Public Transport Authority

Thornlie-Cockburn Link

Biological Assessment of Native Vegetation Clearing Permit Areas

November 2020

Executive summary

METRONET is the State government's program of projects to increase the size of Perth's railway network, whilst also supporting the planning of integrated station precincts, to support growth of the Perth metropolitan region. The Thornlie-Cockburn Link Project (TCL) is an extension of the passenger railway between Thornlie and Cockburn. The alignment extends from Beckenham Station to Thornlie Station and through to Cockburn Central Station, a distance of approximately 18 kilometres (km).

The Public Transport Authority (PTA) has commissioned a number of biological surveys for the TCL project, including reconnaissance and detailed flora and vegetation surveys, fauna surveys, black cockatoo habitat assessment and targeted flora surveys (GHD 2013, 2019a, 2019b and, 2020). During the design process, additional areas have been identified as requiring assessment. Consequently, further ecological surveys of these additional areas are required to support environmental approvals.

GHD Pty Ltd (GHD) was engaged by the PTA to undertake an ecological survey of Native Vegetation Clearing Permit (NVCP) areas for the TCL project. The purpose of the survey was to delineate key flora, vegetation and fauna values within the NVCP areas. This report summarises the ecological survey results. The results will be used to identify and assess the ecological impacts of the project and inform environmental assessment.

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.6 and the assumptions and qualifications contained throughout the Report.

Survey results

Vegetation

Seven vegetation types and cleared areas were mapped within the survey area. Three represented remnant native vegetation communities VT01, VT02 and VT04. The remaining vegetation types are in a varied state of degradation due to previous modifications such as clearing, revegetation and weed invasion.

The vegetation condition ranged from Good to Completely Degraded. Cleared areas associated with roads, rail and infrastructure made up nearly half (44 %) of the survey area, most of the survey area was in Degraded condition (52 %).

No Threatened Ecological Communities (TECs) as listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or the *Biodiversity Conservation Act 2016* (BC Act) were identified during the field survey. No Priority Ecological Communities (PECs) as listed by the Department of Biodiversity, Conservation and Attractions (DBCA) were identified within the survey area. No other significant vegetation growing in association with watercourses or wetlands was identified during the survey.

Flora

No flora listed under the EPBC Act or BC Act were recorded in the survey area. *Grevillea olivacea*, listed as a Priority 4 (P4) by DBCA was located in several locations within the survey area. A likelihood of occurrence assessment was conducted post-field surveys for all significant flora taxa identified in the desktop and field assessments undertaken by GHD (2019a). The likelihood of occurrence assessment concluded that one taxon is known to occur within the survey area (*Grevillea olivacea*), and one may possibly occur, *Caladenia huegelii* (Grand Spider Orchid), listed as Endangered by the EPBC Act and Threatened under the BC Act.

Black Cockatoo Habitat

The Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) – listed as Vulnerable under both the EPBC Act and BC Act was heard on two occasions near the survey area. Based on the vegetation assemblages present, the survey area contains approximately 9.67 ha of suitable foraging habitat for black cockatoos, 5.23 ha is considered to have high habitat value. Recent foraging signs of the Forest Red-tailed Black Cockatoo included chewed Marri fruits in several locations within the survey area. No suitable black cockatoo roost sites were located within the survey area. Ninety-seven potential breeding trees were recorded within the survey area. No potential nest hollows were detected in these trees and no black cockatoo breeding behaviour was observed within the survey area.

Other significant fauna

No other significant fauna species were recorded during the survey. Five significant fauna are considered likely to occur within the survey area based on the habitat types available:

- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) – listed as Endangered under both EPBC Act and BC Act
- Southern Brown Bandicoot / Quenda (*Isoodon fusciventer)* – listed as P4 by DBCA
- Peregrine Falcon (*Falco peregrinus*) – listed as other specially protected fauna by DBCA
- Perth Slider (*Lerista lineata*) – listed as P3 by DBCA
- Black Striped Snake (*Neelaps calonotos*) – listed as P3 by DBCA.

Assessment against the ten clearing principles

An assessment of the survey area against the Ten Clearing Principles determined that clearing within the survey area is likely to be at variance to:

- b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to WA
- e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.

The assessment also determined that clearing within the survey area may be at variance to:

- (c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.

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1. Introduction

1.1 Project background

METRONET is the State government's program of projects to increase the size of Perth's railway network, whilst also supporting the planning of integrated station precincts, to support growth of the Perth metropolitan region. The Thornlie-Cockburn Link Project (TCL) is an extension of the passenger railway between Thornlie and Cockburn. The alignment extends from Beckenham Station to Thornlie Station and through to Cockburn Central Station, a distance of approximately 18 kilometres (km). The TCL also includes two new stations, park and ride facilities at Ranford Road and Nicholson Road in Canning Vale, the duplication of the existing rail bridge over the Canning River, and drainage infrastructure areas outside of the rail reserve.

The Public Transport Authority (PTA) has commissioned a number of biological surveys for the TCL project, including reconnaissance and detailed flora and vegetation surveys, fauna surveys, black cockatoo habitat assessment and targeted flora surveys (GHD 2013, 2019a, 2019b and, 2020). During the design process, additional areas have been identified as requiring assessment. Consequently, further ecological surveys of these additional areas are required to support environmental approvals.

1.2 Purpose of the report

GHD Pty Ltd (GHD) was engaged by the PTA to undertake an ecological survey of Native Vegetation Clearing Permit (NVCP) areas for the TCL project. The purpose of the survey was to delineate key flora, vegetation and fauna values within the NVCP areas. This report summarises the ecological survey results. The results will be used to identify and assess the ecological impacts of the project and inform environmental assessment.

1.3 Project location

The NVCP areas are located adjacent or near to the TCL Development Envelope (DE), which extends from Beckenham Station to Cockburn Central Station. The NVCP areas (referred collectively as the survey area) cover 19.83 hectares (ha). The survey area is mapped in Figure 1, Appendix A.

1.4 Scope of works

The scope of works included:

- An ecological survey of the survey area to identify and map:
  - Vegetation community types present, including presence of any Threatened or Priority Ecological Communities (TECs and PECs).
  - Vegetation condition, including the locations of any Weeds of National Significance (WoNS) or Declared Weeds
  - Vegetation growing in association with wetlands or watercourses
  - Significant flora
  - Black cockatoo potential (or confirmed) trees and foraging habitat
  - Significant fauna

- Preparation of an ecological survey report (this document) that includes the results and findings of the survey, including a justification of the survey methodology, and supporting maps and figures
- An assessment against the Ten Clearing Principles as listed under Schedule 5 of the *Environmental Protection Act 1986* (EP Act)
- Provision of spatial data in GIS format.

1.5 Relevant legislation, conservation codes and background information

In Western Australia (WA) significant communities, and flora and fauna are protected under both Commonwealth and State Government legislation. In addition, regulatory bodies also provide a range of guidance and information on expected standards and protocols for environmental surveys.

An overview of key legislation and guidelines, conservation codes and background information relevant to the survey area are provided in Appendix B.

1.6 Limitations and assumptions

This report has been prepared by GHD for PTA and may only be used and relied on by PTA for the purpose agreed between GHD and PTA as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than PTA arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible. The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

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

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

GHD has prepared this report on the basis of information provided by PTA and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of infrastructure, access tracks and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions may change after the date of this report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

This report has assessed the flora and fauna values within the survey area, as shown in Figure 1, Appendix A. Should the survey area change or be refined, further assessment may be required.

2. Methodology

2.1 Desktop review

Prior to the commencement of the field survey, a desktop assessment was undertaken to identify relevant ecological information pertaining to the survey area and to assist in survey design. The desktop assessment involved a review of previous reports and memorandum relevant to the project, including:

- Thornlie Cockburn Link, Biological Assessment of Additional Areas (GHD 2020)
- Thornlie-Cockburn Link Project Flora and Fauna Survey (GHD 2019a)
- Thornlie-Cockburn Link Project Additional Targeted Flora Survey Memorandum (GHD 2019b)
- Ranford Road Bushland, Flora and Fauna Report (Natural Area Consulting 2016)
- Thornlie Extension Environmental Assessment (GHD 2013).
- Harry Sandon Reserve and Ken Hurst Park: Vegetation and Flora Assessment Report (360 Environmental 2012).

2.2 Field survey

2.2.1 Vegetation and significant flora

GHD ecologist [redacted] (flora license no. FB62000080-2) completed an out of season flora and vegetation assessment of the survey area on 28 and 29 July 2020. The field survey was undertaken to identify and describe the dominant vegetation units, assess vegetation condition and search for significant flora taxa.

The survey methodology employed by GHD was undertaken with reference to the Environmental Protection Authority (EPA) Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016).

Data collection

Field survey methods involved a combination of sampling quadrats and relevés located in identified vegetation units and traversing the survey area by foot. One non-permanent quadrat (measuring 10 m x 10 m – area of 100 m ^{2}) and eight relevés were located within identified vegetation units and throughout the survey area to cover geographic range. The quadrat and relevé data was supplemented by previous survey effort in adjacent areas (as part of the TCL project) to achieve adequate sampling sites and effort per vegetation unit. Field data at each quadrat was recorded on a proforma data sheet and included the parameters detailed in Table 1. Field data is provided in Appendix C.

Table 1 Data collected during the field survey

Aspect	Measurement
Collection attributes	Site code, personnel/recorder, quadrat dimensions and photograph of the quadrat
Physical features	Landform, slope, aspect, soil attributes, ground surface cover, leaf and wood litter
Location	Coordinate recorded in GDA94 using a hand-held Global Positioning System (GPS) tool to an accuracy approximately ± 5 m.
Vegetation condition	Vegetation condition using the condition rating scale adapted by EPA (2016) for the South West Botanical Province.

Aspect	Measurement
Disturbance	Level and nature of disturbance (e.g. weed presence, fire and time since last fire, impacts from grazing, anthropogenic impacts)
Flora	List of dominant flora from each structural layer, list of all species within the quadrat including stratum, average height and cover (using National Vegetation Information System (NVIS)).

Vegetation units and mapping

Vegetation units were identified and boundaries mapped using a combination of aerial photography, field data/ observations and previous vegetation mapping. The vegetation units were aligned to previously described vegetation units (e.g. GHD 2019a, 2020) where possible. The vegetation units were described based on structure, dominant taxa and cover characteristics as defined by quadrat data and field observations. Vegetation unit descriptions followed NVIS and were consistent with NVIS level V (Association) (NVIS Technical Working Group 2017).

Identification of vegetation growing in association with wetlands or watercourses

Vegetation growing in association with wetlands or watercourses was identified based on field observations (e.g. vegetation structure, typical and common species, soils and landforms).

Vegetation condition

The vegetation condition was assessed and mapped in accordance with the vegetation condition rating scale for the South West and Interzone Botanical Provinces of WA (devised by Keighery (1994) and adapted by EPA (2016)). The scale recognises the intactness of vegetation and consists of six rating levels. The vegetation condition rating scale is outlined in Appendix B.

