Attachment 1

Environmental Assessment Report

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EAST WANNEROO PRECINCT 8

ENVIRONMENTAL ASSESSMENT REPORT

Prepared for: Qube

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1 INTRODUCTION

1.1 Site Location

The East Wanneroo Precinct 8 Structure Plan has been developed to guide urban development in the Precinct from rural and semi-rural properties to urban development. The area is located in the City of Wanneroo, approximately 20km north of Perth (Figure 1).

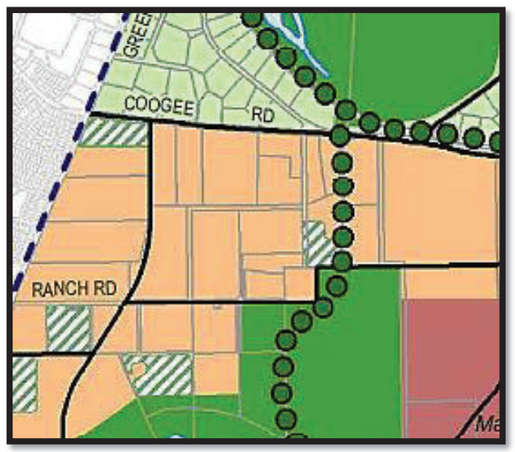
The site is generally bound by Coogee Road to the north, Pinjar Road and Mornington Drive to the west, Pinelake Trail and rural land to the east and Mariginiup Lake to the south. The site is zoned Urban, Parks and Recreation and contains part of Bush Forever Site 147 'Mariginiup Lake and Adjacent Bushland, Mariginiup'.

1.2 Background

Planning for East Wanneroo has been undertaken over a number of years. The Western Australian Planning Commission (WAPC) released the East Wanneroo Structure Plan (Appendix 1) and accompanying report in January 2011. Precinct 8 is located in the north-west corner of the Structure Plan area with a significant portion identified as suitable for potential urban development. The site has been recognised in the WAPC *Directions 2031 and Beyond* and the draft *Outer Metropolitan Perth and Peel Sub- Regional Strategy* as an "Urban Expansion Area 2011-15".

The East Wanneroo District Structure Plan guides the progressive urbanisation of East Wanneroo in response to the proposals set out in the North-West Sub-regional Planning Framework 2018. The Western Australian Planning Commission (WAPC) released the final East Wanneroo District Structure Plan (EWDSP) and accompanying report in August 2021 (DPLH, 2021). Precinct 8 is located in the central western part of the Structure Plan and has been identified as suitable for potential urban development (Plate 1).

Plate 1: East Wanneroo District Structure Plan (DPLH, 2021)



The District Structure Plan identifies areas of bushland to be retained as Parkland, denoted in green, and Parklands Subject to Confirmation, denoted by green stripes. Other areas of native vegetation that occur within the site were not identified as areas for potential protection. There is also an ecological linkage identified in the Structure Plan that runs north-south denoted by solid dark green circles.

A Concept Structure Plan for Precinct 8 has been prepared by Rowe Group Design (Appendix 1).

1.3 Scope of Works

The Environmental Assessment Report has been undertaken to assess the environmental impact of the proposed Structure Plan for Precinct 8. The report includes:

- Historical land uses and disturbances using historical aerial photography and Contaminated Sites Database search;
- Aboriginal and cultural heritage;
- Physical Characteristics of the site including:
  - Landform;
  - Drainage and wetlands; and
  - Geological and soil mapping;
- Flora and Vegetation;
- Fauna, including Black Cockatoo Habitat Assessment
- Environmental policy areas and implications on the proposed development;
- Information on regulatory requirements such as the referral of the project to any State or Commonwealth authorities;
- An assessment of the environmental impact of the LSP; and
- Recommendations for any additional environmental work to be undertaken at subdivision stages.

2 LEGISLATION, POLICY AND GUIDELINES

The following legislation, policy and guidelines have been considered during this environmental assessment and will guide the required and expected management outcomes from Commonwealth, State and Local government agencies.

2.1 State Legislation

2.1.1 Zoning

The site is currently zoned 'Urban Deferred' in the Metropolitan Region Scheme (MRS) (National Map, 2022) and 'Rural Resource' under the City of Wanneroo District Planning Scheme 2 (WAPC, 2001).

2.1.2 *Environmental Protection Act 1986*

Planning schemes together with their amendments are required to be referred to the Environmental Protection Authority (EPA) by the responsible authority for a decision by the EPA on whether to assess them under the formal environmental impact assessment (EIA) process.

Under the EP Act, clearing of native vegetation requires a permit from DWER unless there is an exemption under Schedule 6 of the EP Act or Items under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. Proposals that require clearing in accordance with an approved subdivision are exempt under Schedule 6 of the EP Act.

It is likely that any clearing that will be required for the development will be considered at the subdivision stage by DWER and is likely to be exempt from the requirements of a clearing permit.

2.1.3 *Biodiversity Conservation Act 2016*

The *Biodiversity Conservation Act 2016* (BC Act) protects all native species and threatened ecological communities The BC Act recognises that activities involving the taking of flora or fauna (other than threatened species) and the disturbing of fauna (including threatened species) that are approved under the EP Act do not require further approval under the BC Act, if they are undertaken in accordance with any biodiversity conservation conditions that are applied to an authorisation. These activities include clearing of native vegetation done in accordance with an implementation decision under Part IV of the EP Act.

2.2 State Policy and Guidance

2.2.1 State Planning Policy No. 2.8 Bushland Policy for the Perth Metropolitan Region

SPP 2.8 in conjunction with Bush Forever (Government of Western Australia, 2000) seeks to ensure the protection of at least 10 per cent of the original extent of each vegetation complex within the Perth Metropolitan Region. SPP 2.8 was developed to ensure that bushland protection and management issues were appropriately addressed and integrated as a part of future land use. Bush Forever identified approximately 51,200 hectares of regionally significant vegetation for retention. The management of these areas include reservation and acquisition by the State government, negotiated planning solutions with owners who are seeking urban and/or industrial development and advice, assistance and incentive programs to support private conservation.

The northern part of Bush Forever Site 147 'Mariginiup Lake and Adjacent Bushland, Mariginiup' forms part of the Structure Plan Area.

2.2.2 State Planning Policy No. 2.9 Water Resources

SPP 2.9 aims to ensure the protection and appropriate management of water resources in line with state guidelines is included within the planning framework. The broad aims of this policy are to:

- Protect, conserve and enhance water resources.
- Assist in ensuring the availability of suitable water resources to maintain essential requirements for human and other biological life and to maintain or improve the quality and quantity of water resources.
- Promote and assist in the management and sustainable use of water resources.

As a part of implementing this policy, the Better Urban Water Management (WAPC 2008) framework was developed. This framework provides detail on how water resources should be considered at each stage of planning by identifying the various actions and investigations required with regard to regional and local planning strategies, town planning schemes, structure plans, subdivisions, strata subdivision and development applications (WAPC 2008).

The site is located to the west of the Gnangara Urban Water Protection Conservation Area.

