

# Chapter 11

## Biodiversity

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## 11 Biodiversity

**This chapter provides an assessment of the potential impacts of the project on biodiversity and identifies mitigation measures to minimise impacts. This chapter is based on the Biodiversity Development Assessment Report provided in Technical Paper 3 (Biodiversity Development Assessment Report).**

### 11.1 Overview

The project has been designed to avoid biodiversity impacts where possible, by providing bridges and viaducts over key riparian and vegetated areas and ensuring these structures are designed to maintain fauna connectivity. Mitigation measures have also been proposed to minimise or avoid potential biodiversity impacts which have not been avoided through design.

Residual biodiversity impacts would be offset in accordance with the NSW Biodiversity Assessment Method (BAM). Up to 942 ecosystem credits and 3,016 species credits may be required to offset impacts to threatened fauna, flora and ecological communities.

The key biodiversity impacts include:

- potential impact upon around 33 hectares of native vegetation off-airport and 27 hectares of native vegetation on-airport outside the Western Sydney International Stage 1 Construction Impact Zone
- clearing of threatened ecological communities, including Cumberland Plain Woodland
- removal of threatened species and/or their habitat or potential indirect impacts from noise, dust or light spill
- potential impacts on groundwater dependent ecosystems resulting from changes to groundwater level or flow during construction and operation.

Opportunities to minimise these impacts would be investigated further during design development.

### 11.2 Legislative and policy context

#### 11.2.1 Off-airport

The Commonwealth and NSW legislation applicable to the assessment of biodiversity impacts relating to the off-airport areas of the project includes:

- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act)
- *Biodiversity Conservation Act 2016* (NSW) (BC Act)
- *Fisheries Management Act 1994* (NSW) (FM Act)
- *Biosecurity Act 2015* (NSW).

The Commonwealth Minister for the Environment advised that environmental impacts of the off-airport components of the project on Commonwealth land would be assessed based on the provision of preliminary documentation. The assessment is provided in Appendix K (EPBC Act Draft Impact Assessment of off-airport proposed action (EPBC 2020/8687)).

#### 11.2.2 On-airport

The Commonwealth Minister for the Environment advised that the on-airport components of the project would be assessed based on the provision of preliminary documentation. The assessment is provided in Appendix J (EPBC Act Draft Environmental Impact Assessment of on-airport proposed action (EPBC 2019/8541)). To address the information requirements, potential biodiversity impacts of the project on-airport (but outside the Western Sydney International Stage 1 Construction Impact Zone) have been assessed under the BAM.

Further detail on the biodiversity legislative context for the project is provided in Chapter 2 of Technical Paper 3 (Biodiversity Development Assessment Report).

### 11.3 Assessment approach

The approach for the biodiversity assessment applies to both off-airport and on-airport sections of the study area. Further detail regarding the assessment approach and methodology, and key considerations of the biodiversity assessment, is provided in Chapter 3 of Technical Paper 3 (Biodiversity Development Assessment Report).

#### 11.3.1 Study area and assumptions

The study area for the biodiversity assessment comprises:

- the construction footprint (excluding within the Western Sydney International Stage 1 Construction Impact Zone and south of Western Sydney International, as this area is covered by the South West Growth Centre Strategic Assessment, refer to Section 4.1) (see Figure 11-1)
- any areas identified for potential surface indirect impacts
- areas that may be subject to potential groundwater drawdown (e.g. Orchard Hills).

#### Consideration of biodiversity values in areas of restricted access

The biodiversity assessment has adopted conservative assumptions for the presence of flora and fauna and has partially relied upon baseline information from the *Draft Cumberland Plain Conservation Plan* (Department of Planning, Industry and Environment, 2020b) to inform the assessment. Additional biodiversity field surveys would be carried out after exhibition of this Environmental Impact Statement and an updated Biodiversity Development Assessment Report would be prepared as part of the Submissions Report process.

#### Western Sydney International Stage 1 development – on-airport assumptions

The *Western Sydney Airport – Airport Plan* (Airport Plan) (Department of Infrastructure and Regional Development, 2016a) provides authorisation for the clearing of biodiversity values within the Western Sydney International Stage 1 Construction Impact Zone, and therefore impacts on biodiversity within this footprint are not considered further for the project.

#### 11.3.2 Desktop review

A desktop assessment was undertaken to identify threatened flora and fauna species, populations and ecological communities, migratory species or critical habitat previously recorded or predicted to occur in the locality of the project.

This assessment included database searches, a review of publicly available spatial data, and a review of previous surveys and assessments undertaken within the study area or surrounds (refer to Section 3.3 of Technical Paper 3 (Biodiversity Development Assessment Report)).

#### 11.3.3 Threatened flora surveys

Threatened terrestrial flora surveys were undertaken within the on-airport and non-restricted off-airport areas. Targeted seasonal surveys were conducted on on-airport lands by Department of Infrastructure and Regional Development (2016e), Department of Infrastructure and Regional Development (2018b) and SMEC (2014).

Findings from these surveys have been adopted for the assessment of on-airport lands (outside the Western Sydney International Stage 1 Construction Impact Zone, within which the clearing of biodiversity values is already authorised under the Airport Plan).

Detailed survey methods are presented in Table 3-8 of Technical Paper 3 (Biodiversity Development Assessment Report).

#### 11.3.4 Threatened fauna surveys

Threatened terrestrial fauna surveys were undertaken in the off-airport lands within the study area. Surveys within on-airport lands were previously carried out by Department of Infrastructure and Regional Development (2016e), Department of Infrastructure and Regional Development (2018b) and SMEC (2014).



Surveys of off-airport lands were conducted where property access was available. Candidate species which did not require survey were dismissed during habitat suitability assessments, as discussed in Appendix B of Technical Paper 3 (Biodiversity Development Assessment Report).

#### 11.3.5 Groundwater dependent ecosystems

Groundwater dependent ecosystems within the study area were identified using the *Atlas of Groundwater Dependent Ecosystems* (Bureau of Meteorology, 2020) and existing vegetation mapping (Open Lines and Biosis, 2020).

Geospatial data showing the groundwater drawdown results for the project (refer to Chapter 15 (Groundwater and geology)) was then overlaid with the mapping of groundwater dependent ecosystems to identify potential impacts.

#### 11.3.6 Aquatic ecology

The aquatic ecology assessment for the project was limited to a desktop assessment based on results from detailed existing aquatic assessments undertaken for on-airport as part of the *Western Sydney Airport - Environmental Impact Statement, Biodiversity Assessment* (Department of Infrastructure and Regional Development, 2016e) and off-airport as part of the *M12 Motorway Environmental Impact Statement* (Transport for NSW, 2019b).

Aquatic habitats within the study area were assessed against the applicable guidelines. Further detail about assessment approach for aquatic ecology is provided in Section 3 of Technical Paper 3 (Biodiversity Development Assessment Report).

#### 11.3.7 Prescribed impacts

Prescribed impacts include impacts on biodiversity values other than clearing of native vegetation or loss of habitat. For example, the removal of non-native vegetation and human-made structures, or impacts on the movement of threatened species that maintains their life cycle.

Relevant prescribed impacts have been assessed for the construction and operation of the project in accordance with sections 9.1.1.2 and 9.2 of the BAM.

### 11.4 Existing environment

A summary of the existing biodiversity environment for the project is presented below. Further detail is provided in Technical Paper 3 (Biodiversity Development Assessment Report).

#### 11.4.1 Off-airport

The off-airport environment for the purposes of the biodiversity assessment is the area north of Western Sydney International and excludes the area south of Western Sydney International, as this area is covered by the South West Growth Centre Strategic Assessment (see Figure 11-1).

##### Landscape context

The landscape features outlined below were used to inform the assessment of habitat suitability of the study area for threatened species and the potential movement of species across the landscape.

##### *Rivers, streams and estuaries*

Blaxland Creek, Cosgroves Creek and a number of unnamed creeks occur in the off-airport study area.

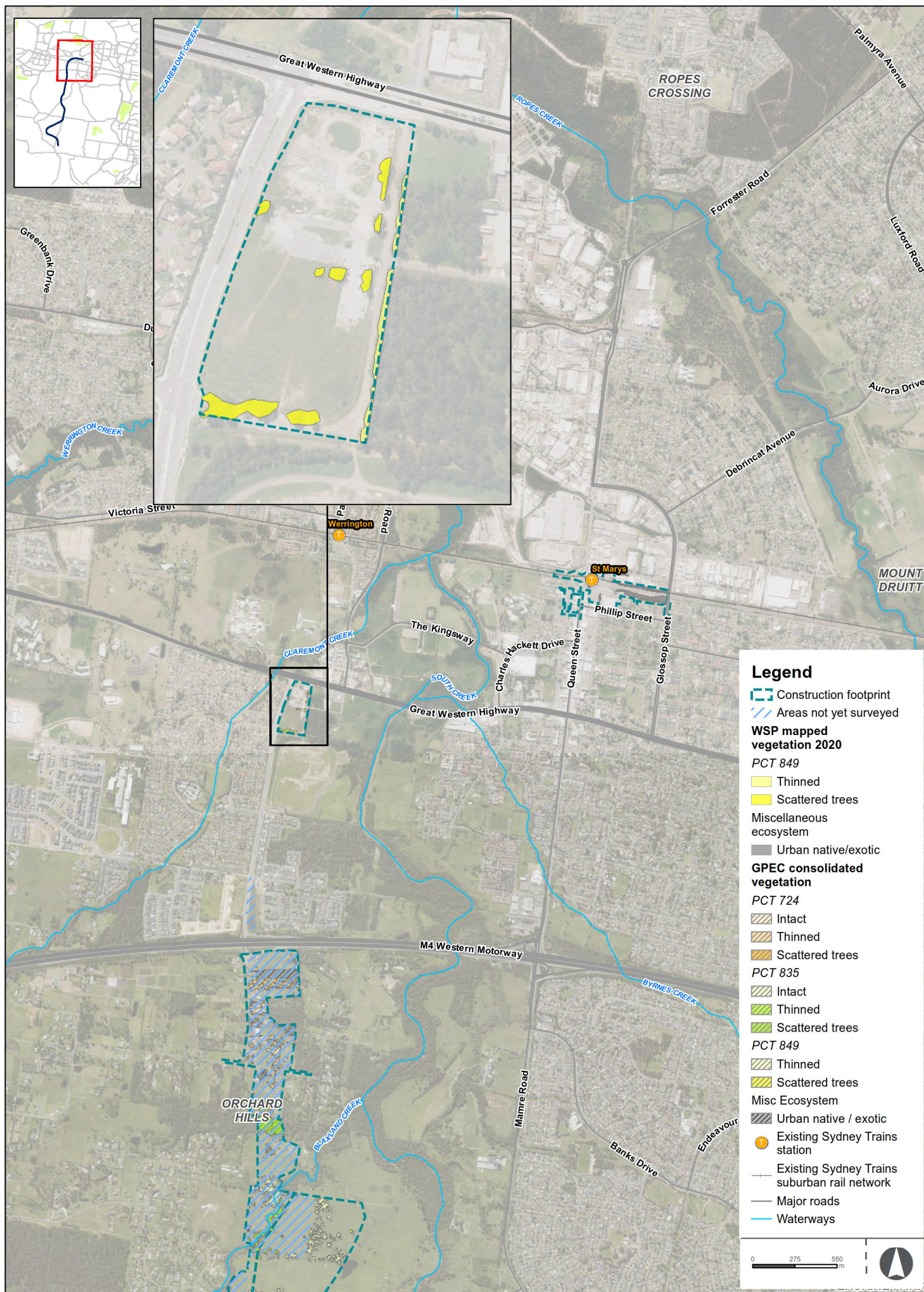
##### *Connectivity*

Connectivity refers to the biodiversity links that connect different areas of habitat. Significant links within a site contribute to its overall biodiversity value (Office of Environment and Heritage, 2016).

The off-airport study area contains highly fragmented landscapes with connectivity that is limited to riparian corridors, which have been subject to varying levels of clearing and disturbance. The Defence Establishment Orchard Hills between Luddenham Road and Patons Lane within the off-airport land, has connectivity to a large bushland patch to the west.

The construction footprint is not located within the Western Sydney Airport biodiversity offset area and would have no direct or indirect impacts to this area.