Targeted flora searches

Significant flora identified as part of database searches completed by GHD (2019a & 2020) were targeted during the field survey. Within the survey area, potential habitats and locations of previous records were searched by opportunistic sampling. Where individuals were identified, the location and number of plants present was recorded using a handheld GPS. Additional data was also recorded to support the lodgement of a Threatened and Priority Flora Report Form.

Flora identification and nomenclature

Species well known to the survey ecologist were identified in the field; all other species were collected and assigned a unique collection number to facilitate tracking. All specimens collected during the field assessment were dried and processed in accordance with the requirements of the WA Herbarium. Species were identified by the use of taxonomic literature, electronic keys and online electronic databases.

The conservation status of recorded flora was compared against the current lists available on FloraBase (WA Herbarium 1998–) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Threatened species database provided by the Department of Agriculture, Water and the Environment (DAWE). Nomenclature used in this report follows that used by the WA Herbarium as reported on FloraBase.

2.2.2 Black cockatoo and significant fauna

A black cockatoo habitat assessment of the survey area was undertaken con-currently with the vegetation and significant flora survey. The survey area was traversed on foot to identify and map suitable black cockatoo habitat. An assessment of the likelihood of occurrence of

significant fauna was also undertaken based on database searches results (completed for GHD 2019a & 2020) and previous local studies in consideration of fauna habitats occurring within the survey area.

The survey methodology employed by GHD was undertaken with reference to the EPA Technical Guidance – Terrestrial Fauna Surveys (EPA 2020)

Black cockatoo habitat assessment

The black cockatoo habitat assessment was undertaken in accordance with the EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's Cockatoo (endangered) *Calyptorhynchus latirostris*, Baudin's Cockatoo (vulnerable) *Calyptorhynchus baudinii*, Forest Red Tailed Black Cockatoo (vulnerable) *Calyptorhynchus banksii naso* (Department of Sustainability, Environment, Water, Populations and Communities (DSEWPaC) 2012). The assessment included:

- The identification and recording (via GPS) of the locations of potential and actual breeding habitat within the survey area (relevant tree species with a diameter at breast height (DBH) of >500 millimetres (mm) for Jarrah, Marri and Tuart or DBH of >300 mm for Wandoo or Salmon Gum)
- Identifying, describing and recording the size of existing tree hollows and any evidence of use by black cockatoos within the survey area
- Identifying, recording and describing the locations of potential night roosting habitat
- Identifying, recording and describing the locations of potential foraging habitat.

The survey distinguished between actual and potential breeding habitat as per the following:

- Actual nest trees: Evidenced as currently being used or have been used in the past
- Potential breeding habitat: trees with available hollows that do not show evidence of use now or in the past. Trees with hollows that do not show evidence of use now or in the past where the hollow is not available (e.g. hollows are occupied by bees or galahs); and those trees without hollows but which have the potential to develop hollows in the future, and which have DBH >500 mm or 300 mm for different species. This was a ground based assessment using binoculars to identify potential and/or actual breeding hollows.

Fauna species identification

Identification of fauna species was made in the field using available field guides and electronic guides. Nomenclature used in this report follows that used by the WA Museum and the DBCA NatureMap (DBCA 2007–) with the exception of birds, where by Christidis and Boles (2008) was used.

2.3 Limitations

2.3.1 Field survey limitations

The EPA (2016, 2020) Technical Guide states flora and vegetation and fauna survey reports for environmental impact assessment in WA should contain a section describing the limitations of the survey methods used. The limitations and constraints associated with this field survey are discussed in Table 2. Based on this assessment, the present survey effort has not been subject to any constraints which affect the thoroughness of the assessment and the conclusions which have been formed.

Table 2 Field survey and data analysis limitations

Aspect	Constraint	Comment
Sources of information and availability of contextual information.	Nil	Adequate information is available for the survey area, this includes: • *Thornlie Cockburn Link, Biological Assessment of Additional Areas* (GHD 2020) • *Thornlie-Cockburn Link Project Flora and Fauna Survey* (GHD 2019a) • *Thornlie-Cockburn Link Project Additional Targeted Flora Survey* (GHD 2019b) • *Ranford Road Bushland, Flora and Fauna Report* (Natural Area Consulting 2016) • *Thornlie Extension Environmental Assessment* (GHD 2013) • *Harry Sandon Reserve and Ken Hurst Park: Vegetation and Flora Assessment Report* (360 Environmental 2012).
Scope (what life forms were sampled etc.)	Nil	Vascular flora and terrestrial vertebrate fauna were sampled during the survey. Non-vascular flora, invertebrate and aquatic fauna were not surveyed.
Proportion of flora collected and identified (based on sampling, timing and intensity) Proportion of fauna identified, recorded and/or collected	Minor	The vegetation and flora survey was undertaken in winter; 28 and 29 July 2020. The flora recorded from the field survey are limited to dominant flora only identified as part of describing vegetation types. As with any biological survey, ephemeral species such as orchids are not always present in each year/season or at the particular time a single botanical survey is conducted. The black cockatoo habitat assessment was undertaken in in conjunction with the vegetation and flora survey. The assessment was limited to identifying habitat types for black cockatoos and other significant fauna utilising the survey area. No sampling for invertebrates or aquatic species occurred.
Flora determination	Minor	Flora determination was undertaken by the GHD ecologist in the field and at the WA Herbarium. One taxon could only be identified to family level and four taxa could only be identified to genus level due to lack of flowering and/or fruiting material required for identification. These collections showed no similarities with known, likely or possibly occurring conservation significant flora identified in the desktop searches. The taxonomy and conservation status of the WA flora is dynamic. This report was prepared with reliance on taxonomy and conservation status current at the time report development, but it should be noted this may change in response to ongoing research and review of International Union for Conservation Nature criteria.
Completeness and further work which might be needed (e.g. was the relevant area fully surveyed)	Minor	One small area of VT01 (0.11 ha) was inaccessible during the survey (see Access restrictions below). This area was assessed through cyclone fencing. All other areas were adequately surveyed during the field survey in line with the scope.
Mapping reliability	Minor	The vegetation was mapped using high-resolution ESRI aerial imagery obtained from Landgate, topographical features, previous broad scale mapping (GHD 2020, 2019a, 2019b, 2013 Natural Area Consulting 2016 and 360 Environmental 2012) and field data. Data was recorded in the field using hand-held GPS tools (e.g. Samsung S2 Tablets and Garmin GPS). Certain atmospheric factors and other sources can affect the accuracy of GPS receivers. The Garmin GPS units used

Aspect	Constraint	Comment
		for this survey are accurate to within ±5 metres on average. Therefore the data points consisting of coordinates recorded from the GPS may contain inaccuracies.
Timing/weather/ season/cycle	Minor	The vegetation, flora and black cockatoo habitat assessment were conducted during winter (28 & 29 July 2020). This timing is outside of the recommended survey timing for vegetation surveys on the Swan Coastal Plain (optimal timing spring – September to November; EPA 2016). The closest weather recording station to the survey area is Gosnells City weather recording station (No. 009106, Bureau of Meteorology (BoM) 2020) (located approximately 2.3 km from the survey area). The Gosnells City station has no data for the monthly rainfall average for May and June. The total rainfall average recorded for July was 14.4 mm; however, 15 days of data were not available. Even though data was not available for the 3 months prior to the field survey, the weather conditions recorded prior to the field survey is considered unlikely to have significantly impacted upon the vegetation, flora and black cockatoo habitat assessment.
Disturbances (e.g. fire, flood, accidental human intervention)	Nil	Parts of the survey area has been subjected to historical disturbances (e.g. anthropogenic); however, these disturbances did not impact the survey.
Intensity (in retrospect, was the intensity adequate)	Nil	The vascular flora of the survey area was sampled with reference to EPA (2016). The quadrat and relevé data was supplemented by previous survey effort in adjacent areas (as part of the TCL project) to achieve three quadrats per vegetation unit. However, due to the linear nature of the survey areas, where vegetation units were restricted, or in degraded condition, less than three quadrats per vegetation unit were described. The survey area was sufficiently covered by the GHD ecologist during the field survey.
Resources	Nil	Adequate resources were employed during the field survey: 2 person days were spent undertaking the field survey using one ecologist.
Access restrictions	Minor	The survey area was accessed on foot and traversed by vehicle. A small patch of VT01 (0.11 ha) located within the Western Power Jandakot Distribution Centre was fenced off an inaccessible. This area was described and mapped by observing through the cyclone fence that surrounded it.
Experience levels	Nil	GHD ecologist Angela Benkovic undertook the field survey. Angela is suitably qualified and experienced in her field with over 14 years' experience undertaking flora surveys within WA.

3. Field results

3.1 Vegetation and flora

3.1.1 Vegetation types

The survey area consisted of multiple patches located adjacent to the TCL project. These areas occur along an already highly modified landscape with occasional bushland remnants. Previous surveys of the TCL project identified 13 vegetation types. Seven of these vegetation types as well as cleared areas, were mapped within the survey area (Table 3 and Figure 2, Appendix A). Of these vegetation types three represented remnant native vegetation communities: VT01, VT02 and VT04. The remaining vegetation types are in a varied state of degradation due to previous modifications such as clearing, revegetation and weed invasion.

The two dominant vegetation types within the survey area were VT06 (4.68 ha) and VT12 (4.44 ha). VT06 was represented by clumps of native trees, whilst VT12 was dominated by planted trees and/ or introduced shrubs.

The occurrences of remnant native vegetation VT01 (0.20 ha) and VT04 (0.35 ha) was mapped along Training Place at the western most extent of the survey area. VT02 (0.07 ha) was mapped within the south extent of Ken Hurst Park, adjacent to the Canning Landfill and Recycling Facility and rail corridor.

Vegetation type VT02 occurs along the outer edge of a Conservation Category Wetland (CCW) (UFI 16112). The vegetation of VT02 was a mixture of lowland and upland species growing on a substrate of grey sandy soil. There was no evidence of permanent water or seasonal inundation within the area or surrounds. VT02 is not considered to be representative of vegetation that grows in association with watercourses or wetlands.

3.1.2 Vegetation condition

The vegetation condition within the survey area ranged from Good to Completely Degraded condition. The extents of the vegetation condition ratings mapped within the survey area are detailed in Table 4 and mapped in Figure 3, Appendix A.

Cleared areas associated with roads, rail and infrastructure made up nearly half (44 %) of the survey area, most of the survey area was in Degraded condition (52 %). The survey area is patchy, linear and in most cases fragmented from nearby bushland. Weed dominance and loss of basic structure from historical clearing has likely resulted in the reduced condition. Two sections of the survey area were mapped as Good in condition. A patch of Banksia woodland (VT01) that occurred within the Western Power Jandakot Distribution Centre was fenced off and inaccessible, however the vegetation was easily observed through the cyclone fencing. Vegetation type VT02, located within Ken Hurst Park was also mapped as Good condition.

