



**Transport
for NSW**

Advanced train control Migration System Central Coast & Newcastle Line- Area 3 Review of Environmental Factors



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Document author:	Jonathan Dowling
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Abbreviations

AHIMS	Aboriginal Heritage Information Management System
AMS	Advanced train control Migration System
ATP	Automatic Train Protection
CEMP	Construction Environmental Management Plan
Central Coast Council	Central Coast Council refers to the newly created Council consisting of the former Gosford and Wyong Shire Councils following commencement of the NSW council amalgamations on 12 May 2016.
DP&E	NSW Department of Planning and Environment
EEC	Endangered Ecological Community
EPA	Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979 (NSW)</i>
EP&A Regulation	<i>Environmental Planning and Assessment Regulation 2000 (NSW)</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)</i>
ESD	ecologically sustainable development (refer to Definitions)
ETCS	European Train Control System
FM Act	<i>Fisheries Management Act 1994 (NSW)</i>
Heritage Act	<i>Heritage Act 1977 (NSW)</i>
Infrastructure SEPP	<i>State Environmental Planning Policy (Infrastructure) 2007</i>
IS	Infrastructure and Services
LEP	local environmental plan
LEU	lineside electrical unit
LGA	local government area
NES	(Matters of) National Environmental Significance
NPW Act	<i>National Parks and Wildlife Act 1974 (NSW)</i>
Native Vegetation Act	<i>Native Vegetation Act 2003 (NSW)</i>
NW Act	<i>Noxious Weeds Act 1993 (NSW)</i>
POEO Act	<i>Protection of the Environment Operations Act 1997 (NSW)</i>
OEH	Office of the Environment and Heritage
Roads Act	<i>Roads Act 1993 (NSW)</i>
REF	Review of Environmental Factors
SEPP	state environmental planning policy
SHR	State Heritage Register
TfNSW	Transport for NSW
TSC Act	<i>Threatened Species Conservation Act 1995 (NSW)</i>
ULX	underline crossing

Definitions

Balise	An electronic beacon or transponder placed between the rails of a railway as part of an automatic train protection (ATP) system.
ecologically sustainable development	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 (refer to Section 4.1).
the Proposal	The construction and operation of the Central Coast & Newcastle Line Advanced train control Migration System works.
Underline crossing	An underline crossing (under track crossing) where the cable route crosses under the track from one side of the line to the other.

Executive summary

Transport for NSW (TfNSW) is the government agency responsible for the delivery of major transport infrastructure projects in NSW, including the Advanced train control Migration System (AMS) project.

The AMS project forms part of the overall Automatic Train Protection (ATP) program. The ATP program plays a key role in delivering faster and more reliable services under the NSW Government's *Sydney's Rail Future* (June 2012). The ATP program will deliver significant safety benefits to customers and rail staff and responds to one of the key recommendations from the Waterfall Special Commission of Inquiry.

The AMS project will be implemented in stages across 9 discrete areas, with separate environmental impact assessments being prepared for each area. The works which are subject to this environmental impact assessment pertain to the deployment of AMS infrastructure within Area 3, located on the Central Coast & Newcastle Line between Warnervale and Wickham (the Proposal).

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

Description of the Proposal

AMS infrastructure will be progressively installed across the electrified rail network. The Proposal involves the installation and operation of trackside signalling equipment at approximately 40 locations between Warnervale and Wickham (Area 3) on the Central Coast & Newcastle Line. Figure 1-1 provides an overview map of the Proposal.

Area 3 traverses a 63 kilometre section of the railway corridor located in the Central Coast, Lake Macquarie and Newcastle City local government areas. Depending on the topography, signal locations are generally located up to 15 metres from the existing rail tracks.

The proposed trackside signalling equipment would communicate with a train mounted system which will improve network capacity and passenger safety by providing information to the driver such as speed limits and signal location and applying brakes automatically if the driver does not respond appropriately. The installation of the train mounted system will be carried out at a train maintenance facility.

Construction of the Proposal is expected to commence in mid-2017 and continue for about 18 months.

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 proposed development. 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 'signalling, train control, communication and security systems'.

As TfNSW is a public authority and the proposed activity falls within the definition of rail infrastructure facilities under Infrastructure SEPP, the Proposal is permissible without consent. Consequently the environmental impacts of the Proposal 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 Proposal. The REF has been prepared in accordance with clause 228 of the *Environmental 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.

Stakeholder communication

The communications approach for the Proposal has been designed to serve as an educational tool for interested stakeholders and communities located in close proximity to works being undertaken in the rail corridor.

The works being undertaken as part of the Proposal are based on safety and rail system requirements. For this reason, there is minimal opportunity for any community feedback into project deliverables. An educational approach to the communication activities has been adopted to allow interested stakeholders to find out more about the program and any likely resulting impacts.

The communication approach being implemented for the program has also been developed having regard for the requirements of the planning process.

Refer to Chapter 5 for more information about the communications approach for the Proposal.

Environmental impact assessment

This REF identifies the potential environmental benefits and impacts of the Proposal and outlines the mitigation measures to reduce the identified impacts. This REF identifies that, subject to the implementation of mitigation measures, potential environmental impacts can be controlled and reduced to acceptable levels which would not significantly affect the environment.

The main environmental issues relate to construction impacts such as erosion and sedimentation risks, work within the curtilage of heritage items, ground contamination and potential impacts to threatened species and/or communities as well as short-term traffic, air quality and noise issues for nearby receivers. Such impacts would be managed through the implementation of a Proposal wide Construction Environmental Management Plan (CEMP) and specific Signal Location Environmental Control Maps (ECM).

No operational impacts are anticipated as a result of the Proposal.

Conclusion

This REF has been prepared having regard to sections 111 and 112 of the EP&A Act, and clause 228 of the EP&A Regulation, to ensure that TfNSW takes into account to the fullest

extent possible, all matters affecting or likely to affect the environment as a result of the Proposal.

Should the Proposal proceed, the likely impacts would be appropriately managed in accordance with the mitigation measures outlined in this REF. TfNSW has determined that an environmental impact statement (EIS) is not required for the Proposal, nor is the approval of the Minister for Planning.

1. Introduction

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 Central Coast & Newcastle Line Advanced train control Migration System (AMS) project (the Proposal), to be delivered by Infrastructure and Services (I&S).

1.1. Overview of the Proposal

The Proposal involves the installation of trackside signalling equipment at 40 locations between Warnervale and Wickham (Area 3) on the Central Coast & Newcastle Line (refer Figure 1-1). Detailed location maps are provided in Appendix 3.

The Proposal comprises new track assets installed on rail sleepers; new signalling cabling installed above and below ground at each signal location; and the extension of a number of existing signalling cabinets and the installation of new signalling cabinets. This 63 kilometre stretch of railway corridor between Warnervale and Wickham is located in the Central Coast, Lake Macquarie and Newcastle City local government areas. A detailed description of the Proposal is provided in Chapter 3.

The Proposal would take place at 40 existing signal locations along the railway line. Depending on the topography, signal locations are within the rail corridor and up to 15 metres from the rail line. The proposed trackside signalling equipment would communicate with a train mounted system which will improve network capacity and passenger safety by providing information to the driver such as speed limits and signal location and applying brakes automatically if the driver does not respond appropriately. The installation of the train mounted system will be carried out at a train maintenance facility.

The Proposal would deliver significant safety benefits to customers and rail staff and responds to one of the key recommendations from the Waterfall Special Commission of Inquiry.

Construction of the Proposal is expected to commence in mid-2017 and continue for about 18 months.

1.2. Purpose of this Review of Environmental Factors

The purpose of this REF is to describe the Proposal, to assess the likely impacts of the Proposal 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 Proposal.

This REF has been prepared by TfNSW in accordance with clause 228 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). For the purposes of these works, TfNSW is the proponent and the determining authority under Part 5 of the EP&A 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 Proposal to significantly impact a matter of national environmental significance (NES) or Commonwealth land, and the need to make a referral to the Commonwealth Department of the Environment and Energy for any necessary approvals under the EPBC Act.

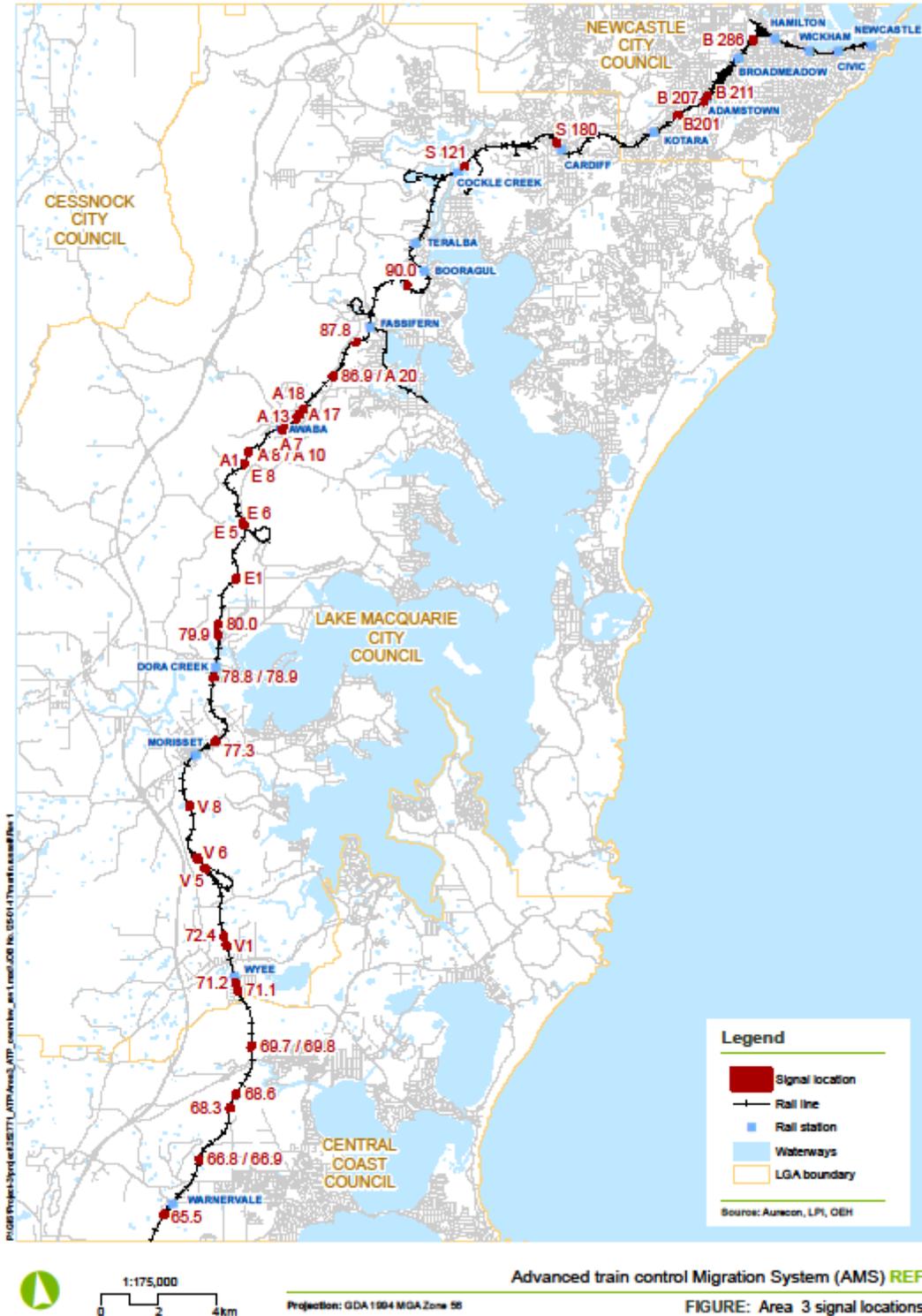


Figure 1-1 Overview map of the Proposal

2. Need for the Proposal

Chapter 2 discusses the need and objectives of the Proposal, having regard to the objectives of the overall ATP Program. This chapter also provides a discussion of the options that have been considered during development of the Proposal and why the preferred option has been chosen.

2.1. Strategic justification

The requirement to implement an automatic protection technology was one of the key recommendations from the Waterfall Special Commission of Inquiry.

The ATP program would implement an Advanced train control Migration System (AMS) which utilises a European Train Control System (ETCS) limited supervision system with modifications to suit the Sydney network. AMS provides additional protection by communicating trackside information such as signal aspect, permitted line speed and distance to the next signal to the train driver. The onboard system derives a permitted speed profile by combining trackside data with data on the train's performance characteristics, such as its braking capability. The AMS provides information to the train driver, via a screen in the driver's cab, on how far and how fast the train is permitted to travel.

The onboard system also monitors the actual train speed and location against the permitted speed profile. The system applies the brakes automatically if the driver fails to respond appropriately.

AMS will upgrade the signalling system across the electrified rail network. The electrified rail network has been divided into nine areas, where AMS would be progressively deployed until approximately 2019. As noted in Section 1.1 this REF addresses AMS works in Area 3.

AMS will benefit the Central Coast & Newcastle Line by providing greater reliability and safety to the train services along the line and associated community and customer benefits.

2.2. Alternative options considered

A comprehensive review of automatic train protection technology options has been undertaken. The review assessed technology options against key criteria including technical capability, economic viability and level of risk mitigation.

The review recommended that the European Train Control System (ETCS) (Limited Supervision) is adopted as the preferred automatic train protection technology. The ETCS was recommended as the preferred technology because it:

- is a high integrity safety system that controls risks associated with drivers over-speeding or exceeding the limit of their movement authority
- is available 'off the shelf' from multiple suppliers designing to common specifications
- is a mature technology with a large and rapidly growing user base
- is flexible in its application and can be overlaid, with minimal impact, to existing signalling systems and rolling stock
- will provide a major risk mitigation of the rail network's direct risks
- has a defined upgrade path to allow future functionality enhancements

- has the potential to enable future signalling changes which will deliver significant capacity benefits.

The NSW government response to the recommendations of the Waterfall Special Commission of Inquiry outlines its commitment to installing automatic train protection technology across the electrified rail network. As such, a 'do nothing' option was not considered a feasible alternative.

3. Description of the Proposal

Chapter 3 describes the Proposal and summarises key design parameters, construction method, and associated infrastructure and activities.

3.1. The Proposal

The Proposal involves the installation of trackside AMS signalling equipment on the Central Coast & Newcastle Line between Warnervale and Wickham (Area 3) under the overall ATP Program. The Proposal would take place at 40 existing signal locations along the railway line.

The works comprise:

- new track assets (i.e. balises)
- new signalling cabling
- extension to existing signal cabinets and (if required) the installation of new cabinets.

Figure 3-1 provides a schematic of the typical proposed works at each signal location.

The typical construction footprint at each signal location would be around 40 metres long and 20 metres wide. Additional cabling extending beyond this footprint may be required at particular signal locations for balises. The site-specific footprint for each signal location that has been assessed in this Review of Environmental Factors (REF) is shown in Appendix 3.

The new signalling cabling would connect to the existing 240 volt electricity network at each signal location. All cabling would be located wholly within the rail corridor and underline crossings (ULXs) would be constructed to provide a crossing beneath the rail track where necessary.

New track assets

A balise would be mounted to the rail sleepers in the area between load bearing rails (referred to as the four foot) on the approach to a trackside signal. Depending on the type of sleeper (i.e. concrete or timber), the balise may be mounted using a combination of cable clips, vortex brackets, mechanical anchors or adhesives. A series of balises are required at each signal location and are spaced at intervals. Balises are categorised as infill, fixed or control balises depending on their proximity to the signal.

New signalling cabling

Cables would connect the balises to a junction box which would be positioned adjacent to the track. These cables would be installed in elevated galvanised steel troughing or inside buried conduits. Other options for cable installation include pit and pipe, galvanised pipe or surface pipes.

Buried conduits can be installed by directional bores within or near the cess (the area immediately adjacent to the ballast shoulder). ULXs would be constructed to provide a crossing beneath the rail track where necessary. The ULX and underbore depths can vary depending on site conditions. As a minimum, it is anticipated ULXs would be 1.8 metres from the top of the rail.

A combination of ULXs and above ground troughing may be used at each signal location depending on the ground conditions and site access constraints. If existing troughing and pipes have sufficient spare capacity, the new signalling cabling would be installed in these facilities.

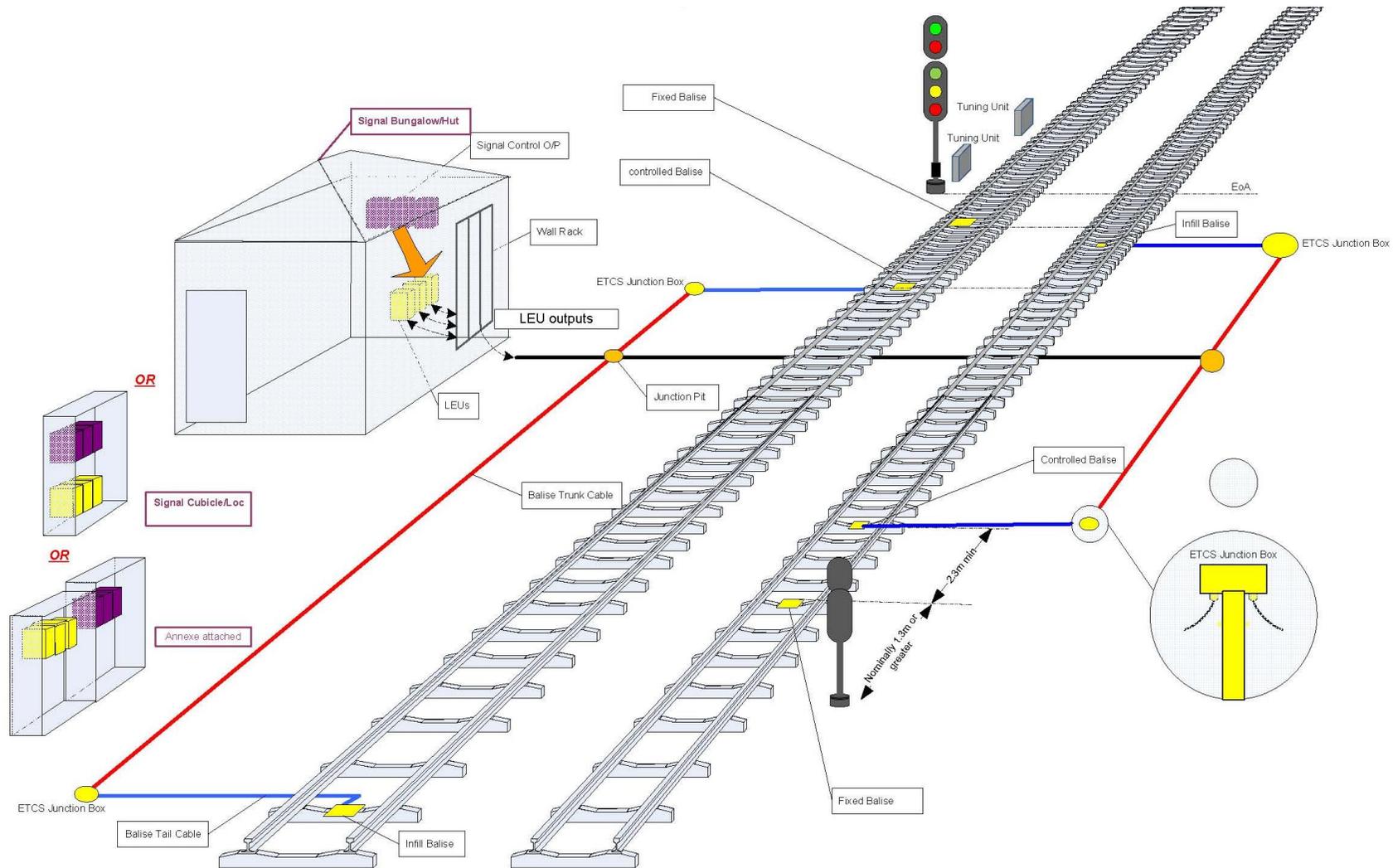


Figure 3-1 Schematic of proposed works

It is possible that supersucking, a form non-destructive digging using pressurised water and a vacuum source, would be required at some signal locations.

Cables from the pothead would terminate at a lineside electrical unit (LEU), which is housed in either a signal bungalow or a signal cabinet.

Signal cabinets

Where space within the existing signal cabinet or bungalow is constrained, a new signal cabinet would be installed. Existing signalling cabinets would be extended by about six square metres.

The new signal cabinet would generally be installed on a newly constructed concrete plinth adjacent to the slab for the existing signal cabinet. Alternatively, the new signal cabinet would be bolted to the existing cabinet.

The signal cabinets would be fitted out with a LEU.

Where possible, the concrete plinths and cabinets would be pre-fabricated off site and delivered to the signal location in time for works to commence.

3.2. Construction methodology

3.2.1. Work methodology

The work methodology would involve the following stages:

- identify and mark up areas for stockpiling materials and segregating waste
- establish site access, including fenced off exclusion zones
- install erosion and sediment controls
- trenching and pit and pipe work (if required)
- install new signal equipment
- test all equipment prior to commissioning
- clear the work sites of any remaining construction plant or materials.

3.2.2. Plant and equipment

The following plant and equipment is likely to be used for the works:

- Supersucker
- Excavator (7 tonne) for excavation as well as rock breaking where required
- Hand and power tools
- Bobcat
- Compactor
- Generator
- Boring equipment
- Front end loader (5 tonne).

3.2.3. Timing

Construction of the Proposal is expected to commence in mid-2017 and continue for about 18 months.

Main civil and structural construction works at each signal location would be complete within around three weeks. Installation of the signalling equipment would follow the civil and structural works and take about one week to complete.

The construction team would complete civil works at each signal location prior to progressing to the next signal location.

Works would generally be scheduled to take place during standard working hours:

- 7.00am to 6.00pm Monday to Friday
- 8.00am to 1.00pm Saturday
- No work on Sunday or public holidays.

However, due to access constraints and the requirement for a safe working site, some works may be undertaken outside standard working hours and during scheduled track possessions. This includes installation of track assets (i.e. balises).

If works, other than the installation of track assets, is required outside the standard working hours, further approval would be obtained and the affected community would be advised, in accordance with the TfNSW *Construction Noise Strategy* (7TP-ST-157).

3.2.4. Site access and storage of materials

Access to the work sites would be via existing railway corridor access gates and access tracks. Access gates are locked at all times except for site deliveries and access / egress by site staff. Distance from the access gates to the work sites can range between 10 metres and 800 metres.

The construction process would require an average of 10 to 20 vehicle movements and a team of 5 to 15 people on site per day.

Temporary site storage areas would be established in cleared areas within the signal location footprint.

Amenities such as portable toilets may be provided at some work sites where there is adequate space and suitable access.

3.3. Operations, management and maintenance

The operation of the new signalling system would commence following the installation and commissioning of the train mounted system.

Sydney Trains or its appointed contractor would maintain the system. Maintenance would be undertaken in accordance with Sydney Trains standards.

4. Statutory considerations

Chapter 4 provides a summary of the statutory considerations relating to the Proposal including a consideration of NSW Government policies/strategies, NSW legislation (particularly the EP&A Act), environmental planning instruments, and Commonwealth legislation.

4.1. 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 generally defined under the provisions of clause 7(4) of Schedule 2 to the *Environmental Planning and Assessment Regulation 2000* 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 throughout the development and assessment of the ATP Program. The principles for ESD would be facilitated through the application of a range of environmental management tools such as the implementation of the construction environmental management plan and adherence to the TfNSW environmental management system. Table 4-1 identifies how the Proposal complies with the principles of ESD.

Table 4-1 ESD principles and how they relate to the Proposal

Principle	Compliance
Precautionary principle	There are no threats of serious or irreversible damage posed by the Proposal. The signal locations are generally within a previously disturbed area in the rail corridor. All of the environmental risks have been carefully considered through the preparation of this REF and would be managed through the implementation of the construction environmental management plan. The plan is unlikely to be stalled by a lack of scientific certainty.
Intergenerational equity	The Proposal will help ensure that future generations have a safer, more comfortable and more reliable rail transport options.
Biodiversity conservation and ecological integrity	Due to the highly modified nature of the signal locations along the rail corridor, no biodiversity of ecological significance is anticipated to be encountered. However, construction of the Proposal would be undertaken in accordance with a construction environmental management plan which would ensure the biodiversity conservation and ecological integrity of the receiving environment is retained.

Principle	Compliance
Improved valuation and pricing of environmental resources	The REF has examined all of the environmental impacts associated with the Proposal and has recommended mitigation measures for the identified environmental risks that may result. The management of these risks has been factored into the overall budget allocation for the project, hence demonstrating that environmental resources have received appropriate valuation in the context of the Proposal.

4.2. NSW Government policies and strategies

In addition to statutory requirements, a number of NSW Government policies and strategies are relevant to the Proposal. Table 4-2 summarises the NSW Government policies and strategies applicable to the Proposal.

Table 4-2 Relevant NSW Government policies/strategies

Policy/Strategy	Commitment	Comment
State Priorities – NSW: Making It Happen (NSW Government, 2015)	<p>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. NSW: Making it Happen focuses on 12 key ‘priorities’ to achievement 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.</p> <p>One of the 12 priorities identified as part of NSW: Making It Happen relates to investment in building infrastructure. The ongoing development and investment in transport infrastructure is identified as part of the wider building infrastructure priority.</p>	The Proposal would support the objective of improving the reliability of the public transport network.
NSW Long Term Transport Master Plan	<p>In December 2012, the NSW Government released the NSW Long Term Transport Master Plan. The Plan brings together land use planning with transport planning, and integrated planning for freight and passenger movements across all modes of transport.</p> <p>The Plan responds to the transport challenges of NSW through four types of actions:</p> <ul style="list-style-type: none"> • integrate transport services • modernise our system • growing our networks to meet future demand • maintain important road and public transport assets. 	The Proposal would be consistent with the NSW Long Term Transport Master Plan as it would modernise and support the growth of the network.

Policy/Strategy	Commitment	Comment
Sydney's Rail Future	<p>Sydney's Rail Future, released in June 2012, is a plan developed to transform and modernise Sydney's rail network so that it can grow with our future population.</p> <p>The plan is an integral part of the NSW Long Term Transport Master Plan.</p>	<p>The Proposal would support the plan for Sydney's Rail Future. The plan specifically identifies the ATSC Program as an important technological advancement to support faster, more reliable train services.</p>
Draft Metropolitan Strategy for Sydney to 2031	<p>In 2013, the NSW Government released the draft Metropolitan Strategy for Sydney to 2031 for consultation.</p> <p>The draft Strategy identifies nine key 'city shapers' that will play an important role in shaping the future growth of Sydney.</p> <p>The draft Strategy has been aligned with the NSW Long Term Transport Master Plan.</p>	<p>The Proposal would be consistent with the draft Metropolitan Strategy by ensuring the ongoing safe and efficient operation of the rail network, supporting the growth of Sydney.</p>

4.3. NSW legislation and regulations

4.3.1. Environmental Planning and Assessment Act 1979

The EP&A Act establishes the system of environmental planning and assessment in NSW. This Proposal 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 Proposal. Having regard to these provisions, TfNSW has determined that no significant environmental impact is likely, and as a consequence an environmental impact statement is not required, nor is the approval of the Minister for Planning.

Clause 228 of the 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 Proposal in accordance with clause 228. Appendix 1 specifically responds to the factors for consideration under clause 228.

4.3.2. Other NSW legislation and regulations

Table 4-3 provides a list of other relevant legislation applicable to the Proposal.

Table 4-3 Other relevant legislation applicable to the Proposal

Applicable legislation	Considerations
<i>Heritage Act 1977</i>	Section 57(1) of the <i>Heritage Act 1977</i> (Heritage Act) lists the types of activities/works that require approval from the Office of Environment and Heritage (OEH) Heritage Division when working on/in an item/place listed on the State Heritage Register (SHR). An application for an exemption can also be made under some circumstances. Approval from

Applicable legislation	Considerations
	<p>the Heritage Division is also required under Section 139 of the <i>Heritage Act 1977</i> prior to the disturbance or excavation of land if a project will, or is likely to result in, a relic being discovered, exposed, moved, damaged or destroyed.</p> <p>The Proposal involves works within or near items listed on the Sydney Train's section 170 Heritage and Conservation Register, and the heritage schedules of the Wyong Local Environmental Plan (LEP), Lake Macquarie LEP and Newcastle LEP. Given the disturbed nature of the rail corridor and limited excavation required, it is unlikely that the proposed works would affect any known or unknown archaeological items of heritage significance.</p> <p>It is noted that no works are proposed within the curtilage of any item listed on the SHR and therefore, approval or exemption under the <i>Heritage Act</i> is not required.</p> <p>More information on heritage is included in Section 6.6.</p>
<p><i>National Parks and Wildlife Act 1974</i></p>	<p>The excavating, moving or exhibiting of Aboriginal objects requires a permit under Section 87 of the <i>National Parks and Wildlife Act 1974</i> (NPW Act). The harming or desecrating of Aboriginal objects or places is an offence under Section 86 of the NPW Act. Under Section 90, an Aboriginal heritage impact permit may be issued in relation to a specified Aboriginal object, Aboriginal place, land, activity or person or specified types or classes of Aboriginal objects, Aboriginal places, land, activities or people.</p> <p>There are no Aboriginal objects or places known to occur in the immediate vicinity of the signal locations and no known items or places would be affected by the proposed work. A search of the Aboriginal Heritage Information Management System (AHIMS) confirmed that there are no known Aboriginal sites within 100 metres of the rail corridor. Given the disturbed nature of the rail corridor, impacts on Aboriginal heritage are not expected.</p> <p>Safeguards have been proposed to address circumstances if an unexpected find occurs.</p> <p>All native birds, reptiles, amphibians and mammals, except the dingo, are protected in NSW under the NPW Act. The harming of protected fauna is prohibited under the NPW Act, but an exemption applies in relation to things that are essential to the carrying out of an activity to which Part 5 of the EP&A Act applies and where the determining authority has complied with the provisions of that part.</p> <p>More information on Aboriginal heritage is included in Section 6.6.</p>
<p><i>Threatened Species Conservation Act 1995</i></p>	<p>The <i>Threatened Species Conservation Act 1995</i> (TSC Act) is directed at conserving threatened species, populations and ecological communities of animals and plants.</p> <p>A number of threatened species, populations, endangered ecological communities occur in the vicinity of the Proposal (i.e. Heath Wrinklewort (<i>Rutidosis heterogama</i>), Charmhaven Orchid (<i>Corunastylis</i> sp. Charmhaven), and Black-eyed Susan (<i>Tethratherca juncea</i>) and the Wallum froglet (<i>Crinia tinnula</i>)). However, it is anticipated that due to the nature of works and the location of construction footprint, no vegetation removal except for the clearing of grasses and weeds would be required. Therefore, impacts to these species, populations or communities are unlikely as a result of the proposed works and further consideration under the TSC Act is not required.</p>

Applicable legislation	Considerations
	<p>The potential impact on vegetation and biodiversity would be minimised through a hierarchy of controls outlined in Section 6.4.3. Should vegetation other than grass and weeds need to be trimmed or removed to support the construction of the Proposal, further consideration of the TSC Act would be undertaken and approval from TfNSW obtained.</p> <p>Section 6.4 provides further information about the biodiversity constraints associated with the proposal.</p>
<i>Native Vegetation Act 2003</i>	<p>The <i>Native Vegetation Act 2003</i> (NV Act) regulates the clearing of native vegetation on land in NSW except for excluded land which includes national parks, state forests and urban areas. Section 25(g) of the NV Act provides that any clearing that is part of an activity that is permissible without consent does not require approval under the Act.</p> <p>It is unlikely clearing of native vegetation would be required for the Proposal (refer to Section Table 6-4 Error! Reference source not found.). Hence, no further consideration of the NV Act is required.</p>
<i>Protection of the Environment Operations Act 1997</i>	<p>The <i>Protection of the Environment Operations Act 1997</i> (POEO Act) provides a licensing framework for certain activities as defined in Schedule 1 of the POEO Act. The Proposal is not considered to fall within the definition of Section 33 'Railway systems activities' of Schedule 1. As such, the Proposal does not require an environment protection licence (EPL) under the POEO Act.</p>
<i>Roads Act 1993</i>	<p>Under Section 138 of the <i>Roads Act 1993</i>, a person must not "erect a structure or carry out a work in, on or over a public road, or dig up or disturb the surface of a public road..." other than with the consent of the appropriate roads authority. However, clause 5(1) in Schedule 2 of the Act states that public authorities do not require consent for works on unclassified roads.</p> <p>The Proposal does not require any work to be undertaken in, on or over a classified road. Therefore, approval from Roads and Maritime Services (RMS) would not be required.</p>
<i>Crown Lands Act 1987</i>	<p>The proposed work would not be undertaken on crown land and the provisions of this Act are not applicable to the Proposal.</p>

4.4. Environmental planning instruments

4.4.1. State Environmental Planning Policy (Infrastructure) 2007

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

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 'signalling, train control, communication and security systems'.

