



Transport  
for NSW

# New Intercity Fleet Springwood to Lithgow Rail Corridor Modifications

Review of Environmental Factors  
Volume 1



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# Abbreviations

Term	Meaning
<b>AHIMS</b>	Aboriginal Heritage Information Management System
<b>ASA</b>	Asset Standards Authority (refer to Definitions)
<b>BoM</b>	Bureau of Meteorology
<b>CEMP</b>	Construction Environmental Management Plan
<b>CNS</b>	<i>Construction Noise Strategy</i> (TfNSW, 2017)
<b>CNVMP</b>	Construction Noise and Vibration Management Plan
<b>dB</b>	Decibel
<b>DBYD</b>	Dial Before You Dig
<b>DoEE</b>	Commonwealth Department of the Environment and Energy
<b>DP&amp;E</b>	NSW Department of Planning and Environment
<b>ECM</b>	Environmental Controls Map
<b>EMS</b>	Environmental Management System
<b>EPA</b>	Environment Protection Authority
<b>EP&amp;A Act</b>	<i>Environmental Planning and Assessment Act 1979</i> (NSW)
<b>EP&amp;A Regulation</b>	<i>Environmental Planning and Assessment Regulation 2000</i> (NSW)
<b>EPBC Act</b>	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cwlth)
<b>EPL</b>	Environment Protection Licence
<b>ESD</b>	Ecologically Sustainable Development (refer to Definitions)
<b>GHG</b>	Greenhouse Gas
<b>Heritage Act</b>	<i>Heritage Act 1977</i> (NSW)
<b>IAQM</b>	The Institute of Air Quality Management
<b>ICNG</b>	<i>Interim Construction Noise Guideline</i> (Department of Environment and Climate Change, 2000)
<b>Infrastructure SEPP</b>	<i>State Environmental Planning Policy (Infrastructure) 2007</i> (NSW)
<b>INP</b>	<i>NSW Industrial Noise Policy</i> (EPA, 2000)
<b>IRSAD</b>	Index of Relative Socio-economic Advantage and Disadvantage
<b>ISCA</b>	Infrastructure Sustainability Council of Australia



<b>Term</b>	<b>Meaning</b>
<b>L<sub>Aeq</sub></b>	The energy average noise level
<b>L<sub>A90</sub></b>	Noise level exceeded for 90 per cent of sample period
<b>LEP</b>	Local Environmental Plan
<b>LGA</b>	Local Government Area
<b>NCA</b>	Noise Catchment Area
<b>NML</b>	Noise Management Levels
<b>NorBE</b>	Neutral or Beneficial Effect
<b>NPW Act</b>	<i>National Parks and Wildlife Act 1974 (NSW)</i>
<b>OEH</b>	NSW Office of the Environment and Heritage
<b>POEO Act</b>	<i>Protection of the Environment Operations Act 1997 (NSW)</i>
<b>RBL</b>	Rating Background Level
<b>REF</b>	Review of Environmental Factors (this document)
<b>Roads and Maritime</b>	NSW Roads and Maritime Services (formerly Roads and Traffic Authority)
<b>SEPP</b>	State Environmental Planning Policy
<b>SHR</b>	State Heritage Register
<b>SoHI</b>	Statement of Heritage Impact
<b>TEC</b>	Threatened Ecological Communities
<b>TfNSW</b>	Transport for New South Wales
<b>TMP</b>	Traffic Management Plan
<b>TSC Act</b>	<i>Threatened Species Conservation Act 1995 (NSW)</i>
<b>UNESCO</b>	The United Nations Educational, Scientific and Cultural Organization
<b>WARR Act</b>	<i>Waste Avoidance and Resource Recovery Act 2001 (NSW)</i>

## Definitions

Term	Meaning
<b>Asset Standards Authority</b>	The ASA is an independent body within TfNSW, responsible for engineering governance, assurance of design safety, and ensuring the integrity of transport and infrastructure assets.  Design Authority functions formerly performed by RailCorp are now exercised by ASA.
<b>Carriages/cars</b>	Individual pieces of rolling stock designed to carry passengers.
<b>Concept design</b>	The concept design is the preliminary design presented in this REF, which would be refined by the Contractor (should the Project proceed) to a design suitable for construction (subject to TfNSW acceptance).
<b>Crossover</b>	A crossover is a section of track that allows trains to pass from one track to another for the purposes of accessing a siding, passing trains and other operational services (maintenance).
<b>Detailed design</b>	Detailed design broadly refers to the process that the Contractor undertakes (should the Project proceed) to refine the concept design to a design suitable for construction (subject to TfNSW acceptance).
<b>Determination</b>	TfNSW is a determining authority for projects which require assessment under Part 5 of the EP&A Act and must undertake this role in accordance with Section 111. To make a determination, TfNSW will prepare a report to document the consideration of the relevant legislative requirements and the potential environmental impacts of the project and determine whether these impacts are likely to be significant. TfNSW may also impose conditions of approval, as part of the determination.
<b>Ecologically Sustainable Development</b>	As defined by clause 7(4) Schedule 2 of the EP&A Regulation. Development that uses, conserves and enhances the resources of the community so that ecological processes on which life depends are maintained, and the total quality of life, now and in the future, can be increased.
<b>Feasible</b>	A work practice or abatement measure is feasible if it is capable of being put into practice or of being engineered and is practical to build given project constraints such as safety and maintenance requirements.
<b>Interchange</b>	Transport interchange refers to the area/s where passengers transit between vehicles or between transport modes. It includes the pedestrian pathways and cycle facilities in and around an interchange.
<b>New Intercity Fleet</b>	The New Intercity Fleet is a new fleet of trains that will replace the existing intercity fleet and is intended to service the Central Coast and Newcastle, the Blue Mountains and the South Coast Lines.
<b>Noise sensitive receiver</b>	In addition to residential dwellings, noise sensitive receivers include, but are not limited to, hotels, entertainment venues, pre-schools and day care facilities, educational institutions (e.g. schools, TAFE colleges), health care facilities (e.g. nursing homes, hospitals), recording studios and places of worship/religious facilities (e.g. churches).
<b>NSW TrainLink</b>	From 1 July 2013, NSW TrainLink became the new rail provider of services for regional rail customers.

<b>Term</b>	<b>Meaning</b>
<b>Out of hours works</b>	Defined as works <i>outside</i> standard construction hours (i.e. outside of 7am to 6pm Monday to Friday, 8am to 1pm Saturday and no work on Sundays/public holidays).
<b>Platform coping</b>	Refers to the capping/covering of station platform edges, typically with a concrete top layer.
<b>Project</b>	The construction and operation of the New Intercity Fleet – Springwood to Lithgow Rail Corridor Modifications.
<b>Project site</b>	The Rail corridor between Springwood and Lithgow railway stations, including ancillary facilities and temporary construction compounds both within and outside the existing rail corridor.
<b>Proponent</b>	A person or body proposing to carry out an activity under Part 5 of the EP&A Act - in this instance, TfNSW.
<b>Rail possession</b>	Possession is the term used by railway building/maintenance contractors to indicate that they have taken possession of the track (usually a block of track) for a specified period, so that no trains operate for a specified time. This is necessary to ensure the safety of workers and rail users.
<b>Reasonable</b>	Selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the measure.
<b>Sensitive receivers</b>	Land uses which are sensitive to potential noise, air and visual impacts, such as residential dwellings, schools and hospitals.
<b>Sydney Trains</b>	From 1 July 2013, Sydney Trains replaced CityRail as the provider of metropolitan train services for Sydney.
<b>Track slewing</b>	Re-positioning of rail tracks.
<b>Train sets</b>	A series of train carriages/cars that are linked together for a particular service.
<b>Vegetation Offset Guide</b>	The TfNSW guide that applies where there is vegetation clearing proposed, and where the impact of the proposed clearing is not deemed 'significant' for the purposes of section 111 of the EP&A Act. The Guide provides for planting of a minimum of eight trees for each large tree with a diameter at breast height (DBH) of more than 60 cm, four trees where the DBH is 15-60 cm, or two trees where DBH is less than 15 cm.

# Executive summary

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## Overview

Transport for NSW (TfNSW) was established in 2011 as the lead agency for integrated delivery of public transport services across all modes of transport in NSW. TfNSW is the proponent for the Springwood to Lithgow Rail Corridor Modifications (the Project).

This Review of Environmental Factors (REF) has been prepared to assess the environmental impacts associated with the construction and operation of the Project under the provisions of Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

## New Intercity Fleet Program

In May 2014, the NSW Government announced it is delivering the New Intercity Fleet to replace trains carrying customers from Sydney to the Central Coast, Newcastle, Blue Mountains and the South Coast. The introduction of the New Intercity Fleet would allow for the replacement of the older electric trains currently used to provide intercity services. These ageing electric trains are experiencing a number of adverse operational impacts relating to a decline in their reliability and availability on the network, increasing maintenance costs and reducing customer amenity.

The New Intercity Fleet would:

- provide a more consistent and improved level of customer service for intercity customers
- facilitate the replacement of two electric train sets currently in operation
- reduce the costs of intercity operations
- increase capacity for intercity customers.

## The Project

The Project comprises modifications to stations and other rail corridor upgrades extending from between Springwood Station and Falconbridge Station up to and including Lithgow Station to facilitate the introduction of the new trains which are marginally wider and longer than the existing trains. The Project would also allow the Blue Mountains Line to be consistent with the existing electrified rail network.

The key features of the Project are summarised as follows:

- extension of platforms at Katoomba Station and Lithgow Station
- modifications to station platform edges (also known as platform coping)
- re-positioning of rail tracks (track slewing) along the length of the rail corridor
- modification of the existing platform canopy at Falconbridge Station
- survey and geotechnical investigations
- signalling works to accommodate the new track position and platform modifications
- adjustment of the overhead wiring system and supporting structures as required.

The modifications are needed to accommodate the new and existing trains and will bring the Blue Mountains Line up to the standard of the rest of the electrified rail network.

Subject to approval, construction is expected to commence in 2018 and take around two years to complete. A detailed description of the Project is provided in Chapter 3 of this REF.

## Design options considered

TfNSW commissioned the development of a series of design reports which provided assessments that determined the preferred design for the Project. These reports evaluated the potential for clearance infringements of Asset Standards Authority (ASA) standards resulting from the introduction of new trains which would be wider and longer than the existing trains that travel along the Blue Mountains Line to Lithgow. This included an assessment of infringements to the station platforms, canopies, trackside structures and train passing clearances.

Various design options were considered to achieve the required width clearances and platform lengths within the Project site.

The preferred option for meeting the required width clearances is an optimised combination of track slewing and platform coping modifications. Options involving track slewing or coping modifications only would either result in greater impacts to heritage listed platform buildings and building canopies (under coping modifications only), or would require additional changes in the corridor such as relocating overhead wiring supports along much of the corridor (under track slewing only).

The preferred option of meeting the required platform lengths involves the extension of Katoomba and Lithgow on one end of the platforms only, in areas where the platforms have previously been modified and would best suit operational requirements.

## Statutory considerations

The EP&A Act provides for the environmental impact assessment of development in NSW. Part 5 of the EP&A Act generally specifies the environmental impact assessment requirements for activities undertaken by public authorities, such as TfNSW, which do not require development consent under the EP&A Act.

The *State Environmental Planning Policy (Infrastructure) 2007* (the Infrastructure SEPP) is the primary environmental planning instrument relevant to the Project and is the key environmental planning instrument which determines that this Project is permissible without consent and therefore is to be assessed under Part 5 of the EP&A Act.

Clause 79 of the Infrastructure SEPP allows for the development of 'rail infrastructure facilities' by or on behalf of a public authority without consent on any land. Clause 78 defines 'rail infrastructure facilities' as including elements such as 'railway stations, station platforms and areas in a station complex that commuters use to get access to the platforms', 'public amenities for commuters' and 'associated public transport facilities for railway stations'.

As TfNSW is a public authority and the proposed activity falls within the definition of rail infrastructure facilities under the Infrastructure SEPP, the Project is permissible without consent. Consequently the environmental impacts of the Project have been assessed by TfNSW under Part 5 of the EP&A Act.

This REF has been prepared to assess the construction and operational environmental impacts of the Project. The REF has been prepared in accordance with section 111 of the EP&A Act and clause 228 of the *Environment Planning and Assessment Regulation 2000* (the EP&A Regulation).

In accordance with section 111 of the EP&A Act, TfNSW, as the proponent and determining authority, must examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

Chapter 6 of this REF presents the environmental impact assessment for the Project, in accordance with these requirements.

## Community and stakeholder consultation

The REF would be displayed for a period of approximately three weeks at the following locations:

- Blue Mountains City Council, 2-6 Civic Place, Katoomba
- Katoomba Library, Blue Mountains Cultural Centre, 30 Parkes Street, Katoomba
- Blue Mountains City Council, 104 Macquarie Rd, Springwood
- Lithgow City Council, 180 Mort Street, Lithgow
- Lithgow Library and Learning Centre, 157 Main Street, Lithgow
- Wentworth Falls Library, School of Arts Building 217 Great Western Highway, Wentworth Falls
- TfNSW Reception, Level 5, Tower A, Zenith Centre, 821 Pacific Highway, Chatswood.

Community consultation activities for the Project would be undertaken during the public display period of the REF.

The REF would also be available to download from the TfNSW [website](#)<sup>1</sup> and [haveyoursay website](#)<sup>2</sup>. A Project Infoline (1800 684 490) would be available for members of the public to make enquiries.

TfNSW would review and assess all feedback received during the public display period, prior to determining whether or not to proceed with the Project.

Should the Project proceed to construction, the community would be kept informed for the duration of the construction period. Figure 1 presents an overview of the consultation and planning process and the current status of the Project.

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<sup>1</sup> <http://www.transport.nsw.gov.au/projects/intercity-fleet>

<sup>2</sup> <https://www.nsw.gov.au/improving-nsw/have-your-say/>



**Figure 1 Planning approval and consultation process for the Project**

## **Environmental impact assessment**

This REF identifies the potential environmental benefits and impacts of the Project and outlines the mitigation measures to reduce the identified impacts.

The key impacts of the Project are as follows:

- potential impacts to State heritage listed and locally listed heritage items from platform extensions, platform coping modifications and other upgrades
- temporary noise and vibration impacts during construction
- potential temporary access changes for vehicles, cyclists and pedestrians in and around the station areas during construction
- temporary reduction in the visual environment of heritage listed stations and Blue Mountains National Park vistas from the presence of construction sites.

Further information regarding these impacts is provided in Chapter 6 of the REF.

## Conclusion

This REF has been prepared in accordance with the provisions of section 111 of the EP&A Act, taking into account to the fullest extent possible, all matters affecting or likely to affect the environment as a result of the Project.

This REF has considered and assessed potential impacts in accordance with clause 228 of the EP&A Regulation and the requirements of the EPBC Act (refer to Chapter 6, Appendix A and Appendix B). Based on the assessment contained in this REF, the Project is unlikely to have a significant impact on the environment or any threatened species, populations or communities. Accordingly an EIS is not required, nor is the approval of the Minister for Planning.

The Project has also taken into account the principles of Ecologically Sustainable Development (ESD) (refer to Section 3.1.3 and Section 4.6). These principles would be further considered during the detailed design, construction and operational phases of the Project. This would ensure the Project is delivered to maximise the benefits to the community, is cost effective and minimises any adverse impacts on the environment.



# 1 Introduction

---

Transport for NSW (TfNSW) was established in 2011 as the lead agency for integrated delivery of public transport services across all modes of transport in NSW. TfNSW is the proponent for the Springwood to Lithgow Rail Corridor Modifications (the Project).

## 1.1 Overview of the Project

### 1.1.1 New Intercity Fleet Program

The existing intercity train fleet currently operated by TfNSW provides services on three main routes, comprising:

- Sydney to Central Coast/Newcastle (North Line)
- Sydney to Blue Mountains (Western Line)
- Sydney to Wollongong/Nowra (South Coast Line).

The *NSW Long-term Transport Master Plan* (TfNSW, 2012a) and its supporting document, *Sydney's Rail Future: Modernising Sydney's Trains* (TfNSW, 2012b), identifies the need to enhance rail passenger services, in particular for longer distance travel outside of the Sydney suburban network.

In May 2014, the NSW Government announced it is delivering the New Intercity Fleet, to replace trains carrying customers from Sydney to the Central Coast, Newcastle, Blue Mountains including Lithgow and the South Coast. The introduction of the New Intercity Fleet would allow for the replacement of the older electric trains currently used to provide intercity services. These ageing electric trains are experiencing a number of adverse operational impacts relating to a decline in their reliability and availability on the network, increasing maintenance costs and reducing customer amenity.

The New Intercity Fleet would:

- provide a more consistent and improved level of customer service for intercity customers
- facilitate the replacement of two electric train sets currently in operation
- reduce the costs of intercity operations
- increase capacity for intercity customers.

The New Intercity Fleet comprises approximately 512 cars (carriages) which would progressively come into service from 2019.

Modifications are needed along the rail corridor from west of Springwood Station to Lithgow Station to accommodate the new and existing trains. These modifications will bring the Blue Mountains Line up to the standard of the rest of the electrified rail network.

### 1.1.2 Key features of the Project

The Project is located on a section of the Blue Mountains Line (also known as the Main Western Line). The Project comprises modifications to stations and other corridor upgrades along a stretch of around 75 kilometres of rail corridor from between Springwood Station and Faulconbridge Station up to and including Lithgow Station. Springwood Station is located around 70 kilometres west of the Sydney Central Business District (CBD).

The Project would facilitate the introduction of the new trains which are marginally wider and longer than the existing trains.

The key features of the Project are summarised as follows:

- extension of platforms at Katoomba Station and Lithgow Station
- modifications to station platform edges (also known as platform coping)
- re-positioning of rail tracks (track slewing) along the length of the rail corridor
- modification of the existing platform canopy at Falconbridge Station
- survey and geotechnical investigations
- signalling works to accommodate the new track position and platform modifications
- adjustment of the overhead wiring system and supporting structures as required.

Subject to approval, construction is expected to commence in early 2018 and take approximately two years to complete. A detailed description of the Project is provided in Chapter 3 of this Review of Environmental Factors (REF).

## 1.2 Location of the Project

The Project involves modification works at, and between, the following stations:

- Falconbridge
- Linden
- Woodford
- Hazelbrook
- Lawson
- Bullaburra
- Wentworth Falls
- Leura
- Katoomba
- Medlow Bath
- Blackheath
- Bell
- Newnes Junction (not in use)
- Eskbank (not in use)
- Lithgow.

All of the stations within the Project site are listed on the RailCorp Section 170 Heritage and Conservation Register, with six stations also listed on the State Heritage Register (including Lawson, Katoomba, Medlow Bath, Blackheath, Eskbank and Lithgow stations). The regional context of the Project and locations of stations listed above is shown in Figure 2 and Figure 3. Zig Zag Station and Mount Victoria Station do not form part of the Project.

The Project is located in the local government areas of the Blue Mountains and Lithgow. The works would take place alongside the existing operational railway infrastructure and within the existing delineated rail corridor. A number of ancillary facilities are required inside and outside the rail corridor to accommodate site office(s), amenities, lay down and storage areas for materials during construction.

The area surrounding the Project is a mountainous sandstone region characterised by varying, often steep topographical features including plateaux and escarpments extending off the Great Dividing Range. For around 40 kilometres, the Project would be located adjacent to the Blue Mountains National Park which is a UNESCO declared World Heritage Area. No works would be undertaken within the boundary of the National Park.



Figure 2 Project site overview (part 1 of 2)

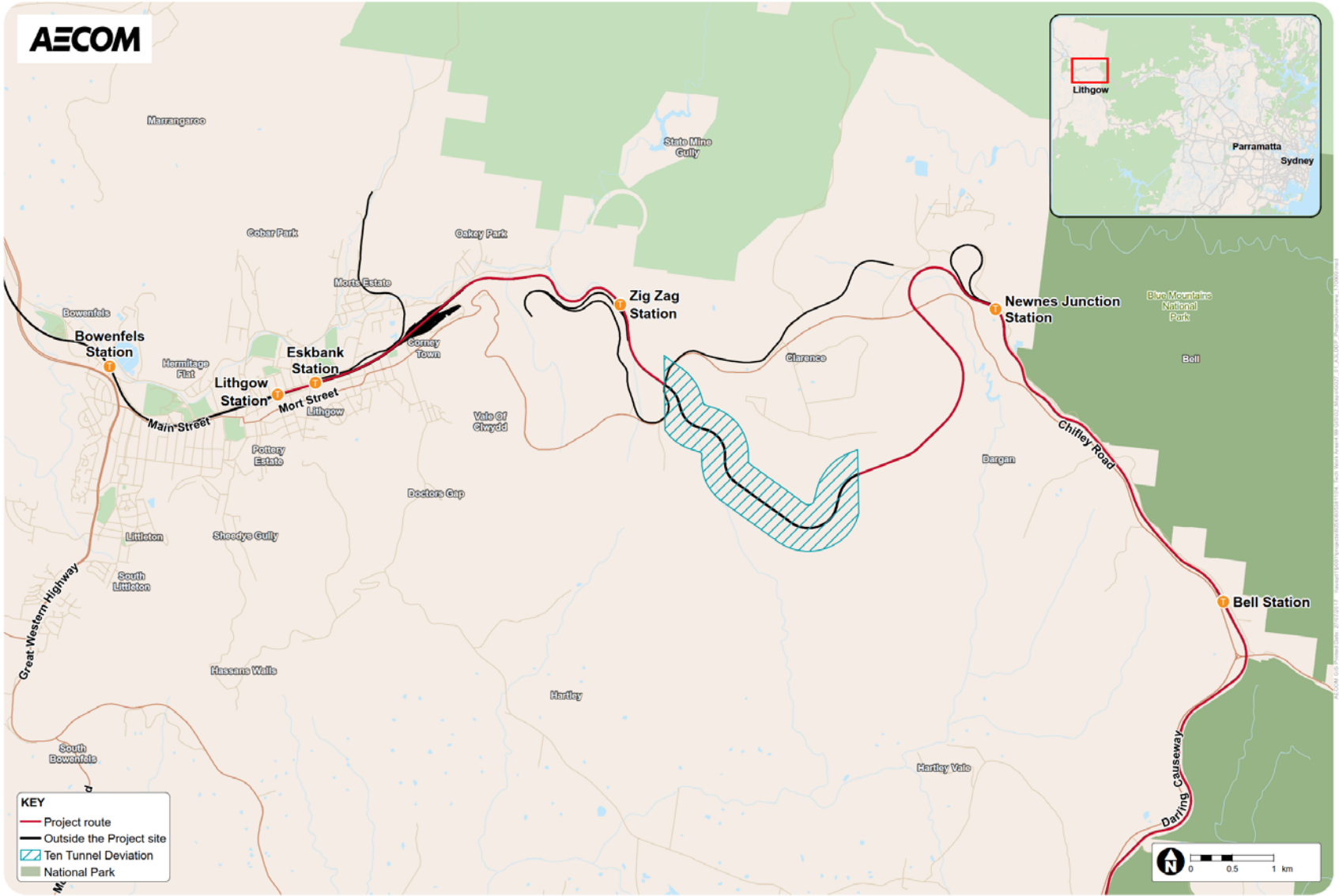


Figure 3 Project site overview (part 2 of 2)

## 1.3 Existing infrastructure and land uses

The majority of the works would take place within the existing delineated rail corridor zoned as SP2 Infrastructure (Rail) under the *Blue Mountains Local Environmental Plan 2015* (Blue Mountains LEP) and *Lithgow Local Environmental Plan 2014* (Lithgow LEP). The existing Blue Mountains Line between Springwood and Lithgow originally opened in 1868 as an electrified railway consisting of twin lines running in each direction. There are a number of sidings (branch lines) in both directions at Lawson Station, Katoomba Station and Wentworth Falls Station. The rail corridor consists of a modified environment characterised by rail infrastructure including stations, track and an overhead wiring system.

The land uses surrounding the Project site predominately consists of bushland associated with the Blue Mountains National Park. Residential centres of various sizes are located at Hazelbrook, Lawson, Wentworth Falls, Leura, Katoomba, Blackheath, Eskbank and Lithgow stations, where the rail corridor is adjacent to residential and commercial land uses.

### 1.3.1 Rail line

The Blue Mountains Line is defined by the underlying topography of the Greater Blue Mountains area, characterised by tight and winding curves. Many sections of the rail line are at relatively steep grades and some sections of track have been constructed in cuttings, on embankments, bridges and other structures.

The majority of the existing track is generally rail that has been laid on concrete sleepers and ballast. Other track forms can be observed, such as the horizontal beam (known as transom) supports over the pedestrian subway at Lawson Station.

The rail line is electrified and powered by an overhead wiring system. The overhead wiring system is generally mounted on non-galvanised and unpainted structures (remnants of the original electrification works undertaken in the 1950s) though in some instances the original structures have been replaced by newer galvanised structures.

### 1.3.2 Stations

There are 15 stations within the Project site, two of which (Newnes Junction Station and Eskbank Station) are no longer operational for public use. All of the stations are listed on the RailCorp Section 170 Heritage and Conservation Register, with six stations also listed on the State Heritage Register (see Table 7 for heritage listings). Table 1 provides further details of the stations within the Project site. Figure 2 and Figure 3 show the existing features of the Project site and surrounding area. Enabling works required at Mount Victoria Station and Zig Zag Station to accommodate the new intercity fleet are not part of the Project.

**Table 1 Stations with the Project site**

Station	Details
Faulconbridge	<ul style="list-style-type: none"><li>island platform with a single track in each direction</li><li>platforms 1 and 2 are about 186 metres long</li><li>surrounding area is mostly low density residential</li></ul>
Linden	<ul style="list-style-type: none"><li>island platform with a single track in each direction</li><li>platforms 1 and 2 are between 121 and 125 metres long</li><li>surrounding area is mostly vegetated</li></ul>
Woodford	<ul style="list-style-type: none"><li>island platform with a single track in each direction</li><li>platforms 1 and 2 are between 183 and 187 metres long</li><li>surrounding area is mostly low density residential</li></ul>

Station	Details
Hazelbrook	<ul style="list-style-type: none"> <li>island platform with a single track in each direction</li> <li>platforms 1 and 2 are between 183 and 186 metres long</li> <li>surrounding area is mostly low density residential with some commercial development</li> </ul>
Lawson	<ul style="list-style-type: none"> <li>island platform with a single track in each direction</li> <li>platforms 1 and 2 are between 182 and 184 metres long</li> <li>surrounding area is mostly low density residential with some commercial development</li> </ul>
Bullaburra	<ul style="list-style-type: none"> <li>island platform with a single track in each direction</li> <li>platforms 1 and 2 are 183 metres long</li> <li>surrounding area is mostly low density residential.</li> </ul>
Wentworth Falls	<ul style="list-style-type: none"> <li>island platform with a single track in each direction</li> <li>platforms 1 and 2 are between 183 and 184 metres long</li> <li>surrounding area is mostly low density residential with some commercial development</li> <li>the station is currently being upgraded as part of the Transport Access Program</li> </ul>
Leura	<ul style="list-style-type: none"> <li>island platform with a single track in each direction</li> <li>platforms 1 and 2 are between 183 and 186 metres long</li> <li>surrounding area is a combination of low density residential and commercial development</li> <li>the station is currently being upgraded as part of the Transport Access Program</li> </ul>
Katoomba	<ul style="list-style-type: none"> <li>island platform with a single track in each direction</li> <li>platforms 1 and 2 are between 197 and 198 metres long</li> <li>surrounding area is mostly commercial development with low to medium density residential further out from the station</li> </ul>
Medlow Bath	<ul style="list-style-type: none"> <li>island platform with a single track in each direction</li> <li>platforms 1 and 2 are 183 metres long</li> <li>surrounding area is mostly vegetated with low density residential</li> </ul>
Blackheath	<ul style="list-style-type: none"> <li>island platform with a single track in each direction</li> <li>platforms 1 and 2 are between 197 and 198 metres long</li> <li>surrounding area is a combination of low density residential and commercial development</li> </ul>
Bell	<ul style="list-style-type: none"> <li>island platform with a single track in each direction</li> <li>platforms 1 and 2 are between 197 and 198 metres long</li> <li>surrounding area is mostly vegetated, with a small number of low density or rural residences</li> </ul>
Newnes Junction	<ul style="list-style-type: none"> <li>one facing side and one island platform (total of three platforms) with three tracks</li> <li>platforms 1 and 2 are between 124 and 130 metres long. Platform 3 is about 122 metres long</li> <li>currently not in use by the public</li> <li>surrounding area is mostly vegetated, with a small number of low density or rural residences</li> </ul>
Eskbank	<ul style="list-style-type: none"> <li>facing side platforms with a single track in each direction</li> <li>platforms 1 and 2 are between 24 and 50 metres long</li> <li>currently not in use by the public</li> <li>surrounding area consists of commercial development and medium density residential</li> </ul>
Lithgow	<ul style="list-style-type: none"> <li>island platform with a single track in each direction</li> <li>platforms 1 and 2 are between 190 and 192 metres long</li> <li>surrounding area is a combination of medium density residential and commercial development</li> </ul>

## 1.4 Purpose of this Review of Environmental Factors

This REF has been prepared by AECOM on behalf of TfNSW to assess the potential impacts of the Project. TfNSW is the proponent and a determining authority under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The purpose of this REF is to describe the Project, to assess the likely impacts of the Project having regard to the provisions of section 111 of the EP&A Act, and to identify mitigation measures to reduce the likely impacts of the Project. This REF has been prepared in accordance with clause 228 of the *Environmental Planning and Assessment Regulation 2000* (the EP&A Regulation).

This assessment has also considered the relevant provisions of other relevant environmental legislation, including the *Threatened Species Conservation Act 1995* (TSC Act), the *Heritage Act 1977* (Heritage Act) (NSW) and the *Roads Act 1993* (Roads Act).

Having regard to the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), this REF considers the potential for the Project to have a significant impact on matters of National Environmental Significance (NES) or Commonwealth land, and the need to make a referral to the Commonwealth Department of Environment for any necessary approvals under the EPBC Act. Refer to Chapter 4 for more information on statutory considerations.

## 2 Need for the Project

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Chapter 2 discusses the need and the objectives of the Project (in the context of the wider objectives of the New Intercity Fleet Program). This chapter also provides a summary of the options that have been considered during development of the Project and why the preferred option has been chosen.

### 2.1 Strategic justification

#### 2.1.1 Overview of the New Intercity Fleet Program

Improving transport customer experience is a focus of the NSW Government's transport initiatives. Trains are an important component of the transport system and, as such, play a critical role in shaping the customer's experience and perception of public transport.

In May 2014, the NSW Government announced it is delivering a New Intercity Fleet to replace two existing train sets. The new fleet will service stations on the intercity train network, connecting customers travelling to and from Sydney to the Central Coast, Newcastle, the South Coast, Blue Mountains and Lithgow.

The New Intercity Fleet has been developed to drive a stronger customer experience outcome by increasing the safety, comfort and accessibility of the fleet and create a more consistent, improved experience for intercity customers. It is anticipated that this will encourage greater public transport use, provide improved transport links between intercity locations and metropolitan Sydney, reduce the operating and maintenance costs and provide a more reliable service and increased capacity to support a growing population.

The introduction of the New Intercity Fleet will allow for the replacement of the existing intercity trains which are experiencing a number of adverse operational impacts including:

- declining reliability – higher average peak period breakdown rates in comparison to the rest of the fleet
- lower availability – as a result of the declining reliability, the existing intercity fleet are experiencing increases in failures requiring repair and increased routine maintenance levels. This results in a decreased availability of trains on the network
- higher maintenance costs – they require maintenance every 15, 45 and 90 days whereas newer fleet would generally require maintenance every 90 days
- lower customer amenity – older trains do not include the modern amenities that would be provided by the New Intercity Fleet.

The New Intercity Fleet would provide a better experience for public transport customers by delivering an accessible, modern, safe and comfortable travel experience. The New Intercity Fleet Program aims to provide:

- a more consistent, improved experience for intercity customers which is comparable to that experienced by customers on other rail lines particularly in terms of reliability and capacity improvements to support the growing train network
- reduced operating and maintenance costs
- increased availability of trains on the network
- generally lower energy consumption
- improved amenities including wider seats with arm rests and more space, charging stations for mobile electronic devices, dedicated space for luggage, prams, bicycles and wheelchairs



- a less greenhouse gas intensive mode of travel per passenger.

The New Intercity Fleet Program has been divided into the following key elements:

- acquisition of trains for the new fleet
- construction of a new maintenance facility (subject to separate approval)
- upgrades of existing stabling facilities (subject to separate approvals)
- modifications to the Ten Tunnels Deviation (subject to a separate approval)
- enabling works across the network will facilitate the operation of the New Intercity Fleet, including modifications on the Blue Mountains Line (the subject of this assessment).

## **2.2 Need for the Project**

The NSW Government's decision to introduce the New Intercity Fleet would result in a number of changes from the existing fleet including an increase in the total length of the trains up to 205 metres and an increased train width to cater for growing customer patronage and improved customer comfort.

Modifications are needed along the rail corridor from west of Springwood Station to Lithgow Station to accommodate the new and existing trains. These modifications will bring the Blue Mountains Line up to the standard of the rest of the electrified rail network.

The Project includes essential enabling works that will facilitate the safe and reliable operation of New Intercity Fleet between Springwood and Lithgow on the Blue Mountains Line.

## **2.3 Design development**

TfNSW undertook a series of design assessments for the early development of the Project. The outcomes of these assessments informed the scope of works needed to allow for the safe operation of the New Intercity Fleet along the Blue Mountains Line.

The assessments also determined the track design alignment for the rail and the potential for clearance infringements of Asset Standards Authority (ASA) standards resulting from the introduction of new trains which would be longer and wider than the existing trains that travel along the Blue Mountains Line to Lithgow. These investigations identified potential infringements to the station platforms, canopies, trackside structures and train passing clearances.

The design development also took into consideration existing platform lengths and identified stations where the platforms would need to be extended to allow customers and staff to access the new longer trains.

## **2.4 Project options**

Options for enabling the safe and efficient operation of the New Intercity Fleet on the Blue Mountains Line were developed following a succession of workshops with TfNSW, relevant stakeholders (including Sydney Trains and NSW TrainLink) and the project team. Options considered for the Project are described in the following sections.

### 2.4.1 Options to achieve necessary width clearances

The following options were considered to obtain the required width clearances, therefore removing potential infringements between the New Intercity Fleet trains and existing infrastructure:

- track slewing only
- platform coping modifications only
- combination of both slewing and platform coping modifications
- do nothing.

Under a 'do-nothing' option, the platform copings and canopies, tracks, overhead wiring systems and signalling utilities between Springwood and Lithgow would not undergo any upgrade works and would remain the same. This option was not supported as the Blue Mountains Line would then not meet standard ASA clearance requirements and the New Intercity Fleet would not be able to operate on the line. This would be inconsistent with NSW Government objectives of enhancing rail passenger services for longer distance travel outside of the Sydney suburban areas, would not improve public transport comfort from Sydney to the Blue Mountains and would not meet the needs of the Blue Mountains community.

Options to meet the necessary width clearances that involved a track slewing only option would result in additional changes to other infrastructure in the corridor and was not considered feasible. For example, in order to slew the track to the necessary design requirements it would be necessary to relocate the supports of the overhead wiring system and other structures along much of the rail corridor.

Achieving the necessary width clearances through platform coping modifications only was also not considered a feasible option as it would result in greater impacts to the platforms and building canopies which are of heritage value. The preferred option nominates an optimised combination of both track slewing and platform coping modifications to achieve the necessary width clearances while reducing the level of impact to heritage fabric and the need to relocate other structures along the rail corridor.

### 2.4.2 Options to achieve necessary platform lengths

Platform extensions are required at Katoomba Station and Lithgow Station to accommodate the longer trains. As services terminate at these stations, all doors of the train (including the driver's door) would need to be able to open to a platform to allow customers and train operators to egress where services terminate. As such, the 'do nothing' option would not be feasible as it would be inconsistent with NSW Government objectives of enhancing rail passenger services for longer distance travel outside of the Sydney suburban areas. As services would not terminate at the other stations, platform extensions were not identified as being needed. At shorter platforms, trains would allow egress from specific carriages, similar to what is currently experienced along the rail network. This would minimise unnecessary alterations to heritage stations.