Table 3 Recorded vegetation types

Vegetation type	Vegetation type description	Landform and substrate	Extent (ha)	Sample locations and notes	Representative photograph
Banksia menziesii and *B. attenuata* woodland (VT01)	*Eucalyptus todtiana* and *Nuytsia floribunda* isolated trees over *Banksia menziesii, B attenuata* woodland over *Xanthorrhoea preissii, Hibbertia* spp. sparse shrubland over diverse heathland	Plain with grey sandy soils	0.20 ha	Relevé: 11 Quadrats: 1, 3, 4, 8, 11 Relevé: 2 (GHD 2019a) Quadrats: 3, 4, 5 (GHD 2020) Represents native vegetation.	
Regelia inops Hypocalymma angustifolium shrubland (VT02)	*Melaleuca preissiana/ Banksia ilicifolia/ B. littoralis* isolated trees over *Regelia inops, Hypocalymma angustifolium* shrubland over *Phlebocarya ciliatum, Dasypogon bromeliifolius* closed herbland	Plain with grey sandy soils	0.07 ha	Quadrat 13 Quadrats: 2, 10 (GHD 2019a) Represents native vegetation.	
Adenanthos cygnorum shrubland (VT04)	*Corymbia calophylla, Eucalyptus todtiana* isolated clumps of trees over *Adenanthos cygnorum* sparse shrubland over **Cenchrus setaceus* sparse grassland	Modified terrain with yellow sandy soils.	0.35 ha	Relevé: 10 Relevé: 1 (GHD 2019a) Represents native vegetation.	

Vegetation type	Vegetation type description	Landform and substrate	Extent (ha)	Sample locations and notes	Representative photograph
Scattered natives (VT06)	*Corymbia calophylla/ Eucalyptus rudis/ E. todtiana/ E. gomphocephala/ *Eucalyptus* spp. isolated clumps of trees over introduced herbland/ grassland	Plain with grey sandy soils	4.68 ha	Relevé: 12, 14 Relevé: 4, 5, 6, 7 8 & 9 (GHD 2019a) Represents native vegetation.	
Grassland/ Herbland (VT07)	Weedy closed grassland/ herbland with occasional natives	Modified landforms	1.18 ha	Represents non-native vegetation.	
Revegetation (VT10)	*Melaleuca rhaphiophylla* isolated trees over **Callistemon phoeniceus, Chamelaucium uncinatum* and *Kunzea glabrescens* shrubland over planted Restionaceae spp.	Modified landforms	0.19 ha	Relevé: 16 Recent planting likely to be 10 years old (or less).	

Vegetation type	Vegetation type description	Landform and substrate	Extent (ha)	Sample locations and notes	Representative photograph
Planted trees and/ or introduced shrubs (VT12)	**Eucalyptus* spp. and **Casuarina* sp. isolated trees over *Adenanthos cygnorum, *Acacia longifolia, *Acacia iteaphylla, Kunzea glabrescens* isolated clumps of shrubs over dense weeds	Modified landforms	4.44 ha	Relevé: 13, 15, 17 Represents non-native vegetation.	
Cleared	Road, rail and/ or infrastructure		8.71 ha		

Table 4 Vegetation condition ratings mapped within the survey area

Vegetation Condition	Extent in survey area (ha)
Good	0.18
Good - Degraded	0.09
Degraded	10.37
Degraded - Completely Degraded	0.07
Completely Degraded	0.40
Cleared	8.71
Total	**19.83**

3.1.3 Significant ecological communities

No TECs as listed under the EPBC Act or the BC Act were identified during the field survey. Additionally no PECs as listed by DBCA were identified within the survey area.

3.1.4 Vegetation growing in association with watercourses or wetlands

No vegetation growing in association with watercourses or wetlands was identified during the field survey. VT02 lies on the edge of a CCW, with a mixture of lowland and upland species growing on a dry grey sandy substrate. No permanent water or seasonal inundation was observed within the area mapped as VT02 or within the immediate surrounding area. Relevé 16 describes a man-made drainage line that has been revegetated (VT10) with native and non-native vegetation. This drainage line continues west for approximately 500 m. The vegetation in this area was mapped as VT06 and was dominated by isolated clumps of *Eucalyptus gomphocephala, E. rudis* and *Corymbia calophylla.* Another man-made drainage line follows the rail alignment along Railway Parade (R14). The vegetation in this area was also mapped as VT06 and dominated by *C. calophylla*. Although water was present within both man-made drainage lines at the time of the survey these areas are not considered riparian or wetland vegetation due to the highly modified landscape.

3.1.5 Flora diversity

Seventy-one (71) flora taxa (including subspecies and varieties) representing 24 families and 54 genera were recorded from the survey area during the field survey. This total comprised of 32 native and 39 introduced or planted flora taxa.

Dominant families recorded from the survey area included:

- Myrtaceae (17 taxa)
- Proteaceae (10 taxa)
- Fabaceae (8 taxa).

3.1.6 Significant flora

No flora listed under the EPBC Act or BC Act were recorded in the survey area. *Grevillea olivacea*, listed as a Priority 4 (P4) by DBCA was located in several locations within the survey area. *Grevillea olivacea* was not identified within the database searches as the natural distribution of this species is within the Geraldton Sandplains and the northern extent of the Swan Coastal Plain (SCP). The species has naturalised in Perth and is commonly found within parks and roadside vegetation.

Likelihood of occurrence

A likelihood of occurrence assessment was conducted post-field surveys for all significant flora taxa identified in the desktop and field assessments undertaken by GHD (2020, 2019a, 2019b and 2013). This assessment took into account previous and closest records, habitat

requirements, efficacy of the survey, intensity of the survey, flowering times and the cryptic nature of species. The likelihood of occurrence assessment presented in GHD (2019a) are also applicable to this survey and survey area. The likelihood of occurrence assessment post-survey concluded that one taxon is known to occur within the survey area (*Grevillea olivacea,* as discussed above), and one may possibly occur, *Caladenia huegelii* (Grand Spider Orchid), listed as Endangered by the EPBC Act and Threatened under the BC Act.

Caladenia huegelii was recorded in several separate locations within Banksia woodland near the survey area. The closest was ~1.5 km east within Ken Hurst Park (GHD 2019b). The small pocket of VT01 located within the fenced Western Power Distribution Centre is considered suitable habitat for this species. As the survey was undertaken outside of the reported flowering period for *Caladenia huegelii* its presence within the survey area is considered possible.

The remaining taxa are considered unlikely to occur within the survey area due to the cleared and degraded nature of the survey area and lack of suitable habitat. Previous reports identified a significant number of conservation significant species occurring within 1 km of the survey area which is largely a result of its proximity to the Brixton Street Wetlands. The Brixton Street Wetlands is the most floristically diverse Bush Forever site on the SCP and contains a number of rare and restricted plant species and vegetation communities (DAWE 2020b). A large proportion of the significant flora found within this reserve are considered unlikely to be present within the survey area due to a lack of suitable habitat.

3.1.7 Introduced flora

Thirty-nine (39) introduced/ planted flora taxa were recorded in the survey area. The whole survey area has been impacted to some degree and has resulted in the introduction of a number of introduced species. The most commonly recorded weed species in the survey area were grasses: **Cenchrus setaceus,*Ehrharta calycina, *E. longifolia, *Eragrostis curvula* and **Briza maxima.*

No Declared Pests, as listed under the *Biosecurity and Agriculture Management Act 2007*, or WoNS were recorded within the survey area during the field survey

3.2 Significant fauna

3.2.1 Black cockatoo habitat

The Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) – listed as Vulnerable under both the EPBC Act and BC Act was heard on two occasions near the survey area. A summary of the Black Cockatoo assessment is presented in Table 5.

Potential breeding

Ninety-seven potential breeding trees were recorded within the survey area (Figure 4, Appendix A). These trees were represented by *Eucalyptus rudis, E. gomphocephala* and *Corymbia calophylla* and had a trunk diameter at breast height (DBH) greater than 500 mm. No potential nest hollows were detected in these trees and no black cockatoo breeding behaviour was observed within the survey area.

Foraging habitat

Based on the vegetation assemblages present, the survey area contains approximately 9.67 ha of suitable foraging habitat for black cockatoos. High value foraging vegetation types were VT01, VT04 and VT06 (5.23 ha). These areas included *Banksia* woodlands and scattered occurrences of Corymbia calophylla, Eucalyptus rudis and E. gomphocephala as well as a suite of shrub species known to be utilised by black cockatoos. VT12 is considered to have low

foraging value with introduced *Eucalyptus* spp. and *Casuarina* spp (4.44 ha). Recent foraging signs of the Forest Red-tailed Black Cockatoo included chewed Marri fruits in several locations within the survey area (Plate 1 and Figure 4, Appendix A).

Plate 1 Forest Red-tailed Black Cockatoo foraging evidence

Roosting habitat

No suitable black cockatoo roost sites were located within the survey area. The closest known roosts in proximity to the survey area are Bibra Lakes and Leeming, both <1 km north (GoWA 2020a).

Table 5 Black Cockatoo habitat within the survey area

Habitat type	Survey area
Foraging habitat	**Carnaby's Cockatoo** There is 9.67 ha of foraging habitat within the survey area for Carnaby's Cockatoo including: • *Banksia* Woodland (VT01) – 0.20 ha • *Adenanthos cygnorum* shrubland (VT04) – 0.35 ha. • Scattered natives (VT06) – 4.68 ha. • Planted trees and/ or introduced shrubs (VT12) – 4.44 ha **Forest Red-tailed Black Cockatoo** Four habitat feeding events were recorded for the Forest Red-tailed Black Cockatoo in the survey area on Marri fruits. There is 9.48 ha of foraging habitat for the Forest Red-tailed Black Cockatoo within the survey area: • *Adenanthos cygnorum* shrubland (VT04) – 0.35 ha • Scattered natives (VT06) – 4.68 ha • Planted trees and/ or introduced shrubs (VT12) – 4.44 ha It is noted that both VT04 and VT12 contain isolated foraging species for black cockatoos (such as Marri, *Casuarina* spp. and/ or *Eucalyptus* spp.) and therefore use is likely to be opportunistic.
Actual breeding habitat	No evidence of breeding was recorded within the survey area during the field survey
Potential breeding habitat	97 trees with a DBH of >500 mm were recorded. These consisted of 48 *Corymbia calophylla*, 37 *Eucalyptus gomphocephala* and 12 *E. rudis*. None of these trees had any hollows considered suitable to for breeding.
Roosting habitat	No roosting sites were recorded as being used by Black Cockatoos within the survey area

3.2.2 Other conservation significant fauna

No other significant fauna species were recorded during the survey. Five significant fauna are considered likely to occur within the survey area based on the habitat types available:

- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) – listed as Endangered under both EPBC Act and BC Act
- Southern Brown Bandicoot / Quenda (*Isoodon fusciventer)* – listed as P4 by DBCA
- Peregrine Falcon (*Falco peregrinus*) – listed as other specially protected fauna by DBCA
- Perth Slider (*Lerista lineata*) – listed as P3 by DBCA
- Black Striped Snake (*Neelaps calonotos*) – listed as P3 by DBCA.

All other significant fauna are considered unlikely or highly unlikely to occur within the survey area.

