APPENDIX 12

Traffic Impact Assessment

Kurri Kurri Lateral Pipeline Project

Traffic Impact Assessment

APA Group

08 March 2022

→ The Power of Commitment

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Contents

Table index

Figure index

Acknowledgment of Country

We acknowledge Aboriginal and Torres Strait Islander peoples as the Traditional Owners of all lands throughout Australia on which we do business, and we pay our respects to Elders, past, present and emerging.

1. Introduction

1.1 Overview

Snowy Hydro Limited is proposing to develop a gas-fired peaking power station, referred to as the Hunter Power Project (HPP), at the site of the former Hydro Australia Pty Ltd (Hydro) aluminium smelter at Kurri Kurri. The HPP is proposed to provide up to 750 megawatts (MW) of 'on-demand' electricity to supplement Snowy Hydro's generation portfolio with dispatchable capacity when the needs of electricity consumers are highest. The HPP is currently undergoing assessment under both NSW and Commonwealth planning and environmental assessment frameworks.

The Kurri Kurri Lateral Pipeline Project (the Project) has been developed by the APA Group (APA) for Snowy Hydro Limited as a gas supply solution for the HPP. The Project is a proposed buried gas transmission pipeline, storage pipeline and associated surface facilities that will connect the HPP in Kurri Kurri, New South Wales (NSW) to the Sydney to Newcastle Jemena Gas Networks (JGN) Northern Trunk gas transmission pipeline near Newcastle, NSW.

This Traffic Impact Assessment (TIA) forms part of the Environmental Impact Statement (EIS) that is being prepared to support the Project's application for approval. A TIA is required to review existing traffic conditions and site access arrangements (including public transport); assess traffic implications arising from the construction and operation of the Project; and determine measures to minimise any adverse effects to existing road users.

1.2 The Project

1.2.1 Key features

The Project comprises the following primary components:

– A buried, steel, medium diameter (up to 14 inch), **medium pressure[1] transmission pipeline** of approximately 20.4 kilometres in length to provide a gas supply from the existing Sydney to Newcastle Pipeline (SNP) (Plumpton to Hexham Northern Trunk), via a SNP receipt facility, to the HPP site.

– A **compressor station** at the termination of the transmission pipeline to boost gas pressure prior to transfer to a storage pipeline.

– A buried, steel, large diameter (up to 42 inch), **high pressure storage** (up to 15.3 MPag) pipeline of around 24 km in total length downstream of the compressor station with approximately 70 terajoules (TJ) of useable gas storage ready to supply the HPP.A **delivery station** to receive gas from the storage pipeline and control temperature, pressure and flow rate prior to delivery of gas to the HPP.

1.2.2 Location and study area

The Project is situated in the Lower Hunter region of New South Wales, encompassing the Local Government Areas (LGAs) of Cessnock, Maitland and Newcastle (refer to Figure 1-1).

The primary study area for the assessment has been defined as the road network within two kilometres from the project's access points (approximated by a two-kilometre buffer from the transmission pipeline alignment, refer to Figure 1-2). Due to the large project footprint and the nature of project activities, the assessment also extends to portions of Maitland Road and New England Highway leading to the Newcastle Port area.

[1] Up to 6.9 megapascal (MPa)

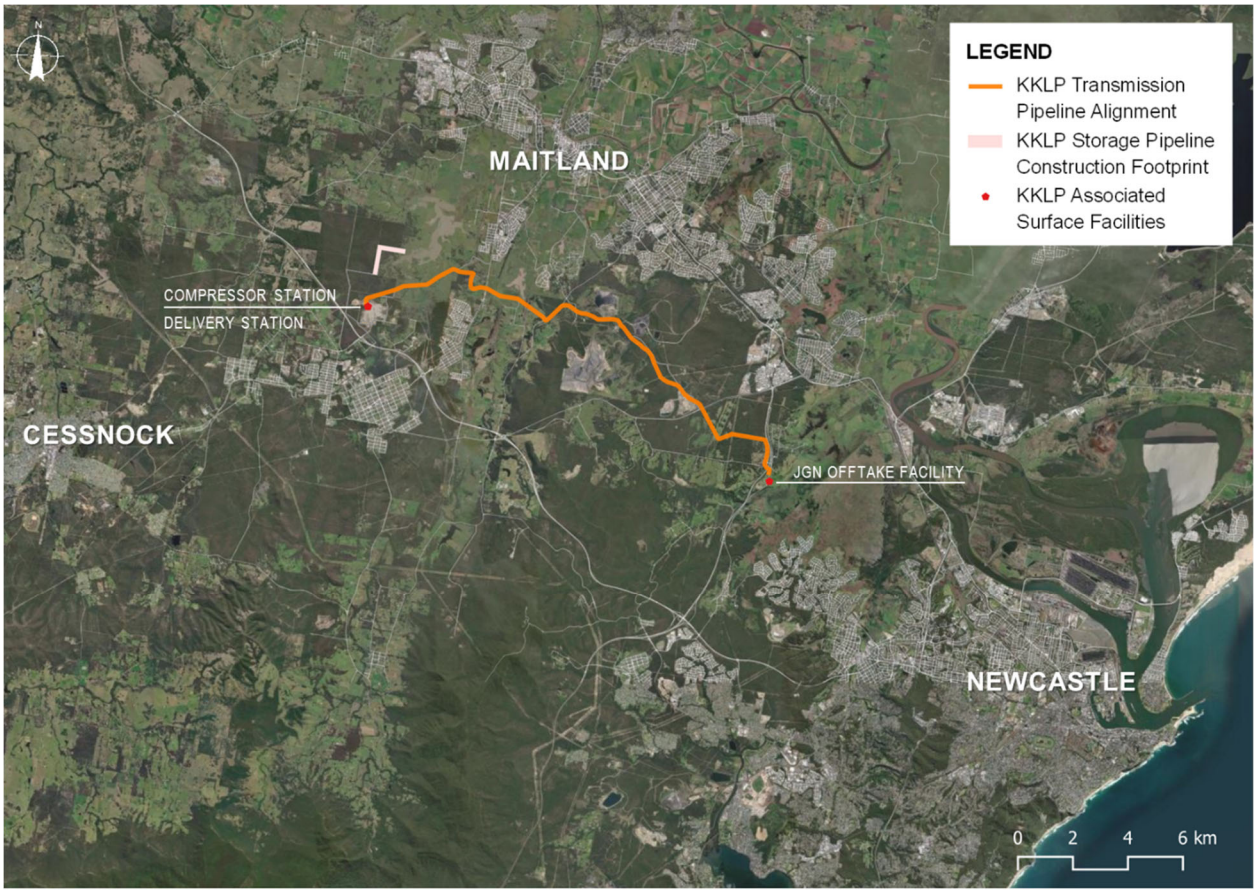


Figure 1-1 *Project location*

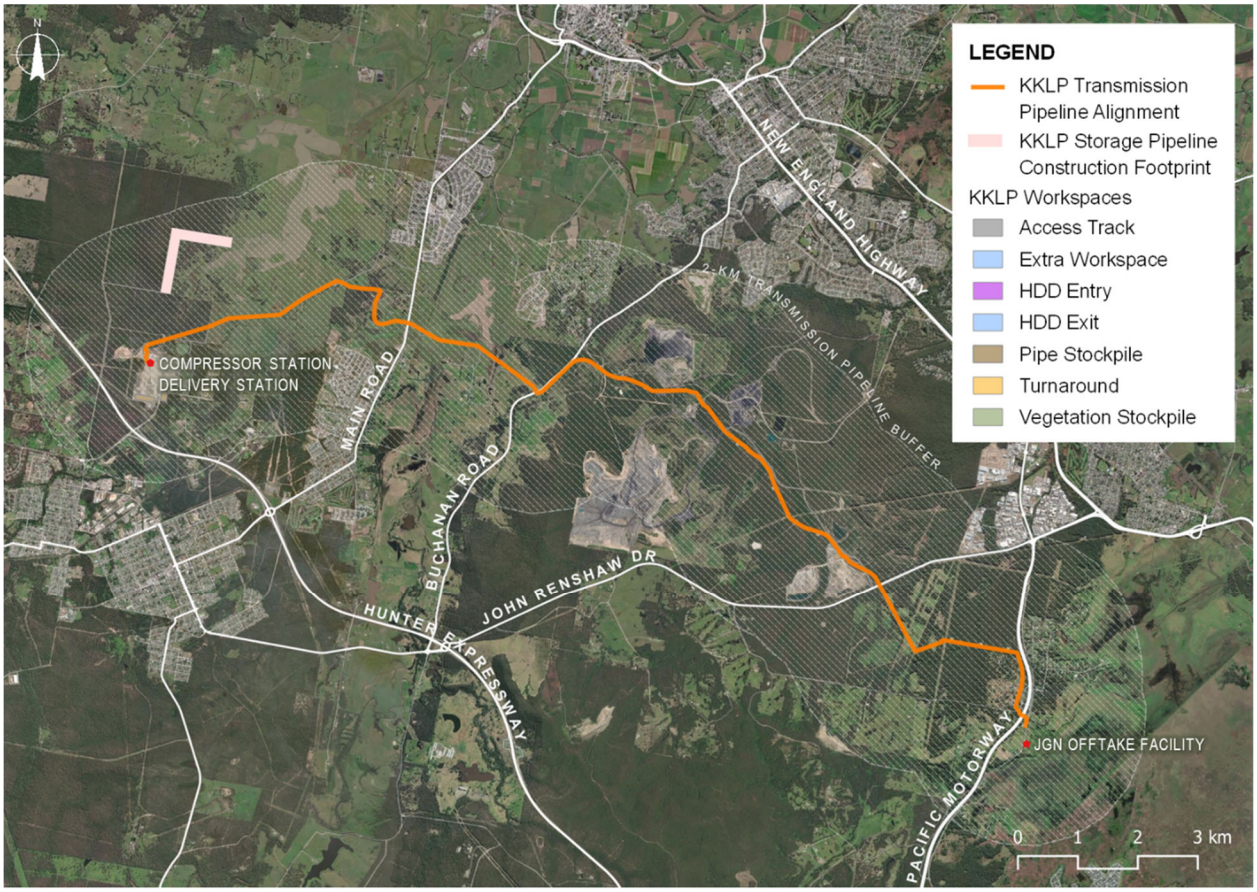


Figure 1-2 *Study area*

1.2.3 Project timing

Subject to approval of the Project, construction is planned to commence during Q4 of 2022 and is anticipated to be operational by Q4 of 2023.

1.3 Document purpose and structure

GHD Pty Ltd (GHD) has been commissioned by APA Group to prepare a Traffic Impact Assessment (TIA) which will support the Environmental Impact Statement (EIS) required to obtain approval for the construction and operation of the Project.

This report documents the results of the TIA and covers:

- A description of the existing traffic and transport environment in the study area.
- A review of the existing road and transport conditions, traffic volumes and crash data.
- An assessment of the potential impacts of the Project and the performance of key intersections during construction and operation.
- Recommendations on suitable mitigation measures to minimise the impacts.

The remaining Sections of this report are structured as follows:

- **Section 2** describes the legislative and policy context for the assessment, and relevant guidelines. The section further details the assumptions used in the study, including any study limitations.
- **Section 3** describes the existing environment as relevant to the traffic impact assessment.
- **Sections 4-5** describe details of the proposed works.
- **Section 6** examines the potential traffic and transport impacts associated with the proposed works.
- **Section 7** provides recommendations of proposed mitigation options for the identified impacts of the Project.
- **Section 8** presents a summary of the traffic assessment findings and sets out the principal conclusions for the study.

1.4 Disclaimer

This report: has been prepared by GHD for APA Group and may only be used and relied on by APA Group for the purpose agreed between GHD and APA Group as set out in Section 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than APA Group arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer Section 2.3 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

2. Legislative and policy context

This section summarises the legislation, guidelines and/or policies driving the approach to the assessment.

2.1 Secretary's environmental assessment requirements

Table 2-1 lists the Planning Secretary's environment assessment requirements (SEARs) relevant to transport and traffic, and the corresponding sections where these requirements are addressed.

Table 2-1 SEARs traffic and transport requirements

Requirement	Relevant section
Description of the project.	Section 1.2 The Project Section 4 Construction activities Section 5 Operation and maintenance
A description of the existing environment likely to be affected by the project, using sufficient baseline data	Section 3 Existing conditions
Any crossings or utility installation, any potential interactions with Hunter Expressway (6011), the Pacific Motorway (6003), John Renshaw Drive (MR588) and Main Road (MR195 Maitland – Kurri Kurri) and any planned projects (including M1 Motorway to Raymond Terrance, Black Hill Development MR588 intersection works, MR195 Testers Hollow).	Section 3.4 Other developments Section 4.1.3 Road and rail crossings
Details of traffic types and volumes likely to be generated by the project, including all relevant vehicular traffic routes and intersections for access to / from the site along the proposed pipeline route option(s)	Section 4.1.4 Logistics Section 6.1 Traffic generation
An assessment of the likely impacts of the project on traffic.	Section 6 Impact assessment
Details of measures to mitigate and/or manage potential impacts including a schedule of all required road upgrades, road maintenance contributions, and any other traffic control measures, developed in consultation with the relevant road authorities; and details of measures to mitigate and/or manage potential impacts of the project on rail infrastructure.	Section 7 Mitigation measures

2.2 Relevant legislation, policies and guidelines

The assessment was undertaken with reference to the following:

– Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development (Austroads, 2016)
– Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections (Austroads, 2021)
– Guide to Traffic Generating Developments Updated Traffic Surveys (Roads and Maritime, 2013)
– Roads and Maritime Services Traffic Modelling Guidelines (2013)
– Traffic Control and Work Sites Technical Manual (Transport for NSW, 2020)

2.3 Study limitations and assumptions

The study limitations and key assumptions applicable to this study include:

– Estimates of the expected construction and operational traffic volumes of the Project have been provided by APA Group.
– Traffic distribution estimates have been based on high level assumptions on heavy vehicle routes and construction methodology.

- Information about existing traffic was obtained from permanent counts data published on the Transport for NSW Traffic Volume Viewer, and secondary data from available traffic studies and reports of other developments within the study area as discussed in Section 3.3.1. No additional data collection has been conducted as part of this study.
- A traffic growth rate of 1.0 per cent per annum was utilised.
- In the absence of hourly data, peak hour traffic was estimated to be 10 per cent of daily traffic.

3. Existing conditions

3.1 Existing road network characteristics

3.1.1 Road hierarchy

Roads within New South Wales are categorised in the following two ways:

– By classification (ownership).
– By the function that they perform.

Road classification

Roads, as defined by the *Roads Act 1993*, are classified based on their importance to the movement of people and goods within NSW (as a primary means of communication).