Consequently, development consent is not required, however the environmental impacts of the Proposal 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 prior to the commencement of certain types of development. Chapter 5 of this REF discusses the consultation undertaken in relation to the Proposal.

4.4.2. Other environmental planning instruments

Table 4-4 provides a list of other relevant environmental planning instruments applicable to the Proposal.

Table 4-4 Other relevant environmental planning instruments applicable to the Proposal

Applicable instrument	Considerations
<i>State Environmental Planning Policy No. 14 – Coastal Wetlands (SEPP 14)</i>	The Proposal is not located within an area covered by the SEPP and therefore no further consideration of SEPP 14 is necessary.
<i>State Environmental Planning Policy No. 19 – Bushland in Urban Areas (SEPP 19)</i>	This SEPP protects and preserves bushland within certain urban areas, as part of the natural heritage or for recreational, educational and scientific purposes. Wyong Shire (Wyong Shire Council now forms part of Central Coast Council) and Newcastle City LGAs are not listed in Schedule 1 as an area where bushland needs to be preserved, so no further consideration of this SEPP is required. Lake Macquarie LGA is listed in Schedule 1 as an area where bushland needs to be preserved. The proposed work would not require removal or disturbance to bushland on or adjacent to land reserved or zoned for public open space. Therefore no further consideration of SEPP 19 is required.
<i>State Environmental Planning Policy No. 26 – Littoral Rainforests (SEPP 26)</i>	The Proposal is not located within an area covered by the SEPP and therefore no further consideration of SEPP 26 is required.
<i>State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44)</i>	Wyong Shire (Wyong Shire Council now forms part of Central Coast Council), Lake Macquarie and Newcastle City LGA are listed in Schedule 1 as an area possessing habitat or feed trees for koalas. However, the proposed work would not require the removal of koala habitat or feed trees, so no further consideration of this SEPP is required.
<i>State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55)</i>	SEPP 55 provides for a consistent state-wide planning approach to the remediation of contaminated land. The policy states that land must not be developed if it is unsuitable for a proposed use because it is contaminated. If the land is unsuitable, remediation must take place before the land is developed. If contaminated land is encountered during the construction works a suitable remediation plan would be developed, if required.
<i>State Environmental Planning Policy No. 71 – Coastal Protection (SEPP 71)</i>	The Proposal is within the coastal protection zone designated in the Coastal Protection SEPP. Approval under this SEPP is not required as the SEPP relates to the development of local environmental plans and assessment of Part 4 development applications. The Proposal complies with the aims and matters for consideration of the SEPP. No further consideration of the SEPP is required.

Applicable instrument	Considerations
<i>State Environmental Planning Policy (Major Development) 2005</i>	This SEPP identifies certain developments which are deemed major projects. The Proposal is not listed in this SEPP.
<i>State Environmental Planning Policy (State and Regional Development) 2011</i>	The Proposal is not listed in the SEPP and has not been declared as State Significant Infrastructure or State Significant Development under the SEPP.
<i>State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011</i>	The Proposal is in the Macquarie Tuggerah and the Hunter River catchments which are not part of a drinking water catchment. This SEPP does not apply to the Proposal.
<i>Wyong Local Environmental Plan 2013</i>	<p>The Proposal is in the Central Coast LGA (Wyong now forms part of the Central Coast LGA) and is subject to the Wyong Local Environmental Plan 2013 (Wyong LEP). The proposed works would be undertaken on land zoned SP2 Infrastructure.</p> <p>Rail infrastructure is permissible with consent.</p> <p>As the Infrastructure SEPP overrides the development consent requirements of any LEP, the Proposal can proceed without development consent.</p>
<i>Lake Macquarie Local Environmental Plan 2014</i>	<p>The Proposal is in the Lake Macquarie LGA and is subject to the Lake Macquarie Local Environmental Plan 2014 (Lake Macquarie LEP). The proposed works would be undertaken on land zoned SP2 Infrastructure.</p> <p>Rail infrastructure is permissible with consent.</p> <p>As the Infrastructure SEPP overrides the development consent requirements of any LEP, the Proposal can proceed without development consent.</p>
<i>Newcastle Local Environmental Plan 2012</i>	<p>The Proposal is in the Newcastle City LGA and is subject to the Newcastle Local Environmental Plan 2012 (Newcastle LEP). The proposed works would be undertaken on land zoned SP2 Infrastructure.</p> <p>Rail infrastructure is permissible with consent.</p> <p>As the Infrastructure SEPP overrides the development consent requirements of any LEP, the Proposal can proceed without development consent.</p>

4.5. Commonwealth legislation

4.5.1. Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth EPBC Act requires the assessment of whether the Proposal is likely to significantly impact on matters of NES or Commonwealth land. These matters are considered in full in Appendix 2.

The Proposal would not impact on any matters of NES or on Commonwealth land. Therefore a referral to the Commonwealth Department of the Environment and Energy is not required.

5. Stakeholder communication

Chapter 5 discusses the information that will be provided to the community on the Proposal both during the planning approval process and during construction.

5.1. Communication approach

The communications approach for the Proposal has been designed to serve as an educational tool for interested stakeholders and communities located in close proximity to works being undertaken in the rail corridor.

The works being undertaken as part of the Proposal are based on safety and rail system requirements. For this reason, there is minimal opportunity for any community feedback into projects deliverables. An educational approach to the communication activities has been adopted to allow interested stakeholders to find out more about the program and any likely resulting impacts.

The communication approach being implemented for the program has also been developed having regard for the requirements of the planning process.

The following principles for the Proposal would be adopted:

- generally raising awareness of the Proposal through notifications, site signage, door knocks, advertisements in local newspapers and directing interested stakeholders to the Transport for NSW website
- ensuring that up to date information about the Proposal is available on the Transport for NSW website
- making information available about the appropriate planning processes being followed compliant with legislative requirements
- recording any enquiries and interactions from the community regarding the Proposal
- ensuring a transparent approach.

5.2. Consultation requirements

Table 5-1 provides details of consultation requirements under the Infrastructure SEPP.

Table 5-1 Infrastructure SEPP consultation requirements

Consultation with Councils development with impacts on council related infrastructure and services	Relevance to the Proposal
<p>Where railway station works:</p> <ul style="list-style-type: none"> substantially impact on storm water management services place a local road system under strain involve connection to or impact on a council owned sewerage system involve connection to and substantial use of council owned water supply significantly disrupt pedestrian or vehicle movement involve significant excavation to a road surface or footpath for which Council has responsibility. 	<p>The proposed works are considered to be minor and should not have an impact on council related infrastructure or services.</p>
Consultation with Councils development with impacts on local heritage	Relevance to the Proposal
<p>Where railway station works:</p> <ul style="list-style-type: none"> substantially impact on local heritage item (if not also a State heritage item) substantially impact on a heritage conservation area. 	<p>The proposed works are not expected to have a substantial impact on local heritage items or heritage conservation areas.</p>
Consultation with Councils development with impacts on flood liable land	Relevance to the Proposal
<p>Where railway station works:</p> <ul style="list-style-type: none"> impact on land that is susceptible to flooding – reference would be made to 'Floodplain Development Manual: the management of flood liable land'. 	<p>The proposed works are not expected to impact on flood liable land or change flood patterns.</p>
Consultation with public authorities other than Councils	Relevance to the Proposal
<p>Where development is identified as 'specified development' (i.e. adjacent to land reserved under the NPW Act or within the foreshore area identified in the Sydney Harbour Foreshore Authority Act), the relevant agency should be consulted.</p>	<p>The proposed works are not specified development.</p>

5.3. Communication activities

Table 5-2 identifies the communication activities are intended to be undertaken during the planning, construction and commissioning phase of the Proposal.

Table 5-2 Communication activities

Project phase	Communication tool or activity	Timeframe
Planning	Establish a 1800 number for any enquiries related to the Proposal and log these interactions in a register (Consultation Manager).	Prior to REF determination
Construction	Install signage at each of the access gates identifying that works being undertaken as part of the Proposal and timeframe for delivery.	Prior to construction commencement

Project phase	Communication tool or activity	Timeframe
	Maintain the 1800 number for any enquiries related to the Proposal and log these interactions in a register (Consultation Manager).	Throughout construction phase
	Use a variety of communication tools such as letter box notifications, door knocks and website updates to keep stakeholders informed of construction activities.	Throughout construction phase
Commissioning	Update information on the website to reflect completion of the Proposal including overall benefits of work undertaken.	At completion

6. Environmental impact assessment

Chapter 6 of the REF provides a detailed description of the likely environmental impacts associated with the construction and operation of the Proposal. For each likely impact, the existing environment is characterised and then an assessment is undertaken as to how the Proposal would impact on the existing environment.

To determine the likely impact of the overall Proposal, a preliminary environmental risk assessment has been undertaken for each proposed signal location. The preliminary environmental risk assessment has been undertaken for the following environmental issues:

- water quality / hydrology
- acid sulfate soils
- biodiversity
- noise
- heritage
- contamination
- land use
- traffic and access.

A number of other environmental issues, such as air quality and waste, would generally pose the same potential risk at each proposed signal location. As such, these issues have not been included in the risk assessment. The potential risk and likely impact of these issues are discussed in the relevant section and appropriate standard mitigation measures have been identified to be implemented at all signal locations.

The risk assessment has identified whether the works at the proposed signal locations would present no impact or a low, medium or high risk of impact for the relevant environmental issue. The risk has been determined based on proximity to a sensitive waterbody, heritage item and /or residential property as well as the occurrence of actual or potential acid sulfate soils, threatened species and/or communities and contamination.

Where a high risk has been identified at a proposed signal location, a site-specific assessment has been provided in the relevant section. Where required, appropriate site-specific mitigation measures have been identified to be implemented at these signal locations.

The results of the preliminary environmental risk assessment are provided in Table 6-1.

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 at Appendix 1.

Table 6-1 Preliminary environmental risk assessment

Signal location	Water quality / hydrology	Acid Sulfate Soils	Biodiversity	Noise	Heritage	Contamination	Land use	Traffic and access
65.5	Low	Low	High	Medium	Low	Low	Low	Low
66.8	Low	Low	High	Low	Low	High	Low	Low
66.9	Low	Low	High	Low	Low	High	Low	Low
68.3	Medium	Low	Medium	Low	Low	High	Low	Low
68.6	High	Low	High	Low	Low	Low	Low	Low
69.7	Medium	Low	High	Low	Low	High	Low	Low
69.8	Medium	Low	High	Low	Low	High	Low	Low
71.1	Low	Low	High	Medium	High	Low	Low	Low
71.2	Low	Low	Medium	Medium	High	Low	Low	Low
V1	Medium	Low	High	Low	High	High	Low	Low
72.4	High	Low	High	Low	High	Low	Low	Low
V5	Medium	Low	High	Low	High	High	Low	Low
V6	Low	Low	Medium	Low	High	Low	Low	Low
V8	Medium	Low	Medium	Low	High	Low	Low	Low
77.3	Low	Low	Low	Medium	High	Low	Low	Low
78.8	Medium	High	Medium	Medium	High	Low	Low	Low
78.9	Medium	High	Medium	Medium	High	Low	Low	Low
79.9	Medium	Low	High	Low	High	High	Low	Low
80	Medium	Low	High	Low	High	Low	Low	Low
E1	Low	Low	Medium	Low	High	Low	Low	Low
E5	Low	Low	Medium	Low	High	Low	Low	Low
E6	Low	Low	Medium	Low	High	Low	Low	Low

Signal location	Water quality / hydrology	Acid Sulfate Soils	Biodiversity	Noise	Heritage	Contamination	Land use	Traffic and access
E8	Low	Low	Medium	Low	High	High	Low	Low
A1	Low	Low	Medium	Low	High	High	Low	Low
A7	Low	Low	Medium	High	High	High	Low	Low
A10	Low	Low	Medium	Medium	High	Low	Low	Low
A8	Low	Low	Medium	Medium	High	Low	Low	Low
A13	Low	Low	Low	Medium	High		Low	Low
A17	Low	Low	Low	High	High	Low	Low	Low
A18	Low	Low	Low	Medium	High	Low	Low	Low
86.9	Low	Low	High	Low	High	Low	Low	Low
A20	Low	Low	High	Low	High	Low	Low	Low
87.8	Low	Low	Medium	Low	High	Low	Low	Low
90	Low	Low	Medium	Low	High	High	Low	Low
S121	Medium	Low	Low	Low	High	Low	Low	Low
S180	Medium	Low	Low	High	High	Low	Low	Low
B201	Low	Low	Low	High	Low	Low	Low	Low
B207	Low	Low	Low	High	Low	Low	Low	Low
B211	Low	Low	Low	High	High	High	Low	Low
B286	Low	Low	Low	High	Low	Low	Low	Low

6.1. Landforms, geology and soils

6.1.1. Existing environment

The Central Coast & Newcastle Line between Warnervale and Wickham (Area 3) is generally undulating, with flat areas around Warnervale, Newcastle and major crossings at Dora Creek and Cockle Creek. The elevation ranges from less than 10 metres at Warnervale, Eraring, Fassifern, Booragul and Boolru to about 60 metres at Awaba. Even with the undulating landscape the topography between Warnervale and Wickham is generally flat at each of the signal location footprint.

The geology throughout the Proposal area comprises the Tuggerah Formation between Warnervale and Morisset, Munmorah Conglomerate between Morisset and south of Awaba, Moon Island Beach subgroup around Awaba, Newcastle Coal Measures north of Awaba and Quaternary gravel and sand between Adamstown and Wickham. Quaternary gravel and sand is found around creeks throughout the Proposal area.

Potential Acid Sulfate Soils (PASS) are soils rich in iron sulfides (pyrite). If these soils are brought into contact with oxygen, oxidisation occurs and they become Acid Sulfate Soils (ASS) which are highly acidic. There is a risk of encountering potential acid sulfate soils along the margins of estuarine floodplains and coastal lowlands. A review of the Acid Sulfate Soil (ASS) Risk mapping indicates there is an extremely low to low probability of encountering ASS at all signal locations except Signal Location 78.8 and Signal Location 78.9 which have a high probability of PASS. The ASS Risk Maps include the following details:

- probability of occurrence of acid sulfate soil
- depth to acid sulfate soil
- environmental risk associated with disturbing the soil
- the landform element on which the soil occurs.

6.1.2. Potential impacts

Where space is available, existing conduits or GST would be used for the signal cabling works. Where space within existing cabling conduits or GST are not available, the signal and signal cabinet would be connected using underground cables installed in 0.3 metre wide trench at a depth of 0.6 metres. Land disturbance may also be required at signal locations to install new signalling cabinets where space is not available within existing cabinets. In general, up to 20 square metres of land would be disturbed at each signal location during construction of the Proposal.

Excavated soil and rock for any cable trenching would be temporarily stockpiled on site and backfilled upon completion, provided it is not contaminated or weed infested.

Where trenching is difficult to undertake in rocky terrain, rock breaking may be required.

Trenching activities may result in erosion if appropriate mitigation measures are not in place. Soil erosion has the potential to destabilise landforms and deposit sediments in drainage systems and waterways. Sediment deposition and fine particles in suspension within waterways have direct impact on water quality and aquatic life.

As noted in Section 6.1, two signal locations are within areas identified as having a risk of ASS accordingly the Preliminary Environmental Assessment presented in Table 6-1 classifies these as high risk from an ASS perspective. If not appropriately controlled, the acid generated by ASS could lead to fish kills in nearby waterways and/or longer term degradation of buried rail assets such as cable conduits.

Given the site characteristics and the scope and size of the proposed work at each signal location, it is anticipated that erosion and sediment risks are minimal and can be effectively managed through the implementation of standard measures as outlined in the *Managing Urban Stormwater: Soils and Construction Guidelines* (the Blue Book) (Landcom 2004).

No operational impacts are expected.

6.1.3. Mitigation measures

Site specific erosion and sediment control measures will be identified as part of CEMP/ECM. The proposed erosion and sediment control measures will be implemented in accordance with *Managing Urban Stormwater Soils and Construction* (Landcom, 2004) (the Blue Book) and the *Acid Sulfate Soils Manual* (ASSMAC 1998) (if required) and would include, but not be limited to, those outlined below:

- Appropriate stockpiling of materials would take place away from drainage lines, waterways and drains
- Any soil that may be contaminated or weed infested would be stockpiled separately before being removed from the site
- Stockpiles and disturbed areas shall be appropriately stabilised to minimise erosion
- Disturbed areas would be reinstated as soon as possible
- The actual risk of intercepting ASS would be identified through soil sampling in accordance with the NSW *Acid Sulfate Soil Manual* (1998). Sampling must be undertaken at sites where there is a risk of encountering ASS. Where there is a risk of encountering ASS, soil samples must be taken from the horizon 10 metres below proposed excavation depth
- If PASS is confirmed and expected to be encountered during excavation works an ASS Management Plan must be prepared (as part of the CEMP). Alternative routes for trenching works must also be considered
- As a minimum, the following measures must be implemented where PASS or ASS has been identified:
 - Implement the recommendations of the ASS Management Plan
 - Oxidisation of PASS must be minimised by controlling the extent of excavations
 - Exposed ASS must be neutralised and surface water drainage and potential acid runoff controlled
 - Containment strategies must be implemented to ensure any acidic leachate associated with the oxidation of ASS is contained for treatment or removal off site.

6.2. Water quality and hydrology

6.2.1. Existing environment

The Central Coast & Newcastle Line between Warnervale and Wickham (Area 3) crosses Wallarah Creek, Spring Creek, Mannering Creek, Swampy Creek, Wyee Creek, Cobra Creek, Pourmalong Creek, Dora Creek, Muddy Lake, Stoney Creek, Palmers Creek, L T Creek, Cockle Creek, Winding Creek, Tickhole Creek, Styx Creek and the unnamed channel at Honeysuckle Drive. The rail corridor is part of the Macquarie Tuggerah and Hunter catchments.

Track drainage and runoff generally discharges into bushland and nearby creeks, and into existing culverts in urban areas.

The existing drainage system within the railway corridor consists of an informal arrangement of pit and pipe and outfall points to stormwater. Overland flows from adjoining properties generally pass beneath the ballasted areas via culverts and buried pipes.

Existing shelters above signal cabinets and bungalows are located at a number of signal locations. Rainwater runoff from these shelters discharges to the ground and does not present a risk to local water quality.

Signal Location 79.9 and Signal Location B286 are located on floodplains, as identified on the available flood mapping covering the Proposal area.

Signals locations within 50 metres of a waterway are listed in Table 6-2 Signal location within 50m of major waterways.

Table 6-2 Signal location within 50m of major waterways

Signal location	Area/suburb	Waterway	Comments (Meters (m))
68.6	Walarah	Walarah Creek	Located about 50m north of Wallarah Creek
72.4	Wyee	Wyee Creek	Located about 50m north of Wyee Creek

6.2.2. Potential impacts

Without appropriate safeguards, contaminants such as fuels and hydraulic oils from plant and equipment may reach nearby drains and discharge into local waterways. These contaminants may have the potential to harm aquatic life and affect the quality of water downstream. However, the risk of such an occurrence is generally low, given the distance between the proposed signal locations and drains and creeks. Two signal locations (Signal Location 68.6 and Signal Location 72.4) have been classified as high risk from a water quality perspective due their proximity to a waterway.

During excavation works there is the potential for sediment-laden water to be discharged into local water bodies and/or the nearby stormwater system during a rainfall event. Rain or groundwater may enter trench excavations. If inappropriately managed, sediment-laden water could be discharged into local water bodies and/or the nearby stormwater system.

Signal Location 79.9 and Signal Location B286 are located on a floodplain hence there is potential for flooding during heavy rain. The proposed work at each signal location is relatively minor and would not have any potential impacts on flood patterns.

As noted in Section 6.1, there is a risk of encountering acid sulfate soils at a number of signal locations.

No operational impacts are expected. The works would not affect the landform or the flow of water in the area.

6.2.3. Mitigation measures

During construction water quality impacts would be minimised through a range of control measures in addition to the erosion and sedimentation controls included in Section 6.1. The water quality measures would include, but not be limited to those outlined below:

- Erosion and sediment controls at each worksite would be detailed on the ECM and comply with *Managing Urban Stormwater: Soils and Construction* (Landcom 2004) (the Blue Book)
- Erosion and sediment controls would be regularly inspected and maintained, particularly following heavy rainfall
- The effectiveness of erosion and sediment controls would be monitored daily and adjusted if required
- Plant and equipment would be maintained in accordance with the manufacturer's specifications and checked regularly for oil leaks
- Refuelling of plant and equipment would occur in impervious bunded areas located a minimum of 40 metres from drainage lines or waterways
- Concrete slurries and wash-out would be collected for reuse or for off-site disposal
- Appropriately sized spill response kits must be kept on at the signal locations and staff trained in their use
- Earthworks would be suspended during periods of heavy or prolonged rainfall. Plant and equipment would be removed from the signal location where there is a high risk of inundation
- Dry street sweepers or hand-held brooms would be used to clean local roads in the event of tracked sediment
- Works are to be undertaken in accordance with the TfNSW *Chemical Storage and Spill Response Guidelines* (9TP-SD-066)
- Water discharge from the signal location must be carried out as per TfNSW Water Discharge Guidelines (7TP-SD-024).

6.3. Air quality

6.3.1. Existing environment

The local air quality along the rail corridor between Warnervale and Wickham (Area 3) is typical of an urban/rural environment. The urban area is largely influenced by transport, industrial, commercial and domestic sources. The rural areas consist of large areas of bushland that are likely to have relatively good air quality. There are some industrial/agricultural facilities in the rural areas, such as Eraring Power Station, collieries and intensive agriculture facilities.

6.3.2. Potential impacts

There is a risk of impact on local air quality during the following activities, particularly during warm and dry weather:

- stockpiling of virgin and spoil materials
- excavation of trenches
- backfilling of trenches
- transporting of wastes
- plant movement on access
- emissions from plant and machinery.

No dust or emissions are anticipated during the operation of the AMS.

6.3.3. Mitigation measures

Air quality impacts throughout construction would be minimised through a range of control measures which would include, but not be limited to, those outlined below:

- Plant and equipment would be maintained in accordance with manufacturers' specifications
- Regular inspection of plant and equipment would be undertaken to ascertain that fitted emission controls are operating efficiently
- Plant or machinery would not be left idling
- All work areas and stockpiles would be monitored by construction personnel for dust generation during working hours
- Stockpiles would be maintained and contained appropriately, which could include covering or regular watering to minimise dust
- Trucks transporting spoil and other waste materials from the signal location would be covered appropriately
- Disturbed areas would be rehabilitated as soon as practicable.

6.4. Biodiversity

6.4.1. Existing environment

The Central Coast & Newcastle Line between Warnervale and Wickham (Area 3) experienced significant disturbance during construction of the railway line. There are large areas of bushland adjacent to the corridor between Warnervale and Boorgul. To the north of Boorgul the rail corridor generally traverses urban, commercial and industrial areas.

A desktop review of Endangered Ecological Communities (EECs) and a search of the Office of Environment and Heritage (OEH) Wildlife Atlas and the EPBC Protected Matters Search Tool identified there are potentially 61 species of fauna, 23 species of flora, 2 endangered ecological communities and 74 migratory bird species listed as threatened under the EPBC Act and recordings of 79 threatened fauna species, 21 threatened flora species and 26

endangered ecological communities listed under the TSC Act in the broader study area (within five kilometres of the rail corridor).

Table 6-3 **Error! Reference source not found.** lists threatened species which have previously been recorded in the vicinity of the Proposal. Disturbance of vegetation at these Signal Locations has the potential to impact these species.

Table 6-3 Threatened species locations

Signal location	Threatened species	Conservation status	Proximity to site
66.8 66.9	Heath Wrinklewort (<i>Rutidosia heterogama</i>),	EPBC Act (Vulnerable) TSC Act (Vulnerable)	Around 15 individuals are located around the rail corridor to the south of the signal locations, with one individual within the rail corridor. The nearest individual is located around 60 metres from the signal locations and outside the site footprint.
	Charmhaven Orchid (<i>Corunastylis sp. Charmhaven</i>) (provisional listing)	EPBC Act (Critically endangered) TSC Act (Critically endangered)	Area south of the signal locations identified as potential habitat for the orchid. There are no records of the species in the vicinity of the signal locations.
68.6	Black-eyed Susan (<i>Tethratheca juncea</i>)	EPBC Act (Vulnerable) TSC Act (Vulnerable)	One individual is located outside the rail corridor around 180 metres north of the signal location.
V5	Wallum froglet (<i>Crinia tinnula</i>)	TSC Act (Vulnerable)	One individual recorded around 80 metres north of the signal location and outside the rail corridor.
	Charmhaven apple (<i>Angophora inopina</i>)	EPBC Act (Vulnerable) TSC Act (Vulnerable)	One individual located around 180 metres north of the signal location and outside the rail corridor.

Table 6-4 lists the signal locations located near EECs listed under the TSC Act

Table 6-4 Endangered ecological communities

Signal location	Vegetation type	Endangered Ecological Community (EEC)
65.5 66.8 66.9 69.7 69.8 71.1 V1 86.9	Swamp sclerophyll forest on coastal floodplain	Yes

Signal location	Vegetation type	Endangered Ecological Community (EEC)
A20		
68.6 72.4	River-flat eucalypt on coastal floodplains	Yes
79.9 80	Swamp oak floodplain forest	Yes

There are no records of threatened fauna in the rail corridor. The rail corridor is disturbed and is unlikely to provide suitable habitat for fauna species. Fauna species may traverse the rail corridor or forage along the edges.

Site surveys complete for the concept design phase identified a noxious weed, Lantana (*Lantana camara*) at Signal Location 90.0.

The preliminary environmental risk assessment (refer Table 6-1) classified signal locations as high risk from a biodiversity perspective based on their proximity to Endangered Ecological Communities (EECs) or to threatened species (refer to Table 6-3 and Table 6-4).

6.4.2. Potential impacts

All construction works would be carried out within the rail corridor, and predominantly in areas subject to regular slashing/clearing for ongoing track maintenance and access. The majority of the new assets would either be installed within or close to the ballasted rail track area or around the existing signals or signal cabinet/huts. Where possible, the new infrastructure would utilise existing conduits for power and signal connections. In circumstances where there is no additional capacity in existing conduits; preference would be given to installing galvanised steel troughing and if this is not possible, underground conduits to connect new assets would be excavated.

It is anticipated that due to the nature of works and location of construction footprint, no vegetation removal except for the clearing of grasses and weeds would be required. Should vegetation other than grass and weeds need to be trimmed or removed to support the construction of the Proposal, further approval would be obtained from TfNSW.

Previous ecological assessments complete for the TfNSW Digital Train Radio System (DTRS) project identified potential habitat for the Heath Wrinklewort and Charmhaven Orchid near Signal Location 66.8 and Signal Location 66.9. As noted in Section 6.4.1 these signal locations have accordingly been classified as high risk. Heath Wrinklewort is a small daisy like species that can occur in disturbed areas, including rail ballast. The Charmhaven orchid flowers in late February and early March and is not easily identifiable at other times. If trenching works are required around Signal Location 66.8 and Signal Location 66.9, there is potential for direct and/or indirect impacts to these species.

In circumstances where new underground conduits or crossings are required, the construction impact would be minimised through a hierarchy of controls outlined in the Section 6.4.3, particularly in the vicinity of any threatened species or endangered ecological community.

Trimming of native vegetation may be required along the access tracks to Signal Location E8 and Signal Location A1 to ensure plant, vehicles and/or equipment can safely access the signal location. Any trimming activities are expected to be minor and given the extent of the surrounding bushland, trimming is not expected to significantly impact fauna habitat. The

desktop review (refer Section 6.4.1) indicated no EECs or threatened species are around the signal locations, consequently no EECs or threatened species are expected to be impacted.

A Black-eyed Susan has been recorded around 180 metres away from Signal Location 68.6. The Lake Macquarie region provides suitable habitat for this species and contains important populations. However, there are no records of the species within the rail corridor and the Proposal is not expected to impact the species.

The Wallum froglet has been recorded around 80 metres from the Signal Location V5 outside the rail corridor. The froglet is unlikely to use the open areas in the rail corridor as it generally prefers acidic swampland. However, there is a culvert within 10 metres of the Signal Location V5 and there is potential for the froglet to occur in this area. The froglet may also move along a creek located 160 metres north of the signal location.

The Charmhaven apple is also located about 180 metres north of Signal Location V5 outside the rail corridor. As this species is located outside the rail corridor and no vegetation removal except for the clearing of grasses and weeds is required impacts are not expected.

As noted in Table 6-4, EEC's have been identified in the vicinity of some signal locations. Some of these EECs are located inside the rail corridor and adjacent to the site footprint. As no vegetation removal except for the clearing of grasses and weeds is required impacts to these EECs are not expected.

