depends on a number of factors, such as existing land use, the scale of the landscape, viewshed and distribution of visual receptors and the value placed on the landscape. Areas of high sensitivity to change include areas of significant natural landscape features, and landscapes inherent with natural, heritage or cultural values.

Avoiding sensitive receivers and sensitive natural landscapes (such as Hexham Swamp) where possible would minimise any potential future impacts and the need for mitigation. For example, corridor options that can be aligned with existing infrastructure corridors would assist in minimising visual impacts due to the presence of existing structures and achieving a consolidated infrastructure footprint. This would help reduce the potential visual impacts from the future freight rail on the wider landscape.

5.1.10 EXISTING AND PLANNED TRANSPORT INFRASTRUCTURE

EXISTING RAIL INFRASTRUCTURE

The major rail corridors in the study area are the Main North Rail Line and Hunter Valley Rail Network with several other infrastructure corridors (used and disused) that require consideration as options are developed.

Richmond Vale Railway (also identified as the Richmond Vale Rail Trail) is a disused rail alignment that has been investigated as part of the corridor alignment options. Sections of the disused rail alignment runs through the Pambalong Nature Reserve and adjacent to the Hexham Wetlands National Park. While the use of this corridor could be advantageous a detailed geotechnical study would be required to confirm civil works to support the proposed freight line, and the embankment would need to be widened to meet current engineering and design requirements. In addition, the alignment would need to be coordinated with the Richmond Vale Rail Trail.

Existing railway stations at Fassifern, Tarro, Hexham, Beresfield and Thornton would be affected by the proposed corridor options.

Hexham Train Services Facility (near Hexham station) and Newstan Colliery sidings (near Fassifern station) may be also affected by options.

FUTURE RAIL INFRASTRUCTURE

The Australian Government investigated the potential for high speed rail between Melbourne and Brisbane from 2010 to 2013 and commenced a major project business case for faster rail between Sydney and Newcastle. Part of the preferred alignment was through the western part of Newcastle and Lake Macquarie.

The NSW Government is currently investigating fast rail connections between Sydney and Newcastle. Details of any future route are yet to be released. As that investigation advances, it would need to consider possible implications with future infrastructure associated with the Lower Hunter Freight Corridor.

EXISTING ROAD INFRASTRUCTURE

The study area includes several key roads, which provide access for local communities. While there are limited hard barriers constraining the location of any future freight rail corridor, consideration of community severance, constructability and cost of possible engineering solutions is important.

Major arterial roads in the study area, include:

- M1 Pacific Motorway Sydney – Newcastle
- A43 New England Highway, Newcastle – Queensland
- M15 Hunter Expressway, Newcastle – Branxton.

Other main roads within the study area include:

- John Renshaw Drive
- Lenaghans Drive
- George Booth Drive
- Newcastle Link Road.

It is likely that the Lower Hunter Freight Corridor would have multiple interface points with local roads. While any potential impacts could be mitigated by introducing overbridges and crossings, the project would consider ways to minimise these interfaces to avoid community severance and managing the cost and deliverability of the project itself.

KNOWN FUTURE ROAD UPGRADES

The NSW Government is planning the M1 Pacific Motorway extension to Raymond Terrace, from south of John Renshaw Drive to Heatherbrae and Raymond Terrace. This is located in the north end of the Lower Hunter Freight Corridor study area and would need to be considered in the next stage of corridor development.

5.1.11 UTILITIES

The study area contains a number of major overhead and underground utilities. The focus at this stage of corridor planning is to identify larger trunk infrastructure that would be costly or difficult to relocate, including electricity transmission lines, substations, gas mains and water mains.

The locations of individual trunk utility services are shown in Figure 5.9. Significant electricity easements are located in the vicinity of West Wallsend and Killingworth including a major electrical substation. This existing utility infrastructure is a major constraint for corridor identification, particularly where the corridor needs to travel in parallel with major utilities. Other power, gas and water utilities are also evident in the area between Black Hill and Beresford travelling east-west across the study area.

POTABLE AND SEWER WATER INFRASTRUCTURE

Hunter Water Corporation mains extend from Tarro to the southwest and from Tarro to Shortland. Other water pipelines include the Fletcher Trunk Main (Fletcher to Lenaghan) and a water pipeline parallel to John Renshaw Drive.

The two principal potable water supplies in the Lower Hunter are Grahamstown Dam and the Tomago Sandbeds. Water supply storage is fed by the Grahamstown Dam, with diversions from the Williams River at Seaham to the north of the dam. These are located in the northern section of the broad study area north of Tarro. The location of these potable water supplies was taken into consideration when identifying corridor options.

The Wyong/Central Coast water supply areas are located to the south of the broad study area and therefore are not a consideration for the location of the recommended corridor.



KEY

Utilities

- Major Gas Pipeline
- Jemena Gas Pipeline
- Major Water Pipeline
- High Voltage Electricity Transmission Line
- Low Voltage Electricity Transmission Line
- Substation

Environment

- NSW National Park and Wildlife Service Estate
- Lands acquired under National Parks and Wildlife Act
- Other Parks

Infrastructure

- Existing Rail Network
- Freight Sidings
- Major Road Network
- Proposed M1 Pacific Motorway extension to Raymond Terrace
- Disused Richmond Vale Railway

Figure 5.9 Location of trunk utility services (Source: TfNSW)

ELECTRICAL INFRASTRUCTURE

High voltage electricity transmission lines extend from Newcastle Substation in Killingworth in all directions (refer to Figure 5.9). This includes lines that branch to the east (into the suburbs of Newcastle) and to the north. The line that extends to the north from the Killingworth Electrical Substation remains in the study area, and eventually turns to the east at Black Hill to continue to the north of Hexham and eventually connecting to Tomago. Corridor options would also likely impact 132kV overhead power line easements. The location of electricity network was taken into consideration when identifying the corridor options, however, interaction would be unavoidable given the extensive network in this region. Where impacts are expected, site specific mitigation and safety treatments would be required.

GAS INFRASTRUCTURE

The Jemena gas main is considered a high-risk utility with a one-kilometre zone of influence. Protection of the gas pipeline would need to be further investigated should a corridor option be within the zone of influence.

Structures including ‘bridges’ in the vicinity of Killingworth and Ladysmith Roads and ‘piles’, similar to that adopted as part of the Hexham Relief Road project, would need to be designed to minimise the effects of soil settlement on the gas main.

TELECOMMUNICATIONS INFRASTRUCTURE

Telecommunications infrastructure was reviewed but due to its nature (e.g. mobile towers) was considered to not be a significant constraint as items could be relatively easily relocated or otherwise addressed if needed.

5.2 INVESTIGATION AREA REFINEMENT

Based on the outcome of the constraints and opportunities analysis, the broad study area was refined to include areas that would be considered for further investigation for the Lower Hunter Freight Corridor alignment (referred to as the investigation area). The potential routes analysed and reasons for identifying the recommended corridor alignment are discussed in Chapter 6.

The key constraints and opportunities that were used to define the investigation area are discussed below:

- The investigation area excludes the steep topography of Mount Sugarloaf Ranges for the following reasons:
 - The high cost of constructing a future freight rail line due to additional engineering structures required to traverse an area of steep topography
 - Reduced operational efficiencies and feasibility of the route due to the additional length of the route
 - These areas of steep terrain are also understood to be affected by geological instability and subsidence, which would also increase the risk to the constructability and cost of a potential freight rail line in this location.

Therefore, the investigation area was generally restricted to the west as far as the M1 Pacific Motorway only. The Stockrington region also has some steep terrain but has been included in the investigation area due to the existing disused rail corridors that required further investigations before they could be excluded from the corridor identification process.

- All existing and planned major urban areas and particularly residential areas are considered to be a significant constraint to the location of a corridor and were avoided where possible. The investigation area therefore excluded the current and developing urban areas of Barnsley, West Wallsend, Minmi and Fletcher.

The investigation area still included some existing communities and rural residential properties such as at Killingworth, Lenaghan, and Black Hill, which are addressed further in the corridor alignment investigation undertaken in Chapter 6.

- The investigation area still included several areas of environmental and community significance. Only the Hunter Wetlands National Park and Blue Gums Hill Regional Park were excluded from the investigation area. Pambalong

Nature Reserve and Tank Paddock remained in the investigation are due to the need to investigate potential impacts further in the corridor planning process.

- The Richmond Vale Railway embankment provides a physical separation to the adjacent Hunter Wetlands National Park and has been identified by Newcastle City Council as a future cycleway link. The use of the Richmond Vale Railway embankment for future freight purposes was investigated and it was found to be structurally unsuitable for a modern freight rail line without major works, if not complete removal and reconstruction.

However, the direct alignment of this disused infrastructure corridor between Minmi and Hexham provides an opportunity for the location of the Lower Hunter Freight Corridor that was suitable for further investigation and as such was not excluded from the investigation area.

- Existing community facilities were generally avoided, including the West Wallsend Cemetery, schools, Minmi fire station and sports fields.
- The investigation area does not exclude the existing infrastructure including the Killingworth Substation and the 330kV transmission line easements due to the benefits of co-locating the recommended corridor with existing infrastructure.

The disadvantages and additional costs involved in crossing the high voltage wires discouraged the use of the easements themselves and multiple crossings (and is discussed in the corridor alignment discussion in Chapter 6).

- Areas of potential heritage significance were also not excluded from the investigation area. This is in part due to the requirement for detailed ground-truthing to understand the specific heritage significance and potential design measures that could mitigate any impacts.

6 CORRIDOR OPTIONS DEVELOPMENT

6.1 OVERVIEW

Following the outcomes of the constraints and opportunities analysis, a range of possible corridors was identified by Transport for NSW. This included an initial list of options across the southern, central and northern sections of the investigation area, which were shortlisted for further assessment. Both stages of the options development and assessment were supported by a multi-criteria analysis (MCA). The MCA process was based on a range of criteria that considered environmental and socio-economic factors and expanded upon the objectives and operational requirements for the Lower Hunter Freight Corridor.

This chapter summarises this options assessment process for the shortlisted options and how the recommended corridor alignment was selected. Further detail, including the initial list of options and the MCA process, is provided in Appendix B.

6.2 SHORT LIST OF OPTIONS

Based on the outcomes of the initial options assessment, four ‘end to end’ options were identified as:

- **Navy Blue Option** – Fassifern – West Wallsend – Minmi – Adjacent to Hexham Wetlands National Park – Hexham
- **Gold Option** – Fassifern – West Wallsend – Seahampton – Adjacent to Hexham Wetlands National Park – Hexham
- **Pink Option** – Fassifern – West Wallsend – Black Hill – Tarro
- **Light Blue Option** – Fassifern – West Wallsend – Lenaghans Drive – Adjacent to Hexham Wetlands National Park – Hexham.

The shortlisted options are shown in Figure 6.1.

The shortlisted options were carried forward into a detailed MCA process, which considered criteria relating to: Freight movement, economic growth, community impacts, environmental impacts, integrated land use and transport, and future proofing. For each criterion, the options were rated as being ‘very good’, ‘good’, ‘reasonable’ and ‘lower’. Further detail on the options analysis is available in Appendix B.

As shown in Figure 6.1, only one alignment – the Pink Option - was identified south of West Wallsend that would meet the objectives of the Lower Hunter Freight Corridor and would avoid significant impacts on communities and the environment. Figure 6.1 provides a summary of the key advantages and disadvantages for the corridor between Fassifern and West Wallsend, given these are common across all four options (and as such, not discussed in Section 6.2.1 to Section 6.2.4.



KEY

- Short List Options**
- Navy Blue Option
 - Gold Option
 - Pink Option
 - Light Blue Option
 - ▤ Tunnel

- Environment**
- NSW National Park and Wildlife Service Estate
 - Lands acquired under National Parks and Wildlife Act
 - Other Parks

- Infrastructure**
- Existing Rail Network
 - Freight Sidings
 - Major Road Network
 - Proposed M1 Pacific Motorway extension to Raymond Terrace
 - Disused Richmond Vale Railway

Note: Stylised representation, corridor widths may not be to scale

Figure 6.1 Short list of options

Table 6.1 Southern section (Pink Option) – Summary of key advantages and disadvantages

SUMMARY	
Key advantages	<ul style="list-style-type: none"> — The corridor alignment avoids the planned urban areas at Fennel Bay. It would also provide benefits to communities north of Fassifern, including the recently developed residential areas west of Booragul Station. — It provides the longest separation of passenger and freight services on the Main North Rail Line. — It performs best with respect to travel time savings, especially given the avoidance of the Booragul Loop which is both steep and circuitous, which would also lead to increased noise and emissions. — The recommended corridor is located as far as practicable from existing communities at Barnsley and West Wallsend, with consideration of the constraints of the mining operations (present and past), Killingworth substation and high voltage wires to the west. — Avoids areas west of the M1 Pacific Motorway which comprise of steep and unstable terrain and form part of the National Parks estate. — Use of Government owned land — Lower constructability risks.
Key disadvantages	<ul style="list-style-type: none"> — Some sections of steep grades, requiring engineering solutions (such as tunnels) to address this constraint. — Would have direct or indirect impact existing community land uses (such as a cemetery and sporting fields), planned land uses (e.g. the approved Driver Training Centre at the Rhondda Colliery) and historical mine sites (West Wallsend Colliery No.1). — Would interface with former and existing utilities.

6.2.1 NAVY BLUE OPTION: FASSIFERN – WEST WALLSEND - MINMI – ADJACENT TO HEXHAM WETLANDS NATIONAL PARK – HEXHAM.

Overall, the navy blue option was assessed as performing reasonably against all criteria except for community and environmental criteria which have been assessed as lower than other options. This reflects the impact of the option on the Tank Paddock, the Hunter Wetlands National Park and culturally sensitive Aboriginal heritage areas. This option was also expected to have an impact on land identified for future residential growth around Minmi and Fletcher. Noise and visual impacts on those communities would also be more significant.

A summary of the key advantages and disadvantages of this option that differs to the other three options are provided in Table 6.2.

Table 6.2 Navy Blue Option – Summary of key advantageous and disadvantages

SUMMARY	
Key advantages	<ul style="list-style-type: none"> — Has the shortest length of new track and highest journey time saving of the four options. — A low impact on major utilities. — Least amount of grades steeper than 1:100 for freight trains to negotiate resulting in better overall train speeds, lower noise and emissions.
Key disadvantages	<ul style="list-style-type: none"> — Would pass close to residential areas in Minmi and Minmi Primary School and would generate noise and visual impacts. — Locating the alignment in the Richmond Vale Railway embankment could impact the highly sensitive environmental areas of the Tank Paddock and Hunter Wetlands National Park (preserved under the Coastal Management SEPP). — Use of the Richmond Vale Railway embankment as a future freight rail corridor could further sever important pathways of Aboriginal cultural significance that links Hexham Swamp to the Sugarloaf Range. It would also require works to the embankment to make it suitable for current engineering and operational requirements. — Highest impact of the shortlisted options on vegetation required to be cleared (114 hectares). — Impact to approximately 58 hectares of Threatened Ecological Communities and a high impact on biodiversity connectivity in comparison to the other three options. — Could impact proposed residential development around Minmi/Fletcher.

6.2.2 GOLD OPTION: FASSIFERN – WEST WALLSEND – SEAHAMPTON – ADJACENT TO HEXHAM WETLANDS NATIONAL PARK – HEXHAM

The gold option was assessed as performing reasonably against criteria relating to freight movement, partly due to its alignment utilising a former rail corridor through Stockrington and the disused Richmond Vale Railway embankment. This option offers favourable gradients for freight trains and enables significant journey time savings compared to the existing rail network. The assessment for freight movement is not scored higher due to the significant infrastructure (such as tunnels, bridges and viaducts) required to deliver it. The related constructability impacts results in a lower rating for the economic growth.

The performance of this option against environmental criteria is also rated as lower than the other shortlisted options. There is significant impact to environmentally sensitive areas including Pambalong Nature Reserve, the Tank Paddock and Hunter Wetlands National Park. In addition, this option is likely to have an impact on areas of Aboriginal cultural significance.

A summary of the key advantages and disadvantages of this option that differs to the other three options are provided in Table 6.3.

Table 6.3 Gold Option – Summary of key advantageous and disadvantages

SUMMARY	
Key advantages	<ul style="list-style-type: none"> — Has a marginally longer length of new track compared to the Navy Blue option but has a good travel time saving. — Avoids densely populated and urbanised areas by using an alignment along a former rail corridor through Stockrington and the disused Richmond Vale Railway embankment. — Would pass through bushland and rural areas, providing significant reductions in freight rail noise impacts within existing urban areas.
Key disadvantages	<ul style="list-style-type: none"> — Severs Stockrington and has a significant impact on its rural community. — Passes through areas of steep terrain, which would have increased requirements for tunnelling, bridges and viaduct solutions. — Cultural heritage impacts, including impacts to the culturally significant Tokol site (Doghole) and important pathways that link Hexham Swamp with Sugarloaf Range. — Locating the alignment in the Richmond Vale Railway embankment could impact the highly sensitive environmental areas of the Pambalong Nature Reserve, Tank Paddock and Hunter Wetlands National Park (preserved under the Coastal Management SEPP). It would also require works to the embankment to make it suitable for current engineering and operational requirements. — Impact to approximately 62 hectares of Threatened Ecological Communities and a high impact to biodiversity connectivity in comparison to the other three options. — Greatest impact on areas of high priority conservation lands (proposed National Park estate) and other sensitive environmental areas, such as Stockrington, Pambalong Nature Reserve, and Tank Paddock.

6.2.3 PINK OPTION: FASSIFERN – WEST WALLSEND – BLACK HILL – TARRO

The pink option performed well against community, environmental and integrated land use and transport criteria. It also performs reasonably well against the freight movement criteria but would require significant infrastructure (such as tunnels, bridges and viaducts) to deliver it which impacts its constructability. This option also impacts some sensitive environmental areas (for instance, it is adjacent to the Pambalong Nature Reserve), but would be largely contained within previously disturbed areas in comparison to the other three options.

A summary of the key advantages and disadvantages of this option that differs to the other three options are provided in Table 6.4.

Table 6.4 Pink Option – Summary of key advantageous and disadvantages

SUMMARY	
Key advantages	<ul style="list-style-type: none"> — Has the least impact on areas of high conservation value and RAMSAR wetlands, and has the lowest impact on biodiversity connectivity in comparison to the other three options. — Has the least impact on Threatened Ecological Communities (49 hectares). — Use of the western side of the M1 Pacific Motorway minimises property, noise and visual impacts at Lenaghan as much as possible and the more densely populated areas around Minmi and Fletcher. — Allows for planned residential and commercial development to occur into the future at Minmi, Fletcher and Black Hill with minimal impacts resulting from delivery of the infrastructure. — Would use the greatest amount of Government owned land by being located adjacent to the M1 Pacific Motorway and the proposed M1 Pacific Motorway extension to Raymond Terrace. — Likely to have the lowest potential impact on Aboriginal and non-Aboriginal heritage of the four options by virtue of using the greatest amount of previously disturbed areas and existing infrastructure corridors.
Key disadvantages	<ul style="list-style-type: none"> — Has the longest length of new track, resulting in marginally less favourable journey time saving when compared to other options. — Includes extensive and complex new infrastructure compared to other options, which increases complexity, cost and risk for construction. This includes several bridges over the M1 Pacific Motorway near the Hunter Expressway interchange and Black Hill, underpasses at George Booth Drive and the Newcastle Link Road, several creek and wetland crossings in viaduct, including at Pambalong Nature Reserve and Purgatory Creek. — Has the greatest impact on major utilities requiring crossings of water mains, gas pipelines, and electricity lines. — Impacts the eastern edge of the proposed Black Hill Employment Area. — Likely to impact the protected wetlands at Pambalong Nature Reserve, noting potential engineering solutions, including a viaduct, are available to mitigate this impact.

6.2.4 LIGHT BLUE OPTION: FASSIFERN – WEST WALLSEND – LENAGHANS DRIVE – ADJACENT TO HEXHAM WETLANDS NATIONAL PARK – HEXHAM

The light blue option was assessed as performing reasonably well overall. It scored well against the integrated land use and transport criteria due to the alignment avoiding impacts on future residential growth areas around Minmi/Fletcher. However, the option is likely to have an impact on properties at Lenaghan and would be visible to residential communities of Minmi and Fletcher. The impact on the environment is also likely to be significant, especially where the option crosses the Richmond Rail Vale Trail embankment through the Hunter Wetlands National Park. This area has a high ecological value and is designated as a wetland of international importance.

A summary of the key advantages and disadvantages that differs to the other three options are provided in Table 6.4.

Table 6.5 Light Blue Option – Summary of key advantageous and disadvantages

SUMMARY	
Key advantages	<ul style="list-style-type: none"> — Would have the least impact on major utilities. — Uses Government owned land where it is adjacent to the M1 Pacific Motorway and the Richmond Vale Railway embankment. — Reduces existing and future property impacts at Minmi when compared to the Navy option. — Avoids, in part, direct impacts on areas of higher biodiversity value such as the Tank Paddock, Stockrington and Pambalong Nature Reserve. It would have a moderate impact on biodiversity connectivity in comparison to the other corridor options.
Key disadvantages	<ul style="list-style-type: none"> — Has a significant impact on the Lenaghan community, directly affecting several properties and generating noise and visual impacts for Lenaghan, Minmi and Fletcher. — Re-use of the Richmond Vale Railway embankment could impact the highly sensitive environmental areas of Hunter Wetlands National Park and wetlands preserved under the Coastal Management SEPP. — Use of the Richmond Vale Railway embankment as a future freight rail corridor could further sever important pathways of Aboriginal cultural significance that links Hexham Swamp to the Sugarloaf Range. It would also require works to the embankment to make it suitable for current engineering and operational requirements. — Over a third of the alignment is affected by grades steeper than 1:100. This has the potential to increase noise and emissions for this option when compared to the other options. — Impact to approximately 56 hectares of Threatened Ecological Communities. — Impacts to Winston Court, a local heritage item, and a former race track that is located within the curtilage and considered to be an important feature of the heritage item.

6.3 RECOMMENDED CORRIDOR

The recommended corridor is the Pink Option, which was ranked highest at the completion of the options development and MCA process and is presented in Figure 6.2. It achieves the best balance between the different constraints and opportunities in the study area in responding to the Lower Hunter Freight Corridor objectives and operational requirements.

The key reasons for identifying the Pink Option as the recommended corridor are because this alignment:

- Would achieve the required travel time savings and would provide the longest separation of passenger and freight services for freight services operating to the north of Tarro (despite requiring in the greatest length of new rail).
- Allows for planned residential and commercial development to occur into the future at Fassifern, West Wallsend, Minmi, Fletcher and Black Hill with minimal impacts resulting from delivery of the infrastructure.
- Uses the western side of the M1 Pacific Motorway to minimise property, noise and visual impacts at Lenaghan as much as possible and the more densely populated areas around Minmi and Fletcher
- Uses the most amount of Government owned land, utilising extensive areas from West Wallsend along the eastern side of the M1 Pacific Motorway to the Hunter Expressway, along the western side of the motorway to Black Hill and along the southern side of the future M1 Pacific Motorway extension to Raymond Terrace.
- Has the least impact on areas of high conservation value and RAMSAR wetlands, and least impact biodiversity connectivity by maximising the use of previously disturbed areas.

Further discussions about potential impacts and mitigation measures for the future freight rail line that would be located in the recommended corridor are discussed in Chapter 7.

6.3.1 RECOMMENDED CORRIDOR ALIGNMENT

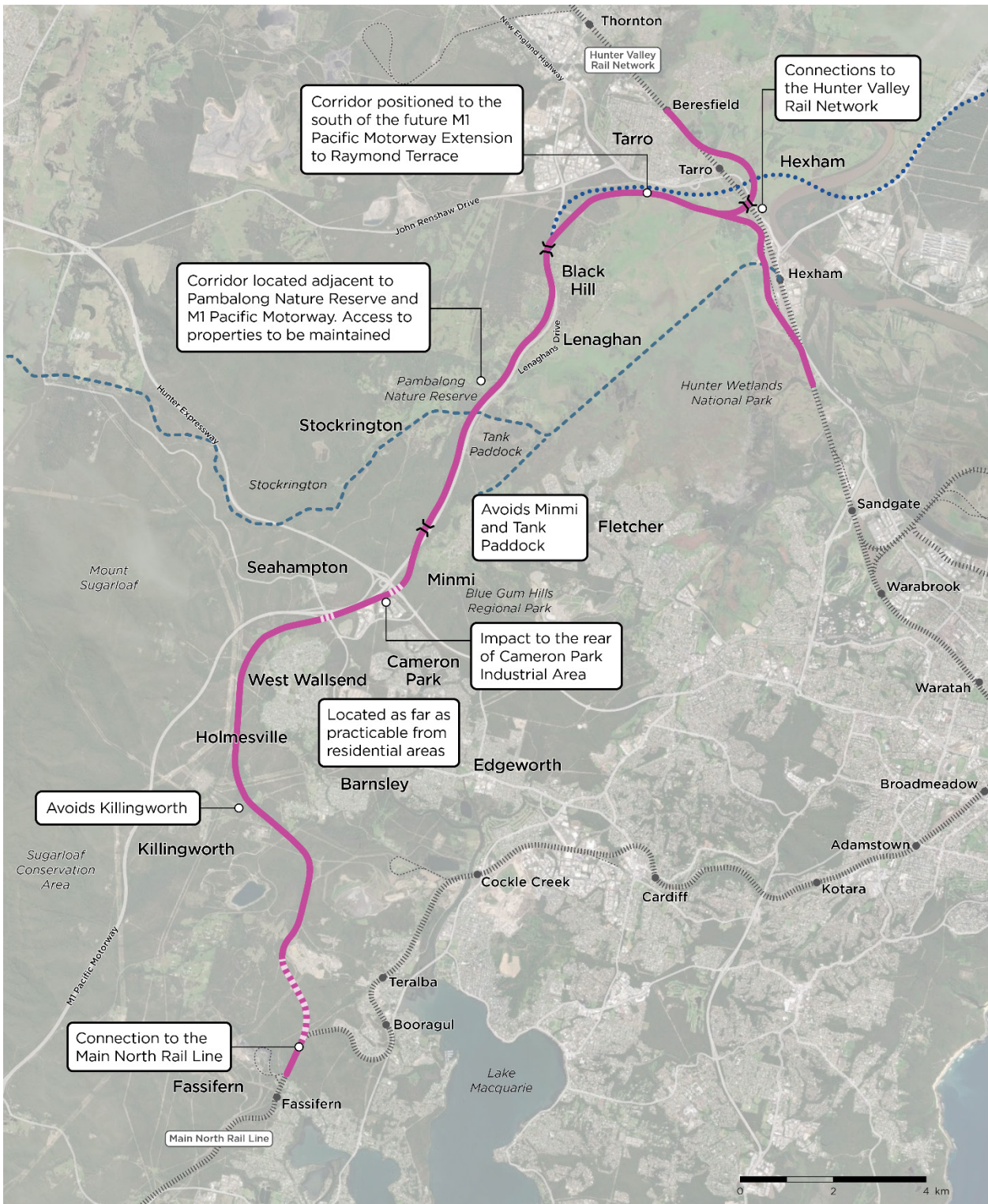
This section summarises the characteristics of the recommended corridor alignment from Fassifern in the south to Hexham in the north.