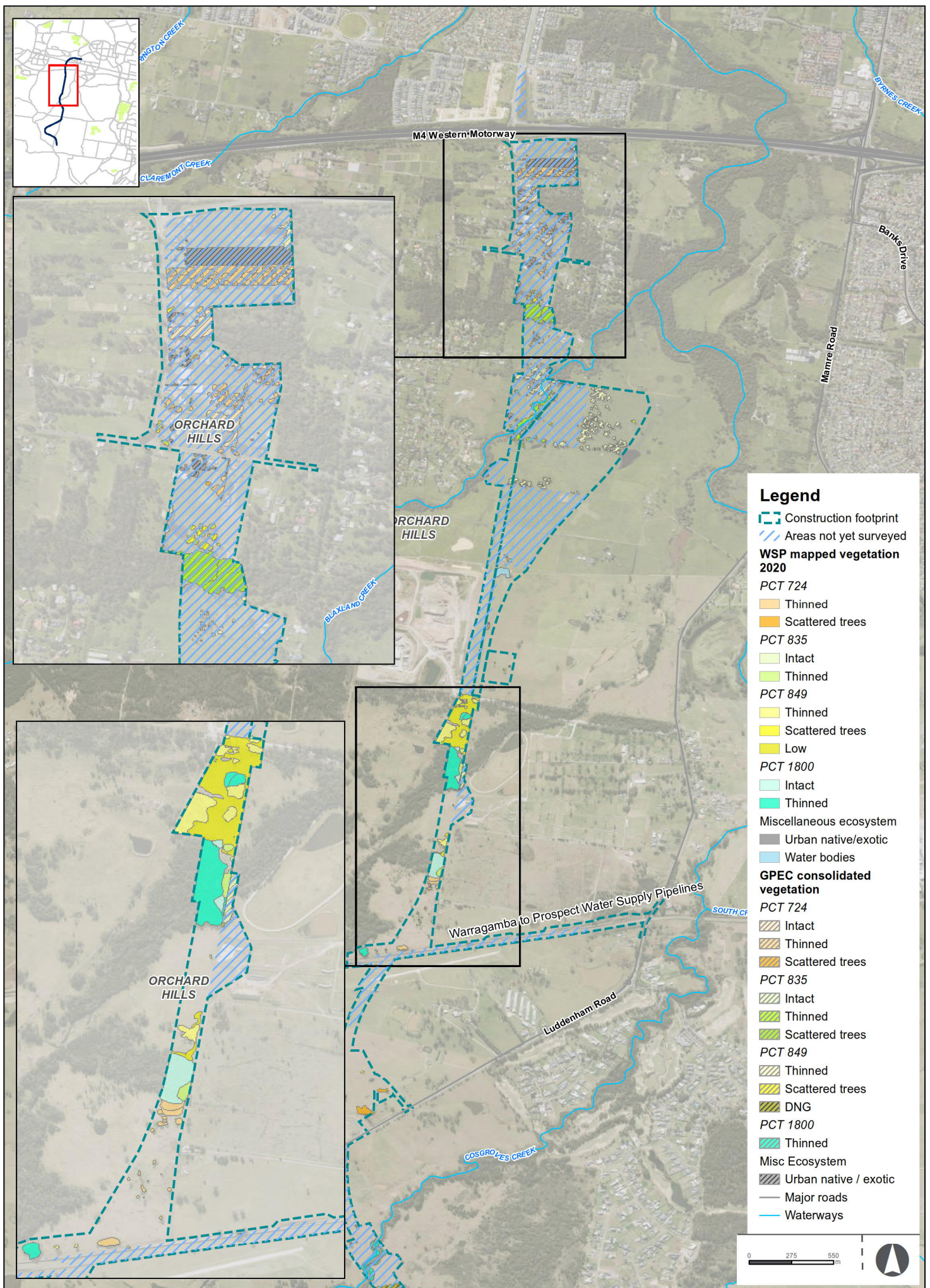


Vegetation types (PCTs) across the study area

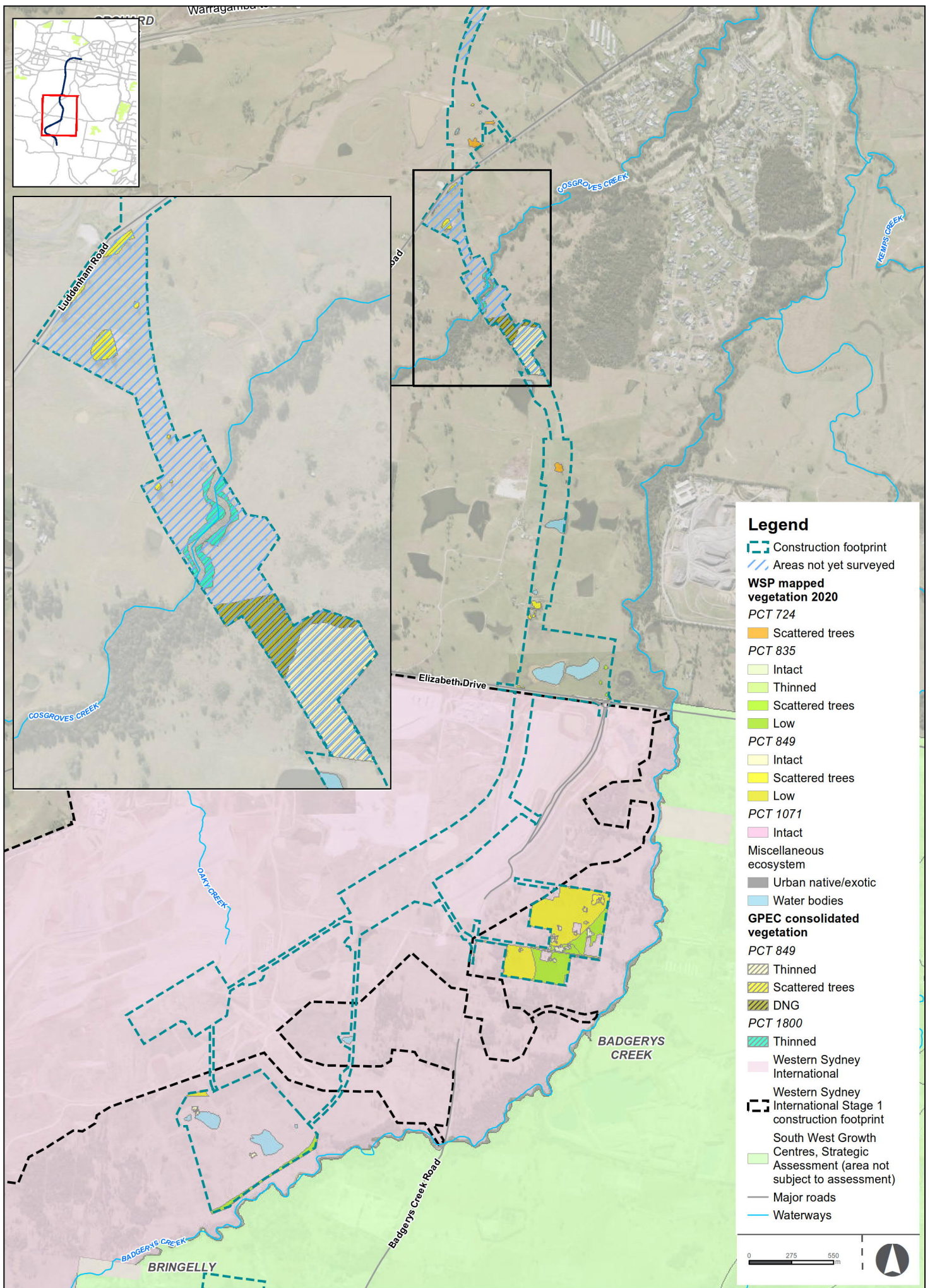
**Figure 11-1a**

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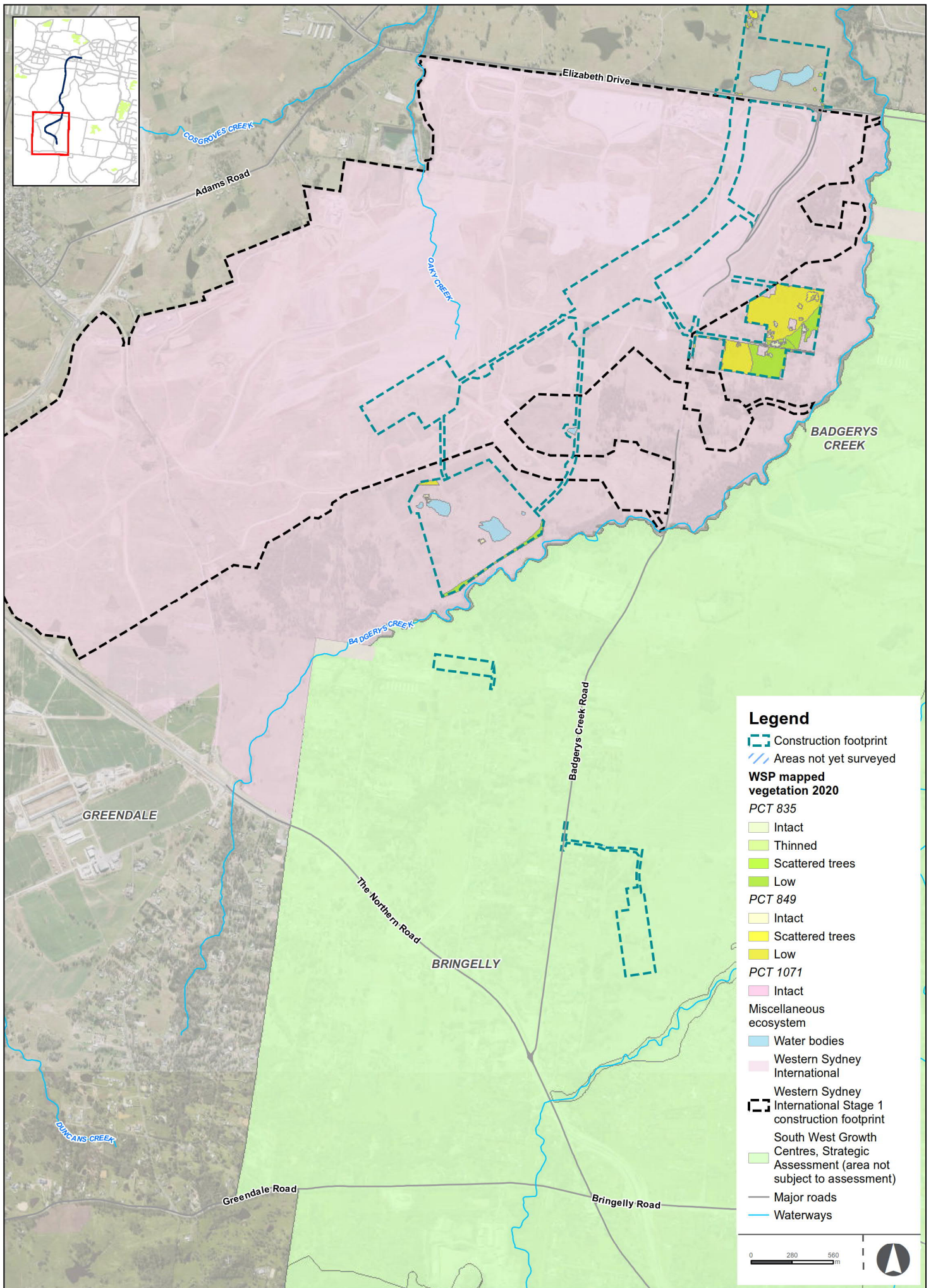


Vegetation types (PCTs) across the study area

**Figure 11-1c**

Indicative only, subject to design development





### Native vegetation and threatened ecological communities

Four plant community types (PCT) were recorded in the off-airport study area:

- PCT 724 – Broad-leaved Ironbark – Grey Box – *Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion
- PCT 835 – Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
- PCT 849 – Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
- PCT 1800 – Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter Valley.

These four PCT meet the relevant criteria for four TECs listed under the BC Act and two TECs listed under the EPBC Act. A summary of each TEC, associated PCT and listing is provided below:

- Cumberland Plain Woodland listed as Critically Endangered under the BC Act (PCT 849) and Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest listed as Critically Endangered under EPBC Act (PCT 849 and PCT 724)
- River-Flat Eucalypt Forest listed as Endangered under the BC Act (PCT 835)
- Shale Gravel Transition Forest listed as Endangered under the BC Act (PCT 724)
- Swamp Oak listed as Endangered under the BC Act (PCT 1800) and Coastal Swamp Oak listed as Endangered under EPBC Act (PCT 1800).

Details of how each PCT meets each element of the scientific determination, including geographical location, characteristic species, soils and geology are in Tables 5-17 to 5-20 of Technical Paper 3 (Biodiversity Development Assessment Report). The extent and distribution of the PCT within the construction footprint is shown in Figure 11-1, while the location of each TEC is shown in Figure 11-2.

### Threatened flora

During field surveys, one threatened flora species was recorded, *Grevillea parviflora subsp. parviflora* is a threatened shrub listed as vulnerable under the BC Act. This species is not listed as threatened under the EPBC Act.

Within off-airport land, a total of 1225 *Grevillea parviflora subsp. parviflora* individuals were recorded. A list of the candidate threatened flora species for the off-airport study area is provided in Table 6.5 of Technical Paper 3 (Biodiversity Development Assessment Report).