There is a low risk of damage to other stands of existing vegetation due to stockpiling of materials or vehicle movements. Appropriate control measures, such as fencing, would be installed to ensure the risk of damage to existing vegetation is minimised.

It is likely, that if not controlled correctly, the proposed works at signal locations could cause the spread of weeds. Lantana (*Lantana camara*) is found at Signal Location 90.0. Any vegetation removal would be assessed by an ecologist to ensure that any identified noxious weeds are removed appropriately.

Fauna is unlikely to be impacted by the proposed works, although there is a low risk that animals could potentially fall into an open trench and become trapped or injured.

No operational impacts are expected.

6.4.3. Mitigation measures

Impacts on flora and fauna throughout construction would be minimised through a range of control measures which would include, but not be limited to, those outlined below:

- If threatened and/or protected flora or fauna species are identified at a signal location, work in the vicinity of the subject flora or fauna would stop immediately. A spotter/catcher or ecologist would be engaged to survey the area, in conjunction with TfNSW's Environmental Officer, and advise on species management
- Signal Location 66.8 and Signal Location 66.9: Prior to the commencement of construction works a suitably qualified ecologist would identify areas of potential habitat for the Heath Wrinklewort and Charmhaven Orchid. Any potential habitat would be fenced and marked as a "no go zone" prior to the commencement of construction works and the "no go zone" marked on the ECM. If disturbance to vegetation is required in at these signal locations further ecological assessments would be required to consider the likely impacts to these species

- Construction staff would be made aware of the ecological constraints and the requirements for no impact to any vegetation at following locations. This information would be included on the Signal Location Specific ECMs and would be marked as “no go zones”:
 - Signal Location 66.8 and Signal Location 66.9: Heath Wrinkleworth 60m south and potential habitat for the Charmhaven Orchid
 - Signal Location 68.6: Black eyed Susan has been identified around 180 metres north
 - Signal Location V5: Wallum forget recorded around 80 metres north. Culvert around the signal location may provide suitable habitat for the froglet. Charmhaven apple recorded around 180 metres north of the signal location.
 - Signal Locations 65.5, 66.8, 66.9, 69.7, 69.8, 71.1, V1, 86.9, A20, 68.6, 72.4 and 79.9: EEC are located within 25 metres of the signal location
- The signal location would be inspected for any trapped or injured fauna at the start of each day
- Trenches/excavations would be covered at the end of each day and inspected before they are backfilled to ensure that no fauna species are harmed
- Construction areas should be kept to a minimum and be clearly demarcated to prevent accidental damage to native vegetation
- Stockpiles, plant, equipment and materials storage are to be located on existing cleared lands away from the drip zone of trees or other native vegetation
- Weeds shall be treated and disposed of appropriately and not mixed with other vegetation to be mulched for reuse
- Piles of cleared vegetation should be mulched as soon as practicable after clearing and mulch reused at the signal location where possible
- Vehicle turning circles and parking areas shall be clearly marked and should occur in areas free of native vegetation
- Soil and vegetation that could contain weed material should be removed from machinery prior to any movements off site
- Where space within existing conduits is not available, new GST would be preferred over underground conduits to connect new assets
- Where trenching or excavation is required for installing new underground conduits or crossings, the route or location would be modified or altered to avoid any damage to trees or tree roots, where possible
- Following confirmation of the detailed design for each signal location where disturbance to vegetation is required, and prior to the commencement of construction works, an experienced and qualified ecologist would undertake a survey to establish the presence of any threatened flora and fauna species and/or communities. Where a threatened species and/or communities is identified, further assessment would be undertaken to consider the likely impacts, for the approval of the TfNSW Principal Manager Environmental Impact Assessment
- Any trees requiring removal, trimming or pruning must be assessed and approved for removal using the TfNSW *Application for Removal or Trimming of Vegetation (9TP-FT-078)*

- All cleared vegetation (if any) shall be offset in accordance with TfNSW's *Vegetation Offset Guide* (9TP-SD-087)
- Management in accordance with TfNSW's guidelines, as applicable:
 - *Fauna Management Guideline* (3TP-SD-113)
 - *Vegetation Management Guidelines* (9TP-SD-111)
 - *Weed Management and Disposal Guideline* (3TP-SD-110).

6.5. Noise and vibration

6.5.1. Existing environment

The works at each signal location would take place within the railway corridor which is surrounded by rural, residential, commercial and industrial land uses. Residential receivers are located in Wyee, Morisset, Dora Creek, Awaba and from Argenton to Wickham. Collieries are located at Wallarah, near Fassifern and near Teralba. The noise environment in the surrounding areas is generally dominated rail noise, road noise and industrial/commercial sources. The distance from the works sites to the nearest residential receiver varies from around 15 metres to more than 1 kilometre (refer Table 6-5).

Table 6-5 Summary of nearest residential receiver to each signal location

Signal location	Suburb	Nearest residential receiver (m)	Other comments
S180	Cardiff	10 to 25m	<ul style="list-style-type: none"> • Signal Locations urban with existing rail and traffic noise • Boundary fences provide some screening
B207 B211	Adamstown		
A17 A7	Awaba	25 to-50m	<ul style="list-style-type: none"> • Signal Location A17 is surrounded by rural residential properties with existing road and rail noise • Signal Location B201 and Signal Location B286 are urban sites with existing rail and traffic noise • Boundary fences provide some screening
B201	Kotara		
B286	Hamilton		
65.5	Warnervale	50 to100m	<ul style="list-style-type: none"> • Signal Location A18 is in a rural area • Signal locations 65.5, 71.1, 71.2, 77.3, A8, A10, A13 is surrounded by rural residential properties • Signal Location 78.8 and Signal Location 78.9 are in an urban area
71.1 71.2	Wyee		
77.3	Morisset		
78.8 78.9	Dora Creek		
A13	Awaba		
A8 A10 A18	Awaba	100 to200m	
66.8 66.9 68.3 68.6	Walarah	200m or more	<ul style="list-style-type: none"> • All signal locations area in rural areas with minimal noise sources and receivers • Some existing road and rail noise, and existing noise from power station and collieries
69.7 69.8	Bushells Ridge		
V1 72.4	Wyee		

Signal location	Suburb	Nearest residential receiver (m)	Other comments
V5 V6 V8	Morisset		
79.9 80	Eraring		
E1 E5 E6	Cooranbong		
E8 A1	Awaba		
86.9 A20 87.8	Fassifern		
90	Fennell Bay		
S121	Argenton		

6.5.2. Potential impacts

The *Interim Construction Noise Guideline* (ICNG) (DECC 2009) defines noise management levels (measured in decibels) for residential receivers and other types of receivers including commercial and industrial premises, places of worship and schools.

The ICNG states:

- Where the predicted or measured $L_{Aeq, 15 \text{ min}}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level
- The proponent should also inform all potentially affected residents of the nature of works to be carried out, the expected noise levels and duration and contact details
- For works above the highly affected noise criteria, respite periods may be required, and for works outside standard hours there needs to be a strong justification and negotiation with the community.

The main noise sources during the construction works would be from rock breaking (if required), supersucking and excavation works associated with trenching and ULX construction. Rock breaking is anticipated to be used only in instances where empty existing conduit does not exist and the terrain is rocky.

The main civil construction works at each signal location are expected to be complete within three weeks. Works following this period involve testing and commissioning the newly installed system and are assumed to have a negligible noise impact.

Based on the duration of the civil works, a qualitative construction noise assessment has been undertaken in accordance with the requirements of the ICNG for the works at all signal locations up to 50 metres away (refer to Table 6-5) from sensitive receivers with and without screening noise screening and/or barriers. The works at these signal locations have been assessed as they represent the worst case scenario (where rock breaking is not required) for each of the key noisy activities (refer Table 6-6). Rock breaking and ULX construction would

not generally be required. However, if required at a signal location, these would represent the worst case scenario.

The results from the qualitative construction noise assessment identified that works up to 25 metres away with screening and works up to 50 metres away without screening present a moderate risk of noise impact and accordingly their risk classification in the Preliminary Risk Assessment (refer Table 6-1) is noted as medium. All works at other signal locations would present a low risk of noise impact (refer to Table 6-5). However, there is potential for noise impacts at locations where rock breaking and ULX construction is required. Where this is the case, all residents within 100 metres of the work would be notified prior to the start of works.

Some works may be undertaken outside standard working hours during scheduled track possessions, although this would be minimised as far as practicable. It is unlikely high noise generating equipment would be required outside standard working hours and therefore it is unlikely work outside standard working hours would present a high risk of noise impact.

Vibration effects from the operation of heavy machinery, such as vibratory rollers or large earth moving equipment have the potential to cause structural disturbance or discomfort. The proposed work would not require the use of vibration-causing heavy machinery.

During operation, the AMS is not likely to increase noise or vibration from the rail corridor.

Table 6-6 Qualitative Construction Noise Assessment

Distance to nearest sensitive receiver		Approx. construction noise level at 7m, dB(A)		Noise screening or barriers		Ambient noise environment at receiver		Timing of construction work		Duration of construction work	
<i>Distance (m)</i>	<i>Rating</i>	<i>Category (refer AS2436 and Note 2)</i>	<i>Rating</i>	<i>Description</i>	<i>Rating</i>	<i>Description</i>	<i>Rating</i>	<i>Category</i>	<i>Rating</i>	<i>Duration</i>	<i>Rating</i>
<10	0	≥110dB(A) (e.g. rock breaking)	110	Receivers screened from effective noise source	-10	Quiet, rural, or isolated	-35	Day (7am – 6pm weekdays, 8am to 1pm Sat)	0	<1 hr	-20
10-25	-10	≥100dB(A) (e.g. bored piling, dump truck unloading)	100	Receivers not screened	0	Suburban	-45	Evenings / weekends (6pm – 10pm weekdays, 1pm – 10pm Sat, 8am – 10pm Sunday / public holidays)	10	<1 day	-10
25-50	-16	≥90dB(A) (e.g. concreting, excavator, back hoe, grader, vibratory roller, front end loader, concrete saw)	90			Urban or near busy roads or industrial activity	-55	Night (10pm – 7am weekdays, 10pm – 8am weekends / public holidays)	20	<1 week	-5
50-100	-22	≥80dB(A) (e.g. small generators, trucks, cherry pickers, pneumatic drill)	80							1 to 3 weeks	0
100-200	-28									> 3 and < 26 weeks	10
200-500	-34									>26 weeks	20
500-1000	-40										
>1000	-46										
Signal locations between 10 to 25 metres from sensitive receivers	-10	≥90dB(A) (e.g. concreting, excavator, back hoe, grader, vibratory roller, front end loader, concrete saw)	90	Receivers screened from effective noise source	-10	Suburban	-45	Day (7am – 6pm weekdays, 8am to 1pm Sat)	0	1 to 3 weeks	0

Distance to nearest sensitive receiver		Approx. construction noise level at 7m, dB(A)		Noise screening or barriers		Ambient noise environment at receiver		Timing of construction work		Duration of construction work	
<i>Distance (m)</i>	<i>Rating</i>	<i>Category (refer AS2436 and Note 2)</i>	<i>Rating</i>	<i>Description</i>	<i>Rating</i>	<i>Description</i>	<i>Rating</i>	<i>Category</i>	<i>Rating</i>	<i>Duration</i>	<i>Rating</i>
Signal locations between 25 to 50 metres away from sensitive receivers with screening	-16	≥90dB(A) (e.g. concreting, excavator, back hoe, grader, vibratory roller, front end loader, concrete saw)	90	Receivers screened from effective noise source	-10	Suburban	-45	Day (7am – 6pm weekdays, 8am to 1pm Sat)	0	1 to 3 weeks	0
Signal locations between 25 to 50 metres away from sensitive receivers with screening	-16	≥90dB(A) (e.g. concreting, excavator, back hoe, grader, vibratory roller, front end loader, concrete saw)	90	Receivers not screened	0	Suburban	-45	Day (7am – 6pm weekdays, 8am to 1pm Sat)	0	1 to 3 weeks	0
Score: <i>Signal locations between 10 to 25 metres away from sensitive receivers with screening (daytime work): 25 (moderate)</i> <i>Signal locations between 25 to 50 metres away from sensitive receivers with screening (daytime work): 19 (low)</i> <i>Signal locations between 25 to 50 metres away from sensitive receivers without screening (daytime work): 29 (moderate)</i>				Impact / risk level ranges Low: <25 (highly likely that noise mitigation will not be required, other than those identified above and if complaints “hot spots” have been considered) Moderate: 25 - 35 (consider standard construction noise control measures (as per the Construction Noise Strategy and inform community) High: 35+ (inform community, implement all practical means to mitigate, >50 requires specialist noise study / advice)							

6.5.3. Mitigation measures

Construction works would adopt Best Management Practice (BMP) and Best Available Technology Economically Achievable (BATEA) practices as described in the ICNG and be carried out in accordance with TfNSW's *Construction Noise Strategy* (7TP-ST-157). Control measures to minimise noise and vibration impacts would include, but not be limited to, those outlined below:

- Maximise the offset distance between noisy plant items and sensitive receivers
- Orient plant and equipment to minimise noise at sensitive receivers
- Avoid the simultaneous operation of two or more noise plant items in close vicinity and adjacent to sensitive receivers
- Carry out loading and unloading at times and locations to minimise impacts on sensitive receivers
- Where necessary, use structures to shield sensitive receivers from noise sources
- Work, other than the installation of track assets, would be restricted to standard working hours (7:00am to 6:00pm Monday to Friday and 8:00am to 1:00pm Saturdays) unless otherwise approved by TfNSW. Should works be required outside of standard working hours: community members would be advised where appropriate, and all relevant approvals would be sought, including submission and approval of TfNSW's *Out of Hours Works Application Form* (9TP-FT-079) in accordance with TfNSW's *Construction Noise Strategy* (7TP-ST-157)
- Provide mitigation in accordance with the requirements of the TfNSW *Construction Noise Strategy* (7TP-ST-157) if high noise generating activities occur for extended periods
- Noise complaints would be managed in accordance with TfNSW *Construction Noise Strategy* (7TP-ST-157). Any noise complaints received would be addressed in accordance with TfNSW complaints management procedures.

In addition, residents within 100 metre radius of the signal locations identified in the Proposal would be notified of the works prior to the commencement of construction. Notification would include the duration of work, potential impacts and contact details for further information.

6.6. Heritage

6.6.1. Existing environment

A search for non-Aboriginal heritage items was undertaken by consulting the following databases: State Heritage Register (SHR), State Heritage Inventory, Wyong Local Environment Plan (LEP) (which is now part of the Central Coast Council), Lake Macquarie LEP (LEP), Newcastle LEP, Australian Heritage Database, (including Commonwealth Register of the National Estate), world heritage sites and Sydney Train's Section 170 Heritage and Conservation Register (Section 170 Register).

The heritage items and conservation areas with potential to be impacted by the Proposal are identified in Table 6-7. As noted in Table 6-7 the curtilage of the Awaba Railway Jib Crane & Former Cottage Potential Archaeological Site includes signal location A7, A8 and A10. The actual jib crane is located around 25 metres from Signal Location A8 and Signal Location A10

and the potential site of a former cottage around 75 metres from Signal Location A7. Where required, appropriate site-specific mitigation measures have been identified to be implemented only at these signal locations indicated in Section 6.6.3.

A number of other heritage items and conservation areas are located adjacent to the Proposal. None of these items are within 50 metres of the proposal. Broadmeadow Rail Locomotive Depot and Hamilton Railway Station Group are listed on the SHR and are over 350 metres and 850 metres respectively from the Proposal. Given the proposed scope of works at each signal locations, there would be no impact on adjacent heritage items and as such these have not been identified below.

Table 6-7 Heritage items located in the footprint of the proposed signal locations

Signal location	Heritage item	Heritage listing	Heritage significance
71 71.2 V1 72.4 V5 V6 V8 77.3 77.2 78.8 78.9 79.9 80 E1 E5 E6 E8 A1 A7 A8 A10 A13 A17 A18 86.9 A20 87.8 S180	Great Northern Railway Line	Lake Macquarie LEP (Local)	The first section of the Great Northern Railway from Newcastle to Maitland was constructed in 1857. The section through Lake Macquarie opened in 1887. The railway is significant because it changed the relationship of Newcastle with its hinterland and the standing of Newcastle as a great commercial centre. It confirmed the importance of Newcastle as a coaling port and linked towns and villages in Lake Macquarie with Newcastle.
A7 A8 A10	Awaba Railway Jib Crane & Former Cottage Potential Archaeological Site	Lake Macquarie LEP (Local) Section 170 Register	The jib crane was built in the 1930s to serve the goods siding. It is thought there were two residences associated with and in proximity of the Awaba Station. One is still extant and is located on the southern side of the rail line between Wilton Road and the station, though it was sold into private ownership in 1992 and the second was demolished. The exact location of the demolished cottage is not known but may be on Adelaide Street.

Signal location	Heritage item	Heritage listing	Heritage significance
			The crane is historically significant for its ability to demonstrate past activity and railway infrastructure in this town. It is the only remaining physical evidence of the once busy railway sidings that were located at Awaba and is rare (one of only 7 in railway ownership in the metropolitan network). The crane has integrity and intactness. The integrity of the privately owned cottage is unknown.
B211	Adamstown Railway Station Group (including the Adamstown Signal Box)	Section 170 Register Newcastle LEP (Local)	Adamstown Station opened in 1888. Apart from being a junction station, Adamstown is also located at the southern end of the extensive Broadmeadow railway yards and in previous years, a large signal box (Adamstown Signal Box) controlled the entry and departure of trains to, and from, the southern end of the railway yards. The components of the heritage item are platforms, platform building, platform shelter, signal box and footbridge. The station is significant because the earliest station buildings were erected in 1890 and led to the subsequent subdivision and development of the town. The signal box and footbridge are rare and the footbridge has unusual design variations.

A search for known Aboriginal heritage items was undertaken for the Proposal, (with a 100 metre buffer of the rail corridor between Warnervale and Wickham (Area 3)) using the Office of Environment and Heritage's Aboriginal Heritage Information Management System (AHIMS). There are no registered items of Aboriginal significance within 100 metres of the rail corridor.

The Proposal is located within the Darkinjung and Biraban and Awabakal Local Aboriginal Land Council's (LALC).

6.6.2. Potential impacts

Proposed work at signal locations A7, A8, A10 and B211 would be within the curtilage of items listed on the Section 170 Register and LEP heritage schedules (refer to Table 6-7). Twenty eight signal locations between Wyee and Cardiff are also located with the curtilage of the Great Northern Railway Line which is listed under the Lake Macquarie LEP heritage schedules. The Proposal involves work on existing signalling locations and installation of track equipment, which is unlikely to result in any direct and / or indirect impacts to the heritage significance of this item. Consultation Lake Macquarie City Council would be undertaken prior to any works commencing at these signal locations.

Work at signal locations A7, A8 and A10 would be within the heritage curtilage of the Awaba Railway Jib Crane & Former Cottage Potential Archaeological Site. No work is proposed to occur in the specific heritage curtilage of the jib crane (5 metres from the outside edge of the crane) and there would be no work around the potential location of the former cottage.

Work at Signal Location B211 would be within the curtilage of the Adamstown Railway Station Group which includes the Adamstown Signal Box. Signal Location B211 is around 15 metres

from the Adamstown Signal Box. The Proposal work would not impact any significant structures at the railway station and/or signal box.

Works at Signal locations A7, A8, A10 and B211 are unlikely to result in direct and/or indirect impacts on Awaba Railway Jib Crane & Former Cottage Potential Archaeological Site and the Adamstown Railway Station Group. Consultation with Sydney Trains and the respective LGA would be required prior to any works commencing at these signal locations.

The proposed works would not result in any visual impacts on heritage listed items adjacent to the signal locations

There are no anticipated impacts on Aboriginal heritage as a result of the Proposal. Due to highly disturbed nature of the rail corridor, it is expected that the potential for items of Aboriginal heritage significance to be buried within the footprint of the signal locations across the Proposal is low.

6.6.3. Mitigation measures

Impact on heritage throughout construction would be minimised through a range of control measures, which would include, but not be limited to, those outlined below:

- Great Northern Railway Line: Consultation Lake Macquarie City Council would be undertaken for works at signal locations which are within the curtilage of the Great Northern Railway Line
- Signal Location A7, A8 and A 10: Works would be within the heritage curtilage of the locally significant Awaba Railway Jib Crane & Former Cottage Potential Archaeological Site. Consultation with Sydney Trains and Lake Macquarie City Council would be undertaken prior to any works commencing at these signal locations. Further assessment will be undertaken to determine the need for any applicable approvals under the Heritage Act (i.e. s139 exception or s140 permit) for works this location
- Signal Location A8 and Signal Location A10: No work is permitted within the heritage curtilage of the jib crane (5m from the outer edge of the crane) which is part of the Awaba Railway Jib Crane & Former Cottage Potential Archaeological Site. This area would be marked as a “no-go zone” on the ECM
- Signal Location B211: Works would be within the heritage curtilage of the locally significant Adamstown Railway Station Group (including the Adamstown Signal Box). Consultation with Sydney Trains and Newcastle City Council would be undertaken prior to any works commencing at this signal location
- If a non-Aboriginal historical relic is discovered, all work likely to affect it would cease and the Project Manager would be contacted. TfNSW staff and the Office of Environment and Heritage (OEH) would be notified as required. An investigation would be undertaken by a suitably qualified archaeologist to identify suitable measures to reduce the impact on the relic discovered before work resumes
- Should Aboriginal heritage items be uncovered, all work in the vicinity would cease and the Project Manager and TfNSW staff would be notified immediately. The Office of Environment and Heritage would be notified in accordance with the *National Parks and Wildlife Act 1974*. The Local Aboriginal Land Council would be notified and an assessment by an archaeologist would be arranged to determine the significance of the objects and any other requirements before work resumes.

6.7. Waste

6.7.1. Overview

TfNSW is required to manage waste in accordance with the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act). The waste hierarchy (Avoid, Reuse, Recycle, Energy Recovery and Disposal) should be followed for all projects.

6.7.2. Potential impacts

The main waste streams that may be generated during construction include:

- excavated material
- slurry from underbore arisings
- slurry from underbore arisings
- concrete
- steel
- wood
- vegetation
- packaging
- general litter including glass, plastic, metal and paper waste.

The volume of concrete waste is expected to be minimal as concrete plinths used for extending existing signal cabinets and bungalows would be pre-manufactured off-site, where possible, and transport to the signal locations when required.

No operational impacts are expected.

6.7.3. Mitigation measures

A Waste Management Plan would be prepared to detail waste types and quantities as well as methods for segregation, handling, storing and disposal. Furthermore, waste impacts would be minimised through a range of control measures, (consistent with the WARR Act) which would include, but not be limited to, those outlined below:

- All waste would be classified in accordance with the *Waste Classification Guidelines* (EPA 2014) and transported to a place that can lawfully accept the waste
- Any material that may be classified as a hazardous waste would be managed appropriately and in accordance with TfNSW procedures
- Packaging would be minimised, where possible and where the safety and delivery of services is not compromised
- Wherever possible, suitable excavated material would be reused at each signal location for backfilling, landscaping and other purposes
- Wherever possible, excess material shall be beneficially reused in accordance with a Resource Recovery Exemption rather than classified and disposed as waste
- Any spoil or waste material tracked onto roads would be swept up immediately

- Adequate numbers of bins and waste containers would be placed available at each signal location. The site manager would ensure bins are not overflowing and are appropriately covered
- Wastewater generated by non-destructive excavation would be taken off site for treatment and disposal
- All waste would be removed from the signal location when work is completed.

6.8. Contaminated land and hazardous materials

6.8.1. Existing environment

The proposed signal locations have been initially investigated for potential land contamination. The investigation included:

- Site assessment
- A review of soil testing undertaken at selected signal locations
- Search of OEH register of contaminated sites
- Search of Sydney Trains records
- Review of all materials that would be used at the signal location to establish their potential for land contamination.

Due to the historical and ongoing use of the signal locations as part of the rail corridor, the following potential sources of contamination may be present in the vicinity of the site:

- Fuel and oil spills and engine emissions
- Rail corridor maintenance activities, such as application of pesticides and herbicides
- Brake linings
- Historical cables / pipework ducting and former site structures, with potential asbestos containing materials
- Fabric of old rolling stock
- Imported fill.

O'Donnell Griffin has undertaken a site survey for each proposed signal location and carried out a ballast contamination risk assessment. The following information was recorded during the assessments:

- Visual evidence of contamination
- Presence of hazardous building materials
- Waste materials
- Surrounding land use.

The following information sources were searched as part of the assessment:

- Hazardous sites register
- Contaminated land register

- Local knowledge
- Track maintenance history.

Signal locations with known or potential contamination are classed as high risk (refer to Table 6-1). Details of potential contamination at high risk signal locations are provided in Table 6-8.

Table 6-8 Signals with potential contamination

Signal location	Contamination	Location (Metres (m))
66.8	Suspected asbestos	No specific location identified – asbestos potentially located in the 40m by 20m work area
66.9	Suspected asbestos	No specific location identified – asbestos potentially located in the 40m by 20m work area
68.3	Suspected asbestos	No specific location identified – asbestos potentially located in the 40m by 20m work area
69.7	Suspected asbestos	No specific location identified – asbestos potentially located in the 40m by 20m work area
69.8	Suspected asbestos	No specific location identified – asbestos potentially located in the 40m by 20m work area
V1	Asbestos present	Under signal location
V5	Suspected asbestos	No specific location identified – asbestos potentially located in the 40m by 20m work area
79.9	Old slab concrete hut likely to contain asbestos and flaking paint (potentially lead)	Power supply location
E8	Suspected asbestos	No specific location identified – asbestos potentially located in the 40m by 20m work area
A1	Suspected asbestos	No specific location identified – asbestos potentially located in the 40m by 20m work area
A7	Suspected asbestos	No specific location identified – asbestos potentially located in the 40m by 20m work area
90	Suspected asbestos	No specific location identified – asbestos potentially located in the 40m by 20m work area
B211	Building structures likely to contain asbestos and flaking paint (potentially lead)	No specific location identified – asbestos potentially located in the 40m by 20m work area

6.8.2. Potential impacts

The Proposal requires minimal excavations. The proposed trenching would vary in length and would generally be about 0.3 metres wide and 0.9 metres deep. Supersucking may be undertaken to find empty conduits and once found this practice replaces trenching.

There is a risk of encountering contaminated material and asbestos during excavation (refer Table 6-8). If encountered, contaminants may pose a risk to health of workers and the environment in general.

If uncontrolled, stockpiling of contaminated spoil could lead to pollution of nearby watercourses due to rainfall runoff or stockpile slippage.

Asbestos removal is likely to be required at Signal locations V1, 79.9 and B211. There is potential for asbestos to be found at Signal locations 66.8, 66.9, 68.3, 69.7, 69.8, V5, E8, A1, A7 and 90. The removal of asbestos would require an experienced, appropriately licensed removal contractor in accordance with the *How to Safely Remove Asbestos Code of Practice* (Safe Work Australia, 2016). An Occupational Hygienist would be on site during removal works.

Construction of the Proposal would not require the use of any chemicals and/or hazardous materials.

The operation of the AMS is not expected to cause contamination or generate hazardous materials.

6.8.3. Mitigation measures

The risk of encountering unknown contaminants during excavation shall be managed in accordance with TfNSW's procedures, the CEMP, ECM and land contamination legislation. Control measures to manage contamination risks would include, but not be limited to, those outlined below:

- All waste spoil would be managed in accordance with the Waste Classification Guidelines (NSW EPA 2014) and *National Environment Protection (Assessment of Site Contamination) Measure 1999*
- All hazardous materials removal and clean-up operations must be carried out in accordance with the NSW *Work Health and Safety Act* and Regulations 2011 and the Safe Work NSW requirements
- As part of the project induction, construction personnel would receive training in the identification, management and handling of contaminated and hazardous materials should they be encountered during the works
- During excavation, site workers will look for signs of potential contamination such as presence of waste and/or other imported materials, odours, soil colouring, floating layer in groundwater etc
- If any previously unidentified contamination is encountered, or suspected, works in the vicinity of the find would be immediately stopped and the affected area fenced off. The site would be investigated and validated, with works to resume after approval from a suitably qualified and experienced Health, Safety and Environment professional is obtained
- Personnel dealing with the hazardous substances should be appropriately trained
- Contaminated soil would be segregated and appropriately contained prior to classification and ultimate disposal
- The quantity of spoil generated would be minimised
- If hazardous materials are required for any unforeseen reason, a Hazardous Waste Management Plan would be prepared. The plan would detail terms applying to the purchase, storage, use, handling and disposal of such materials
- Hazardous materials would be transported, stored and used in accordance with the corresponding material safety data sheets which would be available at the signal location
- No fuels would be stored at any signal location

- Removal of suspected and/or known asbestos, including building structures likely to contain asbestos requires an experienced, appropriately licensed removal contractor in accordance with the *How to Safely Remove Asbestos Code of Practice* (Safe Work Australia 2016). An Occupational Hygienist should be on site during removal works.

6.9. Visual amenity

6.9.1. Existing environment

The Proposal is located in the rail corridor of the Central Coast & Newcastle Line between Warnervale and Wickham (Area 3). The rail corridor is generally surrounded by bushland, rural, residential, commercial and industrial land use types. Major waterway crossings are at Dora Creek and Cockle Creek.

Residents adjoin the rail corridor at signal locations 71.1, 71.2, 77.3, A7, A8, A10, S121, S180, B201, B207, B211, and B286.

The signal locations are generally visible to train passengers and often not visible from outside the rail corridor.

6.9.2. Potential impacts

During construction the visual environment would be temporarily altered through the presence of temporary work buildings, plant and equipment.

Due to the relative minor scale of the works, the Proposal is not anticipated to have a long-term impact on the consistency of the character of the railway corridor. It is not expected to cause additional light reflection or shadowing.

Vegetation trimming may be required along the access path to Signal Location E8 and Signal Location A1 (refer Section 6.4.2). Vegetation removal is not expected in residential areas which could reduce privacy for adjacent property owners.

6.9.3. Mitigation measures

Visual impact during construction would be minimised through a range of control measures which would include, but not be limited to, those outlined below:

- Clearance of vegetation shall be minimised
- The work area shall be maintained in an orderly manner
- All temporary signage associated with the works must be appropriately displayed
- All work equipment and materials would be contained within the designated boundaries of the work site.

6.10. Land use

6.10.1. Existing environment

The proposed signal locations are on land owned by TfNSW and zoned SP2 Infrastructure under the Wyong LEP (now part of the Central Coast Council), Lake Macquarie LEP (LEP) and the Newcastle LEP. The Proposal is located in the rail corridor and is currently used for rail purposes. The neighbouring land uses between Warnervale and Boorgul include bushland and rural residential, with small urban areas at Wyee, Morrisset, Dora Creek, Awaba and Fassifern. Collieries are located at Wallarah, near Fassifern and near Teralba. Eraring Power Station and Morrisset Country Club are located beside the Proposal area. Land use between Teralba and Wickham is residential, commercial and industrial.