FASSIFERN

- The recommended corridor leaves the Main North Rail Line approximately one and a half kilometre to the north of Fassifern Railway Station.
- The steeper terrain where the recommended corridor leaves the Main North Rail Line would require a tunnel for the future freight rail line around 1.6 kilometres in length.
- The use of the existing Main North Rail Line and potential tunnel sections mean that there are unlikely to be impacts on the existing Fassifern community.

WEST OF BARNSLEY TO WEST WALLSEND

- The recommended corridor continues north avoiding operational and historic mine workings. Transport for NSW would undertake stakeholder engagement to ensure future infrastructure would not impact on the operation of these mines and would consider potential geotechnical issues associated with mine workings.
- Further north, the recommended corridor avoids Killingworth and existing electrical easements, and is located as far west as practicable from the existing communities at Barnsley, Holmesville and West Wallsend.
- Most of the land to the west of West Wallsend is Government owned and can provide separation and an opportunity for a green buffer to the communities at Barnsley, Holmesville and West Wallsend.



KEY

- Recommended Corridor**
- Recommended Corridor
 - ▨ Tunnel / Underpass

- Infrastructure**
- Existing Rail Network
 - ⋯ Freight Sidings
 - ▭ Major Road Network
 - ⌒ Major Road Crossings (Bridges)
 - ⋯ Proposed M1 Pacific Motorway extension to Raymond Terrace
 - ⋯ Disused Richmond Vale Railway

Note: Stylised representation, corridor widths may not be to scale

Figure 6.2 Recommended corridor

- The recommended corridor travels north-east alongside the existing M1 Pacific Motorway reservation past West Wallsend. Aligning the recommended corridor with the M1 Pacific Motorway reduces the overall infrastructure footprint in this location and would assist in managing future visual impacts associated with the motorway and future rail infrastructure.

CAMERON PARK TO LENAGHAN

- The recommended corridor uses some land within the rear boundaries of some properties at Cameron Park industrial area where the M1 Pacific Motorway corridor is more constrained. Detailed design as part of a future environmental approval process would determine the potential impact on these properties from future freight rail infrastructure.
- The recommended corridor then crosses under Newcastle Link Road, to the east of the M1 Pacific Motorway and Hunter Expressway interchange, and then crosses over the M1 Pacific Motorway approximately 400 metres to the north of the interchange.
- The recommended corridor avoids the existing Minmi urban release area, and is positioned on the western side of the M1 Pacific Motorway within Government owned land between the motorway and the Stockrington Conservation Area and Pambalong Nature Reserve. Design of the project would need to consider solutions to minimise impacts on the wetlands associated with the Pambalong Nature Reserve (such as section of viaduct).
- The recommended corridor would avoid the Tank Paddock, located to the east of the M1 Pacific Motorway, which has been dedicated to the NSW Government for biodiversity offsets and holds important community significance.
- Stockrington Road and Cedar Hill Drive would be located in the recommended corridor at this location. These roads would be retained with potential modifications to individual property accesses. The project at this location would be on viaduct to minimise impacts to these roads.

BLACK HILL TO HEXHAM

- At Black Hill, the corridor continues to be located to the west of the M1 Pacific Motorway, and crosses Black Hill Road. The rail corridor has been positioned to future proof potential south facing ramps for the M1 Pacific Motorway. This has required the corridor to be located within large lot residential properties, and alternative property access would need to be identified in the next phase of project development.
- The recommended corridor continues to the north, between the M1 Pacific Motorway and the Black Hill Industrial area, before crossing the motorway at the future M1 Pacific Motorway Black Hill interchange (which forms part of the M1 Pacific Motorway extension to Raymond Terrace). This future interchange is located approximately one kilometre south of the existing intersection of the motorway, John Renshaw Drive and Weakleys Drive. At this location, the recommended corridor travels to the west towards the Hunter River. It has been located to the south of the M1 Pacific Motorway extension to Raymond Terrace to improve constructability of the project and to increase distance to Beresfield and Tarro. The recommended corridor has also been located to minimise interaction with high voltage powerlines which would necessitate utility relocation.
- For the northern junction to the existing rail corridor, the recommended corridor would cross over the New England Highway (Maitland Road) and Woodberry Road. For southern junction, the recommended corridor would be located to the west of the New England Highway (Maitland Road) and adjacent to the Aurizon Train Support Facility.
- The northern and southern junctions of the recommended corridor would require use of existing private property as well as the existing rail corridor.

Consideration of the recommended corridor against the planning principles is provided in Table 6.6.

Table 6.6 Recommended corridor assessment against the planning principles

PLANNING PRINCIPLE	ASSESSMENT
Community principles	
Minimise direct impacts on properties and potential acquisitions	<p>Direct property impacts were minimised along the recommended corridor, which was located away from urban areas and commercial properties where possible.</p> <p>Aligning the recommended corridor with the M1 Pacific Motorway and future extension to Raymond Terrace minimises the extent of potential property impacts.</p> <p>Where the corridor does directly impact on properties (e.g. at Cameron Park, Lenaghan and Black Hill), every effort has been made to minimise this impact and to avoid impacts on existing dwellings and structures.</p> <p>Potential property impacts are discussed further in the impacts and mitigation analysis in Chapter 7.</p>
Minimise visual impacts to sensitive receivers.	<p>Future rail infrastructure in the recommended corridor alignment could be hidden from view by topography, vegetation, deep cuts and potential tunnelling. However, sections of viaduct have been identified to address constraints and to minimise impacts on property, National Parks and other reserves.</p> <p>The corridor is also aligned with other infrastructure such as the M1 Pacific Motorway and existing utility easements. Future rail infrastructure crossings would also occur near existing or planned road interchanges along the M1 Pacific Motorway. Combining infrastructure corridors reduces the overall infrastructure footprint associated impacts.</p> <p>Design of the future infrastructure in the recommended corridor would need to take into further consideration the visual impacts on surrounding communities during the next phase of project development.</p>
Minimise noise impacts and mitigation requirements to residential properties and sensitive receivers.	<p>The recommended corridor has been located to maximise separation to existing and planned communities and sensitive receivers such as schools.</p> <p>This separation includes natural vegetation buffers and aligns with existing infrastructure corridors such as the M1 Pacific Motorway to minimise the overall footprint.</p> <p>The future rail would likely incorporate some tunnelling, which would reduce potential noise impacts to surrounding sensitive receivers. Where the potential need for noise mitigation may be required, this would be dependent on the design stage for the project.</p> <p>A strategic review of noise is addressed in Chapter 7 of the report.</p>
Avoid severance of existing communities.	<p>The recommended corridor avoids undue community severance by aligning with the M1 Pacific Motorway road reservation, which is an existing important north south infrastructure corridor in the Hunter region.</p> <p>By aligning with existing infrastructure corridors, this reduces the overall infrastructure footprint and reduces potential for the severance of existing communities.</p> <p>Along its length the recommended corridor can maintain existing property access. The management of access would form part of the next phase of project development.</p> <p>This is addressed in Chapter 7 of the report.</p>

PLANNING PRINCIPLE	ASSESSMENT
Avoid impacts on recreational and community uses.	<p>The recommended corridor does not directly impact upon any existing public recreation facilities. It would have a direct impact on the approved Driver Training Centre at The Rhondda Colliery, and would have impact to the West Wallsend Colliery No.1 heritage item (which has been identified for possible renewal).</p> <p>The recommended corridor avoids impacts to the disused Richmond Vale Railway, which has been identified by the City of Newcastle for a proposed cycleway.</p> <p>A future crossing of a potential cycleway can be addressed in the next phase of the project development.</p>
Environmental principles	
Minimise biodiversity impacts on wetlands, native vegetation and ecological communities and corridors.	<p>The recommended corridor is located on the eastern side of the Pambalong Nature Reserve and Stockrington Conservation Area, but avoids direct impacts to these areas. It also avoids the Tank Paddock and the Hunter Wetlands National Park.</p> <p>The recommended corridor has the least impact on Coastal Management SEPP wetlands. Future freight would need to be designed to ensure that any potential impacts on these wetlands are mitigated.</p> <p>This is addressed in Chapter 7 of the report.</p>
Minimise impacts on Aboriginal cultural heritage and non-Aboriginal heritage significance.	<p>The recommended corridor is aligned to avoid areas of known heritage significance where possible.</p> <p>The recommended corridor is anticipated to have a lower impact to Aboriginal heritage. Additional investigations would need to be undertaken to ground truth locations of relics and items. This analysis would be used to inform the next phase of project development which would need to mitigate impacts on heritage.</p> <p>This is discussed further in Chapter 7.</p>
Ensure potential hydrological and flooding impacts can be mitigated.	<p>North of Minmi, there is potential for extensive flooding and the existing road and rail networks are not immune from these impacts. Given the prevailing hydrological features and impacts on existing rail networks, it was not considered necessary to avoid areas affected by the 1 in 100 year flood event.</p> <p>The recommended corridor would traverse areas of potential flooding and this would need to be considered in the next phase of project development to minimise changes to hydrological and flow characteristics.</p> <p>This is discussed further in Chapter 7.</p>
Ensure emissions will not provide additional impacts.	<p>The recommended corridor would not impact on emissions in the Lower Hunter region and in operation would reduce emissions compared to the current route with flatter grades, reduced curves and improved train efficiency. This is discussed further in Chapter 7.</p>
Operational requirements	
Journey time and length of track.	<p>The recommended corridor provides a sufficiently direct route between Fassifern and Hexham. This would assist in service reliability and reduced and would provide an improvement to existing travel times of between 15 and 20 minutes.</p>

PLANNING PRINCIPLE	ASSESSMENT
Minimisation of curve radii and gradient to ensure efficient train speeds and minimise potential for excessive noise	The recommended corridor meets the design and operational requirements for the project, which would ensure the future rail infrastructure would need appropriate speed and grades for efficient freight train operation. This is discussed further in Chapter 7.
Constructability risk to remove potential risks of unknown factors.	No potential constructability issues were raised that would preclude the recommended corridor from being protected and eventually progressing through the detailed design, approval and construction phases.

The recommended corridor demonstrates the best fit for the Lower Hunter Freight Corridor project objectives and planning principles to provide an effective corridor for future infrastructure compared to the existing network through Greater Newcastle and the alternative route alignment options in the refined investigation area.

Chapter 7 provides further specific detail regarding the potential impacts of future infrastructure in the recommended corridor and potential measures to mitigate those impacts.

7 CORRIDOR IMPACT ASSESSMENT

This chapter outlines the potential impacts of protecting land for the recommended corridor and also considers the potential future impacts of freight rail infrastructure in the recommended corridor proposed for development in the next 10 to 20 years.

This section also identifies additional investigations that would need to be undertaken to support the delivery phase of the project (and future environmental assessment) to ensure impact mitigation is undertaken for future freight rail infrastructure.

7.1 LAND USE AND PROPERTY IMPACTS

7.1.1 ASSESSMENT

This section identifies the land use and property impacts within the recommended corridor and directly adjacent to the recommended corridor. Detailed corridor maps are available in Appendix D.

The recommended corridor has been chosen to minimise direct impacts on properties and land uses.

Around 65 per cent of the alignment (around 21 kilometres of a total corridor of approximately 33 kilometres) is on land under State or local Government ownership. Around 30 per cent of the overall alignment (representing approximately half of the land under State or local Government) is transport corridor. The remaining 35 per cent is under private ownership, this broadly comprises rural residential land and industrial land under a combination of corporate (22 per cent) and individual (13 per cent) ownership. The recommended corridor would not impact on National Park or community use lands.

Impact by land use classification and zoning is presented in Table 7.1 and Table 7.2 respectively. An overview of existing and future land use is shown in Figure 5.2, while land use zoning is shown in Figure 5.3. The tables identify that approximately one third of the total corridor is located within existing road and rail reserve.

Detailed online mapping of the recommended corridor, including property details, is available on the project page on Transport for NSW's website. Transport for NSW will be engaging directly with affected landowners and other key stakeholders.

A discussion about the potential impacts of future infrastructure on the surrounding environment and communities is included throughout Chapter 5 of this report. This includes potential impacts such as noise, emissions and social impacts.

Table 7.1 Key land uses impacted by the corridor

LAND USE	DESCRIPTION	CORRIDOR LENGTH (KM)
Nature conservation	Land that is rural in nature and has only relatively low level of use, with a focus on nature conservation (through being formally reserved by government, or through some other legal or administrative arrangement) for conservation purposes. Land under this classification allows for large-lot residential development, however does not provide for urban or residential intensification.	7.9
Other minimal use	Areas of land that are largely unused (in the context of the prime use) but may have ancillary uses. This includes areas of residual native vegetation cover and excludes land under productive use for agriculture or other purposes. Similar to nature conservation land, large lot residential development is permitted.	4.8

LAND USE	DESCRIPTION	CORRIDOR LENGTH (KM)
Transport (Road/railway corridor)	Land that contains road and rail infrastructure and associated transport corridor land in NSW Government ownership that provides for no other form of development.	11.0
Waste disposal	Land used for disposal of solid inert wastes	1.2
Agriculture	Includes grazing (both native vegetation and modified pastures) and cropping. Includes residential dwellings associated with agricultural use.	6.9
Industry	Existing use – does not relate to land zoned for future industrial use	0.1
Marsh/wetland		0.4
Other (misc.)		0.3
TOTAL		32.6

Table 7.2 Key land uses by zoning impacted by the corridor

ZONE	EXTENT IMPACTED (KM)	ZONE	EXTENT IMPACTED (KM)
E2 Environmental conservation	14.5	RU6 Transition	1.1
E4 Environmental living	3.4	SP2 Infrastructure (road)	9.4
E3 Environmental management	1.7	RU2 Rural landscape	0.7
IN3 Heavy industrial	1.6	E1 National Parks and Nature Reserves	0.2
TOTAL			32.6

GOVERNMENT OWNED LAND

At its southern end the recommended corridor largely avoids impacts on community and environmental values though a combination of alignment in existing road reserve and tunnelling (due to topographic constraints) around Fassifern.

The recommended corridor uses a large portion of Government owned land to minimise impacts on privately owned property. Government owned land includes land to the west of West Wallsend, east of Killingworth and Barnsley (shown on Figure 5.2), as well as the existing M1 Pacific Motorway road reservation.

Using the existing M1 Pacific Motorway road reservation between Cameron Park and Lenaghan enables the recommended corridor to avoid direct impacts on the Minmi urban release area (through being located on the other side of the M1 Pacific Motorway corridor) and other urban areas.

The recommended corridor avoids Government owned land that is environmentally important, including the existing Pambalong Nature Reserve, Hunter Wetlands National Park and Mount Sugarloaf National Park, as well as important biodiversity offset lands that have been dedicated to the NSW Government at Stockrington and the Tank Paddock.

Realignment of the corridor to the west of the M1 Pacific Motorway places the corridor adjacent to the nature reserve and areas nominated for national park listing, however there would be no direct impacts on the national park.

RESIDENTIAL LAND

The recommended corridor has been aligned to avoid direct impacts on planned and existing urban areas and dwellings wherever possible, as follows:

- The recommended corridor alignment avoids direct impacts on developing urban release areas at Cameron Park, Fletcher, Black Hill, Fennel Bay and Minmi.
- Existing communities at Fassifern, Barnsley, Holmesville, West Wallsend, Minmi and Killingworth are not directly impacted by the corridor:
- At Fassifern, the recommended corridor largely uses the existing operational rail corridor before entering a section of tunnel, and therefore has no direct impact to residential property.
- At Barnsley, the closest existing dwelling is over 200 metres from the corridor. However, there is an isolated rural property located closer than this. All are visually separated from the recommended corridor by bushland.
- At Holmesville, the closest residential dwelling is over 400 metres from the recommended corridor and is separated from the recommended corridor by bushland.
- At West Wallsend, the residential dwellings are more than approximately 300 metres from the recommended corridor and separated by bushland and Johnson Park sports ground.
- At Minmi and Lenaghan the corridor is located on the western side of the M1 Pacific Motorway within the road reserve. The corridor impacts a property at Lenaghan with several residences. Private access roads to these residences would be impacted by the recommended corridor. Adjustments would need to be identified in consultation with this property owner during the next phase of project development. However, access to properties to the west of the alignment along Cedar Hill Drive would be maintained.
- For residential receivers on the eastern side of the M1 Pacific Motorway between Minmi and Black Hill, proximity of the M1 Pacific Motorway between the corridor and residential receivers would mean that the motorway would be the dominant source of impacts (including noise, visual, air quality and other amenity impacts)
- North of Black Hill, the corridor leaves the motorway corridor and traverses privately owned large lot rural residential properties to the east (including areas of grazing land). Across this land no residential properties are directly impacted by the corridor. The corridor in this section is co-located immediately south of the future M1 Pacific Motorway extension to Raymond Terrace (for which planning is underway).
- In general, the protection of the recommended corridor would not impact on the continued use of impacted properties as no dwellings are directly impacted and existing use rights would also be maintained.

It is likely that future rail infrastructure may not require the full 60 metres of the corridor width and that the detailed design of the future freight rail line within the recommended corridor would include impact mitigation to ensure access is maintained to properties.

COMMUNITY FACILITIES

Community facilities such as schools, health/medical services, emergency services and other community spaces are not directly impacted by the recommended corridor.

The separation between the recommended corridor and community uses has been maximised to mitigate future potential impacts of rail infrastructure in the recommended corridor, such as potential noise and vibration.

INDUSTRIAL AND EMPLOYMENT LAND USES

The Lower Hunter Freight Corridor would support existing industries in the Hunter Region, including the mining and agricultural sectors and the operation of the Port of Newcastle.

The recommended corridor has avoided industrial land uses where possible and minimises impacts on a small number of industrial lots at Cameron Park and Black Hill Industrial Area (while providing complementary infrastructure for the future expansion of the Black Hill and Beresford industrial areas as discussed in Section 7.2).

These uses can continue operating until such time as the future infrastructure is needed and further refinement of the corridor occurs through the design and environmental approval process.

The corridor at Hexham is located west of the Aurizon Train Support Facility and Australian Rail Track Corporation holding roads.

There is a potential impact on land currently leased by Brancourts for spraying of treated waste. This use can be managed as part of a future detailed design and environmental approval process for future rail infrastructure in the recommended corridor.

OPEN SPACE/RECREATIONAL/NATIONAL PARKS

The recommended corridor has avoided existing public open space and recreational lands.

It would have a partial impact to the approved Driver Training Centre at the Rhondda Colliery, and impacts to this development (once established) would need to be considered in the design and environmental approval process.

The recommended corridor is over 100 metres from Johnston Park at West Wallsend. The recommended corridor does pass through the north of the West Wallsend Colliery No.1 heritage site, which has been identified for future opportunities for renewal and to contain informal walking and cycling opportunities (Lake Macquarie City Council, 2020).

The corridor is located within the M1 Pacific Motorway road reserve to the north east of West Wallsend so it would not require any of the biodiversity lands at Minmi, including the Tank Paddock. It would however be located adjacent to the Pambalong Nature Reserve, which is of biodiversity and recreational value.

The recommended corridor crosses the proposed future Richmond Vale Rail Trail alignment in two places, at Lenaghan in the M1 Pacific Motorway road reserve and at Hexham. The crossings at Lenaghan and Tarro would be designed at a future environmental approval stage to ensure the Richmond Vale Railway embankment can be used for the cycleway.

MINING RELATED USES

Parts of the recommended corridor are located on land that is the subject of sub-surface mining titles and leases. It includes land that is currently being used for mining activities as well as land that has been previously used for mining activities. Liaison with the Department of Planning, Industry and Environment is ongoing regarding the continuation of existing mining activities.

Transport for NSW would consult with mining industry stakeholders to ensure that the recommended corridor does not preclude existing and future mining activities where possible. The future design and construction stage would need to address undermining and possible subsidence issues. Additionally, stakeholder engagement with industry, affected mine owners, and the Division of Resources and Geoscience within Department of Planning, Industry and Environment, would be undertaken to ensure the rail line is compatible with existing mine operations.

7.1.2 SUMMARY

The recommended corridor was located to avoid and minimise direct impacts on privately owned properties.

The potential future freight infrastructure in the recommended corridor is anticipated to be required over the next 10 to 20 years. The protection of land within the recommended corridor would not impact upon the continued use of existing properties. Transport for NSW would engage directly with local property owners as plans for the corridor and future infrastructure are progressed.

In the next phase of project development, the design and supporting environmental impact assessment would need to consider the final project footprint and infrastructure design to:

- Ensure adequate connectivity and minimise potential severance impacts to property (informed by property owner engagement) and communities, including maintenance of access to properties where possible
- Interfaces with community and recreational facilities (namely the future Richmond Vale Rail Trail and the Driver Training Centre at Rhondda Colliery) and required mitigation measures
- Interaction with other land use activities, namely mining (past and present) and adjoining areas of the National Parks estate.

7.2 FUTURE LAND USE OPPORTUNITIES

7.2.1 ASSESSMENT

The Hunter Region is developing rapidly. Greater Newcastle is currently home to around 575,000 people and this population is expected to grow to around 692,000 people by 2036 (Greater Newcastle Metropolitan Plan (DPE, 2018).

The planning and development of urban release areas is presently underway across the study area including at Minmi, Fletcher, Black Hill and the final stages of the Cameron Park release area (east of West Wallsend).

It is important that the recommended corridor be protected to ensure that strategic planning for future land use can take its location into consideration.

Significant effort has been made to locate the recommended corridor away from known future urban areas:

- The recommended corridor alignment has utilised existing government infrastructure corridors to avoid impacts on urban release areas and urban investigation areas. The recommended corridor follows the M1 Pacific Motorway reservation and the existing electrical easements, as well as the future M1 Pacific Motorway extension to Raymond Terrace.
- The recommended corridor uses Government land assets where possible. The land adjacent to West Wallsend includes large areas of remnant vegetation. The majority of this land is conservation land under NSW Government ownership.

The location of the recommended corridor in Government land adjacent to West Wallsend maximises opportunities for investigations into the following:

- Protection and improvement of the vegetation as part of a future biodiversity offset to support a future application for freight rail in the recommended corridor.
- The consideration of complementary land uses such as passive and active recreation uses that could be investigated under a future planning process with key stakeholders.

Impacts on future industrial lands have also been minimised by largely avoiding the existing Black Hill Industrial Area, while being complementary to the planned Black Hill-Beresford expansion precincts. The cluster of freight and logistics industries developing around Beresfield-Black Hill would continue to grow in response to changing freight demand, new freight tasks and potential expansion of Beresfield industrial precinct due to its location and connection to the transport network.

The location of the recommended corridor would enable future freight to bypass the Newcastle urban area along the existing Main North Rail Line. This reduction in freight through the Newcastle urban area would result in improved amenity to those existing communities, providing more favourable conditions for urban renewal. The Greater Newcastle Metropolitan Plan (DPE, 2018) identifies these areas along the Main North Rail Line for future urban renewal:

- Adamstown – Identified as being within a stage 1 Urban renewal corridor Adamstown sits between the catalyst areas of Kotara new town centre and the Broadmeadow sport and entertainment precinct.
- Broadmeadow Station Precinct – Improvements to public transport service integration and increased pedestrian access would facilitate medium density housing transitioning to surrounding residential areas.
- Waratah – Concentration of services and facilities to support student populations, medium density housing and business uses in innovation and start-up hubs.

7.2.2 SUMMARY

The recommended corridor was located to avoid and minimise impacts on future urban land uses in the Hunter Region and would be incorporated into future strategic land use planning.

Strategic planning would be able to consider the location of the future freight infrastructure to ensure optimal amenity for future land release and urban renewal areas.

In the next phase of project development, the design and supporting environmental impact assessment would need to consider:

- Optimising accessibility and integration with freight and logistics and industrial land including the Black-Hill Beresfield and Beresfield Expansion Precinct, and Teralba Industrial Precinct
- Maximising separation and mitigation in relation to future urban and residential communities at Fennell Bay and Minmi
- Minimising impact on recreational land and exploring opportunities for establishing passive and active recreational uses as part of project development.

7.3 UTILITIES

7.3.1 ASSESSMENT

ELECTRICAL INFRASTRUCTURE

The recommended corridor intersects 330kv TransGrid transmission lines at a number of locations near the Killingworth substation and also near Black Hill where the transmission line runs north of Hexham. Several 132kV overhead power line easements are also expected to be impacted. Major electricity lines are shown in Figure 5.9.

Mitigation and safety treatments would require site specific and detailed analysis as part of a future design phase. Easements associated with Killingworth substation may need to be adjusted in consultation with TransGrid in future design phases.

GAS INFRASTRUCTURE

The recommended corridor intersects the Jemena gas main at several locations. The extent of this major gas line is shown in Figure 5.9. The Jemena gas main is considered a high-risk utility with a one-kilometre zone of influence. Protection of the gas main would need to be further investigated as part of any future application for infrastructure within the recommended corridor.

Structures including bridges and piles would be designed to minimise the effects of soil settlement on the gas main, in consultation with Jemena.

WATER INFRASTRUCTURE

The recommended corridor intersects the Hunter Water Chichester gravity trunk main which extends from Tarro to Shortland. The corridor is also in proximity to another water pipeline which runs parallel to John Renshaw Drive. Major water pipelines are shown in Figure 5.9.

The impacts of future potential rail infrastructure within the recommended corridor on existing water pipelines is manageable. Investigation of bridging designs to avoid soil settlement over the length of water pipelines would be required as part of future design phases.

TELECOMMUNICATIONS INFRASTRUCTURE

The recommended corridor is in the vicinity of Optus, Telstra and Vodafone Hutchison Australia for landlines, data services and mobile infrastructure (2/3/4G), as well as the NSW Government Telecommunications Authority's Government Radio Network and Mobile Data Radio Network.

Accurate utility survey information would be critical to ensuring the future rail infrastructure does not impact these services and providers. The future design of rail infrastructure may require the relocation of telecommunications infrastructure.

7.3.2 SUMMARY

Potential impacts from the construction and operation of a future freight rail line within the recommended corridor can be managed through future design, environmental approval and construction processes.

Each utility service provider has its own requirements for the protection of its infrastructure from freight rail located in proximity to or crossing their assets. Transport for NSW would engage directly with utility providers as part of any future design and environmental approval process.