No Commonwealth listed threatened flora was recorded during field surveys or in previous ecological assessments within the off-airport study area. However, areas of potential habitat have been considered for the assessment and are outlined in Table 11-1. Detailed assessments of significance for these species have been carried out in accordance with Significant Impact Guidelines and are provided in Appendix E of Technical Paper 3 (Biodiversity Development Assessment Report).

Table 11-1 Commonwealth listed affected flora

| Scientific name                                      | Common name              | EPBC Act <sup>1</sup> | Area of potential habitat (ha) (off-airport) |
|--|--------------------------|-----------------------|--|
| <i>Acacia bynoeana</i>                               | Bynoe's Wattle           | V                     | 4.18   |
| <i>Acacia pubescens</i>                              | Downy Wattle             | V                     | 12.27  |
| <i>Allocasuarina glareicola</i>                      | -                        | E                     | 4.18   |
| <i>Cynanchum elegans</i>                             | White-flowered Wax Plant | E                     | 4.97   |
| <i>Grevillea parviflora</i> subsp. <i>parviflora</i> | Small-flower Grevillea   | V                     | 4.21   |
| <i>Micromyrtus minutiflora</i>                       | -                        | V                     | 4.18   |
| <i>Pimelea curviflora</i> var. <i>curviflora</i>     | -                        | V                     | 4.97   |
| <i>Pimelea spicata</i>                               | Spiked Rice-flower       | E                     | 8.06   |
| <i>Pultenaea parviflora</i>                          | -                        | V                     | 4.18   |

**Note 1:** V = Vulnerable, E = Endangered under the EPBC Act

#### *Provisional list of EPBC Act listed flora species and vegetation communities following 2019-2020 bushfires*

The Australian Department of Agriculture, Water and the Environment (DAWE) released an initial list of threatened ecological communities which have lost more than 10 per cent of their estimated distribution in areas affected by the 2019-20 bushfires in southern and eastern Australia. Threatened flora high priority lists were released on 23 April 2020 (DAWE, 2020b).

A total of six hectares of unburnt critically endangered Cumberland Plain Woodland would be potentially impacted by the project and a total of 3.67 hectares of unburnt endangered Coastal Swamp-Oak Forest would be potentially impacted by the project. Further discussion and assessment of the impacts is provided in Section 7.2.2 of Technical Paper 3 (Biodiversity Development Assessment Report).

#### **Threatened fauna**

Candidate NSW threatened species for the off-airport study area include; Little Eagle (*Hieraaetus morphnoides*), Cumberland Plain Land Snail (*Meridolum corneovirens*), Southern Myotis (*Myotis Macropus*).

Twenty-four species listed as threatened under the EPBC Act were predicted to occur in the Predicted Matters Search Tool. Of these, one fauna species, the Grey-headed Flying-fox, was recorded foraging in the off-airport study area. As there are no roosting camps within the off-airport study area it has not been considered further as a species credit species; however, it has been included as an ecosystem credit species.

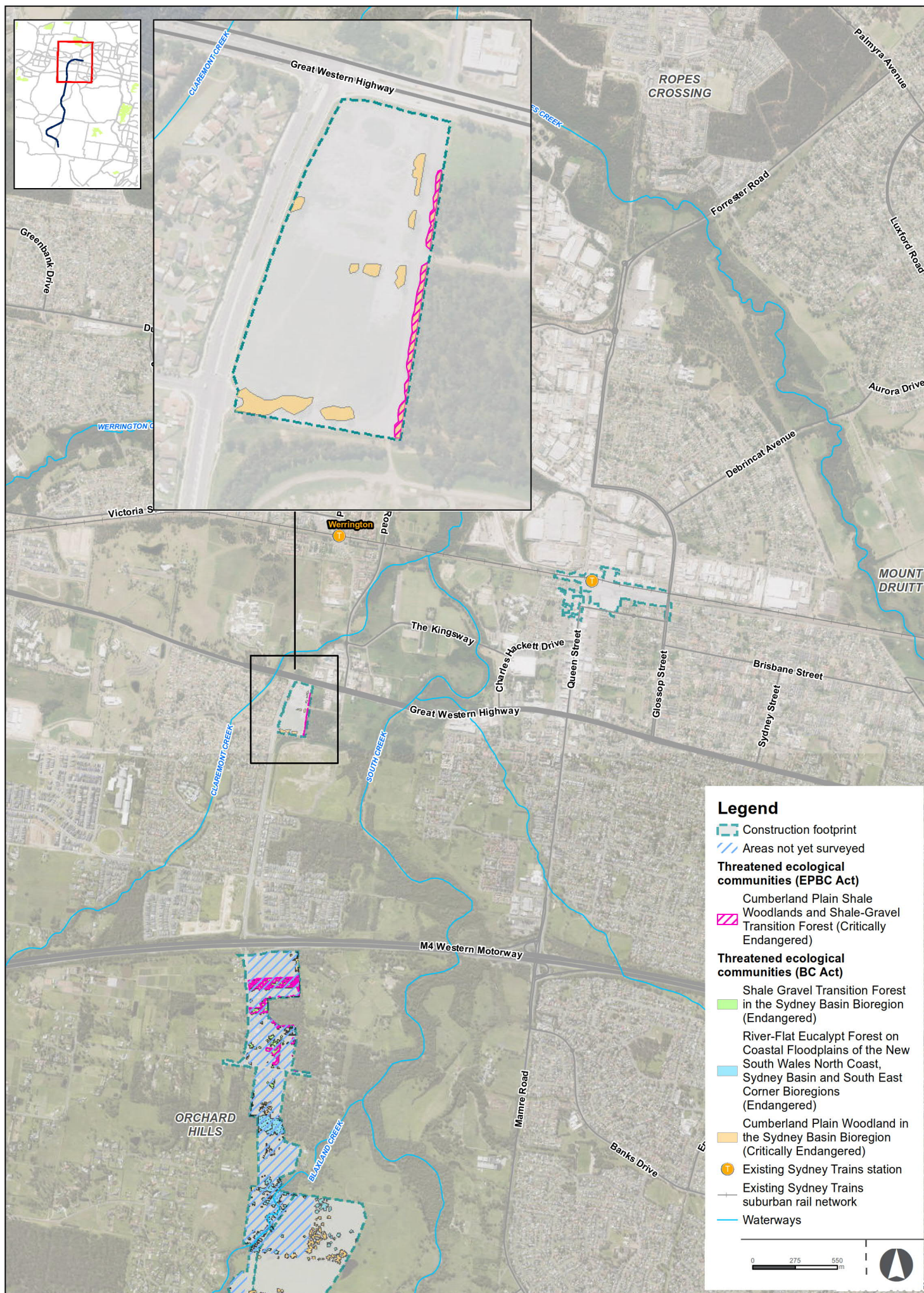
#### *Provisional list of EPBC Act listed fauna species following 2019-2020 bushfires*

On 11 February 2020, DAWE released a provisional list of 113 animal species that have been identified as the highest priorities for urgent management intervention following the 2019-20 bushfires in southern and eastern Australia. This list was revised to a total of 119 species in an updated assessment on 24 March 2020 (DAWE, 2020b). Most of these animals have potentially lost at least 30 per cent of their range to bushfires, and many have lost substantially more.

None of the high priority 'Provisional list of animals requiring urgent management intervention' are considered to occur, or likely to occur, within the study area except for the vulnerable Grey-headed Flying-fox, which has been 'provisionally included as a high priority whilst more information is gathered' (DAWE, 2020b).

In the study area, the extent of Grey-headed Flying-fox habitat impacted by the bushfire has been limited to a relatively small proportion of the available foraging habitat. The nearest fire affected habitat occurred approximately 10 kilometres to the west of the project in the lower Blue Mountains.