4. Ten clearing principles assessment

An assessment of the survey area against the Ten Clearing Principles was undertaken and is provided in Table 6. The assessment determined that clearing within the survey area is likely to be at variance to:

- b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to WA
- e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.

The assessment also determined that clearing within the survey area may possibly be at variance to:

- (c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.

Table 6 Assessment against the Ten Clearing Principles

Principle	Assessment	Outcome
(a) Native vegetation should not be cleared if it comprises a high level of biological diversity.	The survey area is situated in the South West Botanical Province of WA (Beard 1990) within the SWA bioregion and the Perth subregion. The survey area covers 19.83 ha, of which 8.71 ha is road rail or infrastructure and the remaining 11.12 ha is comprised of highly modified vegetation with occasional small bushland remnants. Seven vegetation types were mapped for the survey area including three native vegetation types and four vegetation types that had been highly modified from their natural state.. The condition of the vegetation ranged from Good to Degraded – Completely Degraded. Most of the vegetation was Degraded (93%) with 1.6 % mapped as Good. The survey area is linear, patchy and surrounded by residential housing and infrastructure associated with the rail line. The survey area does not contain areas of native vegetation that are in better condition, or offer a higher floristic value than the surrounding environment. The survey area intersects two Environmentally Sensitive Areas (ESAs), one of which is also Bush Forever site Ken Hurst Park, Leeming (site 245) (GoWA 2020 & GoWA 2000). Desktop searches identified one EPBC Act-listed TEC, which is also listed as a PEC by DBCA, intersecting the survey area; Banksia woodlands of the Swan Coastal Plain TEC/PEC. The vegetation within the survey area did not align with the above mentioned TEC/PEC due to the size and degraded state of the remnant vegetation. No other TECs or PECs were mapped within the survey area. Additionally no other significant vegetation was recorded in the survey area. One thousand, two hundred and eighty six native flora taxa have been previously recorded within 5 km of the survey area (DBCA 2007–). The field survey recorded 71 flora taxa representing 24 families and 54 genera. This total comprised 32 native flora taxa, 39 introduced taxa. The survey area is considered to have low floral diversity due to anthropogenic influences. Desktop searches identified the presence/potential presence of 85 conservation significant flora taxa within 5 km of the survey area. No EPBC Act or BC Act listed flora taxa were recorded within the survey area. One DBCA listed Priority 4 taxon *Grevillea olivacea* was located in several locations within the survey area. *Grevillea olivacea* was not identified within the database searches as the natural distribution of this species is within the Geraldton Sandplains and the northern extent of the Swan Coastal Plain. The species has naturalised in Perth and is commonly found within parks and roadside vegetation. A likelihood of occurrence assessment was conducted post-field surveys for all significant flora taxa identified in the desktop and field assessments undertaken by GHD (2019a). This assessment is also applicable to this survey and survey area. The likelihood of occurrence assessment post-survey concluded that one taxon is known to occur within the survey area (*Grevillea olivacea*), and one may possibly occur,	Unlikely to be at variance

Principle	Assessment	Outcome
	Caladenia huegelii (Grand Spider Orchid), listed as Endangered by the EPBC Act and Threatened under the BC Act. *Caladenia huegelii* was recorded in several separate locations within Banksia woodland near the survey area. The closest was ~1.5 km east within Ken Hurst Park (GHD 2019b). The small pocket of VT01 located within the fenced Western Power Distribution Centre is considered suitable habitat for this species. As the survey was undertaken outside of the reported flowering period for *Caladenia huegelii* its presence within the survey area is considered possible. The remaining taxa identified in desktop searches are considered unlikely or highly unlikely to occur in the survey. The survey area contain vegetation which provides fauna habitat. The survey area, in general, has poor habitat connectivity as remaining vegetation is fragmented by infrastructure and/or residential developments. A desktop review of GHD 2019a reported 557 fauna species have been previously recorded within 5 km of the survey area. This included 28 birds, 63 reptiles, 10 amphibians and 26 mammals. The remainder of species were marine fish and invertebrates. The Forest Red-tailed Black Cockatoo was heard on two occasions near the survey area. The survey area provides habitat for significant fauna species including Carnaby's Cockatoo and Forest Red-tailed Black Cockatoo. Four additional significant fauna species were considered likely to occur within the survey area based on previous records and the habitats present within the survey area. The survey area does not contain areas of native vegetation that are in better condition than the remnant bushland within the surrounding environment. The vegetation within the survey area is highly modified and biodiversity is considered low.	
(b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	Seven vegetation types were mapped for the survey area. VT01, VT04 and VT06 represent 47.0% of the survey area after removing rail, road and infrastructure (8.71 ha) and have high habitat value. VT12 represents 39.9% of the survey area and has a low habitat value depending on floral species composition. The remaining 13.1% of habitat is considered low value for indigenous fauna. The survey area, in general, has poor habitat connectivity as remaining vegetation is fragmented by infrastructure and/or residential developments. The existing rail corridor is a significant barrier for ground dwelling fauna to move through the landscape and therefore additional clearing of vegetation will not necessarily alter the current movement patterns for ground dwelling species. During the survey, the Forest Red-tailed Black Cockatoo was heard on two occasions and foraging evidence (chewed Marri fruits) was recorded at serval locations within the survey area. No other significant fauna species were recorded during the survey. A likelihood of occurrence assessment from GHD (2019a) was reviewed and applied to the survey area. The post survey review concluded five significant fauna are	Likely to be at variance

Principle	Assessment	Outcome
	likely to occur within the survey area based on the habitat types available: Carnaby's Black Cockatoo, Quenda, Peregrine Falcon, Perth Slider and Black-striped Snake. Black cockatoos There is 9.67 ha (87 %) of suitable black cockatoo foraging habitat and 97 potential breeding trees within the survey area. The trees were represented by *Eucalyptus rudis, E. gomphocephala* and *Corymbia calophylla* and had a trunk diameter at breast height (DBH) greater than 500 mm. No potential nest hollows were detected in any of these trees. Quenda There is suitable habitat for the Quenda within the survey area. However, the Quenda is unlikely to rely on the habitats within the survey area. Peregrine Falcon The species is known from the area with records from Jandakot and Gosnells. The Peregrine Falcon is likely to use suitable habitat within the survey area for foraging only. No breeding habitat is present therefore any use of habitat would be opportunistic. Perth Slider There is suitable habitat present and the species is known from the study area. Although this species seems to survive well in small patches of remnant vegetation ongoing development is further reducing remaining suitable habitat. Black Striped Snake The habitat within the survey area is suitable for this species. There are multiple records within 5 km of the survey area. Whilst the vegetation within the survey area provides habitat for significant fauna species, it is unlikely that any of the species rely on the habitat within the survey area. However, the presence of 9.67 ha of foraging habitat and 97 potential breeding trees is likely to be considered significant habitat for fauna indigenous to Western Australia.	
(c) Native vegetation should not be cleared if it includes, or is necessary for the	The desktop review (GHD 2019a, 2019b & 2020) identified the presence/potential presence of 27 taxa listed under the EPBC Act and/or BC Act. A likelihood of occurrence assessment, which takes into account the habitats present, known species distribution and previous records and intensity of field surveys and season, was completed post survey for the Threatened flora taxa identified in desktop searches. This assessment determined that one taxon may possibly occur within the survey area. *Caladenia huegelii*, listed as Endangered by the EPBC Act and Threatened under the BC Act was recorded in several	May be at variance.

Principle	Assessment	Outcome
continued existence of, rare flora.	separate locations within Banksia woodland near the survey area. The closest was ~1.5 km east within Ken Hurst Park (GHD 2019b). A small pocket of VT01 located within the fenced Western Power Distribution Centre is considered suitable habitat for this species and may possibly occur.	
(d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.	The desktop review identified five TECs potentially occurring within the study area. No TECs as listed under the EPBC Act or BC Act were identified within the survey area during the field survey and none are considered likely to occur.	Unlikely to be at variance.
(e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.	The survey area is located within the SWA IBRA Bioregion, which has approximately 34.4% of its pre-European extent remaining. Regional vegetation mapping undertaken by Heddle *et al.* (1980) and updated by Webb et al. 2016) indicates three vegetation complexes present within the survey area. The pre-European extents remaining of these complexes within the SWA IBRA bioregion are (GoWA 2019): • Southern River Complex 18.43% • Bassendean Complex-Central and South 26.87% • Cannington Complex 11.80% The vegetation complexes described and mapped by Heddle *et al.* (1980) and Webb et al (2016) have also been assessed against presumed pre-European extents within their respective LGA (GoWA 2019): • City of Cockburn Bassendean Complex-Central and South 25.42% • City of Melville Bassendean Complex-Central and South 7.82% • City of Canning Bassendean Complex-Central and South 5.43% • City of Gosnells Cannington Complex (data unavailable) Southern River Complex 11.46% All vegetation complexes have less than 30 % of their pre-European extents remaining within the SWA IBRA bioregion and in their respective LGA. Where only 10 per cent or less of the pre-European extent of an ecological community remains that community is considered threatened. The following LGAs have less than 10 % of the pre-European extent:	Likely to be at variance

Principle	Assessment	Outcome
	• City of Canning – Bassendean Complex – Central and South – 5.43 % • City of Melville – Bassendean Complex – Central and South – 7.82 %.	
(f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	The desktop review of GHD (2019a) identified one Australian Government-listed Wetland of International Importance (Ramsar wetland) within 5 km of the survey area; Forrestdale and Thomsons Lakes (site number 35). The survey area is ~5 km away from the Forrestdale and Thomsons Lakes at its closest point. Vegetation clearing within the survey area is not expected to impact this wetland. The Geomorphic Wetlands SWA dataset (Hill *et al.* 1996) identified 5 wetlands that intersect the survey area: the outer edge of one Conservation Category Wetland (CCW) and four Multiple Use Wetlands (MUW). The Canning River and a number of smaller drainage lines occur within the 5 km study area, including the Swan River. The native vegetation present within the survey area does not grow in association with any wetlands or watercourses.	Unlikely to be at variance.
(g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	The survey area stretches east to west through the Pinjarra and Bassendean systems. The Pinjarra system is a flat, poorly drained alluvial plain with a variety of soils including grey deep sandy duplex soils, brown shallow loamy duplex soils and cracking clays. The Bassendean system consists of low dunes, sandplains and wetland depressions with pale, deep, well-draining and highly leached sands. (Tille et al. 1998). The majority of the survey areas lies within a moderate to low risk acid sulphate soil risk area. Approximately 1 ha of the survey area lies within a high to moderate risk area (GoWA 2020). Any clearing of native vegetation within the survey area has the potential to cause water and wind erosion in areas with lighter-texture soils (e.g. sandy soils). The high sand content of the soils and ease with which these materials can be transported by the wind means there is a high risk of wind erosion in this area. However, given these soils are porous and well-drained and the survey area is linear in nature, the risk of water erosion is low. Overall, due to the long and linear nature and already degraded state of the native vegetation to be cleared, clearing for the Project is unlikely to cause substantial land degradation.	Unlikely to be at variance.
(h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the	The closest DBCA managed land is approximately 1.2 km south of the Beckenham section of the survey area. The survey area intersects two Environmentally Sensitive Areas (ESAs), one of which is also Bush Forever site Ken Hurst Park, Leeming (site 245) (GoWA 2020 & GoWA 2000) The majority of the survey area is surrounded by residential development and has been has been historically cleared or otherwise highly modified (e.g. by roads, tracks, housing). The native vegetation that	Unlikely to be at variance.