The classification of a road allows Transport for New South Wales (TfNSW) to exercise authority of all or part of the road. Classified roads include Main Roads, State Highways, Tourist Roads, Secondary Roads, Tollways, Freeways, and Transitways. For management purposes, TfNSW has three administrative classes of roads:

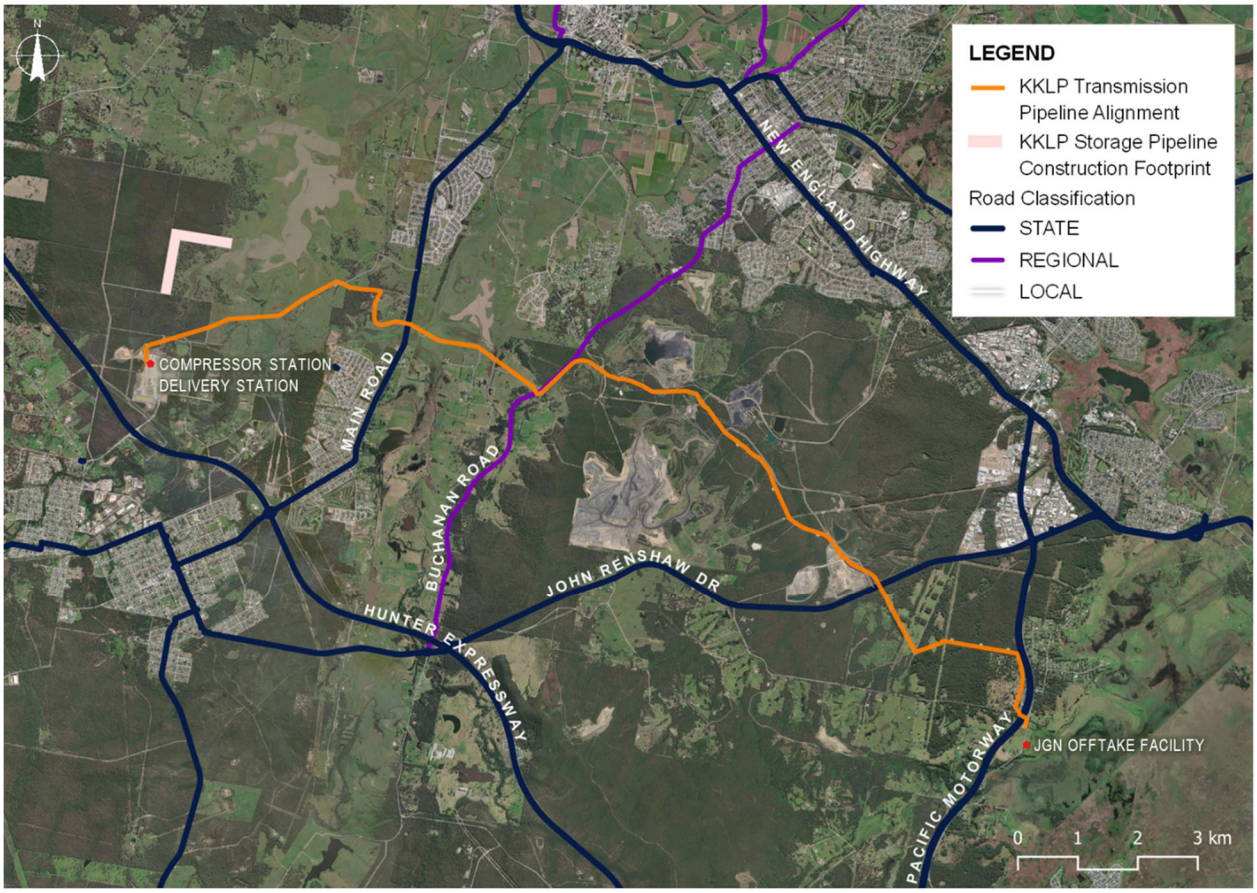
– **State Roads** – Major arterial links through NSW and within major urban areas. They are the principal traffic-carrying roads and are fully controlled and maintained by TfNSW. State Roads include all Tollways, Freeways and Transitways; and all or part of a Main Road, Tourist Road or State Highway.
– **Regional Roads** – Roads of secondary importance between State Roads and Local Roads which, along with State Roads, provide the main connections to and between smaller towns and perform a sub arterial function in major urban areas. Regional roads are the responsibility of councils for maintenance funding, though TfNSW funds some maintenance based on traffic and infrastructure. Traffic management on Regional Roads is controlled under the delegations to local government from TfNSW. Regional Roads may own all or part of a Main Road, Secondary Road, Tourist Road or State Highway; or other roads as determined by TfNSW.
– **Local Roads** – The remainder of the council-controlled roads, Local Roads are the responsibility of councils for maintenance funding. TfNSW may fund some maintenance and improvements based on specific programs (e.g. urban bus routes, road safety programs). Traffic management on Local Roads is controlled under the delegations to local government from TfNSW.

Functional hierarchy

Functional road classification involves the relative balance of the mobility and access functions. TfNSW defines four levels in a typical functional road hierarchy, ranking from high mobility and low accessibility, to high accessibility and low mobility. These road classes are:

– **Arterial Roads** – generally controlled by TfNSW, they typically have no limit in flow and are designed to carry vehicles long distance between regional centres.
– **Sub-Arterial Roads** – can be managed by either TfNSW or local council. Typically, their operating capacity ranges between 10,000 and 20,000 vehicles per day, and their aim is to carry through traffic between specific areas in a sub region or provide connectivity from arterial road routes (regional links).
– **Collector Roads** – provide connectivity between local roads and the arterial road network and typically carry between 2,000 and 10,000 vehicles per day.
– **Local Roads** – provide direct access to properties and the collector road system and typically carry between 500 and 4,000 vehicles per day.

A map of the road classifications within the study area is presented in Figure 3-1. The key roads are discussed further in the following sections.



Source: NSW Road Network Classifications, TfNSW, modified by GHD

Figure 3-1 Road classification of key roads in proximity to site

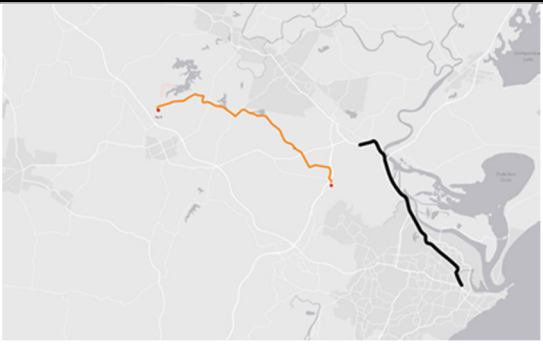
3.1.2 Road characteristics

The following subsections describe the keys roads which will likely be impacted by the construction activities, including roads which are not located in proximity to the site (i.e. haulage routes). The maps within the description tables show the location of the key roads relative to the Project, which is represented by the orange line (transmission pipeline alignment).

Maitland Road

Maitland Road (pictured in Figure 3-2) is an arterial road that connects the Newcastle central business district (CBD) to the northwest edge of the City of Newcastle, connecting to the New England Highway and the Pacific highway. The road forms part of Route A43 of the national highway network. The key features of Maitland Road in proximity to the Project are outlined in Table 3-1.

Table 3-1 Maitland Road key features

Feature	Description	
Carriageway	Sealed carriageway with two lanes in each direction. Single undivided carriageway at the southern portion of the road and divided by a median beginning at the intersection with Maud Street up to the northern terminus. Travel widths of approximately 7 meters (3.5 meters per lane). With lane markings and shoulders provided on both sides of the carriageway.	
Parking	On-street parking is permitted along sections of the road near Newcastle CBD.	

Feature	Description
Speed Limit	Varies, from 50 – 60 km/h
Pedestrian Facilities	Footpaths and pedestrian crossing facilities are provided.
Bicycle Facilities	On-road cycling facilities provided.
Public Transport	Bus stop facilities are present along the length of the road, providing access to local and intercity bus services. The southern terminus of the road is within walking distance from Newcastle Interchange rail station where the Hunter Line and Central Coast & Newcastle lines can be accessed.

Image Source: Google Street View || (L) Northern section (R) Southern section

Figure 3-2 Maitland Road

New England Highway

The New England Highway (pictured in Figure 3-3) is an 830-km highway that forms part of Australia's national highway system. It connects Newcastle in NSW to Toowoomba Region in Queensland. The section of the road in proximity to the Project forms part of Routes A1 and A43. Key features of the section are outlined in Table 3-2.

Table 3-2 New England Highway key features

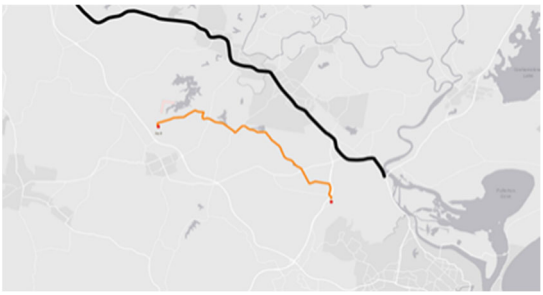
Feature	Description	
Carriageway	Sealed divided carriageway with two lanes in each direction. Travel widths of approximately 7 meters (3.5 meters per lane). With lane markings and shoulders provided on both sides of the carriageway.	
Parking	No designated parking facilities are provided. On-street parking not permitted along the length of the road.	
Speed Limit	Generally 80 km/h	
Pedestrian Facilities	No pedestrian facilities are provided.	
Bicycle Facilities	On-road cycling facilities generally provided with shoulder area.	
Public Transport	Bus stop facilities are present along the length of the road, providing access to local and intercity bus services. Access to the Hunter Rail Line is possible via Tarro Station.	

Image Source: Google Street View || (L) Facing southbound (R) Bus stop facilities along the road

Figure 3-3 New England Highway

John Renshaw Drive

John Renshaw Drive (pictured in Figure 3-4) is a state road that is oriented on an east-west direction from Kurri Kurri to Beresfield in the Hunter Region. It links Hunter Expressway, the Pacific Motorway, and the New England Highway. The key features of John Renshaw Drive in proximity to the Project are outlined in Table 3-3.

Table 3-3 ***John Renshaw Drive key features***

Feature	Description	
Carriageway	Sealed undivided carriageway with two lanes catering to two-way traffic. Carriageway widths of approximately 7 meters (3.5 meters per lane). With lane markings and shoulders provided on both sides of the carriageway.	
Parking	No designated parking facilities are provided.	
Speed Limit	Varies, 80 km/h west of Pacific Highway 100 km/h east of Pacific Highway	
Pedestrian Facilities	No pedestrian facilities are provided.	
Bicycle Facilities	No dedicated cycling facilities are provided.	
Public Transport	No bus stop facilities are provided along the length of the road. However, designated bus pick-up and drop-off points are present along John Renshaw Drive (refer to Figure 3-15).	

Image Source: Google Street View || (L) View facing west (R)approximate location of transmission pipeline crossing

Figure 3-4 John Renshaw Drive

Hunter Expressway

Hunter Expressway (pictured in Figure 3-5) is a state road in the Hunter Region that spans approximately 40 km from Belford (Singleton Council) to Cameron Park (City of Lake Macquarie), passing through the LGAs of Maitland and Cessnock. The key features of Hunter Expressway in proximity to the study area are outlined in Table 3-4.

Table 3-4 ***Hunter Expressway key features***

Feature	Description	
Carriageway	Sealed divided carriageway with two lanes in each direction. Carriageway widths of approximately 7 meters (3.5 meters per lane). With lane markings and shoulders provided on both sides of the carriageway.	
Parking	No designated parking facilities are provided.	
Speed Limit	110 km/h	
Pedestrian Facilities	No pedestrian facilities are provided.	
Bicycle Facilities	No dedicated cycling facilities are provided.	
Public Transport	No public transport facilities can be found along the highway.	

Image Source: Google Street View || (L) Facing northbound (R) Facing southbound

Figure 3-5 ***Hunter Expressway***

M1 Pacific Motorway

The Pacific Motorway (pictured in Figure 3-6), also known as M1, is a state road that links Sydney to Newcastle and the Hunter Regions of NSW. It has a length of 127 km and runs an approximate north-south direction, with the northern terminus beginning at its intersection with John Renshaw Drive (Beresfield); and ending with NorthConnex (Wahroonga.) Key features of the motorway in proximity to the Project are outlined in Table 3-5.

Table 3-5 ***M1 Pacific Motorway key features***

Feature	Description	
Carriageway	Sealed divided carriageway with two lanes in each direction. Carriageway widths of approximately 7 meters (3.5 meters per lane). With lane markings and shoulders provided on both sides of the carriageway.	
Parking	No designated parking facilities are provided.	
Speed Limit	Generally 80 km/h, near the project site.	

Feature	Description	
Pedestrian Facilities	No pedestrian facilities are provided.	
Bicycle Facilities	No cycling facilities are provided.	
Public Transport	No public transport facilities can be found along the highway.	

Image Source: Google Street View || (L) Facing northbound (R) Facing southbound

Figure 3-6 M1 Pacific Motorway

Weakleys Drive

Weakleys Drive (pictured in Figure 3-7), is a state road that links M1 Pacific Motorway to the New England Highway. It is oriented in a north-south alignment and passes through the suburbs of Thornton and Beresfield. The key features of Weakleys Drive are outlined in Table 3-6.

Table 3-6 Weakleys Drive ***key features***

Feature	Description	
Carriageway	Sealed divided carriageway with two lanes in each direction. Carriageway widths of approximately 7 meters (3.5 meters per lane). With lane markings and shoulders provided on both sides of the carriageway.	
Parking	No designated parking facilities are provided.	
Speed Limit	60 km/h	
Pedestrian Facilities	No pedestrian facilities are provided.	
Bicycle Facilities	On-street cycling paths separated by lane markings.	
Public Transport	No bus stop facilities are provided along the length of the road.	

Image Source: Google Street View || View facing north of intersection with M1 / John Renshaw Drive

Figure 3-7 Weakleys Drive

Buchanan Road

Buchanan Road (pictured in Figure 3-8), is a regional road that provides an alternative north-south link between the LGAs of Cessnock and Maitland. It begins with its intersection (roundabout) with John Renshaw Drive in the south and terminates at East Maitland in the north. The key features of the section of Main Road in proximity to the Project are outlined in Table 3-7.

Table 3-7 Buchanan Road key features

Feature	Description	
Carriageway	Sealed undivided carriageway with two lanes catering to two-way traffic. Carriageway widths of approximately 6 meters (3 meters per lane). With lane markings; no shoulders provided.	
Parking	No designated parking facilities available on-street.	
Speed Limit	Varies, from 60 km/h to 80 km/h	
Pedestrian Facilities	No pedestrian facilities are provided.	
Bicycle Facilities	No dedicated cycling facilities are provided.	
Public Transport	No bus stop facilities are provided along the length of the road. However, designated bus pick-up and drop-off points are present along Buchanan Road (refer to Figure 3-15).	

Image Source: Google Street View

Figure 3-8 Buchanan Road

Main Road / Cessnock Road

Main Road / Cessnock Road (pictured in Figure 3-9), is a state road that provides a direct connection between the LGAs of Kurri Kurri and Maitland. It links New England Highway in the north and Hunter Expressway in the south. The key features of the section of Main Road in proximity to the Project are outlined in Table 3-8.

Table 3-8 ***Main Road / Cessnock Road key features***

Feature	Description
Carriageway	Sealed undivided carriageway with two lanes catering to two-way traffic. Carriageway widths of approximately 7 meters (3.5 meters per lane). With lane markings and shoulders provided on both sides of the carriageway.
Parking	No designated parking facilities available on-street.
Speed Limit	60 km/h
Pedestrian Facilities	No pedestrian facilities are provided along the section of the road in proximity to the Project.
Bicycle Facilities	On-street cycling paths separated by lane markings are present on the southern section of the road.
Public Transport	Bus stop facilities are provided along sections of the road located near Hunter Expressway. Designated drop-off and pick-up areas (without designated facilities) are also present along the length of the road (refer to Figure 3-15).