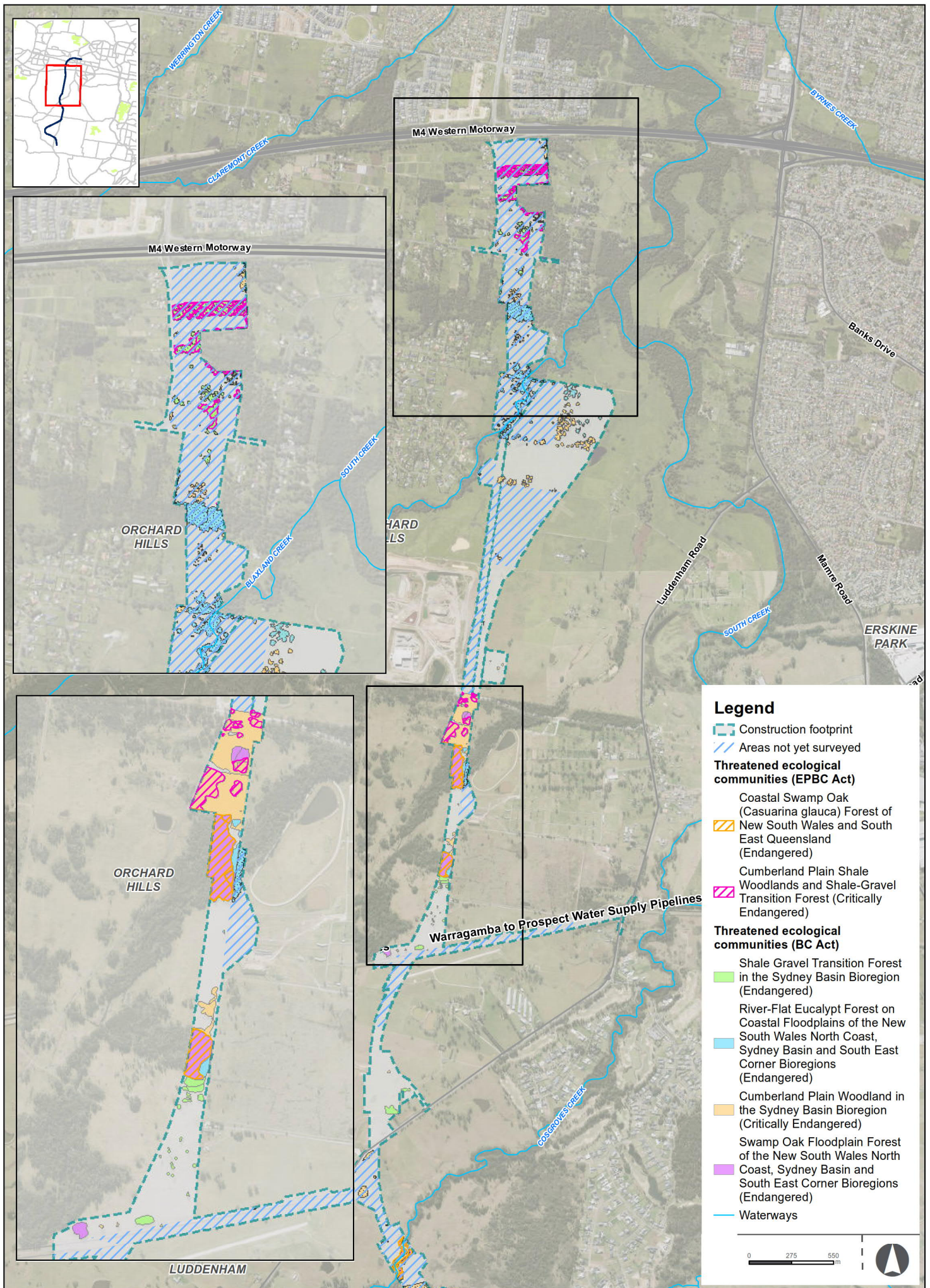


Threatened ecological communities across the study area

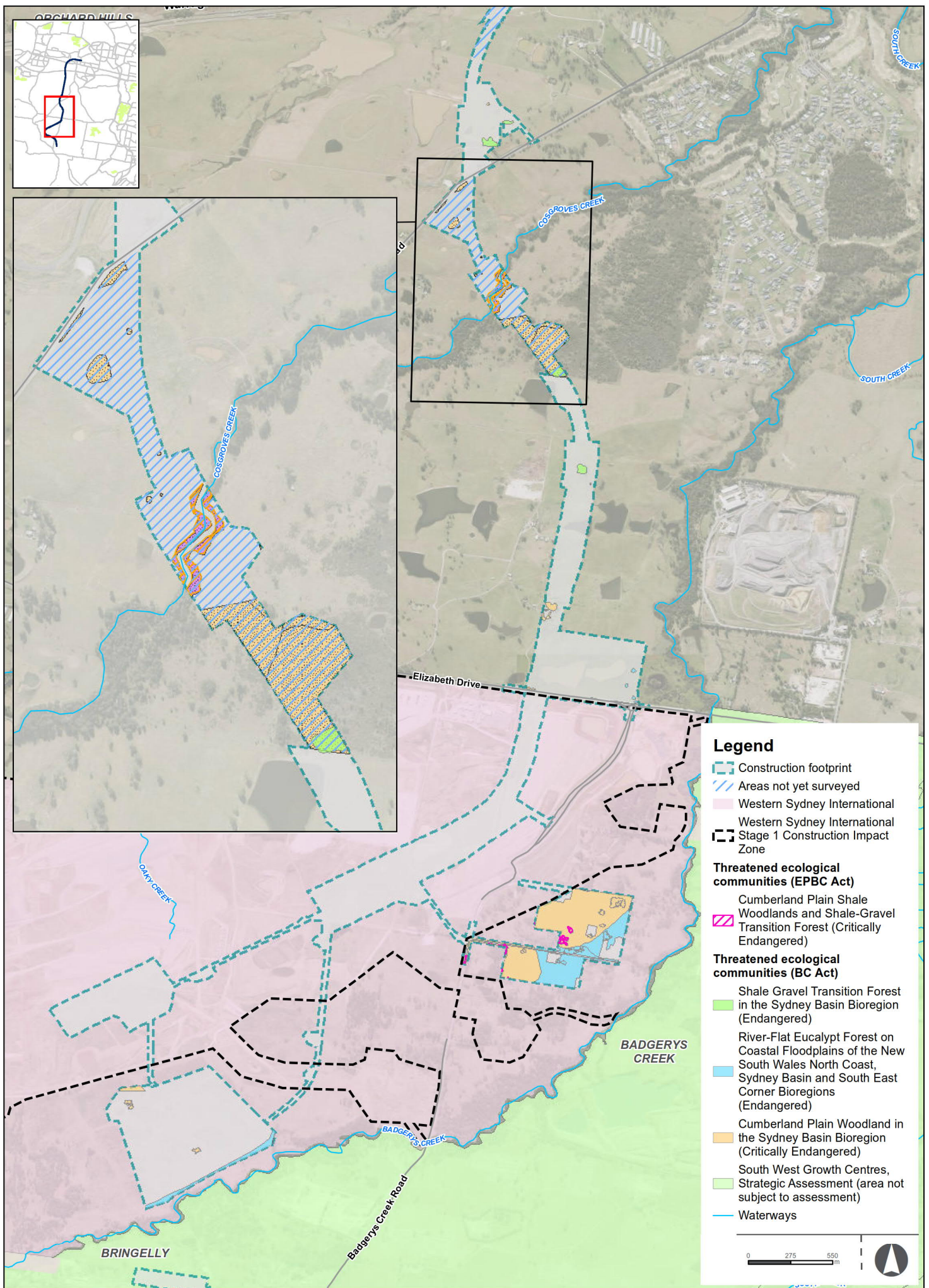
Figure 11-2a

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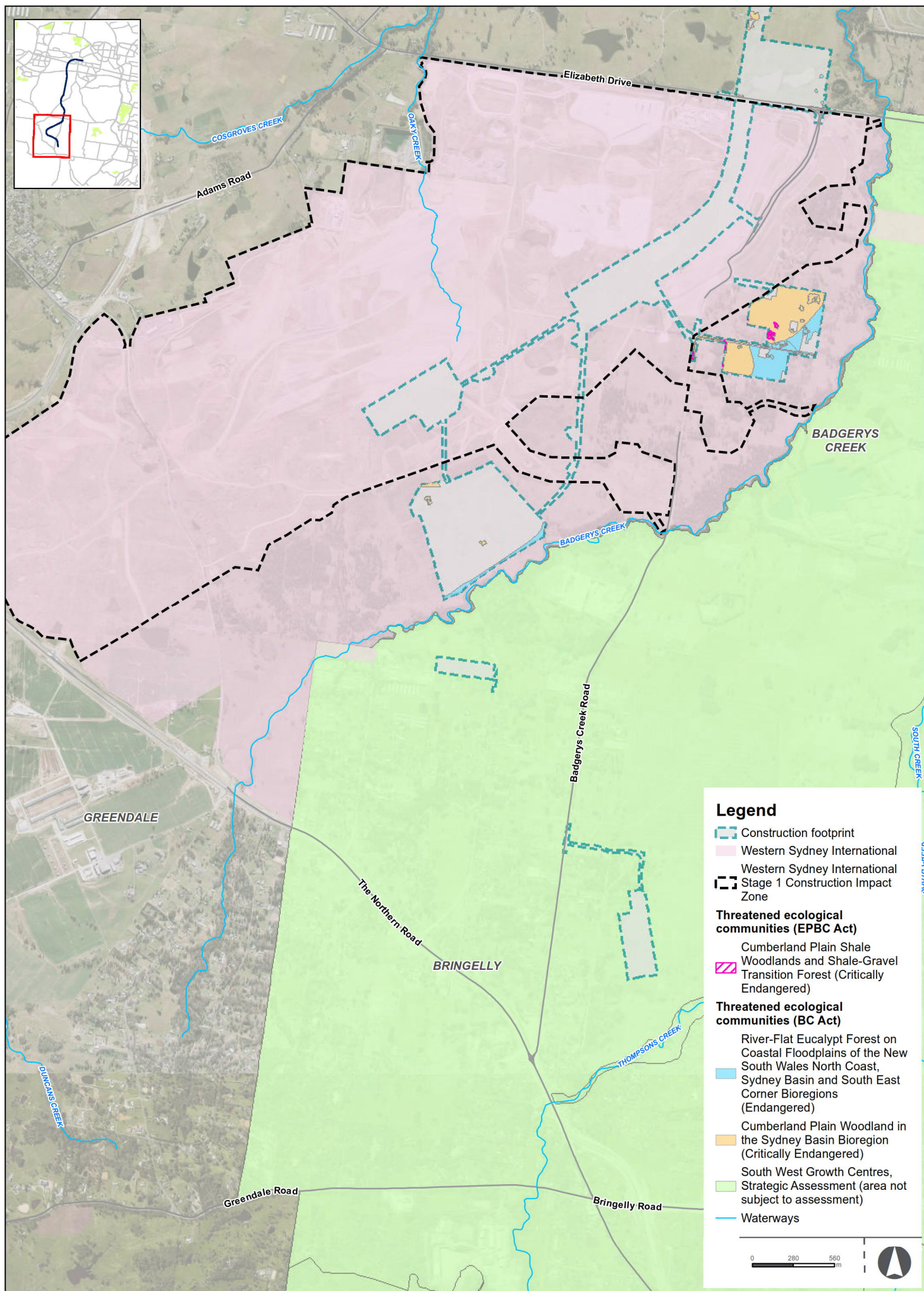


Threatened ecological communities across the study area

**Figure 11-2c**

Indicative only, subject to design development





### **Migratory species**

Eighteen species listed as Migratory under the EPBC Act were predicted to occur in the Predicted Matters Search Tool. Of these, four migratory species were considered to have suitable foraging habitat within the study area:

- Latham's Snipe (*Gallinago hardwickii*)
- White-bellied Sea-eagle (*Haliaeetus leucogaster*)
- White-throated Needletail (*Hirundapus caudacutus*)
- Satin Fly-catcher (*Myiagra cyanoleuca*).

The White-bellied Sea-eagle was recorded flying over both the on-airport and off-airport lands within the study area.

### **Groundwater dependent ecosystems**

Groundwater dependent ecosystems (GDEs) within 10 kilometres of the off-airport study area comprise:

- Cumberland Plain Woodland in the Sydney Basin Bioregion listed as Critically Endangered under the BC Act (PCT 849)
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions listed as Endangered under the BC Act (PCT 835)
- Shale Gravel Transition Forest in the Sydney Basin Bioregion listed as Endangered under the BC Act (PCT 724)
- Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions listed as Endangered under the BC Act (PCT 1800).

### **Aquatic ecology**

#### *Existing aquatic environment*

The off-airport study area is located entirely within the South Creek catchment within the larger Hawkesbury catchment. South Creek, a major tributary of the Hawkesbury-Nepean catchment, flows in a generally northerly direction from its headwaters near Narellan through to Windsor where it joins the Hawkesbury River.

The catchment is highly impacted due to a mix of rural and urban land uses and major infrastructure including roads and rail and has been altered from its natural state (refer to Chapter 19 (Land use and property)). The catchment of South, Cosgroves and Blaxland creeks consists of gently sloping rural residential land that is largely cleared.

#### *Fish habitat and waterway classification*

A summary of waterway classification within the off-airport study area is provided in Table 11-2 and the waterways are shown in Figure 11-3.

Table 11-2 Habitat assessment of the main mapped waterways within the study area

| Rivers and streams                                  | Strahler order  | Mapped key fish habitat? | Habitat sensitivity (NSW Department of Primary Industries 2013) | Waterway classification (fish passage) |
|---|-----------------|--------------------------|---|--|
| Blaxland Creek                                      | 4 <sup>th</sup> | Yes                      | Type 2 – Moderately sensitive key fish habitat                  | Class 2 (moderate fish habitat)        |
| Unnamed tributary of South Creek (Lot 1 DP242968)   | 4 <sup>th</sup> | Yes                      | Type 2 – Moderately sensitive key fish habitat                  | Class 3 (minimal fish habitat)         |
| Claremont Creek                                     | 4 <sup>th</sup> | Yes                      | Type 2 – Moderately sensitive key fish habitat                  | Class 2 (moderate fish habitat)        |
| Cosgroves Creek                                     | 4 <sup>th</sup> | Yes                      | Type 2 – Moderately sensitive key fish habitat                  | Class 2 (moderate fish habitat)        |
| Unnamed tributary of Badgerys Creek (Lot 26 DP2650) | 3 <sup>rd</sup> | Yes                      | Type 3 – Minimally sensitive key fish habitat                   | Class 4 (unlikely fish habitat)        |
| South Creek   | 5 <sup>th</sup> | Yes                      | Type 1 – Highly sensitive key fish habitat                      | Class 2 (moderate fish habitat)        |

*Aquatic biota*

The macroinvertebrate communities within Cosgroves Creek, Oaky Creek, South Creek, Thompsons Creek and their tributaries are known to be dominated by Dipterans (true flies), Acarina (water mites), and Odonata (dragonflies) with lower numbers of other taxa (Department of Infrastructure and Regional Development, 2016e). The macroinvertebrate communities in these waterways are composed of taxonomic groups that have a high tolerance to severe pollution levels (Department of Infrastructure and Regional Development, 2016e).

The macroinvertebrate and fish communities are considered likely to be similar to those assessed for the *Western Sydney Airport Environmental Impact Statement - Biodiversity Assessment* (Department of Infrastructure and Regional Development, 2016e).

*Threatened aquatic species*

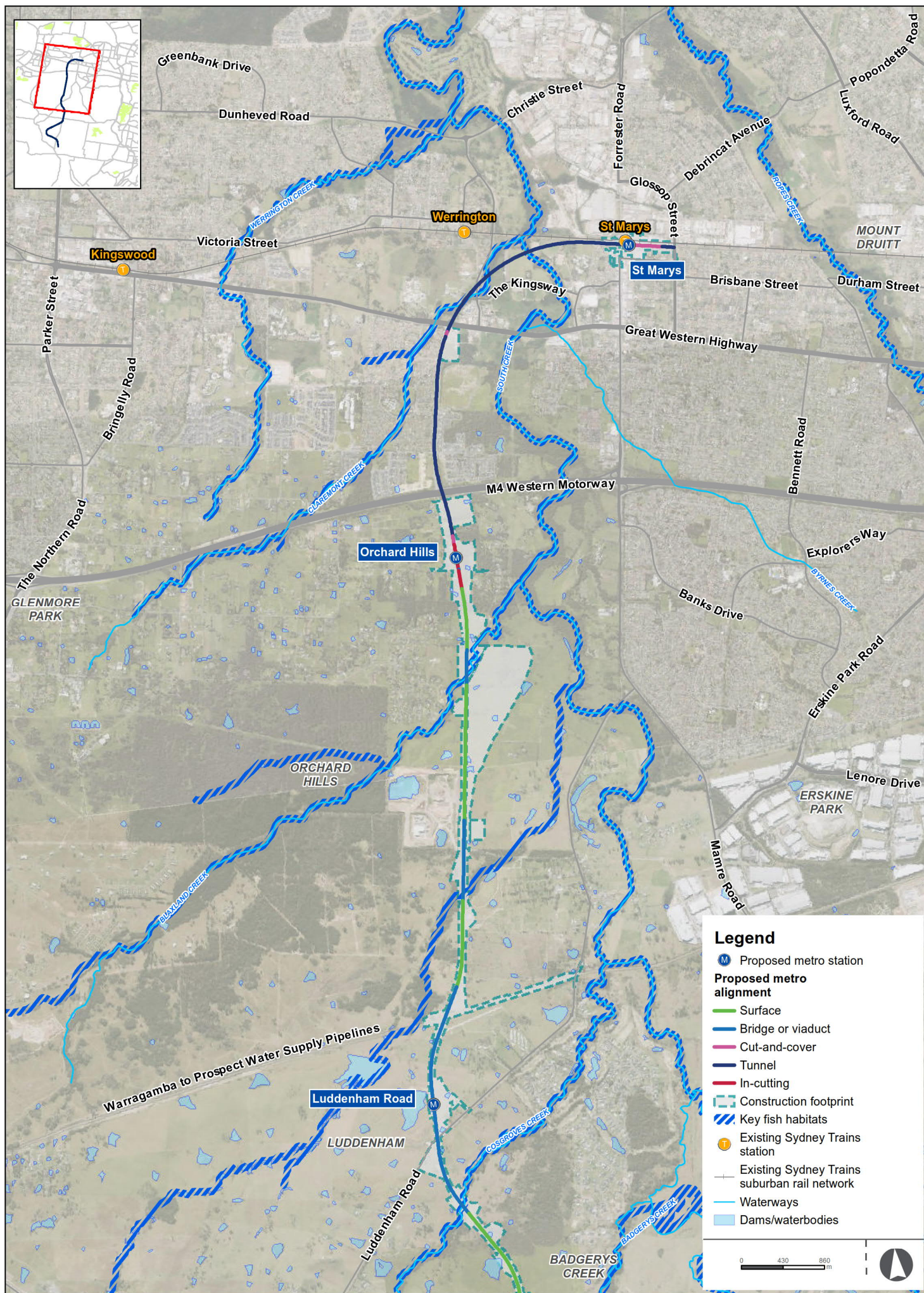
The desktop searches returned three threatened fish listed under the EPBC Act as having the potential to occur within the locality: Australian Grayling, Macquarie Perch and Murray Cod. The Australian Grayling and Macquarie Perch are also listed as threatened species under the FM Act. A further two threatened invertebrate species listed under the FM Act, Adam's Emerald Dragonfly or the Sydney Hawk Dragonfly may also occur in the locality as identified in the *Western Sydney Airport Environmental Impact Statement - Biodiversity Assessment* (Department of Infrastructure and Regional Development, 2016e).

