PENRITH STATION UPGRADE
Ecological Impact Assessment

FINAL REPORT

Prepared for Transport for NSW

20 October 2015

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- Client: Transport for NSW
- Office of Environment and Heritage for access to the NSW Wildlife Atlas

The following Biosis staff were involved in this project:

- Stefan Rose, Ashleigh Pritchard, Jayne Hanford, Jane Murray, Brian Wilson, Lauren Harley

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Summary

Biosis Pty Ltd was commissioned by Transport for NSW (TfNSW) to undertake an ecological impact assessment of the area around the Penrith Station potentially impacted by the proposed Penrith Station Upgrade (the proposal).

The assessment has been carried out in two stages. Stage 1 assesses and reports on the existing environment of the study area and Stage 2 assesses and reports on the impact of the proposal on the flora and fauna values of the study area. The current report presents the combined results of Stage 1 and Stage 2.

The existing environment results are based on a site inspection in November 2014. Some trees on the northern side of the rail corridor may have been impacted by recent works by UrbanGrowth NSW. No trees on the northern side of the rail corridor would be impacted by the proposal.

Ecological values

Key ecological values identified within the study area include:

- Groups of planted trees and isolated trees, mostly located outside of the rail corridor and to the south of the rail corridor.
- Potential foraging resources comprising, two large Spotted Gums *Corymbia maculata* on the northern side of the rail corridor, two Tallowwoods *Eucalyptus microcorys* on the northern side of the rail corridor and 17 Tallowwoods on the southern side of the rail corridor, for nectivorous birds including the threatened Little Lorikeet *Glossopsitta pusilla* and possibly the threatened Grey-headed Flying-fox *Pteropus poliocephalus*.
- The two large Spotted Gums (being winter flowering trees) may also provide a small amount of foraging habitat for the threatened Swift Parrot *Lathamus discolor*. This species has previously been detected near the study area.
- Potential roosting resources for three threatened microbat species (Greater Broad-nosed Bat, Eastern/East Coast Freetail-bat and Eastern Bentwing-bat) within the old Station Master's Residence and possibly within the large adjacent Pepper Tree (tree 10).

Government legislation and policy

An assessment of the proposal against key biodiversity legislation and policy is provided and summarised below.

Legislation / Policy	Relevant ecological feature on site	Permit / Approval required	Notes
***Environment Protection and Biodiversity Conservation Act 1999* (Cwlth)**	Potential for at least two threatened fauna species to forage within the study area (Swift Parrot and Grey-headed Flying-fox).	Since neither the two Spotted Gums nor any of the Tallowwood trees providing potential foraging habitat will be impacted, a Significant Impact Criteria assessment is not required.	Inspection of study area found no direct evidence of any threatened biota or listed migratory species within the study area. A small amount of potential foraging habitat for the Grey-headed Flying-fox (two large Spotted Gum trees and 19 planted Tallowwood trees) and the Swift Parrot (two large Spotted Gums) is present within the study area.
Threatened Species Conservation Act 1995	Potential for six threatened fauna species to occur within the study area (Swift Parrot, Grey-headed Flying-fox, Little Lorikeet, Greater Broad-nosed Bat, Eastern/East Coast Freetail-bat and Little Bentwing-bat)	Since neither the two Spotted Gums or any of the Tallowwood trees, providing potential foraging habitat for the Grey-headed Flying-fox, Swift Parrot and Little Lorikeet, will be impacted by the proposal and no changes to the old Station Master's Residence or tree 10 (potential roosting habitat) are proposed, Assessments of Significance/7-part tests are not required.	Inspection of study area found no evidence of any threatened species or threatened ecological community within the study area. A small amount of potential foraging habitat for the Grey-headed Flying-fox and Little Lorikeet (two large Spotted Gum trees and 19 planted Tallowwood trees) and for the Swift Parrot (two large Spotted Gums) is present within the study area. The old Station Master's Residence and adjacent large Pepper Tree provide potential roosting habitat for three threatened micro-bat species (Greater Broad-nosed Bat, Eastern Bentwing-bat and Eastern/East Coast Freetail Bat).
Fisheries Management Act 1994	None	None	No aquatic habitat present.

Legislation / Policy	Relevant ecological feature on site	Permit / Approval required	Notes
Environmental Planning & Assessment Act 1979	Potential for six threatened fauna species listed under the Threatened Species Conservation Act, to occur within the study area (Swift Parrot, Grey-headed Flying-fox, Little Lorikeet, Greater Broad-nosed Bat, Eastern/East Coast Freetail-bat and Little Bentwing-bat). Likely presence of Protected Fauna species.	Assessments of Significance/7-part tests (section 5A of the EP&A Act) are not required.	Inspection of study area found no evidence of any threatened species or threatened ecological community within the study area. A small amount of potential foraging habitat for the Grey-headed Flying-fox and Little Lorikeet (two large Spotted Gum trees and 19 planted Tallowwood trees) and for the Swift Parrot (two large Spotted Gums) is present within the study area. The old Station Master's Residence provides potential roosting habitat for threatened micro-bat species. No impacts on these habitats are proposed.
	Potential for protected fauna species (any native fauna species) to occur within the study area.	No formal approval required. The potential for impacts on protected fauna is discussed in this impact assessment report.	A few protected fauna species such as birds are known to occur and it is likely that other protected fauna species occur, but impacts will be negligible.
National Parks & Wildlife Act 1974	Potential for protected fauna species (any native fauna species) to occur within the study area.	No formal approval required. The potential for impacts on protected fauna is discussed in this impact assessment report.	A few protected fauna species, such as birds, are known to occur and it is likely that other protected fauna species occur, such as reptiles, but impacts will be negligible.
Noxious Weeds Act 1993	No Noxious Weed species were identified within the study area.	None	None present.
State Environmental Planning Policy No. 44	Koala habitat	None	While 19 planted individuals of one Koala feed tree species (Tallowwood) are present, none will be removed, and the potential clearing area is less than one hectare, so no provisions of SEPP 44 apply.

Legislation / Policy	Relevant ecological feature on site	Permit / Approval required	Notes
TfNSW Vegetation Offset Guide	No native vegetation detected within the study area. Groups of trees and individual trees do occur within the study area	No formal approval required. Compliance with TfNSW Vegetation Offset Guide (TfNSW 2013) will be required.	Inspection of the study area found no native vegetation present but 8 individual trees are proposed for removal, requiring offsetting with a minimum of 36 locally indigenous trees.
TfNSW Weed Management and Disposal Guide	No Noxious weeds are present but environmental weeds are present.	No formal approval required. Compliance with TfNSW Weed Management and Disposal Guide (TfNSW 2015a) may be required.	Environmental weeds are present, immediately to the east of the old Station Master's Residence, but this area is not affected by the proposal.
TfNSW Vegetation Management (Protection and Removal) Guideline	Groups of trees and individual trees do occur within the study area.	No formal approval required. Compliance with TfNSW Vegetation Management (Protection and Removal) Guideline (TfNSW 2015b) will be required.	Tree 16 will be trimmed and other trees in close proximity to earth works may be indirectly impacted.

Note: Guidance provided in this report does not constitute legal advice.

Recommendations

The primary measures to reduce potential impacts on ecological values from works within any site are to avoid, minimise, mitigate and offset, in that order, any removal of native vegetation and habitat. However within the Penrith Station study area, no native vegetation communities are present, no critical habitat is present and no threatened species were detected.

For the 36 trees expected to be provided as a minimum offset, in accordance with the TfNSW Vegetation Offsets Guide (2013), we recommend that Spotted Gums be used within any area proposed for landscaping.

While it is not proposed for removal, it is recommended that a specialist arborist carry out an assessment of the stability of tree 10, due to its senescence, shape and potential for collapse.

Once any requirement for removal or lopping, due to instability is known, and prior to any impacts on tree 10, it is recommended that further investigations by an ecologist to determine whether the tree provides roosting habitat for threatened micro-bat species, should be carried out.

It is recommended that the cultural or heritage value of the prominent large Pine Tree be determined, prior to any removal.

Removal of the large Rubber Tree (Tree 16) is recommended due to the potential for future damage to buildings and paving from the typically invasive root system of this species, regardless of whether the proposal requires it to be trimmed.

If earth works are proposed adjacent to any tree proposed for retention, a qualified arborist should be engaged to advise on the best way to minimise risks to the long-term survival of that tree.

1. Introduction

1.1 Background

Biosis Pty Ltd was commissioned by TfNSW to undertake an ecological impact assessment of the proposed upgrade works at Penrith Station.

The ecological impact assessment has been prepared for the proposal as part of the Review of Environmental Factors (REF) for the Penrith Station Upgrade. The purpose of the study is to assess and report on the impacts to the environment and provide discussion of the best strategies to mitigate any identified ecological impacts.

The assessment has been carried out in two stages. Stage 1 assesses and reports on the existing environment of the study area and Stage 2 assesses and reports on the impact of the proposal on the flora and fauna values of the study area. The current report presents the results of both Stage 1 and Stage 2.

1.2 Location of the study area

The study area is located around Penrith Station, which is situated between Belmore Street in the south and The Crescent in the north, in the residential suburb of Penrith (Figure 1and Figure 2). The study area includes all vegetated areas within the rail corridor and some vegetation on footpaths as well as isolated trees that could potentially be impacted by the proposed works. From aerial photographs, in most cases, the vegetation is restricted to gardens and landscaped areas outside the rail corridor to the south.

The study area is within the:

- Sydney Basin Bioregion.
- Penrith Local Government Area (LGA).

For this Ecological Impact Assessment report:

- 'Local area' is the area within a five kilometre radius of the study area.
- 'Study area' is the area considered during surveys and impact assessment.
- 'Subject site' is the area directly impacted by the Penrith Station Upgrade proposal.

Acknowledgement: Topo (c) NSW Land and Planning Information (2011); Overivew (c) State of NSW (c.2003)

Figure 1: Location of the study area, Penrith Station, NSW

Matter: 19161
Date: 19 November 2014,
Checked by: BW, Drawn by: LDM, Last edited by: lmilne
Location:P:\19100s\19161\Mapping\

0 500 1,000 1,500 2,000
Metres
N

Scale 1:50,000 @ A4, GDA 1994 MGA Zone 56

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Legend

Study area

Figure 2: Penrith Station Upgrade Study Area

0 10 20 30 40 50

Metres

Scale: 1:1,100 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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19161_F2_StudyArea

1.3 Proposed Upgrade Works

The key features of the proposed upgrade works are summarised as follows:

- An existing pedestrian footbridge retained for unpaid access across the railway and extended further south.
- Development of new stairs on both the northern and southern entrances of the pedestrian footbridge.
- A new paid concourse accessible from the pedestrian footbridge with relocated ticket gates and new Customer Information Window, Family Accessible Toilet, store room and stairs to platforms.
- Installation of three replacement lifts to provide access to the platforms/interchange.
- Addition of new canopies for the existing footbridge and new stairs, lift landings, paid concourse, in addition to replacing platform canopies affected by works.
- Reconfiguration of the southern transport interchange which would involve:
  - Upgrading of the bus interchange with reversed traffic flow with set down, pick up and layover spaces for buses, and shelters for weather protection for customers
  - Relocation of the kiss and ride and taxi rank (with shelters) on Belmore Street
  - Landscaping, paving and lighting for the interchange and forecourt area
  - Extension of the western commuter car park with approximately 25 spaces (to offset some of the commuter parking removed for the long-term bus layover)
  - Establishment of a new Bus Driver's Amenities Room and Customer Service Manager's Office in the existing Platform 3 heritage building
- Other ancillary works including services diversion and/or relocation, alterations to traffic signals, station power supply upgrade, minor drainage works, adjustments to fencing, lighting and seating, improvements to station communication systems with new infrastructure (including lighting, CCTV cameras, Passenger Information Display boards and Opal card readers) and wayfinding signage.

2. Methods

2.1 Literature and database review

In order to provide a context for the study area, information about flora and fauna from within five kilometres of the study area (the 'local area') was obtained from relevant public databases. Records from the following databases were collated and reviewed:

- BioNet Atlas of NSW Wildlife. New South Wales, Office of Environment and Heritage (OEH) for threatened biota listed under the Threatened Species Conservation Act (TSC Act).
- NSW Threatened Species Information (OEH).
- PlantNET (The Royal Botanic Gardens and Domain Trust 2014).
- Protected Matters Search Tool of the Australian Government Department of the Environment (DoE) for matters protected by the Environment Protection and Biodiversity Conservation Act (EPBC Act).