Principle	Assessment	Outcome
environmental values of any adjacent or nearby conservation area.	remains within the survey area has been significantly degraded by vehicle tracks and subsequent weed invasion. Clearing within the survey area is unlikely to impact on the environmental values of any conservation areas.	
(i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	The survey area is located in the RIWI Act listed Jandakot and Perth groundwater areas and the Jandakot Underground Water Pollution Control Area, Protection Area Priority 1 (occur within PDWSAs where the existing land uses have low risks to PDWSAs. Four Groundwater subareas proclaimed under the RIWI Act intersect the entirety of the survey area; Airport, City of Canning, City of Melville and City of Gosnells. The survey area has already been disturbed and highly modified. Vegetation clearing for the project is considered unlikely to impact upon groundwater quality. The closest drainage line to the survey area is Yule brook, approximately 400 m south of the Beckenham section of the survey area. The Canning River also occurs approximately 1.5 km west of this section (GoWA 2020). Desktop searches identified one Australian Government-listed Wetland of International Importance (Ramsar wetland) within 5 km of the survey area, Forrestdale and Thomsons Lakes (site number 35) (GoWA 2020). The Geomorphic Wetlands SWA dataset (Hill *et al.* 1996) identified 5 wetlands that intersect the survey area: the outer edge of one Conservation Category Wetland (CCW) and four Multiple Use Wetlands (MUW). The Canning River, Swan River and a number of smaller drainage lines occur within the 5 km study area. It is unlikely that the proposed clearing will disturb or interrupt any natural drainage and surface run-off patterns present in the area.	Unlikely to be at variance.
(j) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.	The soils of the survey area include sands, duplex soils and clays. The vegetation within the survey area has already been highly modified due to historical clearing. Additional clearing is unlikely to cause or exacerbate waterlogging within the survey area given the relatively small area of clearing (along an existing development corridor.	Unlikely to be at variance.

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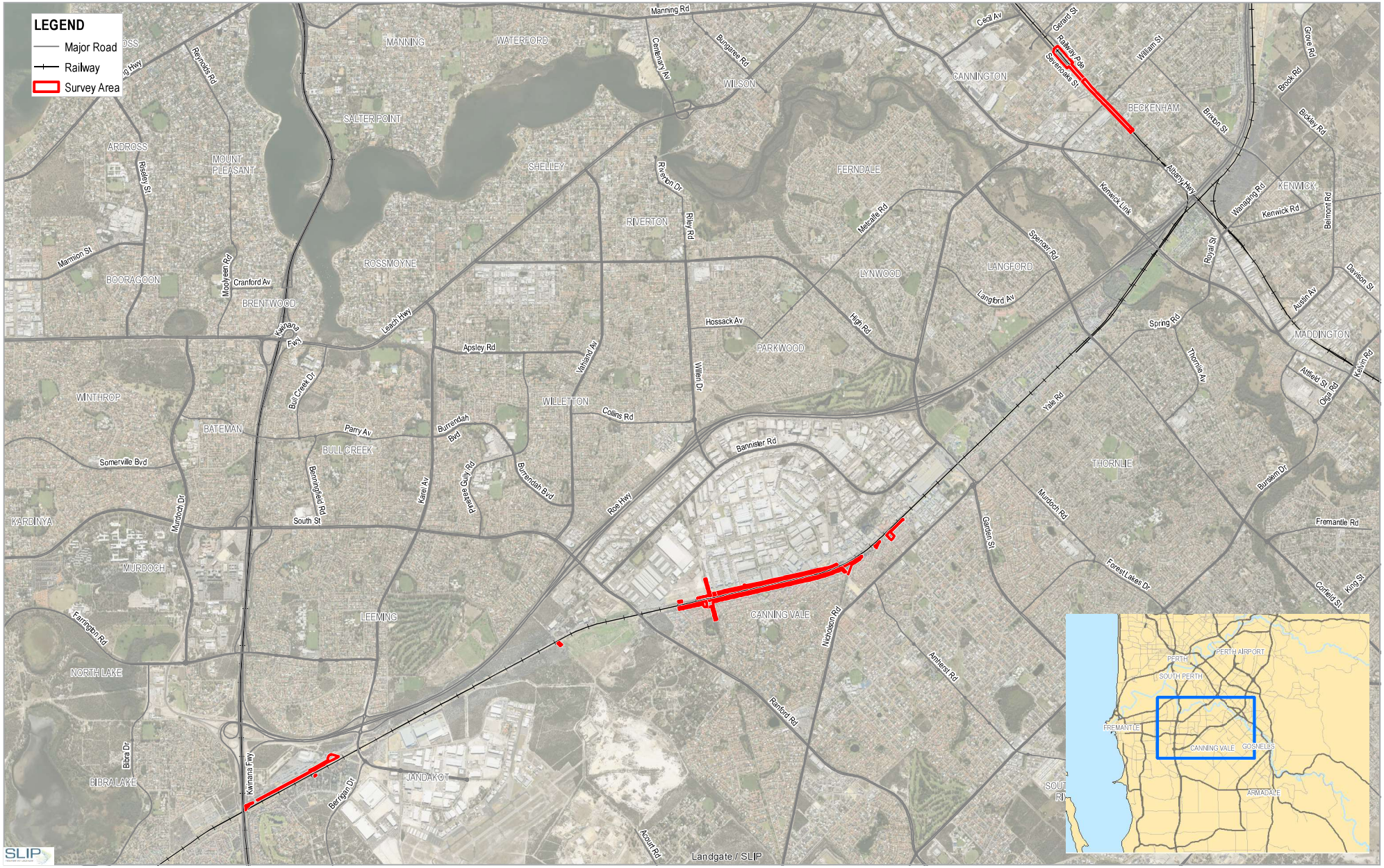
Appendices

Appendix A – Figures



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Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Public Transport Authority
Thornlie Cockburn Link Project

Site Location

Project No. **12533618**
Revision No. **6**
Date **06 Nov 2020**

FIGURE 1

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N

GHD

Public Transport Authority
Thornlie Cockburn Link Project

Vegetation types and sample locations

Project No. 12533618
Revision No. 0
Date 06 Nov 2020

FIGURE 2A

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Metres

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GHD

Public Transport Authority
Thornlie Cockburn Link Project

Vegetation types and sample locations

Project No. 12533618
Revision No. 0
Date 06 Nov 2020

FIGURE 2B

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Metres

Map Projection: Transverse Mercator
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Grid: GDA 1994 MGA Zone 50

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GHD

Public Transport Authority
Thornlie Cockburn Link Project

Vegetation types and sample locations

Project No. 12533618
Revision No. 0
Date 06 Nov 2020

FIGURE 2C

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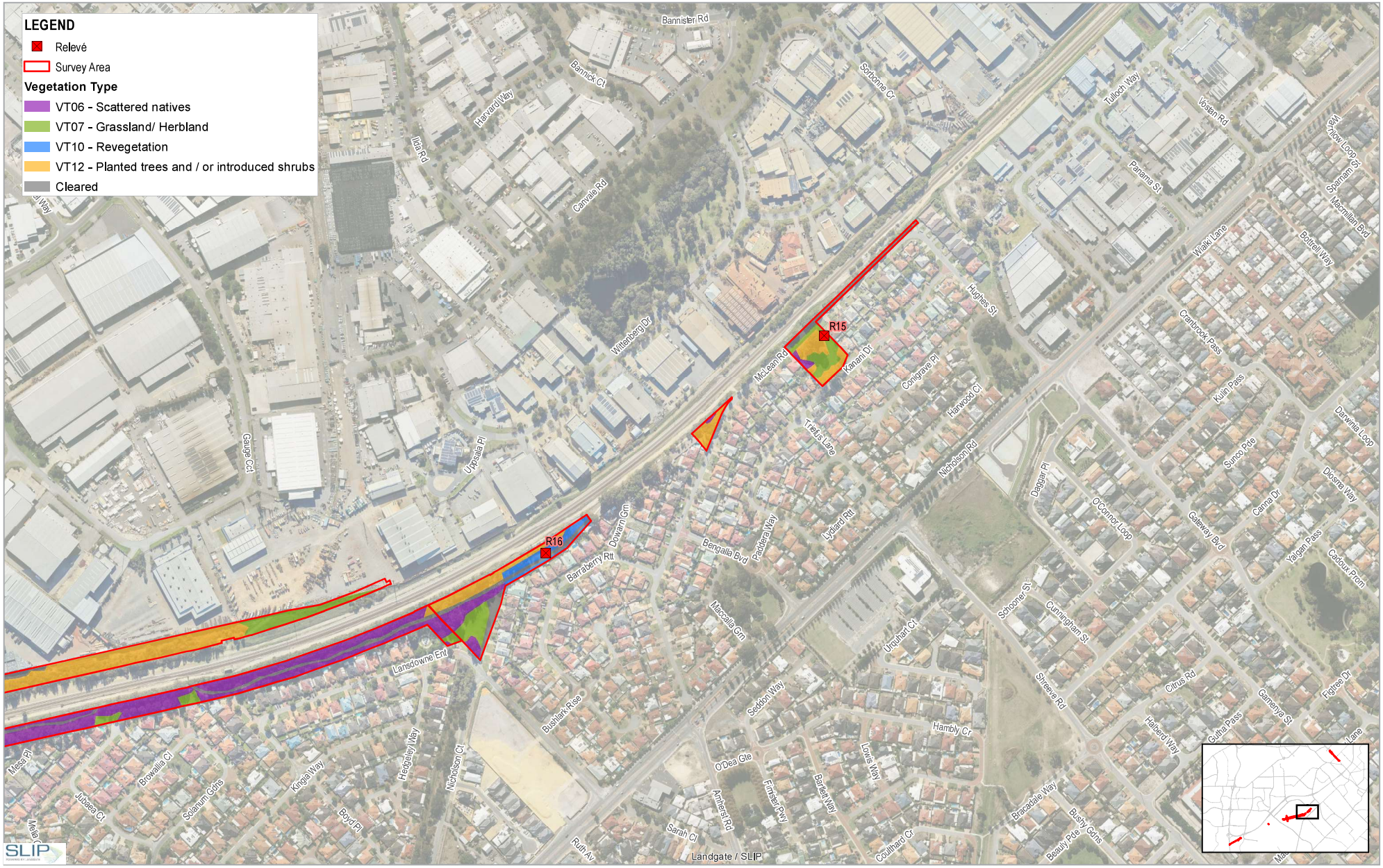