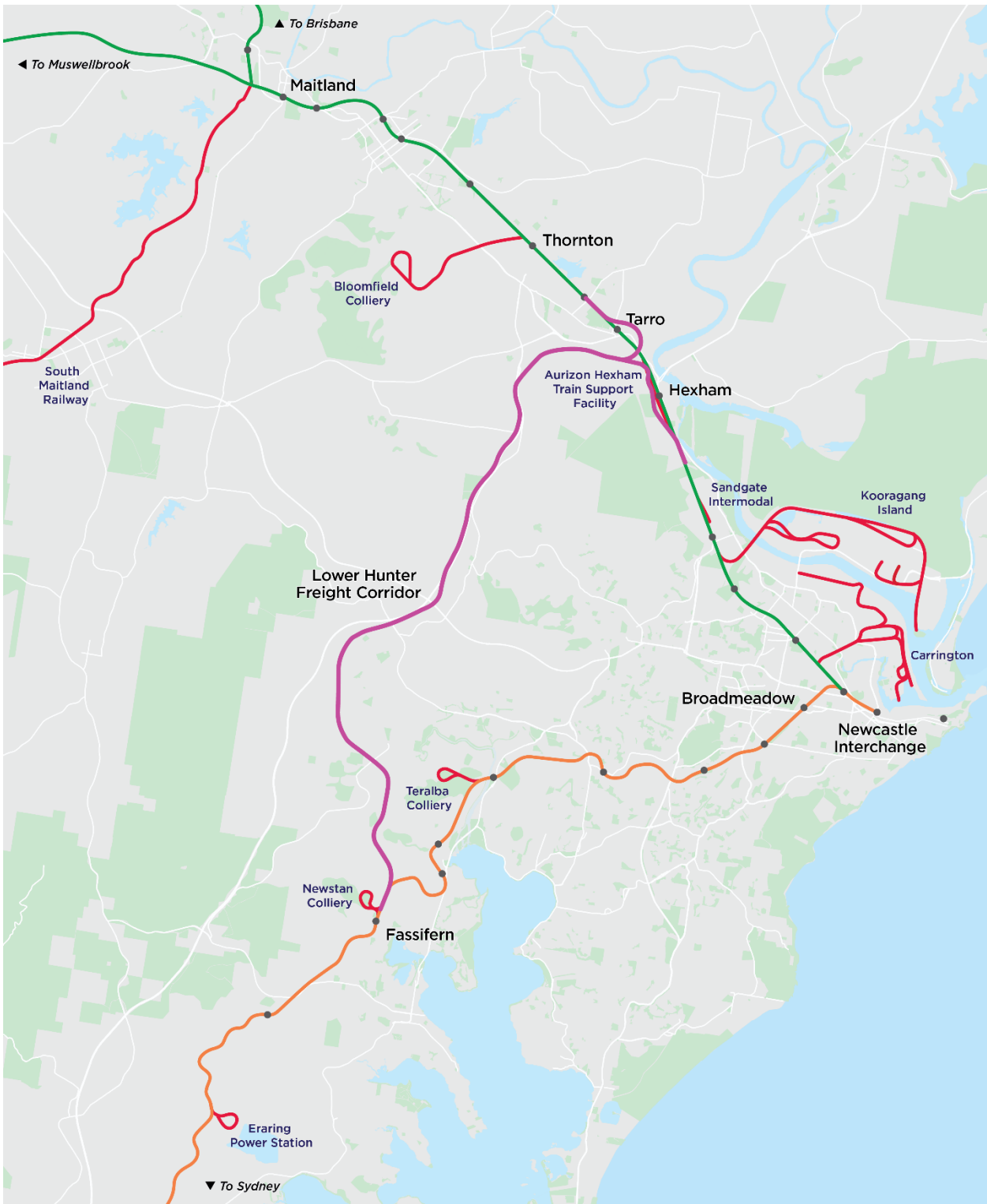
7.4 TRAFFIC AND TRANSPORT NETWORKS

7.4.1 ASSESSMENT

A number of bridges, viaducts and embankments would be required to avoid impacts on the operation of the surrounding local and regional traffic and transport networks. The design of these crossings would be progressed as part of the next phase of project development. It is anticipated that infrastructure required for road crossings would be accommodated within the recommended corridor.

As noted in Section 7.1 and Section 7.2 of this report, the location of the recommended corridor has avoided existing and planned urban release areas. This would reduce the impact of the future infrastructure on local and regional transport networks associated with urban areas.

The existing rail network in the region is provided in Figure 7.1.



KEY

Infrastructure

- Recommended Corridor
- Sydney Trains Network
- ARTC Main Line Network
- Freight Terminals (including ARTC infrastructure), private sidings and other networks
- Sydney Trains Station
- Major Road Network

Figure 7.1 Existing rail network in the Lower Hunter region

EXISTING RAIL FREIGHT

The Main North Line from Fassifern to Maitland (via Newcastle) currently services interstate and intrastate freight traffic (including freight with destinations within Newcastle) in conjunction with passenger train services, which have priority. Much of this freight traffic does not have a destination in Newcastle. Rail freight operations are affected by steep gradients between Fassifern and Broadmeadow, which limit freight speeds, increase travel times and restrict available paths for freight operators. As discussed in Chapter 2, the rail network is already constrained by the competing needs of passenger train services and does not have enough capacity to support the expected demand over the next 20 years.

The recommended corridor would enable freight and passenger services to be separated, and to remove most freight movements through inner Newcastle. The recommended corridor would also have improved curvatures and gradients when compared to the existing corridor, improving overall freight operations. Overall, this would improve rail travel times, rail network capacity and reliability for train services, reducing operating costs and greenhouse gas emissions. Removal of freight from inner Newcastle would also deliver associated amenity benefits to these communities, as well as benefits to the performance of the road network where level crossings remain.

CONNECTION TO THE EXISTING RAIL NETWORK

The recommended corridor would connect to the existing rail network at Fassifern on the Main North Rail Line and at Tarro, Beresfield and Hexham on the Hunter Valley Rail Network. At Tarro, Beresfield and Hexham, the Hunter Valley Rail Network supports the interstate and regional freight movements to / from North West NSW and Brisbane (Up Main/Down Main), and movements to / from the Port of Newcastle (Up Coal / Down Coal). Aurizon operates a train support facility at Maitland Road, Hexham.

Sydney Trains is the rail infrastructure manager for the Main North Rail Line between Sydney and the Newcastle Interchange. The Australian Rail Track Corporation is the rail infrastructure manager in the Hunter Valley Rail Network and has a long-term lease with the NSW Government for the Defined Interstate Rail Network, the Hunter Valley Rail Network and the Sydney Metropolitan Freight Network (refer to Figure 7.1).

The Lower Hunter Freight Corridor would connect with the existing rail network in the following manner:

- At Fassifern
 - The recommended corridor would connect to the Up and Down Main lines to facilitate train movements to and from the south. It is assumed that the connection would be grade separated to cater for the optimum operational efficiency of the junction. Adjustments may be required for the Newstan colliery loop
- At Tarro / Beresfield and Hexham:
 - The northern connection (at Tarro / Beresfield) would need to cross over the Up and Down Main and Coal lines and provide for dual tracks to facilitate parallel movements from the Lower Hunter Freight Corridor to and from the west
 - The southern connection (at Hexham) would cross over the Down Coal line and provide for dual tracks to facilitate parallel movements to and from the Lower Hunter Freight Corridor.
 - Minor adjustments to the existing lines to enable these connections may be required. These would be within the recommended corridor
 - Each connection would be around 2.2 kilometres long to provide sufficient storage for freight trains before the main line connection. This would provide sufficient storage to avoid standing trains on the main line of the future Lower Hunter Freight Line.

STATE AND REGIONAL ROAD NETWORK

The recommended corridor has been aligned with major regional roads such as the M1 Pacific Motorway, George Booth Drive, and New England Highway (Maitland Road) to lessen the impact on surrounding areas. The design of the future freight infrastructure would ensure there is no impact on the operational efficiencies of the road network.

The recommended corridor also crosses above the M1 Pacific Motorway and crosses below George Booth Drive and the Newcastle Link Road. Further detailed engineering and geotechnical investigations would be required to confirm details of the proposed future structures. This design would need to ensure that regional roads are not impacted by any future application for infrastructure within the recommended corridor.

Where the recommended corridor passes close to the existing M1 Pacific Motorway, or partially uses the road reservation, there is sufficient space within the existing road reserve to ensure any future widening of the motorway along these sections is not precluded by the recommended corridor.

LOCAL ROAD NETWORK

The recommended corridor would intersect with existing local roads along its alignment. Maintenance of access and the function of the existing road network would be further addressed as part of any future application for infrastructure in the recommended corridor. Grade separation of future rail infrastructure and the local road network has been assumed, with no proposed level crossings.

The recommended corridor would intersect existing local roads at the following locations:

- Between Teralba and Cameron Park. At this location, the recommended corridor crosses numerous local roads, particularly within West Wallsend and Killingworth
- At Minmi and Lenaghan. At this location, the recommended corridor is aligned with a section of Stockrington Road and Cedar Hill Drive, where there is limited space between the M1 Pacific Motorway and the Pambalong Nature Reserve and proposed National Park. The recommended corridor is also partially within the M1 Pacific Motorway road reservation. Stockrington Road and Cedar Hill Drive would be retained to provide access to private properties.
- At Black Hill. At this location, the recommended corridor runs adjacent to the M1 Pacific Motorway, and would require modifications to internal private roads in the future to accommodate the rail infrastructure. The recommended corridor would then cross Black Hill Road and then cross over the M1 Pacific Motorway at the proposed Black Hill interchange (which forms part of the M1 Pacific Motorway extension to Raymond Terrace).
- At Hexham. At this location, the recommended corridor would cross Woodlands Close
- At Tarro. At this location, the recommended corridor would cross over Woodberry Road.

The future rail infrastructure would be designed to ensure the continued operation of local roads at this location. Minor realignments of these roads at the point of crossing may need to be considered and would be confirmed during the next phase of project development.

INTERNAL PROPERTY ROADS

Private access roads would be impacted by the recommended corridor, such as properties at Black Hill and Tarro. Adjustments would need to be identified in consultation with these property owners during the next phase of project development.

At Hexham, the recommended corridor crosses the access road to the Aurizon train support facility off the Tarro interchange. The recommended corridor at this location would be designed to maintain the continued operation of this access road.

FUTURE RAIL INFRASTRUCTURE

As discussed in Section 5.1.10, the Australian and State Governments are investigating the feasibility for additional passenger rail infrastructure associated with fast rail connections between Sydney and Newcastle.

High speed rail was investigated by the Australian Government between 2010 to 2013, which identified an alignment adjacent to the eastern side of the M1 Pacific Motorway, and had a station in the West Wallsend/Cameron Park area.

The NSW Government is currently investigating fast rail connections between Sydney and Newcastle. Details of any future route are yet to be released. As that investigation advances, it would need to consider possible implications with future infrastructure associated with the Lower Hunter Freight Corridor.

FUTURE ROAD INFRASTRUCTURE

The recommended corridor has been positioned to enable possible future south facing ramps at the existing Black Hill Road interchange to the M1 Pacific Motorway if required.

It is expected that the M1 Pacific Motorway extension to Raymond Terrace would be constructed before the future Lower Hunter Freight Line. The recommended corridor is located to the south of the proposed motorway extension between Black Hill and Tarro, and would cross under a proposed road bridge that would span the New England Highway (Maitland Road), the existing rail line and the Hunter River. The location of the recommended corridor has been determined in liaison with the project team for the motorway project to future proof the construction of the freight infrastructure without impact to the proposed road infrastructure (based on the current concept design).

The Lower Hunter Freight Corridor project team would continue to liaise with the M1 Pacific Motorway extension to Raymond Terrace project team to ensure both infrastructure projects are appropriately designed at this location.

FUTURE CYCLE NETWORK

The Richmond Vale Rail Trail is a proposed 32-kilometre cycleway between Kurri Kurri and Hexham that would use the existing dis-used rail embankment. The project is advancing as three sections, and a development application for sections between Shortland and Tarro, and Pambalong was exhibited in 2020. At the time of writing, the development application had not been determined.

It is assumed that the rail trail would be operational before potential future infrastructure is provided in the recommended corridor. At that stage, the freight project would need to address the operation of the adjacent rail trail at Lenaghan and Tarro where the two infrastructure projects cross to ensure continued operation of the cycleway.

7.4.2 SUMMARY

The strategic review of transport and traffic found that protection of the Lower Hunter Freight Corridor would not impact on the operation of the existing transport and traffic networks. Impacts from the operation of a potential future freight rail line within the recommended corridor would be managed through the next phase of project development.

A traffic and transport impact assessment would need to be prepared during the next phase of project development to support the environmental impact assessment. The construction methodology and impact assessment for the project would need to address the needs of the community and the existing transport conditions and network, as they exist at that time.

7.5 NOISE AND VIBRATION

7.5.1 ASSESSMENT

This section provides a summary of the strategic review undertaken for the potential noise and vibration impacts of the protection of the recommended corridor and potential future infrastructure on the existing and future community.

A strategic review of possible noise impacts associated with the identification of the location of the recommended corridor was utilised as part of the corridor identification process. The key objectives of the review were to:

- Assess likely potential for noise from the future use of the recommended corridor for a freight rail line having regard to current criteria and guidelines
- Consider the potential for subjective noise impacts (disturbance issues)
- Determine the likely need for feasible, reasonable and practical noise mitigation options to address identified potential future noise impacts.

Noise and vibration mitigation options discussed in the strategic review are conceptual for the purposes of identifying and protecting land for a future infrastructure corridor. The design of the project and mitigation measures would be determined in the next stage of project development in accordance with the relevant statutory requirements.

The potential for noise impacts from future freight rail in the Lower Hunter Freight Corridor would be assessed against the applicable rail noise guidelines at the time of detailed design and environmental approval. At present, the relevant guideline is the Rail Infrastructure Noise Guideline (Environmental Protection Authority, 2013). This guideline provides noise triggers for residential and other sensitive receivers to assess and manage potential noise.

The strategic review considered specific features of the recommended corridor, including the potential for squealing and screeching noise around curves, low frequency noise from locomotives on steep grade, and impulsive noise at rail discontinuities. The influence of the local terrain and landscape was also considered in assessing the likely potential for noise at sensitive receivers, such as residential areas.

The potential for noise has not been modelled in detail given the strategic nature of the corridor identification and protection process. The purpose of the review is to inform the discussion of potential future noise impacts in relation to noise propagation and shielding impacts.

SENSITIVE RECEIVER AVOIDANCE

The identification of the recommended corridor has considered the opportunities to minimise any potential future noise and vibration impacts. Much of the corridor was therefore located away from sensitive receivers to minimise the need for impact mitigation for the future freight rail. For example:

- A substantial portion of the corridor is located through existing bushland that would buffer any potential noise from the existing communities at Barnsley, Killingworth and West Wallsend.
- While for topographical reasons, tunnelling at Fassifern would further reduce the potential for operational noise.
- The recommended corridor runs parallel to the M1 Pacific Motorway, increasing the distance to the Minmi and Fletcher communities that would have been more heavily impacted upon if the corridor alignment had used the more direct route to the east of the Tank Paddock. However, in doing so, it is acknowledged that recommended corridor would pass close to rural residential properties and urban areas in Tarro and Beresfield. Further, where the future rail infrastructure would connect to existing rail lines, residents in these areas would experience cumulative rail noise impacts.

Additionally, the recommended corridor aims to reduce freight traffic from the existing Main North Rail Line that travels through the existing communities of Newcastle. The Main North Rail Line includes features that are linked to increased

noise impacts and high annoyance, including small radius curves resulting in wheel squeal and a number of level crossings requiring audible warning alarms (horns and bells).

The recommended corridor would result in a considerable reduction in the number of freight trains travelling along the existing freight route along the Main North Rail Line and would result in a reduced number of sensitive receivers when compared to the route through inner Newcastle.

STRATEGIC NOISE IMPACT ANALYSIS

The recommended corridor has been located so as to maximise distances from the largest number of sensitive receivers, however the strategic noise impact analysis identified that there would likely be some noise mitigation required. Noise mitigation may be required where future infrastructure within the recommended corridor is in proximity to sensitive receivers including existing and future residential dwellings at West Wallsend, Barnsley, Minmi, Lenaghan, Black Hill and Tarro.

It is likely the future freight rail within the recommended corridor would result in the need for approximately seven kilometres of track requiring moderate to comprehensive noise mitigation measures of some sort to meet the current noise guidelines. Isolated residential properties may also require acoustic treatment.

However, the type of noise mitigation is indicative only, and would be further investigated in the next phase of project development and detailed in the supporting environmental impact assessment. Further, the strategic noise analysis also identified that it is anticipated that freight rail noise may reduce over the next 20 years due to:

- Diesel freight locomotive noise emission variations with new rolling stock
- Regulatory reforms regarding the revised regulations and licensing relating to noise emissions from freight trains in the long term
- Implementation of a new steering performance standard for all freight trains that would help reduce the severity and occurrence of squeal noise from curved tracks.

The following conclusions were made in the strategic review about potential noise mitigation for the future rail:

- Moderate mitigation may be required to the south west of Barnsley and at West Wallsend.
- At the southern and central end of Minmi, the corridor moves progressively away from residences and at-source mitigation measures would be considered as priority. Property treatments may be required. No mitigation is required for northern areas of Minmi given the location of the corridor along the western side of the M1 Pacific Motorway.
- At Lenaghan, at-source mitigation measures would be considered as priority and use of noise barriers along at-grade sections may reduce the need for property treatments.
- At Black Hill, the requirement for mitigation is low and road noise barriers may reduce the requirement for mitigation for the future rail infrastructure.
- At Tarro, isolated properties may require treatment and existing road noise barriers may reduce the requirement for mitigation for the future rail infrastructure. Where the northern connection to the Hunter Valley Rail Network, at-source controls and short sections of noise barriers may be required, noting the potential for squeal and wheel/rail noise on the required curves. The requirements for mitigation at this location would need to consider existing rail noise levels.
- At Hexham, at the southern connection to the Hunter Valley Rail Network, noise barriers may be required along the eastern side of the corridor. Again, the requirements for mitigation at this location would need to consider existing rail noise levels.

VIBRATION

The recommended corridor includes two sections of potential future tunnel to the north of Fassifern and where it crosses the Hunter Expressway. The location of these tunnels is not anticipated to impact on any sensitive receivers in terms of ground borne noise and vibration.

Where the corridor connects to the Hunter Valley Rail Network, there is the potential for ground-borne vibration to exceed the recommended criteria at the closest residences, in isolated or cumulatively. Mitigation could be in the form of resilient rail fasteners and/or ballast mats. As with airborne noise, mitigation requirements would be confirmed in the next phase of project development.

7.5.2 SUMMARY

The strategic review of noise and vibration found that protection of the Lower Hunter Freight Corridor would not impact on existing noise and vibration levels.

A detailed assessment of operational noise and vibration would be required as part of the next phase of project development and informed by supporting environmental impact assessments. Consideration of noise and vibration impacts, and requirements for mitigation, would be in accordance with the relevant guidelines that are in place at that time of the assessment.

It is recommended that a future environmental impact assessment would:

- Include predictions of operational noise and vibration levels at individual receptors
- Consider construction impacts in accordance with relevant legislation and guidelines.

7.6 VISUAL AMENITY, BUILT FORM AND URBAN DESIGN

7.6.1 ASSESSMENT

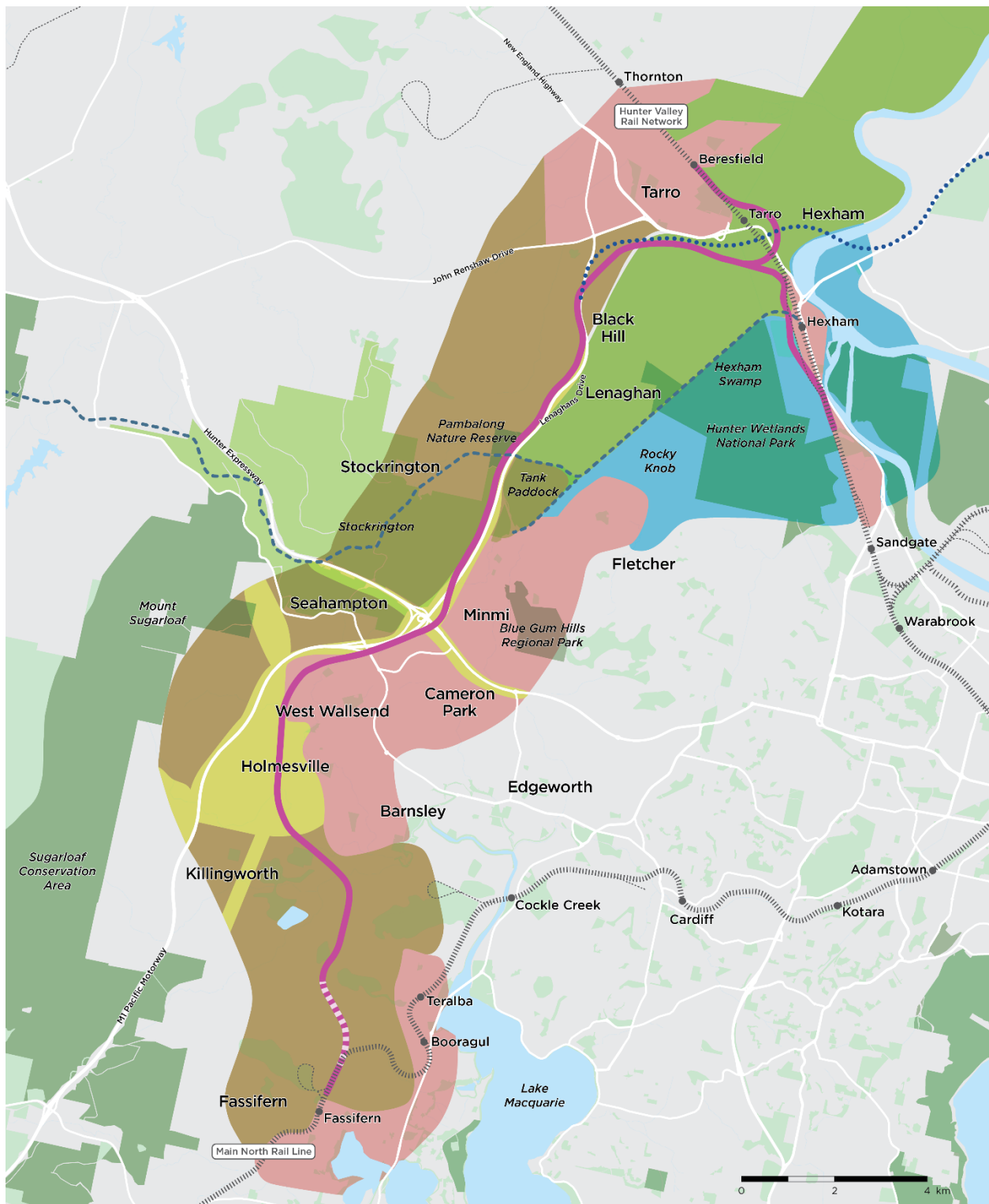
The protection of land for the Lower Hunter Freight Corridor would not in itself impact on the existing landscape character or views. Therefore, this section provides a strategic review of the visual impacts that may occur as a result of the potential future infrastructure within the recommended corridor.

The strategic visual review was carried out in accordance with the Roads and Maritime 2013 Environmental Impact Assessment Guidance Note EIA - N04 Guidelines for Landscape Character and Visual Impact Assessment. The impact analysis was based on an assessment of:

- The sensitivity; or degree to which a particular landscape type could accommodate change arising from the future freight rail line without detrimental effects on its character
- The magnitude; the size of the effects of the development within the landscape.

Four general landscape character zones were established to identify areas that have distinct, recognisable, and consistent natural and/or built elements (refer to Figure 7.2):

- Woodland
- Infrastructure
- Urban
- Agricultural.



KEY	
Landscape Character Areas	
 Agricultural	
 Woodland	
 Urban	
 Infrastructure Corridor	
 Riparian	
Infrastructure	
 Recommended Corridor	
 Existing Rail Network	
 Freight Sidings	
 Major Road Network	
 Proposed M1 Pacific Motorway extension to Raymond Terrace	
 Disused Richmond Vale Railway	

Figure 7.2 Landscape character areas

WOODLAND

The recommended corridor utilises a significant amount of Government owned land through the woodland areas around West Wallsend and Holmesville. Any potential visual impacts could be mitigated by opportunities for the retention and potential protection of surrounding bushland that could serve as both a green buffer and biodiversity offset land.

Bridge structures across roads within the woodland character area would be some of the most visible elements of the project, though again any potential visual impact could be minimised and buffered by the retention of the surrounding bushland.

To minimise any potential visual impacts, the recommended corridor has been aligned with existing infrastructure such as the M1 Pacific Motorway where possible. This results in the avoidance of significant woodland zone areas at the Tank Paddock, Stockrington and Pambalong Nature Reserve, that have higher biodiversity and community value.

INFRASTRUCTURE

The recommended corridor aligns with existing and planned infrastructure where possible, including the Killingworth substation, high voltage powerline easements and the M1 Pacific Motorway.

This landscape zone is considered to have low sensitivity due to the existing structures. Aligning the recommended corridor with existing infrastructure, especially the M1 Pacific Motorway, reduces the overall infrastructure footprint and decreases the potential visual impacts from the future freight rail on the wider landscape. It also allows for integrated mitigation opportunities for visual and noise impact mitigation, such as noise barriers for the road and rail infrastructure. The recommended corridor further provides for integration with existing and planned crossings of the M1 and future M1 Pacific Motorway extension to Raymond Terrace.

URBAN

The recommended corridor has been located to maximise distances to the existing and planned urban areas where possible.

The impact from a future potential freight rail line on the existing urban landscapes is therefore considered to be low.

AGRICULTURAL

The alignment from Black Hill to Tarro and Hexham traverses rural and rural residential land including grazing uses. However, the corridor would be located adjacent to the future M1 Pacific Motorway extension to Raymond Terrace. As such landscape impacts would be substantially absorbed by the motorway, which would be constructed prior to construction of the Lower Hunter Freight Line.

7.6.2 SUMMARY

Protection of land for the Lower Hunter Freight Corridor would have a low impact on existing landscape character or views.

The strategic visual impact review concludes that the recommended corridor has been aligned with existing infrastructure and Government owned land to minimise visual impacts on significant landscapes that are either environmentally sensitive or are urban areas.

A detailed assessment of the visual impact of future rail within the recommended corridor would be required as part of any future detailed project design and environmental approval process. This assessment would determine potential visual impacts and mitigation requirements. It is recommended that a future environmental impact assessment consider:

- Night-time impacts associated with light spill / glare from train headlights and corridor lighting.
- Visual impacts of project construction.
- Design elements to minimise impacts. These elements could include:
 - Design of the final infrastructure adjacent to heritage precincts or items (refer to Section 7.11) is sympathetic to the heritage significance of the precinct or item
 - Use of colours and finishes that are absorbed into the landscape where possible
 - Planting with appropriate species to blend into landscape.
- Screen planting near affected residential receptors.
- Other forms of mitigation associated with refinements and modifications to the potential future project design could help address impacts associated with the siting and scale of the final built form. These include:
 - Restrictions on vegetation clearing
 - Locate storage areas, stockpiles and associated works in cleared or otherwise disturbed areas away from visual receptors
 - Rehabilitate vegetation areas where ground is disturbed.

Opportunities to pre-emptively integrate mitigation measures into the design of the M1 Pacific Motorway extension to Raymond Terrace project will be explored.

7.7 GEOLOGY AND SOILS

This section provides an assessment of the potential impacts of the potential future infrastructure on geology and soils.

A desktop geotechnical engineering review of the key geotechnical considerations was undertaken as part of the corridor options development process. It found that engineering solutions would generally be able to address and mitigate impacts resulting from geological and soil characteristics within the recommended corridor.

7.7.1 ASSESSMENT

GEOLOGY

Geological formations found in the Fassifern area (Narrabeen Group – sandstone, siltstone, conglomerate and claystone) are known for their instability and are prone to stress relief cracking and wall convergence following excavation. These formations are to be carefully investigated and managed during future design, environmental approval and construction processes.