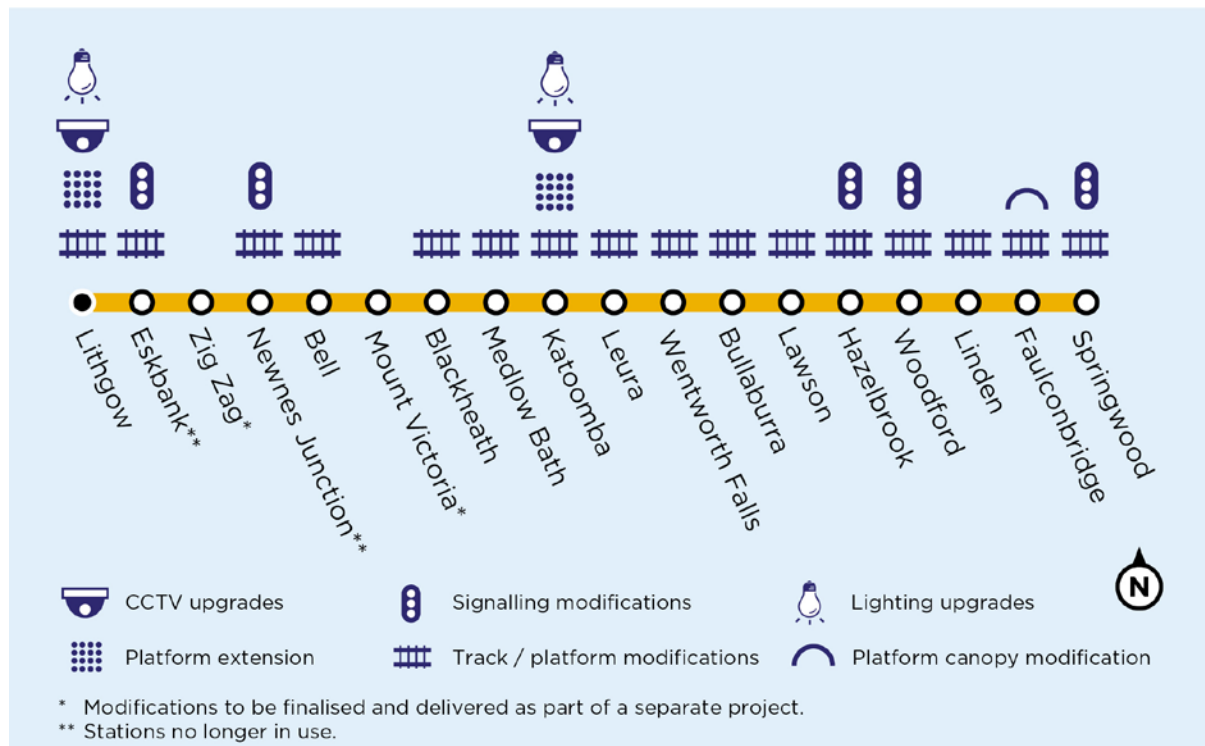
The preferred option for extending the platforms at Katoomba Station and Lithgow Station was to extend in a location which has previously been modified to minimise heritage impacts while meeting operational requirements. The eastern end of Platform 1 at Katoomba Station and the western end of the island platform at Lithgow Station have previously been modified and extending at these locations would also best suit operational requirements. Extending the platforms at each end was considered however this would have greater heritage impacts than the preferred option and was therefore not progressed.

## 3 Description of the Project

Chapter 3 describes the Project including key design parameters, construction method, and associated infrastructure and modifications required.

### 3.1 The Project

The proposed scope of works to be carried out along the Blue Mountains Line is outlined below and shown in Figure 4.



**Figure 4 Scope of works for the project**

#### 3.1.1 Modifications to stations

The following platform modifications would be required as part of the Project:

- extension of Platform 1 at Katoomba Station by around four metres towards the east. This would involve:
  - relocation of an overhead structure and other infrastructure including steel stairs in the location of the proposed extension
  - installation of foundations for the platform extension
  - construction of the platform extension
  - relocation of fencing and access gates at the edge of the extended platform as required
  - extension of CCTV, public announcement systems and lighting to the platform extension

- extension of Platforms 1 and 2 (island platform) at Lithgow Station by around 12 metres towards the west. This would involve:
  - removal of the existing rail corridor access ramp
  - construction of the platform extension
  - installation of new steel stairs for rail corridor access at the end of the extended platform
  - relocation of fencing and access gates at the edge of the extended platform
  - extension of CCTV, public announcement systems and lighting to the platform extension
- horizontal platform coping modifications by up to 25 centimetres (including a +/- 20 millimetre variance) on Platforms 1 and 2 at all stations in the Project site between Faulconbridge Station and Lithgow Station (note: these changes are universal to all platforms and are therefore have not been indicated on Figure 5 and Figure 6)
- reduction in the width of the existing platform canopy at Faulconbridge Station on platform 2 by around 11 centimetres
- relocation of services where required, and installing additional support where cables are removed from the platform coping overhang
- reinstate finishes such as tactile pavers and/or yellow and white line markers as required at all stations.

Materials proposed for the platform extensions at Katoomba Station and Lithgow Station have been selected to minimise visual impact and to blend with the existing brick face of the heritage platforms. The platform extensions would comprise brick faces of similar colour to the adjacent materials on existing platforms. New gates and fences (where required) would also be designed to match the existing design and colour.

Key elements of the platform extensions at Katoomba Station and Lithgow Station are shown in Figure 5 and Figure 6.

### **3.1.2 Corridor works**

#### *Track slewing*

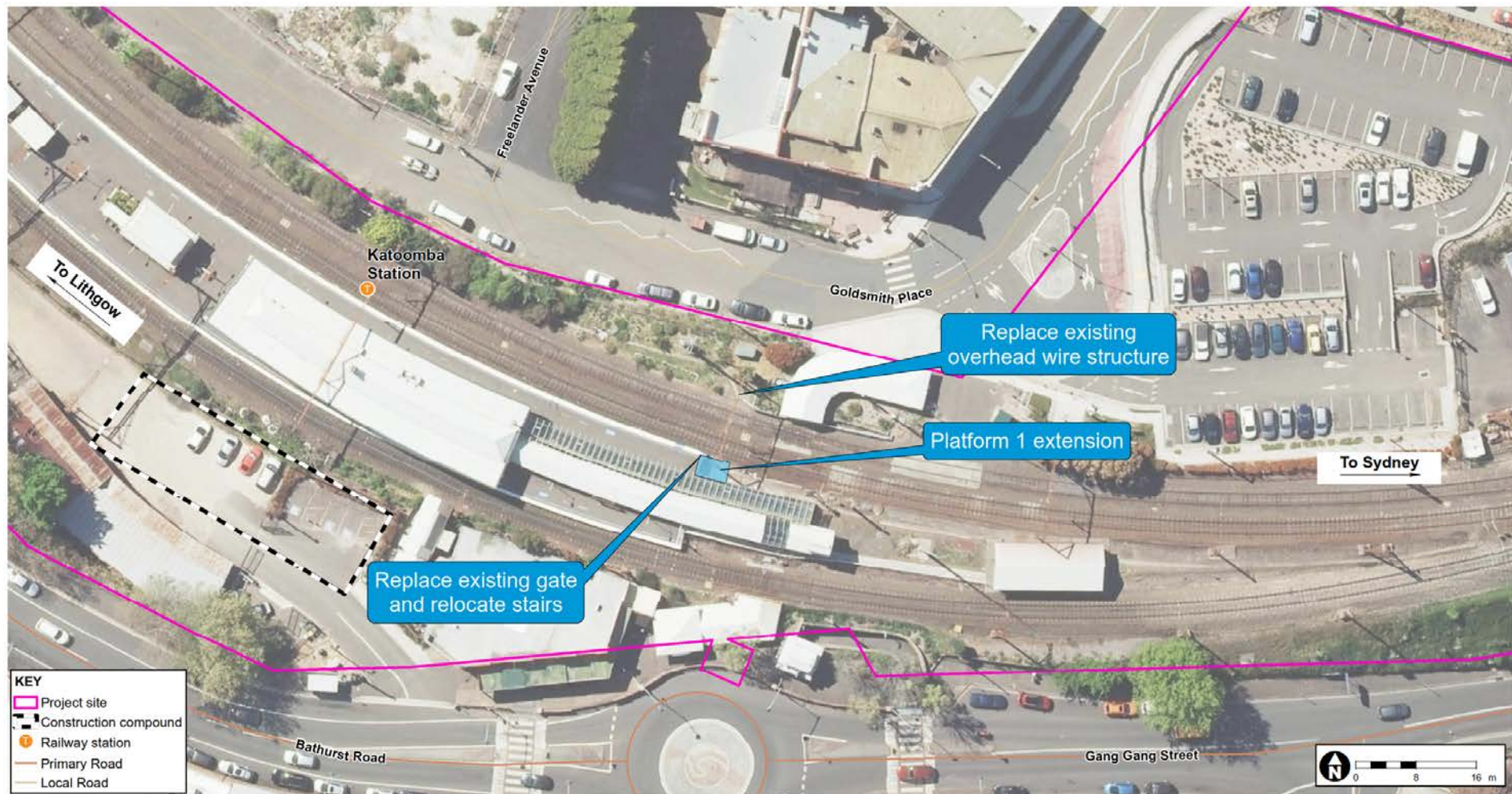
Track slewing would be undertaken at certain sections along the length of the rail corridor between west of Springwood Station and Lithgow Station to ensure adequate passing distances between trains, and adequate clearance between the trains and platforms. This would generally include:

- temporary disconnection of signalling and communications infrastructure
- horizontal slewing of the track by up to 25 centimetres as required
- replacement of crossovers at Bell Station, Eskbank Station and Newnes Junction Station, involving:
  - cutting and removal of sections of existing track
  - removal of ballast and existing foundations
  - widening of the section to accommodate wider track
  - placement of new foundations, footings and constructing new ballast, sleepers and rail
- reconnection of signalling and communications infrastructure.

### *Electrical and signalling modifications*

Other minor modifications within the rail corridor would include:

- relocation of electrical equipment at Eskbank Station and replacement of electrical equipment at Bell Station
- minor signal infrastructure adjustments along the rail corridor at Hazelbrook Station, Woodford Station and Lawson Station to accommodate new track positions as a result of the slewing
- relocating and replacing of overhead wire structures at Katoomba Station and Eskbank Station.



**Figure 5 Proposed work at Katoomba Station**



Figure 6 Proposed work at Lithgow Station

### 3.1.3 Sustainability in design

The development of the concept design for the Project has been undertaken in accordance with the requirements of the TfNSW Environmental Management System (EMS) and the *NSW Sustainable Design Guidelines - Version 3.0* (TfNSW, 2013) which groups sustainability into seven themes:

- energy and greenhouse gases
- climate resilience
- materials and waste
- biodiversity and heritage
- water
- pollution control
- community benefit.

Within each theme, potential initiatives are prioritised into two categories of requirements:

- **Compulsory** – the initiative is required to be implemented when applicable to the Project as they refer to a corporate target, or are fundamental to the delivery of sustainable assets).
- **Discretionary** – the initiative has benefits to be implemented, however may not be the most appropriate.

A shortlist of compulsory initiatives has been developed by TfNSW for the Project. These compulsory initiatives have been reviewed and incorporated into the reference design (unless otherwise justified) and documented in a Sustainable Design Guidelines checklist prepared by TfNSW. The checklist and the initiatives would be reviewed again at the detailed design and construction phases.

## 3.2 Construction activities

### 3.2.1 Work methodology

Subject to approval, construction is expected to commence in 2018 and take around two years to complete. The construction methodology would be further developed during the detailed design of the Project by the construction contractor in consultation with TfNSW.

The proposed construction activities for the Project are identified in Table 2. This staging is indicative and is based on the current reference design and may change once the detailed design methodology is finalised. The staging is also dependent on the Contractor's preferred methodology, program and sequencing of work.



**Table 2 Indicative construction staging for key activities**

Stage	Activities
Site establishment	<ul style="list-style-type: none"> <li>• establishment of site compounds (e.g. erect fencing/hoarding, tree protection zones, site offices, amenities and plant/material storage areas)</li> <li>• establishment of temporary facilities as required (e.g. temporary toilets etc.)</li> <li>• site surveys of all track, platform, overhead wiring, signalling infrastructure, tunnels and structures adjacent to the tracks</li> <li>• utility locating</li> <li>• delivery of materials</li> <li>• construction of hi-rail access pads on the tracks</li> </ul>
Station platform modifications	<ul style="list-style-type: none"> <li>• disconnection of utility services and installation of protection measures for cable routes as required</li> <li>• relocation of services where required</li> <li>• platform coping modifications on Platforms 1 and 2 at all 15 stations</li> <li>• modification of the existing platform canopy at Faulconbridge station</li> <li>• treatment of new coping edge and reinstatement of finishes such as tactile pavers and/or yellow and white line markers</li> <li>• reinstate utility services where required</li> </ul>
Station platform extensions (Katoomba Station and Lithgow Station)	<ul style="list-style-type: none"> <li>• temporary removal fencing for reinstatement (if possible)</li> <li>• removal of the existing rail corridor access ramp at Lithgow Station</li> <li>• construction of foundations for platform extensions at Katoomba Station and Lithgow Station</li> <li>• extension of Platform 1 at Katoomba Station</li> <li>• extension of Platforms 1 and 2 at Lithgow Station</li> <li>• installation of CCTV, lighting, public announcement systems etc. to service platform extensions</li> <li>• installation/extension of existing cables to platform extensions</li> <li>• relocation of fencing and access gates at the edge of the extended platforms as required (towards the east at Katoomba Station and towards west at Lithgow Station)</li> <li>• installation of new steel stairs for access to the rail corridor at the end of the extended platforms at Lithgow Station</li> <li>• relocation of existing stairs on Platform 1 at Katoomba Station</li> <li>• installation of finishes such as tactile pavers and/or yellow and white line markers to platform extensions</li> </ul>
Track slewing works	<ul style="list-style-type: none"> <li>• temporary disconnection of signalling infrastructure and rail utilities as required</li> <li>• removal of existing tracks, ballast and foundation, and widening of track area to accommodate new crossovers at Bell Station and Eskbank Station</li> <li>• re-position/replacement of rail track</li> <li>• replacement of ballast/sleepers/footings/foundations and other items where required</li> <li>• reinstate signalling infrastructure and rail utilities at the completion of works</li> </ul>
Signalling	<ul style="list-style-type: none"> <li>• disconnection of signalling and communications infrastructure where required</li> <li>• relocation of electrical equipment at Eskbank Station and Bell Station</li> <li>• adjustment of signalling infrastructure along the rail corridor at Hazelbrook Station, Woodford Station and Lawson Station to accommodate track slewing</li> <li>• installation additional signage where required</li> </ul>
Overhead wiring systems	<ul style="list-style-type: none"> <li>• relocation and replacement of overhead wire structures at Katoomba Station / Eskbank Station</li> <li>• Replacement of supporting structures where required</li> </ul>
Testing	<ul style="list-style-type: none"> <li>• test and commission signalling and overhead wiring system, new/modifications to station services and platforms, communications and security systems</li> </ul>

### 3.2.2 Plant and equipment

The plant and equipment likely to be used during construction includes:

- trucks
- bobcat
- jack hammer
- excavator
- demolition saw
- concrete pump
- pilling rig
- concrete truck
- franna/mobile cranes
- lighting tower
- hi-rail plant (elevated work platform / flatbed / hiab etc.)
- coring machine
- water cart
- hi-rail dump truck
- generator
- suction trucks
- rail mounted trolley
- rail mounted elevated work platform
- road rail concrete truck
- vibrating roller / compaction plate
- road rail excavator
- elevated work platform
- hand tools.

### 3.2.3 Working hours

Where possible, construction work would be undertaken during standard construction hours, which are as follows:

- 7am to 6pm Monday to Friday
- 8am to 1pm Saturdays
- no work on Sundays or public holidays.

Works undertaken during these hours may include minor civil works and modifications such as the installation of public announcement systems, CCTV and lighting to platform extensions at Katoomba Station and Lithgow Station.

However, a large portion of the works would need to occur outside standard hours, which would be undertaken during routine rail possessions. Routine rail possessions are scheduled closures that would occur regardless of the Project when part of the rail network is temporarily closed and trains are not operating.

It is anticipated that this Project would utilise approximately 10 pre-existing, routine rail possessions over the two-year construction period. This would typically include shutdown periods of 48 hours over a weekend period; however, five of the 10 rail possession periods may extend for 12 days in the area between Newnes Junction Station and Lithgow Station. This would involve five day closures of one line on both sides of a weekend possession period.

Approval from TfNSW would be required for any out of hours work and the affected community would be notified as outlined in TfNSW's *Construction Noise Strategy* (TfNSW, 2017) (refer to Section 6.3 for further details).

### 3.2.4 Earthworks

The Project would require the following minor earthworks:

- excavation for the extensions to the Katoomba Station and Lithgow Station platforms
- replacement of supporting structures for the overhead wiring system
- replacement of crossovers at up to six locations at Bell Station and Eskbank Station

- minor signal infrastructure relocations along the rail corridor at Hazelbrook Station, Woodford Station and Lawson Station to accommodate new track positions as a result of the slewing
- other minor civil works including ground levelling for platform modifications and track slewing.

Tracks, sleepers and ballast may also need to be removed / replaced to accommodate track slewing, particularly to allow for the replacement of crossovers at Eskbank Station and Bell Station. Excavated material would be reused onsite where possible or disposed of in accordance with relevant legislative requirements.

### **3.2.5 Source and quantity of materials**

The source and quantity of materials would be determined during the detailed design phase of the Project, and would consider the requirements of the *NSW Sustainable Design Guidelines – Version 3.0* (TfNSW, 2013). Materials would be sourced from local suppliers where practicable. Reuse of existing and recycled materials would be undertaken where practicable.

### **3.2.6 Traffic, access and vehicle movements**

The anticipated vehicle movements during construction depends on the scope of works, with numerous stages of construction being undertaken at the same time.

The works would require about 10 to 20 medium / heavy vehicle movements (5 to 10 vehicles) for each individual work site. A small number of light / medium vehicles would also be required to service personnel and transport small equipment and other materials as needed to the work sites.

The number of vehicle movements expected during construction would be finalised during the development of the detailed design. Existing access routes would be used to access the rail corridor.

Traffic and transport impacts associated with the Project are assessed in Section 6.4. The potential traffic and access impacts expected during the construction of the Project include:

- minor disruptions due to increased truck and construction machinery movements, particularly along Great Western Highway and local roads providing access to the compound sites
- increased demand for on-street parking within the local network in the short-term, particularly where compound sites have been identified adjacent to existing off-street commuter parking facilities including at Blackheath Station, Katoomba Station and Lithgow Station.

### **3.2.7 Temporary facilities**

It is expected that a number of temporary construction compounds would be required to accommodate a site office(s), amenities, laydown and storage areas for materials. Several options have been identified for the possible locations of these compounds, as shown in Appendix C. The locations of the compounds would be finalised during detailed design and not all of the identified locations are likely to be required.

Sites would be selected to avoid sensitive areas and would be determined in consultation with relevant landowners. Generally compounds would be selected to:

- limit proximity to sensitive receivers where practicable
- minimise noise impacts to residents
- avoid disruption to property access

- avoid impacts to known items of heritage (both non-Aboriginal and Aboriginal)
- use existing cleared areas and access tracks where practicable
- avoid remnant native vegetation or key habitat features
- avoid disturbance to waterways
- provide safe access to the local road network
- where the land is relatively level.

Areas used for site compounds would be rehabilitated at the end of construction.

The majority of areas nominated for the compounds are on land owned by RailCorp in order to minimise disturbance to neighbouring properties. It is also anticipated that laydown areas would be located on station platforms.

Impacts associated with utilising the compounds shown in Appendix C have been considered in the environmental impact assessment including requirements for rehabilitation.

### **3.2.8 Public utility adjustments**

During the concept design stage, a desktop review was conducted and third party utility information was obtained from Dial Before You Dig. The results of the DBYD search were considered in the reference design report (GHD, 2017).

The Project has been designed to avoid relocation of services where feasible. It is not anticipated that any public utility adjustments are required other than changes to RailCorp utilities and the overhead wiring system associated with the railway.

In the event that additional utility relocations are required outside of the Project site, further assessment would be undertaken. The relevant utility providers would be consulted during the detailed design phase of the Project.

A detailed underground services search and investigation (non-invasive) for overhead wire footings would be conducted to locate services in the Project site prior to any detailed design development or excavation.

## **3.3 Property acquisition**

The works would take place within the existing rail corridor. No property acquisition is required for the Project.

## **3.4 Operation management and maintenance**

It is anticipated that the New Intercity Fleet and existing intercity trains would run jointly on the Blue Mountains Line until all of the New Intercity Fleet trains are in service. The modification of the station platforms would result in a larger gap being experienced by customers boarding or alighting between the different train sets at certain points along the platform. Impacts would be temporary, lasting until the complete replacement of the existing fleet. Measures including additional signage, additional station staff, physical platform gap filling solutions and communication strategies would be identified during detailed design to minimise disruptions to customers. Impacts resulting from a larger platform gap are discussed further in Section 6.4.2.

## 4 Statutory considerations

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Chapter 4 provides a summary of the statutory considerations relating to the Project including a consideration of NSW Government polices/strategies, NSW legislation (particularly the *Environmental Planning and Assessment Act 1979* (EP&A Act)), environmental planning instruments, and Commonwealth legislation.

### 4.1 Commonwealth legislation

#### 4.1.1 Environment Protection and Biodiversity Conservation Act 1999

The (Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places - defined in the EPBC Act as 'matters of National Environmental Significance (NES)'. The EPBC Act requires the assessment of whether the Project is likely to significantly impact on matters of NES or Commonwealth land. These matters are considered in full in Appendix A.

The Project would not impact on any matters of NES or on Commonwealth land. Therefore a referral to the Commonwealth Minister for the Environment is not required.

### 4.2 NSW legislation and regulations

#### 4.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act establishes the system of environmental planning and assessment in NSW. This Project is subject to the environmental impact assessment and planning approval requirements of Part 5 of the EP&A Act. Part 5 of the EP&A Act specifies the environmental impact assessment requirements for activities undertaken by public authorities, such as TfNSW, which do not require development consent under Part 4 of the Act.

In accordance with section 111 of the EP&A Act, TfNSW, as the proponent and determining authority, must examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the Project.

Clause 228 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) defines the factors which must be considered when determining if an activity assessed under Part 5 of the EP&A Act has a significant impact on the environment. Chapter 6 of this REF provides an environmental impact assessment of the Project in accordance with section 111 and clause 228 and Appendix B specifically responds to the factors for consideration under clause 228.

#### 4.2.2 Other NSW legislation and regulations

The Project has been assessed against other relevant State legislation and regulations. Table 3 provides a list of other relevant legislation applicable to the Project.

**Table 3 Other legislation applicable to the Project**

Applicable legislation	Considerations
<p><i>Contaminated Land Management Act 1997</i> (CLM Act) (NSW)</p>	<p>Section 60 of the CLM Act imposes a duty on landowners to notify the NSW EPA, and potentially investigate and remediate land if contamination is above EPA guideline levels.</p> <p>Contaminants of potential concern are likely to be limited in extent and are unlikely to be present at concentrations above the relevant assessment criteria. No parts of the Project site or identified ancillary facilities have been declared under the CLM Act as being significantly contaminated (refer to Section 6.6).</p>
<p><i>Crown Lands Act 1987</i> (NSW)</p>	<p>The Project does not involve any works on Crown land.</p>
<p><i>Heritage Act 1977</i> (Heritage Act) (NSW)</p>	<p>The Heritage Act provides for the protection and conservation of non-Indigenous cultural heritage items and establishes the Heritage Council of NSW. Relevant sections of the Heritage Act to the Project include the following:</p> <ul style="list-style-type: none"> <li>• Section 32, where places, buildings, works, relics, moveable objects or precincts of heritage significance are protected by means of either Interim Heritage Orders or by listing on the NSW State Heritage Register.</li> <li>• Sections 57 and 60 require approval from the Heritage Council of NSW where activities that may alter, damage, move or destroy items listed on the State Heritage Register are to be impacted</li> <li>• Under Section 140 of the Heritage Act, a permit is required to disturb or expose land that may contain relics. Where the impacts would be minimal, an exception under Section 139 may be applied for</li> <li>• Section 170 where items listed on a government agency Heritage and Conservation Register are to be impacted. Section 170 also requires that NSW Government agencies, including TfNSW maintain a register of heritage assets.</li> </ul> <p>Heritage assessments and archaeological reviews have been undertaken for the Project and are summarised in Section 6.1. Section 60 permits would be required to be obtained under the Heritage Act from the Heritage Council for impacts to stations listed on the State Heritage Register. An exception under Section 139 (1b) would also be required for works at Lawson where there is potential for minor or no impact on archaeological relics.</p>
<p><i>Mine Subsidence Compensation Act 1961</i> (MSC Act) (NSW)</p>	<p>The MSC Act provides for compensation or repair services where improvements are damaged by mine subsidence resulting from the extraction of coal. The MSC Act also prevents damage by ensuring that new developments are compatible with the risk of mine subsidence.</p> <p>Subsidence Advisory NSW (formerly the Mine Subsidence Board) is responsible for administering the MSC Act. The Project site is located in the Lithgow Mine Subsidence District. As per Section 15 of the MSC Act, TfNSW would require approval from Subsidence Advisory NSW for the Project. A Building Application Form would be submitted to Subsidence Advisory NSW which once approved provides approval to construct.</p>
<p><i>National Parks and Wildlife Act 1974</i> (NPW Act) (NSW)</p>	<p>The NPW Act oversees the preservation, conservation and management of reserved parks. Portions of the Project are located adjacent to the Blue Mountains National Park. Consideration through design has ensured that the Project does not impact on land designated as National Park.</p> <p>Sections 86, 87 and 90 of the NPW Act require consent from OEHS for the destruction or damage of Indigenous objects. The Project is unlikely to disturb any Indigenous objects (refer to Section 6.1).</p> <p>If unexpected archaeological items or items of indigenous heritage significance are discovered during the construction of the Project, all works would cease and TfNSW's <i>Unexpected Finds Procedure</i> would be implemented.</p>

Applicable legislation	Considerations
<i>Noxious Weeds Act 1993</i> (NSW)	Under the <i>Noxious Weeds Act 1993</i> , public authorities are required to control noxious weeds which are likely to spread to adjoining land. Four Weeds of National Significance were recorded in the Project site. Appropriate management methods would be implemented during construction (refer to Section 6.6 and Section 7.2).
<i>Protection of the Environment Operations Act 1997</i> (PoEO Act) (NSW)	<p>The PoEO Act establishes a regulatory framework for the protection of the environment. It provides a mechanism for licensing certain activities, listed in Schedule 1 of the PoEO Act.</p> <p>Part 3.2 of the PoEO Act requires an Environment Protection Licence (EPL) for scheduled development work and the carrying out of scheduled activities. Track works are listed as scheduled activities (Schedule 1, Part 33 'Railway systems activities') under the PoEO Act and would require an EPL.</p> <p>In accordance with Part 5.7 of the PoEO Act, TfNSW would notify the EPA of any pollution incidents that occur onsite. This would be managed in the Construction Environmental Management Plan (CEMP) to be prepared and implemented by the Contractor.</p>
<i>Roads Act 1993</i> (Roads Act) (NSW)	<p>Section 138 of the Roads Act requires consent from the relevant road authority for the carrying out of work in, on or over a public road. However, clause 5(1) in Schedule 2 of the Roads Act states that public authorities do not require consent for works on unclassified roads.</p> <p>Should any classified road require temporary diversions or closures during the construction of the Project (particularly, the Great Western Highway), a Road Occupancy Licence would need to be obtained (refer to Section 7.2).</p>
<i>Threatened Species Conservation Act 1995</i> (TSC Act) (NSW)	The TSC Act protects threatened flora and fauna species, endangered populations and ecological communities and their habitats within NSW. A number of threatened flora and fauna species and TSC Act listed communities have been identified as known to exist or likely to exist within or near the Project site (refer to Section 6.6). Appropriate management methods would be implemented during construction and operation (refer Section 7.2).
<i>Waste Avoidance and Resource Recovery Act 2001</i> (WARR Act) (NSW)	TfNSW would carry out the Project having regard to the requirements of the WARR Act. A project-specific Waste Management Plan would be prepared and would form part of the Construction Environmental Management Plan.
<i>Water Management Act 2000</i> and <i>Water Act 1912</i>	<p>The <i>Water Management Act 2000</i> (WM Act) provides for the sustainable and integrated management of water resources. Aquifer interference approval requirements under the WM Act have not yet commenced, and regulation is managed under Part 5 of the <i>Water Act 1912</i>.</p> <p>The Project would not involve any water use (from a natural source e.g. aquifer, river), water management works, drainage or flood works, controlled activities or aquifer interference.</p> <p>While some earthworks are required for the Project, shallow groundwater within the Project site is located between, 0.6 and 2 metres below ground level. Groundwater is unlikely to be encountered during the works, and the works are therefore unlikely to impact upon water resources (refer to Section 6.6). No approvals or consideration is likely required under the Act.</p>

## 4.3 State Environmental Planning Policies

### 4.3.1 State Environmental Planning Policy (Infrastructure) 2007

The Infrastructure SEPP is the key environmental planning instrument which determines the permissibility of the Project.

Clause 79 of the Infrastructure SEPP allows for the development of ‘rail infrastructure facilities’ by or on behalf of a public authority without consent on any land (i.e. assessable under Part 5 of the EP&A Act). Clause 78 defines ‘rail infrastructure facilities’ as including elements such as ‘railway stations, station platforms and areas in a station complex that commuters use to get access to the platforms’, public amenities for commuters’ and ‘associated public transport facilities for railway stations’.

Consequently, development consent is not required for the Project which is classified as rail infrastructure. The potential environmental impacts of the Project have been assessed under the provisions of Part 5 of the EP&A Act.

Part 2 of the Infrastructure SEPP contains provisions for public authorities to consult with local councils and other agencies prior to the commencement of certain types of development. Section 5 of this REF discusses the consultation undertaken under the requirements of the Infrastructure SEPP.

It is noted that the Infrastructure SEPP prevails over other environmental planning instruments to the extent of an inconsistency, except in some cases including where *State Environmental Planning Policy (Major Development) 2005*, *State Environmental Planning Policy No 14 – Coastal Wetlands* or *State Environmental Planning Policy No 26 – Littoral Rainforest* applies. The Project does not require consideration under these SEPPs and therefore does not require further consideration as part this REF.

### 4.3.2 State Environmental Planning Policy 55 – Remediation of Land

SEPP 55 provides a State-wide approach to the remediation of contaminated land for the purpose of minimising the risk of harm to the health of humans and the environment. While consent for the Project is not required, the provisions of SEPP 55 have still been considered in the preparation of this REF.

Section 6.8 of this REF contains an assessment of the potential contamination impacts of the Project. It is unlikely that any significant remediation work would be required as part of the Project. The proposed land use does not differ to the existing use and is, therefore, unlikely to be affected by any potential contaminants that exist within the rail corridor.

### 4.3.3 State Environmental Planning Policy (State and Regional Development) 2011

*State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP) identifies State significant development and State significant infrastructure. Projects that are characterised as either of these require approval by the Minister for Planning.

The Project is not listed in the SRD SEPP and has not been declared State Significant Infrastructure or State Significant Development.

### 4.3.4 State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011

The Sydney Drinking Water Catchment SEPP has three main aims:

- to support healthy water catchments that deliver high quality water and permit development that supports that goal
- to ensure that consent authorities only allow proposed developments that have a neutral or beneficial effect on water quality



- to support water quality objectives in the drinking water catchment.

The majority of the Project would be located within the boundary of the Sydney Drinking Water Catchment. As per clause 12 of the Sydney Drinking Water Catchment SEPP, public authorities undertaking works on land regulated by the SEPP are required to consider the effect on water quality before undertaking the activity and consider whether the activity would have a neutral or beneficial effect (NorBE) on water quality. The NorBE assessment concluded that the Project would have a neutral effect on water quality. The NorBE assessment is included in Appendix D.

#### **4.4 Local environmental planning instrument and development controls**

The Project is located in the local government areas of the Blue Mountains and Lithgow. The provisions of the Infrastructure SEPP mean that Local Environmental Plans (LEPs), prepared by councils for a local government area, do not apply. However, during the preparation of this REF, the provisions of the following LEPs were considered:

- *Blue Mountains Local Environmental Plan 2015* (Blue Mountains LEP)
- *Lithgow Local Environmental Plan 2014* (Lithgow LEP).

##### **4.4.1 Blue Mountains Local Environmental Plan 2015**

The Blue Mountains LEP is the governing plan for the Blue Mountains local government area. The Project extends across the Blue Mountains local government area at the following stations:

- |                 |                   |
|-----------------|-------------------|
| • Faulconbridge | • Wentworth Falls |
| • Linden        | • Leura           |
| • Woodford      | • Katoomba        |
| • Hazelbrook    | • Medlow Bath     |
| • Lawson        | • Blackheath      |
| • Bullaburra    | • Bell.           |

The majority of the Project would be conducted within the Blue Mountains local government area and would be mostly located within a SP2 Infrastructure land use zone. The aims of the SP2 Infrastructure zone are to provide for infrastructure and related uses, and to prevent development that is not compatible with, or that may detract from the provisions of infrastructure. The Project meets the objectives of the SP2 Infrastructure zone through the provision of rail infrastructure and recognising existing railway land to enable future development for railway and associated purposes.

The Project may require the use of a small portion of land zoned RE1 Public recreation at Faulconbridge for the establishment of construction compounds. Construction compound locations would be selected to avoid vegetated areas. The use of land for construction compounds would be temporary (during the construction stage of the Project), would be restored following the completion of construction and would be unlikely to result in a long-term land use change.

Irrespective of the provisions of the Blue Mountains LEP, the Project is permissible without consent under the provisions of the Infrastructure SEPP.

#### 4.4.2 Lithgow Local Environmental Plan 2014

The Lithgow LEP is the governing plan for the Lithgow local government area. Newnes Junction Station, Eskbank Station and Lithgow Station are located in the Lithgow local government area.

The aims and objectives of the Lithgow LEP have been considered, however, the operation of the Infrastructure SEPP means that LEPs do not apply to the extent that they impose controls that are inconsistent with the provisions of the Infrastructure SEPP.

The majority of the Project located within the Lithgow local government area would take place within the SP2 Infrastructure land use zone. As discussed above, the Project meets the objectives of the SP2 Infrastructure zone.

Irrespective of the provisions of the Lithgow LEP, the Project is permissible without consent under the provisions of the Infrastructure SEPP. Table 4 summarises the relevant aspects of the LEPs applicable to the Project.

**Table 4 Relevant provisions of the Blue Mountains LEP and Lithgow LEP**

Provision description	Relevance to the Project
Clause 2.3 - Zone objectives and Land Use Table	<p>The Project site is listed as SP2 Infrastructure – Railway under the Blue Mountains LEP and the Lithgow LEP.</p> <p>A small portion of land zoned RE1 Public recreation at Faulconbridge may be required for the establishment of a construction compound.</p> <p>The Project is consistent with the objectives of the SP2 Infrastructure.</p>
Clause 5.10 - Heritage conservation	<p>Clause 5.10 of the Blue Mountains LEP and Lithgow LEP aims to conserve the heritage significance of heritage items within the respective local government areas.</p> <p>A number of items located in the Project site are listed on the heritage schedule of the Blue Mountains LEP and the Lithgow LEP in addition to the State Heritage Register and the RailCorp Section 170 Heritage and Conservation Register.</p> <p>A discussion of potential impacts to local heritage is discussed in Section 6.1.</p>
Clause 5.9 - Preservation of trees or vegetation	<p>Clause 5.9 of the Blue Mountains LEP and the Lithgow LEP is aimed at the preservation of trees and development consent is required for tree removal in most instances. However by virtue of clause 5(3) and 79 of the Infrastructure SEPP, the clearing of vegetation for the Project is permissible without development consent and would be assessed under Part 5 of the EP&amp;A Act. A discussion of potential impacts to vegetation is discussed in Section 6.6.</p>
Blue Mountains LEP Clause 6.14 – Earthworks Lithgow LEP Clause 7.1 - Earthworks	<p>Clause 6.14 of the Blue Mountains LEP and Clause 7.1 of the Lithgow LEP aims to ensure that earthworks for which development consent is required will not have a detrimental impact on environmental functions and processes, waterways and riparian land, neighbouring uses, cultural or heritage items or features of the surrounding land. By virtue of clause 5(3) and 79 of the Infrastructure SEPP, the Project is permissible without development consent and would be assessed under Part 5 of the EP&amp;A Act. The description and consideration of earthworks for the Project is outlined in Section 3.2 and Section 6.6 and respectively.</p>

## 4.5 NSW Government policies and strategies

The Project has been assessed against other key relevant State Government policies and strategies. Table 5 provides an overview of additional NSW Government policies and strategies relevant to the Project.

**Table 5 NSW Government policies and strategies applicable to the Project**

Policy/Strategy	Commitment	Comment
<b>NSW: Making It Happen</b> (NSW Government, 2015)	In September 2015, the NSW Government announced a series of State Priorities as part of <i>NSW: Making It Happen</i> (NSW Government, 2015). The State Priorities are intended to guide the ongoing actions of the NSW Government across the State, and guide resource allocation and investment in conjunction with the NSW Budget. <i>NSW: Making It Happen</i> focuses on 12 key 'priorities' to achieve the NSW Government's commitments. These priorities range across a number of issues including infrastructure, the environment, education, health, wellbeing and safety in addition to Government services.	Two key Priorities identified in Making It Happen are supported by the Project.  One such priority is an increased investment in building infrastructure, including transport infrastructure. This priority is directly reflected by the Project.  Making it Happen also seeks to improve the reliability of public transport services, a priority that the delivery of the Project would support.
<b>Rebuilding NSW – State Infrastructure Strategy 2014</b> (NSW Government, 2014)	<i>Rebuilding NSW</i> is a plan to deliver \$20 billion in new productive infrastructure to sustain productivity growth in our major centres and regional communities.  <i>Rebuilding NSW</i> will support overall population growth in Sydney and NSW.  Public transport is viewed as critical to urban productivity, expanding employment opportunities by connecting people to jobs, reducing congestion, and supporting delivery of urban renewal.	The Project supports investment in rail infrastructure, and aligns with the reservation of \$8.9 billion for urban public transport to support Sydney's population, that is expected to reach almost six million by 2031.
<b>NSW Long-term Transport Master Plan</b> (TfNSW, 2012a)	The <i>NSW Long-term Transport Master Plan</i> identifies a planned and co-ordinated set of actions to address transport challenges and will guide the NSW Government's transport funding priorities over the next 20 years.  The Master Plan would meet a number of challenges to building an integrated transport system for Sydney and NSW, including: <ul style="list-style-type: none"> <li>customer-focused integrated transport planning</li> <li>integrated modes to meet customer needs</li> <li>getting Sydney Moving Again</li> <li>sustaining Growth in Greater Sydney.</li> </ul>	The Project implements the following key themes in the Master Plan: <ul style="list-style-type: none"> <li>improving customers' journey experience</li> <li>making better use of existing assets</li> <li>improve regional passenger rail travel, with access to and across the Blue Mountains as a priority.</li> </ul>
<b>Sydney's Rail Future: Modernising Sydney's Trains</b> (TfNSW, 2012)	<i>Sydney's Rail Future: Modernising Sydney's Trains</i> (TfNSW, 2012b) is the NSW Government's long-term plan to increase the capacity of Sydney's rail network and to meet rail customer needs by investing in new services and upgrading existing infrastructure. It aims to improve the customer's experience, improve reliability and increase services across the rail network. Sydney's Rail Future forms an integral part of the <i>NSW Long-term Transport Master Plan</i> .	The Project has been developed with consideration of the objectives of Sydney's Rail Future, including: <ul style="list-style-type: none"> <li>creating a more reliable service</li> <li>maintain a safe, clean and comfortable commuting environment, and;</li> <li>transform and modernise Sydney's rail network by introducing timetabled services with double-deck trains and on-board amenities for long-distance journeys.</li> </ul>

Policy/Strategy	Commitment	Comment
<b>Sustainable Blue Mountains 2025</b> (Blue Mountains Council, 2010)	The aim of <i>Sustainable Blue Mountains 2025</i> is to provide a framework of action for all stakeholders, to help the area in realising its vision for a more sustainable Blue Mountains. The key direction outlined in the plan re relevant to the Project includes: <ul style="list-style-type: none"> <li>• moving around – the community values safe and accessible travel options that improve connections, including reliable and accessible public transport.</li> </ul>	The Project would be consistent with the public transport values and future visions of the Blue Mountains community. The Project would deliver an improved, safe and accessible public transport option to the region.
<b>Lithgow City Council Community Strategic Plan 2013-2026 – Our Place...Our Future</b> (Lithgow City Council, 2013)	<i>Our Place...Our Future Community Strategic Plan 2013-2025</i> sets out the community's vision for the strategic direction of the Lithgow local government area. The plan sets a vision for the future growth and sustainability of the Lithgow local government area. Vision statements in the plan relevant to the Project include: <ul style="list-style-type: none"> <li>• transport - providing a choice of effective transport options for those who live, work and visit our community</li> <li>• growth - providing for sustainable and planned growth.</li> </ul>	The Project would deliver an improved public transport option to the region, providing transport to those residing in and visiting the area. Through the provision of sustainable public transport the Project would also support the planned growth in the region.