Image Source: Google Street View || (L) Crossing location of transmission pipeline (view facing southbound); (R) Bus stop facility approx. 1.6km from the alignment

Figure 3-9 ***Main Road***

Lenaghans Drive

Lenaghans Drive (pictured in Figure 3-10), is a local road that runs an approximate north-south alignment, parallel to M1 Pacific Motorway. It has a length of approximately 6.4 km, beginning at its intersection with Pacific Motorway in Black Hill and terminating at Woodford Street in Minmi. The key features of the section of Lenaghans Drive in proximity to the Project are outlined in Table 3-9.

Table 3-9 ***Lenaghans Drive key features***

Feature	Description	
Carriageway	Sealed undivided carriageway with two lanes catering to two-way traffic. Channelization and turning lanes provided approaching intersection with Black Hill Road. Carriageway widths of approximately 6 meters (3 meters per lane). With lane markings.	
Parking	No designated parking facilities available on-street.	
Speed Limit	80 km/h	
Pedestrian Facilities	No pedestrian facilities are provided.	
Bicycle Facilities	On-road cycling facilities provided with shoulder area on the northern section of the road.	
Public Transport	No bus stop facilities are provided along the length of the road.	

Image Source: Google Street View || (L) Intersection with Black Hill Road; (R) Proposed location of access track (both views facing south)

Figure 3-10 ***Lenaghans Drive***

Other Roads

Other relevant roads in the vicinity of the project site include:

- **Black Hill Road** – Undivided two-lane carriageway that runs an approximate east-west alignment, connecting M1 Pacific Motorway, John Renshaw Drive, and Lenaghans Drive.
- **Hart Road** – Undivided two-lane local road that crosses Hunter Expressway, providing a direct connection from the suburb of Loxford to Kurri Kurri/Weston. It will serve as the main access road to HPP.

3.1.3 Freight routes

Line pipe of the size and specification required for the transmission and storage pipelines, and storage pipeline bend sections, is not manufactured by any existing Australian steel mill. As such, the line pipe for the Project will be manufactured overseas, imported into Australia by ship (HandyMax Class or similar) and unloaded at a suitable port. The Port of Newcastle is likely to be the most suitable option and has been adopted for the purposes of assessment of road transport of pipe sections from port to project construction areas this report.

Laydown areas for pipe segments are proposed for the transmission pipeline on an existing cleared hardstand near KP5 and for the storage pipeline near the compressor facility. The likely construction haulage route (further described in Section 4 Construction activities) is shown in Figure 3-11.

Transport for NSW Restricted Access Vehicle Map identifies the roads along the haulage routes as being approved to accommodate vehicles up to the size of a 26 m B-Double and oversize overmass (OSOM) vehicles, with OSOM travel conditions for some sections of the New England Highway and Hunter Expressway (refer to Figure 3-12 and Figure 3-13).

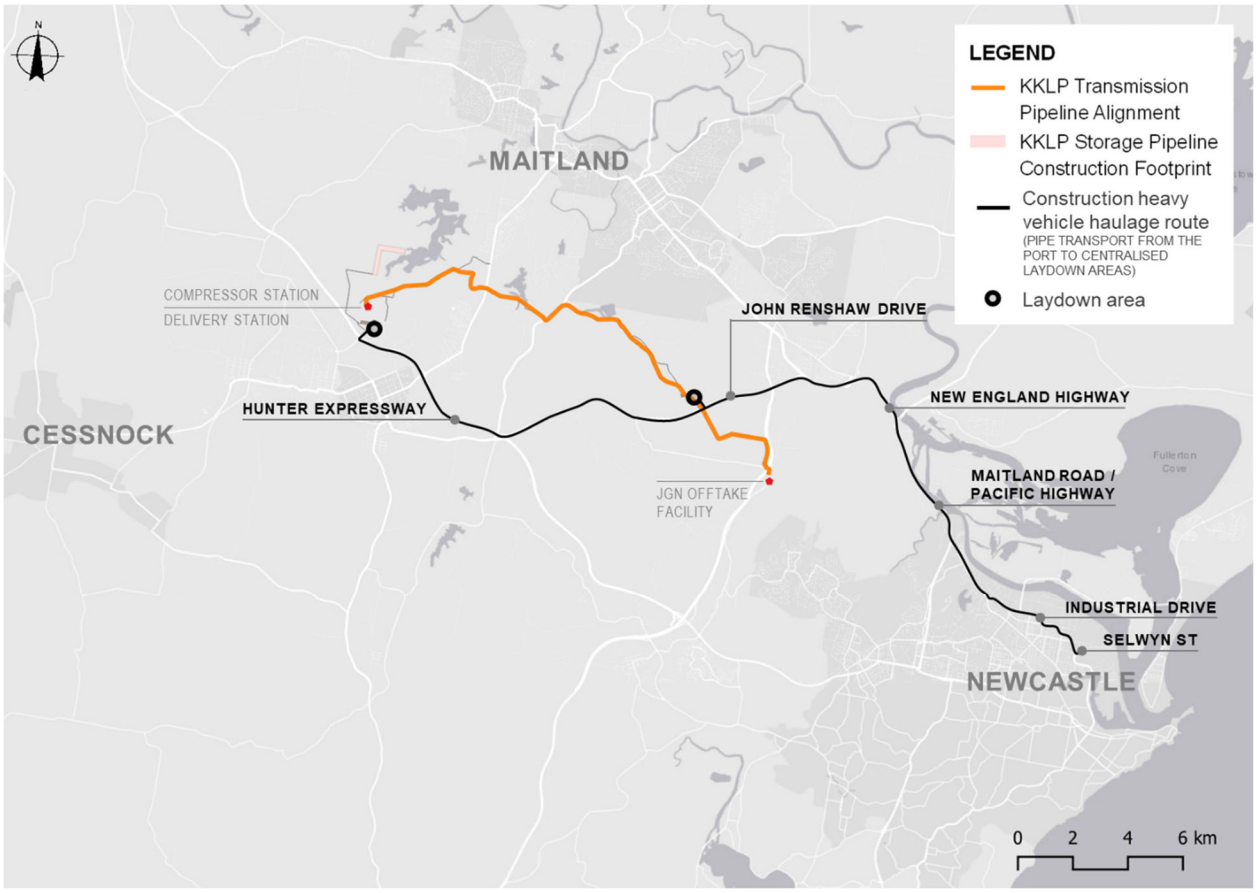
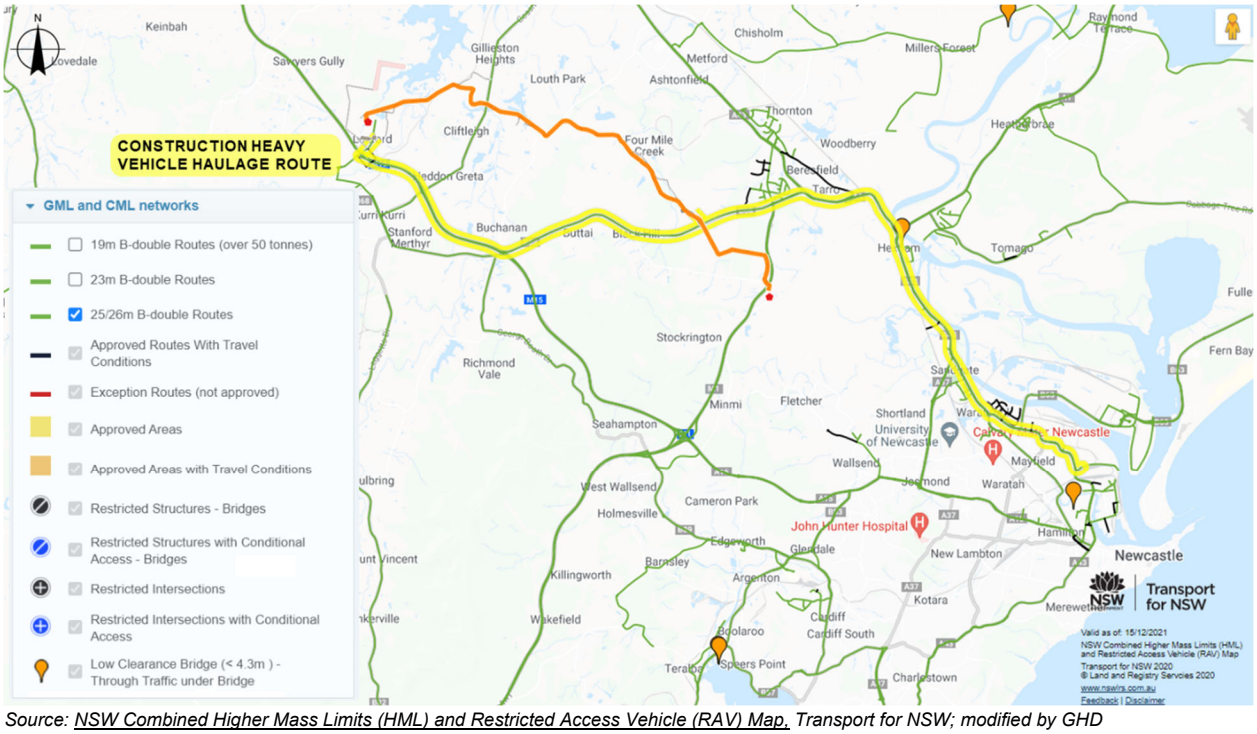
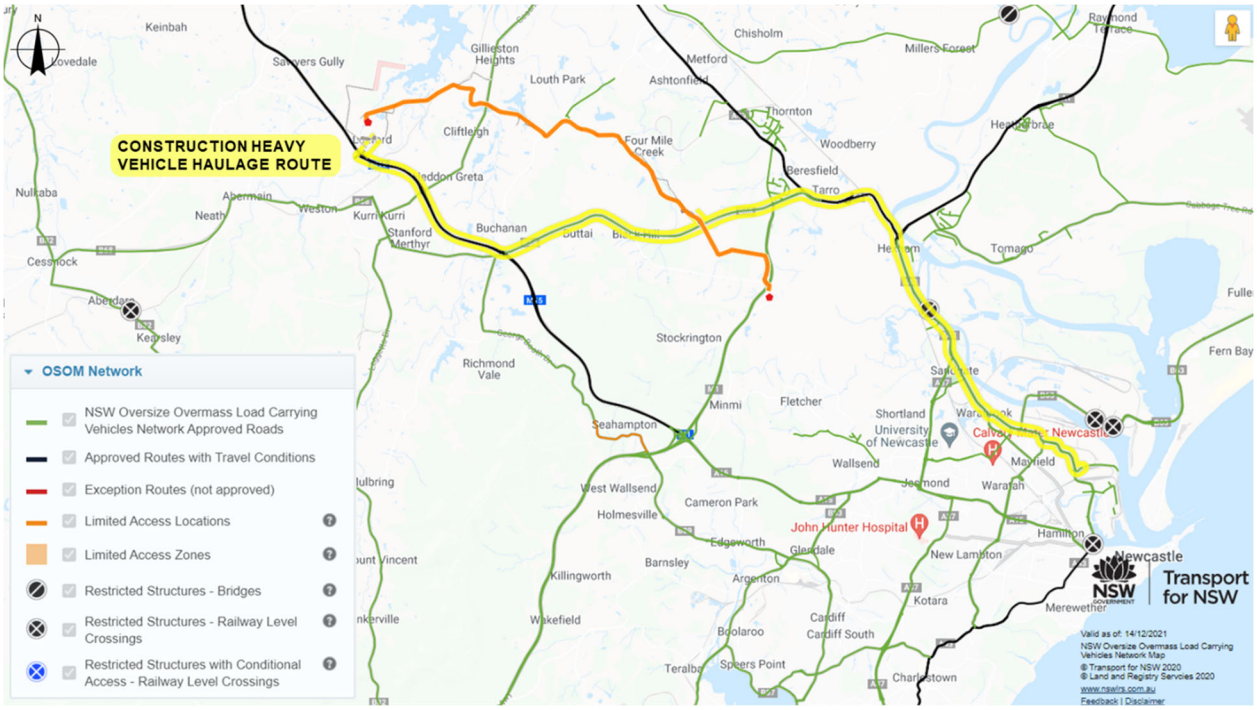


Figure 3-11 ***Construction heavy vehicle haulage route***



Source: NSW Combined Higher Mass Limits (HML) and Restricted Access Vehicle (RAV) Map, Transport for NSW; modified by GHD

Figure 3-12 ***Combined Higher Mass Limits (HML) and Restricted Access Vehicle (RAV) routes***



Source: NSW Oversize Overmass Load Carrying Vehicles Network Map, Transport for NSW; modified by GHD

Figure 3-13 Oversize Overmass (OSOM) routes

3.1.4 Public and active transport

Project activities and any changes in the road environment can impact all road users, including those on public and active transport (walking or cycling). A review of the existing public transport services and active transport facilities in the study area is conducted to determine any potential conflicts and mitigate or minimise negative impacts to these road users in terms of safety and amenity. Opportunities to access the site using public and active transport may also be identified.

In reviewing the site and its accessibility to public transport opportunities, reference was made to the *NSW Planning Guidelines for Walking and Cycling (2004)*. This document outlines a recommended walkable distance of 400 to 800 metres to public transport and other local amenities, or a 1.5-kilometre bicycle-riding distance.

Details of public transport, walking and bicycle riding access are provided in the following sub-sections.

3.1.4.1 Train services

Tarro Train Station of the Hunter Intercity Train Line is the nearest station accessible to the Project. It is located approximately 7 km from the eastern terminus of the transmission line alignment, which exceeds typical walking catchments.

The schedule of available train services from Tarro Station is summarised in Table 3-10, while a map of the nearby train line is shown in Figure 3-14.