Other sources of biodiversity information:

- Relevant vegetation mapping, including:
  - OEH Six Viewer portal for NSW vegetation mapping datum.
  - Vegetation Mapping of the Cumberland Plain (NPWS, 2002).

2.2 Site investigation

Biosis' Senior Ecologist, Brian Wilson, completed a site inspection, flora assessment and fauna assessment over a 3 hour period on 13 November 2014.

2.2.1 Flora assessment

The flora assessment for the current report was undertaken by inspecting all vegetated areas within the study area from the closest access point. For vegetation within the rail corridor, the inspection was usually only able to be carried out through a fence or from an adjacent platform.

A list of flora species was compiled for the study area. Records of any threatened flora species will be submitted to OEH for incorporation into the OEH Atlas of NSW Wildlife.

The general condition of native vegetation was observed as well as the effects of current seasonal conditions. Notes were made on specific issues such as noxious and environmental weed infestations, evidence of management works, roadside impacts such as rubbish dumping and routine maintenance works and the regeneration capacity of the vegetation.

For all trees, the species and its condition were recorded and estimates of height and diameter at breast height (DBH) were made.

2.2.2 Fauna assessment

The study area was investigated for the current report to determine its values for fauna. These were determined primarily on the basis of the types and qualities of habitat(s) present. All species of fauna opportunistically observed during the assessment were noted. This included direct observation, searching for evidence of fauna presence such as nests, examination of tracks and scats and

identifying calls. Particular attention was given to searching for threatened species and their habitats. Fauna species were recorded with a view to characterising the values of the study area and the investigation was not intended to provide a comprehensive survey of all fauna that has potential to utilise the study area over time.

Fauna records will be submitted to OEH for incorporation into the Atlas of NSW Wildlife.

2.2.3 Permits and Licences

The flora and fauna assessment was conducted under the terms of Biosis' Scientific Licence issued by the OEH under the *National Parks and Wildlife Act* (SL100758). Fauna survey was conducted under approval 11/355 from the NSW Animal Care and Ethics Committee.

2.3 Limitations

Database searches, and associated conclusions on the likelihood of species to occur within the study area, are reliant upon external data sources and information managed by third parties.

Ecological surveys provide a sampling of flora and fauna at a given time and season. There are a number of reasons why not all species will be detected at a site during survey, such as species dormancy, seasonal conditions, migration and breeding behaviours of some fauna. In many cases these factors do not present a significant limitation to assessing the overall biodiversity values of a site.

The current site flora and fauna assessment was conducted in spring, which is an optimal time for survey.

The site inspection was only permissible by TfNSW within the publicly assessable areas around the study area, so some observations had to be made from a distance. It is possible that small plants of some species and small fauna species could have been missed, particularly within densely vegetated areas.

2.4 Legislation and policy

The implications for the proposal were assessed in relation to key biodiversity legislation and policy including:

- *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act).
- *Environmental Planning and Assessment Act 1979* (EP&A Act), including where relevant:
  - State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44).
- *Threatened Species Conservation Act 1995* (TSC Act).
- *Fisheries Management Act 1994* (FM Act).
- *National Parks & Wildlife Act 1974* (NP&W Act).
- *Noxious Weeds Act 1993* (NW Act).
- Transport for NSW Vegetation Offset Guide 2013.

2.5 Mapping

TfNSW supplied a study area boundary overlaid onto an aerial image, in the Services Brief (TfNSW, 2014).

The locations of trees and other ecological values mapped in this report are based on site inspection carried out by Biosis ecologists on 13 November 2014 and aerial photo interpretation.

3. Results

3.1 Database and document review

A list of threatened flora species recorded or predicted to occur in the local area, along with an assessment of the likelihood of the species occurring within the Penrith Station study area is provided in Appendix 1.

None of the 20 threatened flora species previously recorded or predicted to occur in the local area, are considered likely to occur within the study area due to the long history of urban and commercial usage and lack of native vegetation/habitat features within the land around the Penrith Station.

A list of the 19 Threatened Ecological Communities (TEC) previously recorded or predicted to occur in the local area, is provided in Appendix 1.

A list of threatened fauna species recorded or predicted to occur in the local area, along with an assessment of the likelihood of the species occurring within the Penrith Station study area is provided in Appendix 2.

Six of the 30 threatened fauna species previously recorded or predicted to occur in the local area, are considered to have a moderate likelihood of occurring within the study area (Grey-headed Flying-fox, Little Lorikeet, Swift Parrot, Greater Broad-nosed Bat, Eastern/East Coast Freetail-bat and Little Bentwing-bat).

A list of the 19 migratory fauna species (EPBC Act) recorded or predicted to occur in the local area, is provided in Appendix 2.

3.2 Site assessment

The ecological values of the study area are described below and mapped in Figure 3. Photographs of those parts of the study area referred to below are presented in Appendix 3.

3.2.1 Vegetation communities

From the database search 19 TEC have been recorded or are predicted to occur within the local area.

However, based on regional vegetation mapping of the Cumberland Plain (NPWS, 2002), remnants of three identifiable native vegetation communities comprising three TEC have been mapped near the study area:

- Shale Plains Woodland (*Cumberland Plain Woodland in the Sydney Basin Bioregion*, Critically Endangered Ecological Community, TSC Act and EPBC Act), commonly known as Cumberland Plain Woodland.
- Shale Hills Woodland (*Cumberland Plain Woodland in the Sydney Basin Bioregion*, Critically Endangered Ecological Community, TSC Act and EPBC Act), commonly known as Cumberland Plain Woodland.
- Alluvial Woodland (*River-flat Eucalypt Forest of the NSW North Coast, Sydney Basin and South-east Corner Bioregions*, Endangered Ecological Community, TSC Act).

The long history of urbanisation in the Penrith area means that intact remnants of these native vegetation communities are now scarce and they are all listed as TECs under NSW and/or Commonwealth legislation. No native vegetation communities are mapped as present within the

Penrith Station study area. Some individual elements may remain of these vegetation communities even in highly disturbed sites, usually as isolated trees, shrubs or groundcover species or as very small patches of vegetation in relatively inaccessible or undisturbed areas.

Within the Penrith Station study area, most parts exhibit a long history of disturbance and consequently exotic vegetation is common, comprising specific plantings, landscaping treatments, and invasion by environmental weeds and garden plants.

One flora species detected within the study area is considered to be a remnant element of a local native vegetation community that is a listed TEC. The two large Spotted Gums *Corymbia maculata* located in the north-east corner of the study area on the northern side of the rail corridor comprise a listed species of the Critically Endangered Ecological Community, Cumberland Plain Woodland.

3.2.2 Description of vegetated areas within the study area

The platforms have no trees, shrubs or other vegetation present. Figure 3 shows the distribution of vegetation within the study area and Figure 4 shows the location of all trees within the study area.

North side of the rail corridor

There is little vegetation remaining on the northern side of the rail corridor either inside or outside the rail corridor boundary. Much of the land has been cleared and is currently either bare ground or a paved car parking area.

A row of planted Tallowwood *Eucalyptus microcorys* trees appears on some aerial images of the northern side of the Penrith Station study area. However most of these trees (located outside the study area) have since been cut down to stumps, leaving a single tree located within the study area. This tree has a DBH of around 30 centimetres. Immediately to the east of this tree, two large Spotted Gums around 50 centimetres DBH and around 20 metres in height, and a substantially lopped Tallowwood are present in the north-east corner of the study area.

South side of the rail corridor

On the southern side of the rail corridor most of the vegetation is planted trees and garden plants.

In the south-east corner of the study area a row of three planted Tallowwood trees (Plate 1) of around 30 centimetres DBH and 14 metres in height, is present, shading the bike lockers. To the north of these is a small Hackberry *Celtis sp.* near the old elevated water tank inside the rail corridor fence and to the west of this are two large Pepper Trees *Shinus ariera* (around 40 centimetres DBH and 10 metres in height) outside the rail corridor fence (Plate 2) and another Hackberry tree inside the fence (Plate 3).

The adjacent car parking area has been landscaped with Crinum Lilies *Crinum pedunculatum*, Mat Rushes *Lomandra* sp., Hairpin Banksia *Banksia spinulosa*, Flax Lilly *Dianella* sp. and Climbing Guinea Flower *Hibbertia scandens*, but several environmental weed species are also present such as Fleabane *Conyza* sp., Moth Vine *Araujia sericifera* and Lambs Tongues *Plantago lanceolata*.

To the east and outside the fenced boundary of the old Station Master's Residence are a large Black Cypress Pine *Callitris endlicheri,* a large Hackberry tree and two large Pepper Trees around 12 metres in height (Plate 4). One of these Pepper Trees is a very old large (tree 10) and may date from the time when the Station Master's Residence was in use. This tree has two large widely separated leaning trunks and these may be at risk of collapse.

Within the fenced boundary of the old Station Master's Residence the vegetation comprises a few planted trees (Hackberry, Cockspur Coral Tree *Erythrina crista-galli* and Jacaranda *Jacaranda mimosifolia*) and various environmental weeds that have become established, including: Fat Hen *Chenopodium album*, Cobblers Pegs *Bidens pilosa*, Black Nightshade *Solanum nigrum*, Paddy's Lucerne *Sida rhombifolia* and Fleabane.

North of the old Station Master's Residence and located in a prominent location between the south-east car parking area and the concourse is a large Pine Tree *Pinus* sp. with a DBH of around 60 centimetres and around 20 metres in height (Plate 6 and Plate 7).

West of the old Station Master's Residence a large Rubber Tree *Ficus elastica* with a large multi-stemmed base and a large canopy around 14 metres in height (Plate 7) is present. Also in this area are three Cypress trees (Plate 9) heavily overgrown with Red Trumpet Vine *Campsis radicans* and four Jacarandas (Plate 10) around 8 metres in height.

A row of trees has been planted along the footpath on the northern side of Belmore Street. At the eastern end are three small Jacarandas around five metres in height then a row of 11 evenly spaced Tallowwoods between 15 and 30 centimetres DBH and around 10 metres tall, is present. In the south-west corner of the study area three Tallowwoods around 30 centimetres DBH and 12 metres in height are present.

A large Jacaranda around 30 centimetres DBH and 10 metres in height and a large Red Tips *Photinia* sp. bush are located adjacent to the bus shelter (Plate 11) and inside a fenced area in the western end of the study area, a large Hackberry around 10 metres in height, a small Camphor Laurel *Cinnamomum camphora* and two Murraya *Murraya paniculatum* bushes are located between buildings (Plate 12).

Legend

- Study area
- Trees
- Vegetation patches

Acknowledgements: Imagery (c) Nearmap 2014; Basemap (c) NSW LPI

Figure 3: Vegetation types within Penrith Station upgrade study area

0 10 20 30 40 50

Metres

Scale: 1:1,100 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

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Matter: 19161
Date: 20 October 2015,
Checked by: BW, Drawn by: LDM, Last edited by: lharley
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19161_F3_Veg

3.2.3 Description of fauna habitat within the study area

Few fauna species were observed during the site inspection in November 2014 and little fauna habitat is present within the study area.

While no patches of native vegetation are present, some larger, mature trees and shrubs with some fauna habitat value are present within the study area. These mostly comprise the two large Spotted Gums on the north side of the rail corridor and the 17 planted Tallowwoods on the south side, which may provide foraging resources for nectivorous birds and flying foxes during flowering periods. The Jacarandas on the south side may also provide foraging resources for nectivorous birds. The very large Pepper Tree (Tree 10) near the old Station Master's Residence contains some hollows that could potentially be used for roosting by microbats. No other trees contain hollows.

The old Station Master's Residence and station buildings may provide roosting/nesting habitat for micro-bats and introduced bird species such as the Feral Pigeon and Indian/Common Myna, which were observed within the study area during the site inspection. Other trees may provide foraging and nesting resources for Pee Wees/Magpie Larks and Noisy Miners observed within the study area during the site inspection.

The steps and concourse do not appear to contain suitable cracks or holes that could be used by fauna species such as microbats or birds.

Due to the limited habitat available and lack of connectivity to other areas of habitat, overall fauna diversity is expected to be low. The threatened Grey-headed Flying-fox and Little Lorikeet may visit the study area to forage on the Spotted Gums and Tallowwoods when flowering. Some threatened microbat species may forage for insects while flying over the study area and potential roosting resources within the study area, comprise the old Station Master's Residence and the large Pepper Tree adjacent to it.