## 4.6 Ecologically sustainable development

TfNSW is committed to ensuring that its projects are implemented in a manner that is consistent with the principles of ecologically sustainable development (ESD). The principles of ESD are defined under the provisions of clause 7(4) of Schedule 2 to the EP&A Regulation as:

- the precautionary principle – If there are threats of serious or irreversible damage, a lack of full scientific uncertainty should not be used as a reason for postponing measures to prevent environmental degradation
- intergenerational equity – the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations
- conservation of biological diversity and ecological integrity – the diversity of genes, species, populations and their communities, as well as the ecosystems and habitats they belong to, should be maintained or improved to ensure their survival
- improved valuation, pricing and incentive mechanisms – environmental factors should be included in the valuation of assets and services.

The principles of ESD have been adopted by TfNSW during the development and assessment of the Project. Section 3.1.3 summarises how ESD would be incorporated in the design development of the Project. Section 6.12 includes an assessment on climate change and sustainability and Section 7.2 lists mitigation measures to ensure ESD principles are incorporated during the construction phase of the Project.

## 5 Community and stakeholder consultation

Chapter 5 discusses the community and stakeholder consultation undertaken to date for the Project and the consultation proposed during the public display of the REF. This chapter discusses the consultation strategy adopted for the Project and summarises consultation with the community, relevant government agencies and stakeholders undertaken so far.

### 5.1 Stakeholder consultation during concept design

During the development of concept design options, TfNSW held a number of workshops with stakeholders including Sydney Trains and NSW TrainLink. Meetings held with Sydney Trains were primarily to discuss requirements for rail possessions to undertake the proposed works. Meetings held with NSW TrainLink were primarily held to discuss requirements to ensure compliance with the existing trains as well as future fleet.

Numerous meetings were also held with the ASA throughout the design development to discuss and determine an agreed approach to the number and type of concessions required as well as train parameters, clearance gap requirements and the consideration of other projects occurring along the Blue Mountains Line.

### 5.2 Consultation requirements under the Infrastructure SEPP

Part 2, Division 1 of the Infrastructure SEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Clauses 13, 14, 15 and 16 of the Infrastructure SEPP require that public authorities undertake consultation with councils and other agencies, when proposing to carry out development without consent. Table 6 provides details of consultation requirements under the Infrastructure SEPP for the Project.

**Table 6 Infrastructure SEPP consultation requirements**

Clause	Clause particulars	Relevance to the Project
<b>Clause 13   Consultation with Councils – development with impacts on council related infrastructure and services</b>	<p>Consultation is required where the Project would result in:</p> <ul style="list-style-type: none"> <li>substantial impact on stormwater management services</li> <li>generating traffic that would place a local road system under strain</li> <li>involve connection to or impact on a council owned sewerage system</li> <li>involve connection to and substantial use of council owned water supply</li> <li>significantly disrupt pedestrian or vehicle movement</li> <li>involve significant excavation to a road surface or footpath for which Council has responsibility.</li> </ul>	<p>The Project is unlikely to substantially impact stormwater services, nor significantly disrupt pedestrian or vehicles movements. Accordingly, consultation with Council is not required in regard to this aspect.</p>

Clause	Clause particulars	Relevance to the Project
<b>Clause 14   Consultation with Councils – development with impacts on local heritage</b>	<p>Where railway station works:</p> <ul style="list-style-type: none"> <li>substantially impact on local heritage item (if not also a State heritage item)</li> <li>substantially impact on a heritage conservation area.</li> </ul>	<p>The Project requires platform extensions, platform canopy modifications (Faulconbridge Station only) and reconfiguring of associated rail infrastructure at stations listed on the Blue Mountains LEP.</p> <p>Consultation with the Blue Mountains City Council would be undertaken in accordance with clause 14 of the Infrastructure SEPP and would continue throughout the detailed design and construction phases. Refer to Section 6.1 for a summary of impacts to locally-listed heritage items.</p>
<b>Clause 15   Consultation with Councils – development with impacts on flood liable land</b>	<p>Where railway station works:</p> <ul style="list-style-type: none"> <li>impact on land that is susceptible to flooding – reference would be made to <i>Floodplain Development Manual: the management of flood liable land</i>.</li> </ul>	<p>The Project is not located on land that is susceptible to flooding. Accordingly, consultation with Council is not required in regard to this aspect. Refer to Section 6.6.</p>
<b>Clause 16   Consultation with public authorities other than Councils</b>	<p>For <i>specified development</i> which includes consultation with the OEH for development that is undertaken adjacent to land reserved under the <i>National Parks and Wildlife Act 1974</i>, and other agencies specified by the Infrastructure SEPP where relevant.</p>	<p>The Project is located adjacent to land reserved under the <i>National Parks and Wildlife Act 1974</i>. Accordingly, TfNSW would give written notice to OEH of the intention to carry out the development, and take into consideration any response to the notice received within 21 days after the notice is given.</p>

### 5.3 Consultation strategy

The consultation strategy for the Project has been developed to encourage stakeholder and community involvement and foster interaction between stakeholders, the community and the project team. The consultation strategy that has been developed, having regard to the requirements of the planning process and ensure that stakeholders, customers and the community are informed of the Project and have the opportunity to provide input.

The objectives of the consultation strategy are to:

- provide accurate and timely information about the Project and REF process to relevant stakeholders
- raise awareness of the various components of the Project and the specialist environmental investigations
- ensure that the directly impacted community is aware of the REF and consulted where appropriate
- provide opportunities for stakeholders and the community to express their views about the Project
- understand and access local knowledge from the community and stakeholders
- record the details and input from community engagement activities
- build positive relations with identified community stakeholders
- ensure a comprehensive and transparent approach.

## 5.4 Public display

The REF display includes:

- public display of the REF at various locations
- distribution of a project update up to a radius of up to 500 metres around major work areas, and to local community and rail customers, outlining the Project and inviting feedback on the REF
- advertisement of the REF public display in local newspapers with a link to the TfNSW website that includes a summary of the Project and information on how to provide feedback
- briefings to Blue Mountains City Council, Lithgow City Council, Sydney Trains, business user groups and other stakeholders.

Additional community consultation activities for the Project, such as information sessions, would also be undertaken during the public display of this REF. The REF will be placed on public display for a period of approximately three weeks at the following locations:

- Blue Mountains City Council, 2-6 Civic Place, Katoomba
- Katoomba Library, Blue Mountains Cultural Centre, 30 Parkes Street, Katoomba
- Blue Mountains City Council, 104 Macquarie Road, Springwood
- Lithgow City Council, 180 Mort Street, Lithgow
- Lithgow Library and Learning Centre, 157 Main Street, Lithgow
- Wentworth Falls Library, School of Arts Building 217 Great Western Highway, Wentworth Falls
- TfNSW Reception, Level 5, Tower A, Zenith Centre, 821 Pacific Highway, Chatswood.

The REF would also be available to download from the TfNSW [website](#)<sup>3</sup> and [haveyoursay website](#)<sup>4</sup>. Additionally, information on the Project will be available through the Project Infoline (1800 684 490) or by email ([projects@transport.nsw.gov.au](mailto:projects@transport.nsw.gov.au)).

During this time feedback is invited. Following consideration of feedback received during the public display period, TfNSW will determine whether to proceed with the Project and what conditions would be imposed on the Project should it be determined to proceed.

## 5.5 Aboriginal community involvement

An assessment of the Aboriginal heritage potential of the Project site was undertaken and can be found in Section 6.1. The results of this assessment did not identify any registered items of Aboriginal heritage significance within the Project site and found that the archaeological potential of the area is low. Therefore it was not considered necessary to undertake specific consultation with the Aboriginal community.

## 5.6 Ongoing consultation

At the conclusion of the public display period for this REF, TfNSW would acknowledge receipt of feedback from each respondent. The issues raised by the respondents would be considered by TfNSW before determining whether to proceed with the Project.

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<sup>3</sup> <http://www.transport.nsw.gov.au/projects/intercity-fleet>

<sup>4</sup> <https://www.nsw.gov.au/improving-nsw/have-your-say/>

Should TfNSW determine to proceed with the Project, the Determination Report would be made available on the TfNSW website and would summarise the key impacts identified in this REF, demonstrate how TfNSW considered issues raised during the public display period, and include conditions of approval proposed to minimise the impacts of the Project.

Should TfNSW determine to proceed with the Project, the project team would keep the community, councils and other key stakeholders informed of the process, identify any further issues as they arise, and develop additional mitigation measures to minimise the impacts of the Project. The interaction with the community would be undertaken in accordance with a Community Liaison Plan to be developed prior to the commencement of construction.



## 6 Environmental impact assessment

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Chapter 3 of the REF provides a detailed description of the likely environmental impacts associated with the construction and operation of the Project.

This environmental impact assessment has been undertaken in accordance with clause 228 of the EP&A Regulation. A checklist of clause 228 factors and how they have been specifically addressed in this REF is included in Appendix B.

### 6.1 Non Indigenous heritage

A number of Statements of Heritage Impact (SoHI) reports have been prepared by AECOM and Artefact Heritage to assess potential impacts associated with construction and operation of the Project and to accompany applications for approval under Section 60 and Section 170 of the Heritage Act. The SoHIs were prepared in accordance with the following guidelines:

- *Heritage Manual* (NSW Heritage Office & NSW Department of Urban Affairs and Planning, 1996)
- *Statements of Heritage Impact* (NSW Heritage Office, 2002).

Visual inspections were undertaken by heritage specialists in April 2017 to assess the heritage significance of each station within the Project site.

A summary of the assessments provided in the SoHIs is discussed in this section.

#### 6.1.1 Existing environment

##### Historical background

During the mid-nineteenth century, the extension of the railway westward was viewed as a priority by the Government in order to capitalise on the rich natural resources of the Bathurst Plains. In 1848, the Sydney Railway Company announced proposals to establish a rail line to Bathurst. In 1855, the first railway in the State was opened between Sydney and present-day Granville, and extended to Parramatta Station in 1860. By 1863, the Main Western Line had reached Penrith, which was the terminus of the line for the next four years. Meanwhile, railway engineers sought to develop a solution to the geographical obstacle posed by the Blue Mountains. An extension of the Main Western Line was opened from Penrith to Wentworth Falls on 11 July 1867, and later extended through Leura in 1868 (also known as the Blue Mountains Line).

In 1868, Patrick Higgins brought the rail line down the Great Zig Zag and into the Lithgow Valley and in 1869 the single track main line through Bowenfels was opened. In October 1869, the Bowenfels Station was opened following selection of Bowenfels as the terminus for the Main Western Line (which includes the Blue Mountains Line). Bowenfels Station was the earliest railway station beyond the Blue Mountains and for five years was the only station for Lithgow Valley. Establishment of the Main Western Line influenced the patterns of settlement at Lithgow and provided the stimulus for the rapid industrial and economic growth of the region in the decades that followed.

An additional section of the line between Wentworth Falls and Mount Victoria opened in 1868, as the Main Western Line progressed towards Bathurst (NSW Heritage Branch, 2010). The establishment of the railway in this location continued the expansion of European settlement in the region.

There have been a number of alterations to many of the stations within the Project site since their original construction. Full details of the alterations and further historical background are provided within the relevant heritage assessments. Details of the existing infrastructure at the stations within the Project site is summarised in Section 1.3.2.

## Database results

Desktop searches of historic registers including the World Heritage List, National Heritage List, Commonwealth Heritage List, NSW State Heritage Register, RailCorp's Section 170 Heritage and Conservation Register and the heritage schedules of the Blue Mountains LEP and Lithgow LEP were undertaken on 7 June and 14 June 2017 for the Project site and a surrounding area of 200 metres.

No items listed on the Commonwealth or National Heritage registers were identified within the Project site. The Greater Blue Mountains Area, which is listed on both the National and Commonwealth Heritage Registers, is located adjacent to, but not within the Project site.

Heritage items identified within the Project site include:

- 14 State Heritage Register listed items (including six stations)
- 14 items listed under Blue Mountains LEP or Lithgow LEP as being State significant
- 24 items listed on the RailCorp Section 170 Heritage and Conservation Register
- 77 locally listed heritage items under Blue Mountains LEP and Lithgow LEP
- four local heritage conservation areas.

Details of the heritage listed items identified from desktop searches within the Project site is provided in Appendix E including maps showing their locations in relation to the Project.

The Ten Tunnels Deviation which is listed on the State Heritage Register would not be impacted by this Project. Proposed modifications to accommodate the New Intercity Fleet through the Ten Tunnels Deviation are currently being developed and will be subject to a separate environmental impact assessment process.

## Statement of significance

All 15 stations within the Project site are listed on the RailCorp Section 170 Heritage and Conservation Register, with six of these stations also listed on the State Heritage Register. Listings and significant elements of individual stations are provided in Table 7.

Heritage statements of significance for the 15 stations within the Project site have been assessed against the criteria set out in the guideline *Assessing Heritage Significance* (NSW Heritage Office, 2001) which is part of the *NSW Heritage Manual* (Heritage Branch, Department of Planning and Environment). The *Assessing Heritage Significance* guideline establishes seven evaluation criteria which reflect four categories of significance and whether a place is rare or representative.

As per the *NSW Heritage Manual* criteria, the statement of significance for the stations within the Project site have been prepared with consideration of historical significance, associative significance, aesthetic/technical significance, social significance, research potentials, rarity and representativeness. Detailed statements of significance are provided in the Project heritage assessments (AECOM and Artefact Heritage, 2017).

**Table 7 Listings and significant elements for stations**

Station	Heritage listings	Level of significance	Significant elements
Falconbridge	<ul style="list-style-type: none"> <li>RailCorp Section 170 Heritage and Conservation Register (Item #4801064)</li> <li>heritage schedule of the Blue Mountains LEP (Item #FB005)</li> </ul>	Local	<ul style="list-style-type: none"> <li>station building (brick)</li> <li>island platform</li> </ul>
Linden	<ul style="list-style-type: none"> <li>RailCorp Section 170 Heritage and Conservation Register (Item #4801918)</li> <li>heritage schedule of the Blue Mountains LEP (Item #LD007)</li> </ul>	Local	<ul style="list-style-type: none"> <li>station building</li> <li>island platform</li> <li>landscape features (mature tree, garden beds)</li> <li>potential archaeological relics (including sidings, a water tank and a Station Master's residence)</li> </ul>
Woodford	<ul style="list-style-type: none"> <li>RailCorp Section 170 Heritage and Conservation Register (Item #4801041)</li> <li>heritage schedule of the Blue Mountains LEP (Item #WD002)</li> </ul>	Local	<ul style="list-style-type: none"> <li>station building (brick)</li> <li>island platform</li> <li>landscape features</li> </ul>
Hazelbrook	<ul style="list-style-type: none"> <li>RailCorp Section 170 Heritage and Conservation Register (Item #4801914)</li> <li>heritage schedule of the Blue Mountains LEP (Item #H007)</li> </ul>	Local	<ul style="list-style-type: none"> <li>station building (brick)</li> <li>island platform</li> </ul>
Lawson	<ul style="list-style-type: none"> <li>State Heritage Register (Item #01177)</li> <li>RailCorp Section 170 Heritage and Conservation Register (Item #4801023)</li> <li>heritage schedule of the Blue Mountains LEP (Item #LN010)</li> </ul>	State	<ul style="list-style-type: none"> <li>station building (brick)</li> <li>island platform (brick framed) and side platform</li> <li>landscape features</li> <li>potential archaeological features</li> </ul>
Bullaburra	<ul style="list-style-type: none"> <li>RailCorp Section 170 Heritage and Conservation Register (Item #4800202)</li> <li>heritage schedule of the Blue Mountains LEP (Item #BL002)</li> </ul>	Local	<ul style="list-style-type: none"> <li>station building</li> <li>island form</li> <li>landscape features</li> </ul>
Wentworth Falls	<ul style="list-style-type: none"> <li>RailCorp Section 170 Heritage and Conservation Register (Item #4801039)</li> <li>heritage schedule of the Blue Mountains LEP (Item #WF002)</li> </ul>	Local	<ul style="list-style-type: none"> <li>station building</li> <li>island platform (brick faced)</li> </ul>
Leura	<ul style="list-style-type: none"> <li>RailCorp Section 170 Heritage and Conservation Register (Item #4801024)</li> <li>heritage schedule of the Blue Mountains LEP (Item #LA016)</li> </ul>	Local	<ul style="list-style-type: none"> <li>station building (brick)</li> <li>island platform (brick faced)</li> <li>landscape features (the mature tree at the eastern end of the platform)</li> </ul>

Station	Heritage listings	Level of significance	Significant elements
Katoomba	<ul style="list-style-type: none"> <li>State Heritage Register (SHR #01174)</li> <li>RailCorp Section 170 Heritage and Conservation Register (Item #4801008)</li> <li>heritage schedule of the Blue Mountains LEP (Item Number #K044)</li> </ul>	State	<ul style="list-style-type: none"> <li>station building</li> <li>out-of-shed (timber on platform)</li> <li>island platform</li> <li>subway and canopy including brick walls</li> <li>crane</li> <li>landscape features (garden beds, hanging plants)</li> <li>potential archaeological features</li> </ul>
Medlow Bath	<ul style="list-style-type: none"> <li>State Heritage Register (SHR#01190)</li> <li>RailCorp's Section 170 Heritage and Conservation Register (Item # 4081011)</li> <li>heritage schedule of the Blue Mountains LEP (Item Number #MB003)</li> </ul>	State	<ul style="list-style-type: none"> <li>station building (brick)</li> <li>island platform (brick faced)</li> </ul>
Blackheath	<ul style="list-style-type: none"> <li>State Heritage Register (SHR#01088)</li> <li>RailCorp's Section 170 Heritage and Conservation Register (Item #4801010)</li> <li>heritage schedule of the Blue Mountains LEP (Item #MB003)</li> </ul>	State	<ul style="list-style-type: none"> <li>station building</li> <li>island platform (brick faced)</li> </ul>
Bell	<ul style="list-style-type: none"> <li>RailCorp Section 170 Heritage and Conservation Register (Item #4801013 )</li> <li>heritage schedule of the Blue Mountains LEP (Item #BELL007)</li> </ul>	Local	<ul style="list-style-type: none"> <li>station building including signal box</li> <li>island platform</li> </ul>
Newnes Junction	<ul style="list-style-type: none"> <li>RailCorp Section 170 Heritage and Conservation Register (Item #4807638)</li> </ul>	Local	<ul style="list-style-type: none"> <li>signal box</li> <li>platform (brick face)</li> </ul>
Eskbank (including Lithgow Signal Box)	<ul style="list-style-type: none"> <li>State Heritage Register (SHR#01138)</li> <li>RailCorp Section 170 Heritage and Conservation Register (Item #4801018)</li> <li>heritage schedule of the Lithgow LEP (Item #I434)</li> </ul>	State	<ul style="list-style-type: none"> <li>main station building</li> <li>down platform shelter</li> <li>yard signal box</li> <li>station platforms</li> <li>landscape features (overgrown garden, trees)</li> <li>potential archaeological features</li> </ul>
Lithgow	<ul style="list-style-type: none"> <li>State Heritage Register (SHR#01833)</li> <li>RailCorp Section 170 Heritage and Conservation Register (Item #4801025)</li> <li>heritage schedule of the Lithgow LEP (Item #I435)</li> </ul>	State	<ul style="list-style-type: none"> <li>station building (brick)</li> <li>Hayley Street footbridge and overhead booking office</li> <li>canopy</li> <li>island platform (brick faced)</li> <li>potential archaeological features (former 1877 railway platform)</li> </ul>

## Existing platforms at Katoomba Station and Lithgow Station

### *Katoomba Station*

Katoomba Station has a single island platform, accessed via lifts and a pedestrian subway. The pedestrian subway and lifts service Platform 1 on the northern side, facing the Great Western Highway and platform 2, fronting Bathurst Road. Platforms 1 and 2 are between 197 and 198 metres long and 13.5 metres wide. The platform is curved so that the orientation of the platform alters from an east-west alignment at the eastern end to a more north-south alignment at the western end.

In 2009, easy access upgrades were undertaken at Katoomba Station which included an extension of the platform on the eastern end to allow the lifts to be located away from the historic platform station building (Figure 7). The platform extension is narrower than the historic platform, being around eight metres wide. It is constructed of a concrete deck on recessed concrete piers.

Katoomba Station was originally constructed as a curved timber platform in 1881. In 1891, the 1881 station building was relocated to become a goods shed and the building was replaced with the present island platform and station building. The 1891 works included the construction of a pedestrian subway. The platform was extended in 1898 and again in 1901 (eastern end).

In 1902, the line was duplicated and an “out of shed” built on the platform. The western end of the platform was extended in 1907, and in 1909 a two-roomed timber building was constructed on the western end of the platform for the use of the inspector and electrician.

Katoomba Station underwent a number of modifications during the 1920s, including the erection of a canopy between the station building and steps. The platform was again extended in 1946, with at least three additional courses of bricks added to raise the platform. The original bullnose coping appears to have been removed during these works. Sometime between 1946 and 1990, a concrete lip has been added to the platform coping of the station, although this is not consistent along the length of the platform.



**Figure 7 Junction between heritage platform and 2009 extension**

## *Lithgow Station*

Lithgow Station is an island platform between 190 and 192 metres in length, which extends from the Eskbank Street overbridge in the east to roughly in line with Hayley Street in the west. The island platform is straight along its southern edge and is slightly curved on its northern end. The platform pavement consists of concrete capping with portions of overlying asphalt paving throughout most of the station. The island platform retaining wall (coping), below the layer of concrete capping, consists of grey-black and brown-grey machine pressed brick. The courses of brick are of varying colour, size and orientation which indicate the station's ongoing development.

Tactile points and safety markings are present along the edge of the platforms. Concrete service pits, platform lighting, garbage bins, platform seating and small landscaped shrubs are also located on the platform.

Extension of the railway to Bowenfels Station through the site of the first and present Lithgow Station was undertaken in 1869. It wasn't until 1877 however that the first railway station for Lithgow was established. The original location of the station was about 300 metres to the west of the present station at what is now the southern foundation of the Sandford Avenue overbridge. The former 1877 platform is still in existence.

During the 1920s, pressure from the community resulted in a new site being selected for the development of a new passenger station, which was officially opened in March 1925 and remains the current location.

Between the station opening in the 1920s to present, a number of modifications and upgrades have been made to Lithgow Station. Over this time, two brick courses have been added as well as the overlying concrete and asphalt for the platform. In 1993/1994, the Hayley Street footbridge and overhead booking office were constructed. This development relocated access to the western end of the station, with access to the rail platform provided by an elevator, stairs and a lift from the Hayley Street pedestrian footbridge.

A modern canopy extension at the western end of the station building was constructed in 2015. This new platform canopy extends from the footbridge stairs to the station platform building (Figure 8).



**Figure 8 Station platform lifts, pedestrian ramp and proposed platform extension area**

## Platform copings

Platform copings, which refers to the capping/covering of station platform edges, run along the length of each platform at every station in the Project site, and are usually constructed of concrete and/or brick. Many of the stations within the Project site have previously undergone platform modifications involving alterations or replacement of the platform coping. Details of the historical context and heritage significance of platform copings at each of the State heritage listed stations, including previous alterations, is outlined below. See above for details on Katoomba Station and Lithgow Station.

### *Lawson Station*

The current Lawson Station island platform was constructed in 1902 as a reinforced concrete cast *in-situ* platform and concrete platform deck. The cast *in-situ* reinforced concrete coping had a vertical profile, and stepped or flared foot and in most cases a projecting moulded coping. The platform was extended in 1946 to its current length, with the extension built out of brick with a brick coping. The height of the deck was raised by adding two courses of brick on top of the original concrete coping. The new brick coping added a sight corbelling (overhang) to the platform deck to the same width as the original concrete coping design.

### *Medlow Bath Station*

The existing Medlow Bath Station island platform was constructed in 1902 at the time of the duplication of the Blue Mountains Line. The platform is a brick design with a concrete and asphalt deck. The original platform had what appeared to be a concrete cap that overhung the vertical brick wall of the platform to create the overhang (corbelling). The platform was extended between 1942 and 1946 that also raised the height of the platform by three course of brick, and created the corbelling that is present today. Sections of the original vertical brick work on the platform coping have also been repaired by applying concrete render.

### *Blackheath Station*

The current island platform at Blackheath Station was constructed in 1898 when the rail line between Blackheath and Mount Victoria was duplicated. The platform was originally a brick and asphalt design, with a straight vertical brick coping with no overhang. The station was extended in 1946 when significant changes were made to the platform design. An extension of the platform was completed in brick, with a brick corbelling at the top that merged into the original width of the platform. The height of the original section of the platform was also raised by adding two courses of bricks to the existing platform.

### *Eskbank Station*

The island platform at Eskbank Station was constructed in 1882 as a single platform and was duplicated later in 1890. The two platforms were originally constructed as vertical brick coping with a protruding brick footing and no corbelling at the top. Later modifications to the down track included raising the height of the platform by adding three courses of brick that added a brick corbel to the platform edge. Later works added a new concrete deck that extended the corbel overhang. Modifications were also undertaken to the up track in the 1940s where the platform height was raised by adding two courses of brick to the original platform but no coping was added.

## Heritage platforms conservation management strategy

Project construction activities have been assessed against the *Heritage Platforms Conservation Management Strategy* (Australian Museum Business Services, 2015). This document is considered to replace the *Conservation Guide: Railway Station Platforms* (Office of Rail Heritage, 2013). The strategy was developed in order to protect heritage

platforms from incremental changes and works associated with large scale renewals. Of relevance to the Project are strategies 1, 2, 3, 5, 7, 8, 9, 11 and 12, specifically:

- **Strategy 1:** Manage and operate heritage platforms in a way that recognises the heritage values of each place. This includes the heritage value of each platform, its associated elements, and the overall heritage value of its station or place.
- **Strategy 2:** Conserve a representative sample of principal platform types, and other key aspects of heritage platform design and arrangement in use within the Sydney Trains managed railway network.
- **Strategy 3:** Where there are numerous, good representative examples of a type, more significant heritage platforms with good integrity should be prioritised for proactive conservation.
- **Strategy 5:** Conserve and manage the fabric of heritage platforms in accordance with statutory requirements and heritage best practice.
- **Strategy 7:** Retain and conserve original or other historic platform detailing and surface features where these contribute to the heritage significance of the platform and the station precinct.
- **Strategy 8:** Major change should be managed through an integrated planning process, which considers measures to avoid, minimise, or mitigate adverse impacts on the heritage significance of the platform and the broader place at each stage of the process.
- **Strategy 9:** Where a new platform or platform addition is required, the new design, form, fabric and surface treatments should be compatible with the existing heritage character of the place, but still be readily identifiable as new work.
- **Strategy 11:** Heritage opportunities and constraints should be carefully considered throughout the options analysis and design process.
- **Strategy 12:** Make a record of existing structural designs, fabric, and uses before changes are made.

### Archaeological heritage potential

A review was undertaken of the historical land uses and previous upgrades of the Project site through the use of aerial imagery, relevant heritage listings, site visits and drawings held in the Sydney Trains Plan Room.

High levels of previous disturbance have occurred around most of the stations in the Project site due to the ongoing development and maintenance of the Blue Mountains Line generally resulting in a low archaeological potential and it being unlikely that archaeological remains are present. Archaeological resources were however, identified at the following stations:

- Linden Station – low archaeological potential associated with sidings, a water tank and a Station Master's Residence
- Lawson Station – archaeological potential including:
  - moderate archaeological potential associated with the first Station Master's residence (1879)
  - second Station Master's residence (c.1880s to c.1896)
  - third Station Master's residence (1896 – still present)
  - railway worker's cottage (1920-25 to 1970s), and low archaeological potential associated with the area of the former railway siding



- Katoomba Station – low archaeological potential associated with the former Ways and Works Office
- Eskbank Station – moderate to high in the State Heritage Register curtilage
- Lithgow Station - moderate to high in the State Heritage Register curtilage.

### 6.1.2 Potential impacts

Heritage impacts have been assessed in terms of potential impacts to the fabric of the heritage item(s), archaeological remains, visual impact and potential for impacts to adjacent heritage items. The works have been assessed against the *Heritage Platforms Conservation Management Strategy* (Australian Museum Business Services, 2015).

Given the proposed work between stations involves only minor alterations to existing track infrastructure, it is not anticipated that there would be any major impacts on listed heritage items or conservation areas located within and outside the broader rail corridor. Therefore, the assessment focuses on impacts resulting from construction activities in close proximity to stations within the Project site.

#### Construction

##### *Modifications to existing platforms at Katoomba Station and Lithgow Station*

Platform extensions would be undertaken at the eastern end of Katoomba Station and western end of Lithgow Station in areas where the platforms have been recently modified. This would allow the opposite ends of the platforms to retain their heritage character. In addition, the impact has been minimised by extending the platform only by the length necessary to allow customers to access the New Intercity Fleet.

Materials proposed for the platform extensions have been selected to minimise visual impact and to blend with the existing brick face of the heritage platforms. The extensions would comprise brick faces of similar colour to the adjacent materials on existing platforms, but would demarcate the existing platform from the new extension. New gates and fences (where required) would also be designed to match the existing design and colour.

##### *Katoomba Station*

The platform extension works at Katoomba Station includes the installation of a brick retaining wall into which concrete would be infilled. The concrete cast *in-situ* would form the platform deck with coping tiles being laid over the top and treated with tactiles and painted as necessary. The new brickwork would be laid in a stretcher bond (refers to the orientation of the brick) in similar colour to the existing platform face. The new mortar would be struck with a flush profile.

The proposed extension of Platform 1 would result in a minor alteration to the visual appearance of Katoomba Station when viewed from the eastern end, Goldsmith Place and possibly certain vantage points from the Hotel Gearin.

The visual impacts have been limited by selecting a brick facing to cover the concrete mass of the platform extension. The brickwork would be in a colour similar to the adjacent heritage brickwork and it is anticipated that with time the two phases of construction would only be visible upon close inspection.

##### *Lithgow Station*

The platform extension works at the western end of Lithgow Station would involve ground excavation to install a suitable sub-grade for the new concrete platform. To accommodate the platform extension, the removal of the existing platform-to-rail corridor pedestrian ramp is

required. This pedestrian ramp consists of original 1920s brickwork as well as later brick courses and would be entirely removed during works.

While the removal of this brickwork would result in an irreversible impact, the majority of the platform brickwork would not be impacted as the majority of the brick retaining wall would be preserved. These works would result in a minor impact to the heritage significance of Lithgow Station.

Service relocations required for the platform extension would be undertaken outside of the heritage fabric areas so no impact is expected.

The removal of the existing barrier fencing at the western end of the island platform would involve removing metal fence posts from the asphalt surface of the platform-to-rail corridor pedestrian ramp. These works would not impact brick fabric in these locations. The re-installation of the fencing would be affixed to the surface of the new concrete and asphalt platform extension area and would not impact heritage fabric.

### *Coping modifications*

To enable the passage of the New Intercity Fleet through stations and maintain a safe gap, modifications to the coping (the edge of the platform) are necessary. These works include the removal of material from the face of the coping in sections and the addition of concrete in others. All stations within the Project site would be subject to coping modifications ranging from a cutting back of up to 25 centimetres to an addition of up to 1.7 centimetres.

Where coping removal is proposed, the coping would be shaved or cutback with a diamond saw. Where it is necessary to extend the coping, concrete would be applied using hand tools. It may be necessary to install temporary formwork and pour concrete into sections where greater additions are required.

The proposed coping modifications on Platform 1 at Eskbank Station would result in the removal of the entire bottom course of stretcher-oriented bricks as well as the incision of over half of the second lowest course of header-oriented bricks. Where platform cutbacks are less severe (a minimum of 95 millimetres), this would also result in the incision of the lowest course of stretcher-oriented bricks. The platform is of moderate heritage value to the overall significance of Eskbank Station, and the lowest courses of brick are the only remaining exterior facing bricks of the original battered wall profile of the station platform (the original bricks above the bottom course have been previously removed due to trimming works over the years).

The cutting of original fabric, as opposed to the removal of whole bricks, would be non-reversible, and would be considered a moderate impact to the heritage significance of the Eskbank Railway Station Group. The visual setting of the station is expected to remain unchanged.

At Lithgow Station, the modifications would require bricks to be cut through their centre. The differing pattern of brick overhang along the side of the platform is indicative of the development of Lithgow Station over time, and these bricks would be cut in half, as opposed to having courses removed which would also have an adverse visual impact. The treatment of the cut bricks would show the original arrangement and give a clean outer appearance however, making the option to cut the brick preferable.

Minor to negligible impacts to the platform copings are expected at all the other stations as the copings have undergone previous modifications and therefore would result in minor impacts to original heritage fabric and no overall impact to the heritage setting. Given the materials and finishes would match to the existing coping, visual impacts at the stations as a result of coping modifications are not likely and are considered negligible.

### *Canopy modifications*

Based on an assessment of the required clearances to accommodate the newer wider trains, the canopy on Platform 1 at Faulconbridge Station would need to be reduced by around 11 centimetres. Modifications to the canopy would occur along the section attached to the station building, thereby minimising impacts to the elements of the canopy that contribute to its heritage significance. As the main heritage features would remain unchanged, minimal impacts to the heritage significance of the station are anticipated as a result of the canopy modifications.

### *Track slewing*

Minor to negligible impacts are expected along the length of the rail line including at stations and crossovers as a result of track slewing. The works would largely be unnoticeable, particularly between stations, and it is considered likely that the tracks have been slewed or sections replaced during previous modifications and routine track maintenance activities.

### *Electrical and signalling modifications*

Electrical and signalling modifications are anticipated at Hazelbrook, Woodford, Lawson, Bell and Eskbank stations. Existing infrastructure would need to be relocated as a result of track slewing activities and would not introduce any new elements to the heritage curtilages. While some ground disturbance would be required, impacts to heritage items and/or areas of archaeological potential are not anticipated. Further electrical and signalling modifications may be identified during detailed design. The impacts of these changes would be assessed during detailed design if required.

### *Overhead wire system adjustments*

Overhead wiring system adjustments are anticipated at Katoomba Station and Eskbank Station. Negligible heritage impacts are anticipated as a result of upgrades and replacement of overhead wiring systems as none have been identified as being of significant heritage fabric.

### *Construction compounds*

Previously disturbed areas have been selected as locations for the construction compounds within the Project site. In some instances these are located either within or adjacent to heritage curtilages (such as at Katoomba Station). Given most of the compounds would be established and dismantled within the 48 hour possession period and would not involve any ground disturbance, impacts to heritage items as a result of the compounds are not anticipated.

### *Archaeological heritage*

Archaeological remains of State significance have been identified in the north-eastern section of Eskbank Station, however these remains are located in excess of 150 metres away from any proposed ground disturbing works (including earthworks) associated with the Project. No archaeological remains would therefore be impacted during construction of Eskbank Station.

Ground disturbing works at Lithgow Station associated with the proposed platform extension would be undertaken in areas that are likely to have been previously disturbed. As a result, any archaeological remains in these areas are likely to have been heavily impacted.

Archaeological potential has been identified at Katoomba Station (former Ways and Works Office) however works would not impact upon these areas.

Ground disturbance at Lawson Station associated with the installation of new impedance bonds and associated enabling works would be located outside of the State Heritage Register curtilage, however the excavations would be located in an area identified in *the*

*Lawson Railway Station and Yard Conservation Management Plan* (AMBS, 2013) as holding moderate archaeological potential to contain relics or deposits of local significance relating to the second Station Master's residence. The archaeological assessment identified that, while the excavation of the impedance bonds pit would occur directly above relics, due to the depth of the relics (approximately 1.4 metres) and the maximum depth of the proposed excavation (one metre) there would be a minor or no impact on any preserved archaeological relics.