The level of habitat disturbance, low surface flows, poor water quality, and creation of farm dams have resulted in reductions in native fish populations (Department of Infrastructure and Regional Development, 2016e).

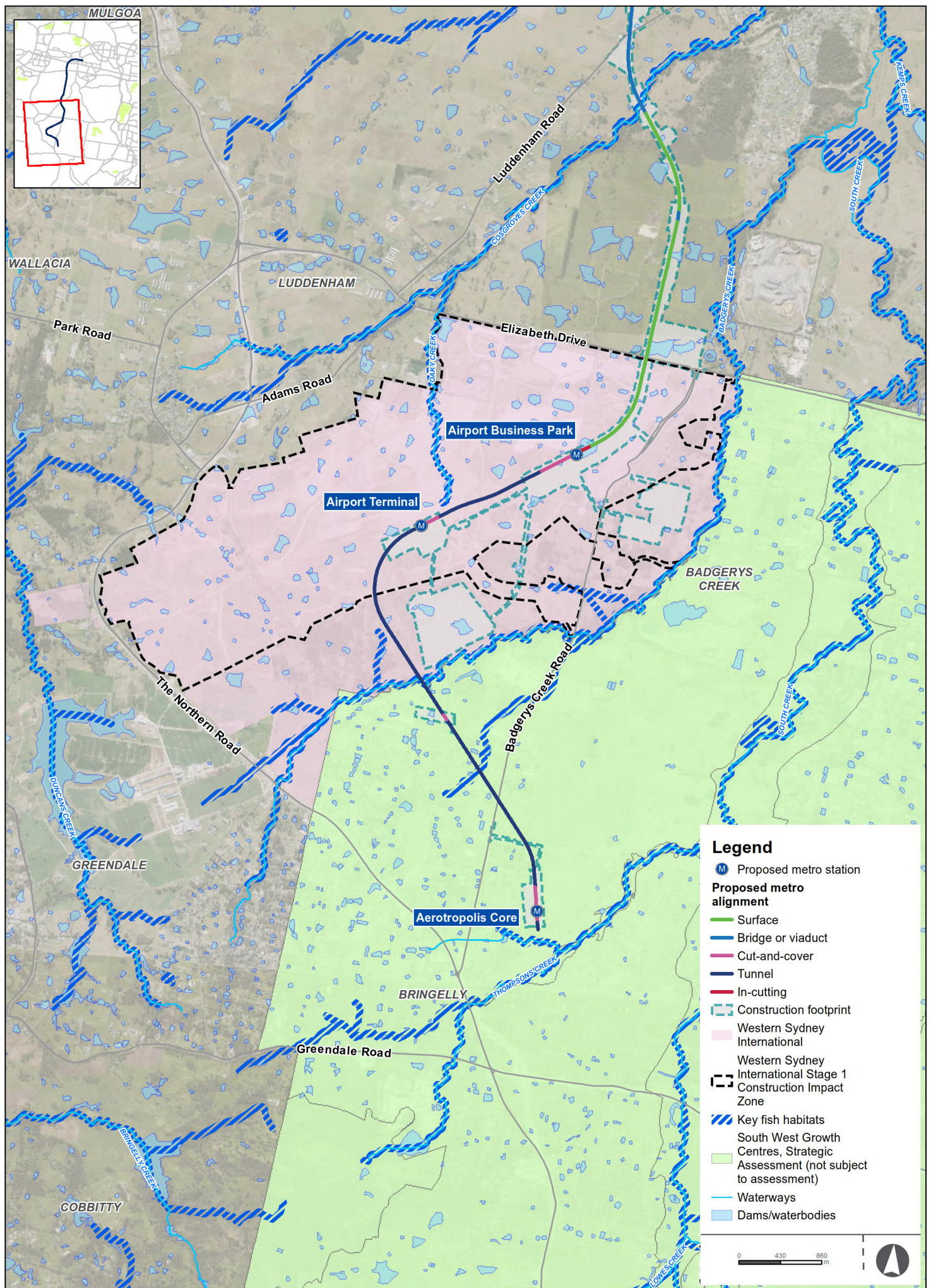
**Wetlands of international importance**

No wetlands of international importance occur within the study area or broader locality.











#### 11.4.2 On-airport

The Airport Plan provides authorisation for the clearing of biodiversity values within the Western Sydney International Stage 1 Construction Impact Zone; therefore, no assessment of the impacts of the project have been undertaken within this area. The following section provides an account of the existing environment for the on-airport study area, outside the Western Sydney International Stage 1 Construction Impact Zone.

##### Landscape context

The study area on-airport encompasses a highly fragmented landscape. Generally, habitat connectivity on-airport was limited to riparian corridors around Badgerys Creek. All riparian corridors have been subject to varying levels of clearing and disturbance. Three unnamed creeks occur within the on-airport study area.

Site preparation activities including clearing and earthworks for Western Sydney International would generally be completed or almost completed when construction activities for the project commence in 2021. To the extent required, all vegetation would be removed from the Stage 1 Construction Impact Zone. Outside the Stage 1 Construction Impact Zone, the land would be cleared of buildings as part of the airport development prior to construction of the project; however, existing road infrastructure and vegetation would remain.

##### Native vegetation and threatened ecological communities

Three PCT were recorded in the on-airport study area:

- PCT 835 – Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
- PCT 849 – Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
- PCT 1071 – *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion.

The three PCT meet the relevant criteria for two TECs listed under the BC Act and EPBC Act. A summary of each TEC, associated PCT and listing is provided as follows:

- Cumberland Plain Woodland listed as Critically Endangered under BC Act (PCT 849) and Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest listed as Critically Endangered under EPBC Act (PCT 849 and PCT 724)
- River-Flat Eucalypt Forest listed as Endangered under the BC Act (PCT 835).

The extent of these TECs within the study area is shown in Figure 11-2.

Details of how each PCT meets each element of the scientific determination, including geographical location, characteristic species, soils and geology are presented in Table 5-17 and 5-21 of Technical Paper 3 (Biodiversity Development Assessment Report). The extent and distribution of each vegetation type and zone within the construction footprint is shown in Figure 5-1 of Technical Paper 3 (Biodiversity Development Assessment Report) while the location of each TEC is shown in Figure 5-2 of Technical Paper 3 (Biodiversity Development Assessment Report).

##### Threatened flora

A total of 12 threatened flora species and 47 threatened fauna species were considered to have a moderate or higher likelihood of occurrence within the on-airport study area.

No threatened flora species were recorded within the on-airport study area or are considered affected by the project. No threatened flora species have been assigned to species credits for offsetting purposes

##### *Provisional list of EPBC Act listed species and vegetation communities following 2019-2020 bushfires*

The information provided for the off-airport study area in Section 11.4.1 is consistent and relevant to the on-airport study area.



### **Threatened fauna**

A total of two threatened fauna species (Cumberland Plain Land Snail and Southern Myotis) were recorded or assumed present within the on-airport study area and have been assigned to species credit calculations for offsetting purposes.

#### *Provisional list of EPBC Act listed species and vegetation communities following 2019-2020 bushfires*

The information provided for the off-airport study area in Section 11.4.1 is consistent and relevant to the on-airport study area.

### **Migratory species**

Migratory species within the on-airport study area is consistent with the off-airport study area with regards to searches of the Protected Matters Search Tool. In addition, Latham's Snipe was recorded in a large, vegetated farm dam within the on-airport lands (but not within the study area for the biodiversity assessment) (Department of Infrastructure and Regional Development, 2016e).

### **Groundwater dependent ecosystems**

GDEs within the locality of the on-airport study area (<10 km) include South Creek and associated tributaries. Other GDEs reliant on subsurface groundwater in the study area are:

- Cumberland Plain Woodland in the Sydney Basin Bioregion
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.

### **Aquatic ecology**

The on-airport study area is located entirely within the South Creek catchment within the larger Hawkesbury catchment. The on-airport study area crosses a number of smaller intermittent unnamed drainage lines and depressions. The Airport Plan designates an Environmental Conservation Zone (ECZ) which is predominantly associated with the riparian vegetation along Badgerys Creek. The project has been designed to avoid impact upon the ECZ by being located in tunnel at this location.

The on-airport study area also contains the catchment areas (but does not cross the main channel) for Oaky Creek (within the Western Sydney International site, to the west of the project) and a tributary of Duncans Creek (within the Western Sydney International site, to the southwest of the project). South Creek is the receiving waterway for creeks within the on-airport study area.

The water quality, catchment conditions and hydrological regimes of the on-airport catchment is consistent with the off-airport study area.

#### *Fish habitat and waterway classification*

Badgerys Creek is mapped as Key Fish Habitat by NSW DPI and would be classified as Type 2 (moderately sensitive key fish habitat) for habitat sensitivity (NSW Department of Primary Industries 2013). In terms of waterway classification for fish passage, Badgerys Creek would generally be classified as Class 2 (moderate fish habitat) (Fairfull and Witheridge, 2003).

The unnamed tributary of Badgerys Creek within the study area (see Figure 11-3) is classified as Class 4 for fish passage waterway classification (unlikely fish habitat) (Fairfull and Witheridge, 2003) as it is highly modified.

#### *Aquatic biota*

The fish communities within on-airport land and in upstream and downstream habitats are indicative of disturbed habitats. Eight fish species were caught during surveys (Department of Infrastructure and Regional Development, 2016e). Five native fish species – Long-finned Eel, Firetail Gudgeon, Western Carp Gudgeon, an unidentified Gudgeon species and Australian Smelt – were recorded, along with exotic species including Goldfish, Common Carp, and Eastern Gambusia.

Given these results the macroinvertebrate and fish communities are likely to be similar to those assessed for the Western Sydney Airport Environmental Impact Statement, Biodiversity Assessment.

### *Threatened aquatic species*

The intermittent nature of the waterways is likely a natural inhibitor to threatened species occurrence and the habitat disturbance that has occurred with the associated flow on effects of erosion, poor water quality, and high abundance of exotic species suggest that the habitat quality for threatened species is poor (Department of Infrastructure and Regional Development, 2016e).

### **Wetland of international importance**

As identified for the off-airport study area, no wetlands of international importance occur within the study area or broader locality.

## **11.5 Potential impacts – construction**

This section presents the potential impacts of the project on biodiversity during construction which have not been avoided through design development to date. Impacts that have been avoided through design are detailed in Chapter 6 (Project development and alternatives) and Section 8.1 of Technical Paper 3 (Biodiversity Development Assessment Report).

The main impacts on biodiversity during the construction phase would be:

- clearing of native vegetation
- clearing of TECs
- removal of threatened species and/or their habitat.

No threatened fish species listed under the FM Act or EPBC Act were recorded or considered likely to occur within the study area (both off-airport and on-airport) and as such the project is unlikely to significantly impact any threatened aquatic species or their habitats.

### **11.5.1 Off-airport**

#### **Direct impacts**

Direct clearing impacts on native vegetation within the off-airport construction footprint are presented in Table 11-3 and shown in Figure 5-1 of Technical Paper 3 (Biodiversity Development Assessment Report). All native vegetation within the off-airport construction footprint is also classified as TECs listed under the BC Act and EPBC Act.