6.10.2. Potential impacts

The Proposal would not affect or alter the current use of the proposed signal locations or the immediate surrounding area as a rail corridor. It would not have any effects on the use of the neighbouring properties.

6.10.3. Mitigation measures

No specific control measures are required.

6.11. Socio-economic impacts

6.11.1. Existing environment

The Proposal is in the Wyong (now part of the Central Coast Council), Lake Macquarie and Newcastle LGAs, which in the 2011 census had a population of around 158,256, 189,006 and 148,535 respectively, with a median age of 39.6, 41 and 37 respectively. The main employment areas in the Proposal area are around the northern part of Lake Macquarie LGA and in the Newcastle LGA.

The Central Coast & Newcastle Line is regularly used by passenger and freight traffic. The rail line plays an important role in the economic activity of the local areas and enables commuters to travel to and from other major economic areas.

6.11.2. Potential impacts

Social and economic considerations typically focus on the effect on the local community as a whole, and on any local businesses. Amenity issues such as noise and traffic are some of the key issues that can affect the community and are discussed in detail in Sections 6.5 and Section 6.12.

The Proposal is not expected to impact commuter parking, station access or any businesses around any signal location. The construction of the Proposal would require scheduled track possessions. Noise impacts would be temporary (less than three weeks).

There would be positive long term effects resulting from the Proposal, as the new AMS would provide a more reliable and safe rail network.

6.11.3. Mitigation measures

In addition to the control measures proposed in the noise and traffic sections, other control measures are outlined below:

- Nearby residents and businesses would be informed about the nature and timing of works
- Signage would notify the public about the works
- Appropriate fencing would help maintain public safety during construction.

6.12. Traffic and access

6.12.1. Existing environment

Access to the railway corridor is obtained using existing access gates. Distance from the access gates to the signal locations can range between 10 metres and 800 metres. These access gates are used regularly by Sydney Train for periodic maintenance activities along the corridor. It is estimated that staff and contractors currently use the gates and access tracks around 14 to 20 times a year.

Access gates are generally positioned in areas to enable safe access to the surrounding road network. Volumes of traffic on the surrounding road network vary according to time of day and are expected to be busiest during morning and evening peak periods.

6.12.2. Potential impacts

During construction, there would be an increased number of vehicles using the local streets; however, the anticipated increase in the volume of traffic is relatively small (about one vehicle per hour would access / egress the corridor).

Pedestrians are not expected to be affected by vehicles accessing or egressing the work sites.

As works are to take place in the rail corridor, access changes to local roads or access to driveways are not expected.

6.12.3. Mitigation measures

Impacts associated with traffic and access would be minimised through a range of control measures, which would include, but not be limited to those outlined below:

- A traffic speed limit shall be enforced at all signal locations
- Scheduled road movements must be minimised where possible
- Deliveries of plant and materials must be undertaken outside peak periods where possible
- Vehicles shall be parked within the rail corridor and not in public commuter parking spaces
- Where access to the signal locations requires access through land not owned by TfNSW, consultation would be undertaken with would land owners and consent to access the land would be obtained where required.

6.13. Light spill

6.13.1. Existing environment

Ambient artificial lighting varies at each signal location depending on the surrounding land use. In many cases, light spillage from suburban street lighting provides artificial light at the signal locations. More remote signal locations such as those between Signal location 68.3 and 90 have minimal artificial light.

The existing signal locations are not fitted with external lighting.

6.13.2. Potential impacts

Some work may be undertaken during night-time periods. Lighting towers would be required to illuminate the work areas, which may result in temporary light spill impacts on nearby residents.

No operational light spill is expected.

6.13.3. Mitigation measures

Lighting required during night works shall be directed towards the work area and away from adjacent sensitive receivers.

6.14. Demand on resources

The Proposal would not significantly increase the demand on any current or likely scarce resource. Water, electricity or materials supplies required for the Proposal would not be significant in comparison to other large scale construction projects. All materials used in the construction of the Proposal are common construction materials.

6.15. Cumulative impacts

Cumulative impacts often result when several different construction projects are scheduled for similar times and locations.

A search of the Department of Planning and Environment's Major Projects register, Wyong Shire Council (now part of the Central Coast Council), Lake Macquarie Council and Newcastle City Council development application register and the TfNSW projects website was undertaken in October 2016. The following projects are located close to the Proposal:

- Wallarah Coal 2 (major project): A proposal to extend an existing coal mine and include a rail spur. The rail spur (once approved) would be adjacent to the rail corridor at Signal Location 69.7 and Signal Location 69.8. To date this proposal has not been approved
- Wickham Station upgrade: TfNSW commenced construction in September 2016 and is expected to finish in 2017. There are no signals located close to the work
- The Newcastle Light Rail: Construction scheduled to commence in 2017 and would be around 1.7 kilometres from the nearest signal location. The proposed work would be located within the rail corridor and is not expected to result in disruptions to the community. Cumulative impact with the light rail construction is not expected.

Where other works are planned during the same scheduled track possessions, coordination meetings would identify the appropriate responsibilities for undertaking notifications to affected stakeholders.

There is also a risk of cumulative impacts if unscheduled work, e.g. emergency work by other utilities or developers is required. Such situations would be monitored and addressed by the Project Manager.

The Proposal involves works at a number of signal locations along the rail corridor. The construction team would complete works at each signal location prior to progressing to the next signal location so cumulative impacts are minimised.

Overall this work, as part of the AMS, would result in significant benefits by providing a more reliable and safe rail network.

6.15.1. Mitigation measures

- Any other major development or works planned in the vicinity of the site would be further investigated before work begins and cumulative impacts minimised where possible
- Consultation with Central Coast Council, Lake Macquarie Council and Newcastle Council and any other relevant stakeholders regarding other developments would be undertaken on an ongoing basis.

7. Environmental management

This chapter of the REF identifies how the environmental impacts of the Proposal would be managed through environmental management plans and mitigation measures.

7.1. Environmental management plans

A construction environmental management plan (CEMP) for the construction phase of the Proposal would be prepared in accordance with the requirements of the TfNSW (Infrastructure and Services) Environmental Management System (EMS). The CEMP would provide a centralised mechanism through which all potential environmental impacts relevant to the Proposal 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

7.2.1. Standard mitigation measures (for all signal locations)

Standard mitigation measures for the Proposal are listed in Table 7-1. These proposed measures would minimise the potential adverse impacts of the Proposal identified in Chapter 6, should the Proposal proceed.

Table 7-1 Proposed standard mitigation measures

Standard mitigation measures
General
This REF has been developed based on the AMS Concept Design, further environmental approvals may be required if design developments during the detailed design phase extend proposed works outside the assessed site footprint provided on the Signal Location Plans.
An Environmental Controls Map (ECM) would be developed for each signal location prior to commencement of construction in accordance with TfNSW's <i>Guide to Environmental Control Map</i> (3TP-SD-015). The ECM would be implemented for the duration of construction.
A project risk assessment including environmental aspects and impacts would be undertaken prior to the commencement of construction.
Weekly inspections to monitor environmental compliance and performance would be undertaken during construction.
Prior to the commencement of construction, all contractors would be inducted on the key project environmental risks, mitigation measures and conditions of approval.
Landforms, geology and soil
Appropriate stockpiling of materials would take place away from drainage lines, waterways and drains.
Any soil that may be contaminated or weed infested would be stockpiled separately before being removed from the site.
Stockpiles and disturbed areas shall be appropriately stabilised to minimise erosion.
Disturbed areas would be reinstated as soon as possible.

Standard mitigation measures

The actual risk of intercepting ASS would be identified through soil sampling in accordance with the *NSW Acid Sulfate Soil Manual* (1998). Sampling must be undertaken at signal locations where there is a risk of encountering ASS (Refer Table 6-1). Where there is a risk of encountering PASS, soil samples must be taken from the horizon 10 metres below proposed excavation depth.

If PASS is confirmed and expected to be encountered during excavation works an ASS Management Plan must be prepared (as part of the CEMP). Alternative routes for trenching works must also be considered.

As a minimum, the following measures must be implemented where PASS or ASS has been identified:

- Implement the recommendations of the ASS Management Plan
- Oxidisation of PASS must be minimised by controlling the extent of excavations
- Exposed ASS must be neutralised and surface water drainage and potential acid runoff controlled
- Containment strategies must be implemented to ensure any acidic leachate associated with the oxidation of ASS is contained for treatment or removal off site.

Water quality and hydrology

Erosion and sediment controls at each worksite would be detailed on the ECM and comply with *Managing Urban Stormwater: Soils and Construction* (Landcom, 2004) (the Blue Book).

Erosion and sediment controls would be regularly inspected and maintained, particularly following heavy rainfall.

The effectiveness of erosion and sediment controls would be monitored daily and adjusted if required.

Plant and equipment would be maintained in accordance with the manufacturer's specifications and checked regularly for oil leaks.

Refuelling of plant and equipment would occur in impervious bunded areas located a minimum of 40 metres from drainage lines or waterways.

Concrete slurries and wash-out would be collected for reuse or for off-site disposal.

Appropriately sized spill response kits must be kept on site and staff trained in their use.

Earthworks would be suspended during periods of heavy or prolonged rainfall. Plant and equipment would be removed from site where there is a high risk of inundation.

Dry street sweepers or hand-held brooms would be used to clean local roads in the event of tracked sediment.

Works are to be undertaken in accordance with the TfNSW *Chemical Storage and Spill Response Guidelines* (9TP-SD-066).

Water discharge from site must be carried out as per TfNSW *Water Discharge Guidelines* (7TP-SD-024).

Air quality

Plant and equipment would be maintained in accordance with manufacturers' specifications.

Regular inspection of plant and equipment would be undertaken to ascertain that fitted emission controls are operating efficiently.

Plant or machinery would not be left idling.

All work areas and stockpiles would be monitored by construction personnel for dust generation during working hours.

Stockpiles would be maintained and contained appropriately, which could include covering or regular watering to minimise dust.

Trucks transporting spoil and other waste materials from site would be covered appropriately.

Standard mitigation measures

Disturbed areas would be rehabilitated as soon as practicable.

Biodiversity

If threatened and/or protected flora or fauna species are identified at a signal location, work in the vicinity of the subject flora or fauna would stop immediately. A spotter/catcher or ecologist would be engaged to survey the area, in conjunction with TfNSW's Environmental Officer, and advise on species management.

Signal Location 66.8 and Signal Location 66.9: Prior to the commencement of construction works a suitably qualified ecologist would identify areas of potential habitat for the Heath Wrinklewort and Charmhaven Orchid. Any potential habitat would be fenced and marked as a "no go zone" prior to the commencement of construction works and the "no go zone" marked on the ECM. If disturbance to vegetation is required in at these signal locations further ecological assessments would be required to consider the likely impacts to these species.

Construction staff would be made aware of the ecological constraints and the requirements for no impact to any vegetation at following locations. This information would be included on the Signal Location Specific ECMs and would be marked as "no go zones":

- Signal Location 66.8 and Signal Location 66.9: Heath Wrinklewort 60m south and potential habitat for the Charmhaven Orchid
- Signal Location 68.6: Black eyed Susan has been identified around 180 metres north
- Signal Location V5: Wallum forget recorded around 80 metres north. Culvert around the signal location may provide suitable habitat for the froglet. Charmhaven apple recorded around 180 metres north of the signal location.
- Signal Locations 65.5, 66.8, 66.9, 69.7, 69.8, 71.1, V1, 86.9, A20, 68.6, 72.4 and 79.9: EEC are located within 25 metres of the signal location.

The signal location would be inspected for any trapped or injured fauna at the start of each day.

Trenches/excavations would be covered at the end of each day and inspected before they are backfilled to ensure that no fauna species are harmed.

Construction areas should be kept to a minimum and be clearly demarcated to prevent accidental damage to native vegetation.

Stockpiles, plant, equipment and materials storage are to be located on existing cleared lands away from the drip zone of trees or other native vegetation.

Weeds shall be treated and disposed of appropriately and not mixed with other vegetation to be mulched for reuse.

Piles of cleared vegetation should be mulched as soon as practicable after clearing and mulch reused at the signal location where possible.

Vehicle turning circles and parking areas shall be clearly marked and should occur in areas free of native vegetation.

Soil and vegetation that could contain weed material should be removed from machinery prior to any movements off site.

Where space within existing conduits is not available, new GST would be preferred over underground conduits to connect new assets.

Where trenching or excavation is required for installing new underground conduits or crossings, the route or location would be modified or altered to avoid any damage to trees or tree roots, where possible.

Following confirmation of the detailed design for each signal location where disturbance to vegetation is required, and prior to the commencement of construction works, an experienced and qualified ecologist would undertake a survey of to establish the presence of any threatened flora and fauna species and/or communities. Where a threatened species and/or communities is identified, further assessment would be undertaken to consider the likely impacts, for the approval of the TfNSW Principal Manager Environmental Impact Assessment.

Standard mitigation measures

Any trees requiring removal, trimming or pruning that have not been previously assessed in accordance with this REF must be assessed and approved for removal using the TfNSW *Application for Removal or Trimming of Vegetation* (9TP-FT-078).

All cleared vegetation (if any) shall be offset in accordance with TfNSW's *Vegetation Offset Guide* (9TP-SD-087).

Management in accordance with TfNSW's guidelines, as applicable:

- *Fauna Management Guideline* (3TP-SD-113)
- *Vegetation Management Guidelines* (9TP-SD-111)
- *Weed Management and Disposal Guideline* (3TP-SD-110).

Noise and vibration

Maximise the offset distance between noisy plant items and sensitive receivers.

Orient plant and equipment to minimise noise at sensitive receivers.

Avoid the simultaneous operation of two or more noisy plant items in close vicinity and adjacent to sensitive receivers.

Carry out loading and unloading at times and locations to minimise impacts on sensitive receivers.

Where necessary, use structures to shield sensitive receivers from noise sources.

Work, other than the installation of track assets, would be restricted to standard working hours (7:00am to 6:00pm Monday to Friday and 8:00am to 1:00pm Saturdays) unless otherwise approved by TfNSW. Should works be required outside of standard working hours: affected community members would be advised where appropriate, and all relevant approvals would be sought, including submission and approval of TfNSW's *Out of Hours Works Application Form* (9TP-FT-079) in accordance with TfNSW's *Construction Noise Strategy* (7TP-ST-157).

Provide mitigation in accordance with the requirements of the TfNSW *Construction Noise Strategy* (7TP-ST-157) if high noise generating activities occur for extended periods.

Noise complaints would be managed in accordance with TfNSW *Construction Noise Strategy* (7TP-ST-157). Any noise complaints received would be addressed in accordance with TfNSW complaints management procedures.

Residents within 100 metre radius of the signal locations identified in the Proposal would be notified of the works prior to the commencement of construction. Notification would include the duration of work, potential impacts and contact details for further information.

Heritage

Great Northern Railway Line: Consultation Lake Macquarie City Council would be undertaken for works at signal locations which are within the curtilage of the Great Northern Railway Line.

Signal Location A7, A8 and A 10: Works would be within the heritage curtilage of the locally significant Awaba Railway Jib Crane & Former Cottage Potential Archaeological Site. Consultation with Sydney Trains and Lake Macquarie City Council would be undertaken prior to any works commencing at these signal locations. Further assessment will be undertaken to determine the need for any applicable approvals under the Heritage Act (i.e. s139 exception or s140 permit) for works this location.

Signal Location A8 and Signal Location A10: No work is permitted within the heritage curtilage of the jib crane (5m from the outer edge of the crane) which is part of the Awaba Railway Jib Crane & Former Cottage Potential Archaeological Site. This area would be marked as a "no-go zone" on the ECM.

Signal Location B211: Works would be within the heritage curtilage of the locally significant Adamstown Railway Station Group (including the Adamstown Signal Box). Consultation with Sydney Trains and Newcastle City Council would be undertaken prior to any works commencing at this signal location.

Standard mitigation measures

If a non-Aboriginal historical relic is discovered, all work likely to affect it would cease and the Project Manager would be contacted. TfNSW staff and the Office of Environment and Heritage (OEH) would be notified as required. An investigation would be undertaken by a suitably qualified archaeologist to identify suitable measures to reduce the impact on the relic discovered before work resumes.

Should Aboriginal heritage items be uncovered, all work in the vicinity would cease and the Project Manager and TfNSW staff would be notified immediately. OEH would be notified in accordance with the *National Parks and Wildlife Act 1974*. The Local Aboriginal Land Council would be notified and an assessment by an archaeologist would be arranged to determine the significance of the objects and any other requirements before work resumes.

Waste

All waste would be classified in accordance with the Waste Classification Guidelines (EPA 2014) and transported to a place that can lawfully accept the waste.

Any material that may be classified as a hazardous waste would be managed appropriately and in accordance with TfNSW procedures.

Packaging would be minimised, where possible and where the safety and delivery of services is not compromised.

Wherever possible, suitable excavated material would be reused at each signal location for backfilling, landscaping and other purposes.

Wherever possible, excess material shall be beneficially reused in accordance with a Resource Recovery Exemption rather than classified and disposed as waste.

Any spoil or waste material tracked onto roads would be swept up immediately.

Adequate numbers of bins and waste containers would be available at each signal location. The site manager would ensure bins are not overflowing and are appropriately covered.

Wastewater generated by non-destructive excavation would be taken off site for treatment and disposal.

All waste would be removed from the signal location when work is completed.

Contaminated land and hazardous materials

All waste spoil would be managed in accordance with the *Waste Classification Guidelines* (NSW EPA 2014) and *National Environment Protection (Assessment of Site Contamination) Measure 1999*.

All hazardous materials removal and clean-up operations must be carried out in accordance with the NSW *Work Health and Safety Act* and Regulations 2011 and the Safe Work NSW requirements.

As part of the project induction, construction personnel would receive training in the identification, management and handling of contaminated and hazardous materials should they be encountered during the works.

During excavation, site workers would look for signs of potential contamination such as presence of waste and/or other imported materials, odours, soil colouring, floating layer in groundwater etc.

If any previously unidentified contamination is encountered, or suspected, works in the vicinity of the find would be immediately stopped and the affected area fenced off. The site would be investigated and validated, with works to resume after approval from a suitably qualified and experienced Health, Safety and Environment professional is obtained.

Personnel dealing with the hazardous substances should be appropriately trained.

Contaminated soil would be segregated and appropriately contained prior to classification and ultimate disposal.

The quantity of spoil generated would be minimised.

Standard mitigation measures

If hazardous materials are required for any unforeseen reason, a Hazardous Waste Management Plan would be prepared. The plan would detail terms applying to the purchase, storage, use, handling and disposal of such materials.

Hazardous materials would be transported, stored and used in accordance with the corresponding material safety data sheets which would be available at the signal location.

No fuels would be stored at any signal location.

Removal of suspected and/or known asbestos, including building structures likely to contain asbestos requires an experienced, appropriately licensed removal contractor in accordance with the *How to Safely Remove Asbestos Code of Practice* (Safe Work Australia, 2016). An Occupational Hygienist should be on site during removal works.

Visual amenity

Clearance of vegetation shall be minimised.

The work area shall be maintained in an orderly manner.

All temporary signage associated with the works must be appropriately displayed.

All work equipment and materials would be contained within the designated boundaries of the work site.

Land use

No specific control measures are required.

Socio-economic impacts

Nearby residents and businesses would be informed about the nature and timing of works.

Signage would notify the public about the works.

Appropriate fencing would help maintain public safety during construction.

Traffic and access

A traffic speed limit shall be enforced at all signal locations.

Scheduled road movements must be minimised where possible.

Deliveries of plant and materials must be undertaken outside peak periods where possible.

Vehicles shall be parked within the rail corridor and not in public commuter car parking spaces.

Where access to the sites requires access through land not owned by TfNSW, consultation would be undertaken with land owners and consent to access the land would be obtained where required.

Light spill

Lighting required during night works shall be directed towards the work area and away from adjacent sensitive receivers.

Cumulative impacts

Any other major development or works planned in the vicinity of the site would be further investigated before work begins and cumulative impacts minimised where possible.

Consultation with Central Coast Council, Lake Macquarie Council and Newcastle Council and any other relevant stakeholders regarding other developments would be undertaken on an ongoing basis.

8. 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 Proposal.

The Proposal will play a key role in delivering faster and more reliable rail services and will provide significant safety benefits to rail customers and staff.

The main environmental issues relate to construction impacts such as erosion and sedimentation and acid sulfate soils risks, potential water quality, biodiversity and heritage impacts as well as short-term traffic and noise issues for nearby receivers.

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, and Appendices 1 and 2). Should the project proceed, these impacts would be effectively managed through the implementation of the mitigation measures and the conditions of approval. As a result, these environmental impacts are not considered to be significant. Accordingly an EIS is not required, nor is the approval of the Minister for Planning.

The Proposal has also taken into account the principles of ESD (refer to Section 4.1). These would be considered further during the detailed design, construction and operational phases of the Proposal. This will ensure the Proposal is delivered to maximum benefit to the community, is cost effective and minimises any adverse impacts on the environment.

References

- Department of Environment and Climate Change (2009) *Interim Construction Noise Guideline*
- Department of Environment, Climate Change and Water (DECCW) (2009) *Waste Classification Guidelines*
- Landcom (2004) *Managing Urban Stormwater, Soils and Construction Guidelines*, March, 2004.
- NSW Acid Sulfate Soil Management Advisory Committee (1998) *Acid Sulfate Soil Manual*
- Office of Environment and Heritage (OEH) (2014a) Threatened Species, Population and Communities Database. Search by region.
<http://www.environment.nsw.gov.au/threatenedSpeciesApp/AreaHabitatSearch.aspx>
- Office of Environment and Heritage (OEH) (2014b) NSW Bionet Atlas of NSW Wildlife Database, Office of Environment and Heritage NSW. <http://www.bionet.nsw.gov.au/>
- Novo Rail (2011) *Review of Environmental Factors ATP Main North Line Berowra to Warnervale*

Appendix 1 – Consideration of clause 228 factors

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

Factor	Impacts
<p>Any environmental impact on a community?</p> <p>During construction there may be minor noise and traffic disturbances to the nearby community from deliveries and construction works. During track possession, some works would take place outside standard working hours. In the long term, the AMS will improve reliability and safety of the Sydney Train services on the Central Coast and Newcastle Lines.</p>	<input type="checkbox"/> nil <input checked="" type="checkbox"/> minor <input type="checkbox"/> significant
<p>Any transformation of a locality?</p> <p>The Proposal would not transform the locality. The works would support the ongoing operation of the rail network.</p>	<input checked="" type="checkbox"/> nil <input type="checkbox"/> minor <input type="checkbox"/> significant
<p>Any environmental impact on the ecosystem of the locality?</p> <p>With the implementation of the proposed control measures, the proposed works are not anticipated to impact on the ecosystem of the locality.</p>	<input type="checkbox"/> nil <input checked="" type="checkbox"/> minor <input type="checkbox"/> significant
<p>Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?</p> <p>There will be a minor reduction in the aesthetic values of the neighbourhood due to the anticipated noise, air quality and traffic impacts resulting during construction. However, these will be temporary and minor in nature. No long-term reduction in the quality or value of the locality is anticipated.</p>	<input type="checkbox"/> nil <input checked="" type="checkbox"/> minor <input type="checkbox"/> significant
<p>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?</p> <p>No such significant places will be affected during construction or operation.</p>	<input checked="" type="checkbox"/> nil <input type="checkbox"/> minor <input type="checkbox"/> significant
<p>Any impact on the habitat of protected fauna (within the meaning of the National Parks and Wildlife Act 1974)?</p> <p>No habitat on which protected or endangered species would be reliant on is anticipated to be impacted by the proposed works.</p>	<input checked="" type="checkbox"/> nil <input type="checkbox"/> minor <input type="checkbox"/> significant
<p>Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air?</p> <p>No protected or endangered species are anticipated to be impacted by the proposed works.</p>	<input checked="" type="checkbox"/> nil <input type="checkbox"/> minor <input type="checkbox"/> significant
<p>Any long-term effects on the environment?</p> <p>The proposed activities are not anticipated to pose any environmental risks in the long term.</p>	<input checked="" type="checkbox"/> nil <input type="checkbox"/> minor <input type="checkbox"/> significant
<p>Any degradation of the quality of the environment?</p> <p>The proposed work is not expected to have any significant adverse impacts on the quality of the environment.</p>	<input checked="" type="checkbox"/> nil <input type="checkbox"/> minor

Factor	Impacts
	<input type="checkbox"/> significant
<p>Any risk to the safety of the environment? During construction there is a risk to the environment due to accidental spills and sedimentation. These risks would be minimised through the implementation of the proposed control measures.</p>	<input type="checkbox"/> nil <input checked="" type="checkbox"/> minor <input type="checkbox"/> significant
<p>Any reduction in the range of beneficial uses of the environment? Works are to take place within the existing rail corridor and would not reduce the beneficial uses of the environment.</p>	<input checked="" type="checkbox"/> nil <input type="checkbox"/> minor <input type="checkbox"/> significant
<p>Any pollution of the environment? During construction there is a risk of noise, water and air pollution. These risks would be minimised through the implementation of the proposed control measures.</p>	<input type="checkbox"/> nil <input checked="" type="checkbox"/> minor <input type="checkbox"/> significant
<p>Any environmental problems associated with the disposal of waste? During construction it is possible spoil may be contaminated and an appropriate remediation plan and/or waste disposal method would be required.</p>	<input type="checkbox"/> nil <input checked="" type="checkbox"/> minor <input type="checkbox"/> significant
<p>Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply? Construction materials are readily available and would be sourced from local contractors where possible.</p>	<input checked="" type="checkbox"/> nil <input type="checkbox"/> minor <input type="checkbox"/> significant
<p>Any cumulative environmental effect with other existing or likely future activities? The distance between the proposed signal locations is such that cumulative noise, air quality and traffic impacts are not expected. Overall this Proposal, as part of the ATP program, will have significant benefits in providing a safer and more efficient rail network.</p>	<input checked="" type="checkbox"/> nil <input type="checkbox"/> minor <input type="checkbox"/> significant
<p>Any impact on coastal processes and coastal hazards, including those under projected climate change conditions? The Proposal would not contribute to or be affected by coastal processes or hazards.</p>	<input checked="" type="checkbox"/> nil <input type="checkbox"/> minor <input type="checkbox"/> significant

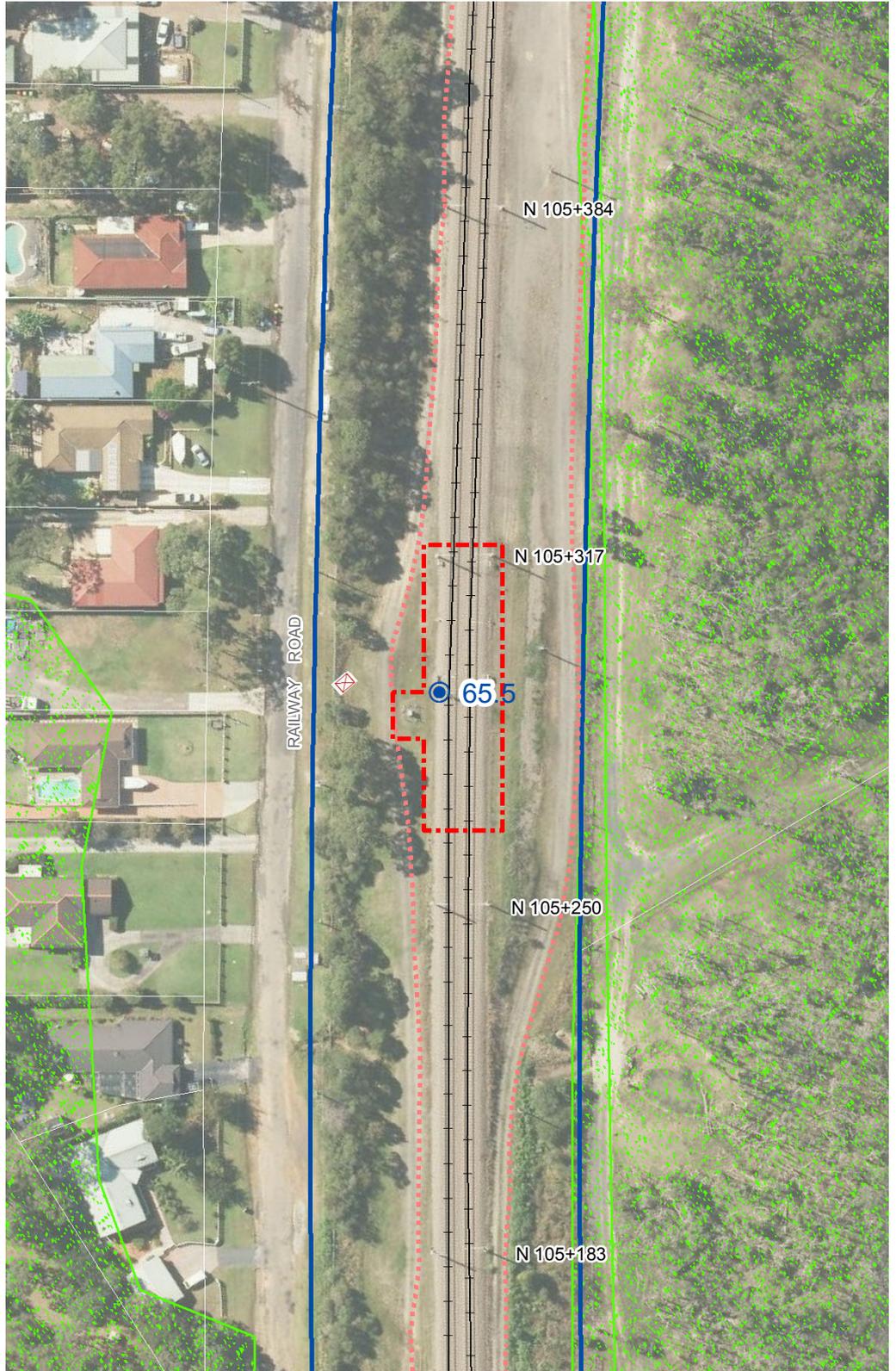
Appendix 2 – Consideration of matters of national environmental significance

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 Proposal should be referred to the Commonwealth Department of the Environment and Energy.