3.2.4 Condition of the vegetation and presence of weeds

The vegetation and fauna habitat throughout the majority of the study area has been modified by a long history of disturbances which have resulted in clearance of native vegetation and replacement by exotic trees and by infestation by environmental weeds in the ground and shrub layers. Some parts of the study area have been treated as a garden or landscape area with a monoculture or as regularly spaced plantings (south side footpath area and various other parts of the study area). However environmental weed infestation is relatively minor in all areas apart from the fenced area around the old Station Master's Residence where a moderate density of environmental weeds occurs.

A number of common environmental weed species were recorded within the study area but none were present at high abundance. Environmental weed species of note included: Cobbler's Pegs, Moth Vine, Fat Hen, Paddy's Lucerne and perennial grasses.

No environmental weeds, that are declared as noxious weeds under the *Noxious Weeds Act 1993* (NW Act) in the Hawkesbury River County Council Local Control Area, were recorded within the study area.

3.2.5 Tree Assessment

The study area contains trees considered likely to be remnants of the natural vegetation of the Penrith area, trees that have been planted, and trees that are invasive species likely to be self sown.

Photographs showing all individual trees, or groups of trees, are presented in Appendix 3. Figure 4 shows the location of all trees within the study area.

Appendix 3 lists all trees and the following parameters:

- Common name.
- Scientific name.
- Diameter at breast height (DBH).
- Approximate height.
- Approximate DBH.
- Tree Protection Zone radius (TPZ) - includes primary and critical root zone
- Structural Root Zone radius (SRZ).
- Landscape Significance Rating.
- Safe Useful Life Expectancy (SULE).
- Expected impact from the proposal.
- Tree type (based on TfNSW Vegetation Offset Guide 9TP-ST-149/2.0).
- Relevant comments.

In addition, with reference to the TfNSW Vegetation Offset Guide, removal of any trees in Appendix 3 for the Penrith Upgrade would require offsetting in the form of replacement trees of locally indigenous species at the ratios presented in Table 5-2 of the TfNSW Vegetation Guide.

Legend

- Study area
- Trees
- Vegetation patches

Figure 4: Trees located within the Penrith Station upgrade study area

0 10 20 30 40 50

Metres
Scale: 1:1,100 @ A3
Coordinate System: GDA 1994 MGA Zone 56

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Matter: 19161
Date: 20 October 2015,
Checked by: BW, Drawn by: LDM, Last edited by: lharley
Location:P:\19100s\19161\Mapping
19161_F4_Trees

3.3 Threatened species

3.3.1 EPBC Act & TSC Act listed species

Lists of threatened and migratory species recorded or predicted to occur within five kilometres of the study area are provided in Appendix 1 (flora) and Appendix 2 (fauna). An assessment of the likelihood of these species occurring in the study area and an indication of where they may occur within the study area (i.e. which habitats or features of relevance to the species) is included. A summary of those species recorded or with a medium or higher likelihood of occurring in the study area is provided in Table 1 and Table 2.

Table 1: EPBC Act threatened species with potential to occur in the study area

Species name	Section of the study area providing habitat
Grey-headed Flying-fox	Potential nocturnal foraging habitat during flowering period of two large Spotted Gums on the northern side of rail corridor and the 19 planted Tallowwoods, mostly located on the southern side.
Swift Parrot	Small amount of potential foraging habitat during winter flowering period of two large Spotted Gums on the northern side of rail corridor.

Table 2: TSC Act threatened species with potential to occur in the study area

Species name	Section of the study area providing habitat
Grey-headed Flying-fox	Potential nocturnal foraging habitat during flowering period of two large Spotted Gums on the northern side of rail corridor and the 19 planted Tallowwoods, mostly located on the southern side.
Swift Parrot	Small amount of potential foraging habitat during winter flowering period of two large Spotted Gums on the northern side of rail corridor.
Little Lorikeet	Potential diurnal foraging habitat during flowering period of two large Spotted Gums on the northern side of rail corridor and the 19 planted Tallowwoods, mostly located on the southern side.
Greater Broad-nosed Bat	May roost within the old Station Master's Residence or adjacent large Pepper Tree (tree 10).
Eastern Bentwing-bat	May roost within the old Station Master's Residence or adjacent large Pepper Tree (tree 10).
Eastern/East Coast Freetail-bat	May roost within the old Station Master's Residence or adjacent large Pepper Tree (tree 10).

3.4 Threatened ecological communities

No threatened ecological communities, listed under either the NSW TSC Act or the Commonwealth EPBC Act, occur within the study area.

4. Potential Ecological Impacts

Plans and drawings prepared by Laing O'Rourke/GHD showing the various components of the Penrith Station Upgrade have been reviewed. The potential impacts have been assessed based on the Concept Design drawing dated 9/10/2015. A plan of the major elements of the proposal is presented in Figure 5.

It is expected that all impacts will occur during the construction phase and no additional impacts will occur during the operational phase of the proposal.

4.1 Impacts on vegetation and trees

There are no areas of native vegetation within the study area. The proposed works will not impact any of the remnant elements of native vegetation identified within the Penrith Station Upgrade study area. Nor will the works impact on any vegetation or trees on the north side of the rail corridor.

The impacts on vegetation and trees are all outside and to the south of the rail corridor. The vegetation to be impacted comprises planted exotic tree species only. Figure 6 shows those eight trees to be impacted by the proposal.

Tree 11 is the smaller of two old Pepper Trees immediately to the east of the old Station Master's Residence.

The prominent large Pine tree (tree 15) north of the old Station Master's Residence is also proposed for removal as it is located within the new lanes of the bus interchange, and an alternative route is not possible due to the design constraints and requirements for the safe operation of buses.

Six Jacaranda trees (trees 20-25) located to the west of the old Station Master's Residence, are also proposed for removal.

Of the 47 trees recorded within the study area, only seven medium trees and one large tree, as defined in the TfNSW Vegetation Offset Guide (TfNSW 2013), would be removed, comprising:

- Tree 11 (medium tree).
- Tree 15 (large tree).
- Trees 20-25 (all medium trees).

The trimming of the large Rubber Tree (tree 16) may be required as part of the proposal.

Since no works are proposed within the fenced area around the old Station Master's Residence, no direct impacts on the environmental weeds in this area are expected.

In accordance with the Guide (TFNSW 2013), this loss of trees would require an offset of a minimum of 36 locally indigenous trees.

Tree 16 mayneed to have limbs trimmed. This tree and any other trees adjacent to areas where construction works are proposed could potentially be subject to indirect impacts associated with soil disturbance or limb damage. Protective measures in accordance with the TfNSW Vegetation Management (Protection and Removal) Guideline (TfNSW 2015b) should permit these trees to achieve their Safe Useful Life Expectancy (SULE).

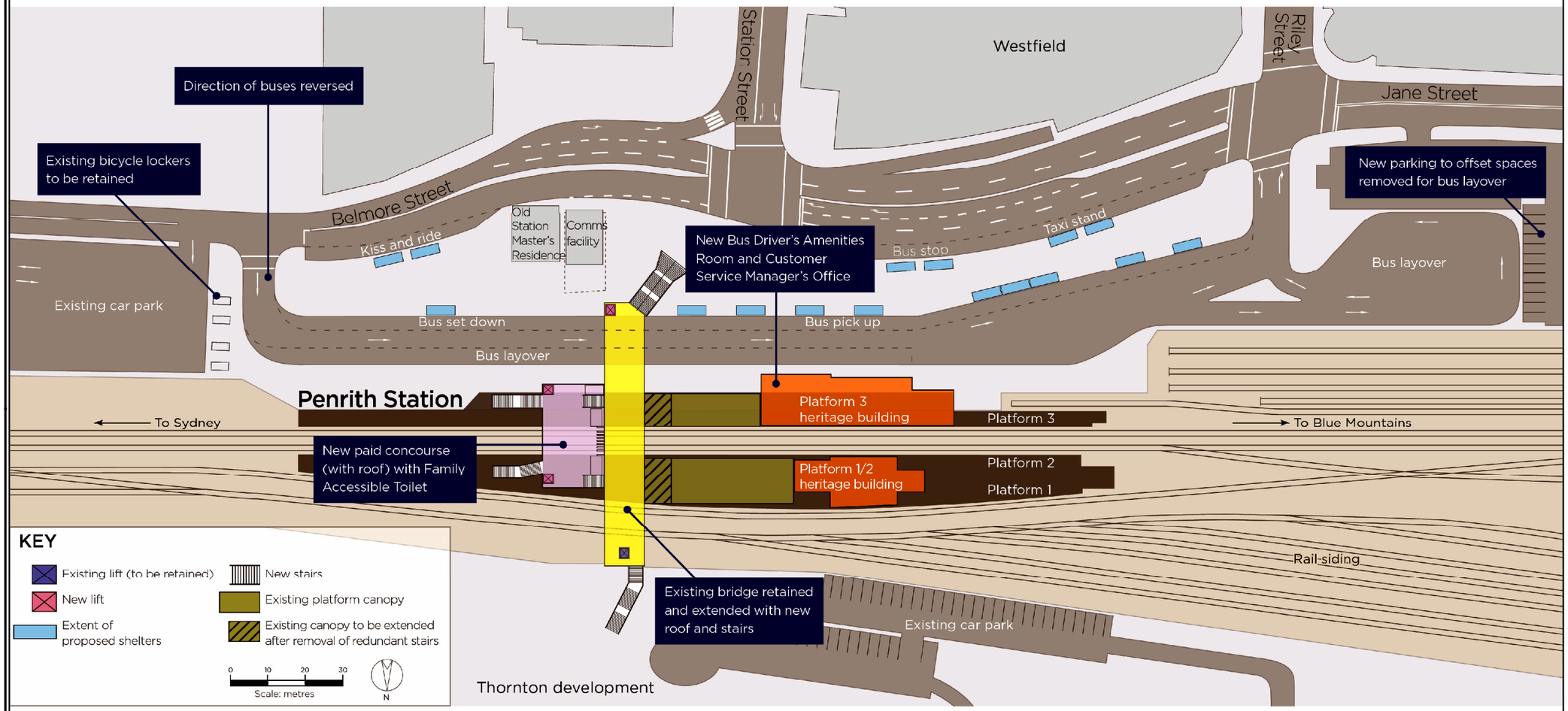

Figure 5: Penrith Station upgrade proposal

0 10 20 30 40 50

Metres

Scale: 1:1,100 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

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Matter: 19161
Date: 20 October 2015,
Checked by: BW, Drawn by: LH, Last edited by: lharley
Location:P:\19100s\19161\Mapping
19161_P_F5_UpgradeProposal

Acknowledgements: Transport for NSW 2015; Basemap (c) NSW LPI

Legend

- Study area
- Trees
- Vegetation patches

Figure 6: Proposed Vegetation Impacts

0 10 20 30 40 50

Metres

Scale: 1:1,100 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

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Matter: 19161
Date: 20 October 2015,
Checked by: BW, Drawn by: LDM, Last edited by: lharley
Location:P:\19100s\19161\Mapping
19161_P_F6_VegImpacts

4.2 Impacts on fauna

With the removal of only eight exotic trees (one large and seven medium) in total and most of those providing little or no fauna habitat values, the impacts on nectivorous fauna will be minor. Negligible impacts on potential foraging resources for the threatened species Grey-headed Flying-fox, Swift Parrot or Little Lorikeet are expected.

The proposal does not involve changes to the old Station Master's Residence, so no impacts on potential roosting habitat for micro-bats are expected.

5. Biodiversity Legislation and Government Policy

This section provides an assessment of the potential impacts on threatened biota, migratory species and their habitats against key biodiversity legislation and government policy.

Where available, links to further information are provided. This section does not describe the legislation and policy in detail and guidance provided here does not constitute legal advice.

5.1 Commonwealth

5.1.1 Environment Protection and Biodiversity Conservation Act 1999 (Cwlth)

The EPBC Act applies to developments and associated activities that have the potential to significantly impact on Matters of National Environmental Significance (NES) protected under the Act.

Matters of NES potentially relevant to the proposal are summarised in Table 3. This table includes an assessment against the EPBC Act policy statements published by the Australian Government which provide guidance on the practical application of EPBC Act.