**Table 11-3 Direct impact on native vegetation (off-airport)**

| <b>Plant community type</b>   | <b>Condition</b> | <b>Area (Ha)</b> |
|---|------------------|------------------|
| PCT 724 – Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion | Intact           | 1.16             |
|   | Thinned          | 3.60             |
|   | Scattered trees  | 0.72             |
| PCT 835 – Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion                       | Intact           | 1.67             |
|   | Thinned          | 3.88             |
|   | Scattered trees  | 0.50             |
| PCT 849 – Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion  | Thinned          | 8.58             |
|   | Scattered trees  | 2.09             |
|   | Low              | 5.33             |
| PCT 1800 – Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter Valley  | Intact           | 1.07             |
|   | Thinned          | 3.04             |
| <b>Total</b>  |                  | <b>31.64</b>     |

Direct clearing impacts on TECs listed under the BC Act and EPBC Act within the off-airport construction footprint are presented in Table 11-4.

**Table 11-4 Direct impact on TECs listed under the BC Act and EPBC Act (off-airport)**

| Threatened Ecological Community   | Conservation status | Area (Ha)    |
|---|---------------------|--------------|
| <b>BC Act</b>   |                     |              |
| Cumberland Plain Woodland in the Sydney Basin Bioregion   | CE                  | 16.00        |
| River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions | E                   | 6.05         |
| Shale Gravel Transition Forest in the Sydney Basin Bioregion  | E                   | 5.48         |
| Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions                       | E                   | 4.11         |
| <b>Total</b>  |                     | <b>31.64</b> |
| <b>EPBC Act<sup>2</sup></b>   |                     |              |
| Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest   | CE                  | 5.86         |
| Coastal Swamp Oak ( <i>Casuarina glauca</i> ) Forest of New South Wales and South East Queensland                                   | E                   | 3.67         |
| <b>Total</b>  |                     | <b>9.53</b>  |

**Notes:**

1. E = Endangered, CE = Critically Endangered under the BC Act and EPBC Act
2. EPBC Act vegetation also forms part of the BC listed vegetation

Direct clearing impacts on threatened species and/or their habitats listed under the BC Act and EPBC Act within the off-airport construction footprint are presented in Table 11-5 and shown in Figure 8-2 of Technical Paper 3 (Biodiversity Development Assessment Report).

**Table 11-5 Direct impact on threatened species habitat (off-airport)**

| Scientific Name  | Common Name                  | BC Act <sup>1</sup> | EPBC Act <sup>2</sup> | PCT  | Zone            | Habitat impact (ha)   |
|--|------------------------------|---------------------|-----------------------|--|-----------------|---|
| <b>Threatened flora</b>                                  |                              |                     |                       |  |                 |   |
| <i>Acacia bynoeana</i>                                   | Bynoe's Wattle               | E                   | V                     | 724  | Intact, thinned | 4.18  |
| <i>Acacia pubescens</i>                                  | Downy Wattle                 | V                   | V                     | 724, 849   | All             | 12.27   |
| <i>Allocasuarina glareicola</i>                          | -                            | E                   | E                     | 724  | Intact, thinned | 4.18  |
| <i>Cynanchum elegans</i>                                 | White-flowered Wax Plant     | E                   | E                     | 849  | Thinned         | 4.97  |
| <i>Dillwynia tenuifolia</i>                              | -                            | V                   | -                     | 724, 849   | All             | 21.48   |
| <i>Grevillea juniperina</i> subsp. <i>juniperina</i>     | Juniper-leaved Grevillea     | V                   | -                     | 724, 835, 849 (1800) where recorded <sup>3</sup> | All             | 1225 individuals<br>1.70 (recorded)<br>16.73 (assumed in restricted areas) <sup>3</sup> |
| <i>Grevillea parviflora</i> subsp. <i>parviflora</i>     | Small-flower Grevillea       | V                   | V                     | 724  | All             | 4.23  |
| <i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> – | Marsdenia viridiflora R. Br. | E                   | -                     | 724, 835, 849, 1800                              | Intact, thinned | 14.79   |

| Scientific Name                                  | Common Name                   | BC Act <sup>1</sup> | EPBC Act <sup>2</sup> | PCT            | Zone            | Habitat impact (ha) |
|--|-------------------------------|---------------------|-----------------------|----------------|-----------------|---------------------|
| <i>Endangered population</i>                     | subsp. viridiflora population |                     |                       |                |                 |                     |
| <i>Micromyrtus minutiflora</i>                   | -                             | E                   | V                     | 724            | Intact, thinned | 4.18                |
| <i>Pimelea curviflora</i> var. <i>curviflora</i> | -                             | V                   | V                     | 849            | Thinned         | 4.97                |
| <i>Pimelea spicata</i>                           | Spiked Rice-flower            | E                   | E                     | 849            | All             | 8.06                |
| <i>Pultenaea parviflora</i>                      | -                             | E                   | V                     | 724            | Intact, thinned | 4.18                |
| <b>Threatened fauna</b>                          |                               |                     |                       |                |                 |                     |
| <i>Hieraaetus morphnoides</i>                    | Little Eagle                  | V                   | -                     | 724,835, 1800  | Intact          | 3.90                |
| <i>Meridolum corneovirens</i>                    | Cumberland Plain Land Snail   | E                   | -                     | 724            | Intact          | 1.16                |
| <i>Myotis macropus</i>                           | Southern Myotis               | V                   | -                     | 835, 849, 1800 | All             | 9.83                |

**Notes:**

1. V = Vulnerable, E = Endangered under the BC Act.
2. V = Vulnerable, E = Endangered under the EPBC Act  
For Juniper-leaved Grevillea, area of habitat was assumed where located in restricted areas. Where habitat was surveyed and recorded, PCT 1800 was observed in addition to 724, 835 and 849.

**Potential indirect impacts on groundwater dependent ecosystems**

Potential impacts on groundwater dependent ecosystems include changes to groundwater level and flow resulting from groundwater drawdown during excavation works.

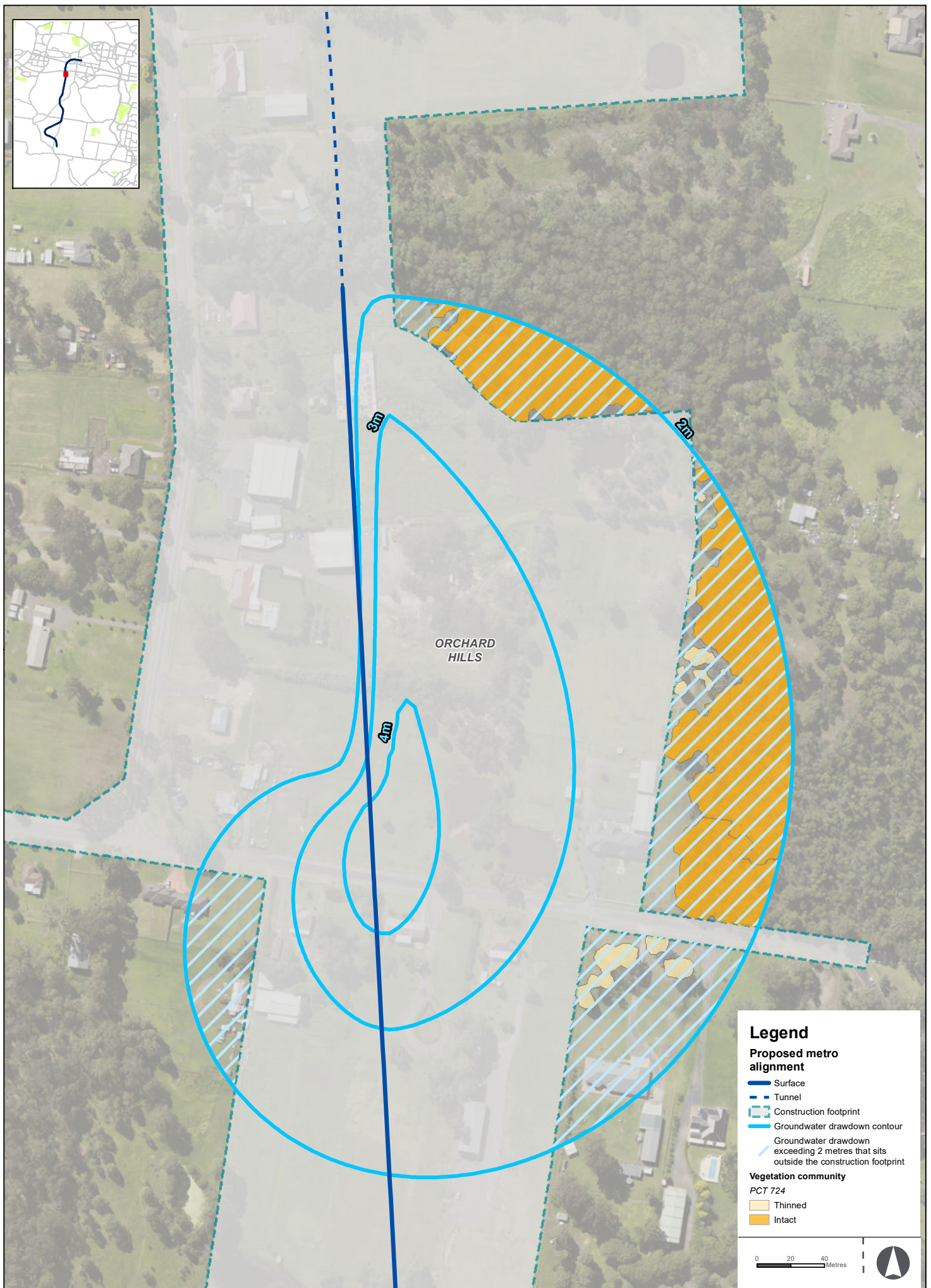
Conservative modelling of these impacts has identified potential drawdown of between one and four metres, with the zone of greatest predicted change (more than two metres) located within around 100 metres of Orchard Hills Station. This maximum change, if it eventuated, would occur at the base of the excavation. Moving away from the excavation, the magnitude of the change in groundwater level would reduce.

Figure 11-4 shows the greater than two metre groundwater drawdown contour in Orchard Hills. Table 11-6 identifies the extent of indirect drawdown impacts on potentially groundwater dependent vegetation that is not already directly impacted by the project construction footprint.

**Table 11-6 Potential groundwater drawdown impacts**

| Native vegetation type  | Condition | Area (Ha)   |
|---|-----------|-------------|
| PCT 724 – Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion | Intact    | 1.66        |
|   | Thinned   | 0.13        |
| <b>Total</b>  |           | <b>1.79</b> |





### 11.5.2 On-airport

#### Direct impacts

Direct clearing impacts on native vegetation for areas outside the Western Sydney International Stage 1 Construction Impact Zone are presented in Table 11-7 and shown in Figure 5-1 of Technical Paper 3 (Biodiversity Development Assessment Report).

**Table 11-7 Direct impact on native vegetation (on-airport)**

| Plant community type  | Condition       | Area (Ha)    |
|---|-----------------|--------------|
| PCT 835 – Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion | Intact          | 0.50         |
|   | Thinned         | 0.09         |
|   | Low             | 9.29         |
| PCT 849 – Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion                    | Intact          | 0.48         |
|   | Scattered trees | 0.52         |
|   | Low             | 16.32        |
| PCT 1071 – <i>Phragmites australis</i> and <i>Typha orientalis</i> coastal freshwater wetlands of the Sydney Basin Bioregion    | Intact          | 0.01         |
| <b>Total</b>  |                 | <b>27.21</b> |

Direct impacts on threatened ecological communities listed under the BC Act and EPBC Act for areas outside the Western Sydney International Stage 1 Construction Impact Zone are presented in Table 11-8.

**Table 11-8 Direct impact on TECs listed under the BC Act and EPBC Act (on-airport)**

| Threatened Ecological Community   | Conservation status <sup>1</sup> | Area (Ha)    |
|---|----------------------------------|--------------|
| <b>BC Act</b>   |                                  |              |
| Cumberland Plain Woodland in the Sydney Basin Bioregion   | CE                               | 17.32        |
| River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions | E                                | 9.88         |
| <b>Total</b>  |                                  | <b>27.20</b> |
| <b>EPBC Act<sup>2</sup></b>   |                                  |              |
| Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest   | CE                               | 0.26         |
| <b>Total</b>  |                                  | <b>0.26</b>  |

**Notes:**

1. E = Endangered, CE = Critically Endangered under the BC Act and EPBC Act
2. EPBC Act vegetation also forms part of the BC listed vegetation

Direct impacts on threatened species and/or their habitats listed under the BC Act and EPBC Act for areas outside the Western Sydney International Stage 1 Construction Impact Zone are presented in Table 11-9 and shown in Figure 8-2 of Technical Paper 3 (Biodiversity Development Assessment Report).