Factor	Impacts
Any impact on a World Heritage property? There are no World Heritage properties in the vicinity the site.	<input checked="" type="checkbox"/> nil <input type="checkbox"/> minor <input type="checkbox"/> significant
Any impact on a National Heritage place? There are no National Heritage places in the vicinity of the site.	<input checked="" type="checkbox"/> nil <input type="checkbox"/> minor <input type="checkbox"/> significant
Any impact on a wetland of international importance? There are no wetlands of international importance in the vicinity of the site.	<input checked="" type="checkbox"/> nil <input type="checkbox"/> minor <input type="checkbox"/> significant
Any impact on a listed threatened species or communities? The nature, scale and location of the works are such that impacts on any Commonwealth listed threatened species or ecological communities or their habitats are not expected. Indirect impacts are also not expected.	<input checked="" type="checkbox"/> nil <input type="checkbox"/> minor <input type="checkbox"/> significant
Any impacts on listed migratory species? The nature, scale and location of the works are such that impacts on any Commonwealth listed migratory species or their habitats are not expected. Indirect impacts are also not expected.	<input checked="" type="checkbox"/> nil <input type="checkbox"/> minor <input type="checkbox"/> significant
Any impact on a Commonwealth marine area? The site is not in the vicinity of any Commonwealth marine areas.	<input checked="" type="checkbox"/> nil <input type="checkbox"/> minor <input type="checkbox"/> significant
Does the Proposal involve a nuclear action (including uranium mining)? The Proposal does not involve any nuclear actions.	<input checked="" type="checkbox"/> nil <input type="checkbox"/> minor <input type="checkbox"/> significant
Additionally, any impact (direct or indirect) on Commonwealth land? The site is not on or close to any Commonwealth land.	<input checked="" type="checkbox"/> nil <input type="checkbox"/> minor <input type="checkbox"/> significant
In relation to coal seam gas and large coal mining developments, any impact on a water resource? The Proposal does not relate to a coal seam gas or large coal mining development.	<input checked="" type="checkbox"/> nil <input type="checkbox"/> minor <input type="checkbox"/> significant

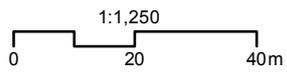
Appendix 3 – Signal location plans

Note: Signal location plans provide an indicative rail corridor boundary which has been derived from local environment plan (LEP) zoning maps specifically zoning category “SP2 Infrastructure”.



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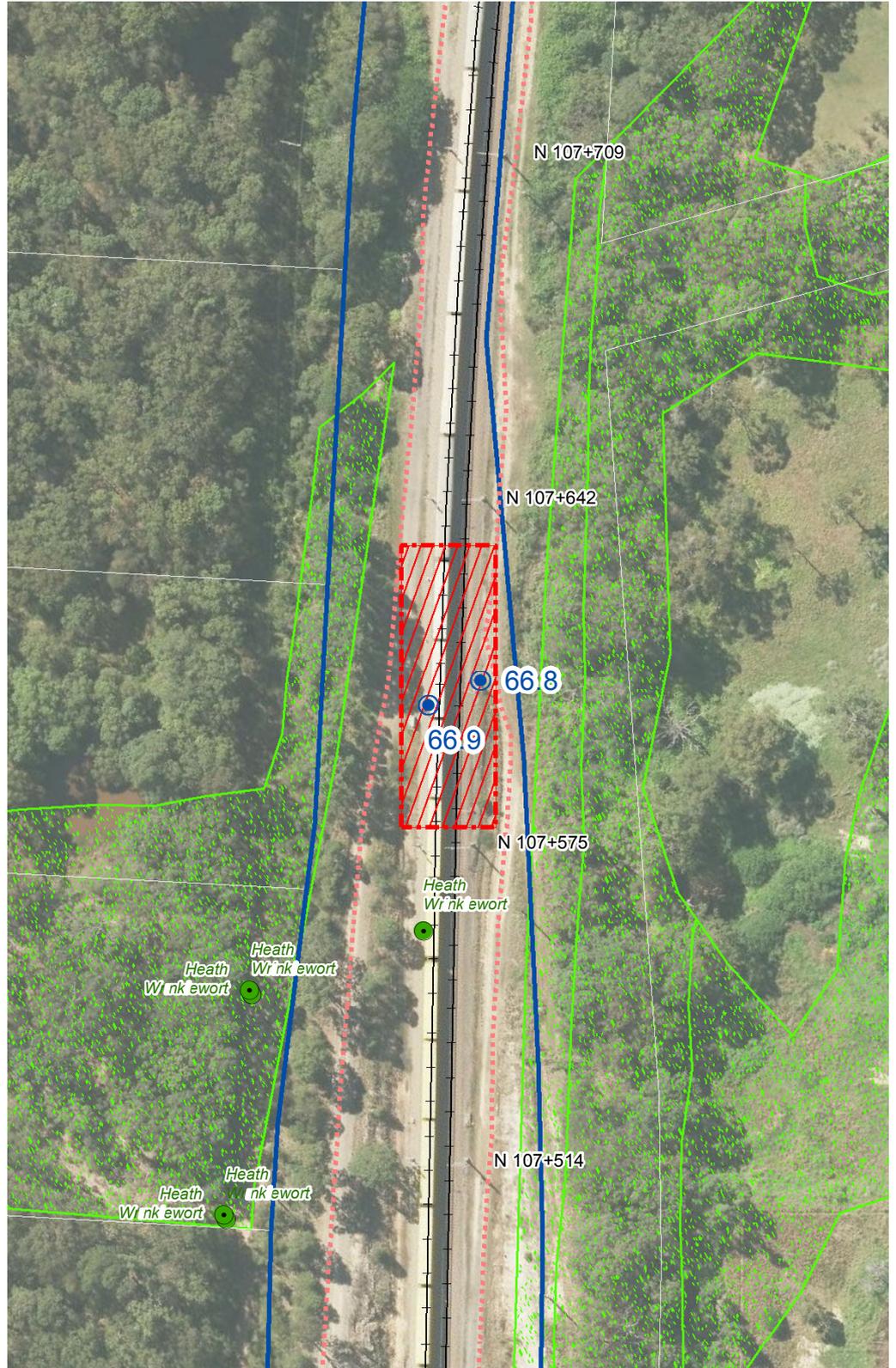


Projection: GDA 1994 MGA Zone 56

Source: Aurecon, OEH, Sydney Trains, LPI

Advanced train control Migration System (AMS) REF

Site 65.5



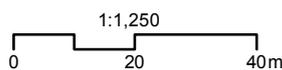
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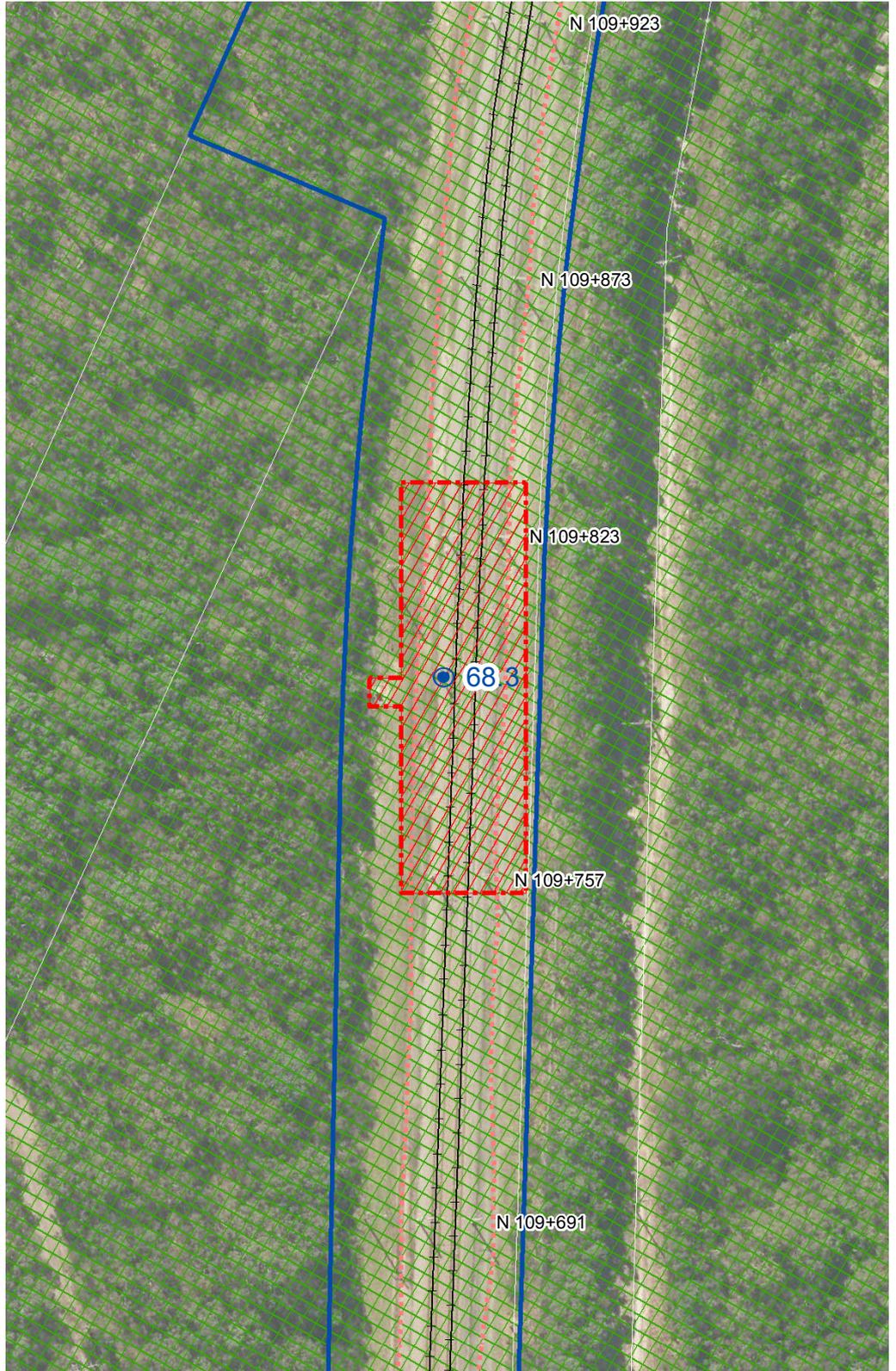
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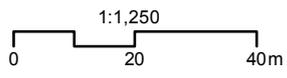
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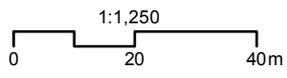
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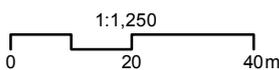
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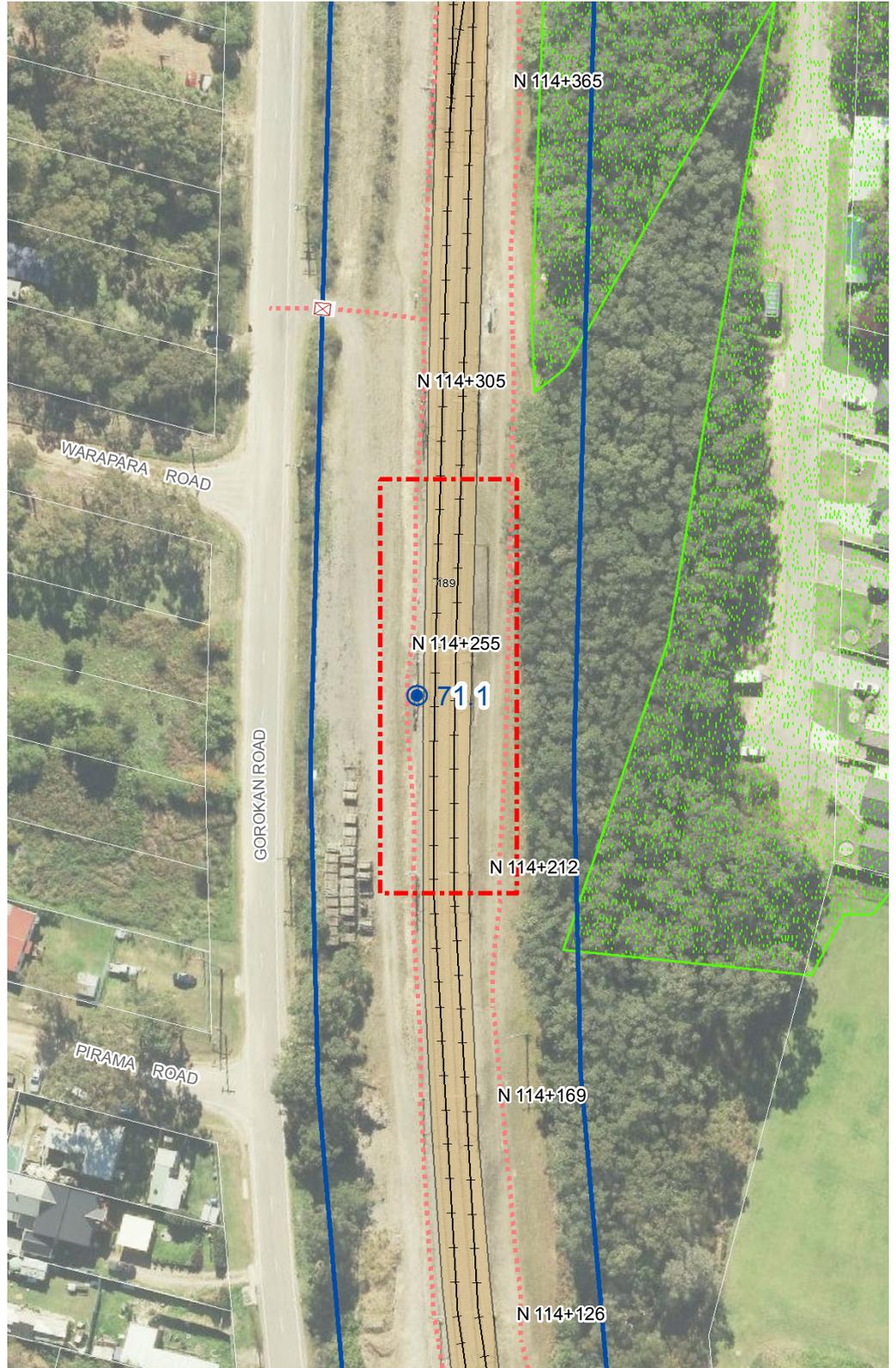
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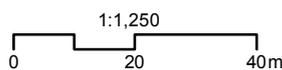
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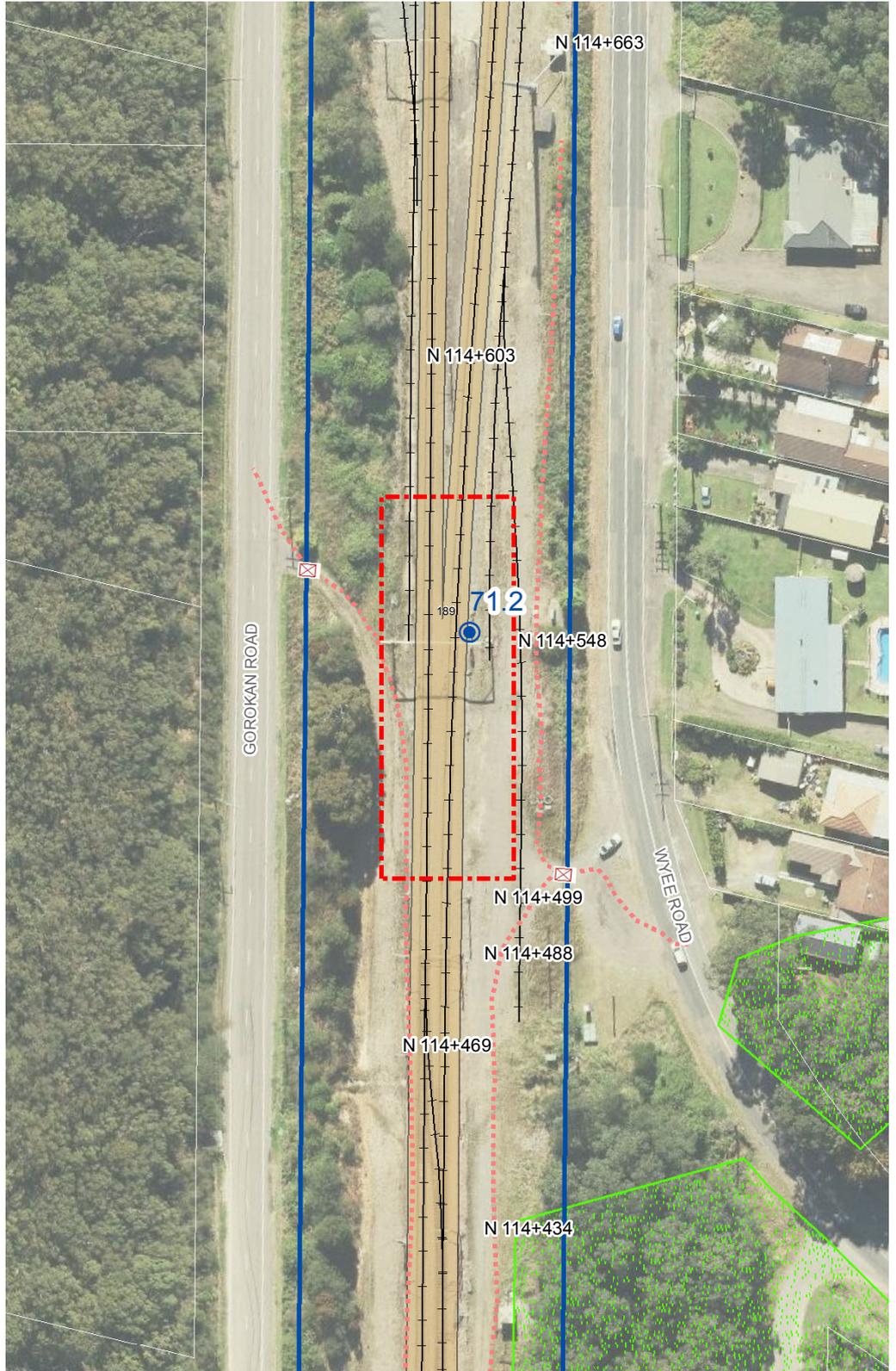
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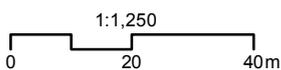
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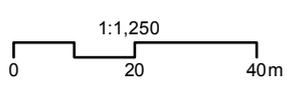
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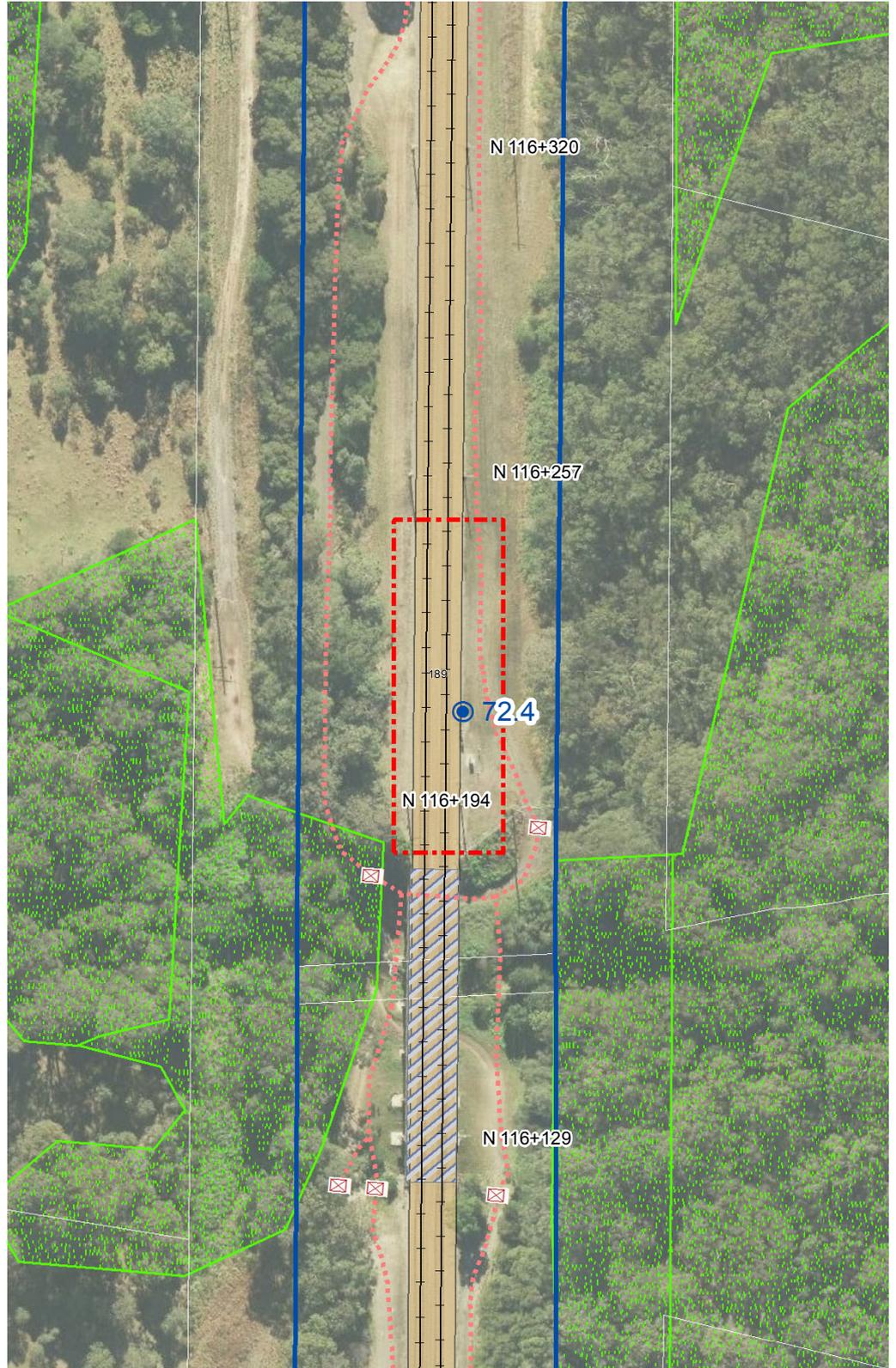
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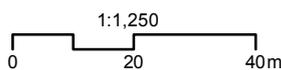
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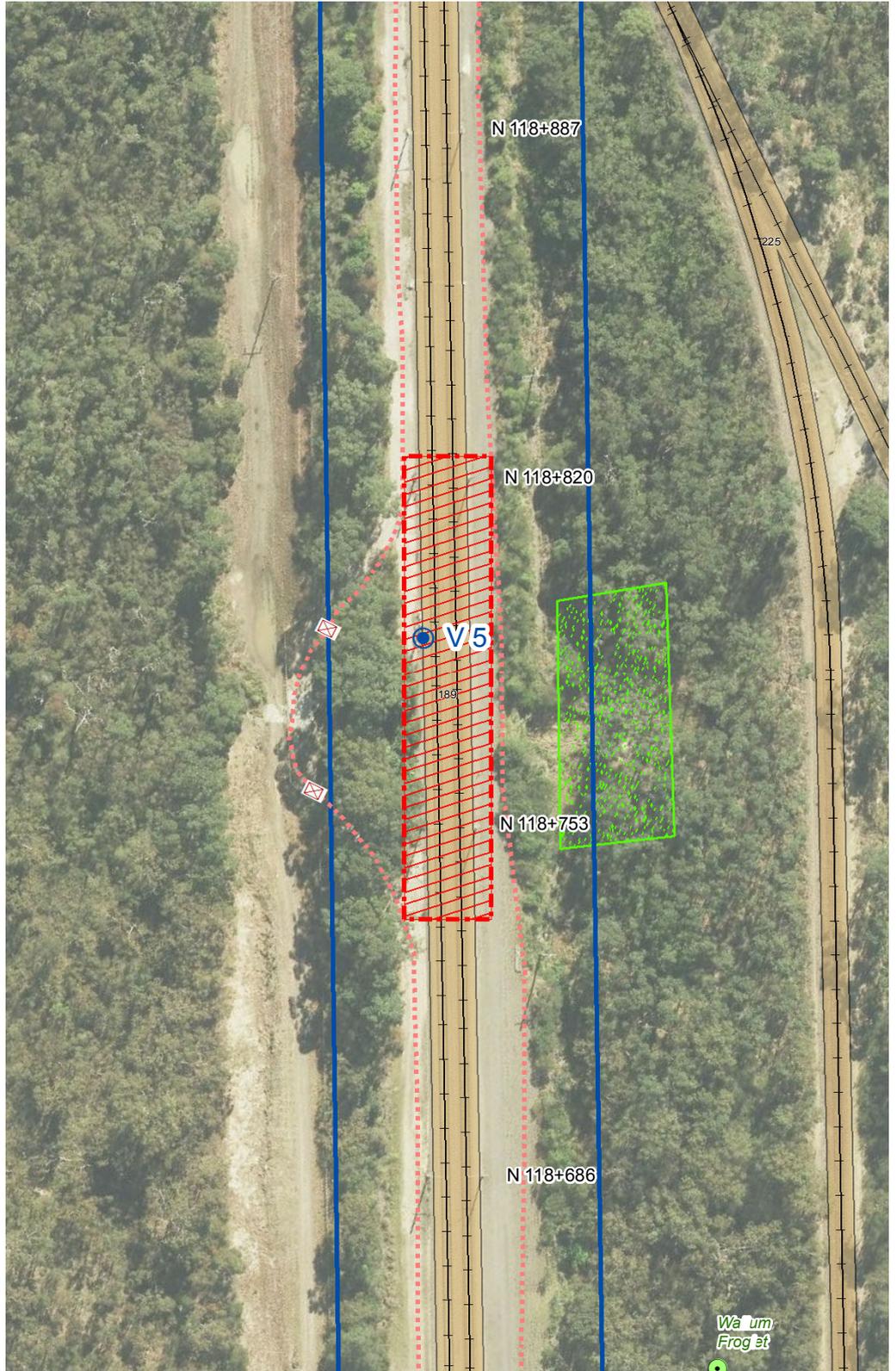
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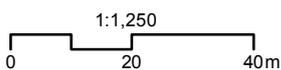
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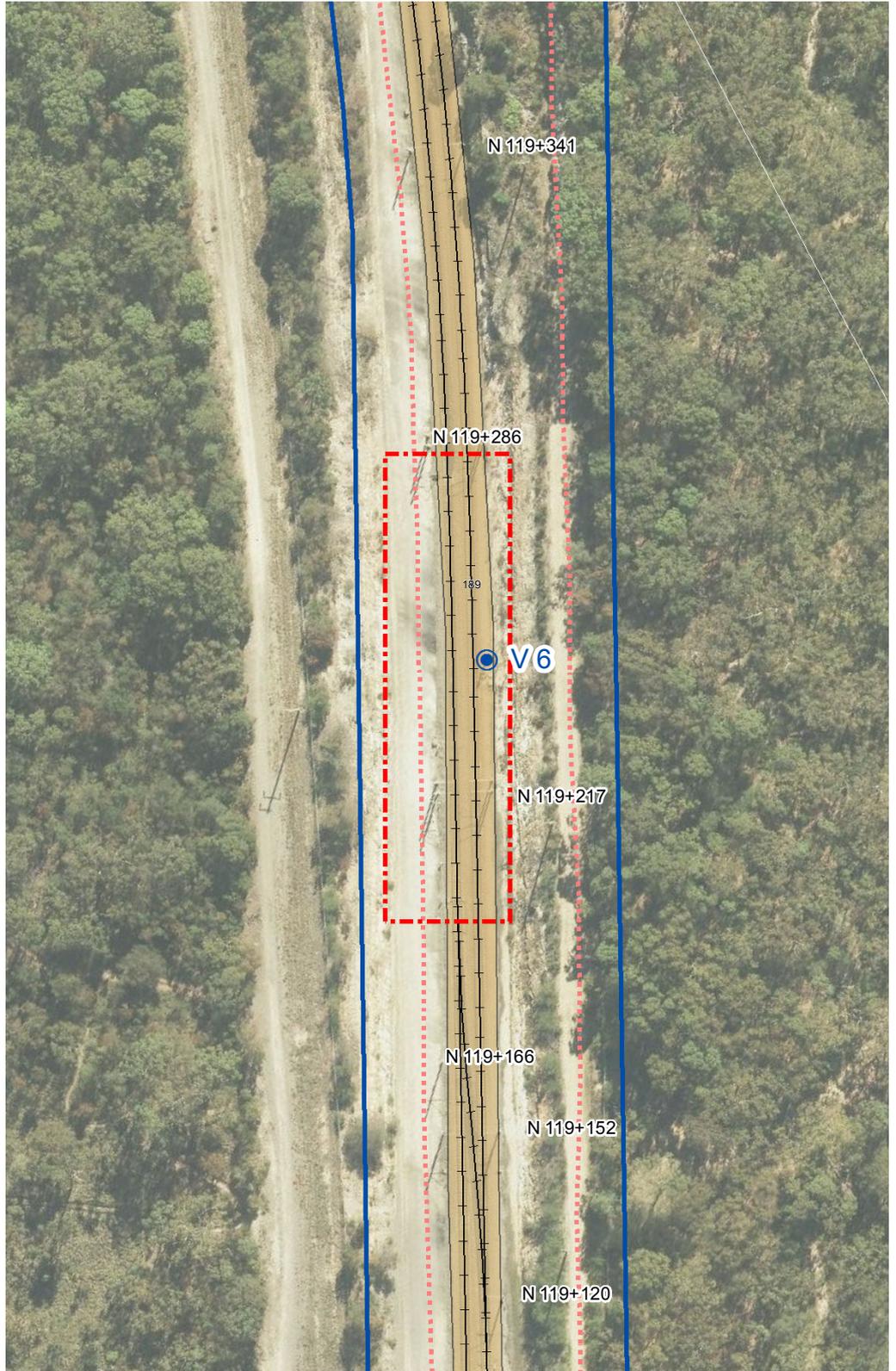
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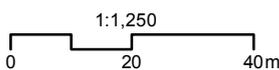
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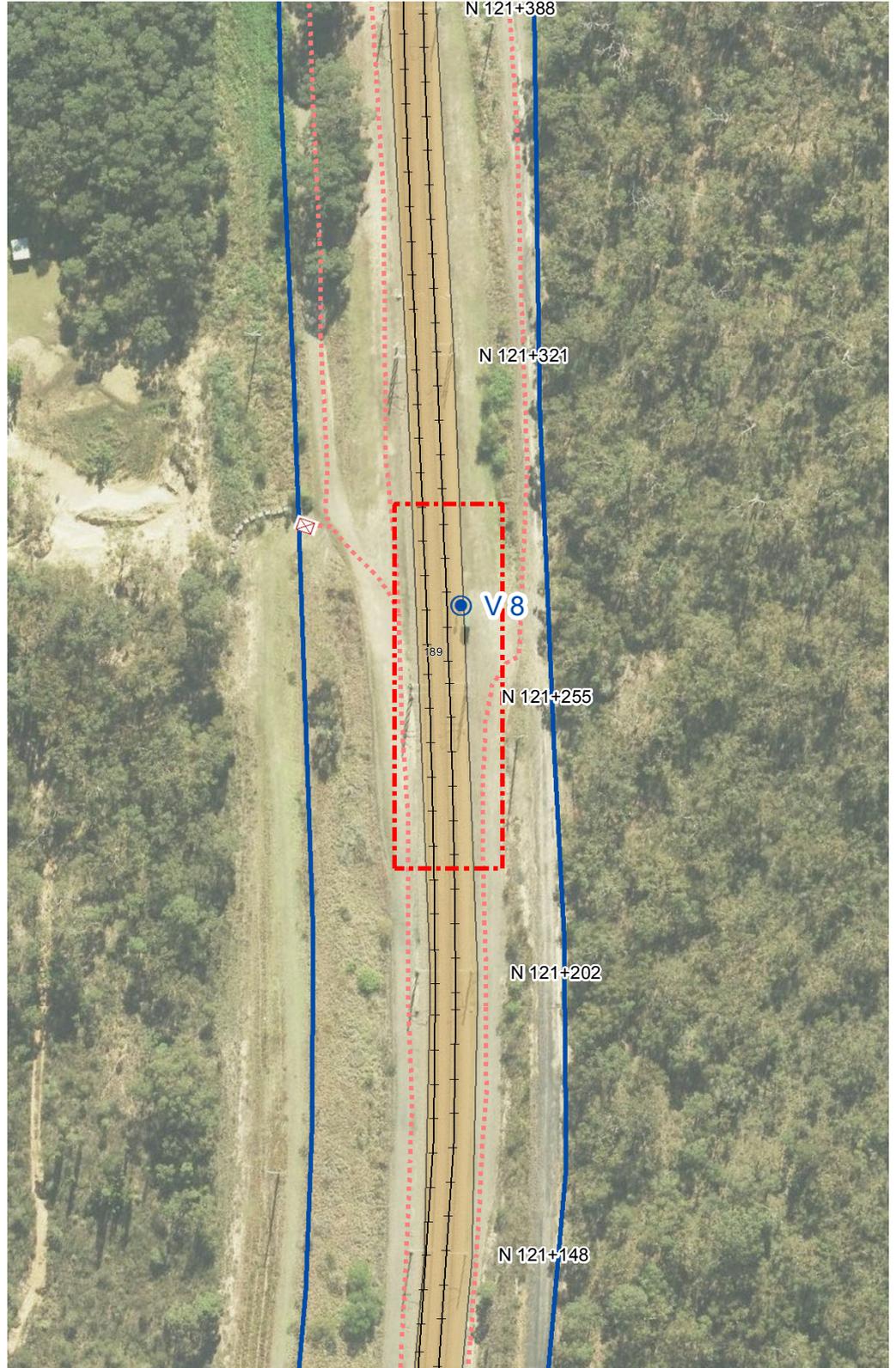
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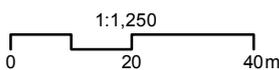
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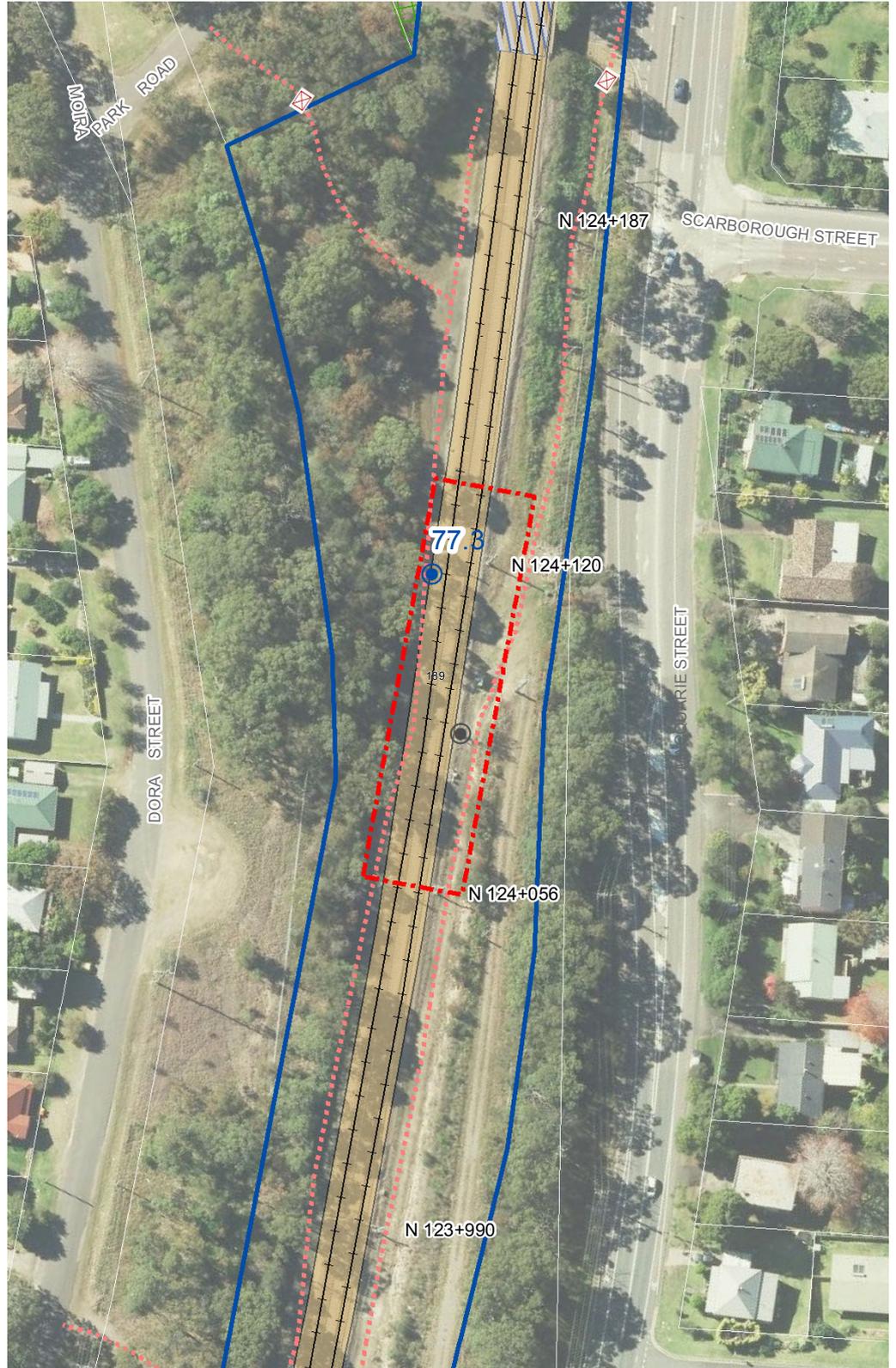
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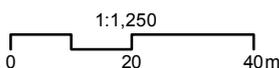
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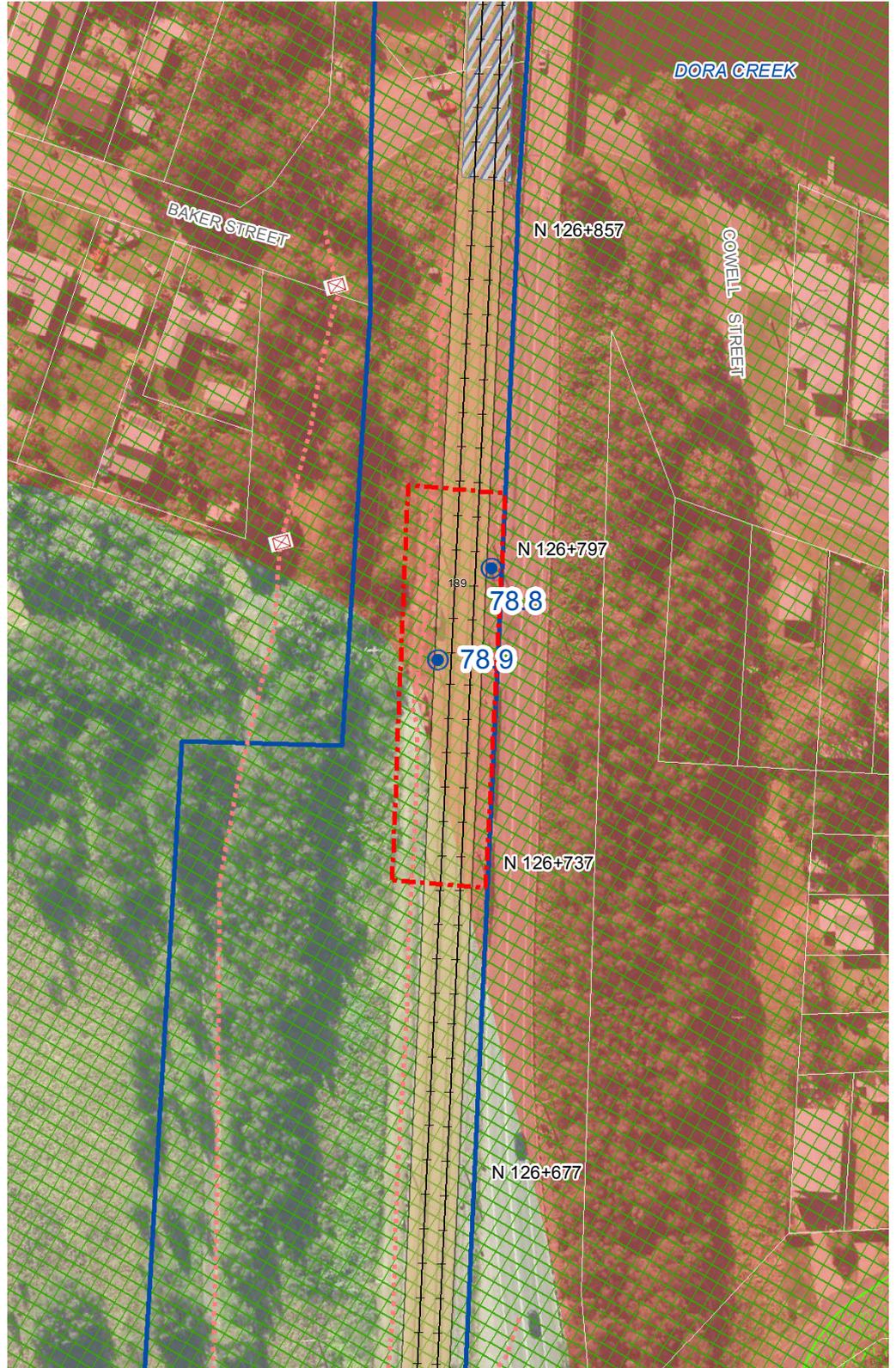
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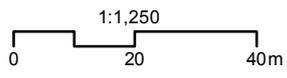
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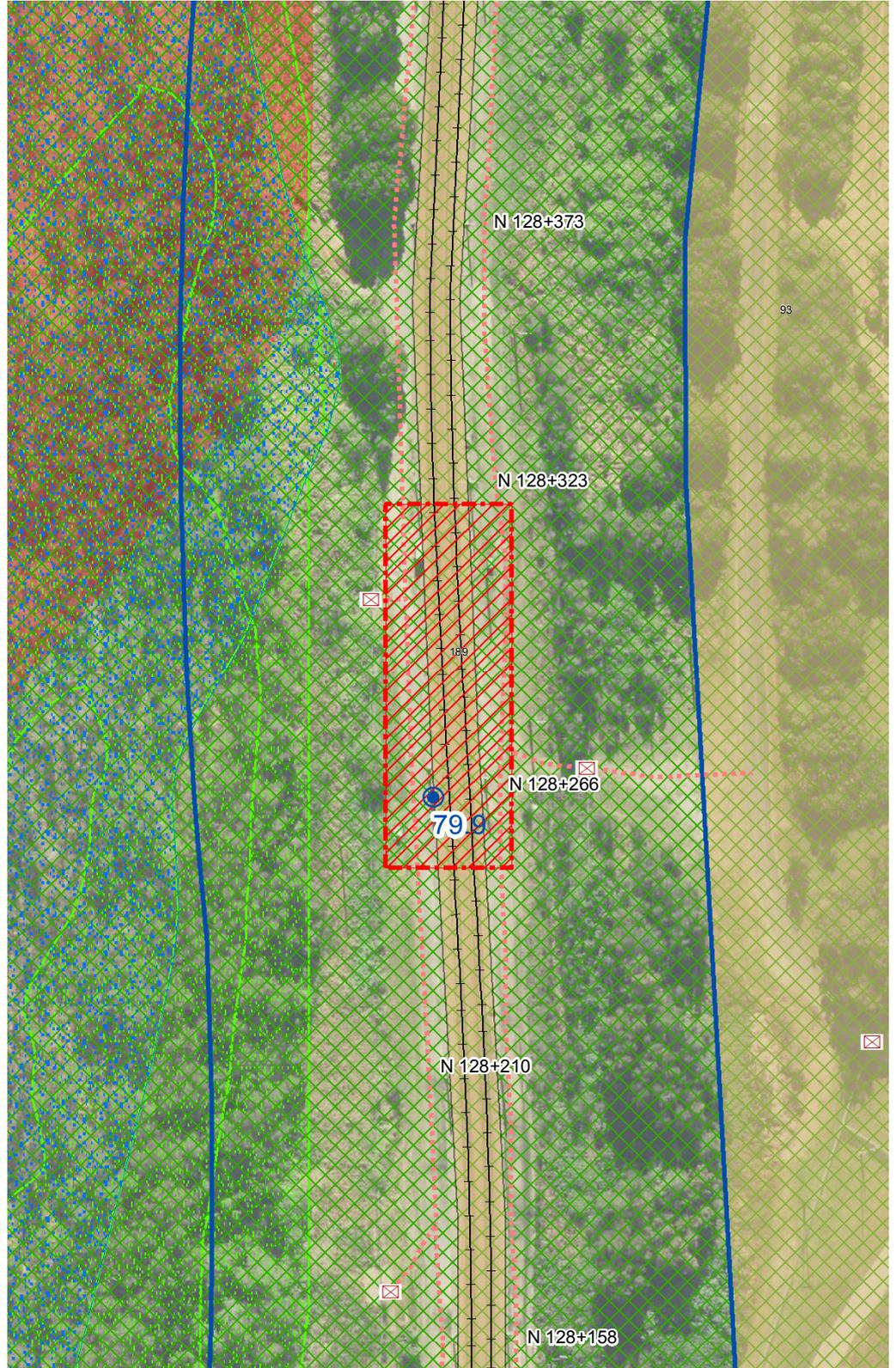
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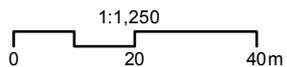
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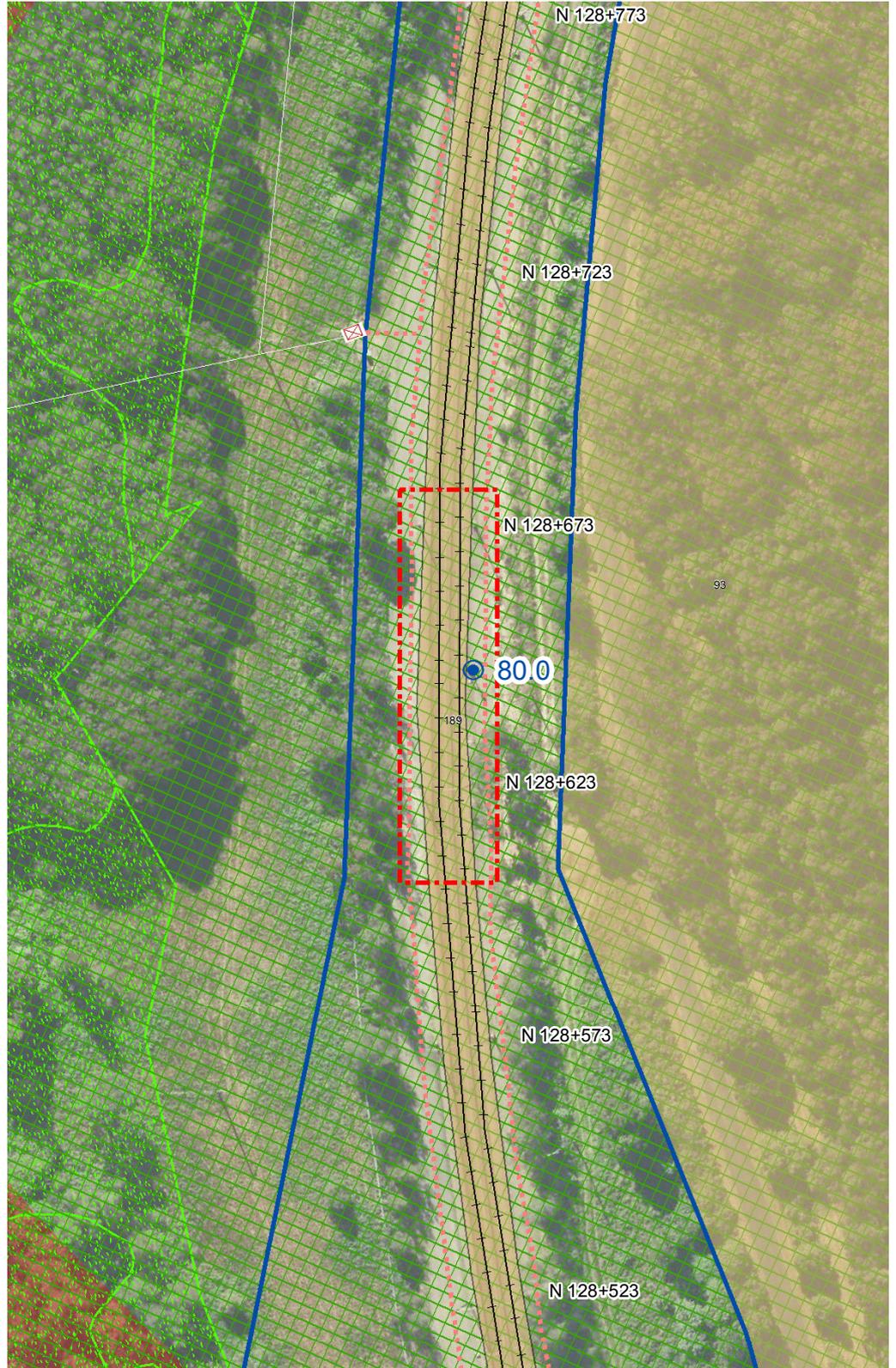
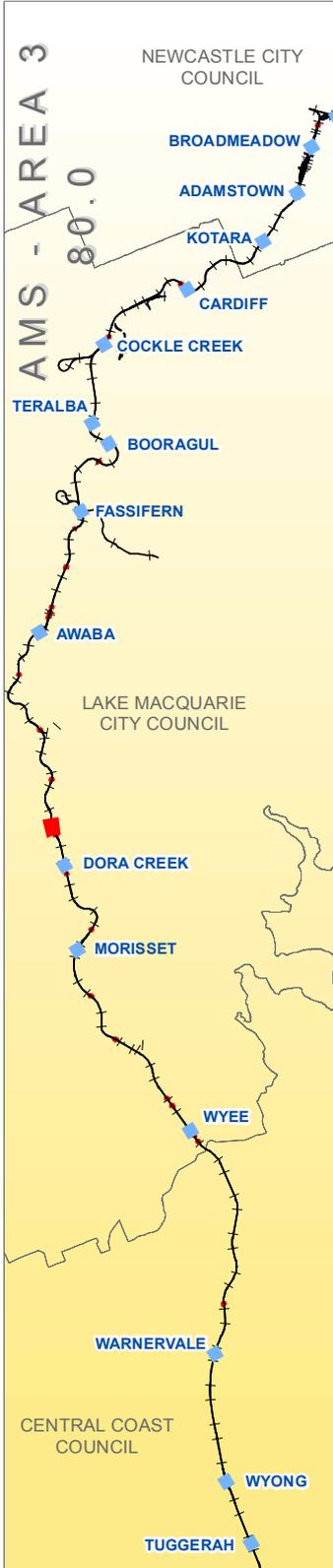
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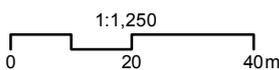
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- Indicative rail corridor
- Rail line
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- Platform
- Station
- Bridge
- Tunnel section
- Substation location
- Area of potential contamination