MINE SUBSIDENCE

It is anticipated that any future freight rail within the recommended corridor north of Fassifern would be in tunnel, to accommodate the steep terrain. Given the area's mining history there is a risk of encountering unstable rock, abandoned mine workings, or ground affected by mine subsidence, which could impact on future tunnelling operations. This risk would need to be addressed as part of future design phases.

Other areas of the recommended corridor, including Minmi and West Wallsend, have the potential to be affected by active and/or old mine workings. This increases the potential for subsidence to negatively impact on any future infrastructure within the recommended corridor. The recommended corridor north of Minmi is generally unaffected by underground mining and therefore subsidence issues.

The future design phase of infrastructure in the recommended corridor would need to address undermining and possible subsidence. Additionally, engagement with industry, affected mine owners, and the Division of Resources and Geoscience within the Department of Planning, Industry and Environment would need to be carried out to ensure the future freight rail design is compatible with existing and future mine operations.

ACID SULFATE SOILS

The recommended corridor intersects areas mapped as potentially containing acid sulfate soils. There is a low probability of acid sulfate soils north of Rhondda Road and north towards Barnsley, which coincides with elevations generally below 10 m AHD and drainage lines leading to Cockle Creek. The corridor then intersects an area of high probability of acid sulfate soils associated with drainage lines north west of Minmi, before again intersecting an area of high probability south of Tarro and Beresfield.

Acid sulfate soils can be appropriately addressed as part of any future design development phase of the project.

7.7.2 SUMMARY

The desktop review of geology and soils found that there would be no significant impact on geology and soils from future infrastructure within the recommended corridor, nor impacts on the infrastructure by the geology and soils. Additional investigations, consultation and engineering design considerations would be required as part of the next design phase.

For example, mine subsidence is currently not mapped in detail due to the variability of this constraint. Consultation with the Subsidence Advisory NSW would determine the extent of subsidence risk. This would inform future mitigation measures and determine further assessment requirements for the design of future freight rail infrastructure within the recommended corridor.

The design of all tunnels, slopes, earthworks and foundations would be subject to geotechnical field investigations, materials and contamination testing and analysis as part of the next phase of project development. Similarly, detailed geological assessment would need to be carried out during the next design phase.

7.8 WATER QUALITY AND HYDROLOGY

7.8.1 ASSESSMENT

This section provides a strategic review of the potential impacts associated with the Lower Hunter Freight Corridor and associated future infrastructure on water quality and hydrology. This is informed by a strategic hydrology and hydraulic analysis which was completed during the development of the initial corridor options.

A number of flood studies have been undertaken for the Hunter region that have included flood modelling and the mapping of flood behaviour within the Hunter River floodplain. These were used as a principal source of information for the analysis of existing hydrological features and constraints within the study area. For catchments where no existing flood models were available at the time, digital terrain analysis using GIS software was carried out to assess cross drainage requirements.

FLOODING

The major hydrological features and catchments described in Section 5.1.7 informed the location of the recommended corridor. Those areas with relatively higher floodplain conveyance such as within the Hunter River floodplain at Tarro would be impacted.

The strategic hydrological and hydraulic analysis concluded that the protection of a Lower Hunter Freight Corridor would have no impact on key hydrological features and that any future freight rail could be designed to maintain the existing hydrological regimes and minimise impacts on neighbouring properties.

The following sections provide a discussion of the potential features and mitigation measures that could inform the next phase of design development of the future freight rail line.

FASSIFERN TO MINMI

In the southern section between Fassifern and West Wallsend, the recommended corridor is largely constrained by terrain, integration with other infrastructure and existing development.

Due to the relatively steep terrain adjacent to this part of the alignment, any flooding impacts would be a result of runoff from local sub-catchments and largely confined to creek crossings. The design of these crossings would be considered during the next phase of design development.

LENAGHAN

The recommended corridor at this location runs generally adjacent to the M1 Pacific Motorway and the Pambalong Nature Reserve. The wetland at this location drains under the motorway and Lenaghans Drive to the Hexham Swamp catchment. At this location, cross drainage design would need to maintain existing hydrological regimes.

CONNECTION TO HEXHAM

Major catchment flooding of the Hunter River system is the dominant flooding mechanism in the northern half of the recommended corridor. Flood levels in the vicinity of the recommended corridor are controlled by ocean water levels influenced by storm surge and the tide, which effect flood levels within the lower estuary up to Green Rocks (approximately eight kilometres upstream of the confluence of the Williams and Hunter rivers).

The recommended corridor, in its northern extent, would cross the north western and northern margins of Hexham Swamp, and the Hunter River floodplain at Tarro. At these locations, the area has a relatively high floodplain conveyance. Future freight line infrastructure and connections to the existing rail line would need to be designed to minimise flood impacts on existing infrastructure and property (for example, a viaduct solution), and with consideration of the M1 Pacific Motorway extension to Raymond Terrace.

Rail elevation for connections to the Hunter Valley Rail Network would also need to be consistent with the existing rail infrastructure.

COASTAL WETLANDS

Low flow hydrological regimes are important for sensitive receiving water environments such as wetlands. The recommended corridor is within or adjacent to mapped Coastal Management SEPP wetlands, such as the wetlands at Pambalong Nature Reserve and Hexham Swamp. The recommended corridor however does avoid the Hunter Wetlands National Park.

The hydrological regime in these wetlands are already controlled to some degree by existing flood gates and tidal flaps as well as existing road and rail infrastructure (refer to Section 5.1.7). This includes tidal flaps on local drainage channels discharging to the Hunter River (Purgatory Creek), and road/rail embankments and culverts (M1 Pacific Motorway and the Richmond Vale Railway at Pambalong Nature Reserve, New England Highway and the Pacific Highway/Maitland Road).

The provision of appropriately designed cross drainage infrastructure that maintains the connectivity of low flow drainage paths, channels and waterways would minimise changes to the hydrological regime. This includes the appropriate sizing and design of bridges, viaducts and culverts. This would be addressed in the next phase of design development and would include consideration to maintaining the hydrological regime at Hexham Swamp and Pambalong Nature Reserve.

WATER QUALITY

The design of the future rail infrastructure would need to consider appropriate water quality management for stormwater in the vicinity of sensitive receiving environments, such as the Hexham Swamp and Pambalong Nature Reserve. Additional controls would be required during construction activities until disturbed areas have been stabilised, or where works would occur in areas of potential acid sulfate soils or contamination.

The two principal water supplies in the Lower Hunter are at Grahamstown Dam and the Tomago Sandbeds. The recommended corridor is not located in the catchments of these water supply areas. Further, water supply areas in Wyong/Central Coast area are located to the south of the recommended corridor. As such, the recommended corridor would not impact these potable water supplies.

7.8.2 SUMMARY

The strategic hydrology and hydraulic analysis found that there would be negligible impact on water quality and hydrology from the protection of the Lower Hunter Freight Corridor. The analysis did however find that there could be potential impacts from the provision of a future infrastructure within the recommended corridor.

A detailed flood and hydrology modelling and assessment would be carried out as part of the next phase of design development and to inform the supporting environmental impact assessment. This would ensure that existing hydrological regimes are maintained and flooding impacts on surrounding properties minimised.

The following flooding constraints would be considered during the next phase of design development:

- Horizontal route alignment – particularly with respect to floodplain crossing points and interaction with other linear infrastructure and built environments (including the M1 Pacific Motorway extension to Raymond Terrace).
- Vertical alignment – design running level to achieve design standard and integration/connection to other linear infrastructure.
- Construction type – such as embankment or bridging.
- Cross drainage requirements – to minimise flood impacts or to maintain existing hydrological conditions.
- Other environmental constraints – with regard to hydrological regimes.

7.9 BIODIVERSITY

7.9.1 ASSESSMENT

This section provides an assessment of the potential impacts on biodiversity of any future rail infrastructure developed within the recommended corridor.

A strategic assessment of ecological constraints and potential impact mitigation was used to inform the corridor options development process. This enabled high biodiversity areas to be avoided where possible and reduced the potential impacts of any future freight rail line.

THREATENED ECOLOGICAL COMMUNITIES

Twenty-eight threatened ecological communities listed under the Biodiversity Conservation Act (BC Act) and/or *Environmental Protection and Biodiversity Conservation Act (EPBC Act)* have been identified as having potential to occur within the Hunter/Central Rivers Catchment Management Area Hunter and Wyong subregions. No threatened ecological communities listed under the *Fisheries Management Act 1994* (FM Act) have the potential to occur within the locality.

The recommended corridor would pass through five threatened ecological communities listed under BC Act, including two which are also listed under the EPBC Act. The affected communities include:

- Freshwater Wetlands
- Lower Hunter Spotted Gum Ironbark Forest
- River-flat Eucalypt Forest
- Swamp Oak Floodplain Forest
- Swamp Sclerophyll Forest.

One additional threatened ecological community, Hunter Lowland Redgum Forest has potential to be identified during detailed surveys although was not identified in the study area during current investigations.

Further investigations would be required to assess the impacts to the affected communities as part of the next phase of design development. This would involve further ground truthing and assessment of vegetation condition and consistency with threatened ecological community listings.

Although the recommended corridor is based on a land clearing width of a 60 metre wide corridor, future design phases are likely to find the future potential rail infrastructure to have significantly less impacts based on the following considerations:

- The entire 60-metre-wide corridor is unlikely to be used for future potential infrastructure
- Design would include tunnels and other structures to minimise impacts in sensitive areas
- The corridor makes use of some of the existing M1 Pacific Motorway road reservation and land adjoining existing powerline transmission lines west of West Wallsend, that both demonstrate edge effects from this existing infrastructure
- Existing clearing and disturbed landscapes between Minmi and Hexham.

ENDANGERED POPULATIONS

No endangered populations were recorded during the field surveys. Seven endangered populations listed under the BC Act have been identified as occurring in the Hunter/Wyong Interim Biogeographic Regionalisation for Australia (IBRA; Environment Australia, 2000) sub-region, which are:

- *Acacia pendula* population in the Hunter catchment
- *Cymbidium canaliculatum* population in the Hunter Catchment
- River Red Gum population in the Hunter Catchment
- Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area
- Pine Donkey Orchid population in the Muswellbrook local government area
- *Eucalyptus oblonga* (Narrow-leaved Stringybark) population at Bateau Bay, Forresters Beach and Tumbi Umbi
- *Eucalyptus parramattensis* subsp. *parramattensis* in the Wyong and Lake Macquarie local government areas.

None of these populations are likely to occur within the recommended corridor. No endangered populations listed under the FM Act occur within the locality.

THREATENED FLORA SPECIES

A total of 53 threatened flora species and one endangered flora population have the potential to occur within the study area. Of these, 25 threatened flora species have a moderate or higher likelihood of occurrence. The remaining threatened flora species known or predicted to occur in the locality are considered unlikely to occur in the study area based on recommended habitat not being present or being outside the known range of the species and habitat is marginal.

No threatened species of plant were recorded in the study area during the field surveys. However, the recommended corridor traverses areas where various threatened flora species have been previously recorded and also contains potential habitat for threatened flora species. The high number of threatened flora species that may be present is a reflection of the wide range of habitats that would be traversed by the recommended corridor.

THREATENED FAUNA SPECIES

A total of 133 threatened species of animal under the BC Act, FM Act and/or the EPBC Act have been recorded or are predicted to have habitat in the locality. Of these, 61 threatened species of fauna have habitat within the study area and have a moderate or higher likelihood of occurrence. Seventy-two threatened species are considered to have a low likelihood of occurrence based on the availability of habitat.

No threatened species were recorded during the field inspections. However, the recommended corridor traverses areas where various threatened fauna species have been previously recorded. No threatened aquatic species listed under the FM Act are likely to be impacted upon by the recommended corridor.

Impacts on koala species and habitats was considered as part of the overall assessment. Koala protection is provided under both the *State Environmental Planning Policy (Koala Habitat Protection) 2020*, and *State Environmental Planning Policy (Koala Habitat Protection) 2021*. Both SEPPs apply to the City of Newcastle and City of Lake Macquarie local government areas (LGAs), with the 2020 SEPP applying to land use zones RU1, RU 2 and RU3, and the 2021 SEPP applying to all other zones. The entire LHFC is identified within both SEPPs as being within the Central Coast koala management area, which requires development assessments to consider relevant koala plans of management. Where no such plan is in place, development assessment must consider impacts on koala habitat, including through a koala assessment report for the development proposed.

The SEPP applies to development assessment under Part 4 of the EP&A Act. It does not have any statutory control over the process of protection of the LHFC and is unlikely to apply to any future environmental assessment process applicable to the project (which is unlikely to be subject to Part 4 of the EP&A Act). However, the principles of koala protection as outlined in the SEPPs have been taken into consideration in the establishment of the proposed corridor and would be considered further in future phases of project development.

Significance assessments under the BC Act and/or the EPBC Act would be required as part of a future potential application for rail infrastructure.

MIGRATORY SPECIES

One species of bird listed as Migratory under the EPBC Act, being, the Glossy Ibis, was recorded in the study area during field surveys. However, habitat within the study area is considered marginal for these species in light of the abundance of similar or greater quality habitat elsewhere in the locality and the degraded nature of these habitats within the study area.

A further 76 migratory (terrestrial, wetland and marine) species have the potential to occur in the wider locality based on EPBC Protected Matters search, other database searches and experience and knowledge of the area. Of these 76 species, 27 have a moderate or greater likelihood of occurrence in the study area on at least an intermittent basis. This is due, in large part, to the study area's location within the Hunter River floodplain and proximity to suitable migratory bird habitat.

RAMSAR WETLANDS AND WETLANDS OF NATIONAL IMPORTANCE

One Internationally important wetland, Hunter Estuary Wetlands is mapped in two areas in proximity to the recommended corridor. Kooragang Nature Reserve is mapped approximately four kilometres to the east across the South Arm of the Hunter River, and the Shortland Wetlands occur approximately five kilometres to the south of the recommended corridor. This wetland is a 'declared RAMSAR wetland' due to its significance to international migratory birds. It also supports important mangrove and saltmarsh communities. Matters related to RAMSAR wetlands are considered to be MNES and a significant impact on a matter of MNES requires referral to DAWE for consideration.

One wetland of national importance, Hexham Swamp, occurs approximately two kilometres south of the recommended corridor. Hexham Swamp is considered of national estate importance as it is the largest remaining waterfowl habitat on the lower north coast of NSW, containing approximately 37 per cent of the remaining non-tidal wetland habitat on the lower Hunter floodplain. The boundary of Hexham Swamp is also consistent with the boundary of the Hunter Wetlands National Park in this area.

Though the recommended corridor avoids the Hunter Estuary Wetlands and Hexham Swamp, additional investigations of the impacts of the future infrastructure on the wetlands would be required during future design phases to ensure the design would suitably mitigate any potential impacts.

CONNECTIVITY AND GREEN CORRIDORS

Green corridors and the connectivity they provide are important to biodiversity values at both the regional and state level.

The southern end of the recommended corridor occurs within a key fauna habitat corridor mapped by National Parks and Wildlife Service. The proposed rail corridor would fragment this vegetation and provide a barrier to ground dwelling fauna to cross the rail line, particularly if the rail corridor requires fencing. Mitigation measures such as fauna overpasses and underpasses would be required to maintain connectivity for terrestrial fauna species as part of future potential rail infrastructure in the Lower Hunter Freight Corridor. It should be noted that any provision of a tunnel would reduce ecological impacts substantially in the area in which the tunnel was constructed.

From Barnsley north to the M1 Pacific Motorway, the native vegetation is currently fragmented by numerous powerlines which extend from Killingworth Substation and numerous roads and clearings for rural residential developments. There are a significant number of four-wheel drive tracks throughout this bushland. This section of the recommended corridor occurs within a key fauna habitat corridor mapped by National Parks and Wildlife Service. These mapped corridors extend to the north and provides connectivity to native bushland at West Wallsend and further west to Heaton State Forest. Designing the rail corridor to adjoin some of the existing power line easements would be preferable than creating further corridors through this area. Aligning the route along the power easement results in a reduction in fragmentation and widen an existing corridor. The potential future rail infrastructure may further fragment the native vegetation and provide a barrier to fauna to cross the rail corridor without suitable mitigations.

The northern section of the recommended corridor occurs in the green corridor mapped by the Lower Hunter Regional Strategy, and therefore has conservation importance in maintaining connectivity from the western bushland at Seahampton further north east across Hexham Swamp and Tarro through to the Hunter River and further east to Ash Island and Raymond Terrace. Between the M1 Pacific Motorway and Pambalong Nature Reserve, the recommended corridor would not significantly further fragment any vegetation than is already occurring. The vegetation further north is consisting of cleared farming lands and the rail corridor would not increase fragmentation in this area. There is a patch of good condition Lower Hunter Spotted Gum Ironbark Forest Endangered Ecological Community at Black Hill. This vegetation would be further fragmented by the recommended corridor. Further west there are freshwater wetlands and Swamp Forests which maybe further fragmented by the rail corridor.

AVOIDANCE AND MITIGATION

The development of the corridor alignments, and selection of the recommended corridor has avoided direct impacts where practicable. This included prioritising the re-use of existing disturbed areas such as using historic rail lines, electrical transmission lines or disturbed areas next to existing roads.

Opportunities to further avoid and minimise impacts would be considered during the next phase of design development. This includes alternative innovative engineering solutions, and installation of supplementary habitat (such as nest boxes, created hollows, bushland regeneration or frog ponds).

OFFSETS

Once the maximum avoidance and mitigation has been incorporated into the project design, unavoidable impacts would require compensatory biodiversity offsets.

Offsets are likely to be required at both State and Commonwealth levels as complete avoidance of significant ecological areas is not likely to be possible. At the current stage of the project, a definitive offset package requirement cannot be determined. Offset requirements would be determined at the design phase and would be required prior to project approval.

Transport for NSW actively mitigates the biodiversity impacts of major infrastructure projects through the identification and preservation of biodiversity offset lands. Transport of NSW has identified strategically located Government owned land to be considered as potential offset areas that could build on and adjoin the existing National Park reserve estate. These potential offset areas are located within the study area, bordering both sides of the M1 Pacific Motorway to the west of West Wallsend and on both sides of Killingworth.

These potential offset areas could provide offset credits for some vegetation communities likely to be impacted upon by any future freight rail infrastructure. However, following future design phases and mitigation, if there are still shortfalls in offsets of some vegetation communities, then additional biodiversity offset areas may be required to be sourced.

7.9.2 SUMMARY

Based on a strategic review of biodiversity, there could be potential impacts on biodiversity from the provision of any future infrastructure within the recommended corridor.

Future approvals for impacts associated with the potential rail infrastructure in the Lower Hunter Freight Corridor on important biodiversity would likely be required at both a State and Commonwealth level. Assessment of impacts and the offset requirements would be determined at the design phase.

The following tasks are recommended to support the design phase for any future freight rail line:

- Undertake additional ecological investigations including detailed, seasonal surveys within the recommended corridor and potential offset lands to understand the extent and condition of flora and fauna communities, populations and species.
- Consider additional detailed ecological information to:
 - Refine the location of the future freight rail line within the 60-metre-wide corridor
 - Investigate alternate engineering solutions to mitigate any potential impacts, such as viaducts and bridges, and installation of habitat such as nest boxes or frog ponds
 - Investigate future offset requirements, including discussions with both the NSW Department of Planning, Industry and Environment (Environment, Energy and Science division), and DAWE about mitigation options, future offsets and timing of an EPBC Act referral.

7.10 ABORIGINAL HERITAGE

7.10.1 ASSESSMENT

This section provides a strategic review of the potential impacts associated with the Lower Hunter Freight Corridor and associated potential future infrastructure on Aboriginal heritage. This is informed by two streams of work - a strategic heritage analysis which was completed during the development of the initial corridor options, and an Aboriginal cultural values assessment, to ensure that cultural heritage matters were taken into consideration during the corridor identification process. The Aboriginal cultural values assessment was informed by an Aboriginal advisory council which was established from within the local community and consists of people who identify as traditional owners of the region.

Section 5.2.5 outlines the areas of Aboriginal heritage significance identified through the strategic review and Aboriginal cultural values assessment. The predictive model, developed to inform the options analysis, identified that Aboriginal heritage sites would be more likely to be found on the ridges and toe slopes near West Wallsend and Stockrington, and on undisturbed elevated landforms adjacent to Hexham Swamp and waterways such as Cockle Creek. The likelihood of identifying Aboriginal sites in areas subject to significant disturbance (such as mining) is low.

As identified in Section 6.3, the recommended corridor would minimise impacts to Aboriginal heritage by virtue of using previous disturbed areas including a section of former rail corridor in the south and areas adjacent to the M1 Pacific Motorway. However, the recommended corridor would pass through areas of cultural heritage, specifically the Cockle Creek catchment and areas between Mount Sugarloaf and Hexham Swamp.

An AHIMS search identified that there are three previously recorded sites within the recommended corridor, which consist of potential archaeological deposits, artefacts and a stone arrangement. Four of these sites would be located within the recommended corridor (consisting of artefacts). Site investigations would be required during the next phase of project development to confirm the location of the previously recorded sites and identify any previously unrecorded sites.

The recommended corridor would pass through a single Aboriginal Land Claim in Wakefield. Transport for NSW has consulted with the relevant claimant.

The development of corridors options considered the presence of Aboriginal cultural heritage values, with the view to minimising impacts where avoidance is not practicable. The cultural values have played a very significant role in identifying the recommended corridor and the Aboriginal community have placed far greater significance on ensuring the recommended corridor avoids culturally significant sites above the potential impact on artefacts. The significance of Aboriginal heritage and potential for discovery of sites and artefacts will, however, require on-going investigation. This will be undertaken as part of the future design and impact assessment phase. Approaches to avoid impacts on Aboriginal heritage sites and cultural values, informed by further engagement with Aboriginal stakeholders, will occur during the next phase of project development. These may include design approaches (e.g. adjustments to the rail infrastructure or alternative engineering design solutions) or alternative construction management practices (e.g. to avoid or minimise ground disturbance).

7.10.2 SUMMARY

A strategic review of Aboriginal heritage found that the impact of the protection of the Lower Hunter Freight Corridor on Aboriginal heritage would be negligible. However, the analysis found that there could be potential impacts from the provision of any future infrastructure within the recommended corridor, depending on detailed studies and ground truthing.

To ensure potential impacts to Aboriginal cultural heritage are minimised, the following approach is recommended during the next phase of design development, and to inform the supporting environmental impact assessment:

- Continue engagement with relevant members of the Aboriginal community to protect cultural values and unrecorded sites associated with the recommended corridor, and carry out engagement in accordance with the relevant HeritageNSW guidelines (such as Aboriginal Cultural Heritage Consultation Requirements for Proponents (Department of Environment, Climate Change and Water, 2010).
- Undertake archaeological surveys of the recommended corridor including ground truthing of previously identified sites, in consultation with the Aboriginal community.
- Identify opportunities to avoid direct or unacceptable impacts to heritage values and items and develop appropriate management strategies in relation to Aboriginal heritage. This could include opportunities for archaeological salvage work, archival recording, interpretation and cultural inductions.
- Consider subsurface archaeological testing within the recommended corridor utilising best practice guidelines.
- Develop a construction heritage management plan at the time of construction in consultation with relevant members of the Aboriginal community. This should include protocols for unexpected finds.

7.11 NON-ABORIGINAL HERITAGE

7.11.1 ASSESSMENT

This section provides a strategic review of the potential impacts associated with the Lower Hunter Freight Corridor and associated potential future infrastructure on non-Aboriginal heritage. This is informed by a strategic heritage analysis which was completed during the development of the initial corridor options.

The recommended corridor passes through or is in close proximity to a number of non-Aboriginal heritage items that relate to the mining and transport history of the Hunter Valley. Table 7.3 lists non-Aboriginal items that are located within the curtilage of listed heritage items.

The recommended corridor also passes close to a number of local heritage items, such as Rhondda Colliery, West Wallsend Cemetery, the West Wallsend Football Club and the West Wallsend Heritage Conservation Area. Potential indirect impacts on nearby heritage items would depend in the design of the future trail infrastructure. As such, this would be considered during the next phase of design development.

Table 7.3 Non-Aboriginal heritage items within the recommended corridor

ITEM	LISTING	LOCATION	COMMENT
Great Northern Railway	Lake Macquarie LEP 2014	Various suburbs from Garden Suburb to Wye	<p>This is an item of local significance.</p> <p>The Great Northern Railway is the current operational railway line between Sydney and Newcastle.</p> <p>Impacts would occur near Fassifern where the corridor connects to the existing line.</p> <p>The proposed future use of the site as a freight rail is consistent with the heritage values of the Great Northern Railway.</p>
Colliery Relics Archaeological (Booragul Ruins)	Lake Macquarie LEP 2014 Section 170 register	115 Old Main Road Booragul	<p>This is an item of local significance.</p> <p>The future freight rail line is likely to be in a tunnel at this location.</p> <p>The location of tunnel portals would consider any relics within the heritage item and consider required mitigation strategies.</p>
Rhondda Colliery (Built)	Lake Macquarie LEP 2014	282 and 284 Rhondda Road, Teralba	<p>This is an item of local significance.</p> <p>The recommended corridor crosses the eastern section of curtilage. Impacts were determined to likely be minor by the strategic heritage review.</p>
Rhondda Colliery Railway (Archaeological)	Lake Macquarie LEP 2014	Various suburbs	<p>This is an item of local significance.</p> <p>The recommended corridor crosses the Rhondda Colliery Railway curtilage at two locations north of Rhondda Road, Teralba.</p> <p>Further investigations would be carried out during the next phase of design development to minimise potential impacts.</p>
Seaham, West Wallsend, Fairley and Killingworth Railway	Lake Macquarie LEP 2014 Section 170 register	Various suburbs	<p>This is an item of local significance.</p> <p>The recommended corridor crosses the curtilage. Impacts were determined to likely be minor by the strategic heritage review.</p>
West Wallsend (no 1) Colliery (Archaeological)	Lake Macquarie LEP 2014	Off Wilson Street, West Wallsend	<p>This is an item of local significance.</p> <p>The recommended corridor transects the northern portion of this item. Further investigation would be required to determine the location and significance of relics or areas of heritage value within the site, and to identify what potential impacts may occur and what mitigation would be required during the next phase of design development.</p>

ITEM	LISTING	LOCATION	COMMENT
Minmi to Hexham Railway – Built	Newcastle LEP 2012	Various suburbs	<p>This is an item of has been identified in the LEP listing as being of State significance however is not listed on the State Heritage Register as a State heritage item.</p> <p>This item is proposed to be repurposed for the Richmond Vale Rail Trail, and the recommended corridor would cross this at two locations (at Lenaghan and at Tarro).</p> <p>The future freight rail would be designed to cross the Minmi to Hexham Railway without significantly impacting upon its heritage significance (or the opportunity to develop the proposed Richmond Vale Rail Trail).</p>

7.11.2 SUMMARY

A strategic review of non-Aboriginal heritage found that the impact of the protection of the Lower Hunter Freight Corridor on non-Aboriginal heritage would be negligible. However, the analysis found that there could be impacts on heritage items from the provision of any future rail infrastructure within the recommended corridor.