**Table 11-9 Direct impact on threatened species habitat (on-airport)**

| Scientific Name               | Common name                 | BC Act <sup>1</sup> | EPBC Act | PCT | Zone   | Impact (ha) |
|-------------------------------|-----------------------------|---------------------|----------|-----|--------|-------------|
| <b>Threatened fauna</b>       |                             |                     |          |     |        |             |
| <i>Meridolum corneovirens</i> | Cumberland Plain Land Snail | E                   | -        | 849 | Intact | 0.48        |
| <i>Myotis macropus</i>        | Southern Myotis             | V                   | -        | 835 | Intact | 0.07        |

**Notes:**

1. V = Vulnerable, E = Endangered under the BC Act.

**Indirect impacts on groundwater dependent ecosystems**

Potential impacts on groundwater dependent ecosystems include changes to groundwater level and flow resulting from groundwater drawdown during excavation works. Based on results in Technical Paper 7 (Groundwater), there are no significant groundwater drawdown impacts expected on native vegetation within the Western Sydney International site. This is consistent with findings of the previous biodiversity assessment (Department of Infrastructure and Regional Development, 2016e).

**11.5.3 Indirect impacts applicable to both off-airport and on-airport**

Table 11-10 provides a summary of the indirect impacts that are applicable to both off-airport and on-airport.

**Table 11-10 Indirect impacts applicable to both off-airport and on-airport**

| Indirect impact   | Description  |
|---|--|
| Inadvertent impacts on adjacent habitat or vegetation     | <p>Sediment-laden runoff and spills could adversely affect water quality and aquatic life, particularly during construction near creek lines and Key Fish Habitats. These impacts have the potential to reduce the viability of habitat for aquatic and semi aquatic species temporarily.</p> <p>The project has been designed to minimise impacts on these sensitive environmental receivers through the use of bridges and viaducts over creek lines and Key Fish Habitat (Cosgroves Creek and Blaxland Creek), and the tunnel beneath the Environmental Conservation Zone associated with Badgerys Creek riparian area on-airport. The mobilisation of sediments would be contained within the construction footprint as sediment containment measures would be implemented to minimise impacts (refer to Chapter 14 (Flooding, hydrology and water quality)).</p>  |
| Reduced viability of adjacent habitat due to edge effects | <p>Potential edge effects during construction include increased noise, dust and light, erosion and sedimentation, introduction of weeds, and the associated degradation of vegetation at the interface of intact vegetation and cleared areas as part of the study area. Edge effects have the potential to impact on a range of flora and fauna species identified as occurring or having the potential to occur within the study area.</p> <p>Most of the study area within the on-airport section of the project contain patches of native vegetation that are highly degraded and fragmented, with limited or no habitat connectivity. The project is likely to increase the potential for edge effects in larger or connected areas including Badgerys Creek.</p> <p>Edge effects are considered unlikely to extend beyond the project's construction footprint and/or would be avoided through mitigation and management measures.</p> |

| Indirect impact   | Description   |
|---|---|
| Reduced viability of adjacent habitat due to noise, dust or light spill | <p>Noise and vibration from activities associated with the project would potentially disturb fauna and may disrupt foraging, reproductive, or movement behaviours. Mitigation measures proposed to minimise noise and vibration impacts during construction are provided in Chapter 10 (Noise and vibration).</p> <p>Elevated levels of dust may be deposited onto the foliage of vegetation adjacent to construction activities impacting on the overall health of the vegetation. However, deposition of dust on foliage is likely to be highly localised, intermittent and temporary and is therefore not considered likely to be a major impact of the project. Mitigation measures proposed to reduce dust impacts during construction are provided in Chapter 22 (Air quality).</p> <p>Ecological light pollution includes light pollution such as direct glare, chronic or periodic increased illumination, and temporary unexpected fluctuations in lighting that can have potentially adverse effects on wildlife. Ecological light pollution may potentially impact nocturnal fauna by interrupting their lifecycle. Some species (i.e. light tolerant microchiropteran bats) may benefit from the lighting due to increased food availability (insects attracted to lights).</p> |
| Transport of weeds and pathogens from the site to adjacent vegetation   | <p>Construction activities, in general, have the potential to introduce or spread pathogens such as <i>Phytophthora</i> (<i>Phytophthora cinnamomi</i>), Myrtle Rust (<i>Uredo rangelii</i>) and Chytrid fungus (<i>Batrachochytrium dendrobatidis</i>) into native vegetation and habitats.</p> <p>The clearing of native vegetation would increase the potential for weed invasion into native vegetation adjacent to the construction footprint.</p> <p>The potential impact of pathogens and/or weeds are unlikely to extend beyond the construction footprint and/or would be avoided through mitigation measures.</p>   |
| Increased risk of starvation, exposure and loss of shade or shelter     | <p>The project would impact 27 hectares of this native vegetation on-airport. This is equivalent to approximately 13 per cent of available native vegetation on-airport.</p> <p>The project would impact on 33 hectares of native vegetation off-airport. This is equivalent to approximately 9 per cent of native vegetation off-airport.</p> <p>An increase in the risk of starvation, exposure and loss of shade or shelter for flora and fauna species is considered unlikely to extend beyond the project's construction footprint and would be avoided through mitigation and management measures. The project's credit liability (see Section 11.7.4) is considered appropriate to offset this impact within the local landscape.</p>  |
| Loss of breeding habitats   | <p>The loss of breeding habitat such as hollow-bearing trees has the potential to affect native animals such as hollow-dependent bats, hollow-nesting and canopy-nesting birds, arboreal mammals and reptiles.</p> <p>The loss of breeding habitats is unlikely to extend beyond the project's construction footprint. Impacts beyond this area would be avoided through mitigation measures.</p>   |

#### 11.5.4 Prescribed impacts applicable off-airport and on-airport

As outlined in Section 11.3.7, relevant prescribed impacts have been assessed for the construction and of the project in accordance with section 9.1.1.2 and 9.2 of the BAM.

A summary of the potential prescribed impacts during construction of the project is in Table 11-11.



Table 11-11 Summary of prescribed biodiversity impacts during construction

| Prescribed biodiversity impact   | Nature   | Extent   | Frequency  | Duration            |
|--|--|--|------------|---------------------|
| Threatened species reliant on human made structures  | Abandoned houses may create roosting and breeding habitat for threatened microbat species such as the East Coast Free-tailed Bat or Eastern False Pipistrelle. Potential for structures (e.g. culverts) which could provide breeding habitat for Southern Myotis | Removal of abandoned houses and any man-made structure which may create breeding habitat for the Southern Myotis, East Coast Free-tailed Bat and Eastern False Pipistrelle         | Short term | One-off event       |
| Threatened species which rely on non-native vegetation   | Foraging habitat for blossom nomads such as the Grey-headed Flying-fox   | Removal of 3.61 hectares of urban exotic/ native landscape plantings within off-airport lands  | Long term  | One-off event       |
| Habitat connectivity   | All threatened and non-threatened species  | Limited to areas of surface disturbance within the construction footprint where bushland patches occur i.e. areas south of Cosgroves Creek and Defence Establishment Orchard Hills | Long term  | Ongoing             |
| Movement of threatened species that maintains their life cycle   | Any species within breeding habitat within the Study area or habitat which support juveniles and/or breeding adults  | Limited to areas of surface disturbance within the construction footprint where bushland patches occur i.e. south of Cosgroves Creek and Defence Establishment Orchard Hills       | Short term | Ongoing             |
| Impact on water quality and hydrological processes that sustain and interact with the rivers, streams and wetlands | Groundwater dependent ecosystems   | 1.79 hectares of native vegetation outside the construction footprint at Orchard Hills   | Short term | During construction |
| Vehicle strikes  | Terrestrial fauna species  | Limited to areas of surface disturbance within the construction footprint where bushland patches occur i.e. south of Cosgroves Creek and Defence Establishment Orchard Hills       | Short term | During construction |

### 11.5.5 Key Threatening Processes

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten the survival or evolutionary development of species, populations or an ecological community. KTPs are listed under the BC Act, FM Act and EPBC Act.

The project may directly or indirectly have a high likelihood of contributing to the KTPs identified in Table 11-12. The project would have a moderate-low likelihood of directly or indirectly contributing to KTPs listed under the BC Act, FM Act and EPBC Act that are not identified in Table 11-12. Standard mitigation measures would be implemented to further reduce the chances of those KTPs occurring.

**Table 11-12 Relevant Key Threatening Processes**

| Relevant Key Threatening Process  | BC Act, EPBC Act, FM Act | High likelihood of the project directly or indirectly contributing to the KTP                           | Location                   |
|---|--------------------------|---|----------------------------|
| Clearing of native vegetation   | BC Act                   | Clearing of native vegetation would occur   | Off-airport and on-airport |
| Degradation of native riparian vegetation along New South Wales water courses | FM Act                   | Blaxland Creek, Cosgroves Creek and associated native riparian vegetation would be modified and cleared | Off-airport                |

### 11.6 Potential impacts – operation

This section presents the potential impacts of the project on biodiversity during operation which have not been avoided through the design and construction planning for the project.

The main impacts on biodiversity during operation would be:

- indirect impacts on adjacent vegetation and habitat during operation
- impacts on adjacent vegetation and habitat arising from a change in land-use patterns
- impacts on aquatic ecology due to changes in hydrology and water quality
- prescribed biodiversity impacts during operation.

Operational impacts are considered likely to extend beyond the construction footprint. Off-airport biodiversity impacts during operation are summarised in Table 11-13. On-airport biodiversity impacts during operation are summarised in Table 11-14.

**Table 11-13 Biodiversity operational impacts (off-airport)**

| <b>Operational biodiversity impact</b>                       | <b>Nature</b>   | <b>Extent</b>  |
|--|---|--|
| Reduced viability of adjacent habitat due to noise           | Increased noise and vibration levels in the study area and immediate surrounds are likely due to train movements, increases in vehicle movements and general human presence around stations.  | Noise and vibration from the operation of the project would potentially disturb fauna and disrupt foraging, reproductive, or movement behaviours |
| Reduced viability of adjacent habitat due to light pollution | Most of the study area north of the M4 Western Motorway is already subject to lighting impacts. There may be some increase in light disturbance around riparian corridors (e.g. Blaxland Creek) but this may benefit fast-flying microbats due to increased food availability (insects attracted to lights). Due to the low impact of the lighting, it is unlikely that animals would alter their behaviour in response.                                | Areas associated with use of street and rail lighting. Lighting associated with the project would be designed to minimise light spill            |
| Habitat connectivity   | The entire rail corridor will be fenced (excluding areas in tunnel or on viaduct) to minimise potential wildlife strike. Fauna connectivity to existing waterways is currently limited. Viaducts, bridges and culverts have been designed to promote fauna habitat connectivity. Fauna movements are unlikely to be limited as a result of the project.   | Areas associated with remnant vegetation   |
| Aquatic ecology – change in peak flood velocities            | Increases in flow velocities can lead to increased potential for scour and erosion and need to be managed to prevent this occurring. Scour protection is to be incorporated within the design of proposed culvert crossings to reduce localised increase in velocities. Incorporation of rock protection would prevent scour and erosion impacts at the proposed culvert locations.   | Areas associated with waterways and water bodies   |
| Aquatic ecology – changes to duration of flood inundation    | The predicted changes in duration of inundation are generally minimal and comply with the design criteria (of limiting the change to no more than 10 per cent) for storm events up to and including the one per cent AEP event across the study area. There are several localised areas for which duration of inundation would increase by greater than 10 per cent. These occur at localised areas constricted by farm dams, or within waterway areas. | Areas associated with waterways and water bodies   |

| Operational biodiversity impact                           | Nature  | Extent   |
|---|---|--|
| Aquatic ecology – catchment and watercourse health impact | The project is not predicted to impact the existing hydrologic regime as the project footprint is minimal on the surface compared to the wider South Creek catchment. The potential changes to baseflow contribution from groundwater would influence the creek geomorphic condition (see Technical Paper 7 (Groundwater)). The project would require the removal and/or relocation of several farm dams but the removal would not impact the availability of surface water for downstream catchments. The impact of the project on catchment and watercourse health is deemed minimal but some localised changes may occur due to viaducts, culverts and baseflow contributions. | Areas associated with waterways and water bodies   |
| Aquatic ecology – water quality                           | Operation of the project has the potential to impact and degrade the water quality of the waterways within the study area and downstream. The most likely source of pollutants from completion and operation of the project would be concentrated flows from impervious surfaces that were previously pervious. An increase in impervious surfaces such as roofs and paved areas would have the potential to cause impacts on the water quality of the receiving waterways through increased runoff volumes and increased sedimentation or erosion.   | Areas associated with waterways and water bodies, specifically, Blaxland Creek and Cosgroves Creek |
| Aquatic ecology – viaduct impacts                         | Provided piers are not located in waterways, the proposed viaducts over Blaxland Creek and Cosgroves Creek will be unlikely to cause localised changes in flow behaviour. Changes to flow velocity and distribution may cause changes to scour and sedimentation characteristics of waterways. Runoff generated by viaducts would be controlled in discrete locations by the construction of grass swales. Water quality treatment measures would be included in each downpipe from viaducts. Where a viaduct crosses a major creek, water quality treatment would be included in the adjacent detention basins.  | Areas associated with waterways and water bodies, specifically, Blaxland Creek and Cosgroves Creek |
| Aquatic ecology – geomorphology impacts                   | Geomorphic impacts are predicted to be negligible because there would be minimal change to contributing catchment areas and therefore no change to flood flows. The viaduct piers have been located out of the main flow paths for each watercourse and the impact would not propagate downstream. The removal of several farm dams to construct the project is likely to result in a change to the frequency of low flow events. These changes may be counteracted by the inclusion of on-site detention basins designed to Penrith Council requirements and to match existing runoff characteristics.   | Areas associated with waterways and water bodies   |