2.2.3 State Planning Policy No. 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning

SPP 5.4 addresses transport noise from within major transport corridors, including freight routes, and its impact on noise sensitive land uses. The policy aims to:

- Protect people from unreasonable levels of transport noise by establishing a standardised set of criteria to be used in the assessment of proposals.
- Protect major transport corridors and freight operations from incompatible urban encroachment.
- Encourage best-practice design and construction standards for new development proposals and new or redeveloped transport infrastructure proposals.
- Facilitate the development and operation of an efficient freight network.
- Facilitate the strategic co-location of freight handling facilities.

Major transport (road) corridors are defined as:

- State roads and national highways;
- Urban primary distributors as described on the metropolitan functional road hierarchy (MRWA, local government) network;
- Other urban roads carrying more than 20,000 vehicles per day;
- Primary freight roads (Perth metropolitan region);
- Primary freight roads (South-West region); and
- Primary freight roads (State-wide).

Currently there is only one regional road (Pinjar) Road adjacent to the western boundary of the site. The East Wanneroo District Structure Plan recognises that the area will require an upgraded internal

regional road network together with improved north south and east west links. The Structure Plan Area may be impacted by the upgrade and extension of Ranch Road and there is the potential for noise attenuation to be required. The exact nature of these measures will be determined at the detailed planning stage through negotiations with Main Roads Western Australia (MRWA). Noise reduction strategies will be designed and implemented in conjunction with local government recommendations and government agency guidelines. Where practicable, management measures will be incorporated into the future development to minimise the impacts of noise and will be subject to subdivision and development approval conditions.

2.2.4 Environmental Protection Authority Guidance Statement No 33 Environmental Guidance for Planning and Development (EPA 2009)

The purpose of EPA Guidance Statement No.33 Environmental Guidance for Planning and Development is to outline the significance of environmental factors and provide the key definitions associated with the environmental factors. This document is primarily targeted at ensuring environmental factors are considered in line with the EPA's principals and objectives and within the planning framework. In particular, EPA Guidance Statement No.33 Environmental Guidance for Planning and Development aims to:

- Provide an overview to environmental protection processes and information;
- Describe the referral and environmental impact assessment process and process under Part IV of the EP Act; and
- Provide the EPA's position and advice on a range of environmental factors, outlining how to protect, conserve and enhance the environmental values.

2.2.5 Draft Gnangara Sustainability Strategy

The Gnangara Sustainability Study (GSS), released for public comment in July 2009, considers the impact of declining ground water resources in the Gnangara Mound and the associated implications for land use. The GSS presents a holistic government approach to the ongoing viability of the mound and the systems it supports. The GSS aims to achieve a water and land management framework for the Gnangara ground water system that is socially acceptable, economically viable and environmentally protective.

The major recommendations of the GSS relate to minimising impacts on wetland and terrestrial ecosystems through land management practices and reducing ground water abstraction. The GSS favours additional urbanisation occurring on land already disturbed, including portions of East Wanneroo and the fringes of State Forest, as opposed to clearing remaining natural vegetation. The strategy also outlines the importance of linkages between bushland areas to increase resilience to falling ground water levels and climate change.

The site is within the GSS study area but is outside of the priority drinking water resource areas (DWER, 2023c). The GSS land use concept is generally in keeping with that identified in the Future of East Wanneroo study, providing for urbanisation of portions of East Wanneroo while retaining a rural interface to the east of the Structure Plan Area.

2.2.6 Position Statement: Wetlands (WRC, 2001)

This position statement was prepared to clarify the Commission's position on the management and protection of wetlands of the Swan Coastal Plain and how this relates to development in the region.

It provides information relating to wetland type, evaluation and management based on the systems developed by the Semeniuk Research Group for wetland classification on the Swan Coastal plain (Hill *et al*., 1996). It also discusses wetland buffers and land use with recommendations for buffer widths depending on the purpose of the buffer and the surrounding land use.

2.2.7 Position Statement 4; Environmental Protection of Wetlands (EPA, 2004)

Position Statement 4 defines important values and functions of wetlands and establishes principles for the environmental protection of wetlands in general (EPA 2004).

The Position Statement provides a set of principles for the protection of wetlands to be used by natural resource managers, landowners and managers when addressing wetland impacts and management.

2.3 *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) is the Australian Government's central piece of environmental legislation.

The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places — defined in the Act as matters of national environmental significance.

The seven matters of national environmental significance to which the EPBC Act applies are:

- World heritage sites
- National heritage places
- Wetlands of international importance (often called 'ramsar' wetlands after the international treaty under which such wetlands are listed)
- Nationally threatened species and ecological communities
- Migratory species
- Commonwealth marine areas
- Nuclear actions.

Under the EPBC Act, a significant impact is determined by the sensitivity, value and quality of the environment which is to be impacted and the intensity, duration, magnitude and geographic extent of the impacts (DEWHA, 2008b). If a proposed action is deemed to have a significant impact, this action should be referred to the Minister.

The EPBC Act applies to 'actions' which:

- Have a 'significant impact' on 'matters of national environmental significance';
- Are undertaken by commonwealth government agencies and have a significant impact on the environment anywhere in the world; or
- Are undertaken by any person and have a significant impact on commonwealth land (even if the activity is not actually carried out on the commonwealth land).

The Matters of National Environmental Significance. Significant Impact Guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999 (DSEWPaC, 2009) provides a guide for determining

the significance of the impact which depends on the sensitivity, value and quality of the environment and the intensity, duration, magnitude and geographic extent of the impacts.

3 EXISTING ENVIRONMENT

3.1 Land Use

3.1.1 Historic Land Use

Earliest available aerial photography for the site from 1965 shows that the site contains alarge amount of uncleared vegetation and some lots completely cleared (Plate 2) (Landgate, 2023). Water is observable in Mariginiup Lake as well as Little Mariginiup Lake located to the north-east of Mariginiup Lake.

Plate 2: Historical Aerial Photograph from 1965

Source: Landgate, 2023

The 1983 aerial photograph shows additional clearing and rural development has started on some of the lots (Landgate, 2023). Little Mariginiup Lake appears to be much drier and is likely to have been drained into Lake Mariginiup from the south-western corner and is completely cleared (Plate 3). One lot in the north-eastern corner of the precinct has been planted with pine trees (Landgate, 2023).

Plate 3: Historical Aerial Photograph from 1983

Source: Landgate, 2023

Further clearing is evident from the photograph taken in 1995 and many of the lots in the precinct have been developed for market gardening and a chicken farm (Plate 4) (Landgate, 2023).

Plate 4: Historical Aerial Photograph from 1995

Source: Landgate, 2023

3.1.2 Current Land Use

The Structure Plan area contains a number of different lands uses including market gardens and large lifestyle blocks. Table 1 shows the status of land use on each lot.