Table 3: Assessment of the proposal against the EPBC Act

Matter of NES	Project specifics	Assessment against Guidelines
Threatened biota	31 threatened species (18 flora and 13 fauna) and 10 Threatened Ecological Communities have been recorded or predicted to occur in the search area. The likelihood of these species occurring in the study area is assessed in Appendix 1 (flora) and Appendix 2 (fauna).	None of the Threatened Ecological Communities listed under the EPBC Act is present within the study area. Only two of these species (Grey-headed Flying-fox and Swift Parrot) are likely to occur, to seasonally forage on flowering trees. Only minor loss of such trees is proposed so the proposal is unlikely to result in a significant impact on either species.
Migratory species	19 migratory species have been recorded or predicted to occur in the search area (Appendix A2.2).	None of these species is likely to utilise the study area.
Wetlands of international importance (Ramsar sites).	The study area does not drain directly into a Ramsar site.	

On the basis of criteria outlined in the relevant *Significant Impact Guidelines* (DoE 2013) it is considered unlikely that a significant impact on a Matter of NES would result from the proposed action.

Biosis does not believe that referral of the proposal to the Commonwealth DoE pursuant to the EPBC Act will be warranted in this case. However, TfNSW may choose to refer the proposed action to the Australian Government Minister for the Environment to determine whether the action requires approval under the EPBC Act.

5.2 State

5.2.1 Threatened Species Conservation Act 1995

The TSC Act provides for the protection and conservation of biodiversity in NSW through the listing of threatened biota; key threatening processes; and critical habitat for threatened biota.

No threatened biota was detected within the study area, however the two large Spotted Gums on the north side of the rail corridor and the 19 Tallowwoods primarily located on the southern side of the rail corridor, provide a small amount of potential foraging habitat for the threatened species Grey-headed Flying-fox and Little Lorikeet. The two large Spotted Gums may also provide a small amount of potential winter foraging habitat for the Swift Parrot. None of the 19 Tallowwood trees within the study area will be removed and neither of the Spotted Gums will be removed for this project. There will not be a significant impact for any local population of the three threatened species.

Habitat critical to the survival of an endangered or critically endangered species, population or ecological community can be identified under the TSC Act and listed on the Register of Critical Habitat kept by the OEH. The study area does not contain declared 'critical habitat'.

Potentially relevant Key Threatening Processes also require consideration and assessment in the Assessment of Significance/7-part test. There are currently 37 key threatening processes listed under the TSC Act. None of the listed key threatening processes are relevant to the proposal.

5.2.2 Environmental Planning and Assessment Act 1979

The EP&A Act was enacted to encourage the proper consideration and management of impacts of proposed development or land-use changes on the environment (both natural and built) and the community. The Act is administered by the NSW Department of Planning and Environment.

Sections of the EP&A Act of primary relevance to the natural environment relate to threatened biota listed under the TSC Act and to protected species listed under the NP&W Act. No threatened biota is likely to be impacted and only minor impacts to protected fauna are likely to occur from the proposal.

5.2.2.1 Assessment of Significance (Section 5A)

Section 5A of the EP&A Act requires proponents and consent authorities to consider if a development will have a significant effect on threatened species, populations or communities listed under the TSC Act and FM Act. Section 5A (and Section 9A of the TSC Act) outlines seven factors that must be taken into account in an Assessment of Significance/7-part test. Where any Assessment of Significance determines that a development will result in a significant effect to a threatened species, population or community a Species Impact Statement (SIS) is required.

Of the 20 threatened flora species and 30 threatened fauna species listed under the TSC Act and previously recorded within the search area, six fauna species are considered to have some potential to occur within the study area.

Table 4, Table 5, Table 6 and Table 7 summarise the potential for the proposed development to have a significant effect on the threatened biota deemed to have a medium or greater likelihood of occurrence within the study area (refer to Section 3.3.1) and determines the need for an Assessment of Significance under Part 5A of the EP&A Act.

While there will be a minor loss of potential foraging habitat for the Grey-headed Flying-fox, Swift Parrot and Little Lorikeet, with the removal of six of the 19 Tallowwoods within the study area, this loss is expected to be negligible for any viable local population of any of these three species.

Table 4: Potential for impacts on threatened flora species listed on the TSC Act

Name	EPBC Act	TSC Act	FM Act	Habitat Values within study area	Adversely affect stages of the lifecycle of the species?	Loss or disturbance of limiting foraging or breeding resources?	Fragmentation of limiting habitat?	Impact Assessment Required?
None present	-	-	-	-	-	-	-	-

Table 5: Potential for impacts on threatened fauna species listed on the TSC Act

Name	EPBC Act	TSC Act	FM Act	Habitat Values within study area	Adversely affect stages of the lifecycle of the species?	Loss or disturbance of limiting foraging or breeding resources?	Fragmentation of limiting habitat?	Impact Assessment Required?
Grey-headed Flying-fox *Pteropus poliocephalus*	V	V	-	May forage on two large Spotted Gums/Tallowwoods during flowering period	No	No	No	No
Little Lorikeet *Glossopsitta pusilla*	-	V	-	May forage on two large Spotted Gums and 19 Tallowwoods during flowering period	No	No	No	No
Swift Parrot	EN	E1	-	May forage on the two large Spotted Gums	No	No	No	No

Name	EPBC Act	TSC Act	FM Act	Habitat Values within study area	Adversely affect stages of the lifecycle of the species?	Loss or disturbance of limiting foraging or breeding resources?	Fragmentation of limiting habitat?	Impact Assessment Required?
Greater Broad-nosed Bat	-	V	-	May roost within the old Station Master's Residence or adjacent large Pepper Tree (tree 10)	No	No	No	No
Eastern Bentwing-bat	-	V	-	May roost within the old Station Master's Residence or adjacent large Pepper Tree (tree 10)	No	No	No	No
Eastern/East Coast Freetail-bat	-	V	-	May roost within the old Station Master's Residence or adjacent large Pepper Tree (tree 10)	No	No	No	No

Table 6: Potential for impacts on threatened populations listed on the TSC Act

Name	EPBC Act	TSC Act	FM Act	Habitat Values within study area	Adversely affect stages of the lifecycle of the species?	Loss or disturbance of limiting foraging or breeding resources?	Fragmentation of limiting habitat?	Impact Assessment Required?
None present								

Table 7: Potential for impacts on threatened ecological communities listed on the TSC Act

Name	EPBC Act	TSC Act	FM Act	Habitat Values within study area	Adversely affect stages of the lifecycle of the species?	Loss or disturbance of limiting foraging or breeding resources?	Fragmentation of limiting habitat?	Impact Assessment Required?
None present								

Notes to tables 4-7:

EPBC Act:	TSC Act:
E - Endangered	E1 – Endangered (Part 1, Schedule 1)
V - Vulnerable	E4A – Critically Endangered (Part 4, Schedule 1a)
	V – Vulnerable (Part 1, Schedule 2)

5.2.3 National Parks & Wildlife Act 1974

Section 111 of the Environmental Planning & Assessment Act requires impacts on Protected Fauna species listed in Schedule 12 and Protected Flora species listed in Schedule 13 of the NP&W Act to be taken into consideration.

Native fauna species comprising mostly birds were observed within the study area and a range of other native fauna, such as skinks, are likely to occur within the study area at least on occasion. Since all native vertebrate fauna species in NSW are protected fauna, some minor loss of protected fauna such as small skinks, as a result of removal of trees could occur. This potential loss is negligible and no further action under this legislation is required.

5.2.4 Noxious Weeds Act 1993

The NW Act was enacted to provide for the identification, classification and control of noxious weeds. Plants declared as noxious weeds are currently listed under Weed Control Order No. 28 Declaring Certain Plants to be Noxious Weeds published in the New South Wales Government Gazette No. 97 (Department of Premier and Cabinet 2011).

No weed species, listed as noxious within the Hawkesbury River County Council Local Control Area, were identified within the study area, so no specific measures will be required for the proposal to manage noxious weeds in accordance with the NW Act.

5.2.5 State Environmental Planning Policies (Part 3 Division 2)

State Environmental Planning Policies (SEPPs) outline policy objectives relevant to state wide issues. Only one SEPP is potentially relevant to the study area, SEPP No. 44 Koala Habitat Protection, discussed below.

SEPP No. 44 Koala Habitat Protection

SEPP 44 applies to areas of native vegetation greater than one hectare and in local government areas listed in Schedule 1 to the SEPP. While 19 trees of one Koala feed tree species, Tallowwood, as listed under SEPP No. 44, occur within the study area, they are all planted trees outside their natural geographic distribution. Since the vegetated area within the study area is far less than one hectare, SEPP 44 does not apply to this proposal.

5.3 Transport for NSW Policies & Guidelines

5.3.1 Transport for NSW Vegetation Offset Guide 9TP-ST-149/2.0

Should removal of any trees within the study area be proposed as part of the proposal, the *Offsets for Individual trees or groups of trees* provisions of this Guide, will need to be addressed.

Within the study area, seven trees meeting the definition of medium tree in Table 5-2 in the Guide, are proposed for removal (tree 11 and trees 20-25).

One tree within the study area, meeting the definition of large tree in Table 5-2 in the Guide, is proposed for removal (tree 15).

A minimum of four locally indigenous trees will need to be planted in order to offset each medium tree to be removed and a minimum of eight locally indigenous trees will need to be planted in order to offset the large tree to be removed. This would require a minimum of 36 locally indigenous trees to be planted as an offset for the trees to be removed for this proposal.

The precise number of trees to be planted, appropriate species and suitable locations for tree planting cannot be determined until information on the final landscaping for the proposal is known.

5.3.2 Vegetation Management (Protection and Removal) Guideline 9TP-SD-111/2.0

Since construction works close to tree 16 and tree removal close to other trees within the study area are proposed, tree protection measures in accordance with this guideline will need to be adopted in these areas.

5.3.3 Weed Management and Disposal Guide 3TP-SD-110/2.0

There are five Hackberry trees within the study area. They are an environmental weed and, subject to expert identification, could potentially be a listed Noxious Weed species.

6. Implications and recommendations

This section identifies the potential implications of the proposal on the ecological values of the study area and includes recommendations to assist TfNSW to minimise impacts on biodiversity. Table 8 lists the ecological features within the study area, the implications of the proposal and recommended mitigation measures.

Table 8: Potential implications and recommendations to minimise ecological impacts

Ecological value	Implications of development	Recommendations
Native vegetation and other vegetation including trees	No native vegetation is present. No threatened flora species, population or ecological community is present.	No action required.
	The permanent removal of narrow strips and small patches of vegetation comprising planted garden areas in order to construct various new facilities.	Offset with new landscaping.
	Of the 8 trees to be removed, 6 are Jacaranda trees, one is a large Pine Tree and one is a Pepper Tree on the southern side of the rail corridor.	Offsets for 7 medium trees and one large tree, in accordance with TfNSW Vegetation Offsets Guide, will apply. Use of Spotted Gums in providing offsets is recommended to provide improved foraging habitat. It is recommended that the cultural or heritage value of the prominent large Pine Tree be determined, prior to any removal.
		Removal of the large Rubber Tree (Tree 16) is recommended, due to the potential for this large tree to cause future damage to buildings and paving, regardless of whether the proposal requires it to be trimmed.
Hollow-bearing trees and other fauna habitat	Old Station Master's Residence is vacant and may provide roosting habitat for threatened micro-bat species and protected fauna, but no changes to the cottage are part of this proposal.	No action required.

Ecological value	Implications of development	Recommendations
	The senescent Pepper Tree (tree 10) may provide roosting habitat for micro-bats. While it will not be removed or trimmed, it is potentially unstable and may need to be removed or lopped for safety reasons.	While it is not proposed for removal, it is recommended that a specialist arborist carry out an assessment of the stability of tree 10, due to its senescence, shape and potential for collapse. Prior to any removal or lopping of tree 10, nocturnal surveys are recommended to determine if threatened micro-bats are roosting within the tree.
Weeds	No Noxious weeds identified within the study area.	No action required.

7. Conclusions

The design of the proposed Penrith Station Upgrade has responded to the constraints identified in the Stage 1 Existing Environment Report and will have a very low impact on the flora and fauna values within the study area.

Only 8 trees will be removed and they comprise exotic planted trees. In accordance with the TfNSW Vegetation Offsets Guide, these trees will be offset by the establishment of a minimum of 36 locally indigenous trees.

Some trimming of a large Rubber Tree (Tree 16) is proposed. It is not expected that this trimming will adversely affect this tree. However, we do recommend that the potential for the typically invasive root system of this species to damage paving and buildings be investigated, and its potential removal should be considered.