- SEPP14 wetlands
- SEPP71 coastal protection
- Threatened fauna
- Threatened flora
- EEC vegetation
- Heritage item/heritage conservation area

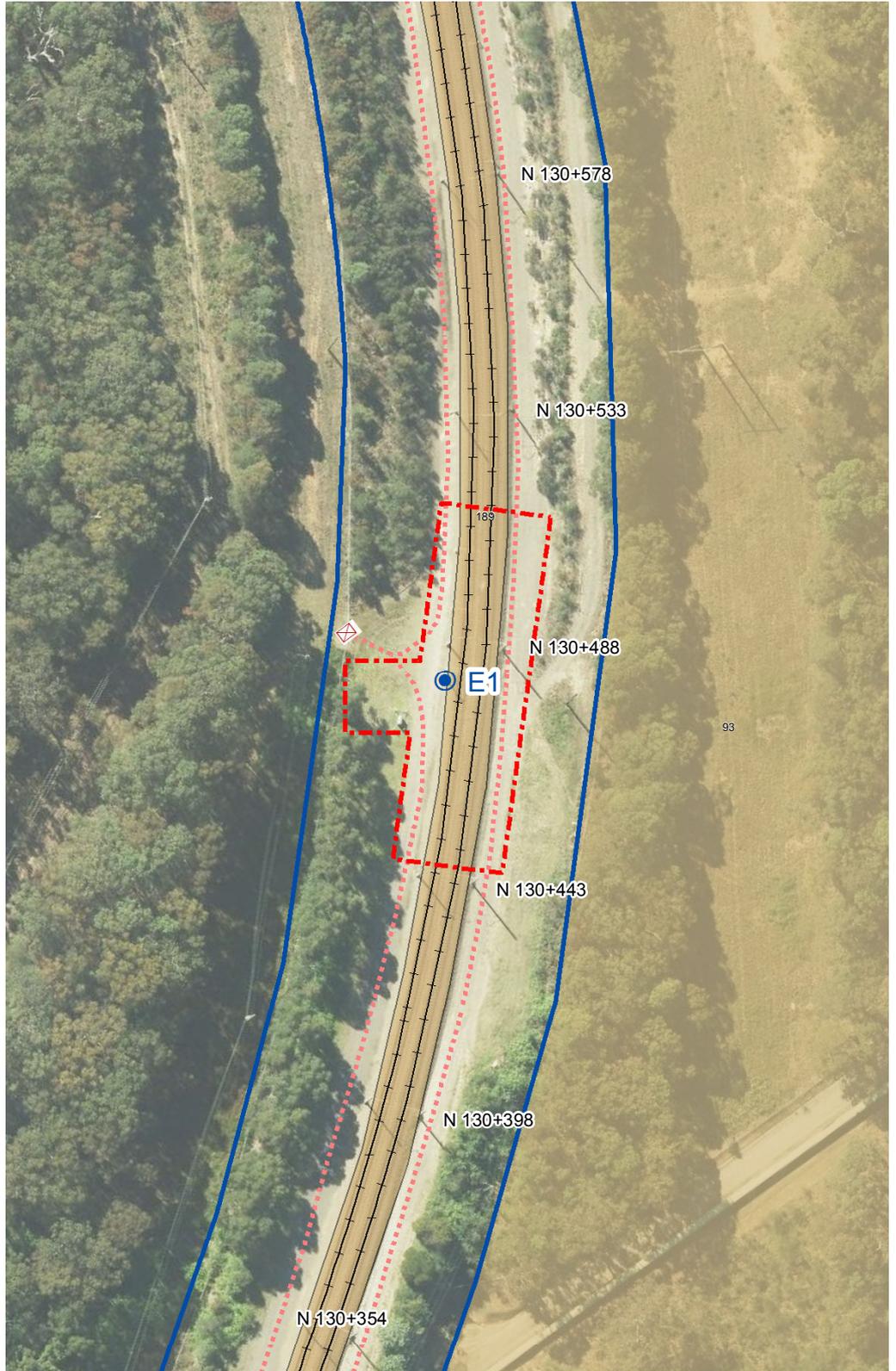
Acid Sulfate Soil Risk

- High risk of ASS occurring within 4m of natural soil surface
- Low risk of ASS occurring within 4m of natural soil surface
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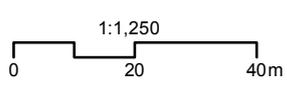
Projection: GDA 1994 MGA Zone 56

Source: Aurecon, OEH, Sydney Trains, LPI



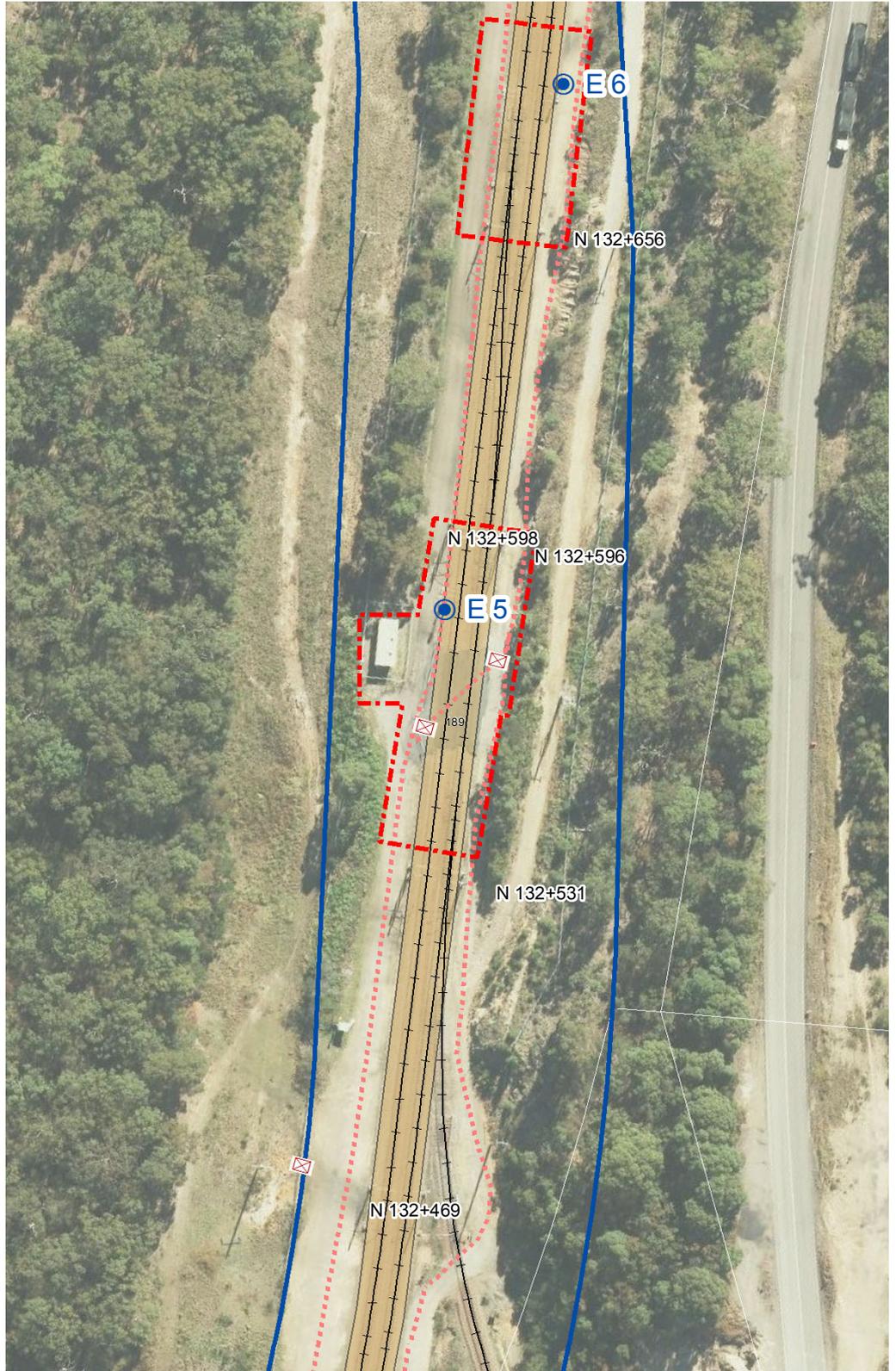
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Site footprint	Platform	SEPP14 wetlands	Acid Sulfate Soil Risk	
Signal location	Station	SEPP71 coastal protection		High risk of ASS occurring within 4m of natural soil surface
Other signal location	Bridge	Threatened fauna		Low risk of ASS occurring within 4m of natural soil surface
Indicative rail corridor	Tunnel section	Threatened flora	No risk of ASS occurring within 4m of natural soil surface	
Rail line	Substation location	EEC vegetation		
Access gate	Area of potential contamination	Heritage item/heritage conservation area		
Access road				



Projection: GDA 1994 MGA Zone 56

Source: Aurecon, OEH, Sydney Trains, LPI



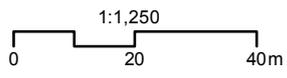
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- Site footprint
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- Other signal location
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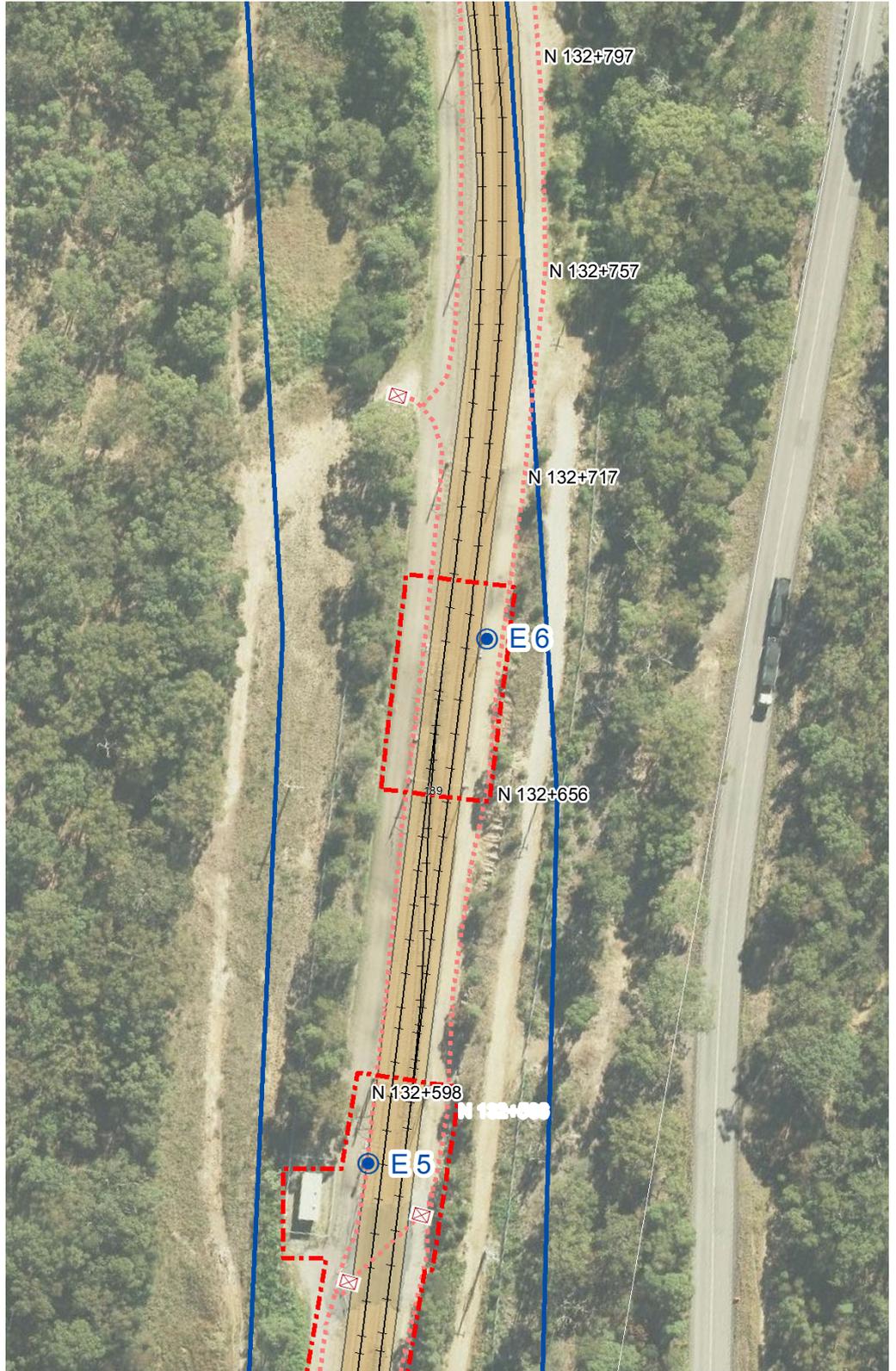
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Projection: GDA 1994 MGA Zone 56