Table 1: Presence of Native Vegetation in each Lot

Lot	Vegetated/Cleared
Lot 3 Mornington Drive	Cleared – market garden
Lot 4 Mornington Drive	Cleared – market garden
Lot 3 Coogee Road	Partly vegetated with cleared paddock
Lot 4 Coogee Road	Partly vegetated with cleared area
Lot 5 Coogee Road	Vegetated
Lot 6 Coogee Road	Partly vegetated with cleared area
Lot 7 Coogee Road	Partly vegetated and remainder cleared for market gardens
Lot 20 Coogee Road	Cleared – structures
Lot 23 Coogee Road	Cleared – paddock and partly vegetated
Lot 24 Coogee Road	Parkland cleared area and remainder cleared
Lot 101 Coogee Road	Cleared – market garden
Lot 102 Coogee Road	Cleared – market garden
Lot 21 Pinelake Trail	Cleared – pine plantation and artificial lake
Lot 802 Mariginiup Road	Mostly cleared containing Little Mariginiup Lake
Lot 1 Ranch Road	Cleared – market gardens
Lot 2 Ranch Road	Vegetated
Lot 3 Ranch Road	Cleared – market gardens
Lot 4 Ranch Road	Cleared – market gardens
Lot 5 Ranch Road	Partly vegetated with cleared areas
Lot 6 Ranch Road	Partly vegetated with cleared areas
Lot 7 Ranch Road	Cleared – market gardens
Lot 8 Ranch Road	Mostly vegetated with cleared areas
Lot 10 Ranch Rad	Vegetated with cleared area on western boundary
Lot 11 Ranch Road	Partly vegetated with market gardens
Lot 19 Ranch Road	Parkland cleared
Lot 22 Ranch Road	Mostly vegetated with cleared areas
Lot 100 Ranch Road	Partly vegetated with cleared areas
Lot 250 Ranch Road	Partly vegetated mostly cleared – market gardens
Lot 251 Ranch Road	Mostly vegetated with cleared areas
Lot 801 Ranch Road	Cleared with planted exotics
Lot 1 Pinjar Road	Cleared – market gardens
Lot 11142 Ranch Road	Vegetated – lake and buffer
Lot 14328 Ranch Road	Lake
Lot 1 Pinjar Road	Cleared – market garden
Lot 2 Pinjar Road	Parkland cleared
Lot 3 Pinjar Road	Partly vegetated with cleared areas
Lot 39 Pinjar Road	Partly vegetated with cleared areas, market gardens and orchard
Lot 42 Pinjar Road	Partly vegetated with cleared areas
Lot 302 Pinjar Road	Partly vegetated with cleared areas
Lot 303 Pinjar Road	Vegetated

There are no registered Contaminated Sites within the Structure Plan Area (DWER, 2023a).

3.1.3 Surrounding Land Use

The surrounding land includes residential development to the west, market gardens, cleared land and native vegetation to the east, special rural lots and Lake Adams to the north and Mariginiup Lake and a strip of native vegetation to the south.

3.2 Heritage

3.2.1 Aboriginal Heritage

There is one Aboriginal Heritage Site mapped in the Structure Plan Area being Site 3741, Lake Mariginiup (DPLH, 2023) (Appendix 2). There is also a Heritage Place mapped in the Structure Plan area which is Place 28616 Lake Mariginiup Scarred Tree, located on the western side of Lake Mariginiup (Appendix 2). The Heritage Place as been lodged but is not yet assessed under Section 5 of the *Aboriginal Heritage Act 1972*.

3.2.2 European Heritage

Heritage sites can be listed under the following lists/registers:

- World Heritage Sites;
- National Heritage Sites;
- Commonwealth Heritage Sites;
- Sites on the register of the National Estate;
- Sites on the Western Australian Heritage Council Register; and
- Sites listed in the City of Wanneroo Scheme Heritage List.

There are no listed Heritage Sites or Interim Heritage Sites on the site (National Map, 2023; Heritage Council of Western Australia, 2023; DCCEEW, 2023, City of Wanneroo, 2023).

3.3 Topography

The site is gently undulating with a high point on the north-western corner and generally slopes down to the south-east. Elevations range between approximately 46m and 70m Australian Height Datum (AHD) (Figure 2).

3.4 Geology and Soils

3.4.1 Geology

The site is mapped as part of the Spearwood System which has the highest relief of the dune systems on the Swan Coastal Plain (Bolland, 1998). The Spearwood system consists of slightly calcareous Aeolian sand remnant from leaching of the underlying Pleistocene Tamala limestone (Davidson, 1995).

3.4.2 Soils

Three Spearwood soil units are mapped on the site and are described as follows:

- Karrakatta Sand Yellow Phase (211Sp_Ky) which are on low hilly to gently undulating terrain and are yellow sand over limestone at 1-2 m (DPIRD, 2023), mapped over most of the site;

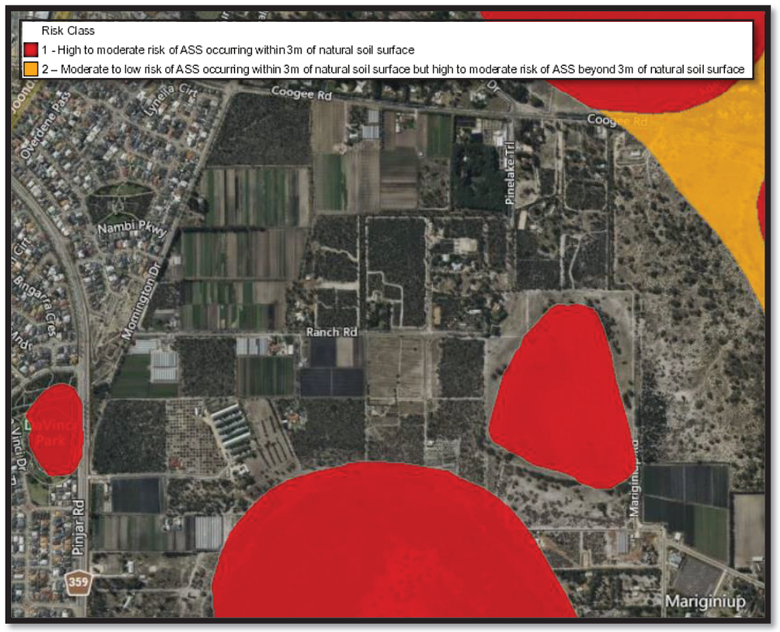
- Spearwood seasonal swamps Phase (211Sp_Ws) which are depressions with free water in winter made up of humus podzols and peat (DPIRD, 2023) which is mapped over the margins of Mariginiup Lake and over all of Little Mariginiup Lake; and
- Spearwood permanent lakes and swamps phase (211Sp_Wp) which are depressions with humus podzols and peats around the edges often with some diatomite (DPIRD, 2023) associated with Mariginiup Lake.

Soil Mapping is shown in Figure 3.

3.4.3 Acid Sulphate Soils

The soils on the site have a Low risk of Acid Sulphate soils <3m from the surface (National Map, 2023), with the exception of the soils of Mariginiup Lake and Little Mariginiup Lake which is mapped as 'High to Moderate' risk <3m from the surface (Plate 5).

Plate 5: Acid Sulphate Soil Risk Mapping



Source: National Map, 2023

3.4.4 Land Degradation Risks

The Land Degradation Risk Categories of the soil phases are outlined in Table 2.