*Table 3-10 **Train services***

Route / Station	Train Service Frequency	
	Monday to Friday	Weekends and Public Holidays
Scone or Dungog to Newcastle Interchange (Southbound)	23 per day	21 per day
Newcastle Interchange to Scone or Dungog (Northbound)	37 per day	24 per day

Source: Hunter Line Timetable, Transport for NSW

Source: Hunter Line Route Details, Transport for NSW; modified by GHD

Figure 3-14 Train services

3.1.4.2 Bus services

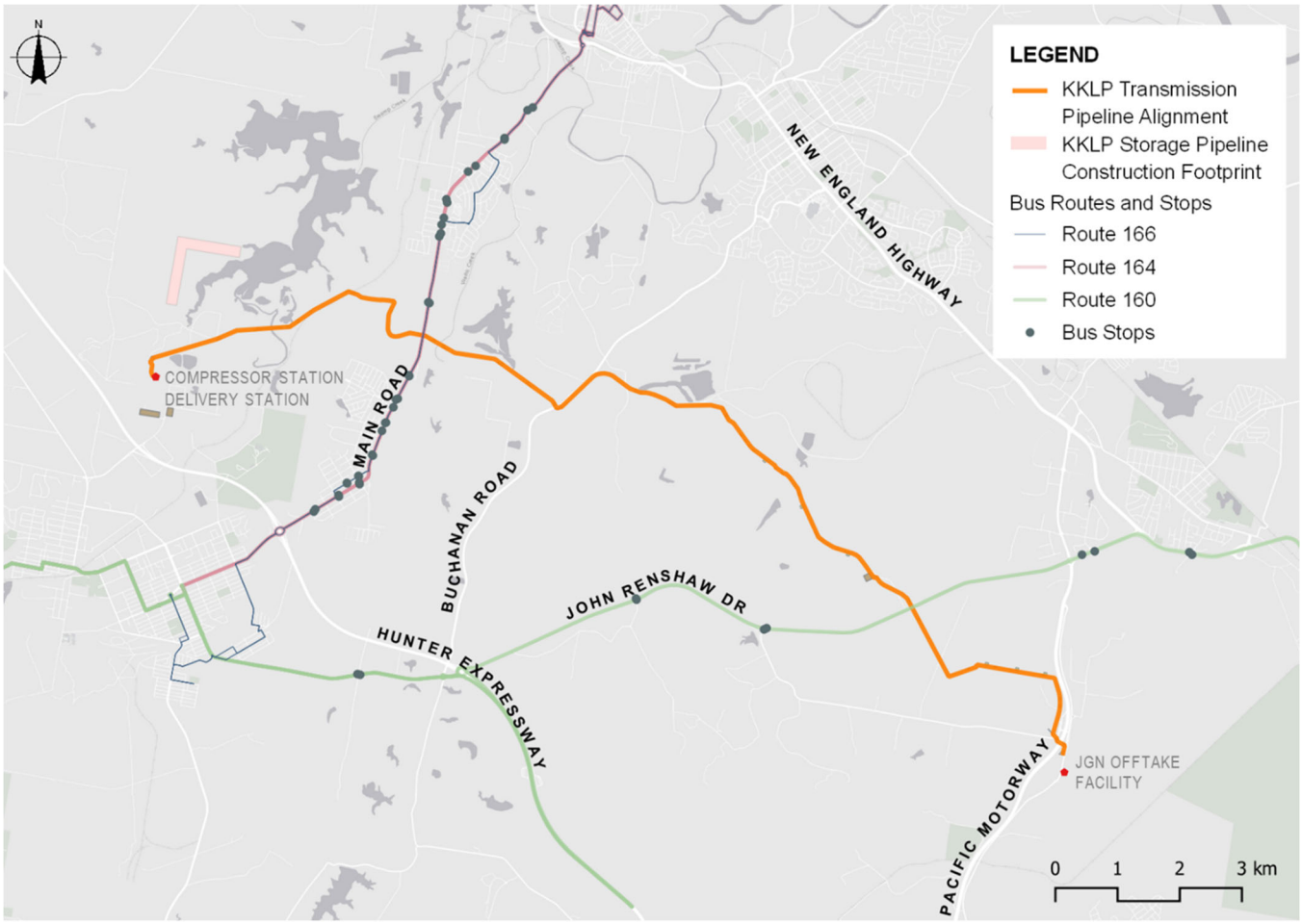
Bus services in the vicinity of the Project area are operated by Rover Coaches. Several bus stops can be accessed along John Renshaw Drive, Main Road, and Buchanan Road, as shown in Figure 3-15.

The routes and approximate frequencies are summarised in Table 3-11.

Table 3-11 ***Bus services***

Bus route description	Bus Service Frequency		
	Monday to Friday	Saturday	Sunday and Public Holidays
Route 160: Cessnock to Newcastle	5 trips per day *Operates between 6:45 am to 6:40 pm*	2 trips per day *Operates between 6:45 am to 6:30 pm*	No operations
Route 164: Cessnock to Maitland via Kurri Kurri	17 trips per day *Operates between 6:15 am to 8:55 pm*	12 trips per day *Operates between 8:00 am to 7:45 pm*	6 trips per day *Operates between 9:00 am to 7:45 pm*
Route 166: Kurri Kurri to Maitland	6 trips per day *Operates between 7:05 am to 5:50 pm*	3 trips per day *Operates between 9:15 am to 2:05 pm*	

Source: Bus Route Timetables 160 164 166, Transport for NSW



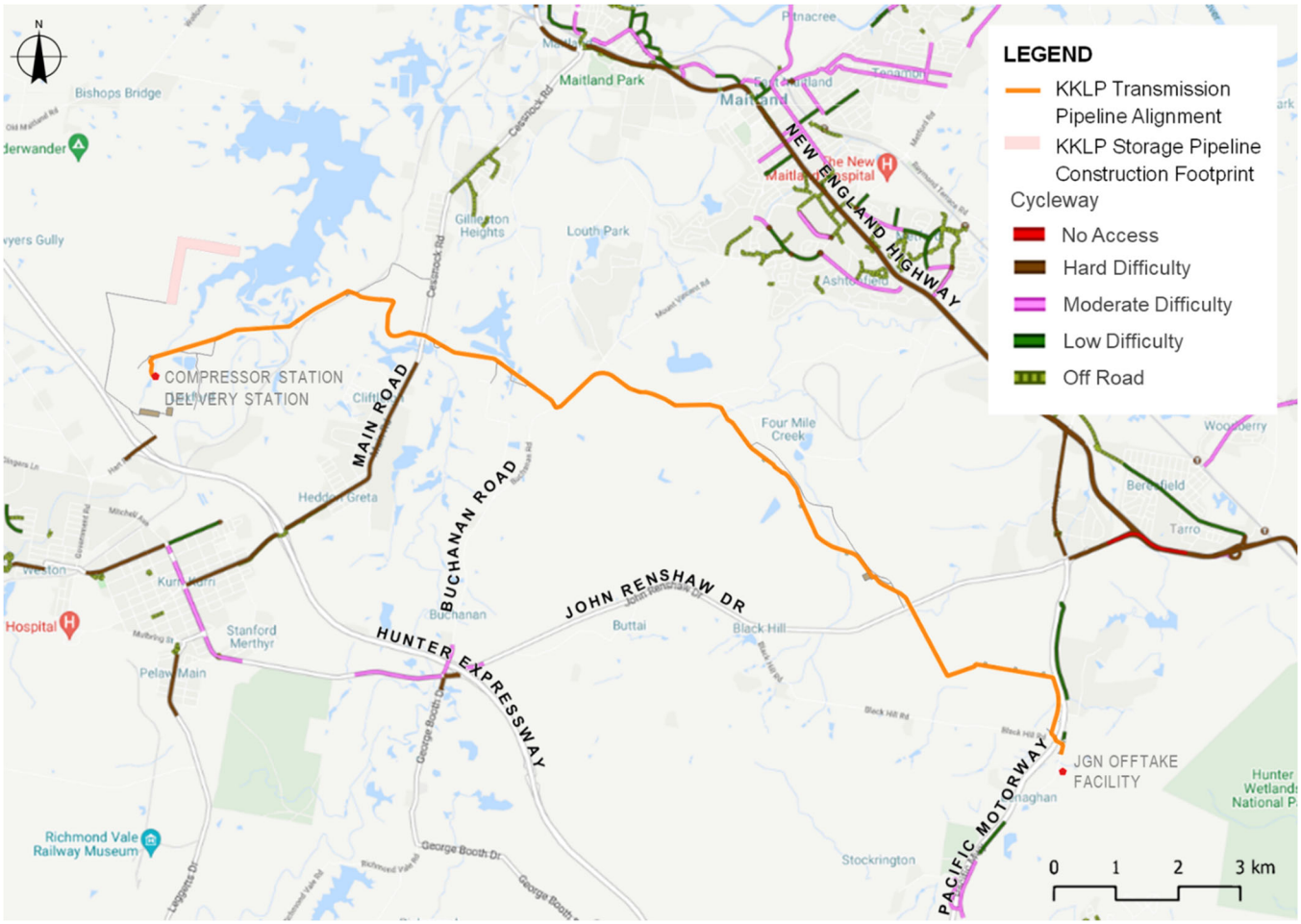
Source: Bus route information from Transport for NSW Bus Routes and Timetables

Figure 3-15 Bus routes and stops

3.1.4.3 Walking and cycling

Active transport facilities in proximity to the Project are currently limited and have poor connectivity.

As shown in Figure 3-16, cycling routes along key roads (John Renshaw Drive, Main Road, Buchanan Road, Pacific Motorway) are not continuous. Footpaths are also observed to be mostly limited to roads within suburbs. There are no dedicated footpaths and cycling lanes that provide direct access to the Project area.



Source: Transport for New South Wales Cycleway Finder; modified by GHD

Figure 3-16 Cycling facilities

3.2 Crash review

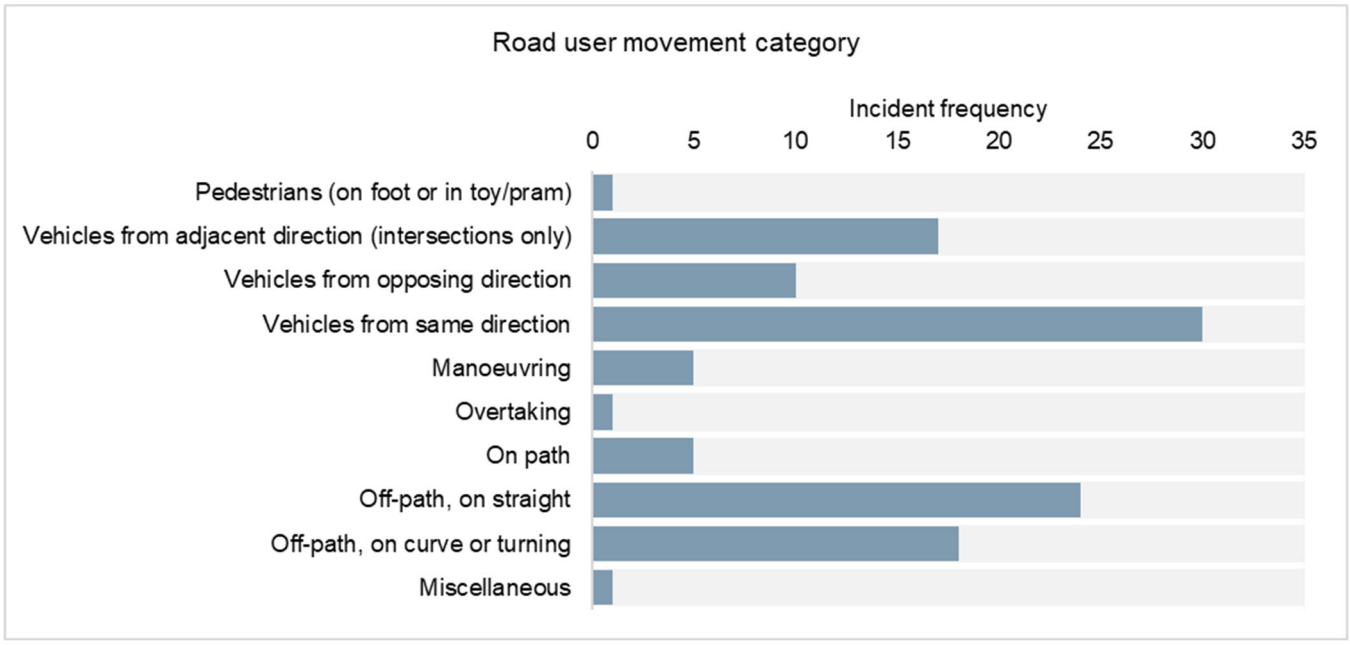
Road crash information in the study area was collected from road crash statistics published by NSW Centre for Road Safety over a five-year period. From 2016 to 2020, a total of 112 road crash incidents were recorded within a two-kilometre buffer zone from the transmission pipeline alignment, as presented in Table 3-12.

Table 3-12 ***Road crash incidents within 2-km radius of Project alignment***

Year	Degree of Crash					Total per year
	Non-casualty (towaway)	Minor/Other Injury	Moderate Injury	Serious Injury	Fatal	
2016	7		3	6	1	**17**
2017	10	3	7	9		**29**
2018	14	3	4	6		**27**
2019	7	3	7	6		**23**
2020	5		6	5		**16**
Total	**43**	**9**	**27**	**32**	**1**	**112**

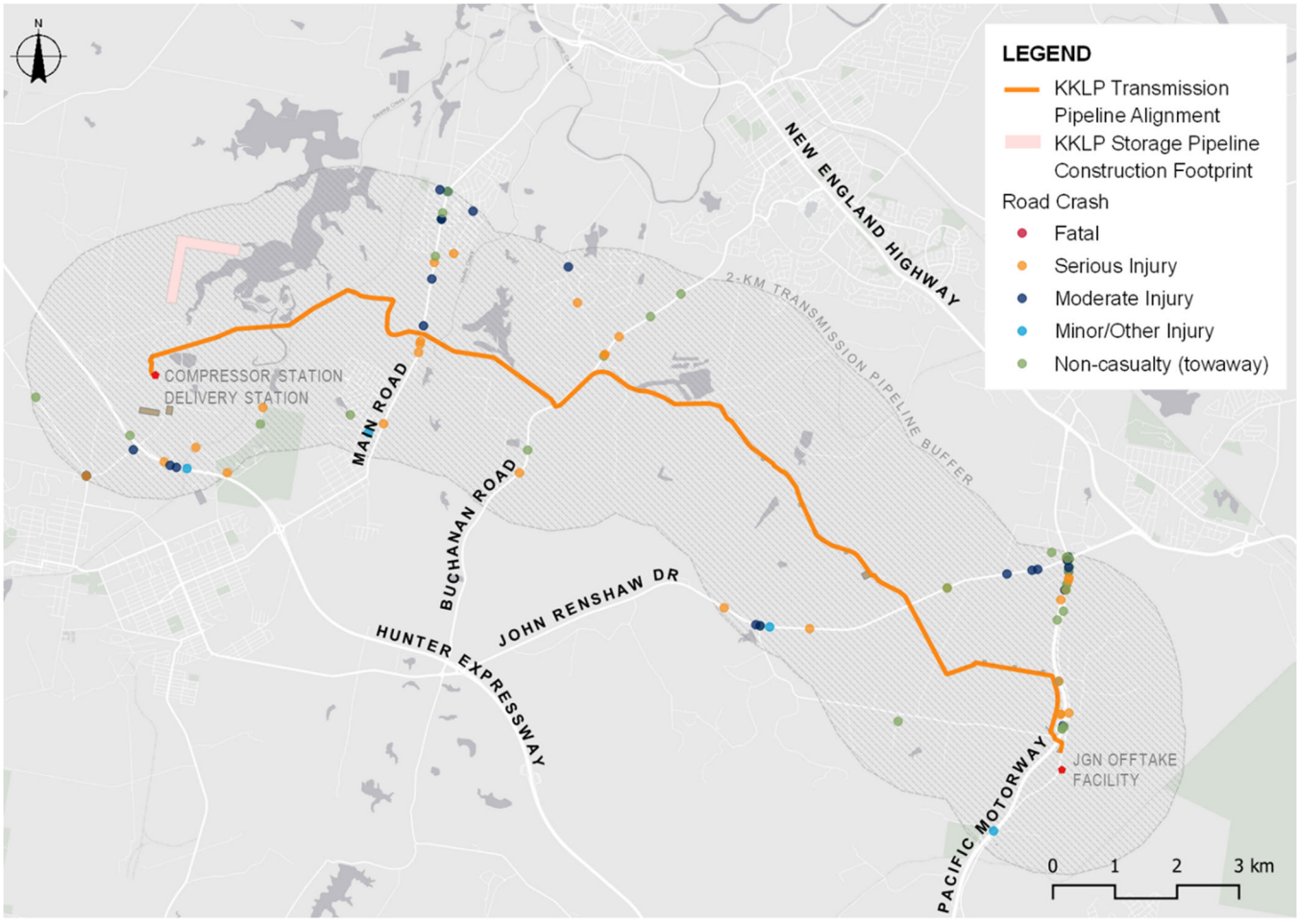
The predominant crash type category is Crashes with vehicles coming from the same direction (30 incidents), followed by Off-path on straight (24 incidents), Off-path on curve (18 incidents), and Vehicles from adjacent direction (17 incidents). A summary of the crash categories is shown in Figure 3-17, while the location of the crashes is shown in Figure 3-18. It is evident from the map that the intersection of Pacific Motorway and John Renshaw Drive (including the southern approach) has a significant number of recorded crashes. Upon inspection,

the crashes are noted to have occurred prior to the upgrade of the junction from a roundabout to a signalised x-intersection.