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N

GHD

Public Transport Authority
Thornlie Cockburn Link Project

Vegetation types and sample locations

Project No. 12533618
Revision No. 0
Date 06 Nov 2020

FIGURE 2D

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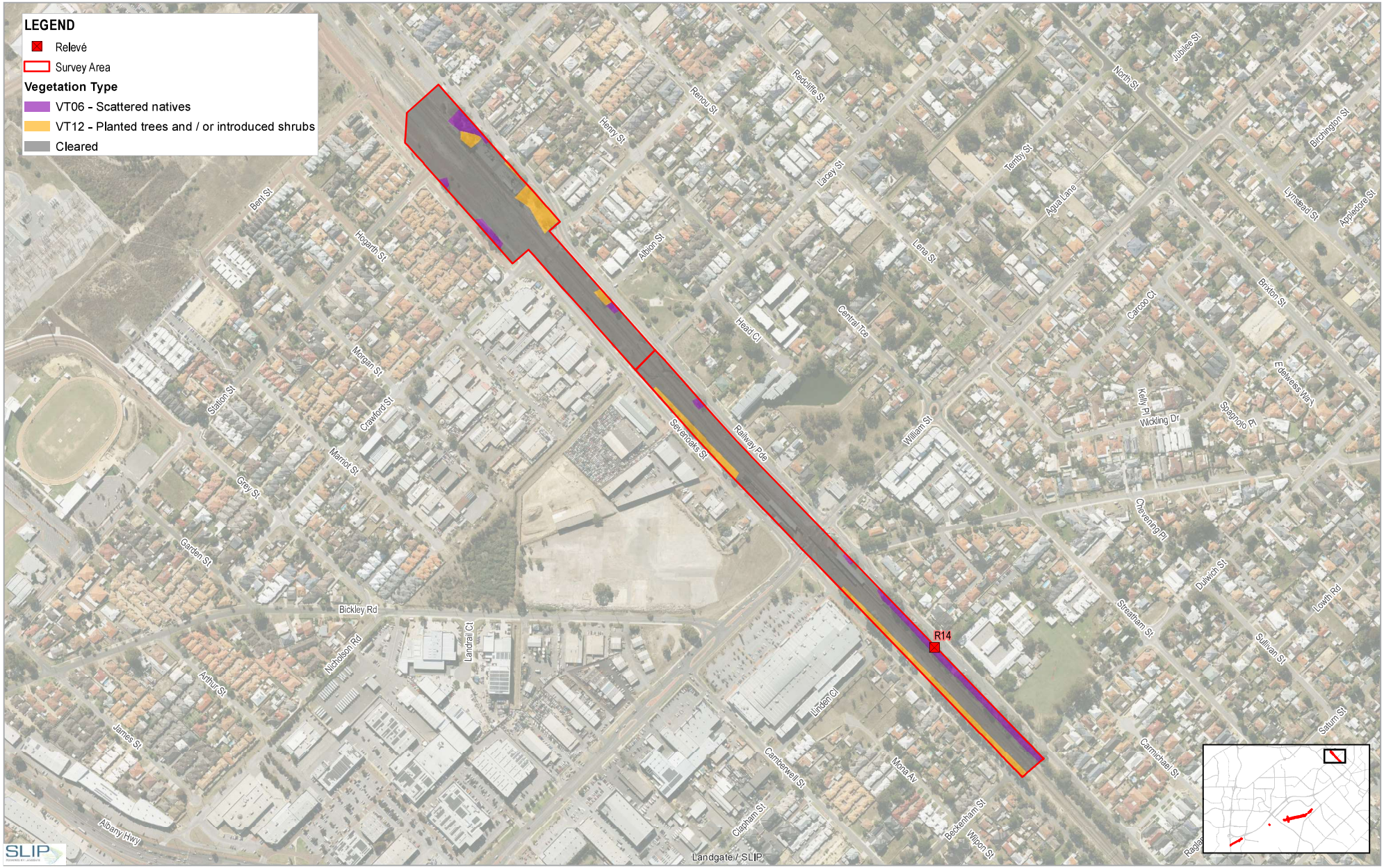

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Metres

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Grid: GDA 1994 MGA Zone 50

N

GHD

Public Transport Authority
Thornlie Cockburn Link Project

Vegetation types and sample locations

Project No. **12533618**
Revision No. **0**
Date **06 Nov 2020**

FIGURE 2E

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Data source: GHD: Vegetation Types, Quadrats, Relevés, Survey Area - 20181019; Landgate: Imagery, Roads. Created by: mmikkonen

Paper Size ISO A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Public Transport Authority
Thornlie Cockburn Link Project

Vegetation Condition And Conservation Significant Flora

Project No. **12533618**
Revision No. **0**
Date **06 Nov 2020**

FIGURE 3A

G:\61\12533618\GIS\Maps\Working\TCL_NVCP\12533618_003_VegCondition_Rev0.mxd
Print date: 06 Nov 2020 - 10:53

Data source: GHD: Vegetation Condition, Survey Area - 20181019, Significant Weeds - 20180307; Landgate: Imagery, Roads. Created by: mmikkonen

Paper Size ISO A3

0 10 20 30 40

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

GHD

Public Transport Authority
Thornlie Cockburn Link Project

Vegetation Condition And Conservation Significant Flora

Project No. **12533618**
Revision No. **0**
Date **06 Nov 2020**

FIGURE 3B

G:\61\12533618\GIS\Maps\Working\TCL_NVCP\12533618_003_VegCondition_Rev0.mxd
Print date: 06 Nov 2020 - 10:53

Data source: GHD: Vegetation Condition, Survey Area - 20181019, Significant Weeds - 20180307; Landgate: Imagery, Roads. Created by: mmikkonen

Paper Size ISO A3

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Public Transport Authority
Thornlie Cockburn Link Project

Vegetation Condition And Conservation Significant Flora

Project No. **12533618**
Revision No. **0**
Date **06 Nov 2020**

FIGURE 3C

G:\61\12533618\GIS\Maps\Working\TCL_NVCP\12533618_003_VegCondition_Rev0.mxd
Print date: 06 Nov 2020 - 10:54

Data source: GHD: Vegetation Condition, Survey Area - 20181019, Significant Weeds - 20180307; Landgate: Imagery, Roads. Created by: mmikkonen

Paper Size ISO A3

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Public Transport Authority
Thornlie Cockburn Link Project

Vegetation Condition And Conservation Significant Flora

Project No. 12533618
Revision No. 0
Date 06 Nov 2020

FIGURE 3D

G:\61\12533618\GIS\Maps\Working\TCL_NVCP\12533618_003_VegCondition_Rev0.mxd
Print date: 06 Nov 2020 - 10:54

Data source: GHD: Vegetation Condition, Survey Area - 20181019, Significant Weeds - 20180307; Landgate: Imagery, Roads. Created by: mmikkonen

Paper Size ISO A3

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Public Transport Authority
Thornlie Cockburn Link Project

Vegetation Condition And Conservation Significant Flora

Project No. **12533618**
Revision No. **0**
Date **06 Nov 2020**

FIGURE 3E

G:\61\12533618\GIS\Maps\Working\TCL_NVCP\12533618_003_VegCondition_Rev0.mxd
Print date: 06 Nov 2020 - 10:55

Data source: GHD: Vegetation Condition, Survey Area - 20181019, Significant Weeds - 20180307; Landgate: Imagery, Roads. Created by: mmikkonen

Paper Size ISO A3

0 30 60 90 120

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Public Transport Authority
Thornlie Cockburn Link Project

Conservation Significant Fauna and Habitats

Project No. **12533618**
Revision No. **0**
Date **16 Nov 2020**

FIGURE 4A

G:\61\12533618\GIS\Maps\Working\TCL_NVCP\12533618_004_ConSigFauna_Rev0.mxd
Print date: 16 Nov 2020 - 09:43

Data source: GHD: Survey Area, Con Sig Fauna, Breeding Trees, Fauna Habitat, Foraging Habitat - 20181019; Landgate: Imagery, Roads. Created by: mmikkonen

Paper Size ISO A3

0 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Public Transport Authority
Thornlie Cockburn Link Project

Conservation Significant Fauna and Habitats

Project No. **12533618**
Revision No. **0**
Date **16 Nov 2020**

FIGURE 4B

G:\61\12533618\GIS\Maps\Working\TCL_NVCP\12533618_004_ConSigFauna_Rev0.mxd
Print date: 16 Nov 2020 - 09:44

Data source: GHD: Survey Area, Con Sig Fauna, Breeding Trees, Fauna Habitat, Foraging Habitat - 20181019; Landgate: Imagery, Roads. Created by: mmikkonen

Paper Size ISO A3

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Public Transport Authority
Thornlie Cockburn Link Project

Conservation Significant Fauna and Habitats

Project No. **12533618**
Revision No. **0**
Date **16 Nov 2020**

FIGURE 4C

G:\61\12533618\GIS\Maps\Working\TCL_NVCP\12533618_004_ConSigFauna_Rev0.mxd
Print date: 16 Nov 2020 - 09:45

Data source: GHD: Survey Area, Con Sig Fauna, Breeding Trees, Fauna Habitat, Foraging Habitat - 20181019; Landgate: Imagery, Roads. Created by: mmikkonen

Paper Size ISO A3

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Public Transport Authority
Thornlie Cockburn Link Project

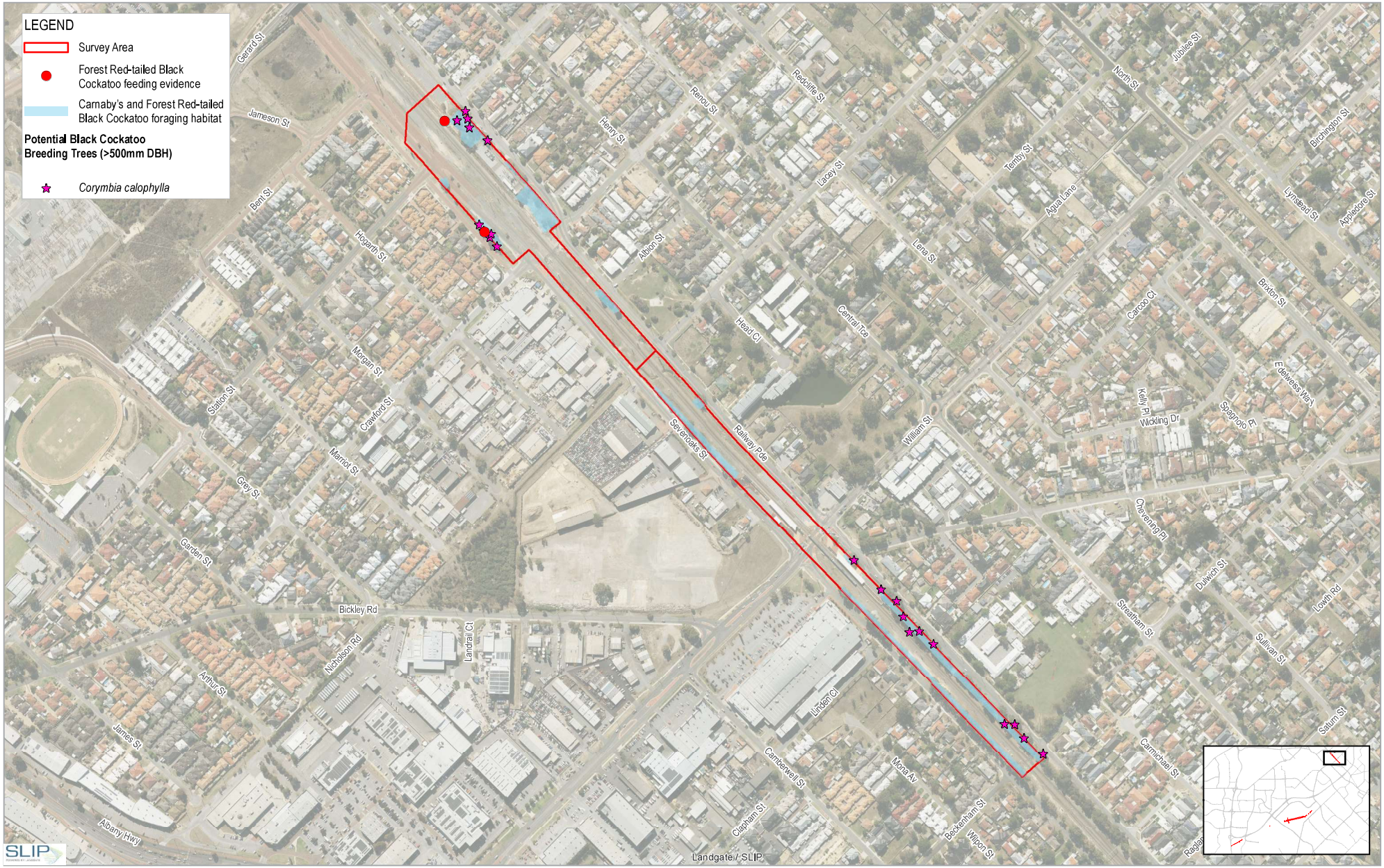
Conservation Significant Fauna and Habitats