Ground disturbance required for track slewing would be undertaken within the rail corridor that consists largely of rail ballast overlying natural bedrock. In addition, no ground disturbing works have been proposed within the footprint of the first Lithgow Station near the Sandford Avenue overbridge. No archaeological remains would be impacted by the works.

For the remaining stations in the Project site, it is unlikely that archaeological remains are present. The archaeological potential in these instances has been assessed as low.

Overall, significant impacts to heritage values are not anticipated during construction provided the measures outlined in Section 7.2 are implemented effectively.

#### *Adjacent heritage items*

Based on the nature of the works and proximity to adjacent heritage items, no direct impacts would occur to any adjacent heritage items.

#### *Heritage conservation areas*

Two conservation areas (Central Katoomba Urban Conservation Area and the Lithgow Main Street Conservation Area) overlap with the station areas and could potentially be impacted by the Project. As the works would largely be located within the rail corridor and are consistent with existing land uses, impacts to the conservation areas would be minimal as a result of the Project. Materials would be selected to minimise visual changes in the character of the stations.

### **Summary of impacts**

Table 8 presents a summary of each station / item, the proposed works to be undertaken and an impact rating for the individual criteria.

**Table 8 Impacts on heritage listed stations and items**

<b>Station / item</b>	<b>Proposed works</b>	<b>Impact rating</b>
Faulconbridge	<ul style="list-style-type: none"> <li>• coping modifications</li> <li>• track slewing</li> <li>• modification of existing platform canopy</li> </ul>	<ul style="list-style-type: none"> <li>• minor impact to fabric from coping modifications</li> <li>• minor impact to fabric from canopy modifications</li> <li>• negligible visual impact</li> <li>• no impact to archaeological remains</li> </ul>
Linden	<ul style="list-style-type: none"> <li>• coping modifications</li> <li>• track slewing</li> </ul>	<ul style="list-style-type: none"> <li>• minor impact to fabric from coping modifications</li> <li>• negligible visual impact</li> <li>• no impact to archaeological remains</li> </ul>
Woodford	<ul style="list-style-type: none"> <li>• coping modifications</li> <li>• track slewing</li> <li>• signalling modifications</li> </ul>	<ul style="list-style-type: none"> <li>• minor impact to fabric from coping modifications</li> <li>• negligible visual impact</li> <li>• no impact to archaeological remains for signal relocations</li> </ul>
Hazelbrook	<ul style="list-style-type: none"> <li>• coping modifications</li> <li>• track slewing</li> <li>• signalling modifications</li> </ul>	<ul style="list-style-type: none"> <li>• minor impact to fabric from coping modifications</li> <li>• negligible visual impact</li> <li>• no impact to archaeological remains for signal relocations</li> </ul>

Station / item	Proposed works	Impact rating
Lawson	<ul style="list-style-type: none"> <li>• coping modifications</li> <li>• track slewing</li> <li>• electrical modifications</li> </ul>	<ul style="list-style-type: none"> <li>• minor impact to fabric from coping modifications</li> <li>• negligible impact to fabric from other works</li> <li>• negligible visual impact</li> <li>• there is archaeological potential associated with the second Station Master's residence to be present greater than 1.4 metres below the current track level. However as the excavation required for the impedance bonds is no greater than 1 metre there would be no impact to any potential archaeological remains in this area</li> </ul>
Bullaburra	<ul style="list-style-type: none"> <li>• coping modifications</li> <li>• track slewing</li> </ul>	<ul style="list-style-type: none"> <li>• minor impact to fabric from coping modifications</li> <li>• negligible visual impact</li> <li>• no impact to archaeological remains</li> </ul>
Wentworth Falls	<ul style="list-style-type: none"> <li>• coping modifications</li> <li>• track slewing</li> </ul>	<ul style="list-style-type: none"> <li>• minor impact to fabric for coping modifications</li> <li>• negligible visual impact</li> <li>• no impact to archaeological remains</li> </ul>
Leura	<ul style="list-style-type: none"> <li>• coping modifications</li> <li>• track slewing</li> </ul>	<ul style="list-style-type: none"> <li>• minor impact to fabric from coping modifications</li> <li>• negligible visual impact</li> <li>• no impact to archaeological remains</li> </ul>
Katoomba	<ul style="list-style-type: none"> <li>• extension of Platform 1</li> <li>• coping modifications</li> <li>• track slewing</li> <li>• Installation of security, communications and lighting equipment</li> <li>• overhead wiring system modification</li> </ul>	<ul style="list-style-type: none"> <li>• minor impact to fabric from the extension of Platform 1 (confined to the junction between the existing platform and the proposed extension) and from coping modifications</li> <li>• negligible impact to fabric from other works</li> <li>• minor visual impact from the extension of Platform 1 and coping modifications</li> <li>• negligible visual impact from other works</li> <li>• negligible impact to archaeological remains from the extension of Platform 1</li> <li>• neutral impact to archaeological remains from other works</li> </ul>
Central Katoomba Urban Conservation Area	<ul style="list-style-type: none"> <li>• coping modifications</li> <li>• track slewing</li> <li>• platform extension</li> <li>• overhead wiring system modification</li> </ul>	<ul style="list-style-type: none"> <li>• negligible to neutral visual impacts</li> </ul>
Medlow Bath	<ul style="list-style-type: none"> <li>• platform coping</li> <li>• track slewing</li> </ul>	<ul style="list-style-type: none"> <li>• minor impact to fabric from coping modifications</li> <li>• negligible impact to fabric from other works</li> <li>• negligible visual impact</li> <li>• no impact to archaeological remains</li> </ul>
Blackheath	<ul style="list-style-type: none"> <li>• coping modifications</li> <li>• track slewing</li> </ul>	<ul style="list-style-type: none"> <li>• minor impact to fabric from coping modifications</li> <li>• negligible impact to fabric from other works</li> <li>• negligible visual impact</li> <li>• no impact to archaeological remains</li> </ul>
Bell	<ul style="list-style-type: none"> <li>• coping modifications</li> <li>• track slewing</li> </ul>	<ul style="list-style-type: none"> <li>• minor impact to fabric from coping modifications</li> <li>• negligible visual impact</li> <li>• no impact to archaeological remains</li> </ul>

Station / item	Proposed works	Impact rating
Newnes Junction	<ul style="list-style-type: none"> <li>• coping modifications</li> <li>• track slewing</li> <li>• crossover replacement</li> </ul>	<ul style="list-style-type: none"> <li>• minor impact to fabric from coping modifications</li> <li>• negligible visual impact</li> <li>• no impact to archaeological remains</li> </ul>
Eskbank	<ul style="list-style-type: none"> <li>• coping modifications</li> <li>• track slewing</li> <li>• crossover replacement</li> <li>• electrical modifications</li> <li>• overhead wiring system modification</li> </ul>	<ul style="list-style-type: none"> <li>• moderate impact to fabric from platform modifications</li> <li>• negligible to neutral impacts to fabric from other proposed works</li> <li>• minor visual impacts to fabric for coping modifications</li> <li>• neutral impact to archaeological remains for all works</li> </ul>
Lithgow	<ul style="list-style-type: none"> <li>• extension of island platform</li> <li>• coping modifications</li> <li>• track slewing</li> <li>• Installation of security, communications and lighting equipment</li> <li>• crossover replacement</li> </ul>	<ul style="list-style-type: none"> <li>• minor impact to fabric from the platform extension and coping modifications</li> <li>• negligible impacts to fabric from other proposed works</li> <li>• negligible to minor to visual impacts</li> <li>• neutral impact to archaeological remains</li> </ul>
Lithgow Main Street Heritage Conservation Area	<ul style="list-style-type: none"> <li>• coping modifications</li> <li>• track slewing</li> <li>• platform extension</li> </ul>	<ul style="list-style-type: none"> <li>• negligible impact to fabric from track slewing</li> <li>• neutral impacts to fabric from other works</li> <li>• negligible visual impacts</li> <li>• neutral impact to archaeological remains</li> </ul>

## Operation

The operation of the Project would not impact non-Indigenous or archaeological heritage.

### 6.1.3 Mitigation measures

The detailed design and construction of the Project would be undertaken with consideration of the heritage values of each station within the Project site. In order to minimise impacts to fabric and the heritage settings, the following mitigation measures would be implemented:

- Works at stations listed on the State Heritage Register (Lawson, Katoomba, Medlow Bath, Blackheath, Eskbank and Lithgow stations) require approval under Section 60 of the *Heritage Act 1977* which would be sought from Heritage Division. Works would be undertaken in accordance with the requirements of the Section 60 approvals.
- Works at Lawson Station require an exception under Section 139(1b) of the *Heritage Act 1977* be obtained prior to works commencing.
- A suitably qualified and experienced heritage conservation architect would be engaged to provide ongoing heritage and conservation advice throughout detailed design and any subsequent relevant design modifications. The nominated heritage conservation architect would provide specialist advice throughout the detailed design phase to ensure that the final design adheres to the Sydney Trains Heritage *Platforms Conservation Management Strategy* (Australian Museum Business Services, 2015).
- A physical membrane should be installed between the heritage listed platforms and the proposed extensions at Katoomba and Lithgow Station to ensure the protection of heritage brickwork during construction in accordance with Strategy 9 of the *Heritage Platforms Conservation Management Strategy*.

- The concrete coping of the proposed platform extensions and the mortar associated with the brick facade used in the works should adhere to Strategy 7 of the *Heritage Platforms Conservation Management Strategy*.
- It is recommended that investigations into the rendering of the length of the corbeled brickwork be undertaken to create a consistent presentation following platform coping modifications and justification be provided (if not feasible).
- For canopy modifications at Faulconbridge Station, it is recommended that the bolt heads used to attach the splice plates to the canopy rafters match those evident on the remainder of the canopy. They would be altered in diameter to ensure the new work is distinguishable from the original.
- Archival recording would be undertaken at the State Heritage Register listed stations (Lawson, Katoomba, Medlow Bath, Blackheath, Eskbank and Lithgow stations) as described in the heritage assessments in accordance with the relevant NSW Heritage Council guidelines. These archival records and design plans for the proposed works should be lodged with Sydney Trains for their records.
- The CEMP would include procedures in accordance with Transport for NSW's (TfNSW's) *Unexpected Heritage Finds Guideline* (Transport for NSW, 2015) to manage activities in the unlikely event that intact archaeological relics or deposits are encountered during ground disturbing activities and construction works.
- A heritage induction would be provided to all on-site staff and contractors involved in the Project. The induction should clearly describe the heritage constraints of the Project site.

Refer to Section 7.2 for a full list of mitigation measures.

## 6.2 Indigenous heritage

This section provides the Aboriginal archaeological due diligence assessment that was undertaken for the Project in accordance with *the Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW, 2010a).

### 6.2.1 Existing environment

An Aboriginal Heritage Information Management System (AHIMS) search was undertaken on 10 March 2017 for a 10 kilometre radius centred on the Project site. A total of 213 AHIMS sites were identified within the search area, with 21 sites identified within 200 metres. Two sites were identified within 50 metres (considered higher likelihood of occurrence) of the Project site, including:

- stone arrangement 'Hazelbrook' (#45-4-0042), located near Hazelbrook Station
- stone arrangement 'Caley's Repulse' (#45-4-0047), located near Linden Station.

A site inspection of the Project site was undertaken on 24 April 2017. The inspection included a visual inspection of the areas of the Project site accessible to the public and AHIMS sites within 50 metres of the Project site. The purpose of this inspection was to determine whether the proposed works would, or are likely to, harm any Aboriginal objects. Impact risk was determined on the basis of archaeological sensitivity, as well as the nature of proposed Project activities.

The visual inspection of the Project site indicated that it has undergone high levels of disturbance through historical and contemporary land use activities. Key landscape disturbances identified during the inspection included vegetation clearance, paving of hardstand areas and bulk earthworks associated with the original construction of the rail

corridor and associated infrastructure (stations, sectioning huts, car parks, etc.). As such, the entire Project site was assessed as retaining a low degree of integrity.

Attempts were made to locate stone arrangement sites 'Hazelbrook' (#45-4-0042) and 'Caley's Repulse' (#45-4-0047), however they were unable to be located during the inspection. The site cards indicate that these items are not located within the Project site.

No evidence of past Aboriginal occupation was observed during the visual inspection, including an inspection of land immediately surrounding the Project site. Taking into account the nature of extent of past ground disturbance activities across the area the Aboriginal archaeological sensitivity of land within and directly adjacent to the Project site was assessed in the field as low.

Within the Project site, the corridor crosses around 25 small waterways. The floral and faunal resources of the Project site would have supported a diverse range of edible resources sufficient to support repeated occupation of Indigenous people. However, considering the Project site has been heavily disturbed as a result of the construction of the existing rail line (including earthworks, landscaped areas and structures including stations, sectioning huts, car parks, etc.), the presence of culturally sensitive buried items is unlikely within the boundaries of the Project site.

## **6.2.2 Potential impacts**

### **Construction**

Construction of the Project would involve some excavation and other ground disturbing activities for the works, particularly for the replacement of crossovers at Eskbank Station and Bell Station, and station platform extensions at Katoomba Station and Lithgow Station. Some excavation may also be required for the replacement of one overhead wiring structure at Katoomba and Eskbank, and relocating track circuit equipment at Woodford, Hazelbrook and Lawson. Ground disturbing activities have the potential to impact Indigenous sites, if present.

The site card for AHIMS site #45-4-0042 indicates the site comprises 30 mounds of stone, however it is unclear whether the AHIMS coordinate represents the description within the site card. No further information is provided within the site card. Nonetheless, it is understood there are no proposed works within proximity and as such it does not represent an impact risk.

The site card for AHIMS site #45-4-0047 indicates the site comprises a stone mound located at Linden. The site is also listed on the Blue Mountains LEP as a historic heritage item. This listing indicates the site is located around 50 metres north of the Project site. It is understood there are no proposed works within proximity to site #45-5-0047 and as such it does not represent an impact risk.

As no further known Indigenous heritage items have been identified within the Project site, Aboriginal heritage is not likely to be impacted by the Project. In addition, given the high level of previous disturbance as a result of the construction of the existing rail line, the potential for unknown items to be present is considered to be low. As such, the Project is unlikely to affect Indigenous heritage during construction.

### **Operation**

There would be no risks to Indigenous heritage during the operation of the Project.

## **6.2.3 Mitigation measures**

If previously unidentified Indigenous objects are uncovered during construction, work would cease in the vicinity of the find and the TfNSW Project Manager and TfNSW Environment and Planning Manager would be notified immediately to assist in co-ordinating next steps



which are likely to involve consultation with an archaeologist, OEH and the Local Aboriginal Land Council(s). If human remains are found, work would cease, the site would be secured and the NSW Police and OEH would be notified.

Refer to Section 7.2 for a full list of mitigation measures.

## 6.3 Noise and vibration

A Noise and Vibration Impact Assessment was undertaken for the Project (AECOM, 2017f). The assessment included establishing the existing background noise levels, construction noise management levels and vibration limits in the vicinity of Project site. Surrounding sensitive receivers that may be impacted by construction noise and vibration have been identified and mitigation measures have been recommended, where necessary, to reduce and manage noise and vibration impacts from the Project.

As operational noise levels are expected to remain largely unchanged, no quantitative modelling of operational noise impacts was undertaken. The findings of the assessment are summarised in this section.

### 6.3.1 Existing environment

#### Noise catchment areas

To assist in determining noise criteria for the receivers surrounding the Project, four noise catchment areas (NCA) were identified as described in Table 9. The noise environment at each of the residential receivers within each NCA is considered to be comparable and these definitions can be used to develop assessment / management criteria for similar existing environments. The NCAs are shown in Figure 9.

**Table 9 Noise catchment areas**

NCA	Description
1	Residences in suburban locations near the rail line and Great Western Highway
2	Residences in Katoomba
3	Rural residences in remote locations between Mount Victoria and Lithgow
4	Residences in Lithgow

#### Representative receivers

Fifty three representative residential receivers were selected to describe the noise impacts within areas considered likely to have similar background noise levels. Impacts were also assessed at 24 representative non-residential receivers (e.g. schools, churches etc.).

The locations of the residential and non-residential receivers identified for use in the assessment are presented in the Noise and Vibration Impact Assessment (AECOM, 2017b) and summarised in Appendix I. It is noted that other residential and non-residential receiver which could potentially be affected are scattered around the vicinity of the Project.

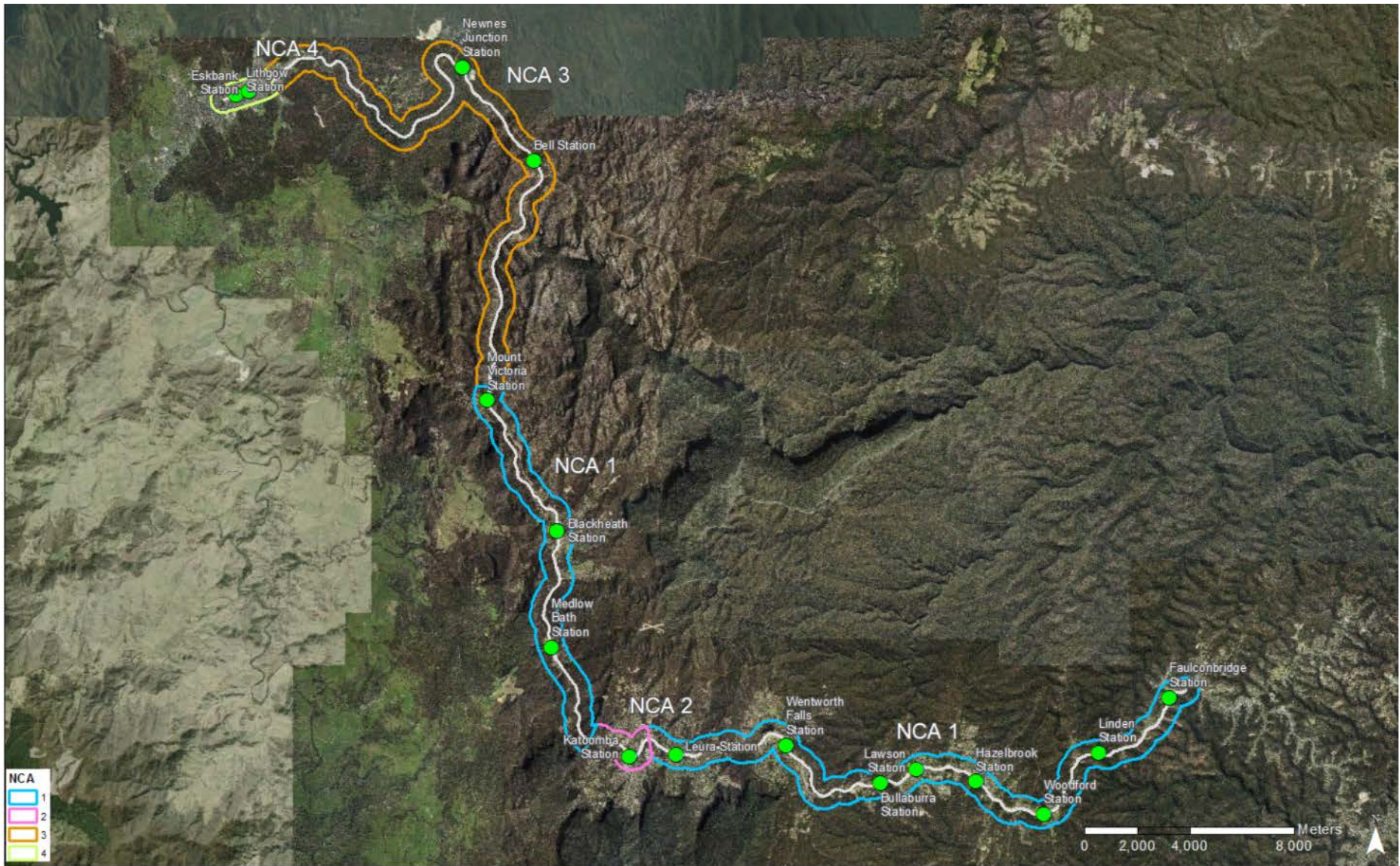


Figure 9 Regional context and NCA locations

## Background noise levels

Long-term unattended measurements were undertaken to establish the existing ambient and background noise environment at potentially affected receivers in the vicinity of the Project.

Long-term unattended noise monitoring was conducted at six locations between 31 March 2017 and 11 April 2017. Noise loggers were placed at representative locations with at least one in each NCA. Noise loggers were calibrated prior to and after the monitoring period with a drift in calibration not exceeding  $\pm 0.5$  dB(A). The results of the unattended noise monitoring is presented in Table 10.

All the acoustic instrumentation employed during the noise measurements comply with the requirements of *AS IEC 61672.1-2004 Electroacoustics - Sound level meters - Specifications* and were within their current National Association of Testing Authorities, Australia (NATA) certified in-calibration period (i.e. calibration in the last two years).

**Table 10 Unattended noise monitoring details**

NCA <sup>1</sup>	Rating Background Level <sup>3</sup>	Ambient noise levels <sup>4</sup>				
	Day <sup>2</sup>	Evening <sup>1</sup>	Night <sup>1</sup>	Day <sup>2</sup>	Evening <sup>2</sup>	Night <sup>2</sup>
NCA1	50 dB(A)	48 dB(A)	30 dB(A)	60 dB(A)	59 dB(A)	56 dB(A)
NCA2	41 dB(A)	39 dB(A)	31 dB(A)	54 dB(A)	53 dB(A)	43 dB(A)
NCA3	31 dB(A)	30 dB(A)	30 dB(A)	45 dB(A)	44dB(A)	43 dB(A)
NCA4	42 dB(A)	40 dB(A)	30 dB(A)	59 dB(A)	58 dB(A)	52 dB(A)

Notes:

1. Results for NCA1 is based on noise logging at three locations which were consistent.
2. Day is defined as 7am to 6pm, Monday to Saturday and 8am to 6pm Sundays and Public Holidays. Evening is defined as 6pm to 10pm, Monday to Sunday & Public Holidays. Night is defined as 10pm to 7am, Monday to Saturday and 10pm to 8am Sundays and Public Holidays.
3. Rating Background Level (RBL) ( $L_{A90}$ ) represents the noise level exceeded for 90 per cent of the monitoring period.
4. Ambient noise level represents the average noise level over the monitoring period.

The noise environment at each of the residential receivers within a NCA is considered to have a similar noise environment to the unattended monitoring location within that NCA. As such each of these residential receivers is assigned the same background noise level.

In accordance with the *NSW Industrial Noise Policy (INP)* (EPA, 2000), noise monitoring affected by adverse weather conditions or extraneous noise events was excluded from the monitoring data. The INP advises that data may be affected where adverse weather, such as wind speeds higher than five metres per second or rain, occurs. Weather data was acquired from the Bureau of Meteorology's Mount Boyce and Penrith weather stations (station ID 063292 and ID 067113).

## Existing noise environment summary

The acoustic environment of NCA 1 is characterised by a mixture of local and highway traffic (The Great Western Highway). Trains were operating during the installation of the noise monitoring equipment and contribute to the acoustic environment. Noise monitoring results indicated lower noise levels during the night, compared to day and evening periods. This is typical of a suburban environment.

The acoustic environment of NCA 2 is characterised by a mixture of natural sounds and local traffic. Similarly to NCA 1 the noise monitoring results indicated lower noise levels during the night, compared to day and evening periods. This is typical of a suburban environment.

The acoustic environment of NCA 3 is characterised mainly by natural sounds with some distant highway noise. Trains were also operating during the installation of the noise

monitoring equipment and contribute to the acoustic environment. Night-time noise levels are very quiet, typical of a rural environment.

The acoustic environment of NCA 4 is characterised by local traffic, particularly from Railway Parade. Trains were also operating during the installation of the noise monitoring equipment and contribute to the acoustic environment. The noise monitoring results indicated lower noise levels during the night, compared to day and evening periods. This is typical of a suburban environment.

### Construction noise criteria

The *Interim Construction Noise Guideline* (ICNG) (Department of Environment and Climate Change, 2009) is the principal guideline for the assessment and management of construction noise in NSW. The ICNG recommends standard hours of construction as:

- Monday to Friday: 7am to 6pm
- Saturday: 8am to 1pm
- Sundays and public holidays: no works.

Noise management levels (NMLs) have been determined for receivers in each of the NCAs in accordance with the ICNG. The ICNG outlines NMLs for non-residential receivers such as commercial properties, schools and places of worship. NMLs for residential receivers are calculated based on the rating background level (RBL) + 10 dB(A) (for daytime periods) or the RBL + 5 dB(A) (for evening and night time periods). A 'highly noise affected' level of 75 dB(A) for residential receivers represents the point above which there may be strong community reaction to noise.

Where works exceed the NMLs, all reasonable and feasible measures (such as equipment selection and location, construction scheduling and respite periods) should be implemented to reduce noise levels as far as practicable.

The construction NMLs developed for the Project for residential and non-residential sensitive receivers are listed in Table 11 and Table 12 respectively.

**Table 11 Construction NMLs for residential receivers**

NCA	Period	RBL, L <sub>A90</sub> dB(A)	Standard hours noise management levels, L <sub>Aeq,15min</sub> dB(A)	Out-of-hours noise management levels, L <sub>Aeq,15min</sub> dB(A)
1	Day	50	60	55
	Evening	48	-	53
	Night	30	-	35
2	Day	41	51	46
	Evening	39	-	44
	Night	31	-	36
3	Day	31	41	36
	Evening	30	-	35
	Night	30	-	35
4	Day	42	52	47
	Evening	40	-	45
	Night	30	-	35

**Table 12 Construction noise management levels – non-residential receivers**

Land use	Noise management levels, $L_{Aeq,15min}$ , dB(A) (applies when properties are in use)
Classrooms at schools and other educational institutions	55 dB(A) <sup>1</sup>
Places of worship	55 dB(A) <sup>1</sup>
Childcare centres	55 dB(A) <sup>1</sup>
Medical	55 dB(A) <sup>1</sup>
Active recreation	65 dB(A)
Library	55 dB(A) <sup>1</sup>
Commercial premises (including offices, retail outlets)	70 dB(A)
Industrial premises	75 dB(A)

Notes:

1. These external management levels are based upon a 45 dB(A) internal noise management level and a 10 dB reduction from outside to inside through an open window.

Sleep disturbance noise goals have also been established for residential receivers which are based on the *NSW Road Noise Policy* (Department of Environment, Climate Change and Water, 2011). Based on the Policy, the sleep disturbance criteria for each NCA is a screening level of 45 dB(A)  $L_{A1(1\text{ minute})}$  and an awakening reaction at 60-65 dB(A)  $L_{A1(1\text{ minute})}$ .

For traffic noise, the criterion applied on public roads generated during the construction phase of a project is an increase in existing road traffic noise of no more than 2 dB(A).

### Construction vibration criteria

When assessing vibration there are two categories of vibration criteria: one related to the impact of vibration to human comfort and one relating to the impact on building structures (cosmetic damage).

#### *Human comfort*

The assessment of intermittent vibration outlined in the NSW EPA guideline *Assessing Vibration: A Technical Guideline 2006* (AVTG) is based on Vibration Dose Values (VDVs). Maximum and preferred VDVs for intermittent vibration arising from construction activities are listed in Table 13. The VDV criteria are based on the likelihood that a person would be annoyed by the level of vibration over the entire assessment period.

**Table 13 Preferred and maximum vibration dose values for intermittent vibration (m/s<sup>1.75</sup>)**

Location	Period	Preferred	Maximum
Critical areas <sup>1</sup>	Day or night time	0.1	0.2
Residences	Daytime <sup>3</sup>	0.2	0.4
	Night time <sup>4</sup>	0.13	0.26
Offices, schools, educational institutions and places of worship	Day or night time	0.4	0.8
Workshops <sup>2</sup>	Day or night time	0.8	1.6

Notes:

1. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. Places where sensitive equipment is stored or delicate tasks are undertaken require more stringent criteria than the residential criteria specified above.
2. Examples include automotive repair shops, manufacturing or recycling facilities. This includes places where manufacturing, recycling or repair activities are undertaken but do not require sensitive or delicate tasks.
3. Daytime period is defined as 7am – 10pm under BS 6472-1992 Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz).
4. Night period is defined as 10pm – 7am under BS 6472-1992.

*Structural damage to buildings*

There is currently no Australian Standard that provides guidance for assessing cosmetic building damage caused by vibration. However, the German standard (DIN 4150-3) *Structural Vibration in Buildings - Effects on structures (1999-02)* provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration and are presented in Table 14. DIN 4150 states that buildings exposed to higher levels of vibration than recommended limits would not necessarily result in damage. The vibration criteria provided below in Table 14 would be adopted for the management of vibration impacts on structures, and include more conservative values for heritage structures.

**Table 14 DIN 4150: Structural damage safe limits for building vibration velocity**

Ref	Type of Structure	At foundation – less than 10 Hz	At foundation – 10 Hz to 50 Hz	At foundation – less than 10 Hz	At the horizontal plane of the highest floor – all frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20 mm/s	20 to 40 mm/s	40 to 50 mm/s	40 mm/s
2	Dwellings and buildings of similar design and/or use	5 mm/s	5 to 15 mm/s	15 to 20 mm/s	15 mm/s
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. heritage listed buildings)	3 mm/s	3 to 8 mm/s	8 to 10 mm/s	8 mm/s

Note:

1. At frequencies above 100 Hz, the values given in this column may be used as minimum values.

## **Operational noise criteria**

The *Industrial Noise Policy* (EPA, 2000) provides guidance in relation to acceptable noise limits for industrial noise emissions, which includes but is not limited to, noise emissions from mechanical plant.

### **6.3.2 Potential impacts**

#### **Construction noise**

To assess the potential noise impacts from the proposed construction works, the construction phases have been divided into 10 distinct construction stages consisting of a number of construction activities. These would be confirmed by the construction contractor prior to construction commencing and further assessment would be undertaken if required. Proposed construction stages for the works are described in Table 15 with the construction stages that have been modelled (i.e. those that represent worst case for noise impacts) highlighted in blue along with the proposed timing of the works.

It is anticipated that this Project would use up to 10 pre-existing, routine rail possessions over the two-year construction period. This would typically include shutdown periods of 48 hours over a weekend period; however, 5 of the 10 possession periods may extend for 12 days in the area between Newnes Junction Station and Lithgow Station. This would involve five day closures of one line on both sides of a weekend possession period.

For construction stages 1 – site establishment, 3 – platform coping modifications and 5 – platform extension, any works outside of standard hours are likely to be low impact site establishment works. As a result the noise impacts from these works, outside standard hours, are expected to be minimal.

The assessment of construction stage 9 – overhead wiring has been completed at known locations of upgrades at Katoomba Station and Eskbank Station. The overhead wiring structure at Katoomba Station would be completely replaced.

A summary of the predicted construction noise levels for each stage during standard working hours for residential receivers is shown in Table 16 to Table 19 and for non-residential receivers in Table 20.

**Table 15 Construction assessment stages and scheduling**

Work Stage	Description	Location <sup>1</sup>	Timing
1 Site establishment	Establishment of site compounds, establishment of temporary facilities, site surveys of all track, platform, overhead wiring and signalling infrastructure, utility location.	All Stations – Faulconbridge to Lithgow	Standard hours or during possession / shutdown
2 Utilities disconnection	Disconnection of utility services and installation of protection measures for cable routes as required	All Stations – Faulconbridge to Lithgow	Standard hours
3 Platform coping modifications	Removal or widening the platform edges (coping) of platforms 1 and 2 at all stations, modification of the existing platform canopy at Faulconbridge Station, reinstate finishes such as tactile pavers and/or yellow and white line markers	All Stations – Faulconbridge to Lithgow	Standard hours or during possession / shutdown
4 Reinstate utilities	Reinstate utility services where required	All Stations – Faulconbridge to Lithgow	Standard hours
5 Platform extension	Construction of platform extensions at Katoomba Station and Lithgow station	Katoomba and Lithgow	Standard hours or during possession / shutdown
6 Communications installation	Installation of CCTV, lighting, public announcement systems, and spark gaps to service platform extensions	Katoomba and Lithgow	Standard hours or during possession / shutdown
7 Track slewing	Track slewing	All Track – Springwood to Lithgow	48 hour possession
8 Signalling	Relocation of electrical equipment at Eskbank Station and replacement of electrical equipment at Bell Station.  Minor signal infrastructure adjustments along the rail corridor at Hazelbrook Station, Woodford Station and Lawson Station to accommodate new track positions as a result of the slewing.	Eskbank, Bell, Hazelbrook, Woodford and Lawson	48 hour possession
9 Overhead wiring	Relocating and replacing of overhead wire structures at Katoomba Station and Eskbank Station	Katoomba and Eskbank	48 hour possession
10 Testing and commissioning	Testing and commissioning	All Track	Standard hours or during possession / shutdown

Notes:

1. Mount Victoria Station and Zig Zag Station are excluded from the works.
2. Modelled work packages are highlighted in blue.



## Noise impacts at residential receivers (construction stages 1, 3, 7, 8 and 9)

### Standard working hours

The predicted construction noise levels at residential receivers during standard hours are presented in Table 16.

**Table 16 Predicted noise impacts at representative residential receivers – standard hours in dB(A)**

Receiver ID	Nearest distance to rail alignment (metres)	NML	Site establishment	Platform coping modifications	Track slewing	Signalling	Overhead wiring system
R1	26	60	55	64	73	< 30	64
R2	43	60	50	59	67	< 30	60
R3	32	60	46	55	68	< 30	57
R4	47	60	45	54	64	< 30	53
R5	74	60	40	49	58	< 30	48
R6	46	60	35	44	64	< 30	44
R7	26	60	34	43	74	< 30	42
R8	65	60	19	28	57	< 30	28
R9	41	60	57	66	69	64	65
R10	43	60	52	61	68	58	59
R11	107	60	50	59	60	62	63
R12	61	60	50	59	65	60	61
R13	27	60	54	63	68	67	68
R14	73	60	53	62	60	51	52
R15	84	60	44	53	58	53	54
R16	44	60	52	61	66	61	62
R17	66	60	42	51	62	49	50
R18	70	60	51	60	62	63	64
R19	56	60	47	56	57	< 30	58
R20	36	60	48	57	69	< 30	67
R21	39	60	37	46	63	< 30	54
R22	51	60	48	57	60	< 30	62
R23	44	60	48	57	67	< 30	56
R24	35	60	47	56	65	< 30	55
R25	38	60	43	52	68	< 30	59
R26	41	60	44	53	64	< 30	55
R27	29	60	41	50	73	< 30	52
R28	91	51	39	48	63	< 30	43
R29	144	51	30	39	50	< 30	39
R30	31	51	37	46	70	< 30	33

Receiver ID	Nearest distance to rail alignment (metres)	NML	Site establishment	Platform coping modifications	Track slewing	Signalling	Overhead wiring system
R31	54	51	42	51	57	< 30	38
R32	73	60	52	61	61	< 30	63
R33	42	60	56	65	67	< 30	65
R34	37	60	43	52	69	< 30	51
R35	49	60	41	50	66	< 30	50
R36	12	60	57	66	<b>80</b>	< 30	63
R37	123	60	46	55	56	< 30	58
R38	38	60	48	57	69	< 30	60
R39	208	41	39	48	50	< 30	49
R40	171	41	44	53	52	< 30	55
R41	52	41	55	64	65	< 30	66
R42	124	41	35	44	55	< 30	50
R43	227	41	40	49	50	< 30	51
R44	492	41	49	58	65	< 30	68
R45	536	41	51	60	61	< 30	61
R46	150	41	46	55	56	< 30	55
R47	40	52	52	61	69	38	57
R48	43	52	43	52	68	37	45
R49	170	52	32	41	41	30	38
R50	82	52	36	45	58	39	42
R51	133	52	44	53	52	48	49
R52	245	52	37	46	51	35	37
R53	290	52	41	50	50	38	39

Notes:

1. Items shaded in GREY indicate predicted noise impact at this receiver during this work stage is above NML.
2. Items in BOLD RED indicate a 'highly affected' residential receiver with a level of 75 dB(A) or higher.

Results show that noise levels at 44 of the representative receivers are predicted to exceed NMLs during some stage of construction during standard construction hours. Exceedances of up to 20 dB(A) are predicted, with the largest exceedances predicted during track slewing activities. Noise levels during track slewing works are controlled by the use of jackhammers. High noise levels during signalling works are attributed to the use of a coring machine.

One representative receiver, R36 (141A Station Street, Blackheath) is predicted to be 'highly affected', experiencing noise levels higher than the 75 dB(A) threshold, due predominantly to the operation of machinery associated with track slewing activities (construction stage 7) and its location in close proximity to the rail line (around 12 metres). However, while this is a major noise source, the duration of operation of this equipment is likely to be short and the resulting impacts, though high, will be short-term only as the works would be conducted during a rail possession. Furthermore, noise levels during track slewing works are mostly due to the use of jackhammers. The noise of high noise emitting equipment would be managed to mitigate impacts as described in Section 6.3.3.

## Outside of standard hours

The predicted construction noise levels at residential receivers outside of standard hours are presented for the daytime, evening and night-time periods in Table 17, Table 18 and Table 19 respectively.