Table 2: Land Degradation Risk Categories

Soil Type	Water Erosion	Wind Erosion	Waterlogging	Flooding	Salinity risk
211Sp_Ky	<3% of map unit has a high to extreme water erosion risk	>70% of map unit has a high to extreme wind erosion risk	<3% of map unit has a moderate to very high waterlogging risk	<3% of the map unit has a moderate to high flood risk	<3% of map unit has a moderate to high salinity risk or is presently saline
211Sp_Ws	<3% of map unit has a high to extreme water erosion risk	<3% of map unit has a high to extreme wind erosion risk	>70% of map unit has a moderate to very high waterlogging risk	<3% of the map unit has a moderate to high flood risk	<3% of map unit has a moderate to high salinity risk or is presently saline
211Sp_Wp	<3% of map unit has a high to extreme water erosion risk	<3% of map unit has a high to extreme wind erosion risk	>70% of map unit has a moderate to very high waterlogging risk	<3% of the map unit has a moderate to high flood risk	<3% of map unit has a moderate to high salinity risk or is presently saline

Source: National Map, 2023

3.5 Hydrology and Wetlands

Annual Average Maximum Groundwater Levels for 1986 to 1995 range from a high of around 44m AHD at the eastern boundary down to 38.5m along the western boundary (Pentium Water, 2023). Depth to AAMGL ranges from 29m at the mid-northern boundary down to 1m for Mariginiup Lake. Groundwater flow is generally in a westerly direction.

There are two lakes within the Structure Plan Area which are Mariginiup Lake (Unique Feature Identifier (UFI) 7953) and Little Mariginiup Lake (UFI 8161) (Figure 4). Both of the lakes are mapped as Conservation Category. Conservation Category wetlands are considered the highest priority wetlands (EPA, 2008). The objective for these wetlands is to preserve and protect the existing conservation values of the wetlands through various mechanisms including:

- Reservation in national parks,
- Crown reserves and State owned land,
- Protection under Environmental Protection Policies, and
- Wetland covenanting by landowners (EPA, 2008).

No development or clearing is considered appropriate in Conservation Category wetlands.

Both lakes have been identified as being groundwater dependent without defined surface water flows in high rainfall events (Pentium Water, 2023).

Lake level monitoring of Lake Mariginiup has been undertaken since 1954 at a single surface water monitoring site (WIR ID 6162577) on a roughly monthly basis since 1954 (DWER, 2024). Monitoring since 2002 indicates lake levels have ranged from dry to 0.45m of water in 2003 (DWER, 2024) (Appendix 3). Historically (between 1978 and 1999) Little Mariginiup Lake had approximately 0.8m of

surface water seasonally however aerial photographs indicate that Little Lake Mariginiup does not contain water most of the time (Landgate, 2024).

3.6 Flora and Vegetation Surveys

There have been several flora and vegetation surveys undertaken in the area being:

- *Environmental Impact Assessment: Ranch Road, Mariginiup* (Ecoscape, 2010) which included a Detailed Flora and Vegetation survey (EPA, 2016) over the lots containing native vegetation (vegetated portions of Lots 19 and 100 Ranch Road and Lot 7 Coogee Road and Lots 19, 801, 22, 251 and 8 Ranch Road;
- *Mariginiup North District Structure Plan Environmental Assessment* (PGV Environmental, 2013), which included a preliminary vegetation assessment on all of the lots within the Structure Plan Area;
- *Level 2 Flora and Vegetation Survey Lot 5 Mornington Drive, Mariginiup (City of Wanneroo)* (Tauss, 2010);
- *Level 2 Flora and Vegetation Survey and Black Cockatoo Habitat Assessment 118 Coogee Road Mariginiup* (Strategen, 2017);
- *Environmental Assessment Study East Wanneroo District Structure Plan* (Emerge, 2018a) which was a preliminary vegetation assessment of the entire DSP;
- *Detailed Flora and Vegetation Assessment Lot 4 Coogee Road Mariginiup* (Emerge, 2018b);
- *Little Lake Mariginiup and Ecological Corridor Rehabilitation Plan* (Tranen, 2011);
- *Lot 7 Coogee Road, Mariginiup – Draft East Wanneroo District Structure Plan* (PGV Environmental, 2019a) which was a Reconnaissance Vegetation Survey (EPA, 2016) on the vegetated portion of Lot 7;
- *Lot 22 and 251 Ranch Road, Mariginiup – Environmental Report* (PGV Environmental, 2019b) which was a Reconnaissance Vegetation Survey;
- *56 Ranch Road and 294 Pinjar Road Detailed Flora and Vegetation Survey* (PGV Environmental, 2023a);
- *Lot 8, 22, 100 and 251 Ranch Road, Mariginiup Flora and Vegetation Survey* (PGV Environmental, 2023b); and
- *Vegetation Assessment of Lot 2 Ranch Road, Mariginiup. Memo* (Western Environmental, 2023)

3.7 Flora

There has been a total of 275 flora species recorded in Detailed Flora and Vegetation surveys undertaken in the Structure Plan area, of which 224 are native species and 56 (20.4%) are weed species (Tauss, 2010, Strategen, 2018, Emerge, 2018 and 2021, PGV Environmental, 2023a and 2023b). In previous flora surveys that have been undertaken on various lots there have been no significant species recorded on the site.

The Monocotyledon families with the highest number of species are from the Poaceae (Grass family), Asparagaceae (Asparagus family), Haemodoraceae (Blood Root family) and Orchidaceae (Orchid family). Dicotyledon families that had the highest number of species are Fabaceae (Pea and Wattle family), Asteraceae (Daisy family), Myrtaceae (Myrtle family) and Proteaceae (Banksia family).

3.8 Vegetation

3.8.1 Vegetation Complex

The vegetation on the western part of the site is part of the Karrakatta - Central and South Complex (shown in yellow in Plate 6) which is described as:

> *Predominantly open forest of Eucalyptus gomphocephala (Tuart) - Eucalyptus marginata (Jarrah) - Corymbia calophylla (Marri) and woodland of Eucalyptus marginata (Jarrah) - Banksia species. Agonis flexuosa (Peppermint) is co-dominant south of the Capel River (Heddle et al., 1980).*

The vegetation on the eastern part of the site is the Pinjar Complex (shown in blue on Plate 6), broadly described as:

> *Vegetation ranges from woodland of Eucalyptus marginata (Jarrah) - Banksia species to a fringing woodland of Eucalyptus rudis (Flooded Gum) - Melaleuca preissiana (Moonah) and sedgelands (Heddle et al., 1980).*

Plate 6: Vegetation Complex Mapping

Source – National Map, 2023

3.8.2 Vegetation Types

Previous surveys on the site have described the native vegetation on different parts of the site. Vegetation as described on each lot is shown in Table 3 and on Figure 5.