Table 11-14 Biodiversity operational impacts (on-airport)

| Operational biodiversity impact                              | Nature  | Extent  |
|--|---|---|
| Reduced viability of adjacent habitat due to light pollution | Ecological light pollution includes direct glare, chronic or periodic increased illumination, and temporary unexpected fluctuations in lighting (including lights from passing vehicles) that can have potentially adverse effects on wildlife. The immediate airport area surrounding the project would have areas lit during operation and be subject to artificial lighting, essentially creating permanent daylight conditions. Light pollution may potentially affect nocturnal fauna by interrupting their lifecycle. Some species (i.e. light tolerant microchiropteran bats) may benefit from the lighting due to increased food availability (insects attracted to lights). It is likely that animals would alter their behaviour in response to the light disturbance and a long-term impact around lighting is likely. | Western Sydney International is proposed to be operational 24 hours a day, 7 days a week and would result in more significant light spill impacts compared to the project.<br><br>The potential for light spill impacts on fauna as a result of the project is therefore considered to be minor |
| Aquatic ecology – Changes to duration of flood inundation    | The flooding assessment for the project (summarised in Chapter 14 (Flooding, hydrology and water quality)) assumes the Stage 1 development of Western Sydney International is complete and operational. Changes to duration of inundation within Western Sydney International as a result of the project are predicted to be minimal. There are localised areas along Badgerys Creek where durations have increased, but these are small areas and are not considered to be a significant impact.   | Areas associated with waterways and water bodies, specifically Badgerys Creek   |
| Aquatic ecology – change in flood level and extent (afflux)  | The changes in flood level and extent (afflux) on-airport from the project are not substantial and are isolated to one location within Western Sydney International. The permanent spoil placement area is located across an overland flow path to Badgerys Creek, causing changes to flood behaviour through redistribution of floodwaters. Modelling indicates that this is not likely to be a substantial impact.  | Areas associated with waterways and water bodies, specifically Badgerys Creek   |
| Aquatic ecology – water quality                              | The most likely source of pollutants from the project would be the transformation of pervious areas to impervious surfaces. This would potentially cause impacts on the water quality of the receiving waterways through increased runoff volumes and increased pollutant loads, sedimentation or erosion. Station areas would feature areas of increased pedestrian and vehicle traffic which would potentially generate pollutants.   | Areas associated with waterways and water bodies in association with on-airport lands, specifically Badgerys Creek  |

## 11.7 Proposed management and mitigation measures

Environmental management for the project would be undertaken through an environmental management approach as detailed in Chapter 25 (Environmental management and mitigation). The construction and operational environmental management frameworks are discussed in Section 25.2 and 25.3 respectively.

A key performance outcome for the project is to appropriately offset residual impacts resulting from the project. Section 11.7.4 presents the biodiversity offsets requirements for the project.

### 11.7.1 Performance outcomes

Performance outcomes have been developed consistent with the requirements of the SEARs for the project. Performance outcomes for biodiversity for the project are listed in Table 11-15 and identify measurable, performance-based standards for environmental management.

**Table 11-15 Performance outcomes – biodiversity**

| SEARs desired performance outcome  | Project performance outcome   | Timing       |
|--|---|--------------|
| The project design considers all feasible measures to avoid and minimise impacts on terrestrial and aquatic biodiversity             | Minimise or where possible avoid impacts on threatened flora and fauna species, and ecological communities listed under the <i>Biodiversity Conservation Act 2016</i> (NSW) and <i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth)    | Construction |
|  | Manage groundwater drawdown at Orchard Hills to avoid or minimise impacts on groundwater dependent ecosystems   | Construction |
|  | No removal of any vegetation within the Thompsons Creek riparian zone or any adjacent areas that are non-certified under the South West Growth Area   | Construction |
|  | Culverts and bridges would be appropriately sized to maintain fauna habitat connectivity.   | Operation    |
|  | Maintain integrity and functionality of rail corridor fencing to minimise wildlife-train collision  | Operation    |
|  | Re-establish native vegetation in accordance with the <i>National Airports Safeguarding Framework</i> principles and guidelines including <i>Guideline C: Managing the Risk of Wildlife Strikes in the Vicinity of Airports</i> (Australian Government, 2014) | Operation    |
| Offsets and/or supplementary measures are assured which are equivalent to any residual impacts of project construction and operation | Impacts on threatened ecological communities and threatened species are offset in accordance with the requirements of the <i>NSW Biodiversity Assessment Method</i> (OEH, 2018)   | Construction |

### 11.7.2 Mitigation measures

A Construction Environmental Management Framework (CEMF) (Appendix F) describes the approach to environmental management, monitoring and reporting during construction. Specifically, it lists the requirements to be addressed by the construction contractor in developing the Construction Environmental Management Plans (CEMP), sub-plans, and other supporting documentation for each specific environmental aspect.

The Biodiversity CEMP for the on-airport works would be developed in consultation with Western Sydney Airport and would be consistent with the existing Western Sydney Airport Biodiversity Construction Environmental Management Plan. Mitigation measures that would be implemented under the provisions of the CEMF to address potential biodiversity impacts are listed in Table 11-16.

**Table 11-16 Biodiversity mitigation measures**

| Ref                 | Mitigation measures  | Applicable location(s)  |
|---------------------|--|---|
| <b>Construction</b> |  |   |
| FF1                 | <p>The Biodiversity Construction Environmental Management Plan (on-airport)/Flora and Fauna Management Plan (off-airport) would minimise and manage the clearing of native vegetation and habitat by:</p> <ul style="list-style-type: none"> <li>seeking to locate site offices, site compounds and ancillary facilities in areas where there are limited biodiversity values (e.g. cleared land)</li> <li>delaying the removal of vegetation until absolutely necessary</li> <li>avoiding the removal of hollow-bearing trees, where possible</li> <li>using a qualified surveyor and suitably qualified ecologist to mark out exclusion zones and clearing/project boundaries prior to construction</li> <li>providing contractors with regularly updated sensitive area maps (showing clearing boundaries and exclusion zones)</li> </ul> | <p>Orchard Hills construction site</p> <p>Off-airport construction corridor</p> <p>Stabling and maintenance facility construction site</p> <p>Luddenham Road construction site</p> <p>Airport construction support site</p> <p>Bringelly services facility construction site</p> <p>Aerotropolis Core construction site</p> |
| FF2                 | <p>A Nest Box Strategy would be prepared to minimise habitat loss to hollow-dependent fauna in accordance with the Flora and Fauna Management Plan and would include the following requirements:</p> <ul style="list-style-type: none"> <li>hollow-bearing trees would be marked/tagged and mapped prior to their removal. The size, type, number and location of nest boxes required would be based on the results of the pre-clearing survey</li> <li>about 70 per cent of nest boxes would be installed about one month prior to any vegetation removal to provide alternate habitat for hollow-dependent fauna displaced during clearing</li> </ul>  | <p>Claremont Meadows services facility construction site</p> <p>Off-airport construction corridor</p> <p>Airport construction support site</p>  |
| FF3                 | <p>Works on-airport would be undertaken in accordance with the nest box strategy included in the Western Sydney Airport Habitat Management subplan and in consultation with Western Sydney Airport</p>   | On-airport  |
| FF4                 | <p>A targeted microbat survey (Eastern Coastal Free-tailed Bat or Eastern False Pipistrelle) of dwellings and structures proposed for demolition, removal or modification would be undertaken in accordance with 'Species credit' threatened bats and their</p>  | Claremont Meadows services facility construction site   |

| Ref              | Mitigation measures   | Applicable location(s)  |
|------------------|---|---|
|                  | habitats NSW survey guide for the Biodiversity Assessment Method (OEH, 2018) prior to disturbance<br>Human-made structures such as culverts and other under-road structures within the construction footprint would be surveyed for threatened microbats (e.g. particularly the Southern Myotis) in accordance with the Biodiversity Assessment Method (OEH, 2018). If threatened microbats are detected, a Microbat Management Plan would be developed as part of the Biodiversity Construction Management Plan and implemented by a suitably qualified bat specialist   | Off-airport construction corridor<br><br>Airport construction support site  |
| FF5              | Works on-airport would be managed in accordance with the Western Sydney Airport Microbat Management Plan and in consultation with Western Sydney Airport  | On-airport  |
| FF6              | During construction, shading and artificial light impacts would be minimised in areas adjoining remnant bushland in intact condition  | Claremont Meadows services facility construction site<br><br>Orchard Hills construction site<br><br>Off-airport construction corridor |
| FF7              | Fish passage and fish habitat associated with Cosgroves Creek and Blaxland Creek would be protected in accordance with the <i>Policy and Guidelines for Fish Habitat Conservation and Management</i> (DPI (Fisheries NSW), 2013)  | Off-airport construction corridor   |
| <b>Operation</b> |   |   |
| FF8              | Wildlife connectivity would be maintained (where possible) through the installation of viaduct/bridge structures designed in accordance with the following: <ul style="list-style-type: none"> <li>• height and width of the area under a bridge to be maximised for all species, noting a minimum height of approximately 3 metres of dry passage will provide connectivity for most terrestrial species</li> <li>• bridges wide enough to encompass water flow, stream bank and riparian vegetation, preferably on both sides of the water course</li> <li>• for small and medium sized mammals, provide fauna furniture as shelter (e.g. vegetation, logs, rocks, leaf-litter, refuge pipes, escape poles, roofing tiles, and roofing iron)</li> <li>• height and carriageway separation designed to allow sufficient light and moisture to enhance growth of vegetation under the structure</li> <li>• if used for multiple purposes (e.g. pathways or access roads) aim to provide the 3 metre of natural passage for fauna</li> <li>• relocation or adjustment of the stream bed avoided where possible</li> <li>• the structure to tie in with the natural hydrology of the surrounding habitat such that the width, depth and gradient of the watercourse are maintained in the structure</li> <li>• consistent with the <i>Policy and Guidelines for Fish Friendly Waterway Crossings</i> (DPI (Fisheries NSW), 2013)</li> </ul> | Off-airport   |



### 11.7.3 Consideration of the interaction between measures

Mitigation measures in other chapters that are relevant to the management of potential biodiversity impacts include:

- Chapter 10 (Noise and vibration), specifically measures to minimise noise and vibration impacts that have the potential to result in indirect impacts on fauna during construction and operation
- Chapter 14 (Flooding, hydrology and water quality), specifically measures to minimise ecological impacts from the discharge of treated construction water and from the operational water treatment plants, and for erosion and sedimentation controls to avoid impacts on aquatic habitat
- Chapter 15 (Groundwater and geology), specifically measures to minimise impacts on groundwater dependent ecosystems
- Chapter 20 (Landscape and visual), specifically measures relating to tree retention and protection during construction and to minimise light spill impacts on surrounding receivers including fauna during construction and operation
- Chapter 22 (Air quality), specifically measures which address dust impacts from spoil handling and stockpiles, reducing potential impacts on surrounding vegetation.

### 11.7.4 Biodiversity offset requirements

Residual impacts that are not able to be avoided or managed through mitigation measures would be offset in accordance with the BAM based on the BAM Calculator calculations for both TECs (ecosystem credits) and threatened species (species credits). Further detail on the calculations for the project's offset obligation is provided in Chapter 12 of Technical Paper 3 (Biodiversity Development Assessment Report).

The project offset obligation has been calculated to require the following biodiversity credits:

- off-airport
  - 895 ecosystem credits
  - 2,998 species credits.
- on-airport
  - 47 ecosystem credits
  - 18 species credits.

The biodiversity offset strategy for the project comprises two options:

- the purchase and retirement of existing biodiversity credits currently available on the biodiversity credit register
- making a payment into the Biodiversity Conservation Fund.

This obligation may be refined as further field work is undertaken and design development reduces the impacts of the project.