**Table 17 Predicted noise impacts at representative residential receivers – daytime outside of standard hours in dB(A)**

Receiver ID	Nearest distance to rail alignment (metres)	NML	Site establishment	Platform coping modifications	Track slewing	Signalling	Overhead wiring system
R1	26	55	55	64	73	< 30	64
R2	43	55	50	59	67	< 30	60
R3	32	55	46	55	68	< 30	57
R4	47	55	45	54	64	< 30	53
R5	74	55	40	49	58	< 30	48
R6	46	55	35	44	64	< 30	44
R7	26	55	34	43	74	< 30	42
R8	65	55	19	28	57	< 30	28
R9	41	55	57	66	69	64	65
R10	43	55	52	61	68	58	59
R11	107	55	50	59	60	62	63
R12	61	55	50	59	65	60	61
R13	27	55	54	63	68	67	68
R14	73	55	53	62	60	51	52
R15	84	55	44	53	58	53	54
R16	44	55	52	61	66	61	62
R17	66	55	42	51	62	49	50
R18	70	55	51	60	62	63	64
R19	56	55	47	56	57	< 30	58
R20	36	55	48	57	69	< 30	67
R21	39	55	37	46	63	< 30	54
R22	51	55	48	57	60	< 30	62
R23	44	55	48	57	67	< 30	56
R24	35	55	47	56	65	< 30	55
R25	38	55	43	52	68	< 30	59
R26	41	55	44	53	64	< 30	55
R27	29	55	41	50	73	< 30	52
R28	91	46	39	48	63	< 30	43
R29	144	46	30	39	50	< 30	39
R30	31	46	37	46	70	< 30	33
R31	54	46	42	51	57	< 30	38

Receiver ID	Nearest distance to rail alignment (metres)	NML	Site establishment	Platform coping modifications	Track slewing	Signalling	Overhead wiring system
R32	73	55	52	61	61	< 30	63
R33	42	55	56	65	67	< 30	65
R34	37	55	43	52	69	< 30	51
R35	49	55	41	50	66	< 30	50
R36	12	55	57	66	<b>80</b>	< 30	63
R37	123	55	46	55	56	< 30	58
R38	38	55	48	57	69	< 30	60
R39	208	36	39	48	50	< 30	49
R40	171	36	44	53	52	< 30	55
R41	52	36	55	64	65	< 30	66
R42	124	36	35	44	55	< 30	50
R43	227	36	40	49	50	< 30	51
R44	492	36	49	58	65	< 30	68
R45	536	36	51	60	61	< 30	61
R46	150	36	46	55	56	< 30	55
R47	40	47	52	61	69	38	57
R48	43	47	43	52	68	37	45
R49	170	47	32	41	41	30	38
R50	82	47	36	45	58	39	42
R51	133	47	44	53	52	48	49
R52	245	47	37	46	51	35	37
R53	290	47	41	50	50	38	39

Notes:

1. Items shaded in GREY indicate predicted noise impact at this receiver during this work stage is above NML.
2. Items in **BOLD RED** indicate a 'highly affected' residential receiver with a level of 75 dB(A) or higher.

**Table 18 Predicted noise impacts at representative residential receivers – evening outside of standard hours in dB(A)**

Receiver ID	Nearest distance to rail alignment (metres)	NML	Track slewing	Signalling	Overhead wiring
R1	26	53	73	< 30	64
R2	43	53	67	< 30	60
R3	32	53	68	< 30	57
R4	47	53	64	< 30	53
R5	74	53	58	< 30	48
R6	46	53	64	< 30	44
R7	26	53	74	< 30	42
R8	65	53	57	< 30	28
R9	41	53	69	64	65
R10	43	53	68	58	59
R11	107	53	60	62	63
R12	61	53	65	60	61
R13	27	53	68	67	68
R14	73	53	60	51	52
R15	84	53	58	53	54
R16	44	53	66	61	62
R17	66	53	62	49	50
R18	70	53	62	63	64
R19	56	53	57	< 30	58
R20	36	53	69	< 30	67
R21	39	53	63	< 30	54
R22	51	53	60	< 30	62
R23	44	53	67	< 30	56
R24	35	53	65	< 30	55
R25	38	53	68	< 30	59
R26	41	53	64	< 30	55
R27	29	53	73	< 30	52
R28	91	44	63	< 30	43
R29	144	44	50	< 30	39
R30	31	44	70	< 30	33
R31	54	44	57	< 30	38
R32	73	53	61	< 30	63
R33	42	53	67	< 30	65
R34	37	53	69	< 30	51
R35	49	53	66	< 30	50

Receiver ID	Nearest distance to rail alignment (metres)	NML	Track slewing	Signalling	Overhead wiring
R36	12	53	80	< 30	63
R37	123	53	56	< 30	58
R38	38	53	69	< 30	60
R39	208	35	50	< 30	49
R40	171	35	52	< 30	55
R41	52	35	65	< 30	66
R42	124	35	55	< 30	50
R43	227	35	50	< 30	51
R44	492	35	65	< 30	68
R45	536	35	61	< 30	61
R46	150	35	56	< 30	55
R47	40	45	69	38	57
R48	43	45	68	37	45
R49	170	45	41	30	38
R50	82	45	58	39	42
R51	133	45	52	48	49
R52	245	45	51	35	37
R53	290	45	50	38	39

Notes:

1. Items shaded in GREY indicate predicted noise impact at this receiver during this work stage is above NML.
2. Items in BOLD RED indicate a 'highly affected' residential receiver with a level of 75 dB(A) or higher.

**Table 19 Predicted noise impacts at representative residential receivers – night-time outside of standard hours in dB(A)**

Receiver ID	Nearest distance to rail alignment (metres)	NML	Track slewing	Signalling	Overhead wiring
R1	26	35	73	< 30	64
R2	43	35	67	< 30	60
R3	32	35	68	< 30	57
R4	47	35	64	< 30	53
R5	74	35	58	< 30	48
R6	46	35	64	< 30	44
R7	26	35	74	< 30	42
R8	65	35	57	< 30	28
R9	41	35	69	64	65
R10	43	35	68	58	59
R11	107	35	60	62	63
R12	61	35	65	60	61
R13	27	35	68	67	68
R14	73	35	60	51	52
R15	84	35	58	53	54
R16	44	35	66	61	62
R17	66	35	62	49	50
R18	70	35	62	63	64
R19	56	35	57	< 30	58
R20	36	35	69	< 30	67
R21	39	35	63	< 30	54
R22	51	35	60	< 30	62
R23	44	35	67	< 30	56
R24	35	35	65	< 30	55
R25	38	35	68	< 30	59
R26	41	35	64	< 30	55
R27	29	35	73	< 30	52
R28	91	36	63	< 30	43
R29	144	36	50	< 30	39
R30	31	36	70	< 30	33
R31	54	36	57	< 30	38
R32	73	35	61	< 30	63
R33	42	35	67	< 30	65
R34	37	35	69	< 30	51
R35	49	35	66	< 30	50

Receiver ID	Nearest distance to rail alignment (metres)	NML	Track slewing	Signalling	Overhead wiring
R36	12	35	80	< 30	63
R37	123	35	56	< 30	58
R38	38	35	69	< 30	60
R39	208	35	50	< 30	49
R40	171	35	52	< 30	55
R41	52	35	65	< 30	66
R42	124	35	55	< 30	50
R43	227	35	50	< 30	51
R44	492	35	65	< 30	68
R45	536	35	61	< 30	61
R46	150	35	56	< 30	55
R47	40	35	69	38	57
R48	43	35	68	37	45
R49	170	35	41	30	38
R50	82	35	58	39	42
R51	133	35	52	48	49
R52	245	35	51	35	37
R53	290	35	50	38	39

Notes:

1. Items shaded in GREY indicate predicted noise impact at this receiver during this work stage is above NML
2. Items in BOLD RED indicate a 'highly affected' residential receiver with a level of 75 dB(A) or higher

Results show that noise levels at all but one representative receiver are predicted to exceed NMLs during some stage of construction during the daytime and evening outside of standard construction hours. Noise levels at all representative receivers are predicted to exceed NMLs during the evening and night-time periods.

Exceedances of up to 25, 27 and 45 dB(A) are predicted during the day, evening and night-time respectively, with the largest exceedances predicted during track slewing activities.

One receiver, R36 (141A Station Street, Blackheath), is predicted to be 'highly affected', experiencing noise levels higher than the 75 dB(A) threshold, due predominantly to the operation machinery associated with track slewing activities and the receivers location in close proximity to the rail line (around 12 metres).

However, as outlined in Section 3.2.3, works would be undertaken during standard working hours where possible, with night works being restricted to rail possessions. As a result, receivers would only be impacted by night works during the 10 rail possessions throughout the construction phase. The construction works would be managed in accordance with the mitigation measures described in Section 6.3.3.

### Noise impacts at non-residential receivers

Construction noise levels at representative non-residential receivers are shown in Table 20. It should be noted that NMLs for non-residential receivers apply whenever the premises are in use therefore no separate assessment for daytime, evening and night-time periods is required.



**Table 20 Predicted noise impacts at representative non-residential receivers in dB(A)**

Receiver ID	Use	Nearest distance to rail alignment (metres)	NML	Site establishment	Platform coping modifications	Track slewing	Signalling	Overhead wiring
N1	School	44	55	44	53	67	< 30	53
N2	Commercial	66	70	42	51	63	51	52
N3	Commercial	26	70	57	66	70	70	71
N4	Commercial	35	70	47	56	65	54	55
N5	Active Recreation	18	65	54	63	77	68	69
N6	Commercial	38	70	53	62	68	67	68
N7	Library	80	55	47	56	59	59	60
N8	Place of Worship	117	55	45	54	55	56	57
N9	Active Recreation	16	65	55	64	77	62	63
N10	School / Childcare	76	55	44	53	60	53	54
N11	Commercial	55	70	49	58	59	< 30	58
N12	Commercial	46	70	52	61	66	< 30	66
N13	Commercial	59	70	50	59	63	< 30	58
N14	Commercial	34	70	62	71	68	< 30	68
N15	Commercial	61	70	50	59	63	< 30	63
N16	Commercial	29	70	58	67	73	< 30	51
N17	Commercial	34	70	59	68	71	< 30	58
N18	Commercial	33	70	55	64	71	< 30	65
N19	Library	46	55	54	63	66	< 30	67
N20	Commercial	35	70	50	59	68	< 30	63
N21	Place of Worship	43	55	62	71	71	48	57
N22	Commercial	20	70	48	57	76	33	57
N23	Commercial	52	70	55	64	65	58	58
N24	Commercial	115	70	50	59	61	48	49

Note: Items shaded in GREY indicate predicted noise impact at this receiver during this work stage is above NML.

Noise levels at receiver N21 (Lithgow Anglican Church, 2 Roy St, Lithgow) are predicted to exceed NMLs by 16 dB(A) during track slewing works, which represents the greatest impact to non-residential receivers. This is on the basis that all identified construction activities would occur along the nearest location on the rail line which is likely to be a conservative estimate, as the actual activities may not include all items of equipment assumed in the calculations.

Predicted noise levels at school receivers, N1 (Children's House Montessori, 585 Great Western Hwy, Faulconbridge) and N10 (Mid Mountains Neighbourhood Centre, 2 Lowden Lane, Lawson) are predicted to exceed NMLs during track slewing works, with the largest exceedances of up to 12 dB(A) predicted at N1.

Recommended mitigation measures are presented in Section 7.2.

### **Sleep disturbance assessment**

As there are several construction stages which are proposed to incorporate out-of-hours works, consideration has been given to the potential for sleep disturbance to residential receivers during night-time works.

Sleep disturbance results are based on the predicted night time  $L_{A1(1 \text{ minute})}$  dB(A) noise levels for construction equipment, assumed to be 8 dB(A) higher than  $L_{eq}$  noise levels.

Results show the majority of representative receivers are predicted to exceed both sleep disturbance screening criteria and sleep awakening criteria during three stages (stage 7 – track slewing, stage – 8 signalling and stage 9 – overhead wiring system) of night-time works. Significant exceedances of sleep awakening criteria are predicted, with highest predicted impacts of 88 dB(A) predicted at receiver R36 (141A Station Street, Blackheath), representing an exceedance of 23 dB(A) above awakening criteria.

Night-time works are anticipated to take place during 10 rail possessions, which would be spread over a two year period. This would provide respite periods between rail possessions, with the longest period of consecutive night-works being limited to two nights.

### **Construction stage 5 – platform extension – Katoomba and Lithgow Station works**

Platform extension works are proposed at Katoomba Station and Lithgow Station. A more comprehensive assessment of constructing the stage 5 - platform extension works at these stations has been conducted in order to assess construction noise impacts in more detail. A total of 404 receivers, including both residential and non-residential receivers, were modelled around Katoomba Station and 586 receivers were modelled around Lithgow Station specifically for the platform extension works.

A summary of modelling results at both stations is presented in Table 21 and Table 22. It is noted that NMLs as well as NMLs +10 have been included to provide context to the number of affected receivers versus the number of highly affected receivers given the larger sample size of modelled receivers.

**Table 21 Predicted noise impacts during construction stage 5 (platform extension) at Katoomba Station and Lithgow Station – residential receivers**

Station	Total no. of receivers	Number of receivers exceeding				Highly affected >75 dB(A)
		Standard hours		Daytime standard	Outside of hours	
		NML	NML+10	NML	NML +10	
Katoomba Station	342	17	0	80	1	0
Lithgow Station	444	57	12	116	24	1

**Table 22 Predicted noise impacts during construction stage 5 (platform extension) at Katoomba Station and Lithgow Station – non-residential receivers**

Station	Total no. of receivers	Number of receivers exceeding	
		Standard hours	
		NML	NML+10
Katoomba Station	62	1 - Commercial	0
Lithgow Station	142	6 - Commercial	1 - Commercial

Results show that during standard construction hours noise levels at up to 17 residential receivers are predicted to exceed NMLs at Katoomba Station and 57 receivers at Lithgow Station. Noise levels are not expected to exceed NMLs by more than 10 dB(A) at any residential receivers around Katoomba Station. Noise levels at 12 residential receivers are however predicted to exceed the NML by more than 10 dB(A) at Lithgow Station.

Outside of standard construction hours, noise levels at up to 80 residential receivers are predicted to exceed NMLs at Katoomba Station and 116 at Lithgow Station. One receiver is predicted to experience exceedances by more than 10 dB(A) at Katoomba Station, and 24 at Lithgow Station with one residence being highly affected (>75 dB(A)).

During stage 5 – platform extension works at Katoomba Station and Lithgow Station, up to six commercial receivers are predicted to exceed NMLs at any time, with noise levels at one receiver predicted to exceed NMLs by more than 10 dB(A). All other non-residential receivers are predicted to comply with NMLs. It should be noted, the 'highly affected' descriptor does not apply to non-residential receivers.

During works at Katoomba Station, receivers to the north of the works are predicted to be most affected largely due to ground topography and shielding from surrounding buildings. At Lithgow Station, receivers along Railway Parade and Main Street are predicted to be the most affected.

Noise levels during the stage 5 - platform extension works are controlled generally by demolition equipment, e.g. demolition (concrete) saw and jackhammers. These are expected to only operate sporadically and during rail possessions for short periods of time, therefore predicted noise levels are only expected to occur for short durations.

It should also be noted that predicted noise levels assume all plant is operating simultaneously, which provides a conservative assessment. Noise levels experienced by the community are likely to be lower than those predicted for significant periods of time.

## Construction traffic assessment

Construction traffic volumes are anticipated to be between 5 to 10 medium/heavy vehicles supplying plant and equipment at the beginning and end of each possession and shutdown, plus a number of light / medium vehicle movements during the duration of the possessions and shutdowns to service personnel and small equipment / material requirements.

During platform works less than five medium / heavy vehicle movements are anticipated per site per possession, with a small number of light vehicle movements to access both during possessions and during normal hours.

In order for construction traffic to generate an increase in noise levels of greater than 2 dB(A), existing traffic levels along construction traffic routes would need to increase by around 60 per cent. From on-site observations the existing traffic flow is substantially greater than the proposed construction traffic numbers. Therefore, the construction vehicles would have a negligible impact on existing road traffic noise in the area. The traffic generated by the Project is considered to comply with the NSW *Road Noise Policy* (DECCW, 2011) criteria.

## Vibration

Vibration-intensive works may include the use of a bored piling rig and jackhammer(s) as well as rail tamping. Tamping equipment used during track slewing works are not expected to impact upon any vibration-sensitive receptors.

The safe working distances of these items of equipment from off-site receivers are shown in Table 23 which is based on recommendations of the *Construction Noise Strategy* (CNS) (TfNSW 2012b). If these safe working distances are complied with, no adverse impacts from vibration intensive works are likely in terms of human response or cosmetic damage.

Based on the indicative construction activities assessed for the Project, it is unlikely that works would occur within the safe working distances for offsite receivers. If vibration-intensive works are required within these safe working distances, mitigation measures to control excessive vibration would be implemented as outlined in Section 7.2.

In addition, all of the stations within the Project site contain heritage structures and have modification works scheduled. It is likely however that works would be undertaken within the safe working distances to the station buildings and platforms. The safe working distances for cosmetic damage are generally considered to be conservative and working within them would not necessarily result in damage.

**Table 23 Safe working distances of vibration intensive equipment to be used during the Project**

Plant	Rating/ description	Cosmetic damage – residential/commercial	Cosmetic damage - heritage	Human response
Bored piling	≤ 800 mm	2 m (nominal)	2 m (nominal)	2 m (nominal)
Jack hammer	Hand held	1 m (nominal)	1 m (nominal)	Avoid contact with structure
Rail tamping	-	5 m (nominal)	5 m (nominal)	5 m (nominal)

There are no residential receivers for which the cosmetic damage or human response safe working distances are encroached by proposed construction activities for the Project. Although some works may be undertaken during standard hours when the stations are open to the public, those affected by intermittent construction vibrations would be in transit and only subject to vibration effects temporarily. No significant issues to the public are considered likely as a result.

The Project would be undertaken in the close vicinity of the heritage-listed station platforms, platform buildings and other station infrastructure, particularly at Katoomba Station and Lithgow Station where the platforms are being extended. Works may potentially be required within the safe working distances and human response thresholds of these structures. Mitigation measures, as described in Section 7.2, would be implemented to protect against damage.

It is also noted that piling is proposed within construction stage 5. However, as this is proposed to be bored piling (rather than impact piling), vibration generated by this process is very low, and is not expected to cause cosmetic damage or human response issues for any receiver location other than potentially the station building itself. As identified above, it is recommended that attended vibration measurements are undertaken when piling commences, to determine site-specific safe working distances. Piling work would not proceed within the safe working distances unless a permanent vibration monitoring system is installed.

## Operation

Changes to environmental noise emissions from the operation of the stations are expected to be negligible as a result of the Project. As such, an assessment under the *Industrial Noise Policy* (EPA, 2000) is not required.

The New Intercity Fleet is expected to be quieter than the existing intercity trains, in particular wheel squeal and engine noise is likely to be lower. Track slewing would only modify the horizontal rail alignment by a maximum of 25 centimetres, therefore operational noise from rail movements is expected to remain the same or be reduced from the current situation. Therefore an assessment under the *Rail Infrastructure Noise Guideline* (EPA, 2013) is not required.

No vibration impacts associated with the operation of the Project are anticipated.

### 6.3.3 Mitigation measures

It has been identified that potential construction noise impacts at residences within the vicinity of the Project may exceed the 75 dB(A) highly affected construction noise threshold. Prior to commencement of works, a Construction Noise and Vibration Management Plan (CNVMP) would be prepared and implemented in accordance with the requirements of the *Construction Noise Strategy* (TfNSW, 2012b) and the Noise and Vibration Impact Assessment (AECOM, 2017f).

The CNVMP would be the key management document to prescribe mitigation measures to minimise construction noise and vibration. The measures would focus on contractor inductions, selection and operation of plant and equipment, work scheduling (including respite periods), prescribing safe working distances for vibration intensive equipment, procedures for noise and vibration monitoring and obtaining approvals for out of hours works.

The CNVMP would be supported by the Community Liaison Plan to be prepared for the Project, which would detail community notification requirements including letter box drops and phone calls. In accordance with TfNSW's *Construction Noise Strategy*, and in consultation with impacted receivers, feasible and reasonable mitigation measures would be implemented to minimise impacts during construction.

In addition to the standard mitigation measures identified in the *Construction Noise Strategy*, a number of additional mitigation measures have been developed as a result of the predicted impacts associated with the Project.

Refer to Section 7.2 for a full list of mitigation measures.

## 6.4 Traffic and transport

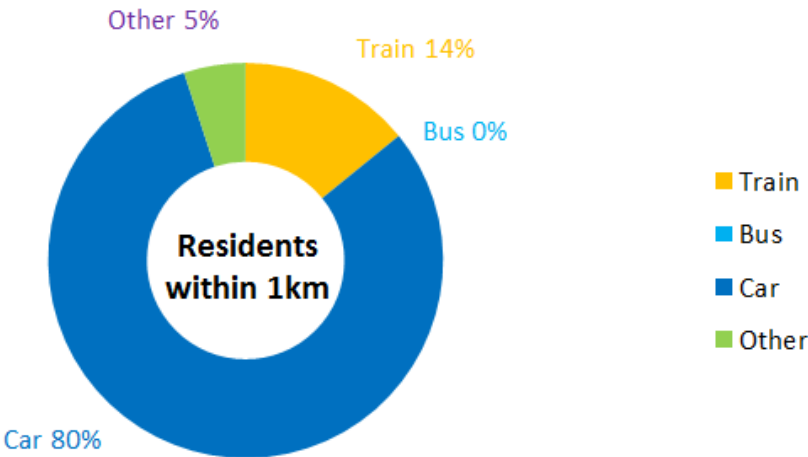
A Traffic, Transport and Access Impact Assessment was prepared for the Project (AECOM, 2017g). The assessment included a desktop review of the existing traffic environment surrounding the Project site. Detailed traffic counts and modelling were not considered necessary as the Project is focused on the rail corridor and is unlikely to have a significant impact on the surrounding road network. The findings of the assessment are summarised in this section.

### 6.4.1 Existing environment

#### Travel mode

Travel data obtained from the TfNSW Transport Performance and Analytics unit (2017) provides an insight into the Journey to Work characteristics of residents and workers. The mode of travel to work for people living within one kilometre of the Blue Mountains Line is presented in Figure 10.

The data suggests that travel by car is the predominate mode of travel to work (80 per cent) for people living within one kilometre of the Blue Mountains Line. Train travel is the second most utilised form of transport (14 per cent) with other modes making up the remaining forms (five per cent). Bus use is limited (zero per cent) as a mode of transport.



Source: TfNSW, 2017

Figure 10 Blue Mountains Line – mode of travel

The Blue Mountains National Park region is a popular attraction for tourists and other recreational users of the park. The Blue Mountains Line is a key access route for visitors to the region.

#### Blue Mountains Line

The Blue Mountains Line is an intercity rail service operated by NSW TrainLink serving the Blue Mountains and Lithgow region of NSW with train services between Bathurst and Central.. As shown in Figure 2 and Figure 3 there are 15 stations within the Project site, including:

- Falconbridge Station
- Bullaburra Station
- Blackheath Station
- Linden Station
- Wentworth Falls Station
- Bell Station
- Woodford Station
- Leura Station
- Newnes Junction Station
- Hazelbrook Station
- Katoomba Station
- Eskbank Station
- Lawson Station
- Medlow Bath Station
- Lithgow Station.

NSW TrainLink also operates regional train and coach services along the Blue Mountains Line.

Eskbank Station and Newnes Junction Station are located within the Project site, however are not open to the public. Mount Victoria Station and Zig Zag Station are located within the Project site, however do not form part of this Project.

### *Train services*

Train services on the Blue Mountains Line vary in stopping patterns with trains commencing and terminating from Bathurst, Lithgow, Katoomba, Mount Victoria and Springwood stations. Limited stops services are provided during the morning and evening peak periods. Table 24 provides a summary of services during the weekday.

**Table 24 Blue Mountains Line weekday services**

Service	Total <sup>1</sup>	Service	Total <sup>1</sup>
Bathurst to Central (all services)	34	Central to Bathurst (all services)	34
commencing at Bathurst	2	terminating at Bathurst	2
commencing at Lithgow	13	terminating at Lithgow	13
commencing at Mount Victoria	11	terminating at Mount Victoria	10
commencing at Katoomba	5	terminating at Katoomba	6
commencing at Springwood	3	terminating at Springwood	3

Note:

1. Rail customer demand.

Source: Sydney Trains, 2017

A review of station barrier counts for stations between Faulconbridge Station and Lithgow Station for 2014 indicated Katoomba Station is the most used station and reflective of the stopping patterns of train services on the Blue Mountains Line with 60 services provided at Katoomba Station during the weekday.

### *Interchange facilities*

All stations, with the exception of Medlow Bath Station and Eskbank Station, provide a number of interchange facilities giving customers the opportunity to transfer between transport modes. These include bus stops, taxi ranks, bicycle storage, kiss and ride zones and car parking facilities.

### *Bus services*

Blue Mountains Transit operates the 600 series bus routes, which provides 12 bus routes that operate near to the stations providing customers the opportunity to transfer onto rail services. These bus routes connect residential areas to local transport interchanges, as well as employment and retail areas throughout the Blue Mountains region.

Lithgow Station is not served by Blue Mountains Transit, however Lithgow Buslines operate bus services to and from Lithgow Station.

Additional regional coach services are provided at Lithgow Station and Mount Victoria Station providing bus links to the other regional destinations. Bell Station is currently not served by bus services.

## Traffic and road network

### Key roads

The road network in the vicinity of the Project is shown in Figure 2 and Figure 3. The key existing roads in the vicinity of the Project site include:

- **Great Western Highway** – a major arterial road that carries around 24,000 vehicles a day through the Blue Mountains area. It is a state road that was upgraded to four lanes between Emu Plains and Katoomba (completed in mid-2015) as part of Roads and Maritime Services' Great Western Sydney Upgrade. The road is a key route providing access between Sydney and Central and Western NSW and a key freight route with heavy vehicles making up 12 per cent of traffic. A permanent classifier located on Great Western Highway, 260 metres west of Victoria Street, Mount Victoria indicates that during 2017, around 18 per cent of traffic along the road consisted of heavy vehicles. The road is generally adjacent to the rail corridor between Mount Victoria Station and Faulconbridge Station. The road forms part of the A32 and A44 road corridor, both of which are routes of national significance.
- **Bells Line of Road / Chiefly Road** – a State road providing access between Sydney and Central and Western NSW that also plays an important role in providing access through the Blue Mountains area. The road performs a secondary role for cross-mountain traffic after the Great Western Highway. It is generally a two-way, two-lane road with opportunities intermittently provided to overtake. The road forms part of the B59 road corridor, which is a route of State significance.
- **Darling Causeway / Station Street** – a State road providing connections between Great Western Highway and Bells Line of Road / Chifley Road. It is a generally a two-way, two-lane road with opportunities intermittently provided to overtake and runs in a north-south direction west of the rail corridor.
- **Main Street / Mort Street** – a State road that forms part of the B59 road corridor. The road is generally a two-way, two-lane road providing access through Lithgow.

Local streets providing access to stations within the Project site are summarised in Table 25.

**Table 25 Local road access**

Station	Local road	Station	Local road
Faulconbridge	Sir Henry Parade	Katoomba	Bathurst Road and Goldsmith Place
Linden	Burke Road	Medlow Bath	Railway Parade
Woodford	Railway Parade	Blackheath	Station Street
Hazelbrook	Railway Parade	Bell	Sandham Road
Lawson	Loftus Street	Newnes Junction	Sandham Road
Bullaburra	Railway Parade	Eskbank	Inch Street
Wentworth Falls	Railway Parade and Station Street	Lithgow	Railway Parade and Main Street
Leura	Railway Parade		



### *B-double routes*

Approved B-double routes in the vicinity of the Project site include:

- Great Western Highway (A32)
- Chifley Road (B59)
- Darling Causeway
- Main Street (B59)
- Mort Street (B59).

### *Traffic volumes*

The Annual Average Daily Traffic (AADT) volumes over the past five years indicate traffic volumes along the section of the Great Western Highway between Springwood and Lithgow have mainly experienced minimal growth and in some instances have declined in volume.

**Table 26 Historical AADT data**

Station ID	2012	2013	2014	2015	2016	2017
6188	-	-	-	11,174	-	10,916
6189 (eastbound)	-	-	-	5,519	5,856	5,440
6190 (westbound)	-	-	-	4,902	4,754	4,633
6191	-	-	-	4,334	4,237	4,043
6193 (eastbound)	-	-	-	5,613	5,939	5,383
99043	22,141	21,240	-	-	-	-
99914	27,333	27,683	28,549	-	31,075	28,201

Source: Roads and Maritime Services, 2017

## **6.4.2 Potential impacts**

### **Construction**

It is anticipated that up to 10 pre-existing rail possessions would be utilised over the two-year construction period. This would typically include shutdown periods of 48 hours over a weekend period; however, 5 of the 10 possession periods may extend for 12 days in the area between Newnes Junction Station and Lithgow Station. This would involve five day closures of one line on both sides of a weekend possession period.

### *Customer and public access impacts*

Platform extension works at Katoomba Station and Lithgow Station are expected to impact pedestrian movements on the station platforms. The reduced space on the platforms may increase pedestrian congestion and reduce the amount of standing area for customers. Although Katoomba Station is the most frequented station on the Blue Mountains line, the likelihood of this occurring is low given the relatively low patronage in comparison to high patronage stations in the Sydney Metropolitan area. In addition, at both stations, the location of the platform extension works is away from main boarding points. Appropriate signage would be provided to mitigate any potential impacts to pedestrian movements on the platforms.

Construction work during rail possessions is not expected to impact pedestrians and customers given the restricted area in which construction works are to be carried out. This would largely be associated with the works undertaken at stations (e.g. platform extensions at Katoomba Station and Lithgow Station). Track slewing works and upgrades to overhead wiring works would be undertaken away from publicly accessible areas.

Replacement bus services would be provided at affected stations during any scheduled rail possessions utilised by the Project. These replacement bus services would provide rail customers a connection to a station that would continue to be served by a Blue Mountains Line / Main Western Line service during the weekend rail possession.

Outside of the rail possessions, access on and to the stations would be maintained during construction and any works to be undertaken within these areas would be managed and controlled at all times to ensure that there is no impact to public safety.

### *Interchange facilities*

The Project would not result in impacts to interchange facilities during construction. Pedestrian and cycling access to and through the station precincts would be maintained during construction.

Works that cause temporary disruptions to pedestrian facilities surrounding stations have the potential for increased safety risks for pedestrians, due to potential interactions with construction plant and vehicles. There may be minor diversions in these locations which would be appropriately signposted to notify pedestrians of the temporary arrangements. Any interaction between construction vehicles and pedestrians would be managed and controlled by traffic controllers as appropriate. Impacts to pedestrians during construction would be managed through the construction Traffic Management Plan (TMP).

### *Traffic*

Impacts on traffic during construction would be temporary with predominate activity undertaken around the periods of rail possessions (when the majority of construction activities are undertaken). Traffic impacts would occur as a result of the movement of construction and service vehicles, particularly along Great Western Highway and local roads providing access to the compound sites.

Potential impacts caused by construction vehicle traffic would include:

- increased travel time due to reduced speed limits around construction sites
- increased travel time due to increased truck and construction machinery movements
- temporary partial or complete closure of roads and altered property accesses during construction.

Traffic generated by construction vehicles, including staff vehicles is likely to be minimal. Between five to 10 heavy vehicles and a number of light vehicles would be generated during each scheduled possession at each works site.

The additional vehicle movements, particularly along the Great Western Highway and local routes are unlikely to have more than minor impacts on traffic conditions given that the additional vehicle movements would be less than ten per cent of the existing total daily movements along the road corridors. The most appropriate local access route to the temporary compounds, especially for large construction vehicles, would be determined during detailed design. There may be localised impacts at construction access points. Heavy vehicles would be restricted to non-peak periods and rail possessions where possible to minimise disruptions to traffic.

## *Parking*

The operation of commuter car parks at Woodford Station, Blackheath Station, Katoomba Station and Lithgow Station may be temporarily affected during the construction of the Project, with compound locations identified adjacent to and within existing off-street commuter parking facilities. The following commuter parking spaces would be temporarily affected during construction:

- about 14 commuter spaces at Woodford Station (making up about a third of the total number of commuter spaces available)
- about seven commuter spaces and three accessible spaces at Katoomba Station (making up about a fifth of the total number of commuter spaces available)
- about 11 commuter spaces at Blackheath Station (making up about half of the total number of commuter spaces available)
- about nine commuter spaces at Lithgow Station (making up a small portion of the total number of commuter spaces available).

This would in turn increase the demand for on-street parking within the local network in the short-term. While the stations would be closed during the possession, passengers may still use surrounding parking to catch the replacement bus service.

## *Property access*

Access to individual properties could be temporarily affected by construction activities, either through the loss of existing access arrangements, or the alteration of access arrangements. However, property access would be maintained at all times, and any impacts would be short-term. Access to all properties would be maintained during construction unless agreed with the property owner in advance.

## **Operation**

Once complete, the Project would not impact on the operation of public transport, interchange facilities, property access or parking in the vicinity of the stations. The platform extensions at Katoomba Station and Lithgow Station would allow customers' access to the longer trains, which are being provided to cater for patronage growth.

The procurement of the new trains would result in a period of time where the older trains and new wider trains would be running concurrently along the Blue Mountains Line while the fleet is being progressively replaced. Modification of the platform coping at stations to accommodate the new trains would result in a larger gap experienced by customers boarding or alighting from the older trains at certain points along the platform. Impacts would be temporary in duration, until the full replacement of the older fleet has been completed.

The Project would not result in operational traffic or access impacts.

### **6.4.3 Mitigation measures**

A construction Traffic Management Plan (TMP) would be prepared by the Contractor in consultation with TfNSW, and provided to the relevant roads authority. The construction TMP would be the primary management tool to manage potential traffic and pedestrian impacts associated with construction.

Temporary measures informing customers of the extra gap between the train and station platforms would be determined during detailed design and implemented during operations to minimise disruptions to customers while both the existing and new fleet are operating on the Blue Mountains Line. These may include a combination of additional signage, additional station staff, physical platform gap filling solutions and communication strategies.

Refer to Section 7.2 for a full list of mitigation measures.

## 6.5 Urban design, landscape and visual amenity

A Landscape and Visual Impact Assessment (LVIA) has been undertaken by AECOM using the Roads and Maritime Services *Environmental Impact Assessment Practice Note – Guideline for Landscape Character and Visual Impact Assessment* (Reference number EIA-N04, 2013) as a reference document, as it is widely accepted by NSW Government authorities. The assessment methodology is described in Appendix F and the findings summarised in this section.

### 6.5.1 Existing environment

Land use adjacent to the Project site predominantly comprises one of the following:

- bushland, including trees, shrub cover and conservation areas
- small pockets of land used for grazing and horticulture
- urban, including low density residential and commercial town centre
- infrastructure corridor.

Refer to Section 1.3 for further detail on the existing land uses surrounding the Project site.

### Landscape character zones

The Project site and the surrounding area has been assessed in distinct landscape character zones (LCZ) which comprise similar landscape features and land uses, including:

- LCZ 1: Infrastructure corridor (rail)
- LCZ 2: Infrastructure corridor (roads running parallel to the rail corridor)
- LCZ 3: Residential
- LCZ 4: Bushland
- LCZ 5: Commercial centre.

### Visual receivers

Visual receivers likely to be impacted by the Project can be broadly categorised as:

- road users
- residential neighbours
- commercial neighbours
- rail customers.

### 6.5.2 Potential impacts

A landscape character and visual impact assessment was undertaken to determine the impacts of the Project to each of the landscape character zones and visual receptors during construction and operation phases. The results of this assessment are presented in Table 27.

While four of the five landscape character zones have been classified as moderate or high sensitivity, given the magnitude of impacts as a result of the Project is negligible, the overall assessment rating for both construction and operation for all landscape character zones was negligible.

Most of the visual receiver groups would be expected to experience a low impact during construction, and a low to negligible impact as a result of operation of the Project.