Table 3: Vegetation Types

Lot	Vegetation Type[#]
Lot 3 Coogee Road	VT1 *Banksia attenuata*, *Banksia menziesii* and *Eucalyptus marginata* woodland over *Jacksonia sternbergiana*, *Adenanthos cygnorum* and *Xanthorrhoea preissii* open scrub over *Hibbertia hypericoides*, **Watsonia meriana* and *Stirlingia latifolia* low shrubland over **Ehrharta calycina*, **Briza maxima* and **Avena barbata* open bunch grassland on sandy loam soils (Strategen, 2017). VT2 **Ehrharta calycina* open bunch grassland with emergent *Agonis flexuosa* and *Xanthorrhoea preissii* (Strategen, 2017).
Lot 4 Coogee Road	AfBEmHh Low open forest *Allocasuarina fraseriana*, *Banksia attenuata*, *Banksia menziesii* and *Eucalyptus marginata* over open shrubland *Jacksonia sternbergiana* and *Hibbertia hypericoides* over open mixed non-native grassland over sparse rushland *Desmocladus flexuosus* and *Alexgeorgea nitens* (Emerge, 2018). BEmAc Isolated clumps of low trees *Banksia attenuata*, *B. menziesii* and *Eucalyptus marginata* over tall shrubland *Adenanthos cygnorum* subsp. *cygnorum* and *Jacksonia furcellata* over mixed native shrubland over open grassland **Ehrharta calycina* over rushland *Alexgeorgea nitens* and/or *Desmocladus flexuosus* (particularly where shrub cover is low) (Emerge, 2018). BiLf Low isolated trees of *Banksia ilicifolia* over shrubland *Lechenaultia floribunda* over sparse grassland *Ehrharta calycina* over sparse to dense rushland *Desmocladus flexuosus* and/or *Alexgeorgea nitens* (Emerge, 2018).
Lot 5 Coogee Road	Tauss BaBmEm *Banksia attenuata-Banksia menziesii- Eucalyptus marginata* low open forest over mid-dense A*llocasuarina humilis-Eremaea pauciflora- Hibbertia hypericoides* heath and open *Mesomelaena pseudostygia* sedges (Tauss, 2010).
Lot 6 Coogee Road	AfBaBmEmLOW *Allocasuarina fraseriana, Banksia attenuata, B. menziesii* and *Eucalyptus marginata* Low Open Woodland over *Xanthorrhoea preissii* Open Shrubland over *Hibbertia hypericoides* Low Shrubland over *Mesomelaena pseudostygia* and *Lyginia barbata* Very Open Sedgeland (Ecoscape, 2010).
Lot 7 Coogee Road	EmAf *Eucalyptus marginata* and *Allocasuarina fraseriana* over mostly weeds including Veldtgrass (*Ehrharta longiflora*), Ursinia (*Ursinia anthemoides*), Flatweed (*Hypochaeris glabra*), Pigface (*Carpobrotus edulis*) and Geraldton Carnation Weed (*Euphorbia terracina*). Some native shrubs are present including Grass Trees (*Xanthorrhoea preissii*), Blueboy (*Stirlingia latifolia*) and Marno (*Daviesia divaricata*) (PGV Environmental, 2019a). EmKg *Eucalyptus marginata* Low Open Woodland over *Kunzea glabrescens* Tall Shrubland over *Hibbertia hypericoides* Low Shrubland. EmXp *Xanthorrhoea preissii, Jacksonia sternbergiana, Hibbertia hypericoides, Daviesia divaricata, Anigozanthos manglesii, Desmocladus flexuosus* and *Alexgeorgea nitens* (PGV Environmental, 2019a).

Lot	Vegetation Type[#]
Lot 23 Coogee Road	AfBaBmEmLOW *Allocasuarina fraseriana, Banksia attenuata, B. menziesii* and *Eucalyptus marginata* Low Open Woodland over *Xanthorrhoea preissii* Open Shrubland over *Hibbertia hypericoides* Low Shrubland over *Mesomelaena pseudostygia* and *Lyginia barbata* Very Open Sedgeland (Ecoscape, 2010).
Lot 24 Coogee Road	PEm Parkland cleared *Eucalyptus marginata* (Jarrah) and *Banksia* sp.
Lot 21 Pinelake Trail	PP *Pinus* sp. (Pine) Plantation
Lot 802 Mariginiup Road	JfPa Upland areas are described as scattered clusters of coloniser species *Jacksonia furcellata* (Grey Stinkwood). The understorey is dominated by the annual native species *Podotheca angustifolia* (Sticky Longheads) with the occasional *Corynotheca micrantha* (Sand Lily) (Tranen, 2011). BF Lake Lake is likely to be dominated by *Baumea articulata* with scattered *Corymbia calophylla* (Marri), *Eucalyptus rudis* (Flooded Gum) and *Melaleuca rhaphiophylla* (Paperbark) as per the description in Bush Forever (Government of Western Australia, 2000).
Lot 2 Ranch Road	AfBaBmEmLOW *Allocasuarina fraseriana, Banksia attenuata, B. menziesii* and *Eucalyptus marginata* Low Open Woodland over *Xanthorrhoea preissii* Open Shrubland over *Hibbertia hypericoides* Low Shrubland over *Mesomelaena pseudostygia* and *Lyginia barbata* Very Open Sedgeland (Ecoscape, 2010).
Lot 5 Ranch Road	BaBm(Af) *Banksia attenuata/ B. menziesii/Allocasuarina fraseriana* Low Open Woodland over *Xanthorrhoea preissii/ Hibbertia hypericoides* Low Shrubland over *Mesomelaena pseudostygia/Alexgeorgea nitens* Sedgeland (PGV Environmental, 2023a).
Lot 6 Ranch Road	Inferred BaBm(Af) Likely to be similar to Lot 5 Ranch Road, however may have less upper storey due to previous clearing.
Lot 8 Ranch Road	JfAc *Jacksonia furcellata/Adenanthos cygnorum* Tall Open Scrub over *Verticordia densiflora* Closed Low Heath (PGV Environmental, 2023b) Af *Allocasuarina fraseriana* Low Woodland over *Xanthorrhoea preissii/Hibbertia hypericoides* Low Open Shrubland (PGV Environmental, 2023b)
Lot 10 Ranch Road	BF Uplands Uplands included in Bush Forever and described as *Eucalyptus marginata* Open Woodland to Open Forest; *Banksia attenuata* and B*. menziesii* Low Open Woodland to Low Open Forest (Government of Western Australia, 2000).
Lot 11 Ranch Road	
Lot 19 Ranch Road	PEm Parkland ?*Eucalyptus marginata* (Jarrah)