The following would be considered during the next phase of project development to avoid and minimise impacts on non-Aboriginal heritage:

- Further assessment of the nature and extent of built and archaeological items with consideration given to avoiding significant features within the corridor
- Opportunities to retain the legibility of heritage items. This could include retention of primary features
- Opportunities to interpret the heritage values of items
- Relocation of significant features from direct impact zones as well as potential interpretation.

A non-Aboriginal heritage impact assessment would also be carried out to support the future environmental impact assessment.

7.12 AIR QUALITY

7.12.1 ASSESSMENT

Protection of the Lower Hunter Freight Corridor would not in itself have impacts on regional or local air quality. Emissions to air would be primarily from train exhausts associated with the operation of the future freight line, due to the combustion of diesel fuel. Key emissions associated with the combustion of diesel fuel includes carbon monoxide (CO), oxides of nitrogen (NO_x) including nitrogen dioxide (NO₂), particulate matter (as PM₁₀ and PM_{2.5}) and, to a lesser degree, air toxics including benzene and formaldehyde.

The Environment Protection Authority operates three monitoring stations within the Lower Hunter region – Beresfield, Wallsend and Newcastle. A review of monitoring results from the three Lower Hunter monitoring stations as reported in the EPA's Annual Compliance Report 2019 shows that between 2015 to 2019:

- Carbon monoxide (CO) remained below the maximum 8-hour average criterion (10 mg/m³) for all years at the Newcastle monitoring station. The Beresfield and Wallsend do not monitor CO, and the one-hour average CO concentrations are not reported by the EPA.

- For NO₂, the annual average concentrations and maximum 1-hour average concentrations have remained under the criteria (being 62 ug/m³ and 246 ug/m³ respectively).
- For PM₁₀, the annual averages remained under the criterion of 25 ug/m³, except in 2019 at Beresfield and Newcastle, which was attributed to the bushfires in 2019. The maximum 24-hour average exceeded the criterion of 50 ug/m³ at all sites on at least one occasion. These events have been attributed to bushfires, dust-storms and regional scale events.
- For PM_{2.5}, the maximum 24-hour average have exceeded the criterion (25 ug/m³) in some years at all three stations but remained under the criterion in 2017 and 2018. Significant exceedances of the criterion occurred in 2019, which was attributed to the bushfires and other regional scale events. The annual average has been below the criterion (8 ug/m³), except at Beresfield monitoring station in 2018 and at all three stations in 2019.

The recommended corridor has avoided existing and future urban areas where practicable, and the majority of the corridor traverses bushland or rural areas with few sensitive receivers. The recommended corridor has also been designed to minimise steep gradients to improve the efficiency of freight movements (and therefore emissions to air) when compared to the existing Main North Rail Line.

Modelling of air quality emissions was carried out during early options development to understand possible contributions to local air quality as a result of new rail infrastructure, which considered Environment Protection Authority modelling procedures. The assessment considered contributions of CO, NO₂, PM₁₀ and PM_{2.5} with an assumed background against the relevant air quality impact assessment criteria. This found that:

- Contributions from a future freight line for the key air quality pollutants (CO, NO₂, PM₁₀ and PM_{2.5}) would unlikely exceed the EPA's air quality criteria. The maximum contribution would decrease as the distance to the rail line increases, noting that for:
 - NO₂, the maximum contribution for the 1-hour average would be around 25 per cent of the criterion, except in the immediate vicinity of the portals, which would be greater
 - CO₂, the maximum contribution for the 1-hour average would be less than one per cent of the criterion
 - particulates (PM₁₀ and PM_{2.5}), the maximum contribution for the 24-hour average would be less than 10 and 20 per cent of the relevant criterion respectively.
- Maximum concentrations at portals are likely to be higher but have been located away from sensitive receivers and existing communities. The strategic air quality review found that these emissions are unlikely to impact sensitive receivers.

The next phase of project development would need to be supported by an air quality impact assessment and would consider other substances such as air toxics.

7.12.2 SUMMARY

The impact on air quality due to the protection of the Lower Hunter Freight Corridor would be negligible. The recommended corridor has been selected to minimise rail gradients to improve the operational efficiency of the future rail line, and thereby minimising emissions to the local air shed when compared to the existing Main North Rail Line. However, the analysis found that there could be potential impacts from the provision of any future infrastructure within the recommended corridor.

During the next phase of design development, an air quality impact assessment would be carried out to support the environmental impact assessment and would identify any further opportunities to reduce air quality contributions to the local and regional airshed.

7.13 CONTAMINATION

7.13.1 ASSESSMENT

The recommended corridor is in proximity to one registered contaminated site located adjacent the Main North Line, south west of Tarro. The site is the Green Acres Farm located at 1 Woodland Close, Tarro and is approximately 83,900m². A notice under Section 35 of the *Environmentally Hazardous Chemicals Act 1985* sets out restrictions applying to the site which is affected by asbestos. The recommended corridor does not traverse any areas currently subject to PFAS investigations by the NSW EPA.

A number of known contaminating activities have been and are being carried out within the recommended corridor, such as agriculture/horticulture, railway yards, mining and extractive industries, and waste storage and treatment. However, at this stage in the corridor protection process, limited contamination analysis has been undertaken.

The need for further contaminated land investigations would be determined in the next phase of design development and would be guided by the SEPP No. 55 – Remediation of Land and the associated Managing Land Contamination: Planning Guidelines.

7.13.2 SUMMARY

Protection of land for the corridor would have negligible impacts on contamination. However, further assessments may be required as part of the next phase of design development. The future investigations could entail a detailed appraisal of the protected corridor's land use history, and an assessment based on a visual site inspection and analysis.

Once the contamination issues are known, appropriate engineering and control measures may need to be implemented during construction to mitigate impacts from contamination.

7.14 SOCIAL

7.14.1 ASSESSMENT

This section provides an analysis of the potential social impacts on the local community from the protection of the recommended corridor and identifies ways in which the recommended corridor and any future infrastructure within it would provide social benefits to the wider Newcastle community.

LOCAL COMMUNITY

The recommended corridor has been aligned to avoid sensitive land uses wherever possible. The corridor itself does not directly impact on any community uses or services such as childcare centres, schools or dwelling structures.

Though the protection of land for the corridor would not create any physical impacts, an analysis of the wider social impacts, including impacts from possible community severance, would need to be undertaken as part of any future detailed design and environmental approval process.

However, by preserving the corridor now, certainty about future land requirements and infrastructure alignments would be provided for the community. This would enable the recommended corridor to be fully incorporated into strategic planning, protecting the corridor from further urban encroachment.

INNER CITY NEWCASTLE

Parts of the existing Main North Rail Line are operating very close to capacity. Over the next 20 years, Transport for NSW expects that forecast demand for rail freight services will place increasing pressure on the Main North Rail Line between Sydney and Newcastle and has estimated that an additional 66 freight services per week in each direction will be required by 2056. This will occur alongside growth in passenger services.

The eventual construction of freight rail infrastructure in the recommended corridor would benefit Newcastle communities by:

- Providing certainty for landholders and developers
- Removing freight transport from inner city neighbourhoods and greatly improving the amenity and liveability of these communities
- Reducing future land use conflicts, in particular residential development and other infrastructure projects.

7.14.2 SUMMARY

The social impacts of protecting the Lower Hunter Freight Corridor are considered to be low given the small number of properties directly impacted by the recommended corridor and the co-location of infrastructure corridors, including the M1 Pacific Motorway.

The potential social benefits of protecting the recommended corridor are substantial, as it would give long lasting confidence to industry and the community regarding the provision of future infrastructure when required.

Detailed social impact assessment, investigating the impacts of the future rail infrastructure on local and regional communities would be undertaken as part of any future environmental impact assessment.

7.15 ECONOMIC

7.15.1 ASSESSMENT

EMPLOYMENT CREATION

Construction of the future rail infrastructure would generate direct and indirect employment opportunities. The number of jobs created during construction of the project would depend on its complexity and scale, as well as the proposed length of the construction period.

A more efficient freight network would also create jobs from associated economic growth and productivity gains. As it becomes cheaper to move goods, the end user pays less for the delivery and overall demand for goods would increase. This can lead to an increase in production, creating new jobs. Additionally, some jobs would arise as a direct impact from additional capacity on the network. More train drivers, workers to load and unload goods and staff responsible for arranging logistics would be required.

FREIGHT CAPACITY

Future rail infrastructure along the recommended corridor can deliver economic benefits by allowing additional freight to travel on rail and reducing road freight. Fewer heavy goods vehicles on the roads reduces congestion, accidents and road maintenance which all bear economic costs. It would also have wider economic benefits on production levels, employment and investment occurring in the region. There would also be improved access to markets from regional areas, particularly export through Port Botany.

A dedicated freight corridor would likely reduce some operating costs. There could therefore be more demand for rail freight as operators take advantage of the improved freight networks to operate in a more cost-effective way. This increased demand for rail freight might then be a catalyst for further investment in rail freight networks, resulting not only in a compounding of freight operating cost savings, but also increased economic activity from delivering better freight networks.

FREIGHT TRAVEL TIME

For freight which travels beyond Newcastle and continues to travel on rail, the Lower Hunter Freight Corridor would reduce the distance it needs to travel by bypassing Newcastle. This would result in time saving benefits, leading to reduced operating costs and improved reliability. The economic benefits are generally derived from travel time savings of between 15 to 20 minutes for an average trip in comparison with the current rail network.

LEVEL CROSSINGS

A future rail line within the recommended corridor would lead to a reduction in the use of level crossings. Level crossings have a significant impact on transport efficiency which translates to reduced economic productivity. Congestion at level crossings equate to large costs attributed to a loss of time saving and adversely affect the logistics network in the region.

WIDER ECONOMIC IMPACTS

Future rail infrastructure within the recommended corridor could result in wider economic impacts arising from a combined output change in competitive markets. Should the new freight line result in significant freight transport cost savings, certain firms that use rail freight would be able to profitably increase their output.

Once operational, the Lower Hunter Freight line may result in agglomeration advantages, in that a more efficient freight network can bring businesses effectively closer together by reducing the time it takes for goods and workers to travel between places along the corridor.

The future rail line would also support the future expansion of the Port of Newcastle, by providing improved access to Sydney, regional NSW and interstate destinations.

OTHER POTENTIAL IMPACTS

As noted in Chapter 4.3.2, the protection of the Lower Hunter Freight Corridor would reduce the cost of delivering future infrastructure and encourages business investment. As 65 per cent of the recommended Lower Hunter Freight Corridor is already in NSW Government ownership, this has reduced the quantum of private properties that would need to be acquired in the future.

Corridor protection would provide certainty around future land use planning and would not impact the existing uses on property (refer to Section 7.1 and Section 7.2 of this report). The protection of the corridor would inform local businesses and assist them in forward planning investment considerations.

Land acquisition (and creation of residual land), modified access arrangements and construction of the future freight line also has the potential to disrupt business operations during its construction and operation phases. The mitigation of these impacts would be considered during the next phase of project development.

7.15.2 SUMMARY

The construction of a freight line in the Lower Hunter would create a number of economic benefits. There would be a large number of construction jobs created from the works along with flow on effects in the economy. Indirect effects would also include the additional economic benefits of increased freight capacity in the Lower Hunter along with ongoing maintenance and support services. Other benefits include the reduced travel time to move freight in and through the Lower Hunter. Initial estimates suggest that the development of a dedicated freight line within the recommended corridor could generate economic benefits with a present value of around \$440 million (subject to the year of opening).

The construction and operation of a future freight line would have the potential to disrupt businesses due to land acquisition and related construction impacts. Approaches to minimise these impacts through design and/or mitigation strategies would be identified during the next phase of project development and the supporting environmental impact assessment.

7.16 CUMULATIVE

7.16.1 ASSESSMENT

The Department of Planning, Industry and Environment's scope requirements for this strategic assessment requires the consideration of cumulative impacts with other infrastructure projects (existing and future) with respect to: transport and traffic, landuse and property, heritage, flooding, water quality and soils, biodiversity, and socio-economic. The interaction of the Lower Hunter Freight Corridor (and associated future rail infrastructure) with existing projects has been considered in the earlier sections of this report.

The potential for cumulative impacts due to the Lower Hunter Freight Corridor and its associated future infrastructure would be dependent on:

- The design of the future Lower Hunter Freight line infrastructure and other large infrastructure projects
- The timing for the delivery of other infrastructure projects relative to the protection and/or delivery of infrastructure associated with the Lower Hunter Freight Corridor.

Other key large infrastructure projects in the Lower Hunter are:

- Richmond Vale Rail Trail. A development application is currently under consideration for the first stage of this regional project.
- The M1 Pacific Motorway extension to Raymond Terrace. The EIS for this project is expected to be released for public exhibition mid-2021. The project is assumed to be operational prior to the delivery of the Lower Hunter Freight line.
- High speed rail and Fast rail. An indicate route for high speed rail has been nominally located to the east of the M1 Pacific Motorway. Fast or faster rail between Sydney and Newcastle is currently being investigated for feasibility and details of any future route are yet to be released.

Consideration of potential cumulative impacts is provided in Table 7.4. Construction related cumulative impacts have not been considered, as this would be highly dependent on if construction activities would overlap.

Table 7.4 Consideration of cumulative impacts

PROJECT	DISCUSSION
Richmond Vale Rail Trail	<p>This project, within the vicinity of the Lower Hunter Freight Corridor, is assumed to be constructed and operational before the construction of any future rail freight infrastructure.</p> <p>The protection of the recommended corridor would not lead to any cumulative impacts, noting the rail trail follows a redundant railway line and the future freight line infrastructure would not preclude the delivery of this project.</p> <p>The future design and construction of the freight line infrastructure would need to address the operation of the rail trail at Lenaghan and Tarro where the two infrastructure projects cross to ensure continued operation of the cycleway.</p>
M1 Pacific Motorway extension to Raymond Terrace	<p>This project, within the vicinity of the Lower Hunter Freight Corridor, is assumed to be constructed and operational before the construction of any future rail freight infrastructure.</p> <p>The protection of the recommended corridor would not lead to any cumulative impacts, however, it is acknowledged that some private properties may be impacted by the future road project and the recommended corridor. Transport for NSW will consult with the relevant property owners concerning future potential impacts from both projects and seek to integrate a future freight rail line into the works being undertaken for the M1 Pacific Motorway extension to Raymond Terrace.</p>

PROJECT	DISCUSSION
	<p>Depending on the design of each project, there is the potential for cumulative impacts associated with:</p> <ul style="list-style-type: none"> — Transport and traffic. Both projects would provide benefits for freight transport in the Hunter Region due to improvements in reliability and travel times. — Flooding and water quality due to the presence of both projects on the Hunter River floodplain. — Heritage, due to potential direct impacts on Aboriginal heritage items and cultural values in the vicinity of Hexham Swamp. — Operational noise for nearby sensitive receivers and communities (such as Tarro). Noise generated by the road project would be considered in the future noise assessments to support the next phase of design delivery. — Visual and landscape, due to the presence of new infrastructure within the landscape and changes to the landscape as a result of vegetation removal. — Socio-economic, due to changes to amenity and land uses. — Biodiversity, due to the removal of vegetation within the same bioregion and/or impacts to biodiversity (direct and indirect). <p>These matters would be considered in the delivery phase of the Lower Hunter Freight line, in which the future environmental impact assessment would account for changes to the current environment due to the construction and operation of the M1 Pacific Motorway extension to Raymond Terrace.</p>
High speed rail	<p>Given the current stage of investigations into high speed rail, the potential cumulative impacts cannot be identified at this stage. The progression of this project to the next stage of planning would need to consider interaction with the Lower Hunter Freight Corridor.</p>
Fast rail	<p>Given the current stage of investigations into fast or faster rail, the potential cumulative impacts cannot be identified at this stage. The progression of this project to the next stage of planning would need to consider interaction with the Lower Hunter Freight Corridor.</p>

7.16.2 SUMMARY

The potential for cumulative impacts as a result of the Lower Hunter Freight Corridor and the delivery of the future rail freight infrastructure is highly dependent on the timing and design of the identified infrastructure projects. Generally, the protection of the recommended corridor would not lead to cumulative impacts, however, property impacts due to the adjacent M1 Pacific Motorway extension to Raymond Terrace would need to be considered by Transport for NSW.

Cumulative impacts would be considered during the next phase of project development and addressed in the supporting environmental impact assessments.

7.17 ENVIRONMENTAL RISK ANALYSIS

An environmental risk analysis has been carried out to identify and confirm key strategic environmental issues for the recommended corridor. An initial environmental constraints identification process was carried out during the initial options development analysis. Strategic Environmental Assessment Guidelines have also identified a range of key issues that must be addressed for the project. These analyses and guidelines provide a basis for an appropriately detailed assessment of the key issues in this Strategic Environmental Assessment.

The following table summarises the potential risks related to the protection of the Lower Hunter Freight Corridor and the additional investigations recommended for the future detailed design and environmental assessment process over the next 10 to 20 years.

Table 7.5 Strategic environmental risk analysis

ISSUE	ADDITIONAL INVESTIGATIONS	STAGE
Land use and property	Engage with local community and relevant stakeholders to discuss future infrastructure timeframes and the next stages of design, approval and delivery. Landowner negotiation; budget allocation; investigation of further opportunities for impact minimisation through delivery phase design adjustments.	Corridor protection, project design and delivery
Utilities	Comprehensive utility surveys and consultation with service providers to discuss future infrastructure design.	Project design and delivery
Traffic and transport	Traffic and transport modelling and assessment.	Project design and delivery
Noise and vibration	Noise and vibration modelling and assessment.	Project design and delivery
Visual amenity, built form and urban design	Detailed visual and landscape impact assessment. Urban design strategy	Project design and delivery
Geology and soils	Detailed geotechnical assessment. Engage with the Subsidence Advisory NSW.	Project design and delivery
Water quality and hydrology	Detailed hydrological and flooding assessment	Project design and delivery
Biodiversity	Undertake additional ecological investigations including detailed, seasonal surveys within the recommended corridor and potential offset lands. Avoidance of high value ecological areas during design to minimise offset requirements. Investigate alternate engineering solutions to mitigate potential impacts, such as tunnelling, viaducts and bridges, and installation of habitat such as nest boxes or frog ponds. Early engagement with the Environment, Energy and Science Group within the Department of Planning, Industry and Environment to agree on an approach to offset planning.	Project design and delivery

ISSUE	ADDITIONAL INVESTIGATIONS	STAGE
Aboriginal heritage	<p>Further assessment including field inspections to characterise corridor impacts. Consideration given to avoiding, interpreting or relocating significant items/features</p> <p>Further engagement with relevant members of the local Aboriginal community.</p> <p>Undertake archaeological survey of the recommended corridor including ground-truthing of previously identified Aboriginal sites</p> <p>Investigate opportunities to avoid direct or unacceptable impacts to Aboriginal heritage values.</p> <p>Mitigation and management strategies to be developed including a protocol for unexpected finds of Aboriginal heritage</p>	Project design and delivery
Non-Aboriginal heritage	<p>Further assessment of the nature and extent of built and archaeological items.</p> <p>Investigate opportunities to avoid, interpret or relocate significant items/features.</p>	Project design and delivery
Air quality	A detailed air quality impact assessment	Project design, delivery and operation
Contamination	A detailed contamination assessment	Project design and delivery
Economic	<p>Progress with corridor reservation.</p> <p>Further impact assessment for economic related impacts.</p>	Corridor protection, project design and delivery
Social	<p>Effective and comprehensive stakeholder engagement</p> <p>A social impact assessment</p>	Project design and delivery

8 STAKEHOLDER ENGAGEMENT

8.1 WITHIN THE TRANSPORT CLUSTER

Extensive consultation has occurred within Transport for NSW between the Lower Hunter Freight Corridor team with the M1 Pacific Motorway extension to Raymond Terrace project team.

8.2 OTHER STAKEHOLDERS

Since early 2015, Transport for NSW has consulted extensively with NSW State agencies and regulatory authorities including the Department of Planning, Industry and Environment, the Department of Premier and Cabinet and the Hunter and Central Coast Development Corporation.

The following agencies and authorities were consulted during the corridor identification process:

- Department of Planning, Industry and Environment, including Planning and Assessment division, Environment Energy and Science division and HeritageNSW (formerly the Office of Environment and Heritage)
 - Department of Premier and Cabinet
 - Subsidence Advisory NSW
 - The Hunter and Central Coast Development Corporation
 - Landcom
 - Lake Macquarie Council
 - City of Newcastle
 - Local Aboriginal Land Councils and community representatives
 - TransGrid.
-

8.3 ENGAGEMENT PROCESS

Transport for NSW will engage with stakeholders and the community throughout the corridor protection process. This draft Strategic Environmental Assessment will be publicly displayed, and landowners, community and stakeholders will be invited to provide feedback. This consultation will include community information sessions as part of the exhibition process and details of these events will be available on Transport for NSW's website. Engagement collateral and online mapping will be provided on the Transport for NSW website.

9 STATUTORY PLANNING CONSIDERATIONS

This draft Strategic Environmental Assessment supports the community and stakeholder engagement for the recommended corridor. The Department of Planning, Industry and Environment have also released an Explanation of Intended Effects, which details how the corridor can be protected under the planning system.

This section outlines the desired outcomes from the corridor protection and potential pathways for that protection.

9.1 STATUTORY PLANNING FRAMEWORK

The Explanation of Intended Effects (EIE) describes the proposed protection of the recommended corridor alignment under *State Environmental Planning Policy (Major Infrastructure Corridors) 2020* (MIC SEPP). The protection of the corridor under the MIC SEPP is designed to ensure that future growth and development is compatible with planned infrastructure. Land generally needs to be identified for infrastructure purposes far in advance of its planned delivery, with strategic planning often taking place decades before construction begins.

Corridor protection within an Environmental Planning Instrument provides a framework for local councils and NSW Government agencies to review development proposals within and surrounding the corridor. NSW Government agencies can acquire property within the proposed corridor through the established legal framework and procedures.

Three key outcomes from the corridor protection process have been identified for the Lower Hunter Freight Corridor:

- Inclusion of the recommended corridor within an Environmental Planning Instrument or Instruments.
- Inclusion of appropriate statutory mechanisms within Environmental Planning Instruments to ensure developments within and surrounding the recommended corridor do not unduly restrict the future construction or operation of the future freight rail line.
- Provide certainty for landowners and developers within and surrounding the recommended corridor.

9.1.1 COMMONWEALTH POLICIES AND LEGISLATION

The Australian Government also has an interest in land use and planning, especially where it has the potential to impact on nationally significant environmental items and communities. This section highlights the key piece of Commonwealth legislation that should be considered as part of the statutory planning process.

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places — defined in the Act as being matters of national environmental significance.

9.1.2 NSW LEGISLATION

ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

Planning in NSW is governed primarily by the *Environmental Planning and Assessment Act 1979*, which provides a framework for both strategic and statutory planning. The Act sets out the mechanisms for the management, development and conservation of land and the provision of opportunity for public involvement and participation in the environmental planning and assessment process.

Part 3 of the Act relates to Environmental Planning Instruments, which control how development may be carried out on land. Two types of Environmental Planning Instrument can be made under the Act:

- State Environmental Planning Policy (SEPP) — prepared for areas or items of State or regional importance.
- Local Environmental Plan (LEP) — prepared for individual LGAs to guide development through the use of land use zones and development standards.

Section 37 of the Act permits the Governor to make an Environmental Planning Instrument for the purpose of environmental planning by the State. Any such instrument is called a State Environmental Planning Proposal (SEPP) and can include provisions for the rezoning of land including environmental studies, engagement requirements and matters for consideration.

Similarly, Section 53 permits the Minister to make Environmental Planning Instruments for local areas for the purposes of environmental planning in each local government area (outside the Greater Sydney Region) or in other areas of the State (including coastal waters of the State as the Minister determines).

9.1.3 NSW LEGISLATION, GUIDELINES AND STATE ENVIRONMENTAL PLANNING POLICIES

Others Acts, polices and guidelines that should also be taken into consideration when developing corridor protection mechanisms are:

- *Water Management Act 2000.*
- *Biodiversity Conservation Act 2016.*
- *National Parks and Wildlife Act 1974.*
- *Crown Lands Act 1989.*
- *Heritage Act 1977.*
- *Native Title (New South Wales) Act 1994.*
- *Fisheries Management Act 1994.*
- *Contaminated Land Management Act 1997.*
- *Land Acquisition (Just Terms Compensation) Act 1991.*
- *State Environmental Planning Policy (Exempt and Complying Development Codes) 2008.*
- *State Environmental Planning Policy (Coastal Management) 2018*
- *State Environmental Planning Policy No. 55 – Remediation of Land*
- *State Environmental Planning Policy (Koala Habitat Protection) 2020*
- *State Environmental Planning Policy (Koala Habitat Protection) 2021*
- Planning Guideline for Major Infrastructure Corridors, Department of Environment and Planning, undated.

9.1.4 LOCAL ENVIRONMENTAL PLANS

The recommended corridor extends across three local government areas, and as such, three regulatory Local Environment Plans are in place, each with a different set of planning controls. The three Local Environmental Plans that need to be considered when developing statutory planning mechanisms for the Lower Hunter Freight Corridor are:

- Newcastle Local Environmental Plan 2012.
- Lake Macquarie Local Environmental Plan 2014
- Cessnock Local Environmental plan 2011.

9.2 STATUTORY PROTECTION CONSIDERATIONS

An Explanation of Intended Effects is on public exhibition for the proposed protection of the corridor under the planning system.

This section provides a summary of the proposed mechanisms to protect the corridor and the desired outcomes of corridor protection for the Lower Hunter Freight Corridor.

9.2.1 *PROPOSED MECHANISMS FOR STATUTORY PROTECTION*

As detailed in the Explanation of Intended Effects, the corridor is proposed to be protected by rezoning the land to SP2 Infrastructure. Under the State Environmental Planning Policy (Major Infrastructure Corridors) 2020, landowners will maintain the ability to lodge development applications for uses that were previously permissible under the former zoning, facilitating the continued use of the land prior to infrastructure delivery. Development applications that proposed works of value of \$200,000 or over would be referred to Transport for NSW for their concurrence. Zoning the corridor to SP2 Infrastructure also provides the ability for landowners to initiate acquisitions requests under the Land Acquisition (Just Terms Compensation) Act 1991.

9.2.2 *MATTERS FOR CONSIDERATION*

Matters such as noise and mining and subsidence may differ by location and the physical structures necessary to facilitate and minimise impacts of and from a future rail line. The following section highlights key considerations when amending the planning controls for the Lower Hunter Freight Corridor.

NOISE

The corridor width has been proposed to ensure that all physical structures would be able to be located within its limits. However, there are some wider effects from noise, which may impact upon the amenity of new residents and workers if not managed appropriately.

Existing NSW guidelines for developments adjoining busy road and rail corridors, the Development Near Rail Corridors and Busy Roads – Interim Guidelines, may be of relevance for development sites affected by this proposed buffer area.

MINING AND SUBSIDENCE

Given the topography between Fassifern and Killingworth, it is likely that future infrastructure within the corridor at this location would be required to be in tunnel and therefore acquisition of land may not be necessary.

However, mechanisms should be considered that would protect the land above the tunnel to prevent the corridor from being undermined or the structural integrity of a future rail tunnel being compromised.

Consultation between Transport for NSW, Department of Planning, Industry and Environment and mine operators and licensees on the nature of past, present and future mining operations within the vicinity of the recommended corridor should be undertaken to determine the best way to protect land for the Lower Hunter Freight Corridor.