Project No. **12533618**
Revision No. **0**
Date **16 Nov 2020**

FIGURE 4D

G:\61\12533618\GIS\Maps\Working\TCL_NVCP\12533618_004_ConSigFauna_Rev0.mxd
Print date: 16 Nov 2020 - 09:45

Data source: GHD: Survey Area, Con Sig Fauna, Breeding Trees, Fauna Habitat, Foraging Habitat - 20181019; Landgate: Imagery, Roads. Created by: mmikkonen



Paper Size ISO A3

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Public Transport Authority
Thornlie Cockburn Link Project

Conservation Significant Fauna and Habitats

Project No. **12533618**
Revision No. **0**
Date **16 Nov 2020**

FIGURE 4E

G:\61\12533618\GIS\Maps\Working\TCL_NVCP\12533618_004_ConSigFauna_Rev0.mxd
Print date: 16 Nov 2020 - 09:46

Data source: GHD: Survey Area, Con Sig Fauna, Breeding Trees, Fauna Habitat, Foraging Habitat - 20181019; Landgate: Imagery, Roads. Created by: mmikkonen

Appendix B – Relevant legislation, conservation codes and background information

Relevant legislation

Federal *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Federal Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, which are defined in the EPBC Act as Matters of National Environmental Significance (MNES).

The biological aspects listed as MNES include:

- Nationally threatened flora and fauna species and ecological communities
- Migratory species

A person must not undertake an action that has, will have, or is likely to have a significant impact (direct or indirect) on MNES, without approval from the Federal Minister for the Environment.

The EPBC Act is administered by the Department of Agriculture, Water and Environment (DAWE).

State *Environmental Protection Act 1986*

The *Environmental Protection Act 1986* (EP Act) is the primary legislative Act dealing with the protection of the environment in Western Australia. The Act allows the Environmental Protection Authority (EPA), to prevent, control and abate pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the foregoing. Part IV of the EP Act is administered by the EPA and makes provisions for the EPA to undertake environmental impact assessment of significant proposals, strategic proposals and land use planning schemes.

The Department of Water and Environment Regulation (DWER) is responsible for administering the clearing provisions of the EP Act (Part V). Clearing of native vegetation in Western Australia requires a permit from the DWER, unless exemptions apply. Applications for clearing permits are assessed by the Department and decisions are made to grant or refuse the application in accordance with the Act. When making a decision the assessment considers clearing against the ten clearing principles as specified in Schedule 5 of the EP Act:

a) Native vegetation should not be cleared if it comprises a high level of biodiversity.

b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a significance habitat for fauna indigenous to Western Australia.

c) Native vegetation should not be cleared if it includes, or is necessary, for the continued existence of rare flora.

d) Native vegetation should not be cleared if it comprises the whole or part of native vegetation in an area that has been extensively cleared.

e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.

f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.

g) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.

h) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.

j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.

Exemptions for clearing include clearing that is a requirement of a written law or authorised under certain statutory processes (listed in Schedule 6 of the EP Act) and exemptions for prescribed low impact day-to-day activities (prescribed in the Environmental Protection (Clearing of Native Vegetation) Regulations 2004); these exemptions do not apply in environmentally sensitive areas (ESAs).

State *Biodiversity and Conservation Act 2016*

The *Biodiversity Conservation Act 2016* (BC Act) provides for the conservation and protection of biodiversity and biodiversity components, as well as the promotion of the ecologically sustainable use of biodiversity components in Western Australia. The BC Act replaces both the repealed *Wildlife Conservation Act 1950* (WC Act) and the *Sandalwood Act 1929* (Sandalwood Act), as well as their associated regulations. To attain the objectives of the BC Act, principles of ecological sustainable development have been established:

- Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations
- If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation
- The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations
- The conservation of biodiversity and ecological integrity should be a fundamental consideration indecision-making
- Improved valuation, pricing and incentive mechanisms should be promoted.

The BC Act is administered by the Department of Biodiversity Conservation and Attractions (DBCA).

State *Biosecurity and Agriculture Management Act 2007*

The *Biosecurity and Agriculture Management Act 2007* (BAM Act) and associated regulations are administered by the Department of Primary Industries and Regional Development (DPIRD) and replace the repealed *Agriculture and Related Resources Protection Act 1976.* The main purposes of the BAM Act and its regulations are to:

- Prevent new animal and plant pests (vermin and weeds) and diseases from entering WA
- Manage the impact and spread of those pests already present in the state
- Safely manage the use of agricultural and veterinary chemicals
- Increased control over the sale of agricultural products that contain violative chemical residues.

The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act. A Declared Pest is a prohibited organism or an organism for which a declaration under Section 22(2) of the Act is in force. Declared Pests may be assigned a control category including: C1 (exclusion), C2 (eradication) and C3 (management). The category may apply to the whole of the State, LGAs, districts, individual properties or even paddocks, and all landholders are obliged to comply with the specific category of control. Categories of control are defined below.

DPIRD Categories for Declared Pests under the BAM Act

Control class code	Description
C1 (Exclusion)	Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2 (Eradication)	Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3 (Management)	Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Conservation codes

Species of significant flora, fauna and communities are protected under both Federal and State Acts. The Federal EPBC Act provides a legal framework to protect and manage nationally important flora and communities. The State BC Act is the primary wildlife conservation legislation in Western Australia. Information on the conservation codes is summarised in the following sections.

Ecological communities

Conservation significant communities

Ecological communities are defined as naturally occurring biological assemblages that occur in a particular type of habitat (English and Blyth 1997). Federally listed Threatened Ecological Communities (TECs) are protected under the EPBC Act. The BC Act provides for the statutory listing of State TECs by the Minister. The legislation also describes statutory processes for preparing recovery plans for TECs, the registration of their critical habitat, and penalties for unauthorised modification of TECs. Prior to the BC Act, the DBCA has be identifying and listing TECs to one of four categories (Presumed Totally Destroyed, Critically Endangered, Endangered and Vulnerable) through a non-statutory process.

Possible TECs that do not meet survey criteria are added to the DBCA Priority Ecological Community (PEC) List under Priorities 1, 2 and 3. These are ecological communities that are adequately known; are rare but not threatened, or meet criteria for Near Threatened. PECs that have been recently removed from the threatened list are placed in Priority 4. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in Priority 5. PECs are not listed under any formal Federal or State legislation, however, may be listed as TECs under the EPBC Act.

Conservation codes and definitions for TECs listed under the EPBC Act and/ or BC Act

Categories	Definition
Federal Government Conservation Categories (EPBC Act)	
Critically Endangered (CR)	An ecological community if, at that time, is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000)
Endangered (EN)	An ecological community if, at that time: A) is not critically endangered; and B) is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000)
Vulnerable (VU)	An ecological community if, at that time: A) is not critically endangered or endangered; and B) is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000)
Western Australia Conservation Categories (BC Act)	
Threatened Ecological Communities	

Categories	Definition
Critically Endangered (CR)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.
Endangered (EN)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.
Vulnerable (VU)	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.
Collapsed ecological communities	
An ecological community is eligible for listing as a collapsed ecological community at a particular time if, at that time – (a) there is no reasonable doubt that the last occurrence of the ecological community has collapsed); or (b) the ecological community has been so extensively modified throughout its range that no occurrence of it is likely to recover – (i) its species composition or structure; or (ii) its species composition and structure. Section 33 of the BC Act provides for a collapsed ecological community to be regarded as a threatened ecological community if it is discovered in a state that no longer makes it eligible for listing as a collapsed ecological community.	

Conservation categories and definitions for PECS as listed by the DBCA

Category	Description
Priority 1	Poorly known ecological communities. Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤100 ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority 2	Poorly known ecological communities. Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200 ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Category	Description
Priority 3	Poorly known ecological communities. (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
Priority 4	Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. (i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
Priority 5	Conservation Dependent ecological communities. Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Other significant vegetation

Vegetation may be significant for a range of reasons other than a statutory listing. The EPA (2016b) states that significant vegetation may include vegetation that includes the following:

- Restricted distribution
- Degree of historical impact from threatening processes
- Local endemism in restricted habitats
- Novel combinations of taxa
- A role as a refuge
- A role as a key habitat for Threatened species or large population representing a significant proportion of the local to regional total population of a species
- Being representative of a vegetation unit in ‘pristine’ condition in a highly cleared landscape, recently discovered range extensions, or isolated outliers of the main range)
- Being poorly reserved.

This may apply at a number of levels, so the unit may be significant when considered at the fine-scale (intra-locality), intermediate-scale (locality or inter-locality) or broad-scale (local to region).

Flora and fauna

Conservation significant flora and fauna

Species of significant flora are protected under both Federal and State legislation. Any activities that are deemed to have a significant impact on species that are recognised by the EPBC Act, and/or the BC Act can warrant referral to the DAWE and/or the EPA.

The Federal conservation level of flora and fauna species and their significance status is assessed under the EPBC Act. The significance levels for flora and fauna used in the EPBC Act align with the International Union for Conservation of Nature (IUCN) Red List criteria, which are internationally recognised as providing best practice for assigning the conservation status of species. The EPBC Act also protects land and migratory species that are listed under International Agreements. The list of migratory species established under section 209 of the EPBC Act comprises:

- Migratory species which are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II)
- Migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China–Australia Migratory Bird Agreement (CAMBA)
- Native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the republic of Korea–Australia Migratory Bird Agreement (ROKAMBA)

The State conservation level of flora and fauna species and their significance status also follows the IUCN Red List criteria. Under the BC Act flora and fauna can be listed as Threatened, Extinct and as Specially Protected species.