References

DoE (2013). *Matters of National Environmental Significance. Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999*. Department of the Environment, Australian Government, Canberra.

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Keith, D. (2004). *Ocean Shores to desert dunes: the native vegetation of New South Wales and the ACT*. NSW Department of Environment & Conservation, Hurstville.

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NSW Scientific Committee (2009). *Final Determination to list Cumberland Plain Woodland in the Sydney Basin Bioregion as a Critically Endangered Ecological Community.* Department of Environment & Conservation (NSW).

Royal Botanic Gardens and Domain Trust (2014). PlantNET - The Plant Information Network System of The Royal Botanic Gardens and Domain Trust, Sydney, Australia http://plantnet.rbgsyd.nsw.gov.au.

TfNSW (2013) Vegetation Offset Guide 9TP-ST-149/2.0

TfNSW (2014). Transport Access Program, Services Brief: Ecological Impact Assessments for Croydon Station and Penrith Station Upgrades. Transport Projects Division, Chatswood.

TfNSW (2015a) Weed Management and Disposal Guide 3TP-SD-110/2.0

TfNSW (2015b) Vegetation Management (Protection and Removal) Guideline 9TP-SD-111/2.0

Appendices

Appendix 1: Flora Results

Notes to tables:

EPBC Act:	TSC Act:
E - Endangered	E1 – Endangered (Part 1, Schedule 1)
V - Vulnerable	V – Vulnerable (Part 1, Schedule 2)

Symbol	Noxious weed status:
N3	Regionally controlled weeds (Class 3)
N4	Locally controlled weeds (Class 4)
N5	Notifiable weeds (Class 5)
W	Weed of National Significance (WoNS)

A1.1 Threatened flora species

The following table includes a list of the threatened flora species that have potential to occur within the study area. The list of species is sourced from the BioNet Atlas of NSW Wildlife and the Protected Matters Search Tool (DoE; accessed on 3.11.14).

The habitat descriptions are compiled primarily from OEH Threatened Species Information:

http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/

with additional information from Harden (1990, 1992, 1993, 2002); PlantNet http://plantnet.rbgsyd.nsw.gov.au; OEH Atlas of NSW Wildlife, Final Determinations for listed species and other sources as cited.

Notes to table:

EPBC Act:	**TSC Act:**
E - Endangered	E1 – Endangered (Part 1, Schedule 1)
V - Vulnerable	V – Vulnerable (Part 1, Schedule 2)

Table 9: Threatened flora recorded or predicted to occur within five kilometres of the study area

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Acacia bynoeana	Bynoe's Wattle	VU	E1	#	negligible	No suitable habitat present	*Acacia bynoeana* is found in central eastern NSW, in the following catchment regions – Hawkesbury/Nepean, Hunter/Central Rivers, Southern Rivers, and Sydney Metropolitan. More specifically it is found from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains. It has recently been found in the Colymea and Parma Creek areas west of Nowra. It seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and recently burnt patches. It grows in sandy clay soils often containing ironstone gravels. Main vegetation types include heath or dry sclerophyll forest on sandy soils. Associated overstorey species include *Corymbia gummifera, Corymbia maculata, Eucalyptus parramattensis, Banksia serrata* and *Angophora bakeri*. Flowering period is mainly summer.

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Allocasuarina glareicola		EN	E1	#	negligible	No suitable habitat present	Found in the Hawkesbury/Nepean and Sydney Metropolitan Catchment Authority Regions. Primarily restricted to the Richmond (NW Cumberland Plain) district, but with an outlier population found at Voyager Point, Liverpool. Grows in Castlereagh woodland on lateritic soil. Also found in Dry Sclerophyll forest/Woodland. Associated species include *Eucalyptus parramattensis, Eucalyptus fibrosa, Angophora bakeri, Eucalyptus sclerophylla* and *Melaleuca decora*. Common associated understorey species include *Melaleuca nodosa, Hakea dactyloides, Hakea sericea, Dillwynia tenuifolia, Micromyrtus minutiflora, Acacia elongata, Acacia brownei, Themeda australis* and *Xanthorrhoea minor*.

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Asterolasia elegans		EN	E1	#	negligible	No suitable habitat present	Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby local government areas. Also likely to occur in the western part of Gosford LGA. Known from only six populations in the catchments of the Colo and Hawkesbury Rivers, only one of which is wholly within a conservation reserve. Found in sheltered forests on mid- to lower slopes and valleys which support sheltered forest on Hawkesbury Sandstone. The canopy at known sites includes *Syncarpia glomulifera, Angophora costata, Eucalyptus piperita, Allocasuarina torulosa* and *Ceratopetalum gummiferum*. The species is considered to be fire sensitive and reliant on seed germination after disturbance to maintain populations. A soil seedbank appears to be established by this species, so for a number of years following fire or other disturbance the species may not be apparent, but be present only as seed in the soil. The size of the seedbank depends not only on the amount of seed contributed by mature plants each season, but on the level of dormancy of the seed which can vary from year to year. The longevity of each crop of seed in the soil is perhaps 5 - 10 years.

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Cynanchum elegans	White-flowered Wax Plant	EN	E1	#	negligible	No suitable habitat present	Restricted to eastern NSW where it is distributed from Brunswick Heads on the north coast to Gerroa in the Illawarra region. The species has been recorded as far west as Merriwa in the upper Hunter River valley. Catchment Management Regions include Hawkesbury/Nepean, Hunter/Central Rivers, Northern Rivers, Southern Rivers and Sydney Metropolitan. *Cynanchum elegans* usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; *Leptospermum laevigatum, Banksia integrifolia subsp. integrifolia; Eucalyptus tereticornis* open forest and woodland; *Eucalyptus maculata* open forest and woodland; and *Melaleuca armillaris* scrub to open scrub. Flowering occurs between August and May, with a peak in November. Flower abundance on individual plants varies from sparse to prolific.
Genoplesium baueri	Bauer's Midge Orchid		V	#	negligible	No suitable habitat present	This terrestrial orchid species grows in open sclerophyll forest or moss gardens on sandstone. Typically the habitat is a drier heathy forest. The species has been recorded from locations between Nowra and Pit
Grevillea juniperina subsp. juniperina	Juniper-leaved Grevillea		V	2007	negligible	No suitable habitat present	Juniper-leaved Grevillea's distribution is centred on an area bounded by Blacktown, Erskine Park, Londonderry and Windsor with outlier populations at Kemps Creek and Pitt Town. It is found on clay soils in open forest on the Cumberland Plain {Robinson, 199

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Haloragis exalata subsp. exalata	Square Raspwort	VU	V	#	negligible	No suitable habitat present	Square Raspwort is known from a few scattered locations in south-eastern NSW including the Nepean River (near Sydney), Lake Illawarra, the Wallaga Lake - Tilba area and the Geehi Valley in Kosciuszko National Park. There are isolated records from northern NSW (Mt Kaputar National Park and Tuggolo State Forest). It also occurs in Victoria. Square Raspwort occurs in damp places near watercourses. It regenerates only from seed. The species appears to be favoured by soil disturbance.
Melaleuca deanei	Deane's Paperbark	VU	V	#	negligible	No suitable habitat present	Melaleuca deanei occurs in Catchment Management Regions Hawkesbury/Nepean, Southern Rivers, and Sydney Metropolitan. Distinctly it occurs in the Ku-ring-gai/Berowra and Holsworthy/Wedderburn areas. There are also more isolated occurrences at Springwood (in the Blue Mountains), Wollemi National Park, Yalwal (west of Nowra) and Central Coast (Hawkesbury River) areas. The species grows in wet heath on sandstone and Dry Sclerophyll Forests. Flowers appear in summer but seed production appears to be small and consequently the species exhibits a limited capacity to regenerate.

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Micromyrtus minutiflora		VU	E1	#	negligible	No suitable habitat present	Found on the Cumberland Plain within dry sclerophyll forest on old alluviums. Restricted to the general area between Richmond and Penrith, western Sydney. Grows in Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel Transition Forest, open forest on tertiary alluvium and consolidated river sediments. Sporadic flowering, June to March.
***Pelargonium sp. Striatellum* (G.W.Carr 10345)**	Omeo Stork's Bill	EN		#	negligible	No suitable habitat present	*Pelargonium sp. Striatellum* (G.W.Carr 10345) is a tufted perennial herb. It has a basal leaf rosette and leafy flowering stems which grow to 15cm tall, with fleshy and often extensively branched rhizomes giving rise to individual plants (ramets) in clonal colonies. The species is known to occur in habitat usually located just above the high water level of irregularly inundated or ephemeral lakes. During dry periods, the species is known to colonise exposed lake beds. *Pelargonium sp. Striatellum* (G.W.Carr 10345) occurs within the South Eastern Highlands and South East Corner IBRA Bioregions and the Hawkesbury-Nepean, Murrumbidgee, Southern Rivers and North East Natural Resource Management Regions.

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Persoonia nutans	Nodding Geebung	EN	E1	1966/#	negligible	No suitable habitat present	Occurs in Hawkesbury/Nepean and Sydney Metropolitan Catchment. Restricted to the Cumberland Plain between Richmond in the north and Macquarie Fields in the south. Core distribution occurs within the Penrith LGA, and to a lesser extent, Hawkesbury LGA. Small populations also occur in the Liverpool, Campbelltown, Bankstown and Blacktown LGAs. Confined to aeolian and alluvial sediments and occurs in a range of sclerophyll forest and woodland vegetation communities with the majority of individuals occurring within Agnes Banks Woodland or Castlereagh Scribbly Gum Woodlan. *P. nutans* also occurs on Shale/Gravel Transition Forest and Cooks River Castlereagh Ironbark Forest. In Castlereagh Scribbly Gum Woodlands it is found in open woodland with dominant overstorey species being *Angophora bakeri, Eucalyptus sclerophylla* and *Melaleuca decora*. The Agnes Banks Woodlands have a similar array of tree species, with the addition of *Banksia serrata* and *Banksia aemula*. *Persoonia nutans* is found on the Agnes Banks and Berkshire Park soil landscapes. Drainage appears to influence the distribution of *P. nutans* as the species is more common on the deeper sands at Agnes Banks. At other locations on the Cumberland Plain it occurs on low rises as opposed to swales or other low lying areas.

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Pimelea curviflora var. curviflora		VU	V	#	negligible	No suitable habitat present	Occurring in Hawkesbury/Nepean and Sydney Metropolitan Catchment Authority Areas. Confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. Occurs on lateritic soils and shale-sandstone transition soils on ridge tops in woodland. Associated with Dry Sclerophyll forests and Coastal valley grassy woodlands. Has an inconspicuous cryptic habit as it is fine and scraggly and often grows amongst dense grasses and sedges. It may not always be visible at a site as it appears to survive for some time without any foliage after fire or grazing, relying on energy reserves in its tuberous roots. Flowers October to May.

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Pimelea spicata	Spiked Rice-flower	EN	E1	2010/#	negligible	No suitable habitat present	Once widespread on the Cumberland Plain, *Pimelea spicata* occurs in two disjunct areas, the Cumberland Plain and the Illawarra. Catchment areas are Hawkesbury/Nepean, Southern Rivers, and Sydney Metropolitan Catchment. In western Sydney, *P. spicata* occurs on an undulating topography of substrates derived from Wianamatta Shale in areas supporting, or that previously supported, the Cumberland Plain Woodland Vegetation Community. Associated species include: *Eucalyptus moluccana, E. tereticornis, E.crebra, Bursaria spinosa*, and *Themeda australis*. *Pimelea spicata* flowers sporadically throughout the year, with flowering likely to depend upon climatic conditions, particularly rainfall. Flowering times recorded for *P. spicata* vary. Rye (1990) noted flowering period as May - January; Benson and McDougall (2001) noted peak flowering period as March/ April.

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Pomaderris brunnea	Brown Pomaderris	VU	V	#	negligible	No suitable habitat present	*Pomaderris brunnea* is found in a very limited area around the Nepean and Hawkesbury Rivers, including the Bargo area. Occurs in the Central West, Hawkesbury/Nepean, Hunter/Central Rivers Catchments. Occurs on clay & alluvial soils. In the Hawkesbury/Nepean region, the species is known to be associated with Dry sclerophyll forests (Cumberland, Upper Riverina, Sydney Coastal, Sydney Hinterland, Sydney Sand Flats), Coastal Floodplain Wetlands and Coastal Valley Grassy Woodlands. Flowers appear in September and October.