Data Source: NSW Road Crash Data 2016-2022, Centre for Road Safety

Figure 3-17 Incident frequency per road crash category



Data Source: NSW Road Crash Data 2016-2022, Centre for Road Safety

Figure 3-18 Road crashes within study area

Table 3-13 provides a summary of the road crash incidents within 500 m of the proposed access points / alignment crossings with public roads. Among these areas, Main Road has the highest number of recorded incidents for 2016-2020, with most of them resulting to injuries (three out of six of which were serious), notably for vehicles traveling northbound.

Table 3-13 Road crash incidents within 500m of proposed access points

Location	Design Speed (km/h)	Year	Crash Type	Degree of crash	Direction	Distance from proposed site access (approximate)
Black Hill Road	80	2016	Out of control on bend	Serious injury	Northbound	350 m to the east
Main Road (north)	60	2017	Pedestrian on carriageway	Moderate injury	Intersection	0 m
		2018	U-turn	Serious injury	Southbound	260 m to the north
		2018	Off-carriageway, left bend into object	Non-casualty (towaway)	Southbound	400 m to the north
Main Road (near Tester's Hollow)	60	2016	Rear-end	Moderate injury	Northbound	130 m to the north
		2016	Head-on (overtake)	Serious injury	Northbound	90 m to the south
		2020	Head-on	Serious injury	Northbound	160 m to the south

3.3 Traffic

3.3.1 Existing traffic volumes

Traffic data was obtained from permanent counts data published on the Transport for NSW Traffic Volume Viewer, and secondary data from available traffic studies and reports of other developments within the study area. The location of the mid-block counts are shown in Figure 3-19, while the list of available data is outlined in Table 3-14.

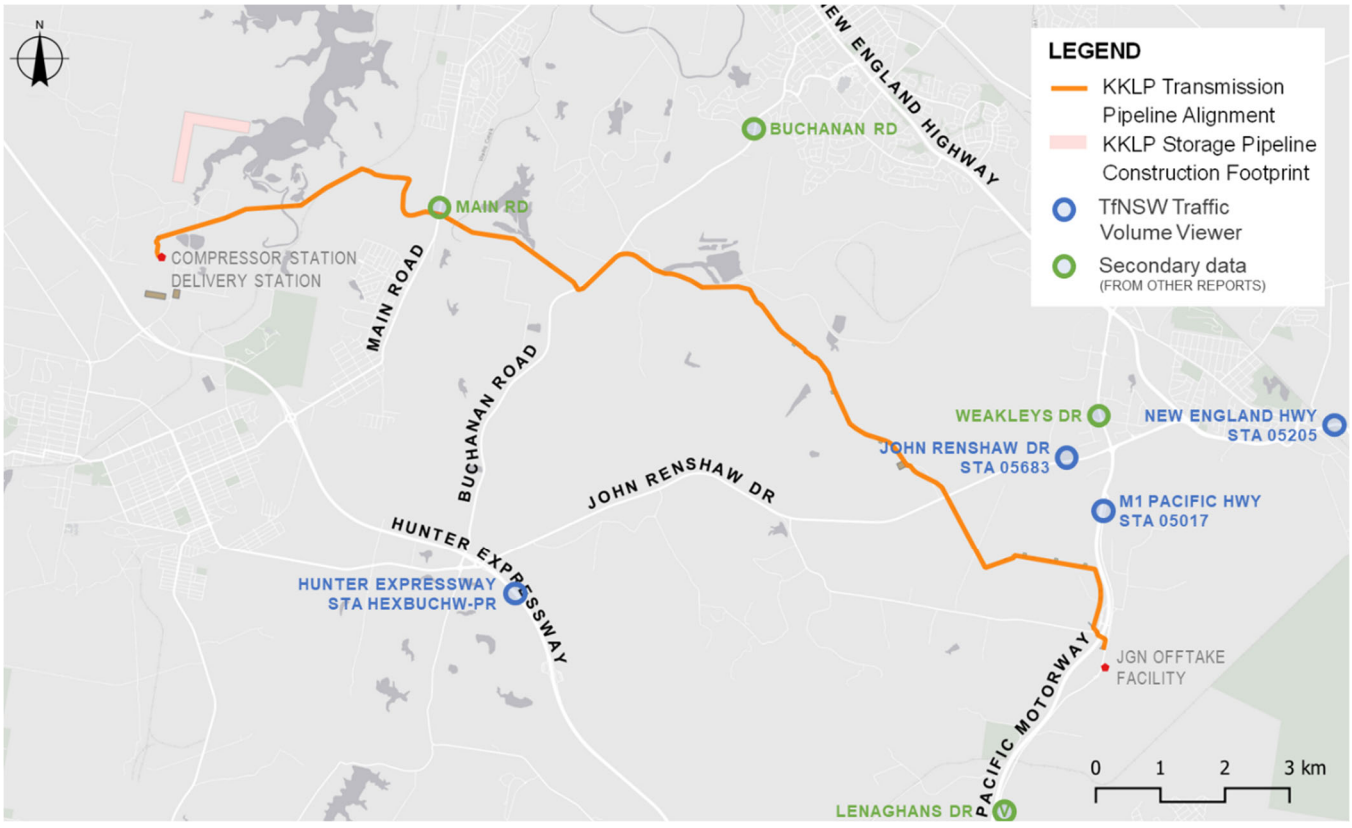


Figure 3-19 Location of traffic volume data

Table 3-14 ***Traffic volume data (directional mid-block counts)***

Road Name	Available counts	Count Year	Source
Maitland Road *	Hourly average (24 hours)	2015	TfNSW Traffic Volume Viewer
New England Highway	Hourly average (24 hours)	2018	TfNSW Traffic Volume Viewer
John Renshaw Drive	Hourly average (24 hours)	2014	TfNSW Traffic Volume Viewer
Hunter Expressway	Hourly average (24 hours)	2021	TfNSW Traffic Volume Viewer
M1 Pacific Motorway	Hourly average (24 hours)	2016	TfNSW Traffic Volume Viewer
Weakleys Drive	Peak hour only	2019	TIA – Stage 1 and 2 Industrial Development – John Renshaw Drive, Black Hill (GTA Consultants, 2021)
Buchanan Road	Peak hour only	2014	TIA – Seniors Living Development, East Maitland (Intersect Traffic Pty Ltd, 2017)
Main Road	Daily average only	2018	Review of Environmental Factors – Cessnock Road Upgrade at Testers Hollow (Jacobs and Roads and Maritime Services, 2019)
Lenaghans Drive	Daily and peak hour only	2007	Traffic Study – Lower Hunter Lands Project, Minmi Link Road & Stockrington (Hyder Consulting Pty Ltd, 2011)

** Not shown in map*

As the Project is not confined to a single area, the peak period of each road is expected to vary depending on location, land use, and direction of travel. The data review showed that peak traffic volumes were observed in the morning between 7:00am-11:00am, and in the afternoon between 3:00pm-6:00pm across the identified key roads.

Since there is no singular “peak hour” for the network, the peak traffic volume for each road is used in the analysis, regardless if the peak volumes did not actually occur at the same time in the road network. This allows for the conservative assessment of the worst-case scenario that could take place in the study area.

Traffic counts for 2021 were estimated from the traffic volume data using the following assumptions:

– growth rate of one per cent per annum
– peak hour traffic is equivalent to 10 per cent of average daily traffic.

A summary of the derived traffic volume counts is provided in Table 3-15.

Table 3-15 ***Traffic volume count summary (2021)***

Road Name	Station ID	Direction	AADT	Peak hour		Existing traffic	
				AM	PM	AM Peak (vph)	PM Peak (vph)
Maitland Road	05205	Southbound	11,397	08:00 - 09:00	17:00 - 18:00	1,013	856
		Northbound	11,626	08:00 - 09:00	17:00 - 18:00	720	1,024
New England Highway	05055	Southbound	38,978	10:00 - 11:00	16:00 - 17:00	1,588	2,924
		Northbound	36,622	07:00 - 08:00	16:00 - 17:00	3,103	2,445
John Renshaw Drive	05683	Eastbound	5693	07:00 - 08:00	16:00 - 17:00	463	429
		Westbound	6038	07:00 - 08:00	16:00 - 17:00	371	565
Hunter Expressway	HEXBUCHW -PR	Eastbound	15,356	07:00 - 08:00	16:00 - 17:00	1,159	1,391
		Westbound	15,323	07:00 - 08:00	16:00 - 17:00	1,139	1,253
M1 Pacific Motorway	05018	Southbound	18,050	10:00 - 11:00	16:00 - 17:00	1,140	1,598
		Northbound	18,327	10:00 - 11:00	15:00 - 16:00	1,201	1,138
Weakleys Drive	N/A	Southbound	No data	10:00 - 11:00	16:00 - 17:00	878	1,089
		Northbound	No data	08:00 - 09:00	16:00 - 17:00	1,228	936
Buchanan Road	N/A	Southbound	No data	08:00 - 09:00	16:30 - 17:30	278	480
		Northbound	No data	08:00 - 09:00	16:30 - 17:30	324	351

Main Road	N/A	Southbound	8,317	08:00 - 09:00	16:00 - 17:00	840	840
		Northbound	8,458	08:00 - 09:00	16:00 - 17:00	854	854
Lenaghans Drive	N/A	Southbound	2009	08:00 - 09:00	15:00 - 16:00	205	239
		Northbound	2009	08:00 - 09:00	15:00 - 16:00	217	205

Note: AADT = Annual Average Daily Traffic vph = vehicles per hour

3.3.2 Mid-block analysis

Level of Service (LoS) is a qualitative description of the performance of a road facility that uses a set of letters from A to F to denote different levels of congestion of a corridor or network, with “A” being the most desirable (i.e. free flow) and “F” being the worst (i.e. forced or breakdown flow). LoS “D” is generally adopted as the acceptable lower-limit threshold for major traffic-carrying roads. LoS descriptions are summarised in Table 3-16.

Table 3-16 Level of Service (LoS) descriptions

Level of Service	Traffic Condition
A	Free flow. Individual drivers are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and manoeuvre within the traffic stream. Excellent general level of comfort and convenience.
B	Stable flow. Reasonable freedom to select desired speeds and to manoeuvre within the traffic stream. General level of comfort and convenience slightly less than that of LoS A.
C	Stable flow. Restricted freedom to select desired speed and to manoeuvre within the traffic stream. Decline in general level of comfort and convenience.
D	Approaching unstable flow. Severely restricted freedom to select desired speed and to manoeuvre within the traffic stream. Poor general level of comfort and convenience. Small increases in traffic flow will generally cause operational problems.
E	Unstable flow, operating at or close to capacity. Virtually no freedom to select desired speed and to manoeuvre within the traffic stream. Minor disturbances within the traffic stream will cause a traffic-jam.
F	Forced flow, operating over capacity. Flow break-down occurs and queuing and delays result.

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

Table 3-17 indicates the LoS and service volumes (capacities) for basic freeway segments. These values will be used to assess New England Highway, Hunter Expressway, and Pacific Motorway. Table 3-18 indicates the LoS and mid-block capacities for urban roads, which will be used for all other roads; the lower per lane capacity for one-lane carriageways in comparison with two-lane carriageways reflects a restriction on drivers' ability to travel at their desired speed.

Table 3-17 Example service volumes for basic freeway segments

Level of Service	Two Lanes (vph)
A	1,440
B	2,260
C	3,150
D	3,770
E	4,120

Sources: Highway Capacity Manual, (2000)

Table 3-18 Urban road peak hour flows per direction

Level of Service	One Lane (vph)	Two Lanes (vph)
A	200	900
B	380	1,400
C	600	1,800
D	900	2,200
E	1,400	2,800

Source: RTA Guide to Traffic Generating Developments (2002)

Table 3-19 presents the LoS of the key roads in the study area.

Table 3-19 Existing mid-block LoS – key roads (2021)

Road Name	Station ID	Direction	AADT (vph)	Existing traffic		Lanes per direction	LOS (2021)	
				AM Peak (vph)	PM Peak (vph)		AM Peak	PM Peak
Maitland Road	05205	Southbound	11,397	1,013	856	2	B	A
		Northbound	11,626	720	1,024	2	A	B
New England Highway	05055	Southbound	38,978	1,636	3,012	2	B	C
		Northbound	36,622	3,196	2,518	2	D	C
John Renshaw Drive	05683	Eastbound	5693	463	429	1	C	C
		Westbound	6038	371	565	1	B	C
Hunter Expressway	HEXBUCHW-PR	Eastbound	15,356	1,159	1,391	2	A	A
		Westbound	15,323	1,139	1,253	2	A	A
M1 Pacific Motorway	05018	Southbound	18,050	1,140	1,598	2	A	B
		Northbound	18,327	1,201	1,138	2	A	A
Weakleys Drive	N/A	Southbound	No data	878	1,089	2	A	B
		Northbound	No data	1,228	936	2	B	B
Buchanan Road	N/A	Southbound	No data	278	480	1	B	C
		Northbound	No data	324	351	1	B	B
Main Road	N/A	Southbound	8,399	840	840	1	D	D
		Northbound	8,541	854	854	1	D	D
Lenaghans Drive	N/A	Southbound	2009	205	239	1	B	B
		Northbound	2009	217	205	1	B	B

Note: AADT = Annual Average Daily Traffic vph = vehicles per hour

This analysis indicates that, presently,

– New England Highway's northbound direction is operating at LoS D, signifying that it is nearing capacity during the AM peak period.

– Main Road is operating near capacity, with existing volumes approaching the limit of 900 vph for LoS D. Main Road has been recorded operate at LoS D as early as 2018, and has been identified by the Cessnock City Council[3] as one of the key roads in the LGA which needed improvements.

– Other roads in the study area are operating below capacity and have the capacity to accommodate additional traffic.