**Table 27 Landscape character and visual impacts during construction and operation**

Land Zone	Sensitivity	Magnitude of change - construction	Magnitude of change - operation	Overall rating
<b>Landscape character impact assessment</b>				
<b>LCZ 1: Infrastructure Corridor (rail) landscape character impact assessment</b>	Low	Negligible: The changes would be temporary and would be typical of what is already experienced at the Project site.	Negligible: Changes would largely involve a replacement like for like or minor relocation of infrastructure, and would be accommodated by the landscape.	<b>Construction:</b> Negligible <b>Operation:</b> Negligible
<b>LCZ 2: Infrastructure Corridor (roads running parallel to the rail corridor)</b>	Moderate	Negligible: The changes would be temporary and would be typical with what is already experienced within the rail corridor LCZ.	Negligible: During operation, the Project would not cause any change to the character of this LCZ.	<b>Construction:</b> Negligible <b>Operation:</b> Negligible
<b>LCZ 3: Residential</b>	Moderate	Negligible: The changes would be temporary and would be similar to the maintenance routine within a rail infrastructure corridor. It would cause no change to the overall landscape character of the rail corridor LCZ, nor to the residential LCZ even where the two lie adjacent to one another.	Negligible: No changes within this LCZ are anticipated, and the changes within LCZ 1 do not alter the character of this LCZ.	<b>Construction:</b> Negligible <b>Operation:</b> Negligible
<b>LCZ 4: Bushland</b>	High	Negligible: The changes would be temporary, and typical with what is already experienced within the rail corridor LCZ. This would not affect the character of the adjacent landscape (i.e. LCZ 4).	Negligible: No changes would occur within this LCZ, and changes within the adjacent LCZ 1 would not change the overall character of either area.	<b>Construction:</b> Negligible <b>Operation:</b> Negligible
<b>LCZ 5: Commercial centre</b>	High	Negligible: No construction activity would result in a change in overall character of this LCZ, although construction activity, while conducted during off-peak times, may be apparent from the commercial centres.	Negligible: No changes would occur within this LCZ, and changes within the adjacent LCZ 1 would not change the overall character of either area.	<b>Construction:</b> Negligible <b>Operation:</b> Negligible

Land Zone	Sensitivity	Magnitude of change - construction	Magnitude of change - operation	Overall rating
<b>Visual impact assessment</b>				
<b>Road user receiver group</b>	Moderate	<p>Low:</p> <p>The changes would only be seen for short periods of time as the vehicle, cyclist or pedestrian passed the site of construction activity.</p> <p>The changes (construction activity) would only be viewed as a small portion of the overall view at any one time, and one view amongst many that make up the greater overall journey.</p> <p>The changes would only be temporary.</p>	<p>Negligible:</p> <p>Replacement of existing rail infrastructure, with only few new elements being introduced to the corridor. If these replaced or additional elements were visible from the road corridor, they are typical of rail infrastructure and would not stand out as a change in the view from the road.</p> <p>Changes to the stations, including the increase or decrease of platform widths or lengths, or the reduction of canopy over the platform at Faulconbridge Station, would not be noticeable from the road as the change in platform length or depth are not large enough to be seen as a 'new' element within the view.</p> <p>Changes to placement of objects, such as track position and other rail infrastructure, would not be visible from the road.</p>	<p><b>Construction:</b> Low <b>Operation:</b> Negligible</p>
<b>Residential neighbour receiver group</b>	Moderate	<p>Low:</p> <p>The temporary construction activity associated with the Project seen from these homes would only vary from track work regularly seen from these properties in frequency.</p>	<p>Negligible:</p> <p>Rail infrastructure would be modified rather than be new elements within views. Changes to track placement would not be visible from the homes, and any new elements within the rail corridor would not be a noticeable.</p>	<p><b>Construction:</b> Low <b>Operation:</b> Negligible</p>
<b>Commercial neighbour receiver group</b>	Low	<p>Low:</p> <p>The temporary construction activity associated with this project seen from these businesses would only vary from track work regularly seen from these properties in frequency.</p>	<p>Negligible:</p> <p>The changes within the rail corridor (including changes to the stations) would either not be visible, or not be discernible as a change in the view as most 'changes' would be a like for like replacement or the minor moving of an element, or a minor change in the size of an element.</p>	<p><b>Construction:</b> Low <b>Operation:</b> Negligible</p>

Land Zone	Sensitivity	Magnitude of change - construction	Magnitude of change - operation	Overall rating
<b>Rail customer receiver group</b>	Low	<p>Low:</p> <p>Buses would replace trains when construction activity occurs on the tracks and within the rail corridor so no views of works would be seen from the stations or trains. Any temporary construction activity that does not stop train activity would be seen by rail customers however these views would not be out of character.</p>	<p>Low:</p> <p>No changes to the rail corridor elements would be visible to rail customers while on the trains. Some minor changes to stations, particularly the lengthening and shortening of platforms, would be visible to station visitors, but the changes would be visibly in keeping with the station characters and would not substantially impact any heritage items as viewed from the platforms by rail customers.</p>	<p><b>Construction:</b> Low</p> <p><b>Operation:</b> Low</p> <p>Visual impact on heritage items is Minor to Negligible for all items</p>

### 6.5.3 Mitigation measures

Most of the visual receiver groups would be expected to experience a low to moderate impact however several mitigation measures would be implemented during construction and operation to minimise any impacts to these receptor groups. Mitigation measures would be considered during design development and construction planning to minimise the level of visual impact of the construction and operation phases of the Project. Areas used for site compounds would be selected using the criteria outlined in Section 3.2.7 and would be rehabilitated at the end of construction.

Refer to Section 7.2 for a full list of mitigation measures.

## 6.6 Socio-economic impacts

This section describes the existing socio-economic profile of the local and regional areas surrounding the Project site and identifies potential impacts resulting from the Project. The data has primarily been sourced from Australian Bureau of Statistics data (ABS, 2011),

The local study area (i.e. within one kilometre of the Project site) includes neighbouring properties of the Project site that may be impacted directly or indirectly as a result of amenity related impacts such as dust, noise, and visual amenity.

### 6.6.1 Existing environment

Regionally, settlement along the Project route largely centres on the townships and residential centres at Faulconbridge, Linden, Woodford, Hazelbrook, Lawson, Bullaburra, Wentworth Falls, Leura, Katoomba, Medlow Bath, Blackheath, Lithgow, and smaller settlements between Bell Station and Lithgow Station.

Based on the estimated resident population for 2016 (ABS, 2016a and ABS, 2016b), the population of the Blue Mountains and Lithgow local government areas is estimated to be 80,072 and 21,474 respectively. Both local government areas have experienced moderate population growth between 2012 and 2016 which is expected to continue to steadily over the next 20 years.

#### Community infrastructure

The closest residential properties are located around 20 metres from the Project site in proximity to Hazelbrook Station, Lithgow Station and Bullaburra Station.

Social infrastructure surrounding the Project site includes a range of education, health and other community facilities. Infrastructure surrounding the Project site is listed in Table 28 and presented in maps in Appendix G.

**Table 28 Community facilities in the vicinity of the Project site**

Station	Community infrastructure
Faulconbridge	<ul style="list-style-type: none"><li>Children's House Montessori, about 250 metres north of the station</li></ul>
Woodford	<ul style="list-style-type: none"><li>Woodford Presbyterian Church, about 200 metres west of the station</li></ul>
Hazelbrook	<ul style="list-style-type: none"><li>Mid Mountains Out of School Hours Service, about 170 metres south east of the station and the Clever Ducks Family Day care, about 445 metres south east of the station.</li><li>Hazelbrook Public School, about 500 metres south east of the station</li><li>Hazelbrook General Practice, about 225 metres north of the station</li></ul>



Station	Community infrastructure
Lawson	<ul style="list-style-type: none"> <li>two day care/preschool facilities including the Mountains Mobile Minders, about 120 metres north of the station and Lawson Community preschool, about 230 metres south east of the station</li> <li>two primary schools including Lawson Public School, about 290 metres south of the station</li> <li>Lawson Medical Practice, about 370 metres east of the station</li> <li>three sporting and recreational facilities including the Lawson Bowling Club, about 30 metres north of the station, and Mid Mountains Neighbourhood Centre, about 195 metres south of the station</li> <li>two places of worship, including Emmanuel Anglican Church, about 100 metres south of the station</li> </ul>
Wentworth Falls	<ul style="list-style-type: none"> <li>four healthcare facilities, including Barratt &amp; Smith Pathology, about 80 metres north west of the station, and The Village Surgery, about 130 metres north west of the station</li> <li>Wentworth Falls Bowling Club, about 250 metres west of the station</li> </ul>
Leura	<ul style="list-style-type: none"> <li>four day care/preschool facilities including Cherry Blossom Early Learning Centre, about 200 metres south east of the station</li> <li>Leura Public School, about 480 metres east of the station</li> <li>Magic in Motion Studios Dance Drama Music, about 310 metres north east of the station</li> <li>two places of worship, including Leura-Wentworth Falls Baptist Church, about 160 metres north of the station</li> </ul>
Katoomba	<ul style="list-style-type: none"> <li>four day care/preschool facilities including Katoomba Out of School Hours &amp; Vacation Care, about 270 metres north of the station</li> <li>St Canices Primary School, about 415 metres south of the station</li> <li>TAFE NSW Blue Mountains, Katoomba, about 150 metres south west of the station</li> <li>seven health care facilities including Upper Mountains Medical Centre, about 40 metres west of the station</li> <li>St Hilda's Anglican Church, about 200 metres south of the station</li> </ul>
Medlow Bath	<ul style="list-style-type: none"> <li>Medlow Park and tennis court, about 25 metres east of the station</li> </ul>
Blackheath	<ul style="list-style-type: none"> <li>two day care/preschool facilities including Kookaburra Kindergarten, about 350 metres south east of the station</li> <li>Blackheath Family Medical Centre, about 350 metres south of the station</li> <li>Blackheath Library, about 50 metres north of the station</li> <li>Sacred Heart Catholic Church Blackheath, about 320 metres north of the station</li> </ul>
Eskbank	<ul style="list-style-type: none"> <li>two day care/preschool facilities including Galloping Gumnut Mobile Childrens Services, about 285 metres south east of the station</li> <li>Lithgow Public School, about 250 metres south west of the station</li> <li>Tablelands Sports and Spinal Physiotherapy, about 465 metres south west of the station</li> <li>three sporting and recreational facilities including a soccer field on Bennet Street 150 metres north east of the station, and Kiddle Park about 200 metres south of the station</li> <li>Uniting church, 190 metres south of the station</li> </ul>
Lithgow	<ul style="list-style-type: none"> <li>two day care/preschool facilities including First Grammar Lithgow, about 450 metres south east of the station</li> <li>Lithgow Public School, about 270 metres south east of the station</li> <li>two health care facilities including Tablelands Sports &amp; Spinal Physiotherapy, about 130 metres south of the station</li> <li>St Patrick's Catholic Presbytery, about 360 metres south west of the station</li> </ul>

No non-residential receivers were identified within proximity to Linden Station, Bell Station or Newnes Junction Station.

The area surrounding the remainder of the Project Site contains a number of recreational and community infrastructure. There is also a significant number of places of worship.

Three quarters of the Blue Mountains local government area is comprised of the World Heritage Blue Mountains National Park. The National Park attracts residents to live in the area and a large number of tourists, with more than two million visitors every year (Blue Mountains Economic Enterprise, 2015).

## **6.6.2 Potential impacts**

### **Construction**

Construction of the Project has the potential to temporarily impact customers, pedestrians, motorists, local businesses, residents, and other local receivers as a result of:

- construction noise, vibration, dust and visual impacts
- temporary changes to vehicular and pedestrian access to and movements around the stations
- temporary impacts to local traffic movements
- temporary loss of parking around the station at Katoomba Station and Blackheath Station
- small increase in truck movements delivering materials and equipment, and transporting waste.

Each of these issues has been assessed separately in sections 6.3, 6.4 and 0.

Increased noise, dust, and reduced visual amenity have the potential to result in amenity impacts on local residents in those areas affected. For example nuisance dust may impact the wellbeing of customers utilising the commercial precincts directly outside of Lawson Station, Wentworth Falls Station, Leura Station, Katoomba Station and Lithgow Station.

It is not anticipated that local businesses would experience more than a minor disruption during construction as the works would largely be concentrated in already scheduled rail possessions across a two year Period. Replacement bus services would continue to service the local communities, tourists and other rail customers. In addition, the construction works would be undertaken entirely within the existing rail corridor (aside from one optional compound at Faulconbridge Station which may be located outside the rail corridor), minimising direct impacts to the surrounding commercial areas.

### **Operation**

Once operational, the Project would not result in any major impacts on social and economic values. Customers may experience access impacts as a result of the increased gap between the narrow gauge trains and the platforms while both types of trains are operating on the Blue Mountains Line.

## **6.6.3 Mitigation measures**

Measures to address amenity impacts relating to specific aspects have been identified in the relevant sections of this REF. In addition to these measures, a number of safeguards would be implemented to minimise potential impacts on the community with a particular focus on keeping the community informed.

Refer to sections 6.3, 6.4 and 6.5 for discussion on the potential noise, traffic/access and visual amenity impacts arising from construction of the Project and the proposed management strategies. Refer to Section 7.2 for a full list of mitigation measures.

## 6.7 Biodiversity

A flora and fauna impact assessment was undertaken for the Project which included a desktop review and site inspection of the Project site and surrounds by two qualified ecologists on 12 and 13 April 2017 and a further inspection by an ecologist on 23 April 2017.

### 6.7.1 Existing environment

The Project site is characterised by a winding alignment traversing a surrounding area of steeply graded terrain typical of the Greater Blue Mountains topography. However, the Project site is a modified, highly disturbed environment, including the existing rail infrastructure as well as associated access tracks and stations. The Project site undergoes routine maintenance and clearance works to ensure the safe passage of freight and passenger trains as well as maintain clearance distances for associated infrastructure (signals, overhead wiring systems, etc.). The area surrounding the Project is a mountainous sandstone region characterised by varying, often steep topographical features including plateau and escarpments extending off the Great Dividing Range. For around 40 kilometres, the Project would be located adjacent to the Blue Mountains National Park; however no works would be undertaken within the boundary of the National Park.

#### *Vegetation communities*

The desktop assessment identified seven threatened ecological communities (TECs) listed under the EPBC Act within a 30 kilometre search radius. Six of these TECs are also listed under the TSC Act. TECs located with the Project site are shown in Figure 11, Figure 12, Figure 13 and Figure 14. A detailed list of the identified threatened communities is provided in Appendix H.

#### *Threatened flora*

The desktop assessment identified 60 threatened plants that potentially occur within or near the Project site. Of these, one was considered to have a high likelihood of occurrence within the Project site (*Acacia flocktoniae*, Flockton Wattle), with 20 threatened species having a moderate likelihood of occurrence within the Project site. A detailed list of the identified threatened flora is provided in Appendix H.

There are 11 known records of *Acacia flocktoniae* within the vicinity of the Project site. A substantial proportion of the Blue Mountains population of this species is actively protected in Blue Mountains National Park.

#### *Fauna habitat*

The vegetation that lies adjacent to the Project site generally consists of native forest over a moderately dense understorey and is in variable condition. Fauna habitats recorded within this zone during the field survey include:

- riparian vegetation comprising natural and constructed drainage channels where surface-water dependent vegetation occurs
- woodland and forest
- heathland.

Fauna habitat also exists within both constructed and natural landscape features of the Project site. Such features include constructed features such as culverts and drainage lines, but also natural rock overhangs, rocky outcrops and caves.

## *Fauna*

The desktop assessment identified 67 threatened fauna species that have the potential to occur within or near the Project site. This includes five amphibians, 39 birds, two insects, 19 mammals, and two reptiles.

Of these species, 14 were deemed as having a moderate likelihood of occurrence in the Project site, with seven determined as having a high likelihood of occurrence within the fauna habitats present in the Project site. A detailed list of the identified threatened fauna is provided in Appendix H.

Threatened fauna species considered likely to occur in the Project site are the Glossy Black-Cockatoo and the Eastern Pygmy-possum listed as Vulnerable under the TSC Act, as well as the Blue Mountains Water Skink, listed as Endangered under both the TSC Act and EPBC Act (refer to Table 29). Four bat species also have a high likelihood of occurrence in the Project area including; Large-eared Pied Bat, Little Bentwing-bat, Eastern Bentwing-bat and the Southern Myotis.

## *Migratory species*

Twelve migratory species were identified as having the potential to occur within the Project site.

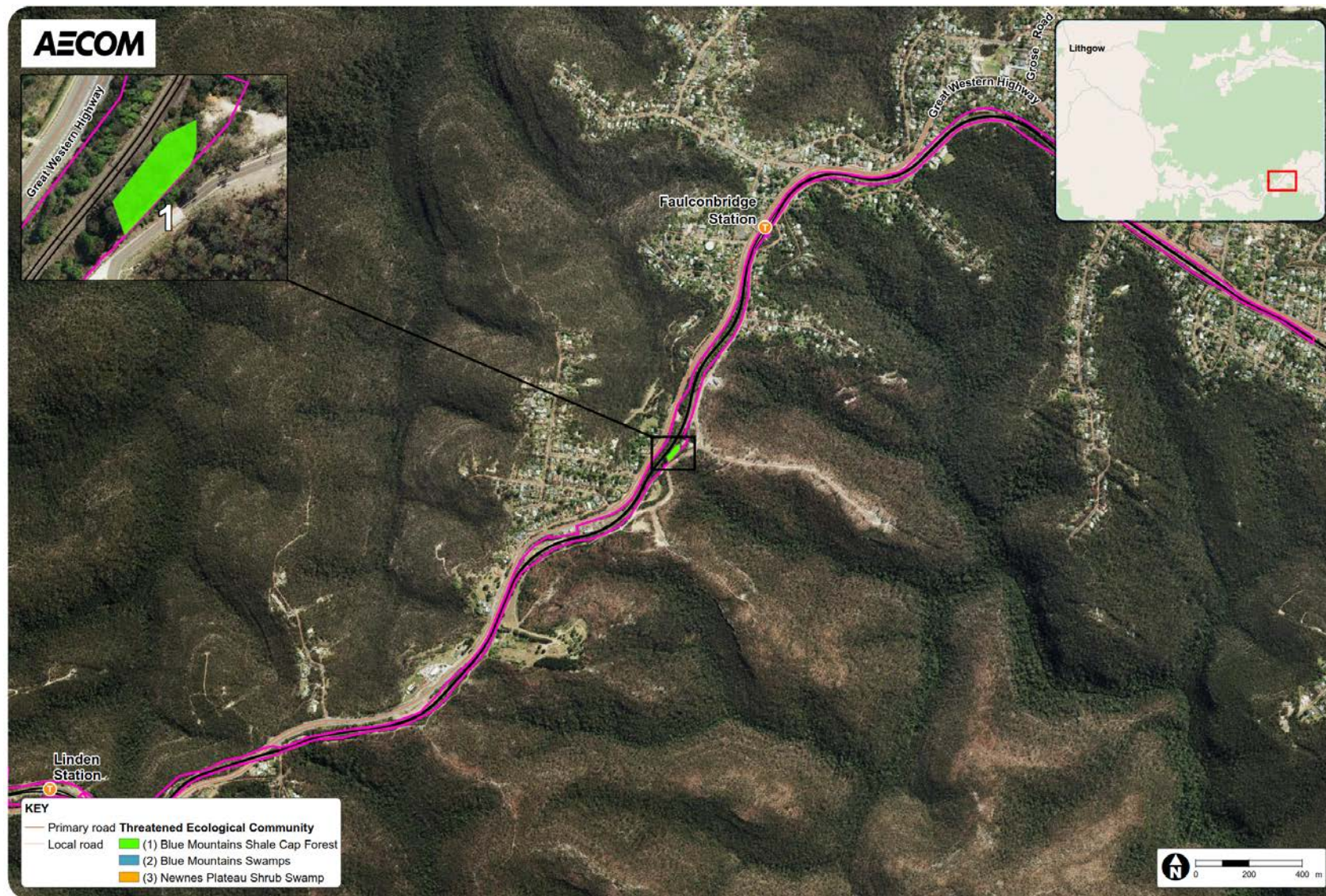
## *Noxious weeds*

There are numerous common environmental and noxious weeds present within the Project site. Areas in close proximity to urbanised areas are prone to an overspill of non-native species from adjacent residential gardens.

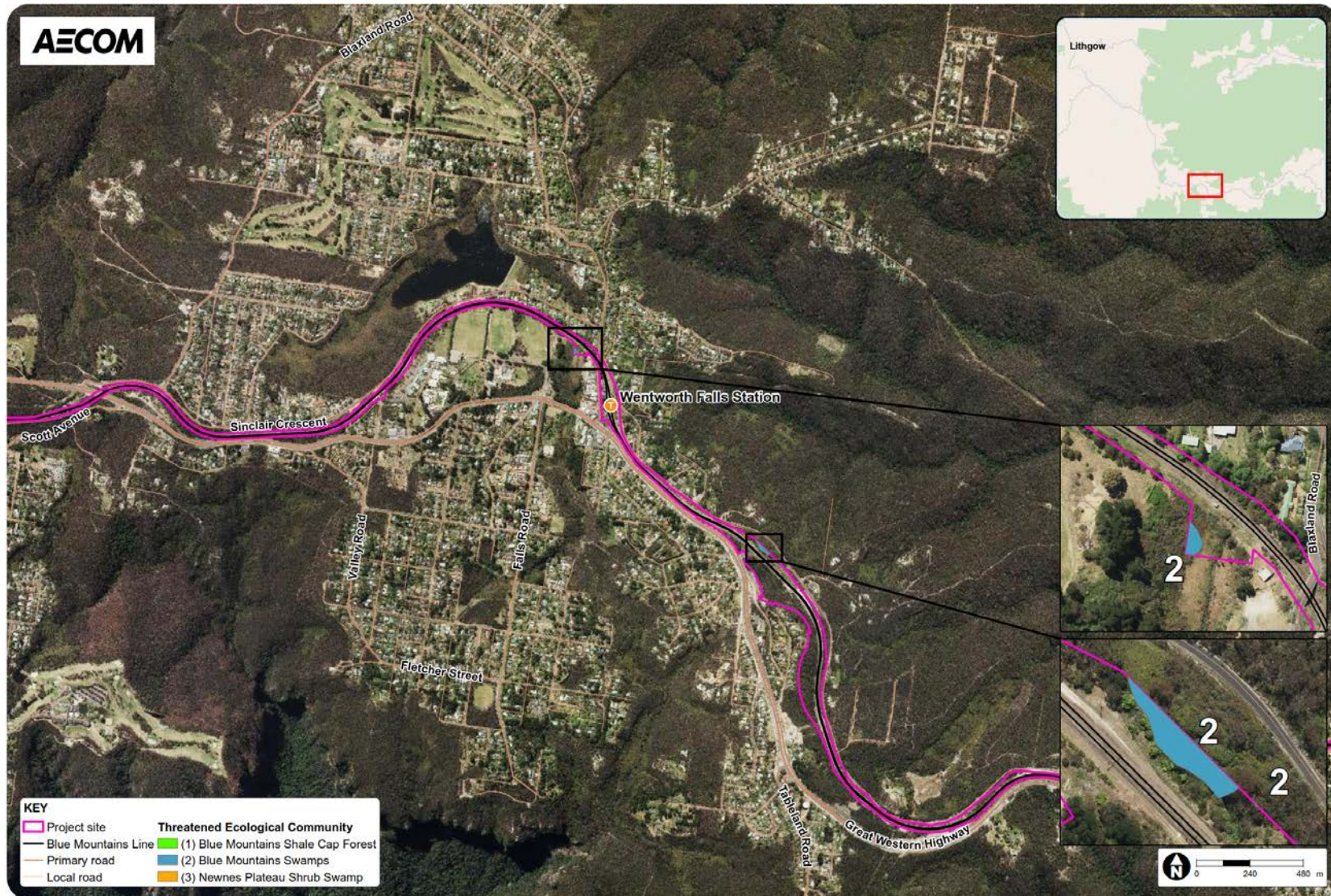
Four weeds of national significance were recorded in the Project site, including:

- *Lantana camara* (Lantana)
- *Asparagus scandens* (Asparagus fern)
- *Senecio madagascariensis* (Fireweed)
- *Rubus fruticosus aggregate* (Blackberry).

Lantana is designated as a Class 3 noxious weed, while the other three are designated as Class 4 noxious weeds.



**Figure 11 TECs within the Project site (part 1 of 4)**



\*Works at Mount Victoria Station and Zig Zag Station do not form part of the Project

**Figure 12 TECs within the Project site (part 2 of 4)**

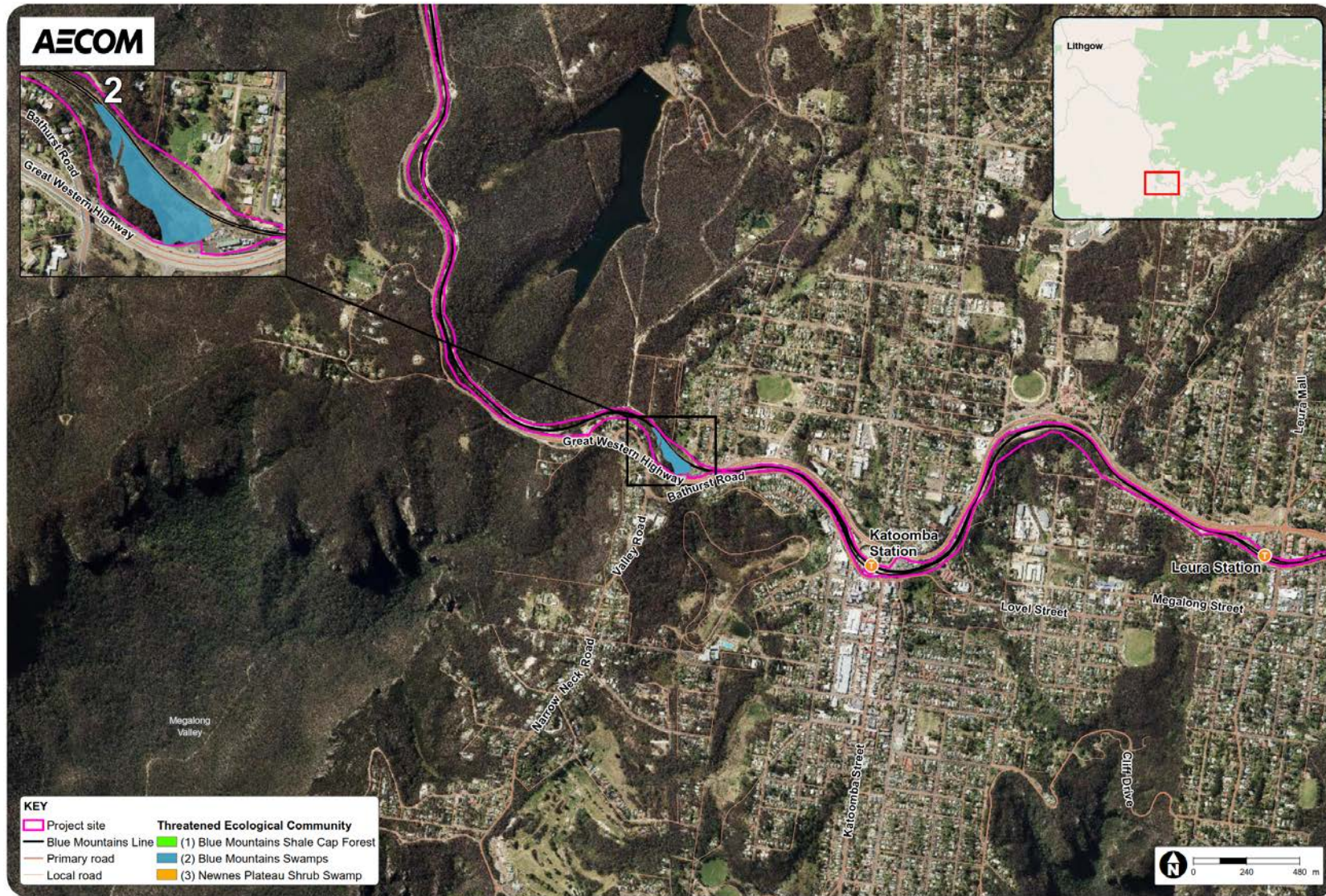
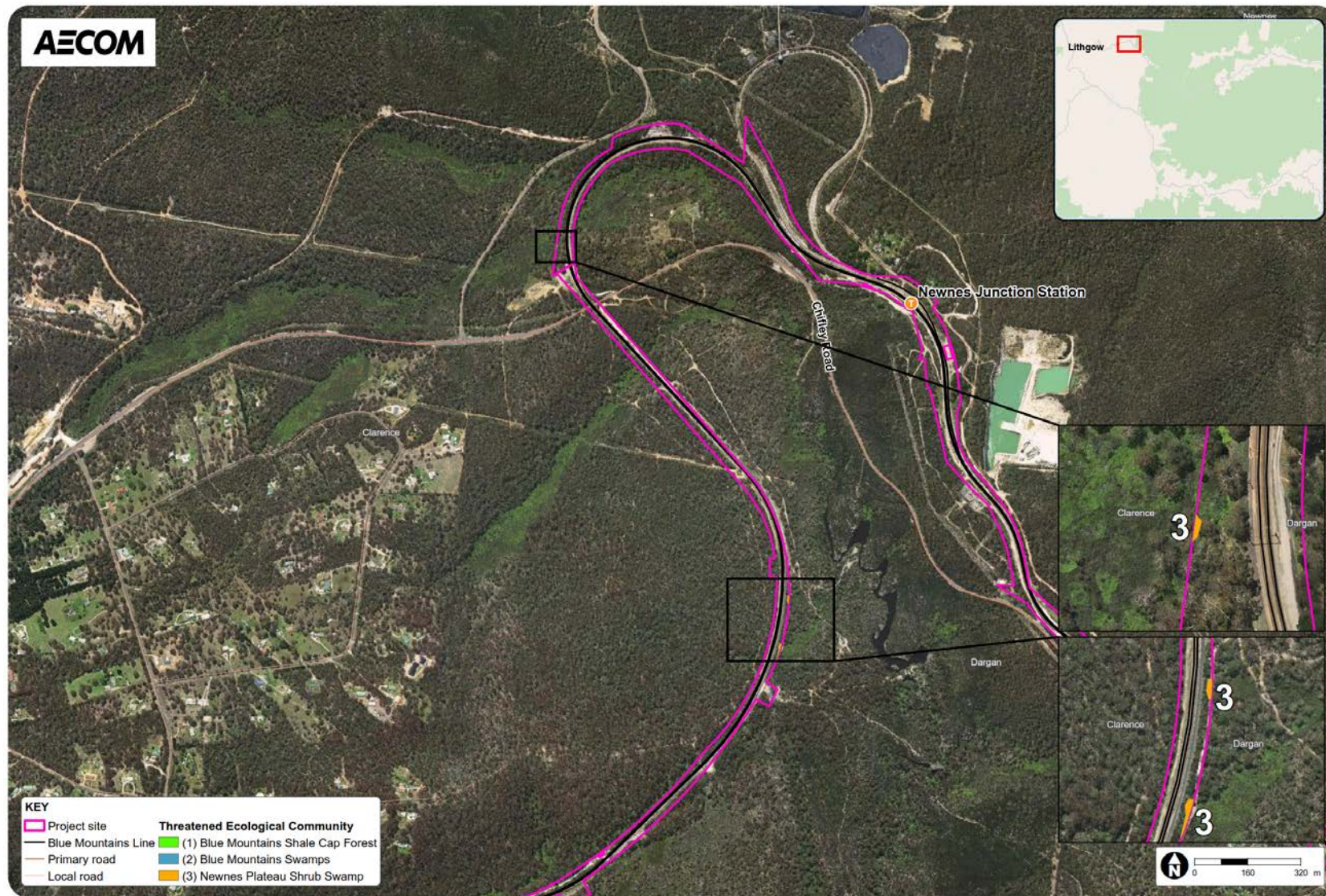


Figure 13 TECs within the Project site (part 3 of 4)



**Figure 14 TECs within the Project site (part 4 of 4)**



## 6.7.2 Potential impacts

### Construction

#### *Clearing of native vegetation*

No clearing of native vegetation is required for the Project. Some earthworks are likely to occur around Hazelbrook, Lawson, Woodford, Katoomba, Bell, Eskbank and Lithgow stations but this will be largely restricted to the middle of the track alignment and would not interfere with any existing vegetation.

As such the impacts likely from Project construction activities are limited to:

- spread of weeds, pests and pathogens
- introduction of additional source of disturbance through noise, vibration and light
- contaminant pollution from stored fuels and hazardous materials
- injury and mortality of fauna species from vehicle strikes.

These impacts are discussed in further detail below.

#### *Threatened ecological communities*

Assessments of significance (seven part tests) were conducted for the known TECs present within the Project site. No significant impacts are considered likely to occur to the TECs present within the Project site because no clearing of native vegetation is proposed. Track slewing would be undertaken in close proximity to the known TEC locations however these works include upgrades to the track within the centre of the rail corridor and the known TEC locations are located at the edges of the rail corridor.

#### *Threatened flora*

No threatened flora species were identified during the site inspections.

One flora species, *Acacia flocktoniae* (Flockton Wattle), is considered likely to occur within the vicinity of the Project site. A population of this species is actively conserved within the Blue Mountains National Park. As the Project site sits outside of the Blue Mountains National Park, the Project would not impact on any known habitat of that population. The potential for such impacts were considered further within an assessment of significance (seven part test). The significance assessment showed that no impact is considered likely because no clearing of native vegetation is proposed for the Project.

#### *Threatened fauna*

All of the threatened fauna species are highly mobile and are likely to preferentially use fauna habitat in the adjacent Blue Mountains National Park. Assessments of significance (seven part tests) were conducted for threatened fauna that were likely to occur in the Project site. Impacts upon these species as a result of the Project are not considered to be significant because the Project would not affect any declared critical habitat and no clearing is anticipated.

During construction, the Project would involve the movement of plant, machinery and heavy and light vehicles on a regular basis, as such there is the potential for direct interactions/collisions between these items and native fauna. The potential for such interactions is however considered to be low on the basis that the high amount of human activity in these areas is likely to discourage the presence of most mobile fauna in the immediate vicinity whilst works are active.

### Disturbance of bat species

The works are unlikely to affect the majority of the existing structures; however the presence of the works, the introduction and presence of noise, vibration, light and site personnel may temporarily disturb their roosting areas, compared with current level of disturbance. The potential for impacts to the four bat species are detailed in Table 29. In the absence of specific bat data identifying the categorical presence of bats it is assumed that they are present. This assumption leads to a temporary but potentially adverse impact for these species, depending on the age and maturity of the bats and their ability to find alternative roosts for the period of disturbance. As the works would largely be undertaken during 48 hour possession periods, temporary disruption to roosting areas may occur, however the potential for impact has been assessed as low. During breeding, bat species would be more sensitive to disturbance. Mitigation measures provided identify potential measures that can lower the impacts to be acceptable.

**Table 29 Potential for impacts upon threatened fauna with a high likelihood of occurrence**

Scientific name	TSC Act	EPBC Act	Likelihood of occurrence	Potential for impact
<i>Calyptorhynchus lathamii</i> Glossy Black-Cockatoo	V	-	Likely	None-low. There are no areas proposed to be cleared that contain large hollow-bearing trees. There is the potential for activities to occur within areas where large hollow-bearing trees occur, though these are not to be cleared, some disturbance may be experienced if occurring between March and August.
<i>Cercartetus nanus</i> Eastern Pygmy-possum	V	-	Likely	None. There would be no removal of areas of important habitat for this species ( <i>Banksia</i> dominated scrub).
<i>Eulamprus leuraensis</i> Blue Mountains Water skink	E	E	Likely	None. The Project would have no impacts upon habitat for this species (naturally fragmented and permanently wet sedge and shrub swamps with boggy soils).
<i>Miniopterus australis</i> Little Bentwing-bat	V	-	Likely	Low. This species occurs in moist eucalypt forest, rainforest or dense coastal banksia scrub. Little Bentwing Bats roost in caves, tunnels and sometimes tree hollows during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.
<i>Chalinolobus dwyeri</i> Large-eared Pied Bat	V	V	Likely	Low. Roosts in disused mine shafts, caves, overhangs and disused Fairy Martin nests for shelter and to raise young. Also potentially roost in tree hollows. Occurs in low to mid-elevation dry open forest and woodlands, preferably with extensive cliffs, caves or gullies. Pied Bat is largely restricted to the interface of sandstone escarpment (for roost habitat) and relatively fertile valleys (for foraging habitat).
<i>Myotis macropus</i> Southern Myotis	V	-	Likely	Low. This species generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage. They forage over streams and pools catching insects and small fish by raking their feet across the water surface.

Scientific name	TSC Act	EPBC Act	Likelihood of occurrence	Potential for impact
<i>Miniopterus schreibersii oceanensis</i> <i>Eastern Bentwing-bat</i>	V	-	Likely	Low. Caves are the primary roosting habitat, but also use derelict mines, stormwater infrastructure, buildings and other man-made structures. They form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. This species tends to hunt in forested areas.

Note: CE – Critically Endangered, E – Endangered, V – Vulnerable

### *Migratory birds*

A total of 12 migratory species were identified in the desktop assessment. Under the EPBC Act, an action is likely to have a significant impact on migratory species if it substantially modifies, destroys, or isolates an area of important habitat for the species. The isolated areas of habitat within the Project site are unlikely to be considered important habitat as they do not contain:

- habitat used by migratory species occasionally or periodically within a region that supports an ecological significant proportion of the population of the species
- habitat that is of critical importance to the species at particularly life-cycle stages
- habitat that is utilised by a migratory species which is at the limit of the species range
- habitat within an area where the species is declining.

Given the above, the Project is deemed unlikely to result in significant impacts upon individuals or habitat of migratory species.

### *Other biodiversity impacts*

Construction activities, unless appropriately managed, can lead to a number of other impacts to biodiversity, including:

- increased potential for the spread of weeds if not adequately controlled
- uncontrolled runoff in cleared areas may result in offsite sedimentation impacts through a reduction in water quality, with the potential to affect local flora and fauna
- additional noise, vibration and light sources during construction can have varying effects on fauna in the Project site particularly nocturnal species. Impacts would be highly localised (within 100 metres) and temporary (up to 48 hours per possession)
- potential impacts from the generation of dust in prolonged periods
- potential impacts from contaminant pollution through inappropriate management/handling of fuels, solvents and other potentially hazardous materials.

### **Operation**

Operation of the Project is not expected to impact on any threatened communities, flora or fauna.

### 6.7.3 Mitigation measures

The Project site is an active operational area, so to the extent that is safe and practicable, consideration should be given to implementing the management measures in Section 7.2 to protect and enhance existing ecological assets and values. These measures have been determined with view primarily to protecting potential threatened species habitat within the Project site. Measures are largely set out to protect threatened fauna and habitat, native flora and habitat as well as control the spread of weeds and disease.

Refer to Section 7.2 for a full list of mitigation measures.

## 6.8 Soils and water

### 6.8.1 Existing environment

#### Landform

The Project site generally follows a ridge line which forms a boundary between several catchments, all of which ultimately flow to the Hawkesbury-Nepean River. From Faulconbridge to Medlow Bath the ridge line separates the Grose River catchment to the north from the Lake Burragorang catchment to the south. From Medlow Bath to Lithgow the ridge line separates the Grose River catchment to the north from the Coxs River catchment to the south.

The Project site predominantly keeps to the very upper reaches of each catchment. However in several locations it is low enough in the catchment to cross small waterways. Within the Project site, the corridor crosses around 25 small waterways, mainly around the city of Lithgow, to the eastern side of Zig Zag Station and the eastern side of Wentworth Falls. Four of these are named waterways; Ida Falls Creek in Lithgow, Lithgow Valley Gully and Dargans Creek in Clarence and Jamison Creek in Wentworth Falls.