Lot	Vegetation Type[#]
Lot 22 Ranch Road	EmAfBaBm *Eucalyptus marginata/ Allocasuarina fraseriana/ Banksia menziesii/B. attenuata* Low Open Woodland over *Calytrix fraseri/Xanthorrhoea preissii/Hibbertia hypericoides/Mesomelaena pseudostygia* Closed Low Heath (PGV Environmental, 2023b). AfBa *Allocasuarina fraseriana/ Banksia attenuata* Low Open Woodland over *Xanthorrhoea preissii/ Hibbertia hypericoides* Closed Low Heath (PGV Environmental, 2023b).
Lot 100 Ranch Road	EmAfBaBm *Eucalyptus marginata/ Allocasuarina fraseriana/ Banksia menziesii/B. attenuata* Low Open Woodland over *Calytrix fraseri/Xanthorrhoea preissii/Hibbertia hypericoides/Mesomelaena pseudostygia* Closed Low Heath (PGV Environmental, 2023b).
Lot 250 Ranch Road	AfBaBmEmLOW *Allocasuarina fraseriana, Banksia attenuata, B. menziesii* and *Eucalyptus marginata* Low Open Woodland over *Xanthorrhoea preissii* Open Shrubland over *Hibbertia hypericoides* Low Shrubland over *Mesomelaena pseudostygia* and *Lyginia barbata* Very Open Sedgeland (Ecoscape, 2010).
Lot 251 Ranch Road	AfBa *Allocasuarina fraseriana/ Banksia attenuata* Low Open Woodland over *Xanthorrhoea preissii/ Hibbertia hypericoides* Closed Low Heath (PGV Environmental, 2023b).
Lot 801 Ranch Road	Parkland ?*Eucalyptus marginata* (Jarrah)
Lot 11142 Ranch Road Lot 14328 Ranch Road	BF Lake Lakebed is likely to be dominated by *Baumea articulata* with scattered *Corymbia calophylla* (Marri), *Eucalyptus rudis* (Flooded Gum) and *Melaleuca rhaphiophylla* (Paperbark) as per the description in Bush Forever (Government of Western Australia, 2000)
Lot 2 Pinjar Road	PEm Parkland cleared with scattered *Eucalyptus marginata* (Jarrah) and exotic trees
Lot 3 Pinjar Road	AfLW *Allocasuarina fraseriana* Low Open Woodland over *Kunzea ericifolia* Tall Open Shrubland over *Stirlingia latifolia* Low Open Shrubland over *Lyginia barbata*, *Mesomelaena pseudostygia* and *Alexgeorgea nitens* Open Sedgeland (Ecoscape, 2010).
Lot 39 Pinjar Road	BaBm *Banksia attenuata/B. menziesii* Low Open Woodland over *Hibbertia hypericoides* Low Shrubland over *Alexgeorgea nitens* Sedgeland (PGV Environmental, 2023a). Mp *Melaleuca preissiana* Low Closed Forest over *Xanthorrhoea preissii/ Hypocalymma angustifolium* Low Shrubland (PGV Environmental, 2023a). BaBmEt *Banksia attenuata/B. menziesii/Eucalyptus todtiana* Low Open Woodland over *Hibbertia hypericoides* Low Shrubland (PGV Environmental, 2023a).

Lot	Vegetation Type[#]
Lot 42 Pinjar Road	BF Uplands Uplands included in Bush Forever and described as *Eucalyptus marginata* Open Woodland to Open Forest; *Banksia attenuata* and B. *menziesii* Low Open Woodland to Low Open Forest (Government of Western Australia, 2000). PF Lake Lakebed is likely to be dominated by *Baumea articulata* with scattered *Corymbia calophylla* (Marri), *Eucalyptus rudis* (Flooded Gum) and *Melaleuca rhaphiophylla* (Paperbark) as per the description in Bush Forever (Government of Western Australia, 2000)
Lot 302 Pinjar Road	
Lot 303 Pinjar Road	

Inferred from desktop studies unless otherwise specified

3.8.3 Vegetation Condition

The condition of the vegetation was assessed according to the system devised by Keighery and described in Bush Forever (Government of Western Australia, 2000) (Table 4).

Table 4: Vegetation Condition Rating Scale

Condition	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

Source: Government of Western Australia, 2000.

The condition of the remnants of intact native vegetation is shown in Table 5 and on Figure 6. Generally, the remnant vegetation shows signs of disturbance and weed invasion and some areas of potential dieback and is rated Good to Very Good. Areas of higher disturbance and weed coverage were rated as Degraded. Small areas that have not been previously cleared and generally in central areas not impacted by edge effects were rated as Very Good and Excellent. There were no areas rated as pristine in the Structure Plan area. All areas that are cleared are Completely Degraded.

A bushfire swept through a large part of the site in November 2023. The native vegetation will recover in time back to the pre-fire condition. However, some new firebreaks may have been created to help fight the fire. An assessment of the vegetation regrowth in areas of POS and Parklands should be carried out to determine the condition of the vegetation in areas where native vegetation is proposed to be retained.

Table 5: Vegetation Condition

Lot	Vegetation Condition[#]
Lot 3 Coogee Road	The VT1 vegetation type was rated as being in Good and Very Good condition (Strategen, 2017). The VT2 vegetation type was Degraded and Completely Degraded (Strategen, 2017). There is a cleared track around and through the lot mapped as Completely Degraded (Strategen, 2017).
Lot 4 Coogee Road	The AfBEmHh vegetation type was mapped as Very Good. BEmAc and BiLf was mapped as being in Very Good – Good condition. A small portion of BEmAc in the north was rated as Degraded. The remaining areas were mapped as Completely Degraded (Emerge, 2018).
Lot 5 Coogee Road	The vegetation was rated as being in Very Good to Excellent condition (Tauss, 2010).
Lot 6 Coogee Road	The vegetation was rated as Excellent (Ecoscape, 2010).
Lot 7 Coogee Road	The northern part of the lot is Completely Degraded, the vegetated portion was rated as mostly Good and there is a small area in the south that was rated as Very Good (PGV Environmental, 2019a).
Lot 23 Coogee Road	The vegetation was rated as Good (Ecoscape, 2010).
Lot 24 Coogee Road	Parkland cleared *Eucalyptus marginata* (Jarrah) and *Banksia* sp.
Lot 21 Pinelake Trail	The plantation is Completely Degraded
Lot 802 Mariginiup Road	The vegetation is largely cleared and is Completely Degraded.
Lot 2 Ranch Road	The vegetation is rated as being in Excellent condition (Emerge, 2021).
Lot 5 Ranch Road	The condition of the vegetation on Lot 5 Ranch Road was mostly Very Good for the central and northern portions, with Good-Degraded and Degraded in the lower southern third of the site. The northern boundary was rated as Good as it had a high percentage of Perennial Veldtgrass (*Ehrharta calycina*) (PGV Environmental, 2023a).
Lot 6 Ranch Road	Inferred to be Degraded due to previous clearing and sparse coverage as noted in aerial photographs.
Lot 8 Ranch Road	The vegetation has been cleared on more than one occasion and was rated as Good as the vegetation structure is considered to have been significantly altered from the pre-clearing condition (PGV Environmental, 2023b)
Lot 10 Ranch Road	The intact vegetation was rated as Very Good to Excellent (Government of Western Australia, 2000).
Lot 11 Ranch Road	
Lot 19 Ranch Road	Completely Degraded due to Parkland clearing
Lot 22 Ranch Road	The condition of the vegetation that has not previously been cleared was mostly Very Good with areas surrounding that were Good or Degraded due to a high weed coverage (PGV Environmental, 2023b).
Lot 100 Ranch Road	The vegetation was mostly Good with a small amount of Degraded due to a high weed coverage (PGV Environmental, 2023b).
Lot 250 Ranch Road	The small area of vegetation was rated as Very Good (Ecoscape, 2010).
Lot 251 Ranch Road	The condition of the vegetation that has not previously been cleared was mostly Very Good with areas that were Good or Degraded due to a high weed coverage (PGV Environmental, 2023b).
Lot 801 Ranch Road	Completely Degraded due to Parkland clearing
Lot 11142 Ranch Road	Riparian vegetation likely to be in Very Good condition with localised areas of disturbance being Degraded or Completely Degraded
Lot 14328 Ranch Road	
Lot 2 Pinjar Road	Completely Degraded due to Parkland clearing
Lot 3 Pinjar Road	Remnant vegetation is Degraded (Ecoscape, 2010).
Lot 39 Pinjar Road	Condition ranged from Degraded to Very Good. The central part of the vegetation was Very Good, the Paperbark vegetation in the southwest corner was rated only Good due to 60% coverage of weeds in the understorey. The north-west corner was rated as Degraded due to a very high weed coverage and several dead Banksia trees (PGV Environmental, 2023a).