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Pterostylis gibbosa	Illawarra Greenhood	EN	E1	#	negligible	No suitable habitat present	Known from a small number of populations in the Hunter region, the Illawarra region and the Shoalhaven region. It is apparently extinct in western Sydney which is the area where it was first collected (1803). All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage. In the Illawarra region, the species grows in woodland dominated by *Eucalyptus tereticornis, E. longifolia* and *Melaleuca decora*. Near Nowra, the species grows in an open forest of *Corymbia maculata, E.tereticornis* and *E. paniculata*. In the Hunter region, the species grows in open woodland dominated by *E. crebra*, Forest Red Gum and *Callitris endlicherii*. The Illawarra Greenhood is a deciduous orchid that is only visible above the ground between late summer and spring and only when soil moisture levels can sustain its growth. The leaf rosette grows from an underground tuber in late summer, followed by the flower stem in winter. The Illawarra Greenhood can survive occasional burning and grazing because of its capacity to reshoot from an underground tuber.

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Pterostylis saxicola	Sydney Plains Greenhood	EN	E1	1835/#	negligible	No suitable habitat present	Restricted to western Sydney between Freemans Reach in the north and Picton in the south (Hawkesbury/Nepean and Sydney Metropolitan Catchment). Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where *Pterostylis saxicola* occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils. All species of *Pterostylis* are deciduous and die back to fleshy, rounded underground tuberoids. The time of emergence and withering has not been recorded for this species, however flowering occurs from October to December and may vary due to climatic conditions. The above ground parts of the plant whither and die following seed dispersal and the plant persists as a tuberoid until the next year.
Pultenaea glabra	Smooth Bush-Pea	VU	V	#	negligible	No suitable habitat present	Found in dry sclerophyll forest on sandstone in the higher Blue Mountains and Glen Davis area. Grows above south facing escarpments of the main plateau and sometimes in forest with an open canopy and moist soil. Flowers September to November, fruit matures October to December.

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Pultenaea parviflora		VU	E1	1998/#	negligible	No suitable habitat present	*Pultenaea parviflora* is endemic to the Cumberland Plain, with a core distribution from Windsor to Penrith and east to Dean Park. Outlier populations are recorded from Kemps Creek and Wilberforce. *P. parviflora* may be locally abundant, particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays and in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland. Often found in association with other threatened species such as *Dillwynia tenuifolia, Dodonaea falcata, Grevillea juniperina, Micromyrtus minutiflora, Persoonia nutans* and *Styphelia laeta*. Flowering may occur between August and November depending on environmental conditions.
Streblus pendulinus	Whalebone Tree	EN		#	negligible	No suitable habitat present	The species is found in warmer rainforests, chiefly along watercourses. The altitudinal range is from near sea level to 800m above sea level. The species grows in well developed rainforest, gallery forest and drier, more seasonal rainforest).

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Thesium australe	Austral Toadflax	VU	V	#	negligible	No suitable habitat present	Found in very small to large populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. *Thesium australe* is a root parasite that takes water and some nutrient from other plants, especially Kangaroo Grass. It is often found in damp sites in association with *Themeda australis*, but also found on other grass species at inland sites. Occurs on clay soils in grassy woodlands or coastal headlands.

Table 10: Threatened Ecological Communities recorded or predicted to occur within five kilometres of the study area

Threatened Ecological Community Name	TSC Act	EPBC Act
Agnes Banks Woodland in the Sydney Basin Bioregion	E3	
Blue Gum High Forest in the Sydney Basin Bioregion	E4B	CE
Blue Mountains Shale Cap Forest in the Sydney Basin Bioregion	E3	CE
Blue Mountains Swamps in the Sydney Basin Bioregion	V2	E
Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion	V2	
Castlereagh Swamp Woodland Community	E3	
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	E3	
Cumberland Plain Woodland in the Sydney Basin Bioregion	E4B	CE
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	
Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions	E3	E
Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion	E3	E
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	
Shale gravel Transition Forest in the Sydney Basin Bioregion	E3	CE
Shale/Sandstone Transition Forest	E3	E
Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion	E3	
Sun Valley Cabbage Gum Forest in the Sydney Basin Bioregion	E4B	
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	
Western Sydney Dry Rainforest in the Sydney Basin Bioregion	E3	CE

Threatened Ecological Community Name	TSC Act	EPBC Act
White Box Yellow Box Blakely's Red Gum Woodland	E3	CE

Appendix 2: Fauna Results

Below is a list of significant fauna species recorded or predicted to occur within five kilometres of the study area.

Notes to tables:

EPBC Act:	**TSC Act:**
EX - Extinct	C1 – Critically endangered
CR - Critically endangered	E1 – Endangered (Part 1, Schedule 1)
EN - Endangered	E2 – Endangered (Part 2, Schedule 1)
VU - Vulnerable	E4 – Presumed extinct (Part 4, Schedule 1)
CD - Conservation dependent	V1 – Vulnerable (Part 1, Schedule 2)

* - introduced species

Fauna species in these tables are listed in alphabetical order within their taxonomic group.

A2.1 Threatened fauna species

The following table includes a list of the significant fauna species that have potential to occur within the study area. The list of species is sourced from the Atlas of NSW Wildlife, and the Protected Matters Search Tool (DoE; accessed on 3.11.2014).

The most recent record relates to:

#	species predicted to occur by the DoE database (not recorded on other databases)
##	species predicted to occur based on natural distributional range and suitable habitat despite lack of records in the databases searched
Year	recorded on databases listed above

The following references have been consulted to compile the habitat descriptions above: Australian Museum Fact Sheets; Barrett et al. 2003; Churchill, 1998; Clayton et al., 2006; Cogger, 1995; OEH Threatened Species Profiles; Morcombe, 2000; Strahan, 1995.

Table 11: Threatened birds recorded or predicted to occur within five kilometres of the study area

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Botaurus poiciloptilus	Australasian Bittern	EN	E1	2013/#	negligible	No suitable habitat present	The Australasian Bittern is distributed across south-eastern Australia. Often found in terrestrial and estuarine wetlands, generally where there is permanent water with tall, dense vegetation including *Typha spp*. and *Eleoacharis spp*. Typically this bird forages at night on frogs, fish and invertebrates, and remains inconspicuous during the day. The breeding season extends from October to January with nests being built amongst dense vegetation on a flattened platform of reeds.

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Calyptorhynchus lathami	Glossy Black-Cockatoo		V	2001	negligible	No suitable habitat present	Inhabits forest with low nutrients, characteristically with key *Allocasuarina* species. Tends to prefer drier forest types. Often confined to remnant patches in hills and gullies. Breed in hollows stumps or limbs, either living or dead.
Chthonicola sagittata	Speckled Warbler		V	2010	negligible	No suitable habitat present	This species occurs in eucalypt and cypress woodlands on the hills and tablelands of the Great Dividing Range. They prefer woodlands with a grassy understorey, often on ridges or gullies. The species is sedentary, living in pairs or trios and nests on the ground in grass tussocks, dense litter and fallen branches. They forage on the ground and in the understorey for arthropods and seeds. Home ranges vary from 6-12 hectares.
Circus assimilis	Spotted Harrier		V	2013	low	No suitable habitat present	The Spotted Harrier is found throughout Australia but rarely in densely forested and wooded habitat of the escarpment and coast. Preferred habitat consists of open and wooded country with grassland nearby for hunting. Habitat types include open grasslands, acacia and mallee remnants, spinifex, open shrublands, saltbush, very open woodlands, crops and similar low vegetation. The Spotted Harrier is more common in drier inland areas, nomadic part migratory and dispersive, with movements linked to the abundance of prey species. Nesting occurs in open or remnant woodland and unlike other harriers, the Spotted Harrier nests in trees.

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Daphoenositta chrysoptera	Varied Sittella		V	2011	low	Marginal habitat provided by large Spotted Gums on northern side of rail corridor.	The Varied Sittella is a sedentary species which inhabits a wide variety of dry eucalypt forests and woodlands, usually with either shrubby understorey or grassy ground cover or both, in all climatic zones of Australia. Usually inhabit areas with rough-barked trees, such as stringybarks or ironbarks, but also in mallee and acacia woodlands, paperbarks or mature Eucalypts. The Varied Sittella feeds on arthropods gleaned from bark, small branches and twigs. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.
Glossopsitta pusilla	Little Lorikeet		V	2012	moderate	A small amount of potential foraging habitat provided by large Spotted Gums on northern side of rail corridor and Tallowwoods mostly located on southern side.	Distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range in NSW, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Mostly occur in dry, open eucalypt forests and woodlands. They feed primarily on nectar and pollen in the tree canopy. Nest hollows are located at heights of between 2m and 15m, mostly in living, smooth-barked eucalypts. Most breeding records come from the western slopes.
Hieraaetus morphnoides	Little Eagle		V	2013	low	Habitat unsuitable	The Little Eagle is most abundant in lightly timbered areas with open areas nearby providing an abundance of prey species. It has often been recorded foraging in grasslands, crops, treeless dune fields, and recently logged areas. The Little Eagle nests in tall living trees within farmland, woodland and forests.

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Ixobrychus flavicollis	Black Bittern		V	2004	negligible	Habitat unsuitable	The Black Bittern is found along the coastal plains within NSW, although individuals have rarely being recorded south of Sydney or inland. It inhabits terrestrial and estuarine wetlands such as flooded grasslands, forests, woodlands, rainforests and mangroves with permanent water and dense waterside vegetation. The Black Bittern typically roosts on the ground or in trees during the day and forages at night on frogs, reptiles, fish and invertebrates. The breeding season extends from December to March. Nests are constructed of reeds and sticks in branches overhanging the water.
Lathamus discolor	Swift Parrot	EN	E1	2012/#	moderate	Small amount of potential foraging habitat provided by large Spotted Gums on northern side of rail corridor.	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects. The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E. pilularis*. This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability.

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Lophoictinia isura	Square-tailed Kite		V	2012	low	No suitable habitat present	Typically inhabits coastal forested and wooded lands of tropical and temperate Australia. In NSW it is often associated with ridge and gully forests dominated by *Eucalyptus longifolia*, *Corymbia maculata, E. elata*, or *E. smithii*. Individuals appear to occupy large hunting ranges of more than 100km^2. They require large living trees for breeding, particularly near water with surrounding woodland /forest close by for foraging habitat. Nest sites are generally located along or near watercourses, in a tree fork or on large horizontal limbs.
Ninox strenua	Powerful Owl		V	2009	negligible	No suitable habitat present	The Powerful Owl occupies wet and dry eucalypt forests and rainforests. It may inhabit both un-logged and lightly logged forests as well as undisturbed forests where it usually roosts on the limbs of dense trees in gully areas. Large mature trees with hollows at least 0.5m deep are required for nesting. Tree hollows are particularly important for the Powerful Owl because a large proportion of the diet is made up of hollow-dependent arboreal marsupials. Nest trees for this species are usually emergent with a diameter at breast height of at least 100cm. It has a large home range of between 450 and 1450 ha.

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Petroica boodang	Scarlet Robin		V	2012	low	No suitable habitat present	During the breeding season the Scarlet Robin is found in eucalypt forests and temperate woodlands, often on ridges and slopes. During autumn and winter it moves to more open and cleared areas. It has dispersive or locally migratory seasonal movements. The Scarlet Robin forages amongst logs and woody debris for insects which make up the majority of its diet. The nest is an open cup of plant fibres and cobwebs, sited in the fork of a tree (often a dead branch in a live tree, or in a dead tree or shrub) which is usually more than 2m above the ground. It is conspicuous in open and suburban habitats.
Ptilinopus superbus	Superb Fruit-Dove		V	2002	low	No suitable habitat present	The Superb Fruit Dove's NSW distribution ranges from northern NSW to as far south as Moruya. It is found in rainforests, closed forests (including mesophyll vine forests) and sometimes in eucalypt and acacia woodlands where there are fruit-bearing trees. It forages in the canopy of fruiting trees such as figs and palms. Nests are constructed high in the canopy throughout September to January.
Stictonetta naevosa	Freckled Duck		V	2013	low	No suitable habitat present	The Freckled Duck breeds in permanent fresh swamps that are heavily vegetated. Found in fresh or salty permanent open lakes, especially during drought. Often seen in groups on fallen trees and sand spits.