10 THE PROCESS GOING FORWARD

This draft Strategic Environmental Assessment is intended to support the community and stakeholder engagement for the identification of the recommended Lower Hunter Freight Corridor. This report provides the strategic justification for the Lower Hunter Freight Corridor, the process of identifying the recommended corridor alignment against project objectives, and an analysis of how potential impact mitigation would be addressed during the delivery phase of the project.

Before making an Environmental Planning Instrument to protect the corridor, the Department of Planning, Industry and Environment will consider feedback from the community on the proposed protection mechanisms, as well as considering Transport for NSW’s response to any feedback received on the preferred alignment and draft Strategic Environmental Assessment. Figure 10.1 demonstrates these next steps within the context of the overall planning process for the protection and future construction of infrastructure in the Lower Hunter Freight Corridor.

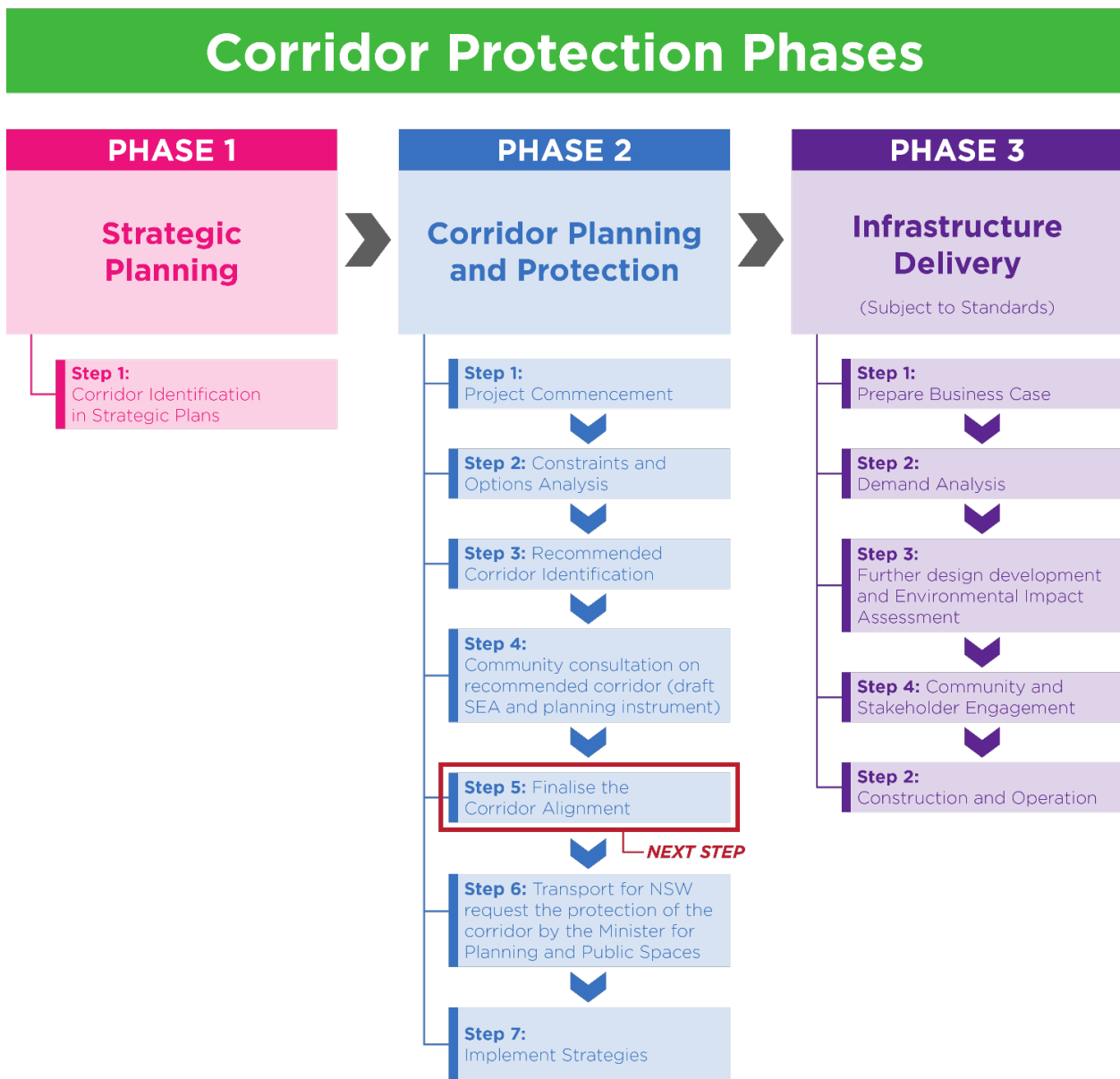


Figure 10.1 Next steps in the Lower Hunter Freight Corridor process

REFERENCES

- City of Newcastle Council (2020). Local Strategic Planning Statement – Planning Newcastle 2040: Global City, Local Character.
- Department of Planning (2006). Lower Hunter Regional Strategy.
- Department of Planning (2011). Newcastle – Lake Macquarie Western Corridor Planning Strategy.
- Department of Planning and Environment (2016). Hunter Regional Plan 2036.
- Department of Planning and Environment (2018). Greater Newcastle Metropolitan Plan 2056.
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- Transport for NSW (2014). Hunter Regional Transport Plan.
- Transport for NSW (2018a). Future Transport 2056.
- Transport for NSW (2018b). NSW Freight and Ports Plan 2018-2023
- Transport for NSW (2018c). Greater Newcastle Future Transport Plan.
- Transport for NSW (2018d). Regional NSW Services and Infrastructure Plan.

APPENDIX A

DRAFT STRATEGIC ENVIRONMENTAL
ASSESSMENT SCOPE



A1 DRAFT STRATEGIC ENVIRONMENTAL ASSESSMENT SCOPE

The following table represents the scope requirements that were sent to Transport for NSW by the Department of Planning, Industry and Environment. The relevant section where the scope requirement is met is detailed in the table.

PARAMETER	DETAILS	RELEVANT SECTION
Content of the Strategic Environmental Assessment	<p>The Strategic Environmental Assessment should address:</p> <p>The strategic justification:</p> <p>[This section should provide a description of the strategic need for the future infrastructure project, as well as provide the rationale for why reservation of a corridor is required at this time. This section should detail the overall objectives of the project as well as how the reservation fits within current government strategic plans and policies at all levels (Local, State and Federal)].</p> <p>Requirements for this section include:</p> <p>Outline the long term transport planning context of the Hunter Region and the project’s broader application to the NSW transport network.</p> <ul style="list-style-type: none"> — Provide strategic justification of the proposed future infrastructure, the overarching objectives of the project and the long term outcomes it seeks to achieve. Consideration should be given to: <ul style="list-style-type: none"> — The strategic transport need for the proposed future infrastructure — How the proposed future infrastructure will integrate with broader transport network (existing and proposed) in the adjoining districts and region — How the corridor reservation and proposed infrastructure project aligns or conflicts with strategic plans or policies (Local, State and Federal) — Analyse alternative solutions that could be undertaken to address the strategic need identified above. This should include: <ul style="list-style-type: none"> — Other transport scenarios (such as a ‘do-nothing’ scenario or a ‘build when required’ [without reservation] scenario); and — Assessment of the strategic costs and benefits of reserving the corridor compared to the alternative transport solutions and consequence of these other solutions. 	Chapter 4
	<p>The infrastructure project and its components</p> <p>[This section should provide an overview of the business requirements of the potential future infrastructure which will be used to inform the corridor alignment.]</p> <p>Requirements for this section include:</p> <ul style="list-style-type: none"> — A high level description of the business requirements of the future infrastructure and any related considerations that will form part of determining the corridor alignment. 	Chapter 3

PARAMETER	DETAILS	RELEVANT SECTION
	<p>These include:</p> <ul style="list-style-type: none"> — Identifying the strategic locations that the future infrastructure project needs to connect (e.g. servicing future growth areas, access to intermodal terminals) — Width needed for a future corridor (e.g. differing infrastructure needs/design over the extent of the corridor) — Strategic connections to other infrastructure networks (e.g. rail, road and cycle modes or key interchanges) — Strategic design requirements (e.g. slope or topography, design standards). 	
	<p>Corridor alignment constraints analysis</p> <p>[This section should identify and provide a strategic assessment of the corridor investigation area constraints.]</p> <p>Requirements for this section include:</p> <ul style="list-style-type: none"> — Strategic environmental opportunities and constraints within the corridor investigation area. — Existing land uses within the corridor investigation area. — Outline the process by which corridor alignments constraints were identified and corridor options assessed. This should include: <ul style="list-style-type: none"> — Describe to process of how the corridor options were derived (e.g. investigation area, constraints analysis) — Explanation of multi-criteria analysis used to assess the constraints within the corridor investigation area — A summary of the assessment of corridor alignment options — Relevant summary of how corridor options have considered the key issues in sections 5-15 of these requirements. 	Chapter 5 and Chapter 6
	<p>Recommended corridor alignment</p> <p>[This section should provide a detailed description of the recommended corridor alignment and how it achieves the overarching objectives of the corridor and the potential future infrastructure, with reference to how the corridor alignment integrates and supports strategic plans.]</p> <p>Requirements for this section include:</p> <ul style="list-style-type: none"> — A description and map of the recommended corridor alignment and potential construction methodology for the future infrastructure. This includes notation of above or below ground construction. — Provide an overview which outlines how the recommended corridor alignment: <ul style="list-style-type: none"> — Meets the overarching objectives of the project — Relates and interacts with existing and proposed infrastructure and transport networks — Integrates with strategic plans and supports broader objectives of the Hunter region, including its connections to the wider freight network (e.g. growth planning, land use and infrastructure strategies) — Identify the sections of the recommended corridor alignment which require reservation (e.g. sections at grade requiring rezoning or tunnel sections requiring design considerations to be applied). 	Section 6.3 and Chapter 7

PARAMETER	DETAILS	RELEVANT SECTION
	<ul style="list-style-type: none"> — Detail how the recommended corridor alignment has considered the key issues in sections 5-15 of these requirements. 	
Issues for assessment	<p>The Strategic Environmental Assessment must also address the following specific matters for the recommended corridor alignment.</p> <p>An assessment of all key issues is required for the sections of the recommended corridor alignment requiring reservation. Sections of the recommended alignment that are proposed to be underground (and therefore will not be reserved) are only required to address the matters that are marked with an *.</p> <p>Land use and property impacts</p> <p>[This section should identify the land use and property impacts within the recommended corridor and adjacent to the recommended corridor alignment. This section should also describe how land use and property impacts were avoided, minimised and/or offset to reduce potential impacts of the recommended corridor alignment on surrounding land uses and properties.]</p> <p>Requirements for this section include:</p> <ul style="list-style-type: none"> — Identify the current land uses within the recommended corridor alignment and describe the potential impacts of the recommended corridor alignment on: <ul style="list-style-type: none"> — Residential land uses — Industrial land uses — Open space/recreational/national parks — Agricultural land — Extractive/mineral/energy resources* — Utility infrastructure* — Major transport infrastructure* — For each land use specify the number of existing lots and potential lots (based on draft environmental planning instruments and development proposals) affected by the recommended corridor alignment. — Consider the potential implications of relevant legislation or protected land ownership, for example: <ul style="list-style-type: none"> — Crown Lands — Native Title Act 1993 — National Parks & Wildlife Act 1974 — Where applicable, outline how the recommended corridor alignment has avoided, minimised and/or offset its impacts to reduce the impact of the recommended corridor alignment on surrounding land uses and properties.* — Consideration of any potential cumulative impacts on the land within the recommended corridor alignment created by the potential future infrastructure and other existing and future infrastructure development. — Outline any recommended mitigation strategies to assist minimising impacts of the recommended corridor on surrounding land uses and properties.* — Outline where future detailed assessments would be required as part of the Environmental Impact Assessment of the future infrastructure.* 	<p>Chapter 7</p> <p>Section 7.1 and Section 7.16</p>

PARAMETER	DETAILS	RELEVANT SECTION
	<p>Future land use opportunities</p> <p>[This section should identify possible future land use changes or opportunities that could be capitalised on as a result of the potential future infrastructure within the recommended corridor alignment.]</p> <p>Requirements for this section include:</p> <ul style="list-style-type: none"> — Outline potential future land use opportunities surrounding the corridor as a result of the potential future infrastructure, including commentary on potential: <ul style="list-style-type: none"> — Economic growth — Areas of change (such as interchanges or major connections with other major infrastructure projects (current and future)) — Housing growth — Consideration of the potential future infrastructure in relation to the Hunter Regional Plan. 	Section 7.2
	<p>Economic impacts</p> <p>[This section should provide an overview of potential future economic impacts and opportunities that may be created by the potential future infrastructure. Economic impacts to the wider region are also to be commented on, providing short, medium and long term scenarios.]</p> <p>Requirements for this section include:</p> <ul style="list-style-type: none"> — Provide commentary on the potential economic impacts of both reserving the corridor and the delivery of the potential future infrastructure. Including: <ul style="list-style-type: none"> — Expected economic (or productivity) change created by the potential future infrastructure. This includes: <ul style="list-style-type: none"> — consideration of the wider economic impact of the potential future infrastructure on the Hunter Region — regional or strategic centres or key employment locations or whether the potential future infrastructure may generate opportunities for new employment locations or centres — the potential cumulative economic impacts of the corridor when considered alongside other infrastructure projects. 	Section 7.15
	<p>Traffic and transport</p> <p>[This section should provide an assessment of the potential impacts of the recommended corridor alignment and potential future infrastructure on the surrounding area of the corridor.]</p> <p>Requirements for this section include:</p> <ul style="list-style-type: none"> — A description of how the recommended corridor alignment will meet the transport related objectives of the corridor and potential future infrastructure. Consideration to be given to: <ul style="list-style-type: none"> — Sensitive land uses — Future growth areas — Strategic plans (current and proposed/draft) 	Section 7.4 and Section 7.16

PARAMETER	DETAILS	RELEVANT SECTION
	<ul style="list-style-type: none"> — Provide an assessment of the traffic and transport impacts on the local, regional, State and National road and rail network. This includes opportunities for potential extension of these networks or identifying where networks may need to be severed due to the potential future infrastructure project and corridor alignment. — Where applicable, outline how the recommended corridor alignment has avoided, minimised and/or offset its impacts so as to reduce negative impact of the recommended corridor alignment on the surrounding traffic flows and transport demand. — Consideration of the potential cumulative impacts on the transport infrastructure within the corridor created by the potential future infrastructure and other existing and future infrastructure development. — Outline any recommended mitigation strategies to assist minimising negative impact of the potential future infrastructure on surrounding traffic flows and transport demand. — Outline where future detailed assessments would be required as part of the Environmental Impact Assessment of the future infrastructure. 	
	<p>Noise and Vibration*</p> <p>[This section should assess the potential noise and vibration impacts of the potential future infrastructure in the vicinity of the recommended corridor alignment. An indicative map of the potential noise and vibration impacts within the vicinity of the corridor.]</p> <p>Requirements for this section include:</p> <ul style="list-style-type: none"> — Identify sensitive land uses (current and future) surrounding the corridor likely to be impacted by the potential noise and vibration of the potential future infrastructure. — Where applicable, outline how the recommended corridor alignment has avoided, minimised and/or offset its impacts so as to reduce the noise and vibration impact of the potential future infrastructure on the surrounding sensitive land uses. — Outline any recommended mitigation strategies to assist minimising the noise and vibration impacts of the potential future infrastructure on surrounding sensitive land uses. — Outline where future detailed assessments would be required as part of the Environmental Impact Assessment of the future infrastructure. 	Section 7.5
	<p>Visual Amenity, Built Form and Urban Design</p> <p>[The visual impact of the recommended corridor alignment and subsequent potential future infrastructure should be identified, with consideration given to visual amenity, built form and urban design of the areas surrounding the corridor.]</p> <p>Requirements for this section include:</p> <ul style="list-style-type: none"> — Identifying strategic visual, built or urban form impacts of the potential future infrastructure on the surrounding area. — Where applicable, outline how the recommended corridor alignment has avoided, minimised and/or offset its impacts on the surrounding visual, built or urban form. 	Section 7.6

PARAMETER	DETAILS	RELEVANT SECTION
	<ul style="list-style-type: none"> — Outline any recommended mitigation strategies to assist minimising the impacts of the potential future infrastructure on surrounding visual, built or urban form. — Outline where future detailed assessments would be required as part of the Environmental Impact Assessment of the future infrastructure. 	
	<p>Soils and Water*</p> <p>[This section should identify soil and water issues related to the recommended corridor alignment.]</p> <p>Requirements for this section include:</p> <ul style="list-style-type: none"> — Identify and describe the geological and hydrological conditions within and surrounding the recommended corridor alignment. Consideration is to be given to: <ul style="list-style-type: none"> — Key hydrological features (e.g. watercourses, dams) — Water supply — Acid sulfate soils — Contaminated land — Describe the hydrological and geological impacts in relation to the recommended corridor and potential future infrastructure, including the strategic assessment of: <ul style="list-style-type: none"> — Location and nature of flood regimes affecting the corridor or to be affected by the potential future infrastructure — Potential impacts on surface water, groundwater, soils, flooding, riparian areas and potable water — Where applicable, outline how the recommended corridor alignment has avoided, minimised and/or offset its impacts on the surrounding hydrological and geological features. — Consideration of the potential cumulative impacts on the hydrological and geological conditions surrounding the corridor created by the potential future infrastructure and other existing and future infrastructure development. — Outline any recommended mitigation strategies to assist minimising the impacts of the potential future infrastructure on surrounding hydrological and geological conditions. — Outline where future detailed assessments would be required as part of the Environmental Impact Assessment of the future infrastructure. 	<p>Section 7.7, Section 7.8 and Section 7.16</p>
	<p>Biodiversity</p> <p>[This section should evaluate the current ecological values within the recommended corridor alignment and identify potential impacts on those ecological values as a result of the potential future infrastructure. This section should also identify how offset obligations will be addressed after the corridor is reserved.]</p>	<p>Section 7.9 and Section 7.16</p>

PARAMETER	DETAILS	RELEVANT SECTION
	<p>Requirements for this section include:</p> <ul style="list-style-type: none"> — Provide a strategic assessment of the potential ecological impacts of the corridor reservation and potential future infrastructure both within the corridor and adjoining with specific reference to: <ul style="list-style-type: none"> — Wetlands — Vegetation and habitat clearing — Connectivity — Edge effects — Riparian/aquatic habitat and marine vegetation — Soil and water quality — Adjoining waterways — Salinity, erosion and sedimentation — Ongoing water management — Where applicable, outline how the recommended corridor alignment has avoided, minimised and/or offset its impacts on the ecological values of the corridor investigation area. This may include: <ul style="list-style-type: none"> — Outlining the approach to offset strategies for ecological impacts and native vegetation clearing — Consideration of NSW Biodiversity Offsets Policy for Major Projects (<i>Office of Environment and Heritage, 2014</i>) — Consideration of the potential cumulative impacts on the ecological values surrounding the corridor created by the potential future infrastructure and other existing and future infrastructure development. — Outline any recommended mitigation strategies to assist minimising the impacts of the potential future infrastructure on surrounding ecological values and within the corridor. — Outline where future detailed assessments would be required as part of the Environmental Impact Assessment of the future infrastructure. <p>All biodiversity assessments should take into account:</p> <ul style="list-style-type: none"> — Impacts on features of High Environmental Value, as described in the relevant Regional Plan; — <i>Draft Guidelines for Threatened Species Assessment</i> (Department of Environment and Conservation/Department of Primary Industries 2005); — <i>Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities</i> (Department of Environment and Conservation 2004); — <i>Draft Policy and Guidelines for Fish Habitat Conservation and Management – Update 2013</i> (Department of Primary Industries 2013); and — <i>Guidelines for Aquatic Habitat Management and Fish Conservation</i> (Department of Primary Industries 1999). 	

PARAMETER	DETAILS	RELEVANT SECTION
	<p>Heritage</p> <p>[This section should identify the impact of the recommended corridor alignment and subsequent potential future infrastructure on aboriginal and non-aboriginal heritage.]</p> <p>Requirements for this section include:</p> <ul style="list-style-type: none"> — Identify the State and local aboriginal and non-aboriginal heritage affected by the recommended corridor alignment including: <ul style="list-style-type: none"> — Heritage items — Conservation areas — Areas of cultural and archaeological significance — Describe the potential impacts of the recommended corridor alignment and potential future infrastructure on the identified State and local aboriginal and non-aboriginal heritage in the corridor. — Where applicable, outline how the recommended corridor alignment has avoided, minimised and/or offset its impacts on the aboriginal and non-aboriginal heritage in or directly adjacent to the recommended corridor alignment. — Consideration of the potential cumulative impacts on the aboriginal and non-aboriginal heritage in the corridor created by the potential future infrastructure and other existing and future infrastructure development. — Outline any recommended mitigation strategies to assist minimising the impacts of the potential future infrastructure on aboriginal and non-aboriginal heritage in the corridor. — Outline where future detailed assessments would be required as part of the Environmental Impact Assessment of the future infrastructure. 	<p>Section 7.10, Section 7.11 and Section 7.16</p>
	<p>Air Quality</p> <p>[This section should identify possible air quality impacts of the potential future infrastructure with consideration of local and regional air quality.]</p> <p>Requirements for this section include:</p> <ul style="list-style-type: none"> — Identify possible air quality impacts of the potential future infrastructure and corridor reservation on the local and regional air quality with specific consideration given to sensitive receivers. — Where applicable, outline how the recommended corridor alignment has avoided, minimised and/or offset its impacts on the local and regional air quality. — Outline any recommended mitigation strategies to assist minimising the impacts of the potential future infrastructure on local and regional air quality. — Outline where future detailed assessments would be required as part of the Environmental Impact Assessment of the future infrastructure. 	<p>Section 7.12</p>

PARAMETER	DETAILS	RELEVANT SECTION
	<p>Social</p> <p>[This section should evaluate the impacts of the recommended corridor alignment and subsequent potential future infrastructure on the directly affected community and its facilities and/or services should be identified and discussed in this section.]</p> <p>Requirements for this section include:</p> <ul style="list-style-type: none"> — Provide a strategic assessment of the social impacts of the recommended corridor alignment and potential future infrastructure on the directly affected community and community facilities/services. — Where applicable, outline how the recommended corridor alignment has avoided, minimised and/or offset its impacts on the community and its facilities/services. — Consideration of the potential cumulative impacts on the community and its facilities/services created by the potential future infrastructure and other existing and future infrastructure development. — Outline any recommended mitigation strategies to assist minimising the impacts of the potential future infrastructure on the community and its facilities/services. — Outline where future detailed assessments would be required as part of the Environmental Impact Assessment of the future infrastructure. 	Section 7.14 and Section 7.16
	<p>Environmental Risk Analysis</p> <p>[This section is to include an environmental risk analysis summary which should identify the potential environmental impacts associated with the recommended corridor alignment.]</p> <p>Requirements for this section include:</p> <ul style="list-style-type: none"> — Provide a matrix assessment of the potential impacts associated with the recommended corridor alignment and the potential future infrastructure (as identified in sections 5-15) with specific attention given to: — Strategic mitigation measures and their staged application — Potentially significant residual environmental impacts after mitigation measures are applied. 	Section 7.17
Consultation	<p>During the preparation of the Strategic Environmental Assessment, there is an expectation that the agency will consult with the relevant local, State and/or Commonwealth Government authorities, service providers, community groups and affected landowners. This may involve:</p> <ul style="list-style-type: none"> — Local, State and Commonwealth government authorities, including engaging with Department of Planning, Industry and Environment about the preparation of the District Plans or Regional Plans; — Specialist interest groups, including Local Aboriginal Land Councils, and others such as Aboriginal stakeholders; — relevant utilities and Environmental Assessment service providers; and — the public, including community groups and adjoining and affected landowners. 	Chapter 8

PARAMETER	DETAILS	RELEVANT SECTION
	<p>The Strategic Environmental Assessment should describe the consultation process and the issues raised and identify where the design of the project or the project alignment has been amended in response to these issues. Where amendments have not been made to address an issue, a short explanation should be provided.</p>	
<p>Statutory planning considerations</p>	<p>Statutory planning considerations: Current planning framework*</p> <p>[This section should identify the existing Environmental Planning Instruments that apply to the recommended corridor alignment and relevant sections or clauses that will be affected by potential statutory planning controls in relation to the corridor reservation.]</p> <p>Requirements for this section include:</p> <ul style="list-style-type: none"> — Identify the existing Environmental Planning Instruments that apply to the recommended corridor and relevant sections or clauses that will be affected by potential statutory planning controls in relation to the corridor reservation. — This should include: <ul style="list-style-type: none"> — All existing relevant local environmental plans — All existing relevant State Environmental Planning Policies — All existing relevant structure plans and Local Action Plans and Development Control Plans — All existing relevant Land Use and Infrastructure Strategies — Other plans, polices and strategies relevant to the recommended corridor <hr/> <p>Statutory planning considerations: Future planning framework*</p> <p>Requirements for this section include:</p> <ul style="list-style-type: none"> — Identify the sections of the recommended corridor alignment that need to be reserved. — Identify if any design considerations should be considered for unreserved sections of the recommended corridor alignment. — Identify if there should be any design considerations for the area within the vicinity of the corridor, and if so, the extent to which these considerations should apply. 	<p>Chapter 9</p>

APPENDIX B

OPTIONS ASSESSMENT



B1 OPTIONS ASSESSMENT

B1.1 INTRODUCTION

This appendix provides a summary of the options development and Multi-criteria assessment (MCA) which was carried out for the Lower Hunter Freight Corridor (LHFC). The information contained in this chapter was prepared by Transport for NSW in April 2021.

B1.2 DEFINING THE INVESTIGATION AREA AND OPTION CREATION

The purpose of options creation is to generate a long list of potential corridor alignments that would support the project and corridor objectives discussed in Chapter 2.

The initial corridor option creation process was deliberately kept broad but, to avoid unfeasible options being taken forward, the following considerations were taken into account:

- Avoid challenging natural topography, such as steep slopes. Flooding through the Hexham landscape was not considered a fatal flaw due to the fact that the existing Main North Rail Line in this locality would be flooded during major rainfall events and main line rail services suspended.
- Avoid existing and planned communities where possible. This included the use of government owned land where available.
- Avoid locations with the most sensitive constraints, such as critical habitat, Aboriginal and non-Aboriginal heritage and environmentally sensitive areas.
- To provide as direct a route as possible ensuring options deliver a travel time saving when compared to the existing rail network through Newcastle.
- To minimise the requirement for complex structures such as bridges and tunnels that would increase the cost of the project to a point where it becomes uneconomical to deliver.

Reviewing the study area based on these considerations allowed some options to be excluded quickly and for focused investigations on other constraints to be carried out.

B1.3 INITIAL OPTIONS IDENTIFICATION

The Project team used the LHFC objectives, business requirements and the constraints mapping discussed in the previous chapter to inform the development of a range of alignments connecting the Main North Rail Line near Fassifern and the Hunter Valley Coal Rail Network near Hexham.