Lot	Vegetation Condition[#]
Lot 42 Pinjar Road	Lots are generally cleared with scattered vegetation so likely to be Degraded to Completely Degraded
Lot 302 Pinjar Road	
Lot 303 Pinjar Road	

3.8.4 Floristic Community Types

Floristic Community Types (FCT) are based on the whole floristic composition of the vegetation rather than being determined by soil type and geomorphology (Vegetation Complexes) or the nature of the dominant species (Vegetation Association). Most of the State-based TECs and PECs are based on the FCT level of vegetation description. For vegetation to be able to be assigned an FCT the vegetation must be in Good condition or better.

Quadrat Data for several of the lots has been analysed to identify the Floristic Community. The vegetation in Lot 5 Coogee Road was determined to be FCT20a '*Banksia attenuata* woodlands over species rich dense shrublands' (Tauss, 2010) (Figure 7).

Lot 2 Ranch Road was inferred to be FCT20a (Ecoscape, 2010) (Figure 7). Further analysis of quadrat data by One Tree Botanical concluded that the vegetation in the northern half of the lot, ie above the 50m AHD contour level were strongly representative of FCT20a while the vegetation in the southern half were transitional between FCT20a and several other Banksia woodland FCTs (Western Botanical, 2023).

The computer analysis of quadrat data concluded that the BaBm(Af) on Lot 5 Ranch Road were most likely representative of FCT 28 '*Spearwood Banksia attenuata or Banksia attenuata – Eucalyptus woodlands*' (PGV Environmental, 2023a).

Lot 39 Pinjar Road contains FCT 28 '*Spearwood Banksia attenuata or Banksia attenuata – Eucalyptus woodlands*', FCT 22 '*Banksia ilicifolia woodlands*' and FCT 21c '*Low lying Banksia attenuata woodlands and shrublands*' (PGV Environmental, 2023a).

Analysis of data from Lots 22, 100 and 251 showed the vegetation is most closely aligned to FCT28 – Spearwood *Banksia attenuata* or *Banksia attenuata – Eucalyptus marginata* woodlands (PGV Environmental, 2023b).

The vegetation on Lot 4 Coogee Road was analysed as being representative of FCT21a – Central *Banksia attenuata - Eucalyptus marginata* woodlands and FCT22 – *Banksia ilicifolia* woodlands (Emerge, 2018).

3.9 Conservation Significance of Flora and Vegetation

3.9.1 Flora

No Threatened or Priority flora species have been recorded on the site in the past surveys.

3.9.2 Vegetation

Vegetation Complex

The status of each vegetation association mapped on the site is shown in Table 6 (DBCA, 2018).

Table 6: Vegetation Association Statistics

Vegetation Complex	Pre-European Extent	Remaining on Swan Coastal Plain		Remaining in Secure Tenure	
	Area (ha)	Area (ha)	%	Area (ha)	%
Karrakatta Central and South	53,080	12,467	23.495	2,053.62	3.87
Pinjar	4,893	1,735.34	35.47	223.61	4.57

Both of the identified complexes have greater than 10% remaining in the Metropolitan Region which is considered a 'constrained area'.

The Bush Forever process used the 10% criterion to identify areas or regional significance. All areas of vegetation containing vegetation complexes with less than 10% remaining were considered regionally significant. For vegetation complexes with more than 10% remaining the aim of Bush Forever was to achieve a 10% protection status. Areas were chosen based on floristics and other criteria such as the presence of wetlands. Both the Karrakatta Central and South and Pinjar vegetation complexes have more than 10% remaining but less than 10% protected. Nevertheless, the areas of remnant vegetation within the site were not identified for retention in the District Structure Plan due to generally poorer condition fragmented by developed and cleared areas as well as fitting in with the overall consolidated planning over the district.

Threatened Ecological Community

The native vegetation on the site has potential to be a Threatened Ecological Community (TEC) at Commonwealth and State level due to the presence of Banksia woodland as a dominant vegetation type.

FCT20a '*Banksia attenuata* woodlands over species rich dense shrublands' is listed as a Critically Endangered TEC under State environmental legislation and is mapped on Lot 5 Coogee Road and the northern part of Lot 2 Ranch Road. The Structure Plan area has a total area of FCT20a of 8.48ha as shown on Figure 7.

The remaining areas analysed contain FCT21a, FCT21c and FCT28 are not listed as TECs or PECs in Western Australia. FCT22, *Banksia ilicifolia* woodlands, that occurs on Lot 3 Coogee Road is ranked as a Priority 3 ecological community. The total area of FCT22 is 0.11ha.

Banksia Woodlands of the Swan Coastal Plain TEC

The Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community (Banksia Woodland TEC) is listed as an Endangered TEC under the Commonwealth EPBC Act. The Banksia Woodland community is a conglomerate of a number of Banksia-dominated FCTs recognised at State level. The FCTs identified on the site form part of the Banksia Woodland TEC. There are also additional areas in the Structure Plan that have not been surveyed for FCT that contain Banksia dominated vegetation. However, the identification of one of the relevant FCTs on a site or Banksia dominated vegetation is not of itself sufficient to assign the vegetation to the Banksia Woodland TEC. The vegetation needs to meet specific criteria to be considered the TEC as follows.

The *Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community* (Conservation Advice) (Commonwealth of Australia, 2016) describes the Banksia Woodland TEC as follows:

> *The ecological community is a woodland associated with the Swan Coastal Plain of southwest Western Australia. A key diagnostic feature is a prominent tree layer of Banksia, with scattered eucalypts and other tree species often present among or emerging above the Banksia canopy. The understorey is a species rich mix of sclerophyllous shrubs, graminoids and forbs. The ecological community is characterised by a high endemism and considerable localised variation in species composition across its range*.

Table 7 outlines the Banksia Woodland TEC criteria contained in the Conservation Advice.

Table 7: Banksia Woodland TEC Criteria

Feature	Characteristic
Banksia Species	The patch must include at least one of the following diagnostic species: • *Banksia attenuata* (Candlestick Banksia) • *Banksia menziesii* (Firewood Banksia) • *Banksia prionotes* (Acorn Banksia) • *Banksia ilicifolia* (Holly-Leaved Banksia).
Vegetation Structure	• A distinctive upper sclerophyllous layer of low trees (occasionally large shrubs more than 2 m tall), typically dominated or codominated[3] by one or more of the *Banksia* species (*B. attenuata, B. menziesii, B. ilicifolia, B. prionotes*); • An emergent tree layer of medium or tall (>10 m) height *Eucalyptus* or *Allocasuarina* (Sheoak) species may sometimes be present above the *Banksia* canopy. • An understory that is often highly species-rich consists of: – A layer of sclerophyllous shrubs of various heights; and, – A herbaceous ground layer of cord rushes, sedges and perennial and ephemeral forbs, that sometimes includes grasses. The development of a ground layer may vary depending on the density of the shrub layer and disturbance history.
Vegetation Condition	An area of Banksia woodland needs to be at least in Good condition to be considered the TEC.
Patch Size	The Banksia woodland TEC needs to meet a minimum 'patch' size depending on its condition to qualify as the TEC, as follows: • 'Pristine' – no minimum patch size • 'Excellent' – 0.5ha • 'Very Good' – 1ha • 'Good' – 2ha

Source: Commonwealth of Australia, 2016

Table 8 outlines the results of surveys if a Banksia Woodland TEC assessment has been undertaken. If an assessment is not available an analysis of the vegetation to identify if the vegetation may be part of the TEC is provided in Table 8. In summary the Structure Plan area contains 24.82ha of Banksia Woodland TEC that is shown on Figure 7.