Threatened species are those are species which have been adequately searched for and are deemed to be, in the wild, either rare, under identifiable threat of extinction, or otherwise in need of special protection, and have been gazetted as such. The assessment of the conservation status of Threatened species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria. Specially protected species meet one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection. Species that are listed as Threatened or Extinct species under the BC Act cannot also be listed as Specially Protected species.

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

For the purposes of this assessment, all species listed under the EPBC Act, BC Act and DBCA Priority species are considered conservation significant.

Conservation categories and definitions for EPBC Act and BC Act listed flora and fauna species

Conservation category	Definition
Threatened species	
Critically Endangered (CR)	Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines.
Endangered (EN)	Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines
Vulnerable (VU)	Threatened species considered to be "facing a high risk of extinction in the wild in the medium term future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines.
Extinct species	
Extinct (EX)	Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).
Extinct in the Wild (EW)	Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).
Specially protected species	
Migratory (MI)	Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species

Conservation category	Definition
Species of special conservation interest (conservation dependent fauna) (CD)	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
Other specially protected fauna (OS)	Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

Conservation codes for DBCA listed Priority flora and fauna

Priority category	Definition
Priority 1	Poorly-known taxa Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
Priority 2	Poorly-known taxa Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
Priority 3	Poorly-known taxa Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4	Rare, Near Threatened and other taxa in need of monitoring A. Rare: Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. B. Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. C. Taxa that have been removed from the list of threatened taxa during the past five years for reasons other than taxonomy.

Other significant flora

Flora species, subspecies, varieties, hybrids and ecotypes may be significant for a range of reasons, other than a statutory listing. The EPA (2016a, b) states that significant flora may include taxa that have:

- A keystone role in a particular habitat for threatened or Priority flora or fauna species, or large populations representing a considerable proportion of the local or regional total population of a species
- Relictual status, being representation of taxonomic or physiognomic groups that no longer occur widely in the broader landscape
- Anomalous features that indicate a potential new discovery
- Being representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
- The presence of restricted subspecies, varieties, or naturally occurring hybrids
- Local endemism (a restricted distribution) or association with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems)
- Being poorly reserved

Other significant fauna

Fauna species may be significant for a range of reasons other than those protected by international agreement or treaty, Specially Protected or Priority Fauna. Significant fauna may include short-range endemic species, species that have declining populations or declining distributions, species at the extremes of their range, or isolated outlying populations, or species which may be undescribed (EPA 2020).

Introduced plants (weeds)

Declared Pests

Information on species considered to be Declared Pests is provided under *State Biosecurity and Agriculture Management Act 2007.*

Weeds of National Significance

The spread of weeds across a range of land uses or ecosystems is important in the context of socio-economic and environmental values. The assessment of Weeds of National Significance (WoNS) is based on four major criteria:

- Invasiveness
- Impacts
- Potential for spread
- Socio-economic and environmental values

Australian state and territory governments have identified thirty-two Weeds of National Significance (WoNS); a list of 20 WoNS was endorsed in 1999 and a further 12 were added in 2012.

References

English, V and Blyth, J 1997, *Identifying and Conserving Threatened Ecological Communities in the South West Botanical Province*, Perth, Department of Conservation and Land Management.

EPA 2016a, *Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment*, EPA, Perth, WA.

EPA 2016b, *Environmental Factor Guideline - Flora and Vegetation*, EPA, Perth, WA.

EPA 2020, *Technical Guide – Terrestrial Fauna Surveys*, EPA, Perth, WA.

Appendix C – Field data

Sample sites

Sample Site	Type	Landform	Condition	Aspect	Slope	Soil Type	Soil Colour	Drainage	Bare Ground	Leaf Litter	Fire evidence	Disturbance	Date
Q13	Quadrat	Other	Good	Flat	NA	Sand	Grey	Good	2-10%	<2%	Old (6+ yr)	Weeds, kangaroos	29072020
R10	Releve	Hillslope	Degraded	South	Gentle	Sand	Yellow	Good	2-10%	<2%	Old (6+ yr)	Weeds	28072020
R11	Releve	Other	Degraded	Flat	NA	Sand	Grey	Good	2-10%	<2%	Old (6+ yr)	Weeds	28072020
R12	Releve	Sand Plain	Degraded	Flat	NA	Sand	Grey	Good	2-10%	<2%	Old (6+ yr)	Weeds	28072020
R13	Releve	Other	Degraded	Flat	NA	Sand	Grey	Good	2-10%	<2%	Old (6+ yr)	weeds, garden escapes	28072020
R14	Releve	Drainage Line	Degraded	Flat	NA	Sand	Grey	Seasonal wet	<2%	11-30%	Old (6+ yr)	Rail	28072020
R15	Releve	Drainage Area/ Floodplain	Degraded	Flat	NA	Clay	Dark Brown	Seasonal wet	<2%	11-30%	Old (6+ yr)	Cleared park	28072020
R16	Releve	Drainage Line	Degraded	Flat	NA	Sand	Grey	Seasonal wet	2-10%	31-70%	Old (6+ yr)	Revege, litter cover is mulch	29072020
R17	Releve	Drainage Area/ Floodplain	Degraded	Flat	NA	Sand	Grey	Seasonal wet	2-10%	2-10%	Old (6+ yr)	Weeds	29072020

Quadrat 13

Species	Cover (%)	Height (m)
Melaleuca preissiana	10	6
Regelia inops	20	1.5
Phlebocarya ciliata	30	0.25
**Arctotheca calendula*	10	0.1
**Brassica tournefortii*	5	0.25
**Ursinia anthemoides*	10	0.1
**Sonchus oleraceus*	5	0.1
Dasypogon bromeliifolius	5	0.25
**Fumaria capreolata*	5	0.1
**Galium murale*	5	0.1
**Lysimachia arvensis*	2	0.1
**Ehrharta longiflora*	10	0.25
**Asphodelus fistulosus*	2	0.25
Lyginia imberbis	2	0.5

Relevé 10

Species	Cover (%)	Height (m)
Acacia saligna	10	4
Adenanthos cygnorum	10	4
Corymbia calophylla	2	10
Eucalyptus todtiana	2	5
**Watsonia meriana var. meriana*	5	1
Acacia pulchella	2	1.5
**Cenchrus setaceus*	10	1
**Pelargonium capitatum*	10	0.5
Conostylis aculeata	2	0.25
Jacksonia furcellata	2	1
**Briza maxima*	5	0.25
**Eragrostis curvifolius*	2	1
Eremophila glabra	1	0.25
Grevillea sp. 1	2	2
Grevillea sp. 2	2	0.25
**Hypochaeris glabra*	5	0.1
**Gladiolus caryophyllaceus*	2	0.25
**Ehrharta longiflora*	5	0.25
**Retama raetam*	1	1

Relevé 11

Species	Cover (%)	Height (m)
Banksia attenuata	5	5
Banksia menziesii	5	5
Adenanthos cygnorum	10	5
**Cenchrus setaceus*	10	1
Xanthorrhoea preissii	2	1.75
Petrophile linearis	2	0.5
**Eragrostis curvula*	5	1
**Gladiolus caryophyllaceus*	2	0.25
Stirlingia latifolia	2	0.5
Acacia pulchella	2	1
**Pelargonium capitatum*	2	0.25
Mesomelaena pseudostygia	2	1
Dianella revoluta var. divaricata	2	1
Bossiaea eriocarpa	2	1.5

Relevé 12

Species	Cover (%)	Height (m)
Acacia saligna	2	4
**Acacia longifolia*	2	4
Banksia attenuata	5	5
**Eucalyptus* sp. (planted)	1	5
Nuytsia floribunda	2	8
**Cenchrus setaceus*	20	1
**Pelargonium capitatum*	5	0.5
**Euphorbia terracina*	2	0.25
Xanthorrhoea preissii	2	1.75
Grevillea bipinnatifida	2	1.5

Relevé 13

Species	Cover (%)	Height (m)
**Casuarina glauca*	2	8
**Casuarina sp.*	2	8
**Gazania linearis*	5	0.5
Grevillea sp. 1	1	1
**Eucalyptus leucoxylon rosea*	5	5
Adenanthos cygnorum	2	3
**Cenchrus setaceus*	10	0.5
**Eragrostis curvula*	10	0.5
**Ehrharta calycina*	10	0.5
**Gladiolus caryophyllaceus*	2	1
**Pelargonium capitatum*	5	0.25
Acacia saligna	5	1.5
Calothamnus sanguineus	2	0.5
Kunzea glabrescens	2	2
Hakea prostrata	2	2
Eucalyptus gomphocephala	2	5
Grevillea olivacea (P4)	1	2
Callitris preissii	2	2
**Leptospermum laevigatum*	2	1.5
**Ricinus communis*	2	1.5

Relevé 14

Species	Cover (%)	Height (m)
Corymbia calophylla	10	20
Jacksonia sternbergiana	2	1.5
**Watsonia meriana* var. *meriana*	20	1.5
Hardenbergia comptoniana	2	cr
**Oxalis pes-caprae*	20	0.25
**Ehrharta calycina*	20	0.5
**Eragrostis curvula*	5	0.5
**Briza maxima*	5	0.25
**Schinus terebinthifolius*	5	2
**Cenchrus clandestinus*	10	0.5

Relevé 15

Species	Cover (%)	Height (m)
**Casuarina sp.*	10	10
**Eucalyptus camaldulensis* (planted)	10	15
**Eucalyptus robusta*	2	15
Melaleuca rhaphiophylla	2	8
Agonis flexuosa	2	5

Relevé 16

Species	Cover (%)	Height (m)
Melaleuca rhaphiophylla	5	5
**Acacia longifolia*	10	4
**Eucalyptus camaldulensis* (planted)	10	20
Chamelaucium uncinatum	2	2
**Callistemon sp.*	2	1.5
**Casuarina* sp.	2	10
**Watsonia meriana* var. *meriana*	5	1
Agonis flexuosa	2	5
Kunzea glabrescens	5	3
Melaleuca preissiana	2	4
Restionaceae sp.	10	0.25

Relevé 17

Species	Cover (%)	Height (m)
Eucalyptus rudis	10	6
Regelia inops	20	2.5
Kunzea glabrescens	5	3
**Casuarina sp.*	10	10
Acacia saligna	5	3
Adenanthos cygnorum	5	3
**Pelargonium capitatum*	10	0.25
**Ursinia anthemoides*	20	0.25
**Ehrharta longiflora*	10	0.25
**Ehrharta longiflora*	10	0.25
**Briza maxima*	5	0.25
**Fumaria capreolata*	20	0.25
**Acacia longifolia*	10	3
**Gladiolus caryophyllaceus*	2	0.5
**Euphorbia terracina*	2	0.5

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