At commencement of the options analysis process the Project team considered very broad corridor alignments based on initial constraints analysis. The study area at this stage of analysis was also very broad and included land west of the M1 Pacific Motorway and north to Thornton. These alignments and the underlying constraints analysis is shown in Figure B.1.

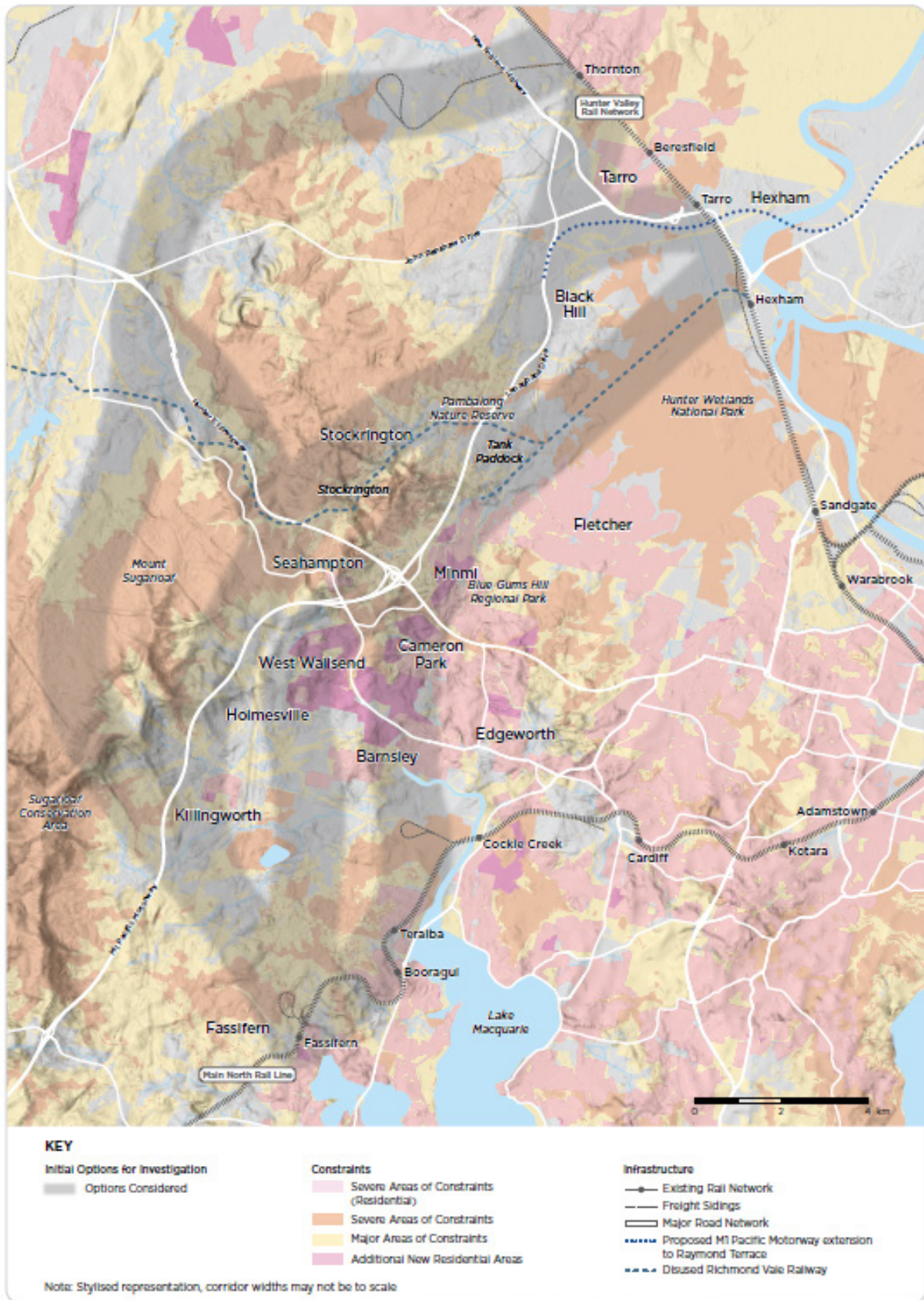


Figure B.1 High level corridor options

The major areas of constraint identified in Figure B.1 include:

- Existing communities and approved future urban growth including at Minmi, Cameron Park and Black Hill.
- Records of Aboriginal and Non-Aboriginal heritage items and sites.
- Major utility easements (such as electricity powerlines near Killingworth).
- Areas of flooding (such as near Hexham and Maitland).
- State conservation areas and existing and proposed National Parks.
- Land of significant slope (6-20 degrees and 45-70 degrees).
- The Booragul Loop on the Main North Rail Line near Fassifern was identified as a significant constraint on the existing network for freight trains. The grade near the Booragul Loop is 1 in 40 or 2.5 per cent.

There are also areas of opportunity identified in Figure B.1, these include:

- Using previously developed railways or existing disturbed land (such as the Richmond Vale Railway between Lenaghan and Hexham, a former rail corridor in use until the mid-1980's).
- The availability of government owned land adjoining the M1 Pacific Motorway corridor, which has been identified to support electricity easements as well as the Australian Government investigation into a high speed rail corridor in 2013.
- Analysis undertaken by the Project team suggested options located further to the west of the existing M1 Pacific Motorway corridor are generally less feasible due to:
 - Longer travel times to port compared with other options and the existing rail network through Newcastle between Fassifern and Hexham.
 - Undulating land with steeper slopes. West of the M1 Pacific Motorway, options would require significant tunnelling in challenging areas for construction which include existing areas of National Park. Aside from substantial cost, long tunnels for rail freight present challenges for future operation and potential significant reductions in service capacity.
 - Unstable terrain due to mine subsidence. The Sugarloaf Ranges west of the M1 Pacific Motorway has a history of geological instability and subsidence events.
 - Significant potential impacts for existing communities at Thornton and Tarro resulting from a future rail junction near Thornton.

Based on constraints analysis undertaken by the Project team and with support from subject matter experts, a long list of options was developed.

B1.4 LONG LIST OF OPTIONS

A total of eleven end to end corridor options were identified by the Project team for further analysis. The corridor options were developed by overlaying alignments using rail design software against existing constraints mapping. The long list of options is shown Figure B.2.



KEY

- Southern Connections**
- Fassifern
 - Rhondda Road
 - Teralba Colliery

- Central Connections**
- Killingworth
 - West Wallsend
 - Cameron Park

- Northern Connections**
- Four Mile
 - Thornton
 - Tarro
 - Hexham via Seahampton
 - Hexham via Minmi

- Environment**
- NSW National Park and Wildlife Service Estate
 - Lands acquired under National Parks and Wildlife Act
 - Other Parks

- Infrastructure**
- Existing Rail Network
 - Freight Sidings
 - Major Road Network
 - Proposed M1 Pacific Motorway extension to Raymond Terrace
 - Disused Richmond Vale Railway

Note: Stylised representation, corridor widths may not be to scale

Figure B.2 Long list of options

To develop the ‘long list’, the study area was separated into three sections, Southern, Central and Northern. The options in each section are described below in Table B.1, Table B.2 and Table B.3, and shown in Figure B.2.

Table B.1 Southern connections




Fassifern	Rhondda Road	Teralba Colliery
	 Connects to the Main North Line between Booragul and Teralba stations. Alignment continues through existing quarry operation.	

Table B.2 Central connections









Killingworth	West Wallsend	Cameron Park
 Proceeds west of West Wallsend Colliery and passes west of Killingworth, east of the Sydney – Newcastle Freeway.		 Provides a more direct route between Barnsley and Cameron Park heading north. Alignment passes through undulating terrain.

Table B.3 Northern connections

Four Mile	Thornton	Tarro	Hexham via Seahampton	Hexham via Minmi
 Original extreme northernmost option to test the opportunity for opening potential mine sites.		 New tunnel from central connection, then follows existing old rail corridor to M1 Pacific Motorway. Follows M1 Pacific Motorway and utilises the same corridor as the future M1 Pacific Motorway extension.	 New Tunnel from central connection follows old rail corridors to the M1 Pacific Motorway then instead of following the M1 Pacific Motorway uses more old rail corridors to connect across Hexham Wetlands to Hexham holding roads.	 From Cameron Park this option heads under a new tunnel to Minmi. Then it follows old rail corridors to connect across Hexham Wetlands to Hexham holding roads.

B1.5 MULTI CRITERIA ANALYSIS (MCA)

A multi criteria analysis (MCA) process was used to examine the comparative performance of the long list corridor options. This was based on six criteria and sixteen sub criteria, which expand on the LHFC objectives and business requirements. The sub criteria assist in identifying the specific aspect of broader criteria and where options have different performance outcomes.

The assessment process involved the Project team and other subject matter experts (e.g. ecologists, flooding and geology specialists, heritage experts, and social planners) scoring the options through a collaborative process that again drew on the constraints and opportunities mapping discussed in Chapter 5.

Each of the criteria are outlined below.

COMMUNITY IMPACTS

*Based on LHFC Corridor Objective 1: Freight rail within urban communities can have significant impacts on amenity and quality of life through noise and air pollution. A new corridor will improve amenity within existing areas but needs to be balanced with the **impacts on future communities** and the environmental constraints associated with building a new corridor.*

This criterion relates to community impacts associated with Objective 1 and assesses how corridor options might affect existing and future communities through consideration of the following:

Property and social impacts: potential impact of options is considered over three sub-criteria including:

- Direct and indirect property impacts and the significance of those impacts on residential and commercial properties, public open space and the potential for any barriers created by options between, for example, local centres or social infrastructure (e.g. schools, parks, community facilities) and their catchments.
- Noise impacts in terms of their possible impact on sensitive receivers (e.g. schools, residential areas).
- Visual impacts on landscape in terms of their possible impact on sensitive landscapes.
- Aboriginal and non-Aboriginal heritage impacts: the impact has been assessed based on three sub criteria including:
 - The presence of Aboriginal Heritage Information Management System (AHIMS) listed sites impacted
 - Impact on other known sites previously identified as having heritage or cultural value and consideration of cultural mapping outcomes.
 - State and local government sites impacted and the nature of the impacts.
- Physical impacts: potential to share existing infrastructure corridors where possible (e.g. within the existing M1 Pacific Motorway corridor) and seeks to utilise existing government land.

ENVIRONMENTAL IMPACTS

*Based on LHFC Corridor Objective 1: Freight rail within urban communities can have significant impacts on amenity and quality of life through noise and air pollution. A new corridor will improve amenity within existing areas but needs to be balanced with the impacts on future communities and the **environmental constraints associated with building a new corridor**.*

This criterion considers future environmental impacts associated with Objective 1 and assesses how corridor options might impact the environment through consideration of the following:

- Environmental impacts: possible impact of options on the natural environment was assessed across three sub-criteria reflecting State, Commonwealth, and local government environmental policies and responsibilities:
- Minimise impact on biodiversity including vulnerable, endangered and critically endangered ecological communities by assessing the area and significance of impact.

- Minimise the extent of native vegetation clearance including flora and fauna by assessing the area lost and the level of significance of those impacts in the context of the status of affected species.
- Minimise impacts to hydrology and riparian corridors: the options were considered in terms of how they may affect water flows in terms of water quality and quantity (flooding), and level of challenge in appropriately managing issues in light of relevant regulation.

INTEGRATED LAND USE AND TRANSPORT

Based on LHFC Corridor Objective 2: Preservation of a freight corridor will allow for certainty in land use planning as Greater Newcastle and the Lower Hunter expand due to population growth. Future land use will incorporate the corridor and enable supporting land uses, ensuring future sensitive noise receivers will not be located close to the corridor.

This criterion assessed the effects of the options on supporting the Government’s strategic spatial and transport planning (Hunter Regional Plan 2036 (DPE, 2016), Greater Newcastle Future Transport Plan (Transport for NSW, 2018c)). To undertake this, two sub-criteria were identified:

- Integration with existing and planned transport: Qualitative assessment based on corridor alignment and integration with other projects identified in strategic planning documents (i.e. potential to align with future extension of the M1 Pacific Motorway extension to Raymond Terrace).
- Coordination with precinct planning: Assessment of the corridor options impact on existing/future residential developments and existing/future businesses, including mining operations.

FREIGHT MOVEMENT

Based on LHFC Corridor Objective 3: To provide an efficient flow of goods through separation of freight and passenger rail between Sydney and Newcastle.

Removing the constraint of the shared passenger and freight rail network through Greater Newcastle would improve efficiency of freight movement through the region and have relieve environmental and amenity impacts for local residents along the Main North Rail Line. The shared rail network through Greater Newcastle gives priority to passenger services during commuter peak periods, which constrains freight growth and has therefore led to investigations to identify dedicated freight rail corridors including the Lower Hunter Freight Corridor.

Assessment of this criteria focuses how options can deliver transport network efficiencies, operational improvements and increase rail freight capacity. To do this, the Project team established three sub-criteria to measure:

- Amount of additional rail capacity created: measured by the number of new freight paths each option creates.
- Reliability improvements: what journey time savings does each option generate compared to the existing route.
- Comparison of costs to operate and maintain the new corridor when compared to the existing route: this considers amongst other metrics the gradients of each are option, those with more increases in gradients will generate increases in fuel consumption and emissions.

ECONOMIC GROWTH

Based on LHFC Corridor Objective 4: To support economic growth and productivity by improving the performance of the freight rail network through reduced travel times, costs and enabling transfer of freight from road to rail.

This criteria assesses the effects of the options on supporting the Hunter region’s long term economic growth by providing freight rail capacity (i.e. considering cost effective ways of constructing and delivering the project) and certainty for investment (i.e. creating opportunity through increased rail freight capacity for businesses to invest in the region).

Two sub-criteria were also identified for the assessment:

- Ability of the corridor to generate additional freight traffic: The assessment of additional freight traffic that could be generated by a new corridor (i.e. the extent to which the corridor can attract freight to transfer from road to rail).
- Ease of construction and delivery: qualitative assessment of the how the project could be constructed and delivered considering; what options exist to stage the project to meet budget requirements, the quantum of major structures, earthworks and service diversions required, the ease of connecting to the new corridor to the existing main line.

PROTECTS LONG TERM FREIGHT CORRIDORS (FUTURE PROOFING)





Based on LHFC Corridor Objective 5: By identifying the corridor at this early stage, TfNSW and the freight industry can have certainty over the future land costs for the project.

This criterion is used to assess the sustainability of identifying a suitable option now and how the infrastructure may be delivered in the future, particularly in terms of their ability to adapt and to future engineering and economic challenges. The ability of options to adapt to future needs, such as future upgrades/extensions to the corridor and more flexible freight rail operations (i.e. potential ‘double stacking’ of containers on freight trains – noting broader network changes would need to be made to accommodate these operations).

B1.6 OUTCOMES OF THE LONG LIST MCA

The Project team and subject matter experts conducted initial assessments of the options against the criteria and sub-criteria described above. Table B.4 explains the assessment scale used.

Table B.4 MCA assessment scale

	Very good performance against criterion / Very low level of constraint
	Good performance against criterion / Low constraints exist
	Reasonable performance against criterion / Medium constraints exist
	Lower performance against criterion / Significant constraints exist

The initial outcome of the MCA process in terms comparative analysis is shown in Table B.5, and is summarised below.

SOUTHERN SECTION

For the southern section, a connection from Fassifern (in part tunnel) was preferred to the Rhondda Road or Teralba options as it:

- Provided a better operational outcome by providing the longest separation of passenger and freight services on the Main North Rail Line, and best operational time savings.
- Avoided direct impacts on nearby communities by remaining in the existing rail corridor and avoiding the future community at Fennel Bay. It would also provide amenity benefits to existing communities north of Fassifern through reduced freight services.
- Minimised areas of steep terrain and established vegetation.

CENTRAL SECTION

For the central section, options were highly constrained, and the Killingworth option was eliminated early in the MCA process given the significant engineering and construction challenges, as well as impacts on cultural and biodiversity values.

The Cameron Park option would have significant impacts on existing and developing communities in Barnsley, West Wallsend and Cameron Park. It would impact land that has already been identified for urban release and development, would impact community connectivity and would visually impact a considerable number of residences.

The West Wallsend option also had limitations, specifically it would require some steeper grades, would direct or indirect impact existing community land uses (such as a cemetery and sporting fields), planned land uses (e.g. the approved Driver Training Centre at the Rhondda Colliery, or) and historical mine sites (West Wallsend Colliery No.1). It would also interface with former and existing utilities. However, it has the advantage of using Government owned land, had lower constructability risks. As such, this option was selected as the preferred option.

NORTHERN SECTION

For the northern section, three of the five options were carried forward for further options assessment:

- Tarro
- Hexham via Seahampton
- Hexham via Minmi and Black Hill.

The Four Mile option was not progressed further as it would have significantly longer journey impacts, greater impacts to private property and areas of National Park, increased subsidence risks and other engineering challenges which would increase cost and constructability risks.

The Thornton option was also not carried forward due to the longer route and travel times to major Newcastle freight destinations, increased impacts on existing communities and private property, and impacts on the wetlands at Beresfield. It also had increased complexity with interfaces with existing road and rail infrastructure, and required a greater number of grade separated crossings with several major roads, had impacts to road and rail infrastructure at Thornton rail station and presented difficulties in accessing the Hunter Valley Rail Network.

Table B.5 Long list MCA results

MCA Criteria	Southern Connections			Central Connections			Northern Connection				
	Fassifern	Rhondda Road	Teralba Road	Killingworth	West Wallsend	Cameron Park	Four Mile	Thornton	Tarro	Hexham via Seahampton	Hexham via Minmi
Freight Movement	●	●	●	●	●	●	●	●	●	●	●
Economic Growth	●	●	●	●	●	●	●	●	●	●	●
Community Impacts	●	●	●	●	●	●	●	●	●	●	●
Environment Impacts	●	●	●	●	●	●	●	●	●	●	●
Integrated Land Use and Transport	●	●	●	●	●	●	●	●	●	●	●
Future Proofing	●	●	●	●	●	●	●	●	●	●	●
Overall Assessment	●	●	●	●	●	●	●	●	●	●	●



B1.7 IDENTIFICATION OF SHORT LISTED OPTIONS

The long list of options were reviewed again by the Project team following the MCA process to identify initial 'end to end' options suitable for community and stakeholder engagement. This review considered the initial MCA scores, specific issues raised during the MCA deliberations, and further inputs from subject matter experts that explored in more detail potential design mitigations to determine the extent that they may improve the ultimate performance of options.

The comparative analysis of sub-options involved consideration of relative advantages and disadvantages of each sub-option. Modifications to sub-options and reasons for not proceeding with some sub-options during this phase of the analysis are detailed in the following sections.

B1.8 SOUTHERN CONNECTIONS

The analysis confirmed that a connection from Fassifern (partially in tunnel) was preferred to either Rhondda Road or Teralba.

The rationale for progressing the Fassifern connection rather than Rhondda Road and Teralba is summarised below:

- Achieves the longest separation of passenger and freight rail services on the Main North Rail Line. The Fassifern connection departs the shared network approximately seven kilometres earlier than other sub-options.
- The Fassifern options outperformed the Rhondda Road options on environmental grounds with the inclusion of tunnel section that avoided steep terrain and established woodlands. Fassifern and Teralba were relatively comparable on environmental grounds.
- Community impacts are significant for Rhondda Road due to grade separation adjacent to existing housing. Existing communities north of Fassifern would benefit most from the Fassifern sub-option through reduced freight services and therefore less noise and emissions. This includes over 450 new homes developed as part of the Billy's Lookout estate.
- The Fassifern connection will also avoid impacts on the planned community at Fennel Bay, which is expected to deliver between 550-650 residential lots.
- The Fassifern connection avoids direct impacts on nearby communities by remaining in the rail corridor and forming a junction with the Main North Rail Line, north of the Fassifern community and existing station.
- The Fassifern options provide the best operation travel time savings, especially given the avoidance of the Booragul Loop which is both steep and circuitous slowing freight trains down and increasing noise and emissions.

The Rhondda Road alignment significantly impacts an existing quarry operation (Metromix Quarries). The Rhondda Road and Teralba alignments would continue to use the Booragul Loop on the main line which is a major operational constraint. This is likely to adversely affect recently developed residential areas within the loop (west of Booragul Station). The Teralba option also passes through flood prone land and has higher property impacts compared to the Fassifern and Rhondda Road sub-options.

B1.9 CENTRAL CONNECTIONS

Through this area there are a range of constraints including the existing communities at Barnsley, West Wallsend, Killingworth and Cameron Park. Steep topography, historic mine sites, a cemetery and playing field near West Wallsend are also notable social and historic constraints.

In addition, there are other infrastructure constraints including the existing Metromix Quarry, mine rehabilitation works at the West Wallsend Colliery and utilities including numerous electricity easements and the Killingworth Sub-Station. The recent approval and future development of the Wakefield Park Motorsports facility near Killingworth is also a physical constraint.

Based on existing constraints there are very limited options through the central study area. The opportunity to utilise existing Government owned land adjacent to West Wallsend including the M1 Pacific Motorway corridor was a significant rationale for progressing with the West Wallsend option.

Further rationale for progressing West Wallsend rather than the Cameron Park option (noting that the Killingworth option was not progressed from the Long list) is summarised below:

- The Cameron Park option has significant impacts on existing and developing communities in Barnsley, West Wallsend and Cameron Park.
- The option would impact land that has already been identified for urban release and development.
- This option would divide communities through an area of green space and result in considerable numbers of homes overlooking the corridor and future infrastructure.
- Significant loss of public green space and habitat corridors.
- Utilises more Government owned land and thereby reduces property impacts.
- Increased constructability risk and need for additional structures to grade separate local roads and other water courses.

It was decided by the Project team that West Wallsend represented the best opportunity for a future corridor which is largely on Government owned land. The alignment option is, however, constrained by steep grades, an existing cemetery, sporting fields and previous mine sites that have historic value and form part of future plans by Lake Macquarie Council for regional park uses. The Government owned land is also impacted by numerous utility easements and former rail lines.

Further refinement of the West Wallsend corridor option will be examined following community and stakeholder engagement.

B1.10 NORTHERN CONNECTIONS

Many of the northern connections, north of West Wallsend to Hexham and Tarro are constrained by their proximity to existing and proposed residential areas around Minmi as well as proposed industrial areas around Black Hill. There are also large tracts of highly sensitive cultural and environmental land in this part of the study area, including the Pambalong Nature Reserve and Hunter Wetlands National Park, an important and protected habitat for migratory birds.

Based on existing constraints there are limited options through the northern study area. The opportunity to utilise existing Government owned land adjacent to West Wallsend including the M1 Pacific Motorway corridor (and potentially the M1 Pacific Motorway extension to Raymond Terrace) is a significant benefit to the Tarro option. The Hexham options also utilise Government owned land and offer the potential to be aligned with the former freight corridor along the Richmond Vale Rail Trail.

Some of the options have already been discounted (Thornton and Four Mile options were not progressed from the Long list). The remaining options, including Tarro, Hexham via Seahampton and Hexham via Minmi require further detailed design to determine engineering feasibility as well as mitigation measures where unavoidable impacts occur.

The Tarro, Hexham via Seahampton and Hexham via Minmi options were progressed for the following reasons:

- The options use the M1 Pacific Motorway corridor where practicable, to reduce impact on communities and the environment.
- Two sub-options are feasible linking north of Minmi to the Richmond Vale Rail Trail (a former freight rail corridor) that can reduce property impacts around Minmi and Lenaghan.
- Property, noise and visual impacts to more populated and urban areas (such as Minmi, Fletcher and Lenaghan) could be reduced by considering alignments to the west of the M1 Pacific Motorway for the option to Tarro.
- Impact on Pambalong Nature Reserve could be mitigated by including a section of viaduct for the option to Tarro.

- Sufficient width between the M1 Pacific Motorway and the Tank Paddock is available to accommodate a rail corridor.
- Potential impacts to Aboriginal heritage at Stockrington and Black Hill require further investigation.

B1.11 SHORT LIST 'END TO END' OPTIONS

The short list of end-to-end corridor options are shown in Figure B.3 and include:

- NAVY BLUE Option – Fassifern – West Wallsend - Minmi – Adjacent to Hexham Wetlands National Park – Hexham
- GOLD Option – Fassifern – West Wallsend – Seahampton – Adjacent to Hexham Wetlands National Park – Hexham
- PINK Option – Fassifern – West Wallsend – Black Hill – Tarro
- LIGHT BLUE Option – Fassifern – West Wallsend – Lenaghans Drive – Adjacent to Hexham Wetlands National Park – Hexham.



KEY

Short List Options

- Navy Blue Option
- Gold Option
- Pink Option
- Light Blue Option
- Tunnel

Environment

- NSW National Park and Wildlife Service Estate
- Lands acquired under National Parks and Wildlife Act
- Other Parks

Infrastructure

- Existing Rail Network
- Freight Sidings
- Major Road Network
- Proposed M1 Pacific Motorway extension to Raymond Terrace
- Disused Richmond Vale Railway

Note: Stylised representation, corridor widths may not be to scale

Figure B.3 Short list of options

B1.12 COMPARATIVE PERFORMANCE ASSESSMENT OF SHORT-LISTED OPTIONS

The performance outcomes for each short-listed corridor is shown in Table B.6. The performance was determined based on the project objectives (refer to Chapter 1 of the Strategic Environmental Assessment report), using the criteria and sub-criteria described in Section B1.5. Section 6.3 provides a summary of the outcomes of this MCA.

















Table B.6 Short list options final performance outcomes

MCA Criteria/Sub Criteria		PINK Option (Recommended corridor)	LIGHT BLUE Option	NAVY BLUE Option	GOLD Option
Freight Movement	Amount of additional rail capacity created	●	●	●	●
	Reliability improvements	●	●	●	●
	Comparison of costs to operate and maintain the new corridor when compared to the existing route	●	●	●	●
Economic Growth	Ability of the corridor to generate additional freight traffic	●	●	●	●
	Ease of construction and delivery	●	●	●	●

Very good
 Good
 Reasonable
 Lower

MCA Criteria/Sub Criteria		PINK Option (Recommended corridor)	LIGHT BLUE Option	NAVY BLUE Option	GOLD Option
Community Impact	Direct and indirect property impacts	●	●	●	●
	Noise impacts	●	●	●	●
	Visual impacts	●	●	●	●
	Indigenous and Non-Aboriginal impacts	●	●	●	●
	Physical impacts (eg. ability to utilise Government owned land)	●	●	●	●
Environmental Impact	Biodiversity impacts	●	●	●	●
	Fauna and Flora impacts	●	●	●	●
	Hydrology and riparian impacts	●	●	●	●

 Very good
  Good
  Reasonable
  Lower

MCA Criteria/Sub Criteria		PINK Option (Recommended corridor)	LIGHT BLUE Option	NAVY BLUE Option	GOLD Option
Integrated Land Use and Transport	Direct and indirect property impact Integration with existing and planned transport				
	Coordination with precinct planning (eg. expansion and growth of residential/industrial areas)				
Future Proofing	Adaptability of options to future needs (eg. future upgrades/extensions to the corridor)				
OVERALL ASSESSMENT					

 Very good
  Good
  Reasonable
  Lower

APPENDIX C

NON-ABORIGINAL HERITAGE



C1 NON-ABORIGINAL HERITAGE

The following table summarises NSW heritage listed items located within the study area and is informed by searches completed in May 2021.