3.4 Other developments

The following ongoing and planned projects / developments have been identified in proximity to study area:

[3] Cessnock LGA Transport and Traffic Strategy (2018)

– **Hydro Kurri Kurri Aluminium Smelter Demolition and Remediation Project:**
  - This project involves ongoing remediation works following the demolition of the aluminium smelter, where the proposed Hunter Power Project will be developed. Demolition works have been completed and the remediation works are expected to be ongoing until late 2023, which would coincide with the KKLP Project construction.
  - Traffic generation of the ongoing works estimated to be 29 vehicles per hour (25 light vehicles and 4 heavy vehicles) during the peak construction period.[4] This estimated traffic would not negatively impact the present project.
– **Hunter Power Project:**
  - Construction activities for the Hunter Power Project are anticipated to commence early 2022 and is intended to be operational by the end of 2023, coinciding with the construction of the KKLP Project.
  - Hunter Power Project's construction works are estimated to have a maximum traffic generation of 142 heavy vehicle movements per day (approximately 13 vph for an 11-hour work period). Light vehicle movements for the project are expected to occur outside of network peak periods.[5] Same as above – low impact.
– **Cessnock Road Upgrade at Testers Hollow:**
  - The upgrade is proposed to raise the height of Cessnock Road (Main Road) at Testers Hollow to reduce the impacts of flood events on the road's usability during flooding events. Construction works started in November 2020 and the upgrade is expected to be completed in early 2023[6], weather permitting.
  - The road upgrade is expected to be complete by the time construction works on the Project commence, which therefore is not expected to result in cumulative traffic impacts with KKLP.

Black Hill Development – MR588 Intersection Works:

- The Black Hill Industrial Park (Hunter Business Park) is a proposed industrial subdivision to be located within the Emerging Black Hill Precinct, at the corner of M1 Pacific Motorway and John Renshaw Drive. Development approval was granted[7] for Stage 1 of the subdivision in August 2021, with applications for the remaining stages currently under way.
- As part of the conditions for approval, a signal-controlled intersection will be constructed at the subdivision's western access at John Renshaw Drive. Timeline of intersection works is currently unknown, but generated traffic from the works is expected to be minimal and is not seen to impact the Project.

– **M1 Pacific Motorway extension to Raymond Terrace:**
  - A 15-kilometre extension from of the M1 Pacific Motorway's current northern terminus in Black Hill to Pacific Highway in Raymond Terrace. The extension would connect to the existing road network via four new interchanges at Black Hill, Tarro, Tomago and Raymond Terrace.
  - The extension is a priority project of the Australian and NSW governments and is seen to "boost the regional economy and improve connectivity, road transport efficiency and safety for local and interstate motorists".
  - The project's EIS was placed on exhibition from 28 July to 24 August 2021. The extension is estimated to begin construction mid-2023[8] and is expected to open in 2028.
  - No interactions with the Project are anticipated as construction works on the eastern terminus of the KKLP Project is expected to be completed by the time the extension works will commence.

[4] Hydro Kurri Kurri Aluminium Smelter Demolition and Remediation Project Traffic Impact Assessment (Hyder, 2016)
[5] Hunter Power Project Environmental Impact Statement (Jacobs, 2021)
[6] Project information, TfNSW (Link to project website)
[7] Development Application - Stage 1A and 1B 198 Lenaghans Drive Black Hill NSW 2322 (Link to application details)
[8] M1 Pacific Motorway Extension to Raymond Terrace Project Information (Link to website)

4. Construction activities

This section provides details of key construction activities that have informed the TIA. The activities assessed as part of this TIA include vehicle traffic associated with the construction of the Project. As the construction works will not be limited to a single location, the Project site has been categorised into three main areas:

– **SP/West TP**, referring to the western section of the transmission pipeline (TP) located in proximity to Main Road. This area is also where the storage pipeline (SP), compressor station and delivery station is located.
– **Central TP**, referring to the section of the TP accessible via Buchanan Road, north of John Renshaw Drive.
– **East TP/Offtake**, referring to the eastern section of the TP, from John Renshaw Drive down to Lenaghans Drive. The JGN Offtake Facility is located in this area.

4.1 Construction methodology

4.1.1 Transmission and storage pipelines

Construction of both the transmission and storage pipelines will use typical methods for modern gas pipelines. Given the larger diameter pipe required for the storage pipeline, there will be some differences in construction methodology relative to the transmission pipeline. Notably, construction equipment will be larger, the construction rate will be slower, and welding and weld testing methods appropriate for the increased wall thickness will be implemented. The construction footprint for the storage pipeline will also be cleared and reinstated incrementally to match construction progress, and to minimise the area of exposed ground during construction.

The construction sequence for the transmission pipeline and storage pipeline will involve the following key steps, which are described in greater detail in subsequent sections:

– Preliminary survey works (including geotechnical surveys, installation of temporary gates in fences)
– Clearing of vegetation and grading the right of way (ROW)
– Stripping and stockpiling of topsoil
– Delivery of pipe segments to the ROW and welding into ‘strings’
– Non-destructive testing (NDT) and coating
– Excavating a trench and any necessary bell holes in which to lay the pipe
– Lowering the pipeline strings into the trench and welding strings together
– Backfilling the trench with excavated material
– Crossing watercourses and roads by open cut trench, horizontal boring or horizontal directional drilling (HDD) methods
– Installing pipeline markers at fences, road crossings and other locations as required by AS 2885
– Testing the structural integrity of the pipeline by hydrostatic testing
– Installing permanent gates in fences, where required
– Rehabilitating the ROW.

4.1.2 Associated surface facilities

Construction of the JGN offtake facility, compressor station and delivery station will be undertaken by specialist crews across several stages of works. These stages broadly comprise site set up, earthworks and civil construction, mechanical, electrical and instrumentation works and testing and commissioning.

Site set up within the construction footprint of each associated surface facility is required to provide a safe and efficient area for construction activities. This includes constructing temporary access to the construction sites, clearing vegetation, installation of temporary fencing and site offices, set up of lay down areas, and relocating existing services if required.

Earthworks will then be undertaken to modify existing ground levels to the required design levels. The topsoil may be required to be replaced with engineered fill or pilings installed to minimise ground settlement. Steel reinforced concrete foundations and piled steel footings will then be installed for fixing surface facility equipment and supports on to.

Following installation of foundations and footings, work to install structural, mechanical, piping, electrical and instrumentation (SMPEI) components can be undertaken. Specialist crews will install structural supports, mechanical equipment, piping spools, electrical equipment, cabinets and panels, cabling, instrumentation, buildings, and walkways.

The majority of major equipment and SMPEI components will be manufactured outside of Australia, although fabrication of skids and installation of equipment will be undertaken within Australia where equipment is shipped as separate components. The major equipment and SMPEI components will be transported to the Port of Newcastle by ship, then transported by semi-trailer to the relevant associated surface facility site for installation.

Testing and commissioning of the associated surface facilities may involve hydrostatic testing of pipework, as well as testing of mechanical and electrical equipment to make sure they have been installed correctly and are ready for commissioning. Commissioning involves fine tuning of equipment and instrumentation by running the facilities through various operating ranges. Once each facility passes all checks following a commissioning plan, it is ready to commence operations.

Construction of the associated surface facilities is estimated to take approximately 9 months to complete, with around five months for commissioning. Note that commissioning will occur sequentially and overlap with the construction phase, such that construction and commissioning of associated surface facilities is estimated to require 11 months in total.

4.1.3 Road and rail crossings

The transmission pipeline alignment crosses five sealed public roads and one railway line.

Crossings of sealed public roads will be constructed by horizontal boring or HDD depending upon the type and nature of the crossing, and geotechnical conditions. The crossing methodology will also take into account any technical requirements, such as design requirements of the infrastructure owner, for example, local council.

Unsealed private roads and will typically be crossed using open cut trenching. The primary haul road for the Bloomfield Coal Mine will be crossed by horizontal boring to avoid potential delays to mining hail truck operations.

Horizontal boring is proposed for the following road and rail crossings:

– KP 0.2, M1 Pacific Motorway
– KP 0.3, Black Hill Road
– KP 8.2, Main haul road for the Bloomfield Coal Mine
– KP 12.0, Buchanan Road
– KP 14.5, Cessnock Road
– KP 16.3, South Maitland Railway.

The storage pipeline does not cross any sealed public roads or railway lines.

4.1.4 Logistics

Logistics considered as part of construction activities for the Project include:

– Pipe importation, transport to site and transport to the ROW
– Delivery of construction plant and equipment
– Delivery of infrastructure for associated surface facilities
– Transport of construction crew.

4.1.4.1 Pipe Importation, Transport to Site and Transport to the ROW

Line pipe of the size and specification required for the transmission and storage pipelines, and storage pipeline bend sections, is not manufactured by any existing Australian steel mill. As such, the line pipe for the Project will be manufactured overseas, imported into Australia by ship (HandyMax Class or similar) and unloaded at a suitable port.

The Port of Newcastle is likely to be the most suitable option and has been adopted for the purposes of assessment in this EIS. Although a single ship will have sufficient capacity to deliver all transmission and storage pipeline pipe segments to the port, it is likely that transmission and storage pipe will be delivered on separate ships as manufacturing is likely to occur at different steel mills.

Some temporary stockpiling of pipe may be required at the port prior to transportation to the site.

The most likely pipe transport method is road transport by truck from the port to centralised laydown areas, then trucked to the ROW when required.

Pipe laydown areas are proposed for the transmission pipeline on an existing cleared hardstand near KP5 and for the storage pipeline near the compressor facility.

The most likely road transport route from the port would follow Selwyn Street, Industrial Drive (A43), Maitland Road/Pacific Highway (A43), New England Highway (A1), John Renshaw Drive (B68) for both transmission and storage pipeline segments.

Transmission pipeline segments are then proposed to be stored on an existing hardstand associated with the former Donaldson Open Cut Coal Mine, with access off John Renshaw Drive. Storage pipeline segments would be transported further along John Renshaw Drive, then the Hunter Expressway (M15) and Hart Road to the proposed laydown areas at the site of the former Hydro aluminium smelter.

Approximately 1,062 and 60 truck deliveries would be required to transport pipe segments from the Port to the laydown areas for the storage pipeline (including the 14” connecting pipeline and pipe bends) and transmission pipeline respectively. The higher number of truck movements for the storage pipeline is primarily due to only two large diameter pipe segments to be transported on a single truck. Deliveries for the transmission pipeline and storage pipeline to laydown areas are likely to require approximately three and 43 days of pipe delivery operations respectively, assuming 25 truck deliveries for each pipeline per day.

Pipes will be transported from each laydown area to the required location on the ROW by extendable semi-trailers.

Approximately three to six round trips per day by extendable semi-trailers will be required to deliver 56 and 12 pipe lengths from the laydown areas to the transmission and storage pipeline ROWs respectively, based on a construction rate of 1 km/day for the transmission pipeline and 200 m/day for the storage pipeline.

Transport by truck from the port to centralised laydown is the most likely pipe delivery scenario to be adopted and is assessed in this EIS given that it also has the potential to have the greatest impact on road users and the road network within and surrounding the Project. Adoption of direct delivery to the ROW would result in reduced impacts on the road network.

4.1.4.2 Delivery of pipeline construction plant and equipment

Construction equipment and heavy machinery for the transmission and storage pipelines will be mobilised directly to the construction footprint, once initial clearing and grading operations have commenced and sufficient space is available.

It is estimated that 140 pieces of heavy construction equipment would be required during the construction phase of the pipelines. To enable a conservative assessment of traffic impact, it is assumed that heavy construction equipment will be transported over a three or four week-period from either Queensland (via the Pacific Highway), Sydney (via the M1 Pacific Motorway), Dubbo (via the Golden Highway) or Victoria (via the Hume Highway). It is likely, however, that common earthmoving equipment such as graders and dozers would be sourced and mobilised from the local area.

Construction equipment would be mobilised by 50-tonne floats, and would generate approximately five heavy-vehicle trips per day over four weeks. Equipment will be demobilised progressively following core construction.

4.1.4.3 Delivery of associated surface facilities plant, equipment and materials

As with pipeline construction, associated surface facility construction equipment and heavy machinery will be mobilised directly to the relevant construction site. It is estimated that around 24 pieces of heavy construction equipment will be required for the construction phase of associated surface facilities.

Estimated deliveries by heavy vehicles to associated surface facilities during the construction phase is summarised below:

– 50-tonne floats: 12 deliveries of large heavy machinery during mobilisation, and the same during demobilisation.
– Cranes: Five Franna cranes distributed across the surface facility construction sites, one 150-tonne crane servicing both the compressor station and delivery station and one pile driving crane, all self-mobilised.
– Semi-trailers (2 and 3-axle): 133 deliveries of structural, mechanical and electrical equipment, temporary offices and lunchrooms, and major equipment skids. The majority of these deliveries (94) are for the compressor station and delivery station, and would generally use the same transport route as storage pipeline deliveries from the Port of Newcastle.
– Heavy rigid trucks: 72 deliveries of bulk materials including gravel and concrete.

4.1.4.4 Transport of construction crew

Daily travel by construction crews between accommodation in the region surrounding the Project and the relevant work area will typically be undertaken by light vehicles (i.e. cars and utes). During work shifts, light vehicles will be parked on the construction footprint at the relevant work area. The use of buses to transport construction crews between accommodation and the work area is not considered practicable due to the proposed use of a range of accommodation providers in the region, the number and geographic spread of work areas that will be active at any one time, and the use of light vehicles to transport tools and equipment required to undertake various pipeline and facility construction tasks.

4.1.5 Construction period and hours

The core construction phase for each Project component is expected to require approximately ten months for associated surface infrastructure, ten months for the storage pipeline and six months for the transmission pipeline. Mobilisation, demobilisation and commissioning activities will be completed prior to and following core construction respectively. The full construction and commissioning of the Project will require approximately 12 months.

Construction activities for the transmission pipeline and JGN facility will be undertaken from 7:00 am to 6:00 pm Monday to Friday, and 8:00 am to 1:00 pm on Saturdays, with no works undertaken during Sundays and public holidays. The deviation from the typical 6:00 am start of construction works will be implemented to mitigate noise impacts to residential areas in the area traversed by the transmission pipeline construction.

Construction activities for the storage pipeline are proposed to be undertaken between 6:00 am and 6:00 pm, seven days per week, given the much larger separation distances to residential areas. Construction crews will typically work a rostered cycle of 21 days on/7 days off, as per the pipeline industry standard, with 10 cycles likely to be required during the construction phase.

Construction shifts for the associated surface facilities are likely to comprise six days/week, with no work Sundays. Activities that may require construction outside the hours of 6:00 am and 6:00 pm include:

– Construction of road crossings
– Horizontal Directional Drilling (HDD)
– Horizontal Boring
– Hydrostatic testing and drying
– Non-destructive testing
– Transportation by oversized trucks
– Unexpected circumstances.

In addition, extended construction hours may be worked where an agreement is reached with the affected landholder in order to reduce the duration of construction activities and/or manage other disturbances.

4.1.6 Construction workforce

The construction workforce for the Project is estimated to peak at around 398 personnel over one month when core construction of the transmission pipeline, storage pipeline and compressor station overlaps. Workforce numbers are estimated to be below 330 personnel over the remainder of the 12-month construction period. Estimated construction workforce numbers for each month of the construction phase are shown in the workforce histogram below (refer to Figure 4-1).

During the peak period (fourth month of construction works, around April 2023), an estimated 398 workers will be mobilised for the construction works. Assuming that workers will be sharing transport to the site (two workers to one vehicle), approximately 199 light vehicle journeys will be generated in the morning and evening during the peak construction period.