Source: Aurecon, OEH, Sydney Trains, LPI



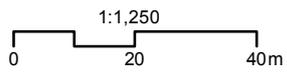
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Projection: GDA 1994 MGA Zone 56

Source: Aurecon, OEH, Sydney Trains, LPI



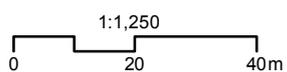
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- Site footprint
- Signal location
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- Rail line
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- Access road

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- Substation location
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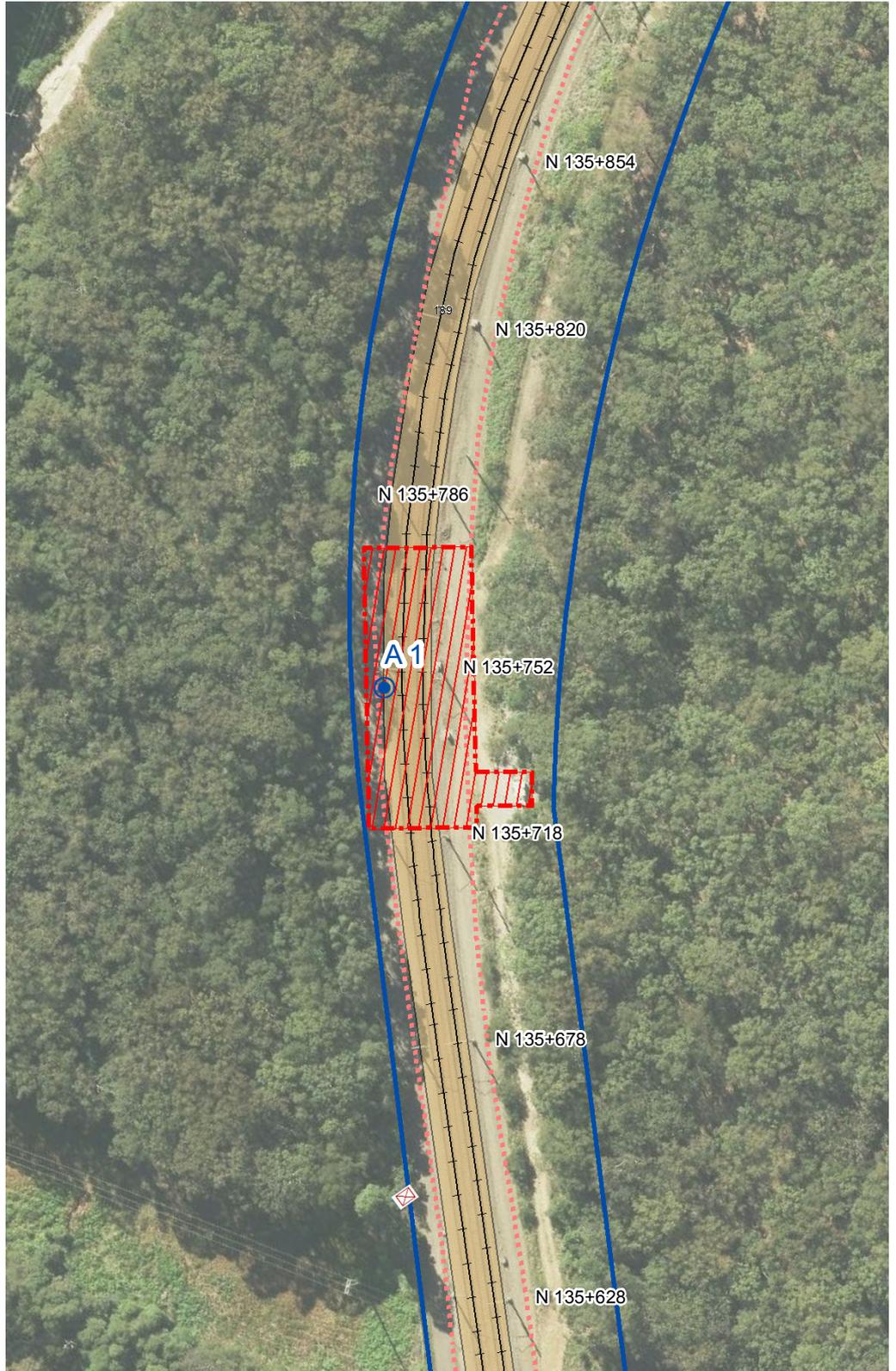
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Projection: GDA 1994 MGA Zone 56

Source: Aurecon, OEH, Sydney Trains, LPI



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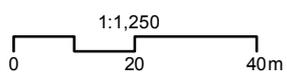
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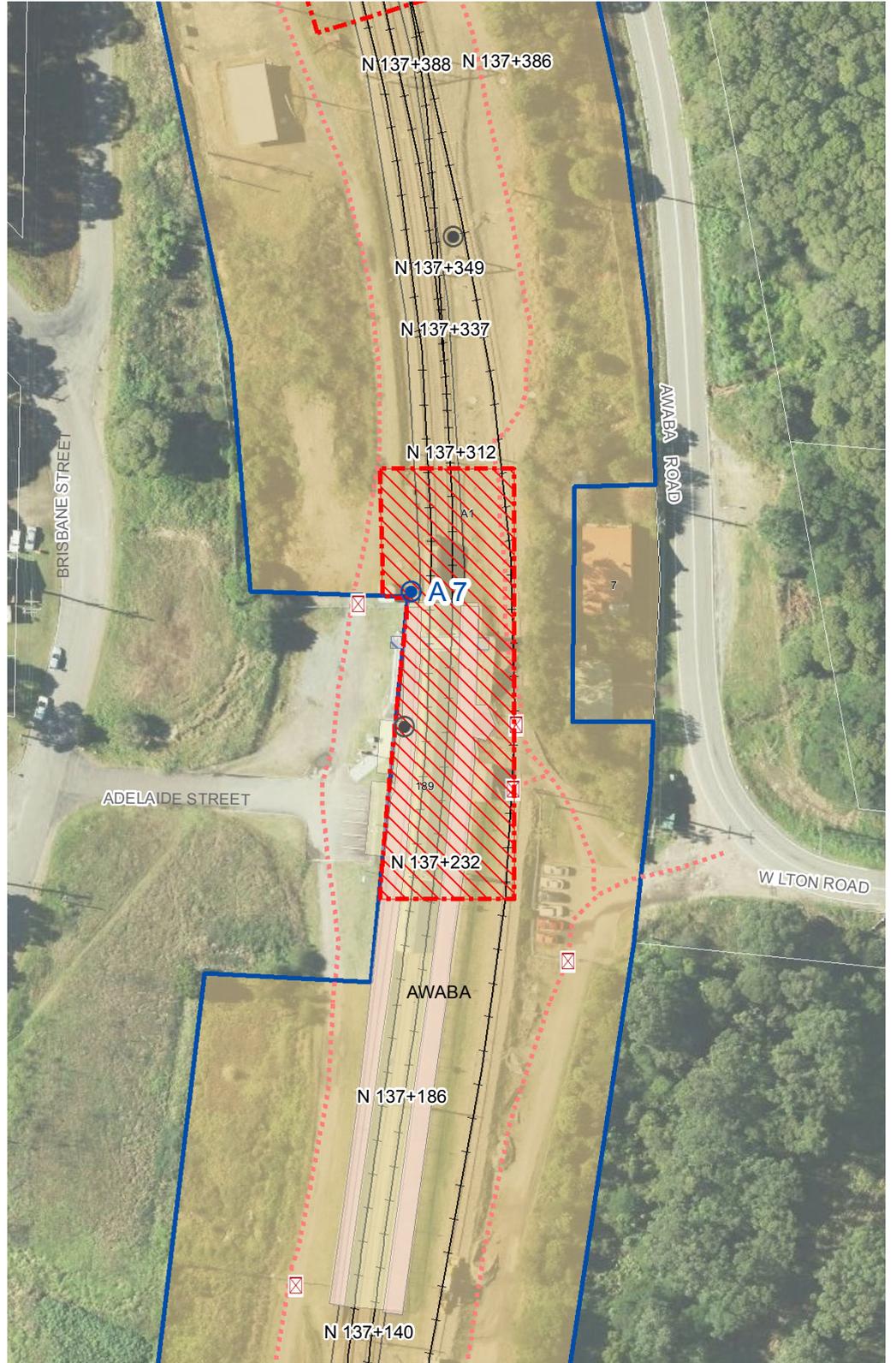
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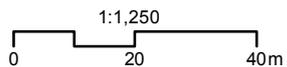
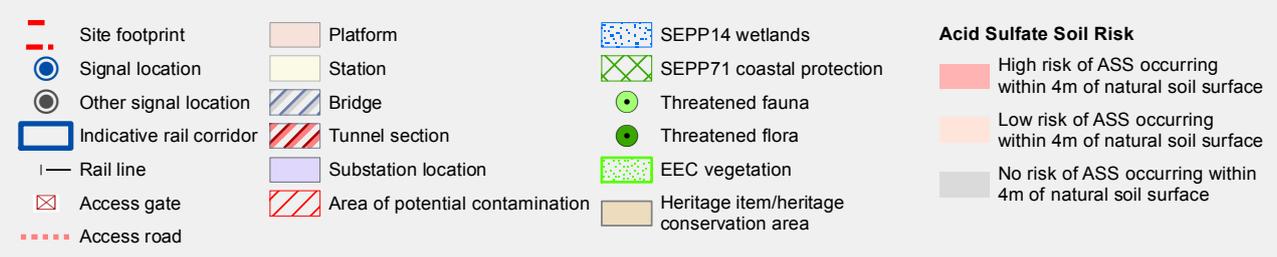


Projection: GDA 1994 MGA Zone 56

Source: Aurecon, OEH, Sydney Trains, LPI

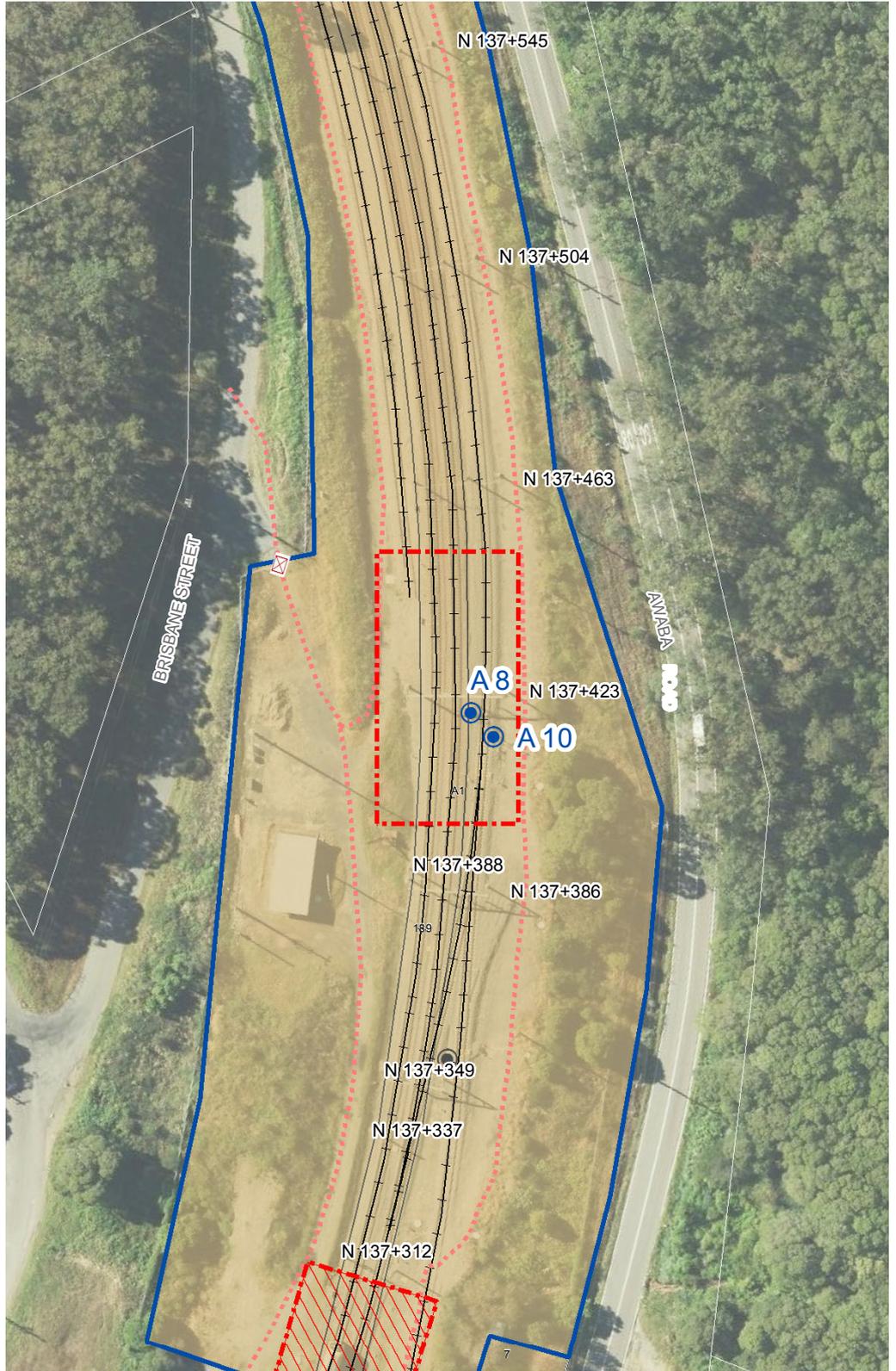


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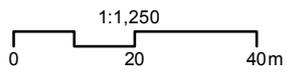
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Source: Aurecon, OEH, Sydney Trains, LPI



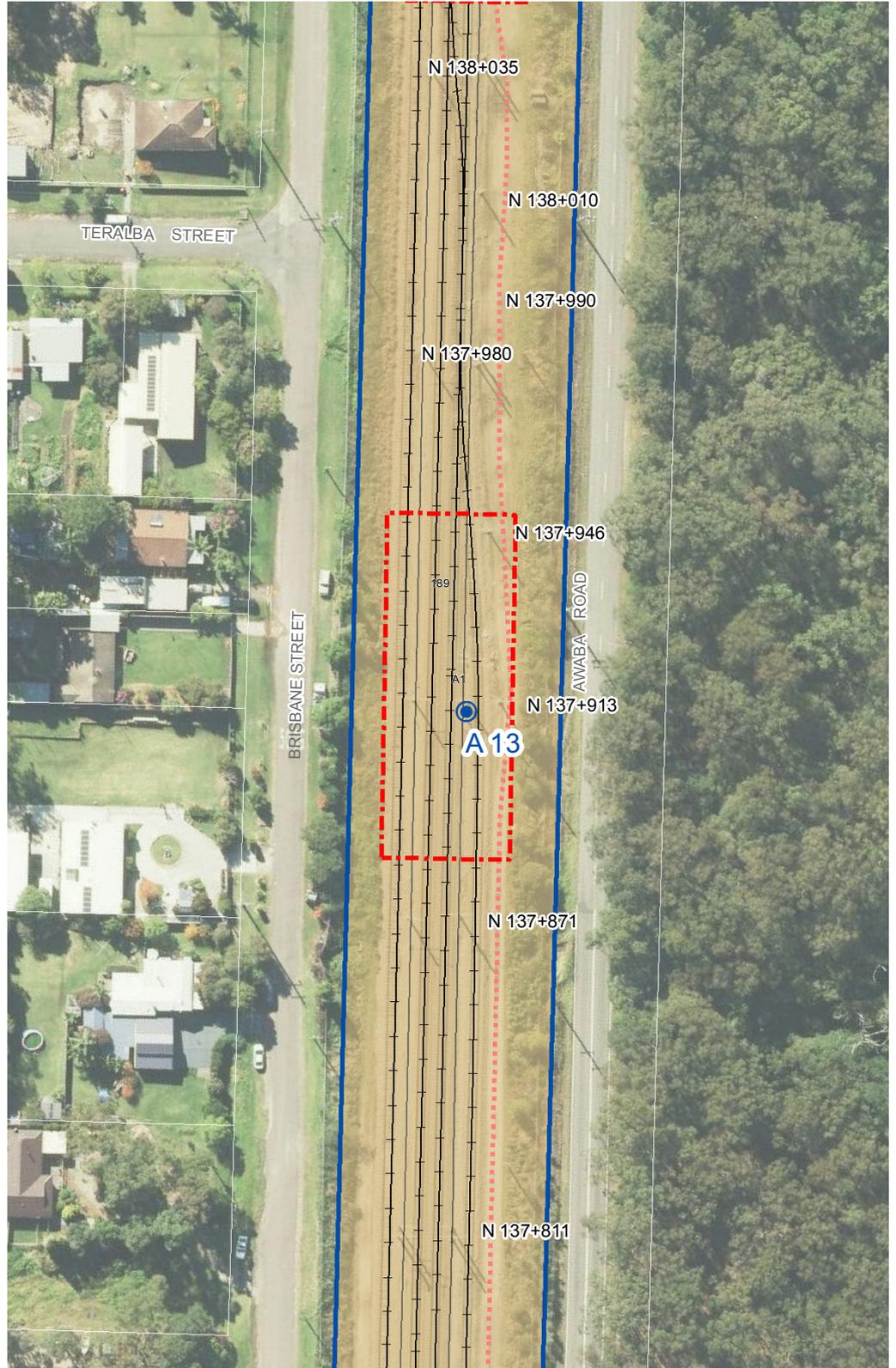
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Site footprint	Platform	SEPP14 wetlands	Acid Sulfate Soil Risk High risk of ASS occurring within 4m of natural soil surface Low risk of ASS occurring within 4m of natural soil surface No risk of ASS occurring within 4m of natural soil surface
Signal location	Station	SEPP71 coastal protection	
Other signal location	Bridge	Threatened fauna	
Indicative rail corridor	Tunnel section	Threatened flora	
Rail line	Substation location	EEC vegetation	
Access gate	Area of potential contamination	Heritage item/heritage conservation area	
Access road			



Projection: GDA 1994 MGA Zone 56

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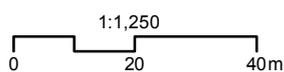
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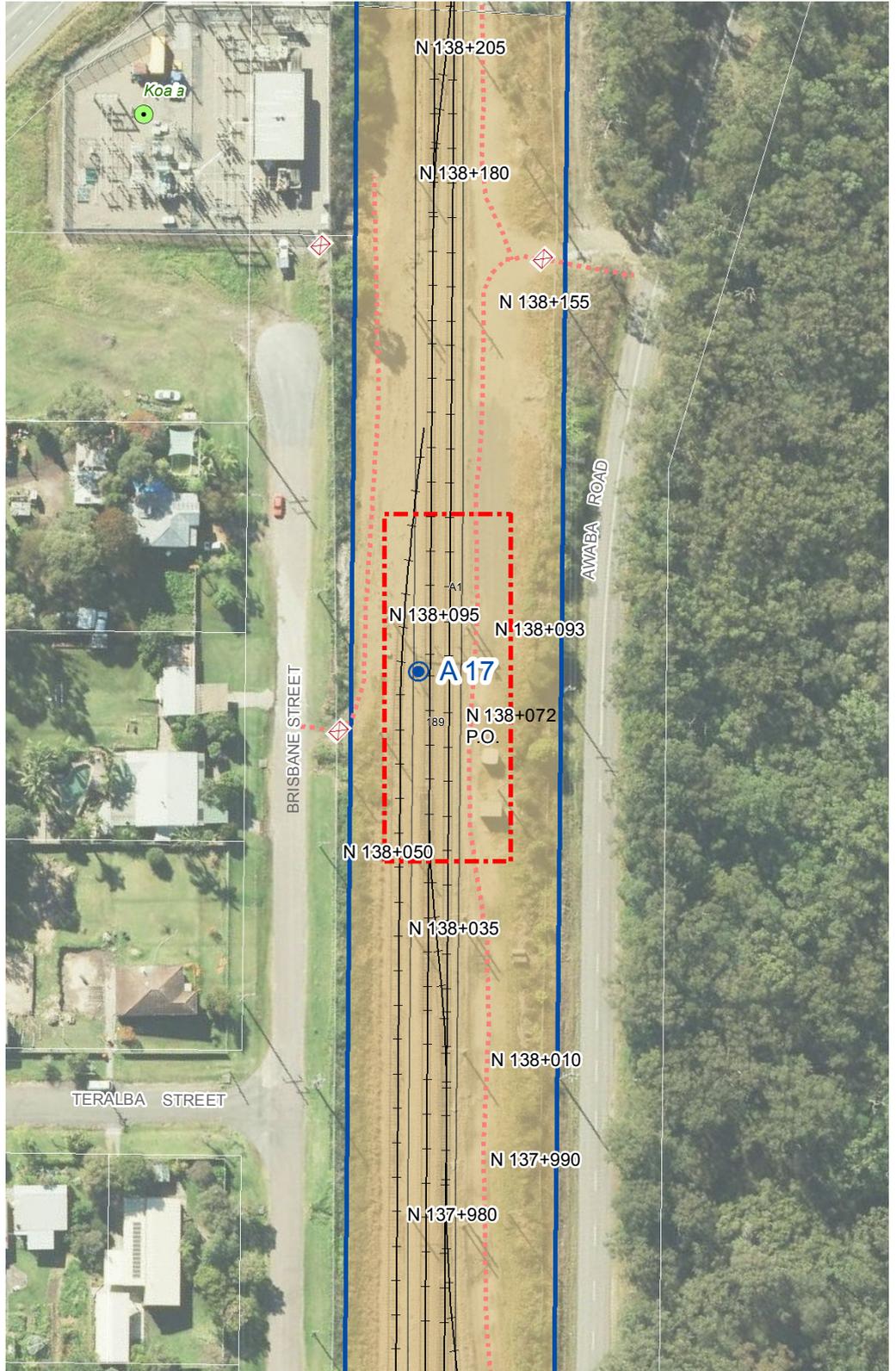
Acid Sulfate Soil Risk