Table C.1 NSW Heritage Register search

ITEM	ADDRESS	SUBURB	LGA	LEP	SECTION 170 REGISTER
Amos Bros. Quarry	Rhondda Road and Old Main Road	Teralba	Lake Macquarie	Yes	Yes
Archaeological Remains (Former Minmi Wastewater Treatment Plant Site)	Lenaghans Drive	Minmi	Newcastle		Yes
Baptist Church	49 Wallace Street	West Wallsend	Lake Macquarie	Yes	
Beresfield Public School	181 Anderson Drive	Beresfield	Newcastle	Yes	Yes
Black Hill 1 Water Reservoir	Lot 1 Unknown	Black Hill	Newcastle		Yes
Brick House	54 Appletree Road	Holmesville	Lake Macquarie	Yes	
Brick House	47 Appletree Road	Holmesville	Lake Macquarie	Yes	
Buttai Cemetery/Elliott Family Graves	659 John Renshaw Drive	Buttai	Cessnock	Yes	
Catholic Church and Convent	5 and 7 Hyndes Street	West Wallsend	Lake Macquarie	Yes	
Clyde Inn Hotel	57 Carrington Street	West Wallsend	Lake Macquarie	Yes	
Cockle Creek Former Railway Station and Bridge Piers	Near Creek Reserve Road	Cockle Creek	Lake Macquarie		Yes
Cockle Creek Railway Underbridge	Across Cockle Creek	Cockle Creek	Lake Macquarie		Yes
Cottage	12 Carrington Street	West Wallsend	Lake Macquarie	Yes	
Cottage	15 Carrington Street	West Wallsend	Lake Macquarie	Yes	
Cottage	53 Wilson Street	West Wallsend	Lake Macquarie	Yes	
Cottage	8 Laidley Street	West Wallsend	Lake Macquarie	Yes	
Cottage Group	27, 29 and 31 Wallace Street	West Wallsend	Lake Macquarie	Yes	
Dairy Cool Rooms	29 Woodford Street	Minmi	Newcastle	Yes	
Duckenfield Colliery Railways (Relics)		Minmi	Newcastle	Yes	
Duckenfield No 2 Colliery Air Furnace Shaft	25 Minmi Road	Minmi	Newcastle	Yes	

ITEM	ADDRESS	SUBURB	LGA	LEP	SECTION 170 REGISTER
Duckenfield Railway No 1 Colliery Branch Line		Minmi	Newcastle	Yes	
Duckenfield Railway Nos 2, 3 and 4 Collieries Branch Line		Minmi	Newcastle	Yes	
Edgeworth Public School - Building B00H	7 Minmi Road	Edgeworth	Lake Macquarie		Yes
Elcom Newcastle Substation	101 Killingworth Road	Killingworth	Lake Macquarie	Yes	
Fassifern Railway Cottage	Wallsend Road	Fassifern	Lake Macquarie	Yes	
Fassifern Railway Station Group	29 Fassifern Road	Fassifern	Lake Macquarie	Yes	Yes
Fassifern To Toronto Branch Railway Line	South and Railway Parades	Fassifern	Lake Macquarie	Yes	Yes
Former Anglican Church	11 Wallsend Road	West Wallsend	Lake Macquarie	Yes	
Former Barnsley Public School	91 Appletree Road	Barnsley	Lake Macquarie	Yes	
Former Co-operative Store	75 York Street	Teralba	Lake Macquarie	Yes	
Former Killingworth Hotel	39 Killingworth Road	Killingworth	Lake Macquarie	Yes	
Former Northumberland Hotel	1 Hyndes Street	West Wallsend	Lake Macquarie	Yes	
Former police station	20 Charlotte Street	Holmesville	Lake Macquarie	Yes	
Former school of arts	65 Carrington Street	West Wallsend	Lake Macquarie	Yes	
Former Shop and Doctors surgery	47 Carrington Street	West Wallsend	Lake Macquarie	Yes	
Former shop and house	52 Carrington Street	West Wallsend	Lake Macquarie	Yes	
Former shop, doctors surgery and house	47 Carrington Street	West Wallsend	Lake Macquarie	Yes	
Former Uniting Church	29 St Helen Street	Holmesville	Lake Macquarie	Yes	
Former West Wallsend (No.1) Colliery	Off Wilson Street	West Wallsend	Lake Macquarie		Yes
Four Mile Creek 1 Water Reservoir	Lot 1 Buttai Rd	Four Mile Creek	Cessnock		Yes
Four Mile Creek 2 Water Reservoir	Lot 1 Buttai Rd	Four Mile Creek	Cessnock		Yes
Garden House Site	177 Woodford Street	Minmi	Newcastle	Yes	
Gartlee Mine	159 Railway Street	Teralba	Lake Macquarie	Yes	

ITEM	ADDRESS	SUBURB	LGA	LEP	SECTION 170 REGISTER
Glen Lovett Hall (Former)	187 Old Maitland Road	Hexham	Newcastle	Yes	
Goninans Administration Building	230 Old Maitland Road	Hexham	Newcastle	Yes	
Great Northern Hotel	2 Anzac Parade	Teralba	Lake Macquarie	Yes	
Hairdressing Salon	55 Carrington Street	West Wallsend	Lake Macquarie	Yes	
Hannel Family Vault	398B Maitland Road	Hexham	Newcastle	Yes	
Hexham Bridge	Pacific Highway	Hexham	Newcastle	Yes	Yes
Hexham Public School (Former)	227 Old Maitland Road	Hexham	Newcastle	Yes	
Hexham Railway Station	Pacific Highway	Hexham	Newcastle	Yes	Yes
Hexham Shipbuilding Yards	404 Old Maitland Road	Tarro	Newcastle	Yes	
Holmesville Hotel	21 George Street	Holmesville	Lake Macquarie	Yes	
House	59 Carrington Street	West Wallsend	Lake Macquarie	Yes	
House	47 Carrington Street	West Wallsend	Lake Macquarie	Yes	
House	32 Seaham Street	Holmesville	Lake Macquarie	Yes	
House	20 William Street	Holmesville	Lake Macquarie	Yes	
House - AS	101 Railway Street	Teralba	Lake Macquarie	Yes	
House - Earsdon Cottage	20 Carrington Street	West Wallsend	Lake Macquarie	Yes	
House - Moria	59 York Street	Teralba	Lake Macquarie	Yes	
J & A Brown's Hexham Workshops	100 Old Maitland Road	Hexham	Newcastle	Yes	
John Brown's Model Farm	29 Woodford Street	Minmi	Newcastle	Yes	
Johnston Family Cemetery	14A Taylor Avenue	Barnsley	Lake Macquarie	Yes	
Miners' Memorial	49a Wallace Street	West Wallsend	Lake Macquarie	Yes	
Minmi Cemetery	27 Minmi Road	Minmi	Newcastle	Yes	
Minmi Coal Carriage	56 Woodford Street	Minmi	Newcastle	Yes	
Minmi Hotel	156 Woodford Street	Minmi	Newcastle	Yes	
Minmi Public School (Foundation Stones and Bell)	56 Woodford Street	Minmi	Newcastle	Yes	Yes
Minmi Public School and Residence (Former)	196 Woodford Street	Minmi	Newcastle	Yes	
Minmi Reservoir Site	15 Reservoir Road	Minmi	Newcastle	Yes	

ITEM	ADDRESS	SUBURB	LGA	LEP	SECTION 170 REGISTER
Minmi To Hexham Railway		Minmi	Newcastle	Yes	
Minmi Train Carriage	96 Woodford Street	Minmi	Newcastle	Yes	
Mt Sugarloaf and the Sugarloaf Range	Mt Sugarloaf Road	West Wallsend	Lake Macquarie	Yes	
Mt Sugarloaf No 1 Colliery Site	Mt Sugarloaf Road	West Wallsend	Lake Macquarie	Yes	
Museum Hotel	70 Wilson Street	West Wallsend	Lake Macquarie	Yes	
Newcastle Crematorium	176 Anderson Drive	Beresfield	Newcastle	Yes	
Newstan Colliery	Fassifern Road	Fassifern	Lake Macquarie	Yes	
Oak Factory	189 Maitland Road	Hexham	Newcastle	Yes	
Our Lady of Lourdes Church	42 Anderson Drive	Tarro	Newcastle	Yes	
Police Station and Courthouse (Former)	40 Church Street	Minmi	Newcastle	Yes	
Post Office (Former)	129 Woodford Street	Minmi	Newcastle	Yes	
Post Office and Residence	54 Carrington Street	West Wallsend	Lake Macquarie	Yes	
Post Office Store	18 George Street	Holmesville	Lake Macquarie	Yes	
Presbyterian Church	48a Wallace Street	West Wallsend	Lake Macquarie	Yes	
Railway Cuttings (Former)	29 Woodford Street	Minmi	Newcastle	Yes	
Railway station	Killingworth Rd	Holmesville	Lake Macquarie	Yes	
Remains of Railway Siding	29 Woodford Street	Minmi	Newcastle	Yes	
Reservoir Residence (Former)	17 Reservoir Road	Minmi	Newcastle	Yes	
Residence	29 Eastern Avenue	Tarro	Newcastle	Yes	
Rhondda Colliery	282 and 284 Rhondda Road	Teralba	Lake Macquarie	Yes	
Rhondda Colliery Railway	From West Wallsend railway on the north side of Stockton Borehole Colliery to the Rhondda Colliery south of Rhondda Road, Teralba	Teralba	Lake Macquarie	Yes	
School Teacher's Residence	7 Minmi Road	Edgeworth	Lake Macquarie	Yes	

ITEM	ADDRESS	SUBURB	LGA	LEP	SECTION 170 REGISTER
Seaham, West Wallsend, Fairley and Killingworth Railway	Cockle Creek to Seaham No 1 Colliery at Seahampton with branches to Fairley and Killingworth	Barnsely	Lake Macquarie	Yes	Yes
Shop	10 Anzac Parade	Teralba	Lake Macquarie	Yes	
Slab Shed (Demolished)	2 Old Maitland Road	Hexham	Newcastle	Yes	
Soldier's Memorial	26 The Broadway	Killingworth	Lake Macquarie	Yes	
Soldiers' Memorial and Park	49 Carrington Street	West Wallsend	Lake Macquarie	Yes	
Speers Point Tram Route	off Frederick Street, off Park Avenue, west side Lake Road	Argentton & Edgeworth	Lake Macquarie	Yes	
St Andrews Presbyterian Church	19 Church Street	Minmi	Newcastle	Yes	
Stockrington No. 2 Colliery (Site of Former)	Dog Hole Road	Stockrington	Cessnock	Yes	
Stockrington No. 2 Colliery (Site of Former)	Dog Hole Road	Stockrington	Cessnock	Yes	
Stone Ford	33 Lenaghans Drive	Minmi	Newcastle	Yes	
Tarro Community Hall	2A Northern Avenue	Tarro	Newcastle	Yes	
Tarro Historic Site (original township of what was formerly known as Upper Hexham)	16 Anderson Drive	Tarro	Newcastle	Yes	
Tarro Pump Station	Anderson Dr	Tarro	Newcastle	Yes	Yes
Tarro Substation	6A Anderson Drive	Tarro	Newcastle	Yes	Yes
Teralba 1 Water Pump Station	1 North St	Teralba	Lake Macquarie		
Teralba Cemetery Billygoat Hill	62 and 64, Pitt Street and 16 Cockle Crescent	Teralba	Lake Macquarie	Yes	
Teralba Conservation Area		Teralba	Lake Macquarie	Yes	
Teralba Public School	57 York Street	Teralba	Lake Macquarie	Yes	Yes
Teralba Railway Residence	148 Railway Street	Teralba	Lake Macquarie	Yes	Yes
Thornton Railway Station	Karuah Street	Thornton	Maitland		Yes
Toronto railway overbridge	1c Reynolds Street	Blackalls Park	Lake Macquarie	Yes	

ITEM	ADDRESS	SUBURB	LGA	LEP	SECTION 170 REGISTER
Travellers Rest Hotel (Former)	23 Maitland Road	Hexham	Newcastle	Yes	
Uniting Church & Hall (Former)	63 Old Maitland Road	Hexham	Newcastle	Yes	
West Wallsend (No 1) Colliery	Off Wilson Street	West Wallsend	Lake Macquarie	Yes	
West Wallsend Cemetery	Cemetery Road	West Wallsend	Lake Macquarie	Yes	
West Wallsend Conservation Area		West Wallsend	Lake Macquarie	Yes	
West Wallsend Co-op	76a Carrington Street	West Wallsend	Lake Macquarie	Yes	
West Wallsend Football Club ground (Johnson Park)	3 Laidley Street	West Wallsend	Lake Macquarie	Yes	
West Wallsend High School	20 Appletree Road	West Wallsend	Lake Macquarie		Yes
West Wallsend High School - Landscape	20 Appletree Road	West Wallsend	Lake Macquarie		Yes
West Wallsend Public School	49a Wallace Street	West Wallsend	Lake Macquarie	Yes	Yes
West Wallsend Public School - Buildings B00A, B00B, B00E and B00F	49A Wallace Street	West Wallsend	Lake Macquarie		Yes
West Wallsend Reservoir and Valve House	30A George Booth Drive	West Wallsend	Lake Macquarie		Yes
West Wallsend Steam Tram Line	West Wallsend to Newcastle via Wallsend, Holmesville, Estelville, Edgeworth and Glendale	Edgeworth	Lake Macquarie	Yes	
West Wallsend Valve House & Underground Reservoir	30a George Booth Drive	West Wallsend	Lake Macquarie	Yes	
Winston Court (Residence)	142 Lenaghans Drive	Minmi	Newcastle	Yes	

APPENDIX D







DETAILED CORRIDOR MAPS

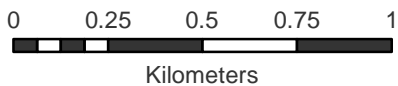


Recommended Lower Hunter Freight Corridor

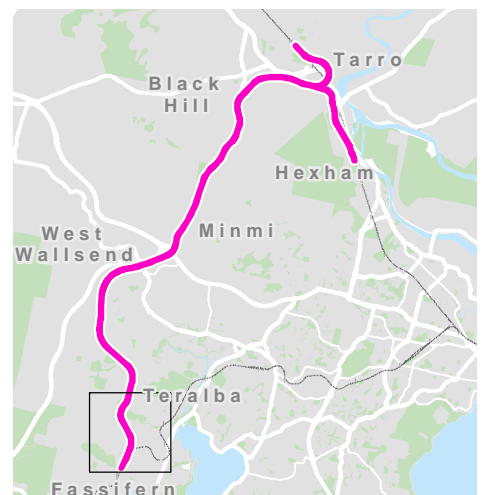
Fassifern, Wakefield and Teralba



-  Recommended Lower Hunter Freight Corridor
-  Impacted Property
-  Impacted Property - tunnel section only
-  Property Boundary
-  Indicative Tunnel Portals
-  Existing Rail Network







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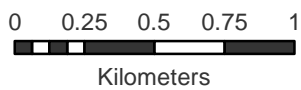


Recommended Lower Hunter Freight Corridor

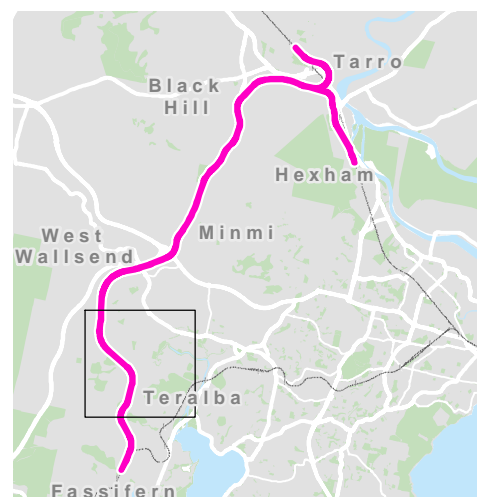
Wakefield, Teralba, Killingworth, Barnsley and Holmesville



-  Recommended Lower Hunter Freight Corridor
-  Impacted Property
-  Property Boundary
-  Existing Rail Network

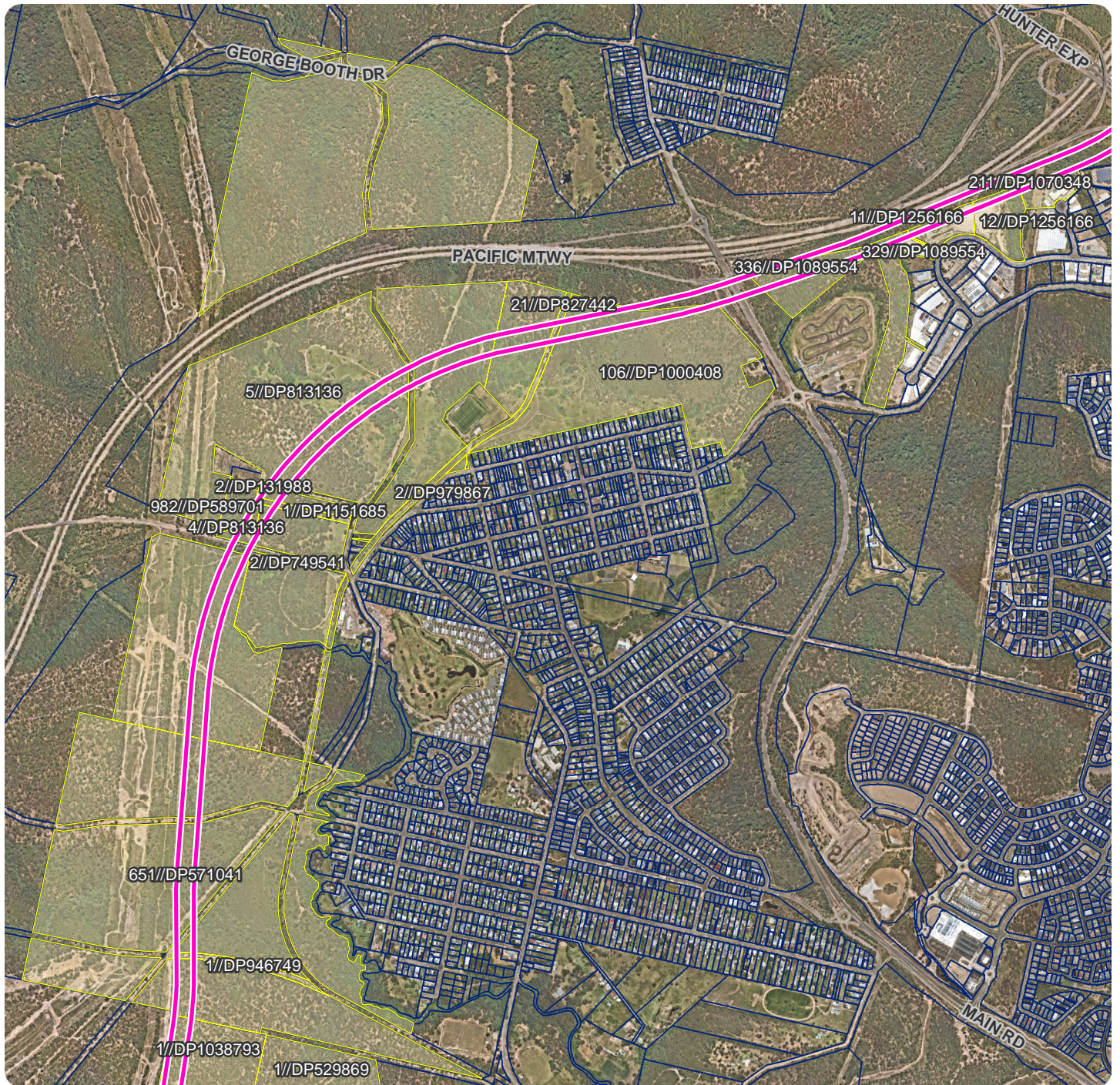





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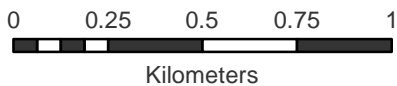


Recommended Lower Hunter Freight Corridor

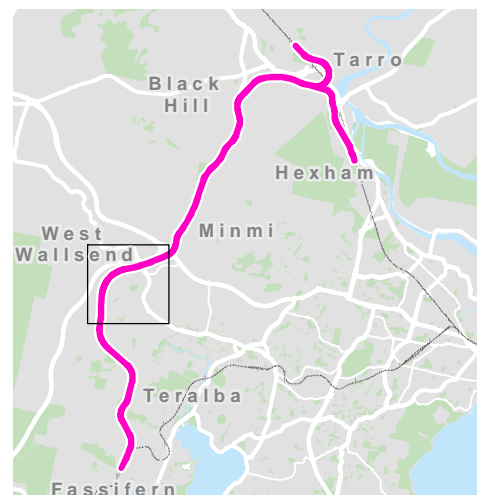
Holmesville, West Wallsend, Seahampton and Cameron Park



-  Recommended Lower Hunter Freight Corridor
-  Impacted Property
-  Property Boundary






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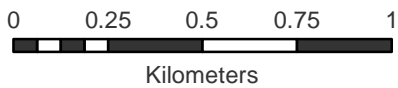


Recommended Lower Hunter Freight Corridor

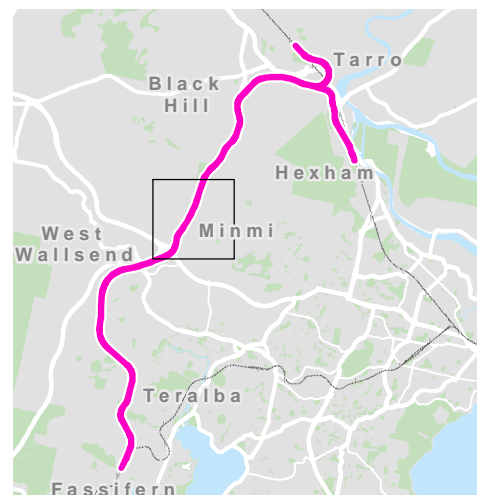
Cameron Park, Stockrington and Minmi



-  Recommended Lower Hunter Freight Corridor
-  Impacted Property
-  Property Boundary






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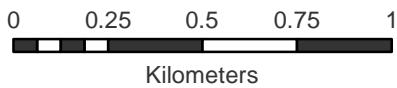


Recommended Lower Hunter Freight Corridor

Minmi, Lenaghan and Black Hill



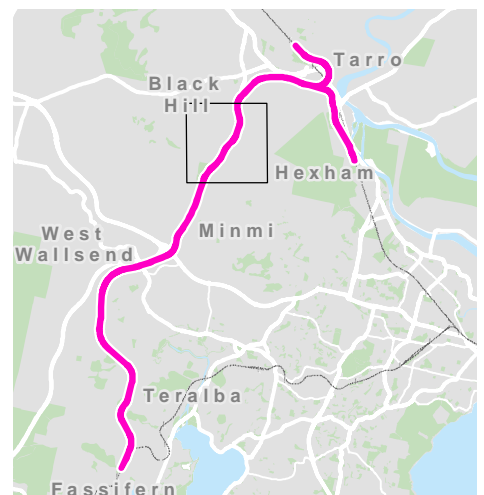
-  Recommended Lower Hunter Freight Corridor
-  Impacted Property
-  Property Boundary



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Aerial imagery (November 2020, January 2021) © Nearmap






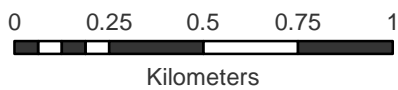
24/06/2021

Recommended Lower Hunter Freight Corridor

Black Hill



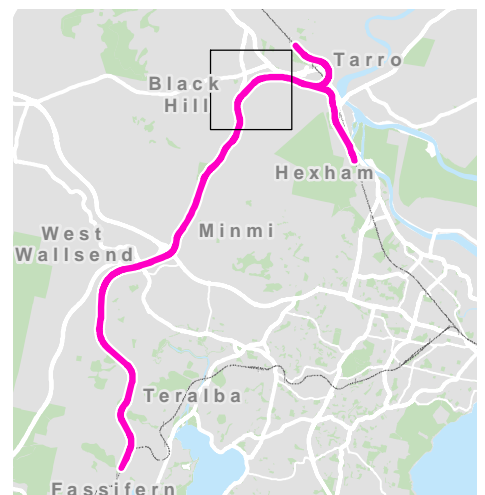
-  Recommended Lower Hunter Freight Corridor
-  Impacted Property
-  Property Boundary



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Aerial imagery (January 2021) © Nearmap







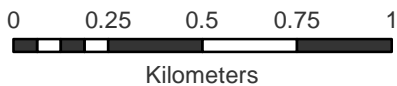
24/06/2021

Recommended Lower Hunter Freight Corridor

Black Hill, Hexham, Tarro, Beresfield and Woodberry



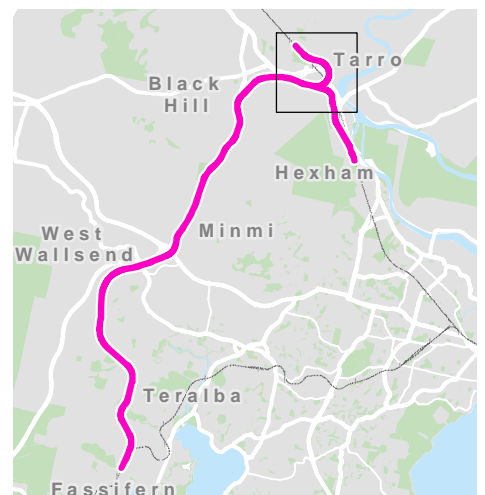
-  Recommended Lower Hunter Freight Corridor
-  Impacted Property
-  Property Boundary
-  Existing Rail Network



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


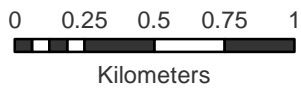
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Recommended Lower Hunter Freight Corridor

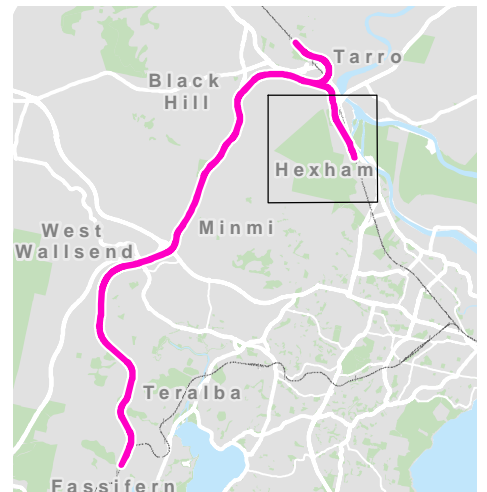
Black Hill and Hexham



-  Recommended Lower Hunter Freight Corridor
-  Impacted Property
-  Property Boundary
-  Existing Rail Network



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WSP is one of the world's leading engineering professional services consulting firms. We are dedicated to our local communities and propelled by international brainpower. We are technical experts and strategic advisors including engineers, technicians, scientists, planners, surveyors, environmental specialists, as well as other design, program and construction management professionals. We design lasting Property & Buildings, Transportation & Infrastructure, Resources (including Mining and Industry), Water, Power and Environmental solutions, as well as provide project delivery and strategic consulting services. With approximately 50,000 talented people globally, we engineer projects that will help societies grow for lifetimes to come.