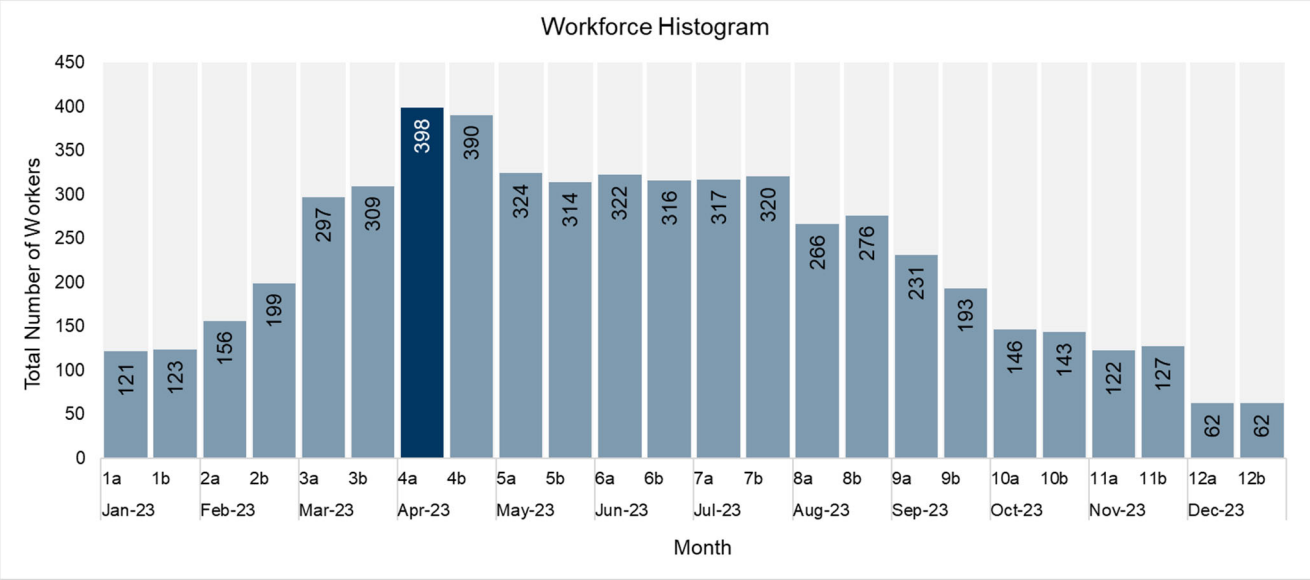


Figure 4-1 Construction workforce histogram

5. Operation and maintenance

A limited range of activities will be required to operate the Project, as described in the following sections. Traffic generation during operations is expected to be minimal.

5.1.1 Pipeline inspections and maintenance

A routine inspection and maintenance program will be implemented for the transmission and storage pipelines during the operation of the Project. Inspection of the easements for issues such as erosion, weeds, subsidence, revegetation and unauthorised third party activity will be undertaken on a regular basis by ground and aerial patrols.

5.1.2 Operation of associated surface facilities

The associated surface facilities are designed to be automated and will be operated unmanned under normal operating conditions. Site inspections would typically be undertaken on a weekly basis.

6. Impact assessment

This section provides details of the estimated traffic that will be generated by the proposed works, and an analysis of its likely impacts to the immediate road network.

As the operation and maintenance stages of the project are expected to generate minimal traffic compared to the construction stage, the analysis of the construction impacts would highlight the most significant impact that the Project would have on the road network. For the purposes of this assessment, the traffic generation during the peak construction period (estimated to take place on the fourth month of construction works, around April 2023) will be analysed to account for the worst-case scenario.

6.1 Traffic generation

The following assumptions were utilised in the estimation of construction traffic generation:

- Light vehicle movements to the three main site areas (SP/West TP, Central TP, East TP/Offtake) were estimated based on the following distribution the location of worker accommodations: 35 per cent Maitland; 20 per cent Kurri Kurri and nearby suburbs; 20 per cent Cessnock; 15 per cent Newcastle; 10 per cent Beresfield/Thornton.
- Heavy vehicle movements:

  Note: The term "truck delivery" as used in this assessment signify one round trip, equal to two vehicle movements (one in, one out).

  - Deliveries from port to laydown areas in the West and Central areas:
    - 50 deliveries per day (25 each per pipeline), equivalent to 5 deliveries per hour

    Note: Deliveries from port to pipe laydown are expected to take place during the first month of the construction stage (around January 2023) and would not likely occur during the same period as peak construction activities in April 2023, but have been included in this assessment to obtain a conservative estimate of the traffic impacts, particularly along haulage routes.
  - Deliveries from laydown:
    - to Central TP and East TP/Offtake: 9 trucks per hour (including fuel trucks)
    - to SP/West TP: 11 trucks per hour (including fuel trucks)

    Note: Deliveries from West laydown areas to SP will only utilise internal access roads and will not impact external roads.

The approximate volumes of traffic which will be generated by the proposed activities are summarised Table 3-19. The table presents the total number of movements for both directions of traffic and describes the highest estimated traffic generation during construction for the affected portions of the road. As work locations change as construction progresses, traffic impacts to particular roads will vary throughout the construction period. Using the highest traffic generation for the affected road provides a conservative assessment of impacts.

Table 6-1 Estimated traffic generation during peak construction period

Affected roads	Direction	Peak construction traffic generation				Total construction traffic generation (vph)	
		AM Peak (vph)		PM Peak (vph)			
		LV	HV	LV	HV	AM Peak	PM Peak
Maitland Road	Southbound	0	4	30	4	4	34
	Northbound	30	4	0	4	34	4
New England Highway	Southbound	0	4	30	4	4	34
	Northbound	30	4	0	4	34	4
John Renshaw Drive	Eastbound	18	13	38	13	31	51
	Westbound	38	13	18	13	51	31
Hunter Expressway	Eastbound	38	9	28	9	47	37
	Westbound	28	9	38	9	37	47

Affected roads	Direction	Peak construction traffic generation				Total construction traffic generation (vph)	
		AM Peak (vph)		PM Peak (vph)			
		LV	HV	LV	HV	AM Peak	PM Peak
M1 Pacific Motorway	Southbound	46	9	0	9	55	9
	Northbound	0	9	46	9	9	55
Weakleys Drive	Southbound	36	0	0	0	36	0
	Northbound	0	0	36	0	0	36
Buchanan Road	Southbound	15	9	28	9	24	37
	Northbound	28	9	15	9	37	24
Main Road	Southbound	39	9	0	9	48	9
	Northbound	0	9	39	9	9	48
Lenaghans Drive	Southbound	46	9	0	9	55	9
	Northbound	0	9	46	9	9	55

Note: LV = light vehicle HV = heavy vehicle vph = vehicles per hour (vph are one-way movements)

Heavy vehicle movements associated with pipe deliveries are expected to take place within the prescribed work hours, between 7:00 am and 6:00 pm. Light vehicle movements associated with the ingress and egress of site personnel are expected to occur slightly earlier and later than the prescribed work hours (respectively), between 6:00 to 7:00 am for ingress, and around 5:00 pm onwards for egress. However, for the purposes of a highly conservative assessment, light vehicle movements were still included during the peak hour analysis.

6.2 Mid-block analysis (during construction)

Future baseline traffic for 2023 was estimated by applying a growth rate of 1 per cent per annum to the existing traffic volumes in Section 3.3.1. Vehicle traffic generated by construction activities were then added to the baseline traffic to assess its impact on the affected roads. The resulting LoS are provided in Table 6-2.

The values indicate that with background traffic growth and additional vehicle traffic generated by the construction works, most roads within the study area would continue to operate at satisfactory levels of service (LoS between A to D).

Construction activities are noted to have the most impact along John Renshaw Drive, increasing traffic volumes by up to 13.5 per cent; and on Buchanan Road, increasing traffic volumes by up to 11.2 per cent. It is reiterated that these values are based on the highly conservative assumption of a worst-case scenario wherein the transmission and storage pipeline deliveries would occur during the same period, and would also coincide with the peak workforce (light vehicle) movements. Realistically, the likelihood of occurrence of this scenario would be very low; but in the extreme case that it does occur, the impact would be restricted to the time required to deliver the transmission pipe segments, which is estimated to be less than a week. Despite the conservative estimates of the impacts, the resulting LoS of both John Renshaw Drive and Buchanan Road would range from B to D, indicating that the roads still have ample capacity to accommodate future construction traffic.

Main Road, which is already operating near capacity in 2021 (LoS D), is expected to operate at LoS E in the southbound direction during AM peak hour and in the northbound direction during PM peak hour.

However, it should be noted that light vehicle construction traffic ingress (which makes up 39 out of the 48 additional vehicles along Main Road) is expected to occur between 6:00 - 7:00 am, outside the morning peak period of Main Road (8:00 - 9:00 am). Realistically, without the additional light vehicles, the increase in traffic along Main Road during the AM peak hour would only be at 1.1 per cent and it would remain to operate at LoS D. The same would be the case in the afternoon peak period, with light vehicle construction traffic egress expected to occur beyond 5:00 pm, outside of Main Road's afternoon peak period (4:00 - 5:00 pm). Without the additional light vehicles, the increase along Main Road during the PM peak hour would only be at 1.0 per cent and LoS D would be maintained.

The values in Table 6-2 indicate that the Project is expected to have minimal adverse impacts to the peak hour traffic volumes along the roads within the vicinity of the Project. While Project construction traffic generation is not

expected to greatly impact the roads during peak period, it is acknowledged that Main Road is already currently operating near capacity and would potentially be sensitive to changes in traffic. As such, measures to further minimise impacts on Main Road would be identified as part of the development of the Construction Traffic Management Plan. It should also be noted that construction activities would only take place for two to three months per area, and any impacts resulting from these activities would be temporary.

Table 6-2 Forecast increase in peak hour two-way traffic volumes – 2023 with construction

Road Name	Direction	Lanes per direction	Existing (2021)				Future traffic (2023)				Future traffic (2023 with construction)					
			Traffic Volume		LoS		Traffic Volume		LoS		Traffic Volume				LoS	
			AM Peak (vph)	PM Peak (vph)	AM Peak	PM Peak	AM Peak (vph)	PM Peak (vph)	AM Peak	PM Peak	AM Peak (vph) (% increase from 2023 base traffic)		PM Peak (vph) (% increase from 2023 base traffic)		AM Peak	PM Peak
Maitland Road	Southbound	2	1,013	856	B	A	1034	874	B	A	1,038	0.4%	908	3.9%	B	B
	Northbound	2	720	1,024	A	B	734	1,044	A	B	768	4.6%	1,048	0.4%	A	B
New England Highway	Southbound	2	1,636	3,012	B	C	1,668	3,072	B	C	1,672	0.2%	3,106	1.1%	B	C
	Northbound	2	3,196	2,518	D	C	3,260	2,569	D	C	3,294	1.0%	2,573	0.2%	D	C
John Renshaw Drive	Eastbound	1	463	429	C	C	473	438	C	C	504	6.6%	489	11.7%	C	C
	Westbound	1	371	565	B	C	379	576	B	C	430	13.5%	607	5.4%	C	D
Hunter Expressway	Eastbound	2	1,159	1,391	A	A	1,182	1,419	A	A	1,229	4.0%	1,456	2.6%	A	B
	Westbound	2	1,139	1,253	A	A	1,162	1,278	A	A	1,199	3.2%	1,325	3.7%	A	A
M1 Pacific Motorway	Southbound	2	1,140	1,598	A	B	1,163	1,630	A	B	1,218	4.7%	1,639	0.6%	A	B
	Northbound	2	1,201	1,138	A	A	1,225	1,161	A	A	1,234	0.7%	1,216	4.7%	A	A
Weakleys Drive	Southbound	2	878	1,089	A	B	896	1,111	A	B	932	4.0%	1,111	0.0%	B	B
	Northbound	2	1,228	936	B	B	1,253	955	B	B	1,253	0.0%	991	3.8%	B	B
Buchanan Road	Southbound	1	278	480	B	C	284	490	B	C	308	8.5%	527	7.6%	B	C
	Northbound	1	324	351	B	B	331	358	B	B	368	11.2%	382	6.7%	B	C
Main Road	Southbound	1	840	840	D	D	857	857	D	D	905	5.6%	866	1.1%	E	D
	Northbound	1	854	854	D	D	871	871	D	D	880	1.0%	919	5.5%	D	E
Lenaghans Drive	Southbound	1	205	239	B	B	209	244	B	B	264	26.3%	253	3.7%	B	B
	Northbound	1	217	205	B	B	221	209	B	B	230	4.1%	264	26.3%	B	B

Notes: vph = vehicles per hour; % increase = versus baseline traffic 2023;

6.3 Worksite access: sight distance

Available sight distance at the access points to the construction worksites was assessed to determine whether there is adequate longitudinal sight distance at the proposed access to allow drivers approaching and exiting the temporary worksite to safely navigate into and out of the site.

This assessment was undertaken based on a desktop assessment only, using Google Maps and Google Street view. However, it is worth noting that the actual sight distances observed on site may differ from the Google images, which may be outdated because of changes to vegetation, changes to the road environment and the level of google camera above the road surface of a vehicle varies from driver eye height etc.

Approach Sight Distance (ASD) is the minimum requirement to provide the driver of a vehicle adequate sight distance to observe the road layout with sufficient time to react and stop if necessary, before entering the conflict area. Approach sight distance is measured from driver eye height (1.10 m to 0.0 m or the road surface for cars, and 2.4 m to 0.0 m for trucks).

Safe Intersection Sight Distance (SISD) provides sufficient sight distance for a driver of a vehicle on the major road to observe approaching vehicles from the minor road and to stop before a potential collision. Safe intersection sight distance is measured from the driver eye height of (1.25 m for cars, and 2.4 m for trucks).

The required sight distances were derived from the *Guide to Road Design, Part 4A: Unsignalised and Signalised Intersections* (Austroads, 2017). Table 6-3 provides a summary of the sight distance requirements for intersections providing access to the proposed construction workspace. As shown, the measured sight distances meet the minimum sight distance requirement at each location. Several of the measured SISDs are notably larger compared to measured ASDs due to the terrain and curvature of the roads.

Table 6-3 Sight distance requirement for cars and trucks

Location	Design Speed (km/h)	ASD (minimum requirement)			SISD (minimum requirement)		
		Required (m)		Measured (direction from access)	Required (m)		Measured (direction from access)
		Cars	Trucks		Cars	Trucks	
Lenaghans Drive	80	114	131	250 m (north)	181	216	400 m (north)
				140 m (south)			500 m (south)
Black Hill Road	80	114	131	350 m (west)	181	216	400 m (west)
				250 m (north)			250 m (north)
John Renshaw Drive	100	165	191	450 m (west)	248	302	450 m(west)
				450 m (east)			450 m (east)
Buchanan Road	80	114	131	400 m (north)	181	216	400 m (north)
				300 m (south)			350 m (south)
Main Road (north)	60	73	82	650 m (north)	122	142	650 m (north)
				400 m (south)			400 m (south)
Main Road (near Tester's Hollow)	60	73	82	400 m (north)	122	142	400 m (north)
				450 m (south)			500 m(south)

Requirements derived from Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections (Austroads, 2021)

6.4 Car parking

Parking for all construction vehicles and worker vehicles will be contained on site within the Project area. As such, car parking would have no impact on the existing road network.

6.5 Public transport

Bus routes have been identified within the study area, specifically along Main Road and John Renshaw Drive. The potential impact of the construction traffic on public bus operations is assessed to be minimal, with a possible increase in journey time during peak period as a result of the slight increase in traffic (approximately up to additional 13 vph along John Renshaw Drive and up to additional 9 vph along Main Road during peak hour).