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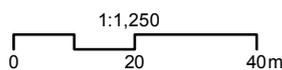
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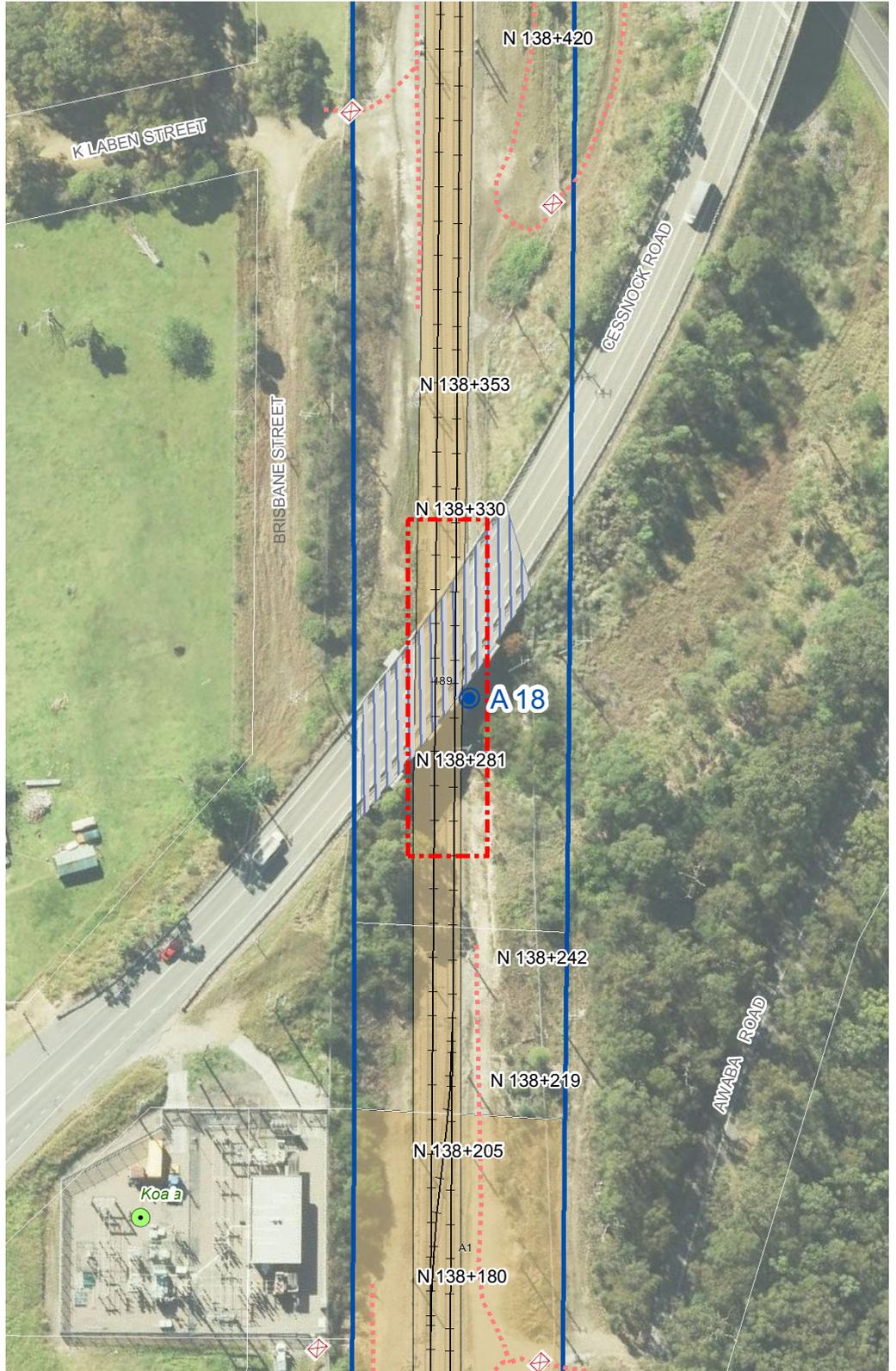
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|--------------------------|---------------------------------|--|--|
| Site footprint | Platform | SEPP14 wetlands | Acid Sulfate Soil Risk
High risk of ASS occurring within 4m of natural soil surface
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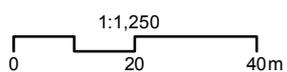
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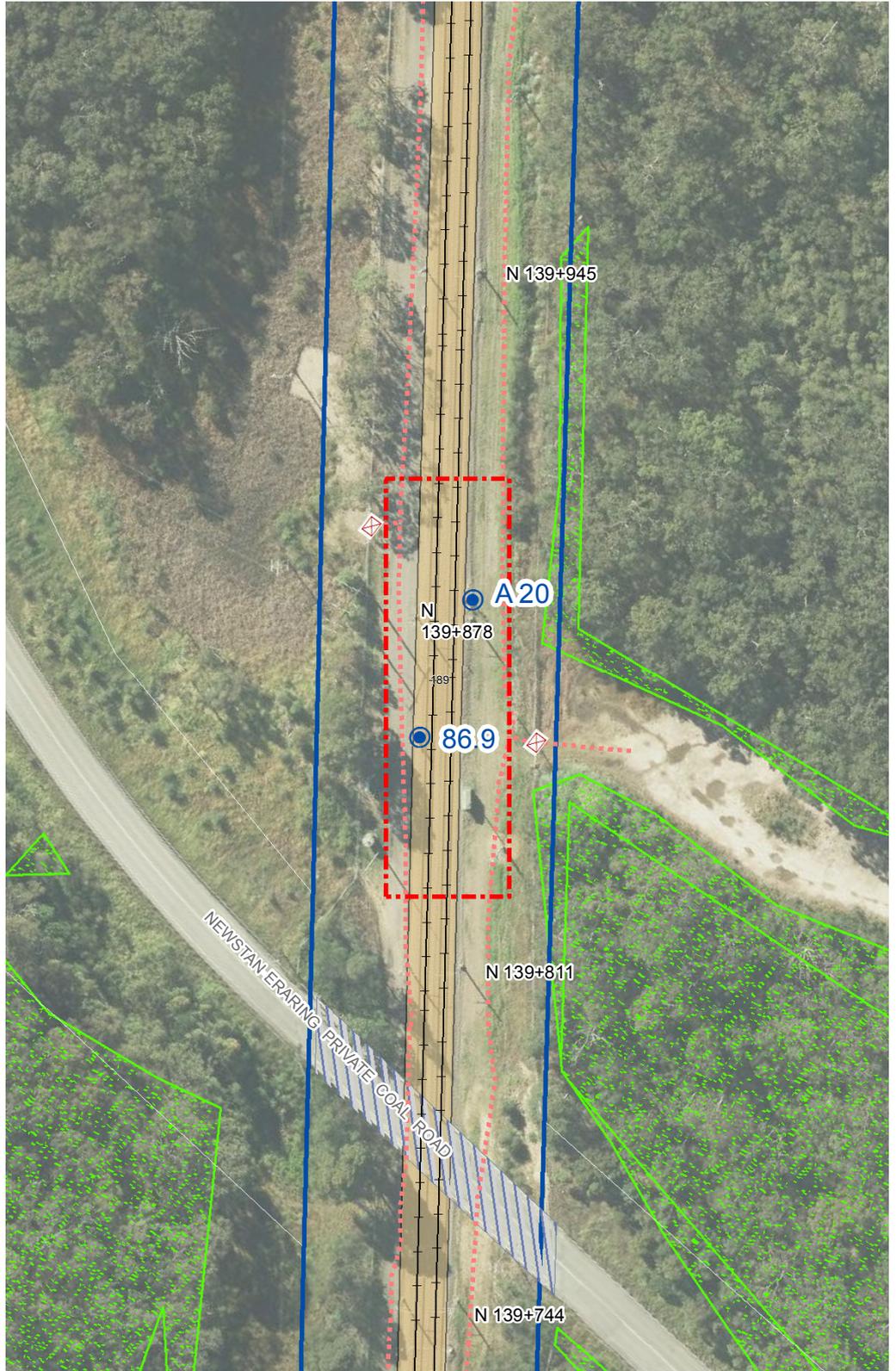
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|--------------------------|---------------------------------|--|-------------------------------|--|
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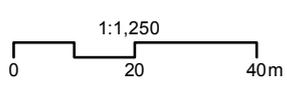
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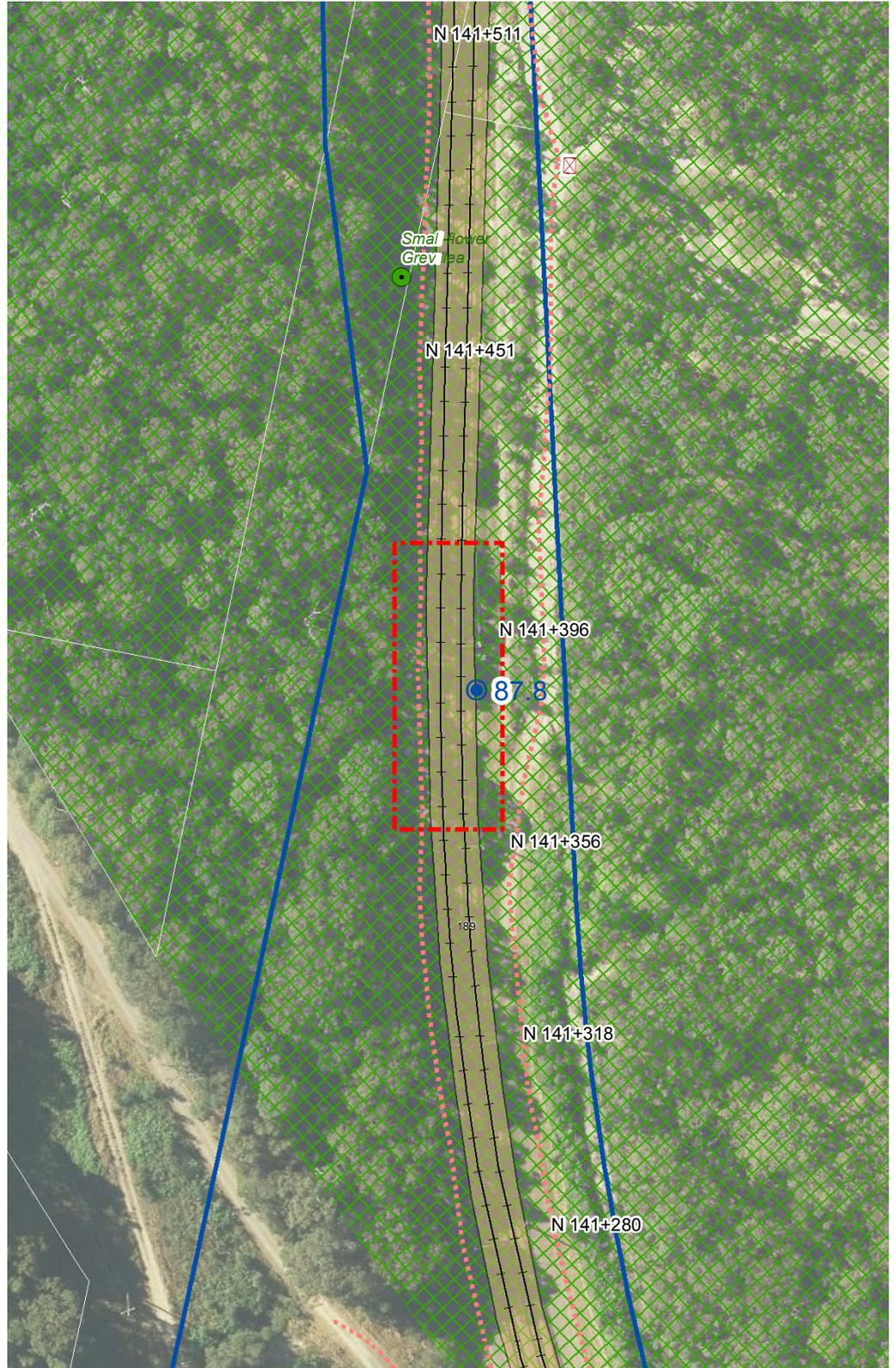
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|--------------------------|---------------------------------|--|-------------------------------|--|
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| Access gate | Area of potential contamination | Heritage item/heritage conservation area | | |
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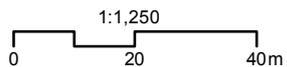
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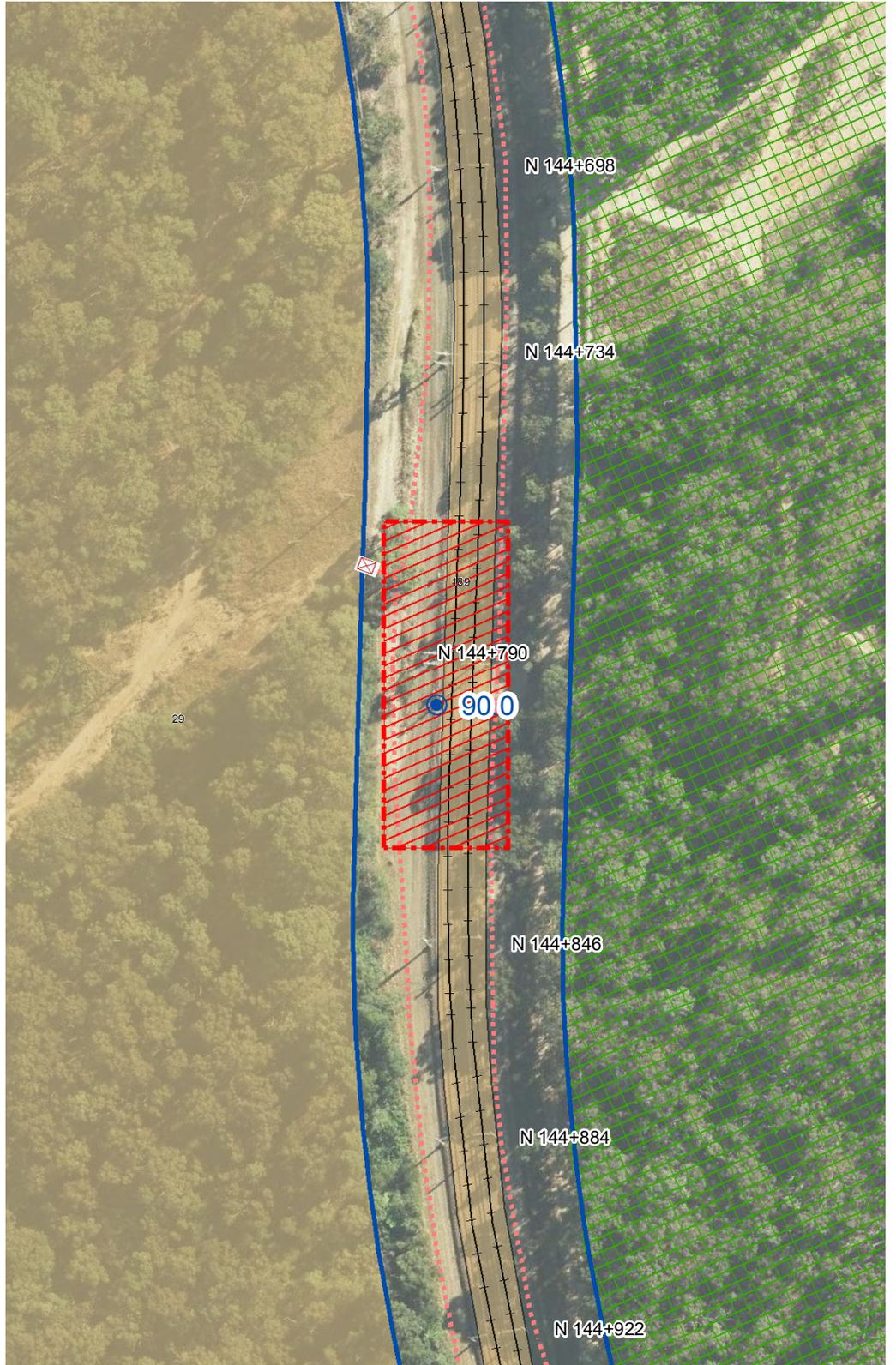
Acid Sulfate Soil Risk

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Projection: GDA 1994 MGA Zone 56

Source: Aurecon, OEH, Sydney Trains, LPI



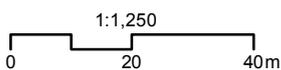
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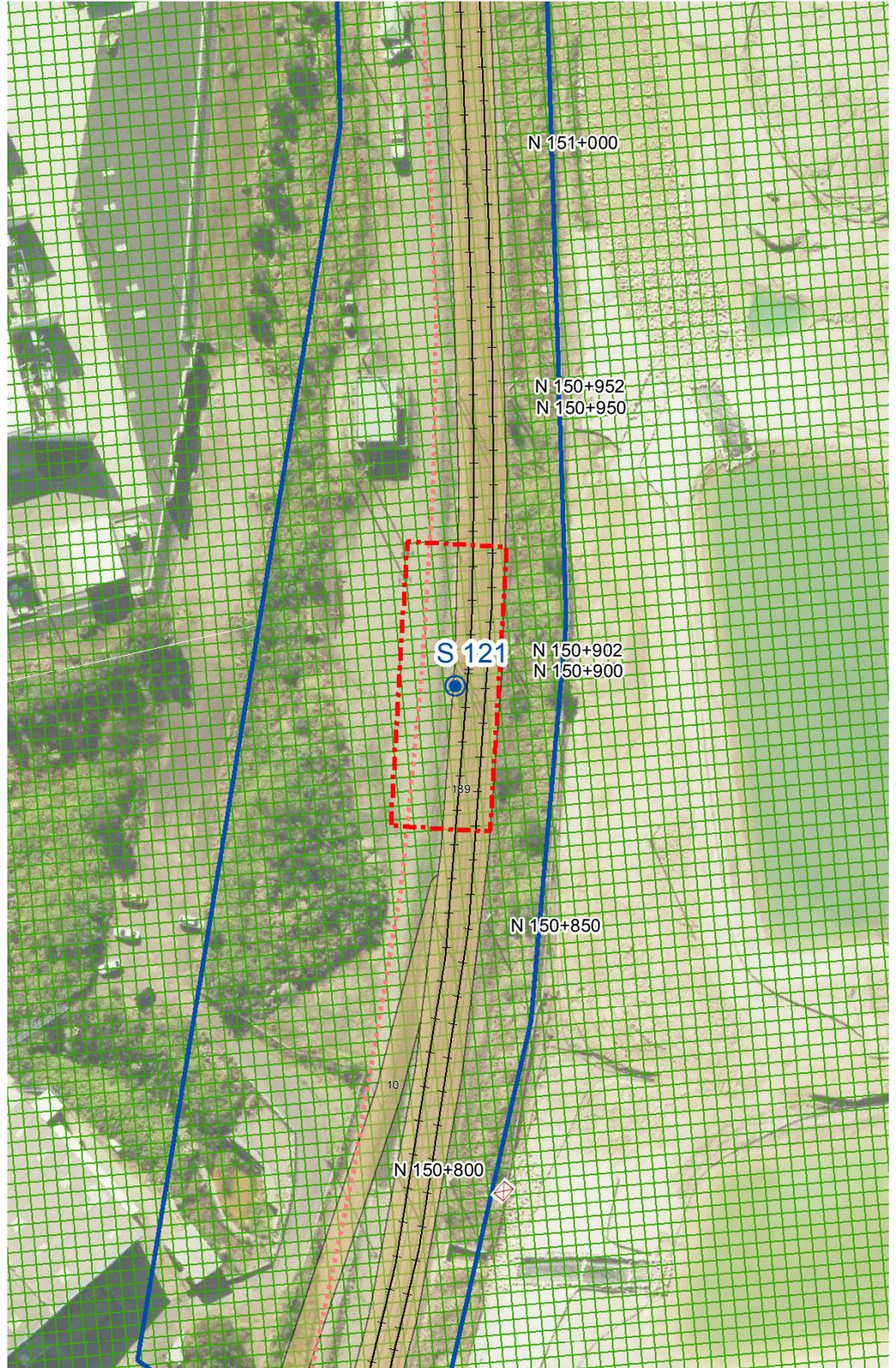
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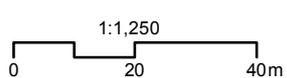
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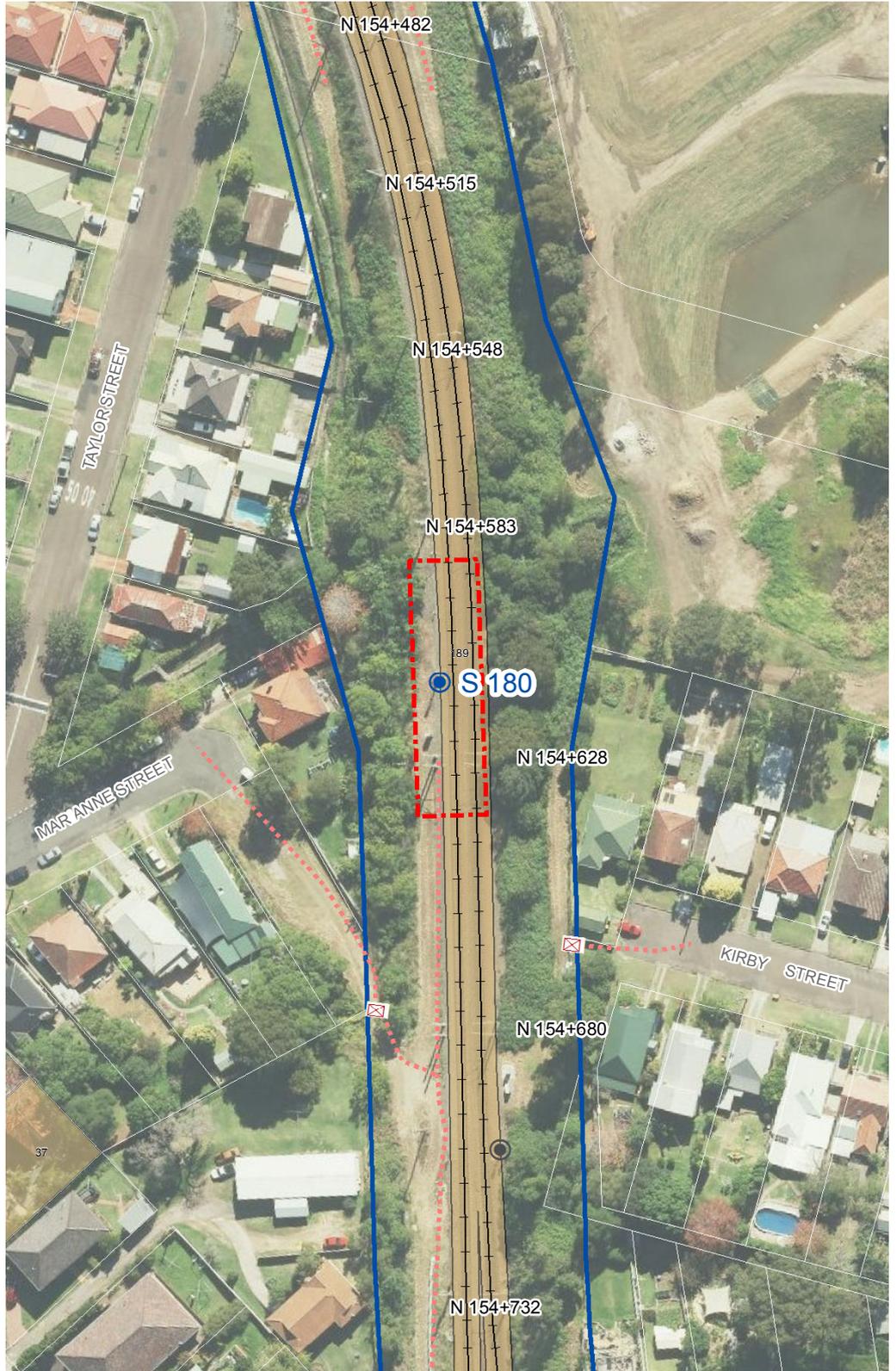
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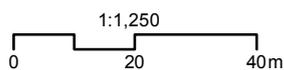
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|--------------------------|---------------------------------|--|-------------------------------|--|
| Site footprint | Platform | SEPP14 wetlands | Acid Sulfate Soil Risk | |
| Signal location | Station | SEPP71 coastal protection | | High risk of ASS occurring within 4m of natural soil surface |
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| Rail line | Substation location | EEC vegetation | | |
| Access gate | Area of potential contamination | Heritage item/heritage conservation area | | |
| Access road | | | | |



Projection: GDA 1994 MGA Zone 56

Advanced train control Migration System (AMS) **REF**

Source: Aurecon, OEH, Sydney Trains, LPI

Site S 180



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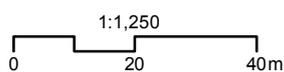
- Site footprint
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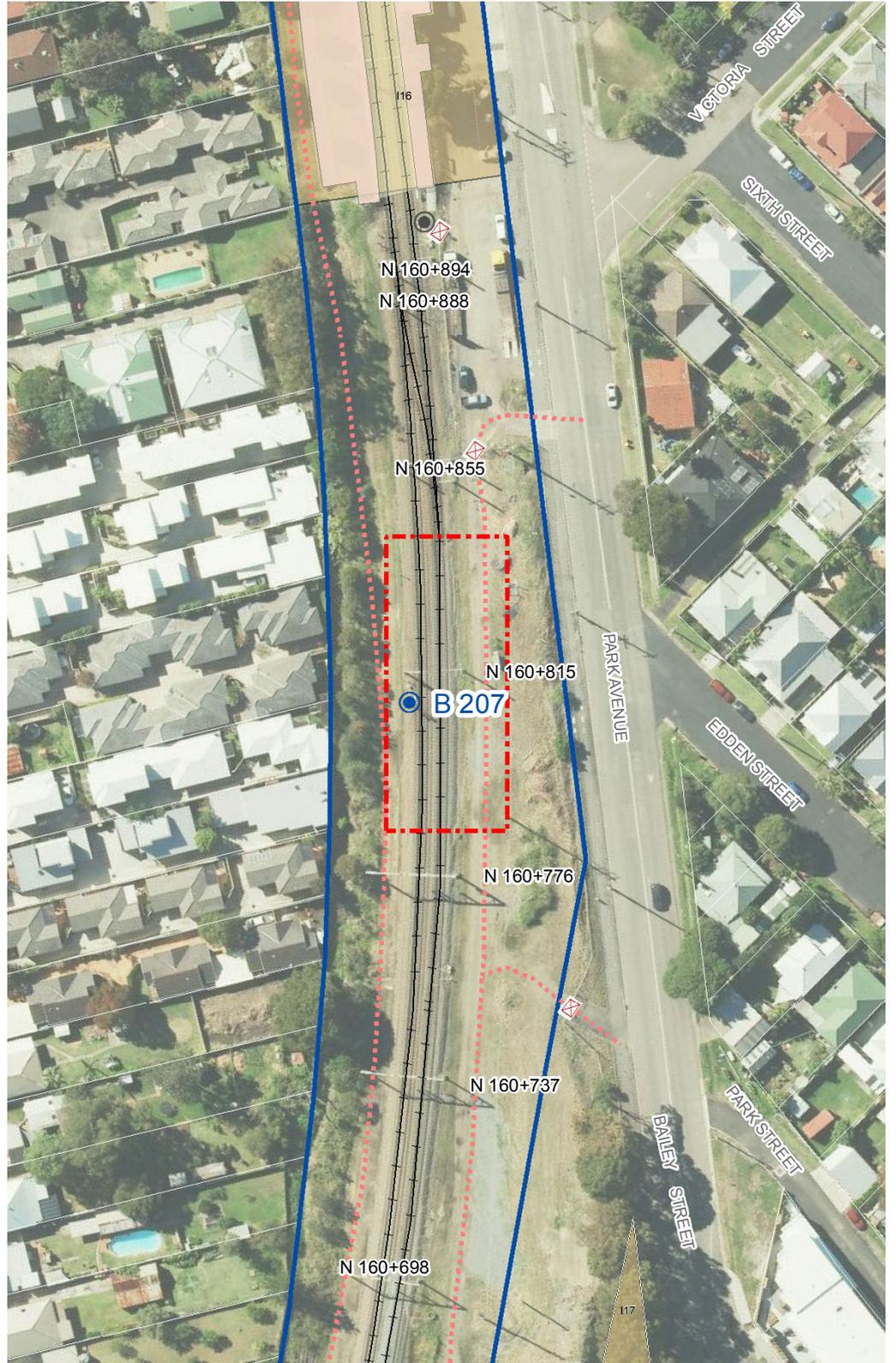
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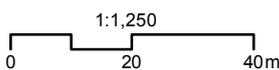
Projection: GDA 1994 MGA Zone 56

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|--------------------------|---------------------------------|--|-------------------------------|--|
| Site footprint | Platform | SEPP14 wetlands | Acid Sulfate Soil Risk | |
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| Access gate | Area of potential contamination | Heritage item/heritage conservation area | | |
| Access road | | | | |

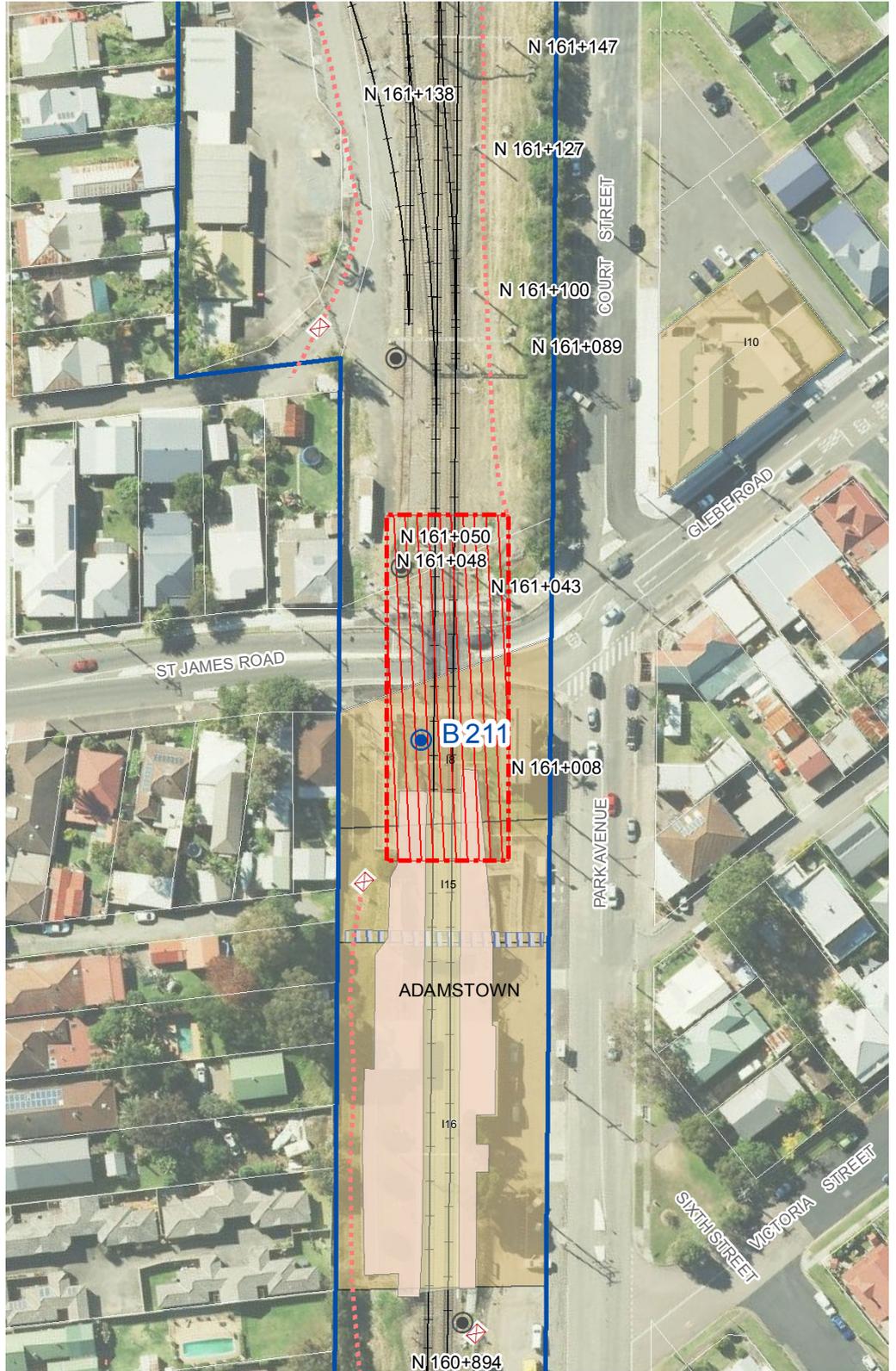


Projection: GDA 1994 MGA Zone 56

Source: Aurecon, OEH, Sydney Trains, LPI

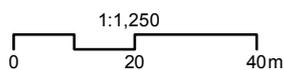
Advanced train control Migration System (AMS) **REF**

Site B 207



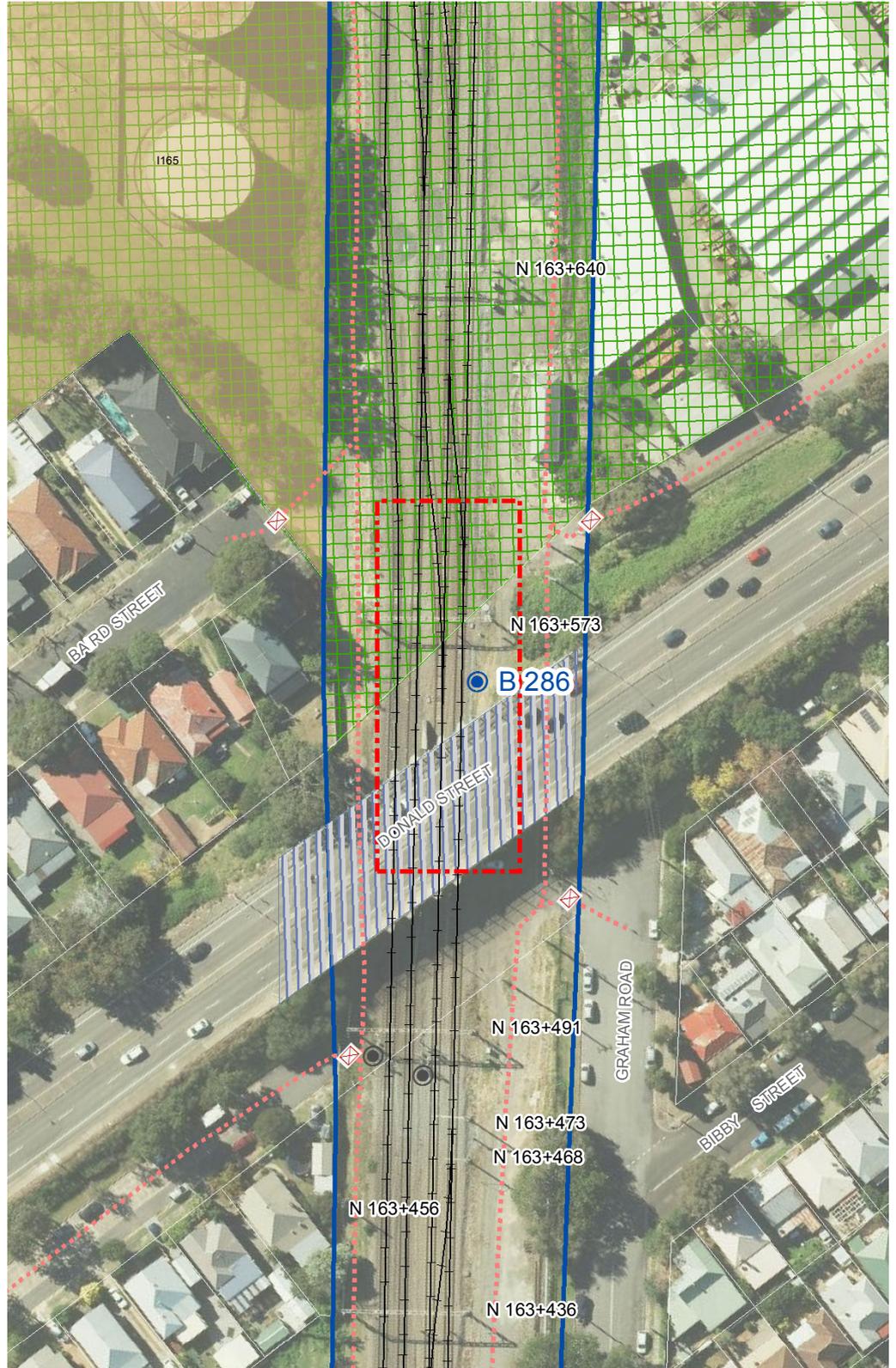
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|--------------------------|---------------------------------|--|-------------------------------|--|
| Site footprint | Platform | SEPP14 wetlands | Acid Sulfate Soil Risk | |
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| Rail line | Substation location | EEC vegetation | | |
| Access gate | Area of potential contamination | Heritage item/heritage conservation area | | |
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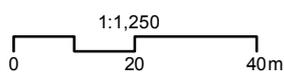
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|--------------------------|---------------------------------|--|-------------------------------|--|
| Site footprint | Platform | SEPP14 wetlands | Acid Sulfate Soil Risk | |
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| Rail line | Substation location | EEC vegetation | | |
| Access gate | Area of potential contamination | Heritage item/heritage conservation area | | |
| Access road | | | | |



Projection: GDA 1994 MGA Zone 56

Source: Aurecon, OEH, Sydney Trains, LPI

Advanced train control Migration System (AMS) **REF**

Site B 286