Table 12: Threatened mammals recorded or predicted to occur within five kilometres of the study area

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Chalinolobus dwyeri	Large-eared Pied Bat	VU	V	#	low	No suitable habitat present	Occurs from the Queensland border to Ulladulla, with largest numbers from the sandstone escarpment country in the Sydney Basin and Hunter Valley. Primarily found in dry sclerophyll forests and woodlands, but also found in rainforest fringes and subalpine woodlands. Forages on small, flying insects below the forest canopy. Roosts in colonies of between three and 80 in caves, Fairy Martin nests and mines, and beneath rock overhangs, but usually less than 10 individuals. Likely that it hibernates during the cooler months. The only known existing maternity roost is in a sandstone cave near Coonabarabran.

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Dasyurus maculatus	Spotted-tailed Quoll	EN	V	2006/#	negligible	No suitable habitat present	Occurs along the east coast of Australia and the Great Dividing Range. Uses a range of habitats including sclerophyll forests and woodlands, coastal heathlands and rainforests. Occasional sightings have been made in open country, grazing lands, rocky outcrops and other treeless areas. Habitat requirements include suitable den sites, including hollow logs, rock crevices and caves, an abundance of food and an area of intact vegetation in which to forage. Seventy per cent of the diet is medium-sized mammals, and also feeds on invertebrates, reptiles and birds. Individuals require large areas of relatively intact vegetation through which to forage. The home range of a female is between 180 and 1000 ha, while males have larger home ranges of between 2000 and 5000 ha. Breeding occurs from May to August.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat		V	2009	moderate	Potential roosting habitat present within the old Station Master's Residence.	Occurs from Victoria to Queensland, on both sides of the Great Dividing Range. Forms large maternity roosts (up to 100,000 individuals) in caves and mines in spring and summer. Individuals may fly several hundred km to their wintering sites, where they roost in caves, culverts, buildings, and bridges. They occur in a broad range of habitats including rainforest, wet and dry sclerophyll forest, paperbark forest and open grasslands. Has a fast, direct flight and forages for flying insects (particularly moths) above the tree canopy and along waterways.

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Mormopterus norfolkensis	Eastern Freetail-bat		V	2008	moderate	Potential roosting habitat present within the old Station Master's Residence and the large adjacent Pepper Tree	Distribution extends east of the Great Dividing Range from southern Queensland to south of Sydney. Most records are from dry eucalypt forests and woodland. Individuals tend to forage in natural and artificial openings in forests, although it has also been caught foraging low over a rocky river within rainforest and wet sclerophyll forest habitats. The species generally roosts in hollow spouts of large mature eucalypts (including paddock trees), although individuals have been recorded roosting in the roof of a hut, in wall cavities, and under metal caps of telegraph poles. Foraging generally occurs within a few km of roosting sites.
Myotis macropus	Southern Myotis		V	2005	low	No suitable habitat present	Scattered, mainly coastal distribution extending to South Australia along the Murray River. Roosts in caves, mines or tunnels, under bridges, in buildings, tree hollows, and even in dense foliage. Colonies occur close to water bodies, ranging from rainforest streams to large lakes and reservoirs. They catch aquatic insects and small fish with their large hind claws, and also catch flying insects.

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Petrogale penicillata	Brush-tailed Rock-wallaby	VU	E1	#	negligible	No suitable habitat present	Occurs along the Great Dividing Range south to the Shoalhaven, and also occurs in the Warrumbungles and Mt Kaputar. Habitats range from rainforest to open woodland. It is found in areas with numerous ledges, caves and crevices, particularly where these have a northerly aspect. Individuals defend a specific rock shelter, emerging in the evening to forage on grasses and forbs, as well as browse in drier months. Home sizes range from 2-30 ha.
Phascolarctos cinereus	Koala	VU	V	#	negligible	No suitable habitat present. While Tallowwoods are a feed tree species they are all planted trees within an urban area	Pittwater LGA and Hawks nest: In NSW the Koala mainly occurs on the central and north coasts with some populations in the western region. Koalas feed almost exclusively on eucalypt foliage, and their preferences vary regionally. Primary feed trees include *Eucalyptus robusta, E. tereticornis, E. punctata, E. haemastoma* and *E. signata*. They are solitary with varying home ranges. In high quality habitat home ranges may be 1-2 ha and overlap, while in semi-arid country they are usually discrete and around 100 ha.

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Pseudomys novaehollandiae	New Holland Mouse	VU		#	low	No suitable habitat present	The New Holland Mouse currently has a disjunct, fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Across the species' range the New Holland Mouse is known to inhabit open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes. The home range of the New Holland Mouse can range from 0.44 ha to 1.4 ha. The New Holland Mouse is a social animal, living predominantly in burrows shared with other individuals. The species is nocturnal and omnivorous, feeding on seeds, insects, leaves, flowers and fungi, and is therefore likely to play an important role in seed dispersal and fungal spore dispersal. It is likely that the species spends considerable time foraging above-ground for food, predisposing it to predation by native predators and introduced species. Breeding typically occurs between August and January, but can extend into autumn.
Pteropus poliocephalus	Grey-headed Flying-fox	VU	V	2012/#	moderate	Potential foraging habitat provided by large Spotted Gums on northern side of rail corridor and Tallowwoods mostly located on the southern side.	Occurs along the NSW coast, extending further inland in the north. This species is a canopy-feeding frugivore and nectivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Roosts in large colonies (camps), commonly in dense riparian vegetation. Bats commute daily to foraging areas, usually within 15km of the day roost although some individuals may travel up to 70km.

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Scoteanax rueppellii	Greater Broad-nosed Bat		V	2008	moderate	Potential roosting habitat present within the old Station Master's Residence and adjacent large Pepper Tree.	Occurs along the Great Dividing Range, generally at 500m but up to 1200m, and in coastal areas. Occurs in woodland and rainforest, but prefers open habitats or natural or human-made openings in wetter forests. Often hunts along creeks or river corridors. Flies slowly and directly at a height of 30m or so to catch beetles and other large, flying insects. Also known to eat other bats and spiders. Roosts in hollow tree trunks and branches.

Table 13: Threatened reptiles recorded or predicted to occur within five kilometres of the study area

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Hoplocephalus bungaroides	Broad-headed Snake	VU	E1	#	negligible	No suitable habitat present	Mainly occurs in association with communities occurring on Triassic sandstone within the Sydney Basin. Typically found among exposed sandstone outcrops with vegetation types ranging from woodland to heath. Within these habitats they generally use rock crevices and exfoliating rock during the cooler months and tree hollows during summer.

Table 14: Threatened amphibians recorded or predicted to occur within five kilometres of the study area

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Heleioporus australiacus	Giant Burrowing Frog	VU	V	#	negligible	No suitable habitat present	Prefers hanging swamps on sandstone shelves adjacent to perennial non-flooding creeks. Can also occur within shale outcrops within sandstone formations. Known from wet and dry forests and montane woodland in the southern part range. Individuals can be found around sandy creek banks or foraging along ridge-tops during or directly after heavy rain. Males often call from burrows located in sandy banks next to water. Spends the majority of its time in non-breeding habitat 20-250m from breeding sites.

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Litoria aurea	Green and Golden Bell Frog	VU	E1	1960/#	negligible	No suitable habitat present	Most existing locations for the species occur as small, coastal, or near coastal populations, with records occurring between south of Grafton and northern VIC. The species is found in marshes, dams and stream sides, particularly those containing bullrushes or spikerushes. Preferred habitat contains water bodies that are unshaded, are free of predatory fish, have a grassy area nearby and have diurnal sheltering sites nearby such as vegetation or rocks , although the species has also been recorded from highly disturbed areas including disused industrial sites, brick pits, landfill areas and cleared land. Breeding usually occurs in summer. Tadpoles, which take around 10-12 weeks to develop , feed on algae and other vegetative matter. Adults eat insects as well as other frogs, including juveniles of their own species.

Table 15: Threatened fish recorded or predicted to occur within five kilometres of the study area

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Macquaria australasica	Macquarie perch	EN		#	negligible	No suitable habitat present	Macquarie Perch are found in the Murray-Darling Basin (particularly upstream reaches) of the Lachlan, Murrumbidgee and Murray rivers, and parts of south-eastern coastal NSW, including the Hawkesbury and Shoalhaven catchments. Macquarie perch are found in both river and lake habitats, especially the upper reaches of rivers and their tributaries
Prototroctes maraena	Australian Grayling	VU		#	negligible	No suitable habitat present	The Australian Grayling occurs in streams and rivers on the eastern and southern flanks of the Great Dividing Range from Sydney southwards to the Otway Ranges in Victoria, and Tasmania. Australian grayling do not occur in the inland Murray–Darling Basin system. Grayling is a diadromous species; migrating between freshwater streams and the ocean. This species has been found in clear, gravel-bottomed streams with alternating pools and riffles, and granite outcrops, and also in muddy-bottomed, heavily silted habitats.

Table 16: Threatened molluscs recorded or predicted to occur within five kilometres of the study area

Scientific Name	Common Name	EPBC Act	TSC Act	Most Recent Record	Likelihood of Occurrence	Rationale for Likelihood	Habitat Description
Meridolum corneovirens	Cumberland Plain Land Snail		E1	2014	Low	No suitable habitat present	Most likely restricted to Cumberland Plain, Castlereagh Woodlands and boundaries between River-flat Forest and Cumberland Plain Woodland. It is normally found beneath logs, debris and amongst accumulated leaf and bark particularly at the base of trees. May also use soil cracks for refuge.

A2.2 Migratory species (EPBC Act listed)

Includes records from the following sources:

- BioNet Atlas of NSW Wildlife (refer to Section 2.1).
- DoE Protected Matters Search (accessed on 3.11.2014 - Appendix 4).

Table 17: Migratory bird species recorded or predicted to occur within five kilometres of the study area

Scientific Name	Common Name	Most Recent Record
Actitis hypoleucos	Common Sandpiper	1981
Anthochaera phrygia	Regent Honeyeater	#
Ardea ibis	Cattle Egret	2009
Ardea modesta	Eastern Great Egret	2013
Calidris acuminata	Sharp-tailed Sandpiper	2012
Calidris ferruginea	Curlew Sandpiper	2010
Calidris ruficollis	Red-necked Stint	2010
Gallinago hardwickii	Latham's Snipe	2013
Haliaeetus leucogaster	White-bellied Sea-Eagle	2013
Hirundapus caudacutus	White-throated Needletail	2013
Merops ornatus	Rainbow Bee-eater	2013
Myiagra cyanoleuca	Satin Flycatcher	1998
Pandion cristatus	Osprey	2013
Plegadis falcinellus	Glossy Ibis	2013
Pluvialis fulva	Pacific Golden Plover	2010
Rhipidura rufifrons	Rufous Fantail	2010
Rostratula australis	Australian Painted Snipe	#
Tringa glareola	Wood Sandpiper	2010
Tringa stagnatilis	Marsh Sandpiper	2010

# denotes species predicted to occur by the DoE database (not recorded on other databases)

Appendix 3: Tree Schedule

Table 18: Tree Schedule for the Penrith Station Upgrade study area

Tree no.	Common name	Scientific name	Approx. height (m)	DBH (cm)	Tree Protection zone (TPZ) radius from centre of trunk (m)	Structural root zone (SRZ) radius from centre of trunk (m)	Significance Rating	SULE	Impact of the Proposal	Tree Type	Comments
1-3	Tallowwood (x3)	*Eucalyptus microcorys*	14	30	3.6	2.25	Low-Medium	2	Nil	Medium	Non-local native species planted near lockers
4	Hackberry	*Celtis sp.*	4	15	2	1.5	Low	2	Nil	Small	Inaccessible exotic naturalized small tree, planted or self sown
5-6	Pepper Tree (x2)	*Schinus areira*	10	40	4.8	2.5	Low-Medium	2	Nil	Medium	Exotic planted trees
7	Hackberry	*Celtis sp.*	6	15	2	1.5	Low	2	Nil	Medium	Exotic naturalized tree, planted or self sown
8	Black Cypress	*Callitris endlicheri*	12	20 x 2	2.4	2	Medium	2	Nil	Medium	Native species, probably planted
9	Hackberry	*Celtis sp.*	12	30	3.6	2.25	Low	2	Nil	Medium	Exotic naturalized tree, planted or self sown