Public transport facilities would not be impacted as a result of the works as the site access points and construction footprint are not located in close proximity to the facilities.

6.6 Impacts to road users

Traffic diversions may be required in some locations for temporary road closures during construction of the pipeline across unsealed roads along the ROW. This could temporarily result in longer vehicle journey distances and increased travel times. Where possible partial road closures will be in place to minimise impacts to road users.

Construction of the transmission pipeline across sealed roads would involve horizontal boring or horizontal directional drilling, which is expected to result in minimal impacts to traffic operations, as road or traffic lane closures would not be required.

Haulage and delivery of materials and equipment will utilise existing approved heavy vehicle and OSOM routes and will not introduce significant changes to the vehicle composition on these roads. Should the delivery of materials and equipment require the use of OSOM vehicles, appropriate travel/access permits will be obtained through the NHVR portal for the sections of the road with travel conditions.

6.7 Road safety

The proposed construction methods for the Project have been designed to minimise disruptions to traffic operations. However, it is recognised that changes in the road environment (reduced number of lanes, detours, changes in circulation) and an increase in the number of vehicles have the potential to impact to road safety.

As discussed in Section 3.2, the section of Main Road in proximity to the project alignment has been reported to have had six road crash incidents from 2016 to 2020, with five of these resulting to injuries (three serious, two moderate), suggesting that hazards may already be present in the existing road environment.

The Project activities have the potential to have an impact on road safety; these impacts shall be mitigated and managed in the construction traffic management plan.

6.8 Impacts to rail

The transmission pipeline crosses a section of South Maitland Railway (SMR) system located west of Main Road. The SMR was an extensive network of privately-owned colliery and passenger railway lines that served the South Maitland Collieries. At present, the rail line in proximity to the Project is not in operation.

The crossing of the rail line would involve horizontal boring and the existing railway infrastructure would not be impacted.

6.9 Impacts to road condition / damage to roads

The increase in traffic associated with the proposed construction activities could result in impacts on the condition of roads along construction routes, particularly along unsealed roads.

Relevant roads will be restored to a state described in a Road Dilapidation Report, to be prepared prior to the commencement of construction activities. Roads will also be monitored throughout the construction works, with temporary repairs carried out if required. With this mitigation measure in place the proposed construction activities are expected to have minimal impacts on road condition / damage to roads.

6.10 Cumulative construction impacts

Cumulative construction impacts resulting from other developments in proximity to the Project (refer to Section 3.4) are expected to be minimal. Vehicle access for Hydro Kurri Kurri Aluminium Smelter Demolition and Remediation Project and Hunter Power Project would mainly utilise Hunter Expressway, which is currently operating at LoS A. Additional construction traffic (approx. 29 vph for the remediation and approx. 13 vph for HPP) would have minimal impact on the road.

Other major planned developments in proximity to the Project are not anticipated to overlap with the KKLP construction works and cumulative impacts resulting from these other projects are unlikely.

Construction of various residential developments in the suburbs surrounding Main Road (Cliftleigh, Gillieston Heights in Maitland) are ongoing and heavy vehicles generated by these activities have been a constant presence in the area for the last several years, with dwelling approvals in the area reported to have had a high increase since 2018. As such, traffic generated from these activities are assumed to have been captured in the baseline traffic data and would not result to significant cumulative impacts. Additionally, works on West TP that would require access from Main Road would be carried out in a span of 2-3 months and would not impact the area for the entire 12-month duration of the Project.

7. Mitigation measures

While the results of the assessment show that the expected increase in traffic associated with the construction stage of the Project can be accommodated by the surrounding road network, additional measures could still be implemented to reduce these impacts. These measures are described in the following sections.

7.1 Construction Traffic Management Plan

A Construction Traffic Management Plan (CTMP) would be prepared by the contractor prior to commencing the Project activities. The CTMP will aim to facilitate the safety of all workers and road users within, including access to, the Project site. The primary objectives of the CTMP will be:

- To minimise the impact of the vehicle traffic (particularly heavy vehicle traffic) on the operation of the adjoining road network.
- To facilitate the continuous, safe, and efficient movement of traffic for both the general public and site personnel / workers.
- To facilitate the establishment of a safe pedestrian environment in the vicinity of the site.
- To provide a description of the types of vehicles and estimated vehicle volumes during each stage of the construction works.
- To provide information regarding the access arrangement and a description of the proposed routes for vehicles accessing and egressing the proposal site.

The CTMP should include the following:

- CTMP objectives (similar to the defined above).
- Vehicle approach and departure routes to the site that will minimise the impacts of heavy vehicles and equipment on the adjacent road network.
- Vehicle types and mobile equipment to be used.
- Areas of parking for site personnel, which should preferably be within site premises (away from residential areas, not impacting public parking).
- Transport options for workers to the site that will maximise safety and maintain accessibility for pedestrians and cyclists.
- Site access constraints such as vehicle restrictions (e.g. road network load limits/height restrictions) on haulage routes.
- Areas of vulnerable road users (pedestrians and bicycle riders) and areas of high potential pedestrian activity.

– Preparation of Traffic Guidance Schemes (TGSs).
– Methods of communicating traffic changes on the road network.
– Road network operational impacts within the vicinity of the site.
– A Driver's Code of Conduct.
– General mitigation measures.

7.2 Traffic management measures

The following are the recommended measures that should be in place prior to the commencement of and during the execution of the project:

7.2.1 Traffic demand management

– Encourage workers to carpool or utilise public transport, where practicable, subject to government guidelines and safety protocols regarding COVID-19.
– Stagger worker schedule, where possible, to allow for a portion of the workforce to arrive and leave the work area outside of peak periods.
– Utilise Buchanan Road as an alternative to Main Road when accessing western work areas (SP / TP West), particularly for staff with accommodation in Maitland.
– Utilise internal access roads from Buchanan Road for heavy vehicle access to portions of the western work areas, where practicable.

7.2.2 Safety

– All staff and subcontractors engaged on site should be required to undergo site induction. The induction will outline the requirements on the CTMP, including site access routes, environmental and occupational health and safety responsibilities, emergency procedures, potential carpooling opportunities and vehicle height restriction under the power lines, among others. Additionally, the Site Manager will discuss CTMP requirements regularly as a part of regular “toolbox talks”.
– Access for emergency vehicles would be maintained at the proposal site during the duration of the construction works, in accordance with emergency vehicle requirements. The emergency services, including fire, ambulance and police, would be advised of all planned changes to traffic arrangements prior to the commencement of works.

7.2.3 Heavy vehicle access

– Key stakeholders, including owners/operators of adjacent lands and emergency service providers, should be notified of any changes to the traffic management arrangements prior to the commencement of works. Co-ordination with the owners of the access roads in the existing collieries (near TP Central) would be critical to ensure that the Project works do not interfere with existing colliery operations.
– Truck drivers should be directed to follow the predetermined haulage routes. Additionally, all drivers must observe post speed limits on adjoining road networks to comply with Australian Road Rules. Drivers are to adjust speeds to suit the road environment and weather conditions appropriately to ensure the safe movement of the vehicles based on the individual vehicle configurations.
– Any oversized or overweight loads will be transported in accordance with the requirements of the relevant road authority.
– A turnaround facility that can accommodate the largest vehicle entering the site must be provided to allow all vehicles to exit the site in a forward direction, with vehicles to also enter in a forward direction.

7.2.4 Road conditions

- Pipeline crossings of unsealed roads will be constructed using methods and depth of cover determined in consultation with the relevant road authority and landholders. Installation of bypass tracks, detours or crossing plates will be undertaken as required.
- All sealed road and rail crossings will be crossed using trenchless construction techniques (horizontal under boring) in consultation with the relevant authority.
- The condition of roads used for transport between construction camps and the ROW will be assessed by a Road Dilapidation Report prior to construction commencing and following completion of construction. Any defects attributable to construction activities will be rectified or compensated in consultation with the relevant road authorities.

7.2.5 Site access and parking

- No parking of light or heavy vehicles on the public road network.
- Site access should be restricted to authorised personnel only and existing employees on site. Pedestrian access to and around the site is to be monitored during work hours
- Temporary deceleration lanes should be provided along any new access points (i.e. those not utilising existing access roads) to improve turning movement safety. Design of these lanes should be in accordance with Austroads Guide to Road Design Part 4.
- Black Hill Road will not be used between the crossing location of the transmission pipeline and the intersection with John Renshaw Drive to avoid impacts to local road users.

7.2.6 Environment

The following environmental requirements should be adhered to:

- All vehicles transporting loose materials will have the entire load covered and/or secured to prevent any large items, excess dust or debris depositing onto the roadway during travel to and from the site, including but not limited to construction rumble strips/wheels wash at the site egress location.
- The lead contractors will monitor the roads leading to and from the site and take all necessary steps to rectify any road deposits caused by site vehicles, to maintain the safety of all road users.
- Vehicles operating to, from and within the site shall do so in a manner, which does not create unreasonable or unnecessary noise or vibration.
- Public roads and access points will not be obstructed by any materials, parked vehicles, refuse skips or the like.

8. Conclusion

8.1 Overview

This Traffic Impact Assessment (TIA) forms part of the Environmental Impact Statement (EIS) that is being prepared to support the Project's application for approval. A TIA is required to review existing traffic conditions and site access arrangements (including public transport); assess traffic implications arising from the construction and operation of the Project; and determine measures to minimise any adverse effects to existing road users.

8.2 Key findings

The key findings of the TIA are summarised as follows:

– The Project site can be categorized broadly into three main areas:
  - **SP/West TP**, referring to the western section of the transmission pipeline (TP) located in proximity to Main Road. This western section of this area is also where the storage pipeline (SP), compressor station and delivery station are located. The area can be accessed via Main Road or Hart Road.
  - **Central TP**, referring to the section of the TP accessible via Buchanan Road, north of John Renshaw Drive. The area can be accessed via Buchanan Road or John Renshaw Drive.
  - **East TP/Offtake**, referring to the eastern section of the TP, from John Renshaw Drive down to Lenaghans Drive. The Offtake Facility is located in this area, which can be accessed via Lenaghans Drive.

– Existing traffic volumes obtained from Transport for NSW Traffic Volume Viewer and existing secondary data were used in the assessment. The majority of the roads in the study area operate below capacity with LoS ranging from A to D). The northbound direction of New England Highway currently operates near capacity during the AM peak period (LoS D). Main Road is also operating near capacity, with existing volumes approaching the limit of 900 vph for LoS D.

– A total of 112 road crash incidents were recorded within a two-kilometre radius from the Project alignment from 2016 to 2020. The predominant crash type category is Crashes with vehicles coming from the same direction, followed by Off-path on straight, Off-path on curve, and Vehicles from adjacent direction. Sections of Main Road in proximity to the project alignment has been reported to have had six road crash incidents from 2016 to 2020, with five of these resulting to injuries (thee serious, two moderate), suggesting that hazards may already be present in the existing road environment.

– The peak construction period, which will generate the most critical number of vehicle trips, is estimated to take place on the fourth month of construction works, around April 2023. Traffic generation during this period was analysed to account for the worst-case scenario.

– The peak construction period is estimated to generate the following vehicle trips:
  - Light vehicles. 199 daily light vehicle trips coming from Maitland (35 per cent), Kurri Kurri and nearby suburbs (20 per cent), Cessnock (20 per cent), Newcastle (15 per cent), Beresfield/Thornton (10 per cent). These trips will utilise different roads to access their respective workspaces.

    Note: Light vehicle movements are expected to occur outside of the road network peak hour and would not impact peak hour operations during the actual scenarios. To obtain a more conservative assessment, light vehicle movements were still included during the peak hour analysis.
  - Heavy vehicles. 50 daily truck deliveries from port to laydown areas.

    Subsequent deliveries from laydown area to work areas: nine trucks per hour to Central TP and East TP/Offtake; 11 trucks per hour to SP/West TP.

    Note: Deliveries from port to pipe laydown are expected to take place during the first month of the construction stage (around January 2023) and would not likely occur during the same period as peak construction activities in April 2023, but have been included in this assessment to obtain a conservative estimate of the traffic impacts, particularly along haulage routes. Deliveries from West laydown areas to SP will only utilise internal access roads and will not impact external roads.

– Future traffic estimates show that that with background traffic growth and additional vehicle traffic generated by the construction works, most roads within the study area would continue to operate at satisfactory levels of service (LoS between A to D).

    - Construction activities would have the most impact along John Renshaw Drive, increasing traffic volumes by up to 13.5 per cent; and on Buchanan Road, increasing traffic volumes by up to 11.2 per cent. This is based on the highly conservative assumption of a worst-case scenario wherein the transmission and storage pipeline deliveries would occur during the same period, and would also coincide with the peak workforce (light vehicle) movements. Realistically, the likelihood of occurrence of this scenario would be very low; but in the extreme case that it does occur, the impact would be restricted to the time required to deliver the transmission pipe segments, which is estimated to be less than a week. Despite the conservative estimates of the impacts, the resulting LoS of both roads would range from B to D, indicating that the roads still have ample capacity to accommodate future construction traffic.
    - Main Road, which is already operating near capacity in 2021 (LoS D), is expected to operate at LoS E in the southbound direction during AM peak hour and in the northbound direction during PM peak hour. However, it should be noted that the light vehicle construction traffic movements (which make up 39 out of the 48 additional vehicles along Main Road) would occur between 6:00 - 7:00 am and 5:00 pm onwards, outside of Main Road's peak periods.
    - While Project construction traffic generation is not expected to greatly impact the roads during peak period, it is acknowledged that Main Road is already currently operating near capacity and would potentially be sensitive to changes in traffic. As such, measures to further minimise impacts on Main Road would be identified as part of the development of the Construction Traffic Management Plan. It should also be noted that construction activities would only take place for two to three months per area, and any impacts resulting from these activities would be temporary.
- Traffic generation during operations and maintenance stage is expected to be minimal as this would entail routine inspection and maintenance of pipeline and associated surface facilities.
- The Project is expected to have minimal adverse impacts to the peak hour traffic volumes along the roads within the vicinity of the Project, with similar peak road network conditions to the existing situation. Notwithstanding, it is acknowledged that Main Road is already currently operating near capacity and would benefit from mitigating measures (e.g. traffic demand management measures as discussed in Section 7.2.1 of this report).
- Sight distance checks for ASD and SISD confirm that access points have sufficient sight distances that meet minimum requirements as prescribed by Austroads Guide to Road Design, Part 4A: Unsignalised and Signalised Intersections.
- Access points along Main Road have been identified to have potential road safety risks given the record of crash incidents in the area. These specific risks shall be taken into consideration and addressed in the preparation of the TMP.
- Project activities are not seen to adversely impact car parking, public transport, and rail services.
- Cumulative construction impacts resulting from other developments in proximity to the Project (refer to Section 3.4 are expected to be minimal. Vehicle access for the concurrent project would mainly utilise Hunter Expressway, which is currently operating at LoS A. Additional construction traffic from these other developments would have minimal impact on the road. Other major planned developments in proximity to the Project are not anticipated to overlap with the KKLP construction works and cumulative impacts resulting from these other projects are unlikely.

8.3 Conclusion

Based on the assumptions and findings outlined in this report, it is considered that the proposal satisfies the planning requirements on traffic engineering grounds and is not anticipated to have adverse traffic impacts on the surrounding road network.

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