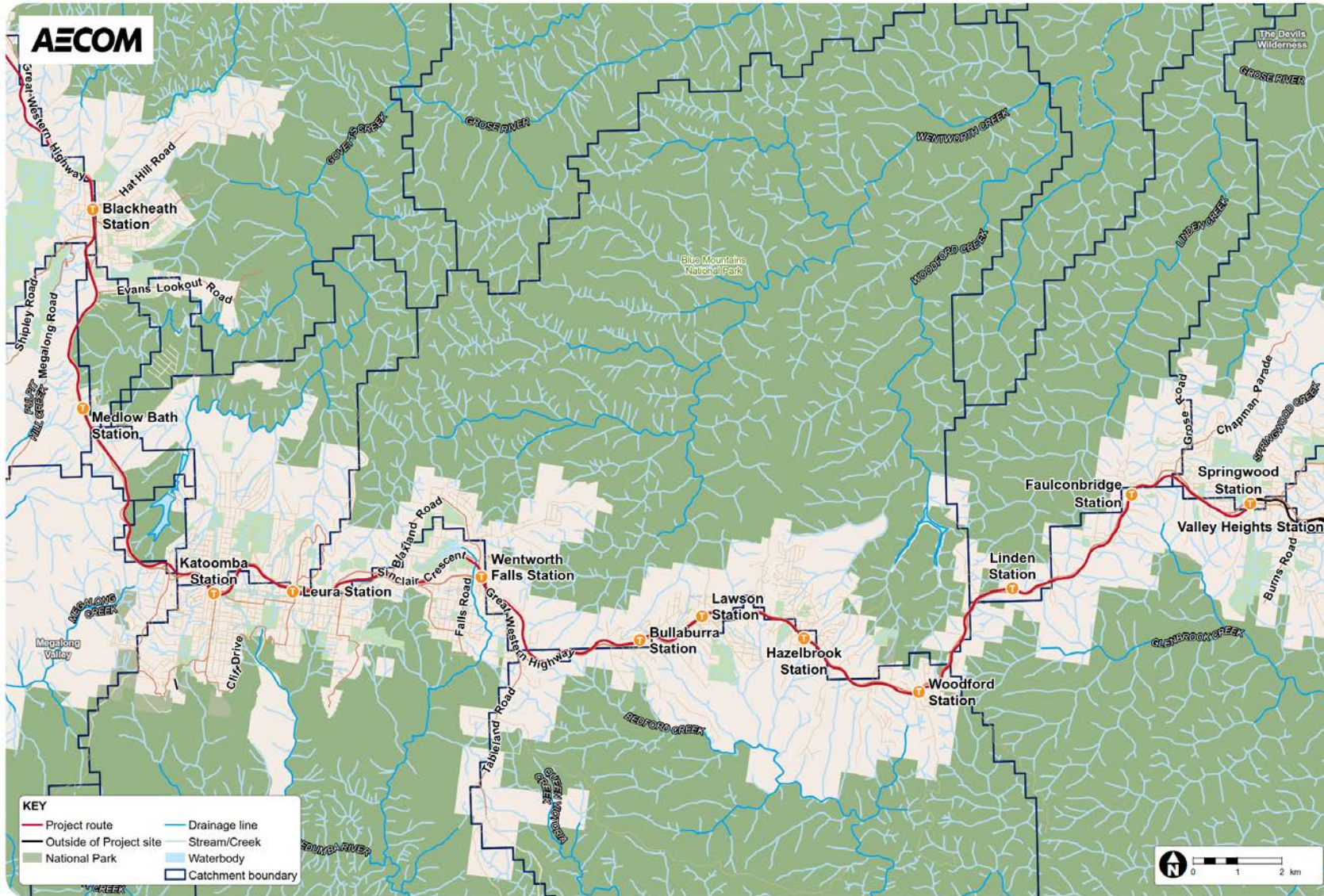
The catchments in the Project site are characterised by steep topography, and large areas of natural bushland interspersed with low density residential areas. Much of the Blue Mountains area lies within SEPP (Sydney Drinking Water Catchment) 2011 drinking water catchments. Hydrologic features can be seen in Figure 15 and Figure 16.

The area immediately surrounding the Project site is a mountainous sandstone region creating steep topographic features.

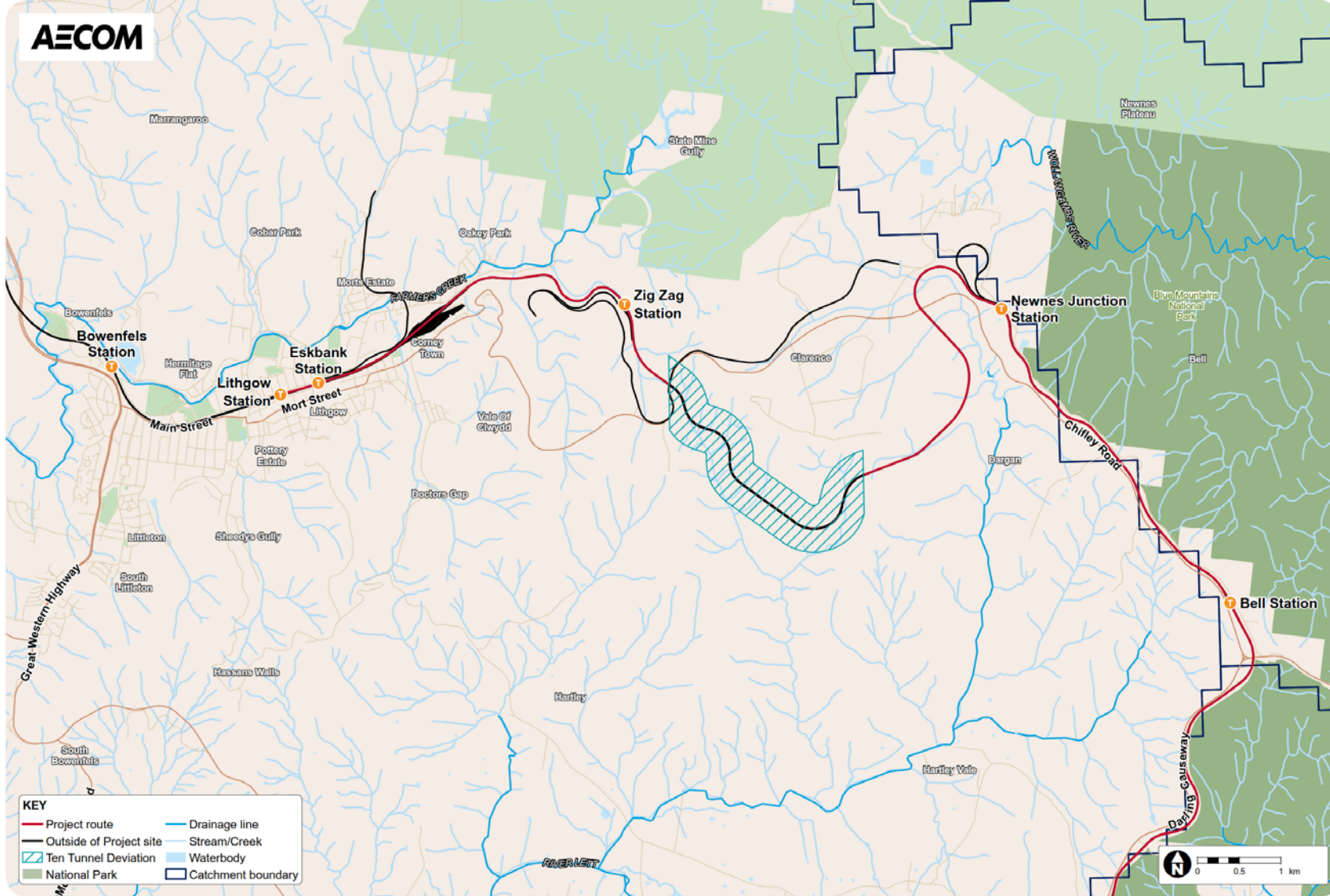
#### *Hydrogeology and groundwater*

Registered groundwater bore information was obtained from the NSW Department of Primary Industries - Office of Water and the Bureau of Meteorology Australian Groundwater Explorer online database.

Based on a review of available groundwater bore search data, shallow groundwater is anticipated to be present on-site between 0.6 and 2 metres below ground level within fill or 1.5 to 10 metres below ground level in natural materials comprising clayey gravel, clay or silty clay and at depth within shale and sandstone. Based on the drillers logs shale and sandstone appear to be present at depths ranging from one to 18 metres below the ground.



**Figure 15 Hydrologic features (part 1 of 2)**



**Figure 16 Hydrologic features (part 2 of 2)**

## Geology and topography

The rail corridor follows a relatively steep and winding path. The landscape features adjacent to parts of the corridor mean some sections of track are constructed with cuttings, tunnels, bridges, embankments or other structures. By following the ridge line the corridor generally avoids crossing waterways and major overland drainage paths.

The alignment of the Project site overlies Triassic age sedimentary beds of the Grose Subgroup. The *Katoomba 1:50,000 Geological Sheet* (Geological Survey of NSW, 1983) describes these beds as quartz sandstone, slightly lithic, with minor interbedded claystone.

## Soils

The Project is underlain by two soil landscape groups as summarised in Table 30.

**Table 30 Soil landscape summary**

Area	Regional geology
Lithgow	<p>Lithgow residual soil landscape</p> <ul style="list-style-type: none"><li>The Lithgow soil landscape is characterised by flat to undulating rises and broad valleys on the Illawarra Coal Measures and the Berry Formation. Local relief is typically less than 20 metres and slope gradients less than 10 per cent.</li><li>Soil profiles are typically moderately deep (&lt;120 centimetres) with dominant soils comprising sandy loam and clay loam. A horizons overlying medium clay. Potential limitations include localised mine subsidence and localised rock fall hazard.</li></ul>
Katoomba	<p>Banks Wall Sandstone of the Triassic Period</p> <ul style="list-style-type: none"><li>The Medlow Bath residual landscape is characterised by narrow crest and moderately inclined sideslopes on Narrabeen Group sandstones. Landforms include gently undulating to rolling rises and low hills on sandstone plateau surfaces. Local relief is typically 20 to 50 metres and slope gradients 10 to 20 per cent.</li><li>Soil profiles are typically moderately deep (&lt;100 centimetres) with dominant soils comprising sand and loamy sand A horizons overlying clayey sand. Potential limitations include stony acid soils, moderate erodibility and localised rock outcrops. Foundation hazard is generally low.</li></ul>

Source: eSPADE website, Penrith, Sydney and Wallerawang 1:100,000 soil landscape sheets

The level 5 Australian Soil Classification Soil Order describes the predominant soil features of Medlow Bath (mb), Warragamba (wb), and Wollangambe (wo) as Tenosols, Dermosols, and Tenosols, respectively. Tenosols have a weakly developed soil profile with poor soil retention, poor structure, and infiltration in these soils can range from rapid for sandy soils to slow for hardsetting or clay soils. On steep slopes, the erosion risk would be high with soil creep and water erosion as potential risks. Sandy soils are highly susceptible to soil creep, sheet and rill erosion.

Dermosols are structured soils with free drainage. Hardsetting surfaces can result in large quantities of surface runoff, causing erosion. These soils generally have a slightly acid to neutral surface pH, grading to neutral and moderately alkaline pH in the subsoil. Generally, these soils are non-sodic and hence non-dispersive, and present a lower erosion risk.

The Australian Soil Resource Information System (ASRIS, 2014) indicates that the Project site has a low to extremely low probability of acid sulfate soil occurrence.

## Flooding

Two known flood studies in the vicinity of the rail corridor have been carried out: the *Jamison Creek Flood Study, Floodplain Risk Management Study and Plan* (Cardno Willing, 2005) at Wentworth Falls and the *Lithgow Floodplain Management Study* (Greater Lithgow City Council, 1992). The latter study is soon to be updated as part of a more recent review of flooding at Lithgow and surrounding areas. However, detailed flooding investigations have not

been undertaken within all built up areas along the Project site, primarily because flood risk is low due to the proximity to the regional ridge line along the length of the Project site.

### **Local drainage**

There are a number of minor drainage structures and stormwater networks in the vicinity of and under the Project site. The structures and networks generally drain away from rail infrastructure (platforms, tracks, equipment, etc.) to local streams, creeks and channels to the Grose River, Lake Burragorang and Cox's River catchments, depending on location. These three catchments all ultimately drain into the Hawkesbury-Nepean River.

### **Existing water quality**

The existing water quality in the Blue Mountains is relatively good with the majority of waterways in the Blue Mountains City Council's 2015-2016 *Waterways Health Report* classified as being in good or excellent health. There is regular testing of Blue Mountains waterways with the health classification based on aquatic fauna metrics, the levels of salts, nitrogen, phosphorus and bacteria, the turbidity and the levels of dissolved oxygen.

The area south and west of the Project site drains to the drinking water catchments of the Coxs River and Lake Burragorang. Besides the importance of preserving aquatic ecosystems, waterway health, and visual amenity, there are also a variety of uses for water bodies such as Megalong Creek, Yosemite Creek and Wentworth Falls Lake that include primary contact recreation, secondary contact recreation and aquatic foods.

### **Contamination**

A preliminary assessment of contamination was undertaken to assess the potential for contamination to be present at the Project which may present a risk to workers and/or the environment during the construction and operation of the Project.

Based on the review of available information, potentially contaminating activities which may impact on the Project during the construction and operational phase of work have been identified and are described Section 6.8.2.

Activities of potential environmental concern and contaminants of potential concern are identified in Table 31. Considering historical use of the Project site as a rail line, the area of concern for these activities incorporates the entire length of the Project site.



**Table 31 Activities of potential environmental concern and contaminants of potential concern**

Activity of environmental concern	Contaminants of potential concern	Relevance to the site
Use of the Project site for rail purposes including platforms – historical use of fuel, grease and chemical for train and station maintenance, possible presence of asbestos in old structures and train brake pads, solvents used in grease	Asbestos, Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethylbenzene, Xylene (BTEX), Polycyclic Aromatic Hydrocarbons (PAHs), Volatile Organic Compounds (VOCs), Volatile Halogenated Compounds (VHCs), metals	Potential for contamination in surface soils due to current use of the site as an active rail facility. Low to medium risk of encountering contamination during the works.
Use and weathering of hazardous materials, such as asbestos-containing fibre-cement building materials and lead based paints, in buildings within and adjacent to the Project including platforms	Asbestos, lead	Potential for contamination in buildings along the rail alignment and at stations. Works with potential to disturb structures should consider potential to encounter contamination.
Storage and use of pesticides, fuels and /or other agricultural chemicals on rural land within and adjacent to the Project site	Metals, Organo-chlorine and Organo-phosphorus Pesticides (OCPs and OPPs), herbicides, pesticides, TPH, BTEX, PAHs, VOCs, VHCs	Excavation works aren't anticipated to encounter groundwater therefore it is unlikely that these contaminants of concern will be encountered during the works.
Use of fill of unknown origin along the rail line and on adjacent land	TPH, BTEX, PAHs, OCPs, OPPs, Polychlorinated Biphenyl (PCBs), metals, herbicides, pesticides, asbestos	Potential for contamination in surface soils and fill materials located in railway sidings due to the current use of the site as an active rail facility. Low to medium risk of encountering contamination during the works.
Localised disposal or burial of waste materials on rail land	TPH, BTEX, PAHs, PCBs, OCPs, OPPs, metals, herbicides, pesticides, asbestos	Potential for contamination in surface soils and fill materials located in railway sidings due to the current use of the site as an active rail facility. Low to medium risk of encountering contamination during the works.
Spillage of fuel, oil, and potentially hazardous loads from trains and carriages	TPH, BTEX, PAHs, metals	Excavation works aren't anticipated to encounter groundwater therefore it is unlikely that these contaminants of concern will be encountered during the works.

## 6.8.2 Potential impacts

### Construction

The proposed works and construction compound locations are presented in Section 3.2. During construction, activities that would disturb soil have the potential to affect local water quality through erosion and sedimentation. The following construction phase activities have been identified as potentially affecting soils and water:

- Excavation works would expose the underlying soil, increasing the risk of soil being entrained in water runoff and subsequent erosion. This could transport sediment downstream and into adjacent waterways.
- Construction activities may directly impact the underground stormwater network, track drainage and alter surface water runoff flows. However, existing drainage points would be protected during construction to minimise risk of damage to the existing infrastructure during ground disturbing works.
- Pollutants (such as fuel, chemicals, sediments or wastewater) could enter into the stormwater network and/or track drainage, or flow into waterways without appropriate safeguards such as covering stockpiles and the provision of adequate bunding.
- Activities disturbing the soil/ground during construction works may affect local water quality through the release of sediments as a result of erosion. Entrained sediments have the potential to increase turbidity, and this could reduce photosynthetic productivity, reduce channel habitat from sediment deposition and contaminate surface water.
- Establishment of the construction sites may include materials delivery, where materials are stockpiled onsite. This may result in pollutants/particles from these materials leaching into the local water system.
- Track slewing and replacement of crossovers could temporarily affect the local hydrology/flow paths and result in sediments being discharged to the drainage network.

However, given the minor nature and extent of construction at each site, these impacts are considered unlikely to significantly impact soils and water quality at each site.

Track works at Bell Station and Eskbank Station would involve the removal of the existing tracks, ballast and foundation, re-positioning and replacing the track and replacing ballast, sleepers, footings and foundations where appropriate. There would also be minor excavation at Lawson Station, Hazelbrook Station and Woodford Station for signal works and Lithgow Station and Katoomba Station for the platform extensions.

The proposed construction compounds may be used for minor volumes of concrete batching or storage of construction materials, chemicals or fuel. These materials may impact on surface water if not contained and are otherwise transported offsite. This would be particularly important to manage in drinking water catchments. The stations from Wentworth Falls to Lithgow reside within the Coxs River or Lake Burragarang drinking water catchment and both Hazelbrook Station and Woodford Station are in the Lake Woodford drinking water catchment.

As shown in Figure 15 and Figure 16, works at Woodford Station, Hazelbrook Station, Wentworth Falls Station, Leura Station, Blackheath Station, Bell Station, Newnes Junction Station, Eskbank Station and Lithgow Station fall within a drinking water catchment. Since areas of the Project site lie within drinking water catchments, Water NSW requires that any impacts from the Project must result in a neutral or beneficial effect (NoRBE) on water quality. This includes an assessment of the adequacy of the mitigation methods and safeguards to be implemented. The NoRBE assessment (Appendix D) determined that the Project would have a neutral effect on water quality.

### *Contamination assessment*

Construction activities involving any ground disturbance works would require the disturbance of contaminated soils and/or hazardous materials.

Excavation and ground disturbance activities associated with the proposed works, while likely to only involve minor volumes of soil and other fill material, have the highest potential to expose in ground contamination, which if not appropriately managed, can present a health risk to construction workers and the community. Contaminants would also pose an environmental risk if they were to enter nearby waterways through the stormwater infrastructure.

There is also a potential for project construction activities to result in the contamination of soil through accidental fuel or chemical spills from construction plant and equipment.

The proposed modifications and upgrades to infrastructure have the potential to disturb asbestos containing materials and other hazardous substances such as lead paint, which may be present in the ground and in existing structure.

### **Operation**

The operational phase would include the ongoing use and maintenance of the rail line and associated infrastructure including station platforms. Ongoing maintenance activities could result in localised soil and water contamination through the use of potentially contaminating substances such as oils, grease, pesticides and herbicides and through the disturbance of hazardous materials including asbestos containing materials as part of ongoing maintenance works. There is a low likelihood of contaminant concentrations caused by operational impacts exceeding the relevant site assessment criteria. Additionally, any impacts are likely to be limited in extent.

The Project would not result in major changes to impervious areas at any location. Therefore there would not be an increase in stormwater runoff volumes or peak flows due to the works during operation. No drainage works are proposed. The capacity of the existing drainage network is not expected to be impacted by the Project.

#### **6.8.3 Mitigation measures**

A number of measures have been developed to address impacts to soil and water, and to reduce the risk of encountering contamination. This includes the preparation and implementation of a site-specific Erosion and Sediment Control Plan for each site in accordance with the 'Blue Book' - *Managing Urban Stormwater: Soils and Construction Guidelines* (Landcom, 2004).

Other measures to mitigate potential impacts from any contaminated soil/materials during construction would be developed and implemented through an unexpected contamination finds procedure and Waste Management Plan as part of the CEMP. An environmental risk assessment would be undertaken as part of the CEMP and would include a section on contamination. Chemical testing and visual characterisation would also be undertaken to confirm the suitability of the material for offsite disposal or reuse. Impacts and mitigation for waste is discussed in Section 6.10.1.

Refer to Section 7.2 for a full list of mitigation measures.

## 6.9 Air quality

A risk assessment was undertaken to assess potential dust impacts resulting from the Project. The assessment was undertaken in accordance with methodology described in the UK Institute of Air Quality Management's (IAQM) *Guidance on the assessment of dust from demolition and construction* (IAQM, 2014). The risk of dust and human health impacts were determined based on the scale of activities and proximity to sensitive receivers using the following four-step process:

- Step 1: screening based on distance to nearest sensitive receptors
- Step 2: assessing the risk of dust impacts from activities based on:
  - the scale and nature of the works, which determines the potential dust emission magnitude
  - the sensitivity of the area
- Step 3: determining site-specific mitigation for dust-emitting activities
- Step 4: reassessing the risk of dust impacts after mitigation has been considered.

Due to the large number of receivers adjacent to the Project site, only areas with the highest risk of dust impacts (i.e. those areas with the largest amount of earthworks and nearby sensitive receptors) were selected to provide a conservative worst case scenario.

### 6.9.1 Existing environment

There are a mixture of land uses surrounding the Project site, however much of the surrounding land contains remnant bushland that forms part of the Blue Mountains National Park. Other land uses in close proximity to the Project site include numerous residential centres at Hazelbrook, Lawson, Wentworth Falls, Leura, Katoomba, Blackheath, Eskbank and Lithgow Stations.

Results obtained from the closest EPA monitoring stations at Bathurst (about 60 kilometres west of Lithgow) and Richmond (about 20 kilometres north east of Faulconbridge) indicate that the average concentrations of PM<sub>10</sub> are fairly similar between the two stations, and below the 24-hour average criteria level as shown in Table 32. This coincides with similar land uses in both areas, characterised by a mix of agriculture, light commercial and residential areas. However, considering the Project site is situated at a higher elevation, and is predominantly residential land use, the concentrations of PM<sub>10</sub> are likely to be slightly lower than Bathurst or Richmond.

**Table 32 average PM<sub>10</sub> concentrations in the vicinity of the Project site**

Location	Average 24-hour PM <sub>10</sub> (µg/m <sup>3</sup> ) 2012 - 2016
Bathurst	14.0
Richmond	15.3

### Sensitive receivers

Sensitive receivers were identified for further assessment where they are located within close proximity to dust generating works and would be exposed to potential dust emissions for more than eight hours per day (e.g. residences, hospitals, schools or aged care homes).

A number of sensitive receivers within 20 metres from the Project site at Hazelbrook Station and Lithgow Station in close proximity to proposed construction works where there is likely to be a medium risk of dust impacts. Earthworks would be required at Hazelbrook Station where excavation of around two cubic metres of material is required for the installation of

underground cables and relocation of track circuits. Similarly, the platform extension at Lithgow Station would involve dusty construction material (concrete). No sensitive receivers were identified within 20 metres of the other stations within the Project site.

## 6.9.2 Potential impacts

### Construction

The main pollutant of concern for the Project is related to particulate matter emissions, specifically those with an aerodynamic diameter of less than 10 micrometres ( $\mu\text{m}$ ), referred to as  $\text{PM}_{10}$ . Particles of this size can enter the pulmonary regions of the respiratory tract.

The Project may also generate other emissions such as odour, exhaust emissions and asbestos fibres. Refer to Section 6.8 for further detail on the potential presence, and likelihood of disturbance of contamination (including asbestos) in the Project site during construction.

The outcome of the qualitative air quality risk assessment indicated that the Project is considered to pose a medium risk for nuisance dust impacts at Hazelbrook Station and Lithgow Station due to the proximity of sensitive receivers to the works, a low risk for nuisance dust impacts at all other locations, and a negligible risk of human health impacts from dust impacts (i.e.  $\text{PM}_{10}$ ) at all locations.

While the platform extension at Katoomba Station would also require use of construction materials with potential for dust generation, the overall sensitivity to human health and dust soiling impacts was classified as low due to the distance of sensitive receivers from the Project site.

However, following the implementation of mitigation measures outlined in Section 7.2, the Project is unlikely to result in significant impacts on sensitive receivers.

### Other emissions

There is a potential for the Project to result in odour, exhaust emissions and asbestos fibres. Potential asbestos fibres would typically be associated with works at the platforms and at earthworks areas along the Project site and largely located away from sensitive receivers. Based on the nature of works, these impacts are likely to be minor and temporary provided the measures outlined in Section 7.2 are implemented effectively.

### Operation

Overall impacts on air quality during the operation of the Project are considered minimal as the Project would not result in a change in land use.

## 6.9.3 Mitigation measures

Mitigation measures aimed at reducing the likelihood of emissions from vehicles. Plant and equipment have been developed in accordance with TfNSW's *Air Quality Management Guideline* (2015h). Section 7.2 provides a full list of mitigation measures proposed to manage air quality issues during construction. The measures are largely aimed at maintenance of vehicles and equipment and co-ordinating vehicle and plant movements, and implementing measures for dust suppression including watering, covering loads and progressive rehabilitation of exposed areas.

In addition to the measures outlined in Section 6.8.3, potential asbestos would be managed in accordance with the following relevant guidelines:

- *How to Safely Remove Asbestos Code of Practice* (Safe Work Australia, 2016a)
- *Code of Practice for the Safe Removal of Asbestos 2nd Edition* (NOHSC: 2002 (2005))
- *The National Model Work Health and Safety Regulations* (Safe Work Australia, 2016b).

If asbestos is encountered during the construction, works in that location would cease and a suitably licenced asbestos removal contractor would be engaged to remove, transport and dispose of the materials in accordance with the *Work Health and Safety Regulation 2011*.

## 6.10 Other impacts

### 6.10.1 Waste

The Project would require a wide range of materials during construction including steel, bricks, pavers, paints, concrete, ballast, cabling and timber. Opportunities to use recycled and sustainable building materials would be considered at the detailed design and procurement stage, where practicable and feasible to do so.

During construction, the Project would generate various types of waste. Typical types of waste that may be generated by the Project would include:

- asphalt and concrete
- excavated spoil
- building material wastes (including, glass, metals, timbers, plastics, packaging, fencing etc.)
- electrical wiring and conduit waste (from electrical connections)
- waste from the removal of overhead wiring system structures (steel supports and metal cabling)
- potential asbestos and hazardous waste from earthworks
- general litter, including food scraps generated by construction workers
- liquid waste such as oils and chemicals from equipment maintenance, in addition to sewage from construction site facilities.

Appropriate planning of construction activities would ensure that the volume of surplus materials is minimised. Where possible, surplus materials and construction waste would be reused or recycled. Construction waste associated with the Project would be managed in accordance with the *Waste Avoidance and Resource Recovery Act 2001* and any offsite disposal of waste would be classified in accordance with the *Environmental Protection Authority's Waste Classification Guidelines Part 1: Classifying waste* (NSW EPA, 2014).

The operation of the Project is not anticipated to result in changes to current operational waste outputs.

A Waste Management Plan would be prepared as part of the CEMP. Construction waste would be managed through the waste hierarchy established under the *Waste Avoidance and Resource Recovery Act 2001*. In addition, the handling, storage, transport and disposal of any asbestos and hazardous waste that may be encountered during construction, would be in accordance with the requirements of the *Protection of the Environment Operations Act 1997* (POEO Act), *Waste Avoidance Resource Recovery Act 2001* (WARR) and relevant guidelines.

Refer to Section 7.2 for a full list of mitigation measures.

## 6.11 Cumulative impacts

Cumulative impacts occur when two or more projects are carried out concurrently and in close proximity to one another. The impacts may be caused by both construction and operational activities and can result in a greater impact to the surrounding area than would be expected if each project was undertaken in isolation. Multiple projects undertaken at a similar time/similar location may also lead to construction fatigue, particularly around noise, traffic and air quality impacts, if not appropriately managed.

### 6.11.1 Existing or potential projects

A search of the Department of Planning and Environment's Major Projects Register, Joint Regional Planning Panel Development and Planning Register, and Blue Mountains and Lithgow Council's Development Application Registers for the Blue Mountains and Lithgow local government areas between 5 and 15 May 2017 identified a number of developments within one kilometre of the Project site. These are outlined in Table 33. In addition, proposed and current Sydney Trains and TfNSW projects were also considered.

**Table 33 Development within proximity to the Project site**

Register	Development	Timing/status	Location in relation to the Project site
Major Projects Register	Extension of the underground Clarence Coal Mine into a number of new mining lease areas primarily to the west of the existing mine	The project was approved on 19 December 2005	Beneath the Project site at Newnes Junction Station. The Project site forms part of a subsidence protection zone for the mining activities
	Two modifications to the extension of the Clarence Coal Mine involving the establishment of a new reject replacement area and upgrade of the effluent irrigation system, increase in employed personnel, and redirection of road haulage routes via Mount Victoria and the Great Western Highway through Lithgow	The project was approved 17 June 2014	About 250 metres from the Project site near Newnes Junction Station at Clarence Colliery (accessed off Clarence Colliery Road)
	Development of a sand and kaoline mine (Newnes Kaolin Mine)	The project was approved 14 March 2006	Immediately adjacent to the Project site at Newnes Junction Station. Some of the site is located within the Project site.
Joint Regional Planning Panel Development and Planning Register	Demolition and reconstruction of a new multi-dwelling 55 unit residential development and hotel conversion to 17 residential multi-dwelling units	The project has been registered however no further information has been provide on the Joint Regional Planning Panel Development and Planning Register	About 20 metres south, of the Project site and around 230 metres east of Katoomba Station, at 2-10 Apex St, 5 Penault Ave, and 7-9 Penault Ave, Katoomba.
	Applications for redevelopment, alterations and additions to the Hydro Majestic Hotel	The project is not yet determined - Public determination meeting has been scheduled	Immediately west of the Project site, south of Medlow Bath Station at 52-88 Great Western Hwy, Medlow Bath

Register	Development	Timing/status	Location in relation to the Project site
	Part demolition of an existing civic centre building, construction a new civic centre and upgrade of the existing library and car park	The project was approved on 13 December 2012	Around 500 metres east of the Project site at 102 – 104 Macquarie Road Springwood
	Additions to existing retail development and additional car parking	The project was determined on March 2012 (Determination: Deferred Commencement Approval).	Around 300 metres south of Katoomba Station at 30-34 Waratah St and 38-40 Parke St, Katoomba
	Retail development at Leura Mall	The project was approved on 11 March 2010	Around 100 metres south of Leura Station at 152-160 Leura Mall, Leura
	Part demolition of Cooinda Aged Care facility and construction of 144 beds, including earthworks, landscaping, and parking areas	The project was approved 18 April 2016	Around 300 metres south of the Project site, south east of Lithgow Station at Short St, Lithgow
TfNSW projects	Upgrade of Wentworth Falls Station including new lifts, canopies, improved station facilities and forecourts, extension of car park and new kiss and ride facilities	The project was approved and is currently under construction	Within the Project site at Wentworth Falls Station
	Upgrade of Leura Station including new lift and stairs, canopy, toilet facilities, taxi ranks and kiss and ride zone, and access paths and other facilities	The project was approved and is currently under construction	Within the Project site at Leura Station

In addition to the above, a search has been undertaken to determine local developments being undertaken within the vicinity of the Project site. This involved searches of development applications currently on exhibition on the Blue Mountains City Council Development Application Register and developments submitted within the last 28 days on the City of Lithgow Council Development Application Register on 15 May 2017.

The searches identified numerous developments on exhibition within the vicinity of the Project site. These primarily involved alterations or additions to existing developments, aside from a new residential development and filling in part of a dam at 92 Railway Parade, adjacent to the Project Site at Medlow Bath Station.

Potential cumulative impacts may occur as a result of construction activities occurring simultaneously with other construction works in the area. Potential impacts could include:

- increased traffic within the road network surrounding the Project site and associated delays for road users
- increased construction noise and vibration levels
- increased dust
- reduced visual amenity.

In addition, the upgrade of Leura Station would result in minor to moderate impacts to the heritage significance of the station (GHD, 2016). The upgrade of Wentworth Falls Station



would result in only negligible to minor impacts on the heritage significance of the station as the works are limited to already modified items.

There is a potential for the Project to result in further heritage impacts to both Leura Station and Wentworth Falls Station as a result of the platform modifications. However, considering visual impacts and impacts to fabric resulting from the Project are likely to be negligible at both of these stations, the Project is unlikely to result in cumulative impacts in conjunction with the station upgrade projects. The Project is also unlikely to result in any visual impacts to heritage items adjacent to the Project Site.

Considering the minor and temporary nature of the works at each section of the Project site, and that the majority of works would be undertaken during scheduled rail possessions, the cumulative impacts would likely be negligible, provided that mitigation measures in Section 7.2 are implemented. In addition, some of the works would be restricted to rail possessions outside standard working hours, and are therefore unlikely to coincide with other construction activities in the surrounding area aside from maintenance works to be undertaken along the rail line during the scheduled possessions.

**6.11.2 Mitigation measures**

The potential cumulative impacts associated with the Project would be further considered as the design develops and as further information regarding the location and timing of potential developments is released. Environmental management measures would be developed and implemented as appropriate.

Consultation with relevant stakeholders including Blue Mountains and Lithgow councils would also be undertaken during construction planning where required, to consider potential cumulative impacts and implement measures required to minimise these impacts.

**6.12 Climate change and sustainability**

**6.12.1 Greenhouse gas emissions**

Greenhouse gas emission sources associated with the Project can be categorised into three types depending on the source of the emissions as outlined in Table 34.

**Table 34 Greenhouse gas emission categories**

<b>Emission Scope</b>	<b>Definition</b>
<b>Scope 1</b>	Direct emissions generated by the Project
<b>Scope 2</b>	Indirect emissions from electricity use generated offsite
<b>Scope 3</b>	Emissions generated during the production of materials used onsite or disposal and maintenance materials

Direct greenhouse gas emissions, primarily carbon dioxide, would be expected during construction of the Project as a result of combustion of fuel in construction equipment and vehicles used to transport materials and personnel to and from site.

The anticipated indirect greenhouse gas emissions would result from:

- electricity used onsite during construction for construction compounds and equipment (generated at a power station offsite)
- disposal and decomposition of waste generated from construction work and staff
- emissions used in the production of materials used on site such as steel and concrete.

The volume of greenhouse gas emissions generated during construction would depend on both the type and quantity of construction equipment, vehicles and materials used.

Due to the small scale of the Project and the short-term temporary nature of the individual construction works, it is considered that greenhouse gas emissions resulting from the construction of the Project would be minimal.

Once operational, the Project would not result in any greenhouse gas emissions, as greenhouse gas emissions would be primarily associated with the operation and maintenance of the new fleet.

The Project may also result in an increase in use of public transport and a relative decrease in use of private motor vehicles by commuters and visitors travelling to and from the Blue Mountains and Lithgow local government areas. A modal shift in transport usage may reduce the amount of fuel consumed by private motor vehicles with a corresponding relative reduction in associated greenhouse gas emissions in the local area.

### **6.12.2 Climate change**

The dynamic nature of our climate system indicates a need to focus attention on how to adapt to the changes in climate and understand the limitation of adaptation.

The NSW Office of Environment and Heritage describes the climate of the Sydney Basin (where a majority of the Project is located) as temperate climate, characterised by warm summers and no dry season (OEH, 2016). However the area around the Blue Mountains falls into a mountainous climate zone, where snow occasionally occurs. Rainfall occurs throughout the year, with wetter areas situated closer to the coast or in higher altitude, such as the area where the Project is situated.

The NSW Climate Impact Profiles (DECCW, 2010b) and Impacts of Climate Change on Natural Hazards Profile – Western Region (DECCW, 2010c) suggests that projected climate change for the Sydney/Coast and Western regions (as representative of the Project site) by 2050 is anticipated to involve:

- increases in daily maximum temperatures by up to three degrees Celsius
- increases in summer rainfall by up to 50 per cent, and a 10 to 20 per cent reduction in rainfall during winter, and associated increases in runoff during summer and autumn
- changes to El Niño – Southern Oscillation (ENSO) cycle.

Impacts on infrastructure resulting from the projected climate change (as a reflection of changes in natural hazards) may include:

- increases in average temperatures
- increase in fire frequency as a result of higher temperatures and changes to rainfall patterns, along with an increase in the number of very high – extreme fire days, and extension of the fire season
- increase in the incidence of flash flooding
- increase in the frequency and intensity of heatwaves due to higher temperatures.

Changes in climate that result in increases in the incidence of flash flooding are unlikely to affect the Project. Refer to Section 6.6 for more information on the potential for flooding to impact on the Project.

Climate change may also lead to an increase in frequency and severity in bushfires. A majority of the Project site is situated on land mapped as bush fire prone (NSW Government, 2017b), however the risk of asset damage from bushfires would be minimised through the implementation of measures outlined in Section 7.2 .

### 6.12.3 Sustainability

The design of the Project would be based on the principles of sustainability, including the incorporation of the *NSW Sustainable Design Guidelines – Version 3.0* (TfNSW, 2013) and TfNSW's Environmental Management System (EMS). These guidelines require a number of mandatory and discretionary initiatives to be applied. Refer to Section 3.1.3 for more information regarding the application of these guidelines.

Further positive impacts in relation to climate change and sustainability associated with the Project include encouraging a reduction in private vehicle use and increase the use of public transport services.

## 7 Environmental management

This chapter of the REF identifies how the environmental impacts of the Project would be managed through environmental management plans and mitigation measures. Section 7.2 lists the proposed mitigation measures for the Project to minimise the impacts of the Project identified in Chapter 6.