Tree no.	Common name	Scientific name	Approx. height (m)	DBH (cm)	Tree Protection zone (TPZ) radius from centre of trunk (m)	Structural root zone (SRZ) radius from centre of trunk (m)	Significance Rating	SULE	Impact of the Proposal	Tree Type	Comments
10	Pepper Tree	*Schinus areira*	12	50 x 2	6	2.75	Medium	Potentially Unstable	Nil	Medium	Exotic planted tree. Senescent and at risk of collapse.
11	Pepper Tree	*Schinus areira*	12	40	4.8	2.5	Medium	2	Removal	Medium	Exotic planted tree
12	Hackberry	*Celtis sp.*	8	20	2.4	2	Low	2	Nil	Medium	Exotic naturalized tree, planted or self sown.
13	Cockspur Coral Tree	*Erythrina crista-galli*	4	15	2	1.5	Low	3	Nil	Small	Rampant environmental weed. Should be shaped or removed.
14	Jacaranda	*Jacaranda mimosifolia*	6	15	2	1.5	Low-Medium	2	Nil	Small	Exotic naturalized tree, planted or self sown.
15	Pine Tree	*Pinus sp.*	20	60	7.2	3	Medium	2	Removal	Large	Exotic large planted tree. Prominent in the area.
16	Rubber Tree	*Ficus elastica*	14	>100	12	4	Low	1	Trimming	Large	Large exotic multi-trunk tree with potentially destructive root system.
17-19	Cypress Tree (x3)	*Cupressus sp.*	10	30	3.6	2.25	Low	3	Nil	Medium	Planted trees overgrown with vines

Tree no.	Common name	Scientific name	Approx. height (m)	DBH (cm)	Tree Protection zone (TPZ) radius from centre of trunk (m)	Structural root zone (SRZ) radius from centre of trunk (m)	Significance Rating	SULE	Impact of the Proposal	Tree Type	Comments
20-23	Jacaranda (x4)	*Jacaranda mimosifolia*	8	20	2.4	2	Low-Medium	2	Removal (all)	Medium	Exotic naturalized tree, planted
24-26	Jacaranda (x3)	*Jacaranda mimosifolia*	5	30	3.6	2.25	Low-Medium	2	Removal (24 & 25 only)	Medium	Exotic naturalized tree, planted
27-37	Tallowwood (x11)	*Eucalyptus microcorys*	10	30	3.6	2.25	Low-Medium	2	Nil	Medium	Non-local native species planted in a row
38-40	Tallowwood (x3)	*Eucalyptus microcorys*	12	30	3.6	2.25	Low-Medium	2	Nil	Medium	Non-local native species planted around car park
41	Jacaranda	*Jacaranda mimosifolia*	10	30	3.6	2.25	Low-Medium	2	Nil	Medium	Exotic naturalized tree, planted
42	Red Tips	*Photinia sp.*	4	15	2	1.5	Low	3	Nil	Small	Garden plant
43	Hackberry	*Celtis sp.*	10	30	3.6	2.25	Low	2	Nil	Medium	Exotic naturalized tree, planted or self sown.
44	Tallowwood	*Eucalyptus microcorys*	12	30	3.6	2.25	Medium	2	Nil	Medium	Non-local native species planted
45-46	Spotted Gum (x2)	*Corymbia maculata*	20	50	6	2.75	High	1	Nil	Medium	Remnant local native species

Tree no.	Common name	Scientific name	Approx. height (m)	DBH (cm)	Tree Protection zone (TPZ) radius from centre of trunk (m)	Structural root zone (SRZ) radius from centre of trunk (m)	Significance Rating	SULE	Impact of the Proposal	Tree Type	Comments
47	Tallowwood	*Eucalyptus microcorys*	3	30	3.6	2.25	Low	3	Nil	Medium	Non-local native species planted

Notes:
Tree is defined as: *a long lived woody perennial plant greater than (or usually greater than) 3 metres in height with one or relatively few main stems or trunks* (AS 4970 – 2009 - Protection of trees on development sites)
TPZ and **SRZ** as defined in AS 4970 – 2009 - Protection of trees on development sites (TPZ includes both Critical Root Zone and Structural Root Zone)
Landscape Significance
The assessment of the landscape significance of a tree is an inherently subjective process.
The landscape significance process adopted in this report takes into account the following factors:
• Whether the tree is in sound condition
• Whether the tree has a SULE of greater than 15 years
• Whether the tree is well developed and typically formed for its species
• Whether the tree is one of the larger and more aesthetically valuable in the locality
• Whether the removal of the tree will transform the landscape
• Whether the removal of the tree will diminish historical or cultural values
A tree may be identified as one of three categories of landscape significance: high, medium or low.
SULE Category Description
1 Long, life span greater than 40 years
2 Medium, life span from 15 to 40 years
3 Short, life span from 5 to 15 years
4 Remove, should be removed within 5 years

5 Small, Young or regularly pruned, trees that can be readily moved or replaced
Unstable, Showing imminent signs of structural failure, unstable in the ground, significant trunk damage rendering the tree structurally hazardous

Tree Type based on TfNSW Vegetation Offset Guide 9TP-ST-149/2.0

Appendix 4: Plates

SOUTHERN SIDE OF RAIL CORRIDOR

Plate 1: Row of planted Tallowwood trees south-east corner of study area (trees 1-3)

Plate 2: Pepper Trees (trees 5 and 6) and Hackberry (tree 7) behind fence along rail corridor in south-east corner of study area

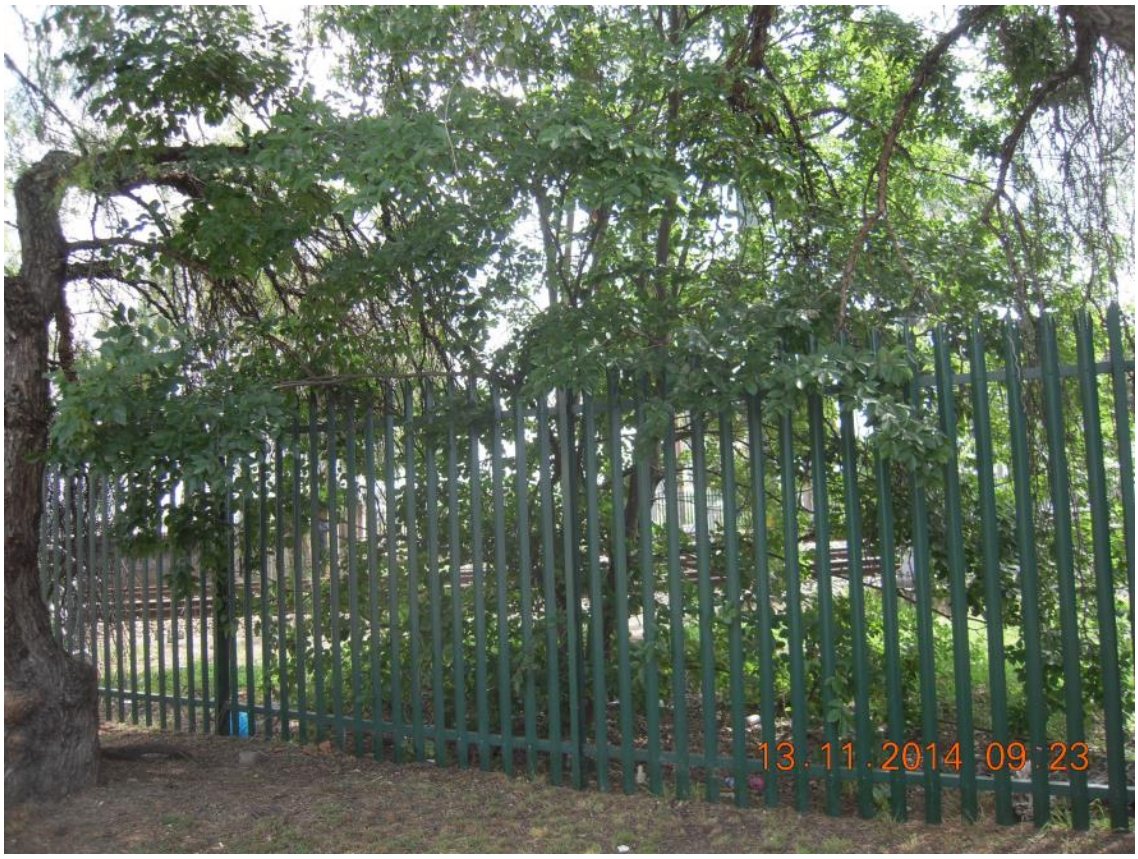

Plate 3: Hackberry (tree 7) inside rail corridor fence

Plate 4: Trees (trees 8, 9, 10 and 11) to the east of the old Station Master's Residence

Plate 5: Base of very large Pepper Tree (tree 10) east of the old Station Master's Residence

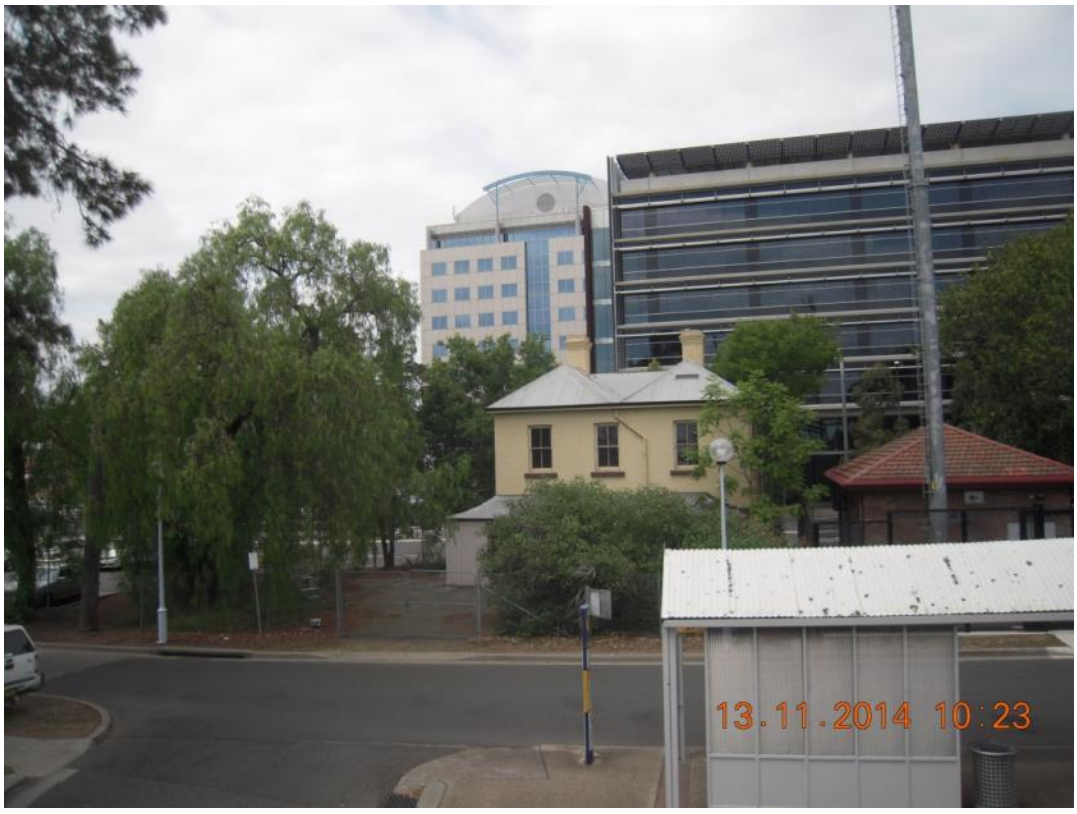

Plate 6: Looking south to old Station Master's Residence showing tree 12 between buildings and trees 13 and 14 in front of cottage

Plate 7 Large Pine Tree (tree 15) located to the north of the old Station Master's Residence

Plate 8: Large Pine Tree (tree 15) and south side steps from existing concourse

Plate 9: Large Rubber Tree (tree 16) west of the old Station Master's Residence

Plate 10: Overgrown Cypress Trees (trees 18 and 19) west of the old Station Master's Residence

Plate 11: Jacarandas (trees 20 and 21) west of the old Station Master's Residence

Plate 12: Jacaranda (tree 26) and the eastern end of row of 11 Tallowwoods along Belmore Road

Plate 13: Jacaranda (tree 41) and Red Tips (tree 42) adjacent to the south side bus shelter

Plate 14: Hackberry tree (tree 43) and Murraya hedge inside rail corridor south-west of platform