### 7.1 Environmental management plans

A CEMP for the construction phase of the Project would be prepared in accordance with the requirements of TfNSW's EMS. The CEMP would provide a centralised mechanism through which all potential environmental impacts relevant to the Project would be managed, and outline a framework of procedures and controls for managing environmental impacts during construction.

The CEMP would incorporate as a minimum all environmental mitigation measures identified below in Section 7.2, any conditions from licences or approvals required by legislation, and a process for demonstrating compliance with such mitigation measures and conditions.

### 7.2 Mitigation measures

Mitigation measures for the Project are listed below in Table 35. These proposed measures would minimise the potential adverse impacts of the Project identified in Chapter 6 should the Project proceed.

**Table 35 Proposed mitigation measures**

No.	Mitigation measure
<b>General</b>	
1.	Any modifications to the Project would be subject to further assessment and approval by TfNSW. This assessment would need to demonstrate that any environmental impacts resulting from the modifications have been minimised.
2.	A CEMP would be prepared by the Contractor in accordance with the relevant requirements of <i>Guideline for Preparation of Environmental Management Plans</i> , (Department of Infrastructure, Planning and Natural Resources, 2004) for approval by TfNSW, prior to the commencement of construction and following any revisions made throughout construction.
3.	A project risk assessment including environmental aspects and impacts would be prepared by the Contractor prior to the commencement of construction and documented as part of the CEMP.
4.	Site specific Environmental Controls Maps (ECMs) would be developed by the Contractor in accordance with TfNSW's <i>Guide to Environmental Controls Map</i> (TfNSW, 2015c) for approval by TfNSW, prior to the commencement of construction and following any revisions made throughout construction.
5.	Prior to the commencement of construction, all contractors would be inducted on the key Project environmental risks, procedures, mitigation measures and conditions of approval.
6.	Site inspections to monitor environmental compliance and performance would be undertaken during construction at appropriate intervals.
7.	Services relocation would be undertaken in consultation with the relevant authority. Contractors would mark existing services on the ECM to avoid direct impacts during construction.

No.	Mitigation measure
<b>Non-Indigenous heritage</b>	
8.	Works at stations listed on the State Heritage Register (Lawson, Katoomba, Medlow Bath, Blackheath, Eskbank and Lithgow stations) require approval under Section 60 of the <i>Heritage Act 1977</i> which would be sought from the Heritage Division. Works would be undertaken in accordance with the requirements of the Section 60 approvals.
9.	Works at Lawson Station require an exception under Section 139(1b) of the <i>Heritage Act 1977</i> be obtained prior to works commencing.
10.	A suitably qualified and experienced heritage conservation architect would be engaged to provide ongoing heritage and conservation advice throughout detailed design and any subsequent relevant design modifications. The nominated heritage conservation architect would provide specialist advice throughout the detailed design phase to ensure that the final design adheres to the Sydney Trains <i>Heritage Platforms Conservation Management Strategy</i> (Australian Museum Business Services, 2015).
11.	A physical membrane should be installed between the heritage listed platforms and the proposed extensions at Katoomba Station and Lithgow Station to ensure the protection of heritage brickwork in accordance with Strategy 9 of the <i>Heritage Platforms Conservation Management Strategy</i> .
12.	The concrete coping of the proposed platform extension and the mortar associated with the brick facade used in the works should adhere to Strategy 7 of the <i>Heritage Platforms Conservation Management Strategy</i> .
13.	It is recommended that investigations into the rendering of the length of the corbeled brickwork be undertaken, as appropriate and advised by the heritage conservation architect, to create a consistent presentation.
14.	For canopy modifications at Faulconbridge Station, it is recommended that the bolt heads used to attach the splice plates to the canopy rafters be matched in profile to those evident on the remainder of the canopy. They would be altered in diameter to ensure the new work is distinguishable from the original
15.	Archival recording would be undertaken at the State Heritage Register listed stations (Lawson Station, Katoomba Station, Medlow Bath Station, Blackheath Station, Eskbank Station and Lithgow Station) as described in the heritage assessments in accordance with the relevant NSW Heritage Council guidelines. These archival records and design plans for the proposed works should be lodged with Sydney Trains for their records.
16.	The CEMP would include procedures in accordance with TfNSW's <i>Unexpected Heritage Finds Guideline</i> (TfNSW, 2015) to manage activities in the unlikely event that intact archaeological relics or deposits are encountered during ground disturbing activities and construction works.
17.	A heritage induction would be provided to workers prior to construction, informing them of the location of known heritage items and guidelines to follow if unanticipated heritage items or deposits are located during construction.
18.	In the event that any unanticipated archaeological deposits are identified within the Project site during construction, the procedures contained in TfNSW's <i>Unexpected Heritage Finds Guideline</i> (TfNSW, 2015a) would be followed, and works within the vicinity of the find would cease immediately. The Contractor would immediately notify the TfNSW Project Manager and the TfNSW Environment and Planning Manager so they can assist in co-ordinating the next steps which are likely to involve consultation with an archaeologist and OEH. Where required, further archaeological work and/or consents would be obtained for any unanticipated archaeological deposits prior to works recommencing at the location.

No.	Mitigation measure
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<b>Indigenous heritage</b>	
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| 19. | If unforeseen Indigenous objects are uncovered during construction, the procedures contained in TfNSW's <i>Unexpected Heritage Finds Guideline</i> (TfNSW, 2015a) would be followed, and works within the vicinity of the find would cease immediately. The Contractor would immediately notify the TfNSW Project Manager and TfNSW Environment and Planning Manager so they can assist in co-ordinating next steps which are likely to involve consultation with an Aboriginal heritage consultant, the OEH and the Local Aboriginal Land Council. If human remains are found, work would cease, the site secured and the NSW Police and the OEH notified. Where required, further archaeological investigations and an Aboriginal Heritage Impact Permit would be obtained prior to works recommencing at the location. |
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<b>Noise and vibration</b>	
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| 20. | Prior to commencement of works, a Construction Noise and Vibration Management Plan (CNVMP) would be prepared and implemented in accordance with the requirements of the <i>Interim Construction Noise Guideline</i> (Department of Environment and Climate Change, 2009), <i>Construction Noise Strategy</i> (TfNSW, 2012b) and the <i>Noise and Vibration Impact Assessment</i> for the Project (AECOM, 2017). The CNVMP would take into consideration measures for reducing the source noise levels of construction equipment by construction planning and equipment selection where practicable.   |
| 21. | <p>The CNVMP would outline measures to reduce the noise impact from construction activities. Reasonable and feasible noise mitigation measures which would be considered, include:</p> <ul style="list-style-type: none"><li>• regularly training workers and contractors (such as at the site induction and toolbox talks) on the importance of minimising noise emissions and how to use equipment in ways to minimise noise</li><li>• avoiding any unnecessary noise when carrying out manual operations and when operating plant</li><li>• ensuring spoil is placed and not dropped into awaiting trucks</li><li>• avoiding/limiting simultaneous operation of noisy plant and equipment within discernible range of a sensitive receiver where practicable</li><li>• switching off any equipment not in use for extended periods e.g. heavy vehicles engines would be switched off whilst being unloaded</li><li>• avoiding deliveries at night/evenings wherever practicable, loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers and loading/unloading areas to be shielded if close to sensitive receivers</li><li>• no idling of delivery trucks, limit the speed of vehicles and avoid the use of engine compression brakes and delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible</li><li>• where possible reduce noise from mobile plant through additional fittings including residential grade mufflers, damped hammers and air parking brake engagement is silenced</li><li>• keeping truck drivers informed of designated vehicle routes, parking locations and acceptable delivery hours for the site</li><li>• selection of site access points and roads as far as possible away from sensitive receivers., planning traffic flow, parking and loading/unloading areas to minimise reversing movements within the site</li><li>• minimising talking loudly; no swearing or unnecessary shouting, or loud stereos/radios onsite; no dropping of materials from height where practicable, no throwing of metal items and slamming of doors.</li></ul> |

No.	Mitigation measure
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| 22. | <p>The CNVMP would include measures to reduce the construction noise and vibration impacts from mechanical activities. Reasonable and feasible noise mitigation options which would be considered, include:</p> <ul style="list-style-type: none"><li>• maximising the offset distance between noisy plant and adjacent sensitive receivers and determining safe working distances</li><li>• using the most suitable equipment necessary for the construction works at any one time</li><li>• directing noise-emitting plant away from sensitive receivers regularly inspecting and maintaining plant to avoid increased noise levels from rattling hatches, loose fittings etc</li><li>• using non-tonal reversing/movement alarms such as broadband (non-tonal) alarms or ambient noise-sensing alarms for all plant used regularly onsite (greater than one day), and for any out of hours works</li><li>• noise emissions should be considered as part of the equipment selection process. The use of quieter and less vibration emitting construction methods should be implemented where feasible and reasonable</li><li>• the noise levels of plant and equipment must have operating sound power or sound pressure levels that would meet the predicted noise levels.</li></ul>      |
| 23. | <p>The CNVMP would be supported by the Community Liaison Plan to be prepared for the Project, which would detail community notification requirements, for example letter box drops and phone calls. In accordance with TfNSW's <i>Construction Noise Strategy</i>, and in consultation with impacted receivers, feasible and reasonable mitigation measures would be implemented to minimise impacts during construction.</p>  |
| 24. | <p>Any works outside standard hours may be undertaken if approved by TfNSW and the community is notified prior to these works commencing. An Out of Hours Work application form would need to be prepared by the Contractor and submitted to the TfNSW Environment and Planning Manager for any works outside normal hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods. High noise and vibration generating activities may only be carried out in continuous blocks, not exceeding three hours each, with a minimum respite period of one hour between each block.</p>  |
| 25. | <p>To avoid structural impacts as a result of vibration or direct contact with structures, the proposed works would be undertaken in accordance with the safe work distances outlined in the Noise and Vibration Assessment (AECOM, 2017f) and attended vibration monitoring or vibration trials would be undertaken where these distances are required to be challenged.</p>  |
| 26. | <p>Vibration resulting from construction and received at any structure outside of the Project would be managed in accordance with:</p> <ul style="list-style-type: none"><li>• for structural damage vibration - German Standard <i>DIN 4150: Part 3 – 1999 Structural Vibration in Buildings: Effects on Structures</i> and British Standard <i>BS 7385-2:1993 Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)</i></li><li>• for human exposure to vibration the acceptable vibration - values set out in the <i>Environmental Noise Management Assessing Vibration: A Technical Guideline</i> (Department of Environment and Conservation, 2006) which includes British Standard <i>BS 7385-2:1993 Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)</i>.</li></ul>  |
| 27. | <p>For vibration-intensive activities which occur within the safe working distance for cosmetic damage for heritage station platforms, platform buildings and other station infrastructure, as presented in Table 23, management methods to mitigate these impacts would include, as a minimum:</p> <ul style="list-style-type: none"><li>• the use of less vibration-intensive methods of construction or equipment would be used where possible to reduce annoyance and potential for cosmetic damage. All equipment would be maintained and operated in an efficient manner, in accordance with manufacturer's specifications, to reduce the potential for adverse vibration impacts.</li><li>• attended vibration measurements would be undertaken when work commences, to determine site-specific safe working distances. Vibration intensive work would not proceed within the safe working distances unless a permanent vibration monitoring system is installed around one metre from the building footprint, to warn operators (e.g. via flashing light, audible alarm, SMS) when vibration levels are approaching the peak particle velocity objective. Condition surveys of sensitive heritage structures would also be carried out before construction works commence.</li></ul> |

No.	Mitigation measure
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<b>Traffic and site access</b>	
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28.	Temporary measures informing customers of the extra gap between the train and station platforms would be determined during detailed design and implemented during operations to minimise disruptions to customers while both the existing and new fleet are operating on the Blue Mountains Line. These may include a combination of additional signage, additional station staff, physical platform gap filling solutions and communication strategies.
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29.	<p>Prior to the commencement of construction, a construction Traffic Management Plan (TMP) would be prepared as part of the CEMP and would include at a minimum:</p> <ul style="list-style-type: none"><li>• identifying traffic management requirements during construction</li><li>• ensuring adequate road signage at construction work sites to inform motorists and pedestrians of the work site ahead to ensure that the risk of road accidents and disruption to surrounding land uses is minimised</li><li>• maximising safety and accessibility for pedestrians and cyclists</li><li>• maintaining a reasonable level of public access across the rail corridor and to public transport services</li><li>• ensuring adequate sight lines to allow for safe entry and exit from the site</li><li>• ensuring that disruptions to traffic flows on public streets are minimised and, where unavoidable, managed in consultation with the relevant roads authority</li><li>• ensuring access to stations, businesses, entertainment premises and residential properties (unless affected property owners have been consulted and appropriate alternative arrangements made)</li><li>• managing impacts and changes to on and off street parking and requirements for any temporary replacement provision</li><li>• managing staff travel to and from the site, including ensuring parking locations for construction workers are away from stations during normal access and busy residential areas during rail possession / closure and details of how this will be monitored for compliance</li><li>• routes to be used by heavy construction-related vehicles to minimise impacts on sensitive land uses and businesses</li><li>• assessing suitability of local roads providing access to the proposed compound sites</li><li>• measures to manage traffic flows around the area affected by the Project, including as required regulatory and direction signposting, line marking and variable message signs and all other traffic control devices necessary for the implementation of the TMP</li><li>• where practicable, avoid delivery of construction material during peak commuter travel periods and school drop off/pick up times</li><li>• limit off-site construction vehicle parking to designated areas</li></ul> <p>Consultation with the relevant roads authorities would be undertaken during preparation of the construction TMP, as required. The performance of all project traffic arrangements must be monitored during construction.</p>
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30.	Communication would be provided to the community and local residents to inform them in advance of changes to parking, pedestrian access and/or traffic conditions including vehicle movements and anticipated effects on the local road network relating to site works.
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31.	Road Occupancy Licences for temporary road closures and / or diversions would be obtained, where required.
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32.	Construction works would minimise temporary loss of parking particularly during works at the stations (e.g. Katoomba Station and Lithgow Station platform extensions).
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<b>Urban design, landscape and visual amenity</b>	
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33.	All permanent lighting would be designed and installed in accordance with the requirements of standards relevant to <i>AS 1158 Road Lighting</i> and <i>AS 4282 Controlling the Obtrusive Effects of Outdoor Lighting</i> to minimise disruption to neighbouring residences.
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No.	Mitigation measure
34.	Temporary lighting during construction would be directed away from adjacent residential receivers where possible to minimise light spillage.
35.	Worksite compounds would be screened with shade cloth (or similar material, where necessary) to minimise visual impacts from key viewing locations.
36.	Temporary hoardings, barriers, traffic management and signage would be removed when no longer required.
37.	During construction, graffiti would be removed in accordance with TfNSW's Standard Requirements.
38.	Selection of materials and colour finishes for new elements of the Project to minimise the bulk of structures (e.g. platforms at Katoomba Station and Lithgow Station).
39.	Areas used for site compounds would be selected using the criteria outlined in Section 3.2.7 and would be rehabilitated at the end of construction.
<b>Socio-economic</b>	
40.	Sustainability criteria for the Project would be established to encourage the Contractor to purchase goods and services locally, helping to ensure the local community benefits from the construction of the Project.
41.	Feedback through the submissions process would be encouraged to facilitate opportunities for the community and stakeholders to have input into the Project, where practicable.
42.	A Community Liaison Plan would be prepared prior to construction to identify all potential stakeholders and methods for consultation with these groups during construction. The plan would also encourage feedback and facilitate opportunities for the community and stakeholders to have input into the Project, where practicable.
43.	Contact details for a 24-hour construction response line, Project Infoline and email address would be provided for ongoing stakeholder contact throughout the life of the Project.
44.	The community would be kept informed of construction progress, activities and impacts in accordance with the Community Liaison Plan.
<b>Biodiversity</b>	
45.	No works are to be undertaken within the boundary of the Blue Mountains National Park.
46.	Construction of the Project must be undertaken in accordance with TfNSW's <i>Vegetation Management (Protection and Removal) Guideline</i> (TfNSW, 2015d) and TfNSW's <i>Fauna Management Guideline</i> (TfNSW, 2015e).
47.	<p data-bbox="296 1579 1326 1635">In order to control the potential impacts of weeds and disease, the following measures should be implemented:</p> <ul data-bbox="296 1646 1398 1944" style="list-style-type: none"> <li data-bbox="296 1646 1382 1780">• control and maintain vehicle hygiene measures at the various site entry/exit points, particularly those passing through areas of native vegetation to reduce the likelihood of introducing or spreading weed or disease infestations within the Project site. Ensure machinery, equipment and other plant are washed down prior to entry to the site to avoid the spread of weeds and other pathogens</li> <li data-bbox="296 1792 1398 1848">• minimise the overall disturbance of soils where possible to avoid providing further disturbed ground for colonisation by weeds</li> <li data-bbox="296 1859 1398 1944">• minimise the import or export of soil material from the site wherever possible to avoid the inadvertent movement of weed seed and where practical, preserve top soil from excavation for reuse later over the top of excavations areas.</li> </ul>
48.	All workers would be provided with an environmental induction prior to commencing work onsite. This induction would include information on the protection measures to be implemented to protect vegetation, penalties for breaches and locations of areas of sensitivity.

No.	Mitigation measure
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| 49. | In the event of any tree to be retained becoming damaged during construction, the Contractor would immediately notify the TfNSW Project Manager and TfNSW Environment and Planning Manager to coordinate the response which may include contacting an arborist to inspect and provide advice on remedial action, where possible.   |
| 50. | Should the detailed design or onsite works determine the need to remove or trim any additional trees, which have not been identified in the REF, the Contractor would be required to complete TfNSW's Tree Removal Application Form and submit it to TfNSW for approval. No vegetation would be removed unless further assessment is undertaken and approval is granted by TfNSW.  |
| 51. | Weed control measures, consistent with TfNSW's <i>Weed Management and Disposal Guideline</i> (TfNSW, 2015f), would be developed and implemented as part of the CEMP to manage the potential dispersal and establishment of weeds during the construction phase of the Project. This would include the management and disposal of weeds in accordance with the <i>Noxious Weeds Act 1993</i> .  |
| 52. | <p>In order to protection of threatened fauna and habitat the following measures should be implemented:</p> <ul style="list-style-type: none"><li>• if unexpected threatened fauna species are discovered, stop works immediately and contact TfNSW environment personnel for advice</li><li>• visibly demarcate work areas to prevent personnel, materials plant or machinery moving into adjacent areas of grassland, waterway, bushland or other habitat in order to prevent unauthorised clearing. These areas should be visited by a qualified site ecologist to ensure that threatened flora such as the Flockton Wattle and TECs are not affected by the works (unless otherwise approved following completion of additional assessment)</li><li>• restrict intrusion into areas of vegetation and waterways in the immediate vicinity of the proposed works. Minimise impacts upon downstream fauna and flora habitats (particularly amphibians) through sediment and bank stabilisation measures. Silt fences, sediment traps and placement of stockpiles and stabilisation after vegetation removal should be implemented as needed to assist in minimising upstream and downstream impacts</li><li>• existing structures to be disturbed should be inspected for the presence of bats, prior to undertaking works. If bats are identified before / during the works, works would cease and the TfNSW project manager and site environmental specialist would be notified.</li></ul> |

### Soils and water

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| 53. | Prior to commencement of works, a site-specific Erosion and Sediment Control Plan for each site would be prepared in accordance with the 'Blue Book' <i>Managing Urban Stormwater: Soils and Construction Guidelines</i> (Landcom, 2004) and updated throughout construction so it remains relevant to the activities. The Erosion and Sediment Control Plan measures would be implemented prior to commencement of works and maintained throughout construction.            |
| 54. | An environmental risk assessment would be undertaken as part of the CEMP and would include a section on contamination. Measures to mitigate potential impacts from any contaminated soil/materials during construction would be developed and implemented through an unexpected contamination finds procedure and Waste Management Plan as part of the CEMP.   |
| 55. | Erosion and sediment control measures would be established prior to any clearing, grubbing and site establishment activities and would be maintained and regularly inspected (particularly following rainfall events) to ensure their ongoing functionality. Records of this process should be made and able to be provided upon request. Erosion and sediment control measures would be maintained and left in place until the works are complete and areas are stabilised. |
| 56. | During the construction phase, work areas are to be stabilised and kept in a clean and tidy condition.   |
| 57. | Rehabilitation of disturbed areas to be undertaken progressively as construction activities are completed. Disturbed surfaces must be stabilised as soon as possible. Traffic movements on any disturbed areas must be limited.  |
| 58. | During construction and operation, any material stockpiles (inclusive of excavated materials that are to be reused on site) are to be covered and contained, with appropriate bunding provided.  |

No.	Mitigation measure
59.	Vehicles and machinery would be properly maintained and routinely inspected to minimise the risk of fuel/oil leaks. Construction plant, vehicles and equipment would also be refuelled offsite, or in a designated refuelling area.
60.	All fuels, chemicals and hazardous liquids would be stored away from drainage lines, within an impervious bunded area in accordance with Australian Standards, EPA Guidelines and TfNSW's <i>Chemical Storage and Spill Response Guidelines</i> (TfNSW, 2015g).
61.	Adequate water quality and hazardous materials procedures (including spill management procedures, use of spill kits and procedures for refuelling and maintaining construction vehicles/equipment) would be implemented in accordance with relevant EPA guidelines and TfNSW's <i>Chemical Storage and Spill Response Guidelines</i> (TfNSW, 2015g) during the construction phase. All staff would be made aware of the location of the spill kits and be trained in how to use the kits in the case of a spill. Environmental spill kits containing spill response materials suited to the proposed works shall be kept on site at all times and used in the event of a spill
62.	In the event of a pollution incident, works would cease in the immediate vicinity and the Contractor would immediately notify the TfNSW Project Manager and TfNSW Environment and Planning Manager. The EPA would be notified by TfNSW if required, in accordance with Part 5.7 of the POEO Act.
63.	The existing drainage systems would remain operational throughout the construction phase.
64.	Should groundwater be encountered during excavation works, groundwater would be managed in accordance with the requirements of the <i>Waste Classification Guidelines</i> (EPA, 2014) and TfNSW's <i>Water Discharge and Reuse Guideline</i> (TfNSW, 2015b).
65.	<p>In order to avoid soil and water impacts that ,may arise from contaminated materials the following should be implemented:</p> <ul style="list-style-type: none"> <li>• all material for off-site disposal is to be tested and classified in accordance with the <i>Waste Classification Guidelines</i> (EPA, 2014).</li> <li>• if evidence is found indicating that contamination in any soil or material is present, it shall be sampled and analysed by an appropriately registered laboratory (NATA) and managed in accordance with the <i>Waste Classification Guidelines</i> (EPA, 2014), the <i>Contaminated Land Management Act 1997</i> and the <i>Guidelines on the Duty to Report Contamination</i> (EPA, 2015).</li> </ul> <p>If asbestos is encountered during the construction, works in that location are to cease and a suitably licenced asbestos removal contractor shall be engaged to remove, transport and dispose of the materials in accordance with the Work Health and Safety Regulation 2011.</p>
<b>Air quality</b>	
66.	Air quality management and monitoring for the Project would be undertaken in accordance with TfNSW's <i>Air Quality Management Guideline</i> (TfNSW, 2015h).
67.	Methods for management of emissions would be incorporated into project inductions, training and pre-start/toolbox talks.
68.	Plant and machinery would be regularly checked and maintained in a proper and efficient condition. Plant and machinery would be switched off when not in use, and not left idling. Plan deliveries to site and plant movements on site to minimise idling times.
69.	Vehicle and machinery movements during construction would be restricted to designated areas (sealed/compacted surfaces where practicable). Clean and stable site access points and roads would be provided as required, which may include temporary sealing of roads and other exposed areas onsite such as spray sealing or applying a crusting or binding agent and prevent mud and dirt being tracked onto sealed road surfaces. Soil would be removed from vehicle and mobile plant undercarriage and wheels in a designated wash down area.
70.	Appropriately cover loads on trucks transporting material to and from the construction site and securely fix tailgates of road transport trucks prior to loading and immediately after unloading

No.	Mitigation measure
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| 71. | <p>To minimise the generation of dust from construction activities, the following measures would be implemented:</p> <ul style="list-style-type: none"><li>• develop a monitoring regime and protocols to respond quickly to unfavourable weather conditions, including restricting activities, covering exposed surfaces / stockpiles and increasing watering</li><li>• ensure relevant construction plant has effective watering mechanisms to damp down during works. Apply water (or alternate measures) to exposed surfaces (e.g. unpaved roads, stockpiles, hardstand areas and other exposed surfaces), regularly water all exposed surfaces using water sprays or sprinkler systems</li><li>• minimise the number of stockpiles onsite, avoid stockpiling in exposed areas and ensure long-term stockpiles are covered or stabilised</li><li>• progressively rehabilitate exposed areas upon completion of different work stages, including providing temporary cover and commencing permanent landscaping as early as possible.</li></ul> |
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| 72. | <p>Asbestos would be managed in accordance with the following relevant guidelines:</p> <ul style="list-style-type: none"><li>• <i>How to Safely Remove Asbestos Code of Practice</i> (Safe Work Australia, 2016)</li><li>• <i>Code of Practice for the Safe Removal of Asbestos 2nd Edition</i> (NOHSC: 2002 (2005))</li><li>• <i>The National Model Work Health and Safety Regulations</i> (Safe Work Australia, 2016).</li></ul> |
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### Waste and contamination

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| 73. | <p>A Waste Management Plan would be prepared under the CEMP for the Project. The plan would address waste management and ensure disturbance works, excavation works and the storage and use of plant and machinery within the Project does not result in an increased risk of exposure to contamination. At a minimum it should include the following:</p> <ul style="list-style-type: none"><li>• identify all potential waste streams associated with the works and outline methods of disposal of waste that cannot be reused or recycled at appropriately licensed facilities</li><li>• detail other onsite management practices such as keeping areas free of rubbish</li><li>• specify controls and containment procedures for hazardous waste and asbestos waste</li><li>• outline the reporting regime for collating construction waste data.</li></ul> |
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| 74. | <p>An appropriate Unexpected Finds Protocol, considering asbestos containing materials and other potential contaminants, would be included in the CEMP. Procedures for handling asbestos containing materials, including licensed contractor involvement as required, record keeping, site personnel awareness and waste disposal to be undertaken in accordance with WorkCover requirements.</p> |
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| 75. | <p>All spoil and waste must be classified in accordance with the <i>Waste Classification Guidelines Part 1: Classifying waste</i> (EPA, 2014) prior to disposal at an appropriately licensed facility.</p> |
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| 76. | <p>Any concrete washout would be established and maintained in accordance with TfNSW's <i>Concrete Washout Guideline – draft</i> (TfNSW, 2015i) with details included in the CEMP and location marked on the ECM.</p> |
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| 77. | <p>The following key waste mitigation and management strategies would be included in the CEMP:</p> <ul style="list-style-type: none"><li>• removal and transport of waste off-site is to be undertaken by a suitably licensed contractor with appropriate approvals obtained under the POEO Act. Disposal of the waste is to occur at a suitably licenced waste facility, which can lawfully accept the waste type in accordance with the POEO Act</li><li>• construction materials would be purchased in accordance with an established procurement strategy that prioritises the selection of materials that utilise best practice recycled materials and sustainability ratings</li><li>• where possible, construction wastes would be diverted from landfill and recycled or reused</li><li>• working areas would be maintained, kept free of rubbish and cleaned up at the end of each working day.</li></ul> |
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| 78. | <p>The handling, storage, transport and disposal of any asbestos and hazardous waste that may be encountered during construction, would be in accordance with the requirements of the <i>Protection of the Environment Operations Act 1997</i> (POEO Act), <i>Waste Avoidance Resource Recovery Act 2001</i> (WARR) and relevant guidelines.</p> |
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No.	Mitigation measure
<b>Cumulative impacts</b>	
79.	The potential cumulative impacts associated with the Project would be further considered as the design develops and as further information regarding the location and timing of potential developments is released. Environmental management measures would be developed in the CEMP, and implemented as appropriate.
80.	Consultation with relevant stakeholders including Blue Mountains and Lithgow councils would be undertaken during construction planning where required, to consider potential cumulative impacts and implement measures required to minimise these impacts.
<b>Climate change and sustainability</b>	
81.	Detailed design of the Project would be undertaken in accordance with the <i>NSW Sustainable Design Guidelines – Version 3.0</i> (TfNSW, 2013).
82.	Measures to manage the risk of bushfire would be incorporated into the CEMP. These may include maintenance of an asset protection zone around the Project site, and ensuring access tracks would be maintained for use in the event of an emergency include bushfire evacuation and defence.
83.	An Emergency Evacuation Plan would be prepared in accordance with the NSW Rural Fire Service Guidelines and included in the CEMP.

## 8 Conclusion

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This REF has been prepared in accordance with the provisions of section 111 of the EP&A Act, taking into account to the fullest extent possible, all matters affecting or likely to affect the environment as a result of the Project.

The Project would ensure adequate width (and associated clearances) for the new trains to travel along the Blue Mountains Line.

The likely key impacts of the Project are as follows:

- potential impacts to State heritage-listed items from the platform coping, platform extensions and other modifications
- temporary noise and vibration impacts during construction
- potential temporary access changes for vehicles, cyclists and pedestrians in and around the station areas during construction
- temporary reduction in the visual environment of heritage listed stations and National Park vistas from the presence of construction sites.

This REF has considered and assessed these impacts in accordance with clause 228 of the EP&A Regulation and the requirements of the EPBC Act (refer to Chapter 6, Appendix A and Appendix B). Based on the assessment contained in this REF, it is considered that the Project is unlikely to have a significant impact upon the environment or any threatened species, populations or communities. Accordingly an EIS is not required, nor is the approval of the Minister for Planning.

The Project would also take into account the principles of ESD (refer to Section 3.1.3 and Section 4.6). These would be considered during the detailed design, construction and operational phases of the Project. This would ensure the Project is delivered to maximise the benefits to the community, is cost effective and minimises any adverse impacts on the environment.

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# Appendix A Consideration of matters of National Environmental Significance

The table below demonstrates TfNSW’s consideration of the matters of NES under the EPBC Act to be considered in order to determine whether the Project should be referred to Commonwealth Department of the Environment.

Matters of NES	Impacts
<p><b>Any impact on a World Heritage property?</b></p> <p>The Greater Blue Mountains World Heritage Area occurs within the locality of the Project site and includes the Blue Mountains National Park. The Greater Blue Mountains World Heritage Area is located immediately adjacent to the Project site at various locations along the Project route, but is not within the Project site. While the Project is located adjacent to the Greater Blue Mountains World Heritage area, the assessment has shown that no impacts would result from the Project, as the Project activities are of a nature and scale that is unlikely to impact the adjacent environment. In addition, no vegetation removal is required.</p>	Nil
<p><b>Any impact on a National Heritage place?</b></p> <p>There are no items on the National Heritage list within the Project site.</p>	Nil
<p><b>Any impact on a wetland of international importance?</b></p> <p>There are no wetlands of international importance located within or adjacent to the Project site.</p>	Nil
<p><b>Any impact on a listed threatened species or communities?</b></p> <p>Based on an ecological assessment of the Project site, no adverse impacts to a listed threatened species or community is anticipated as a result of the Project.</p>	Nil
<p><b>Any impacts on listed migratory species?</b></p> <p>Based on an ecological assessment of the Project site, no adverse impacts to a listed migratory species is anticipated as a result of the Project.</p>	Nil
<p><b>Does the Project involve a nuclear action (including uranium mining)?</b></p> <p>The Project involves enabling works along the Blue Mountains Line. No nuclear actions are proposed as part of the Project.</p>	Nil
<p><b>Any impact on a Commonwealth marine area?</b></p> <p>There are no Commonwealth marine areas located within the vicinity of the Project site.</p>	Nil
<p><b>Does the Project involve development of coal seam gas and/or large coal mine that has the potential to impact on water resources?</b></p> <p>The Project involves enabling works along the Blue Mountains Line. No coal seam gas or other coal operations are proposed as part of the Project.</p>	Nil
<p><b>Additionally, any impact (direct or indirect) on Commonwealth land?</b></p> <p>The Project involves enabling works along the Blue Mountains Line. No direct or indirect impacts to Commonwealth land would result from the Project.</p>	Nil

## Appendix B Consideration of clause 228

The table below demonstrates TfNSW's consideration of the specific factors of clause 228 of the EP&A Regulation in determining whether the Project would have a significant impact on the environment.

Factor	Impacts
<p><b>(a) Any environmental impact on a community?</b></p> <p>There would be some temporary impacts to the community during construction, particularly noise, traffic, visual amenity and air quality. There would also be some permanent impacts in relation to heritage (non-indigenous). The Project would facilitate the operation of the New Intercity Fleet which would provide benefit to the local community through increased passenger comfort.</p>	Minor during construction
<p><b>(b) Any transformation of a locality?</b></p> <p>The Project would introduce temporary visible new elements during construction such as equipment, machinery and personnel. The Project would also include the introduction of new visible elements in the landscape during operation as a result of the platform extensions at Katoomba Station and Lithgow Station, along with more minor modifications of the landscape associated with rail infrastructure. The appearance of the new elements in the platform extensions would be consistent with the existing station elements and are considered to be common features in urban areas.</p>	Minor during construction and operation
<p><b>(c) Any environmental impact on the ecosystem of the locality?</b></p> <p>The Project would not require vegetation removal within the rail corridor and as such, would have a negligible impact to the ecosystem of the locality. Any additional vegetation found to require removal, not assessed in this REF, would be subject to further assessment, and approval from TfNSW. No access to the Blue Mountains National Park is required.</p>	Nil
<p><b>(d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?</b></p> <p>There would be some temporary impacts during construction particularly in relation to noise, traffic and access, air quality, and visual amenity (refer to sections 6.3, 6.4, 6.5, and 0).</p> <p>The platform extensions at Katoomba Station and Lithgow Station would result in a visual change during construction, and impacts to heritage (non-Indigenous). However, only minor impacts are anticipated as the existing platforms have been extended previously, and the proposed extensions would be located on the same sides of the platforms that have undergone previous extensions. The appearance of the new elements in the platform extensions would be consistent with the existing station elements (refer to Section 6.5). Furthermore, each phase of works is expected to be completed over rail possessions. A sensitive approach would also be considered during the development of detailed design, including the selection of materials.</p>	Minor to moderate
<p><b>(e) Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations?</b></p> <p>The Project would have a positive contribution to the locality by enabling the New Intercity Fleet to operate on the Blue Mountains Line.</p> <p>Six stations within the Project site are either listed, or fall within the curtilage of a listing on the State Heritage Register. In addition, all 15 stations within the Project site are listed on the RailCorp Section 170 Heritage and Conservation Register, and are also listed on either the Blue Mountains or Lithgow LEPs. The Project would result in some minor to moderate impacts to State listed items, largely as a result of the minor works at all the station locations.</p> <p>However impacts on heritage would be minimised through the implementation of the mitigation measures in the REF.</p>	Moderate

Factor	Impacts
<p><b>(f) Any impact on the habitat of protected fauna (within the meaning of the <i>National Parks and Wildlife Act 1974</i>)?</b></p> <p>Preliminary searches using the BioNet Atlas, Protected Matters Search Tool and PlantNET, have identified a number of threatened and endangered communities, and flora and fauna within the vicinity of the Project. However, considering the works would be undertaken largely within the rail corridor, and would not require any vegetation removal, the Project is unlikely to impact on ecological values during construction and/or operation. As determined through an ecological assessment, the Project is unlikely to have any impact on the habitat of protected fauna.</p>	Nil
<p><b>(g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air?</b></p> <p>While a number of threatened and endangered species have been identified within the vicinity of the Project site based on searches conducted, impacts to these species are unlikely due to the minor nature and limited geographical extent of the works that would not require the removal of any vegetation. The Project is unlikely to have any impact on endangering any species of animal, plant or other form of life, whether living on land, in water or in the air though this would be determined through an ecological assessment.</p>	Nil
<p><b>(h) Any long-term effects on the environment?</b></p> <p>The Project is unlikely to have any long-term effects on the environment.</p>	Nil
<p><b>(i) Any degradation of the quality of the environment?</b></p> <p>The Project is unlikely to have any degradation of the quality of the environment.</p>	Nil
<p><b>(j) Any risk to the safety of the environment?</b></p> <p>The Project is unlikely to cause any pollution or safety risks to the environment. Specific management measures would be implemented to manage asbestos and other hazardous materials that may be encountered during construction or demolition works.</p>	Minor
<p><b>(k) Any reduction in the range of beneficial uses of the environment?</b></p> <p>The Project is unlikely to have any reduction in the range of beneficial uses of the environment.</p>	Nil
<p><b>(l) Any pollution of the environment?</b></p> <p>The Project is unlikely to cause any pollution of the environment provided the recommended mitigation measures are implemented.</p>	Minor
<p><b>(m) Any environmental problems associated with the disposal of waste?</b></p> <p>The Project is unlikely to cause any environmental problems associated with the disposal of waste. Hazardous waste and special waste may be generated from the Project. Prior to construction, contamination investigations would be undertaken to confirm the presence of contaminated material, particularly asbestos.</p>	Minor
<p><b>(n) Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply?</b></p> <p>The Project is unlikely to increase demands on resources that are, or are likely to become, in short supply.</p>	Nil
<p><b>(o) Any cumulative environmental effect with other existing or likely future activities?</b></p> <p>Cumulative effects of the Project have been assessed as part of the REF. Where feasible, project activities and environmental management measures would be co-ordinated to reduce any cumulative construction impacts.</p>	Negligible
<p><b>(p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions?</b></p> <p>As the Project is not located within the vicinity of the coast, it would not impact on coastal processes and coastal hazards, including those under projected climate change conditions.</p>	Nil