Table 8: Banksia Woodland TEC Analysis

Lot	Characteristic	Banksia Woodland TEC Analysis[#]
Lot 3 Coogee Road		Lot contains Banksia Woodland as part of a larger 'patch) (Strategen, 2017).
Lot 4 Coogee Road		The AfBEmHh vegetation, when combined with adjacent banksia woodland vegetation that appears to meet the criteria, represents the TEC (Emerge, 2018).
Lot 5 Coogee Road	Previous Survey	The site was surveyed prior to the listing of the Banksia Woodland TEC (Tauss, 2010).
	Banksia species	*Banksia attenuata* and *Banksia menziesii* dominated vegetation
	Vegetation Structure	Vegetation has the appropriate structure being *Banksia attenuata* and *Banksia menziesii* dominated over *Allocasuarina humilis-Eremaea pauciflora-Hibbertia hypericoides* heath and open *Mesomelaena pseudostygia* sedges
	Condition	The Lot was rated as being in Very Good to Excellent condition (Tauss, 2010).
	Patch Size	Approximately 8ha
	Conclusion	Vegetation on Lot 5 Coogee Road is representative of the Banksia Woodland TEC
Lot 6 Coogee Road	Previous Survey	The site was surveyed prior to the listing of the Banksia Woodland TEC (Ecoscape, 2010).
	Banksia species	*Banksia attenuata* and *Banksia menziesii* dominated vegetation
	Vegetation Structure	Vegetation has the appropriate structure being *Allocasuarina fraseriana, Banksia attenuata, B. menziesii* and *Eucalyptus marginata* Low Open Woodland over *Xanthorrhoea preissii* Open Shrubland over *Hibbertia hypericoides* Low Shrubland over *Mesomelaena pseudostygia* and *Lyginia barbata* Very Open Sedgeland
	Condition	The Lot was rated as being in Excellent condition (Ecoscape, 2010).
	Patch Size	Approximately 2.2ha
	Conclusion	Vegetation on Lot 6 Coogee Road is likely to be representative of the Banksia Woodland TEC
Lot 7 Coogee Road		The vegetation on the site was assessed as not meeting the requirement to be the Commonwealth listed Banksia Woodland TEC (PGV Environmental, 2019a).
Lot 23 Coogee Road	Previous Survey	The site was surveyed prior to the listing of the Banksia Woodland TEC (Ecoscape, 2010).
	Banksia species	*Banksia attenuata* and *Banksia menziesii* dominated vegetation
	Vegetation Structure	Vegetation has the appropriate structure being *Allocasuarina fraseriana, Banksia attenuata, B. menziesii* and *Eucalyptus marginata* Low Open Woodland over *Xanthorrhoea preissii* Open Shrubland over *Hibbertia hypericoides* Low Shrubland over *Mesomelaena pseudostygia* and *Lyginia barbata* Very Open Sedgeland
	Condition	The Lot was rated as being in Good condition (Ecoscape, 2010).
	Patch Size	Approximately 0.48ha and greater than 30m of cleared/Degraded to other areas of vegetation
	Conclusion	Vegetation on Lot 23 Coogee Road is not likely to be representative of the Banksia Woodland TEC

Lot	Characteristic	Banksia Woodland TEC Analysis[#]
Lot 2 Ranch Road	Previous Survey	The lot was surveyed by Emerge 2021 but the entire report has not been made available.
	Banksia species	*Banksia attenuata, Banksia menziesii* and *Banksia ilicifolia* dominated vegetation
	Vegetation Structure	Vegetation has the appropriate structure being Low Woodland
	Condition	The vegetation was rated as being in Excellent condition (Emerge, 2021).
	Patch Size	Approximately 4.1ha
	Conclusion	Vegetation on Lot 2 Ranch Road is representative of the Banksia Woodland TEC
Lot 5 Ranch Road		The lot contains 3.78ha of Banksia Woodland TEC (PGV Environmental, 2023a).
Lot 8 Ranch Road		The vegetation on Lot 8 does not meet the requirements on the basis that the required Banksia species are absent (PGV Environmental, 2023b)
Lot 10 Ranch Road and Lot 11 Ranch Road	Previous Survey	The lots have not been surveyed but are included in Bush Forever (Government of Western Australia, 2000).
	Banksia species	Uplands included in Bush Forever and described as *Eucalyptus marginata* Open Woodland to Open Forest; *Banksia attenuata* and B. *menziesii* Low Open Woodland to Low Open Forest
	Vegetation Structure	Vegetation has the appropriate structure from peripheral review of the area
	Condition	The intact vegetation was rated as Very Good to Excellent (Government of Western Australia, 2000).
	Patch Size	Approximately 7.5ha
	Conclusion	Vegetation on Lot 10 and 11 Ranch Road is representative of the Banksia Woodland TEC
Lot 22 Ranch Road		The condition of the vegetation that has not previously been cleared was mostly Very Good with areas surrounding that were Good or Degraded due to a high weed coverage (PGV Environmental, 2023b).
Lot 100 Ranch Road		The vegetation in Good condition or better meets the requirements of the Banksia Woodland TEC (PGV Environmental, 2023b).
Lot 250 Ranch Road	Previous Survey	The site was surveyed prior to the listing of the Banksia Woodland TEC (Ecoscape, 2010).
	Banksia species	*Banksia attenuata* and *Banksia menziesii* dominated vegetation
	Vegetation Structure	Vegetation has the appropriate structure being *Allocasuarina fraseriana, Banksia attenuata, B. menziesii* and *Eucalyptus marginata* Low Open Woodland over *Xanthorrhoea preissii* Open Shrubland over *Hibbertia hypericoides* Low Shrubland over *Mesomelaena pseudostygia* and *Lyginia barbata* Very Open Sedgeland
	Condition	The Lot was rated as being in Very Good condition (Ecoscape, 2010).
	Patch Size	Approximately 0.48ha and greater than 30m of cleared/Degraded to other areas of vegetation
	Conclusion	Vegetation on Lot 23 Coogee Road is not likely to be representative of the Banksia Woodland TEC
Lot 251 Ranch Road		The vegetation in Good condition or better meets the requirements of the Banksia Woodland TEC (PGV Environmental, 2023b).

Lot	Characteristic	Banksia Woodland TEC Analysis[#]
Lot 39 Pinjar Road		There is 4.92ha on Banksia Woodland TEC on 294 Pinjar Road (PGV Environmental, 2023a).

3.10 Fauna

3.10.1 Habitat

Fauna habitat on the site consists of woodlands of *Banksia* species with dense understorey provides for most small terrestrial species of all assemblages (PGV Environmental, 2013; Emerge, 2018a).

The Structure Plan area is mostly cleared with some fragmented remnants of vegetation that are generally open woodland habitats. Fauna habitat can be assessed using a number of factors including, the size of the habitat, the level of habitat connectivity, availability of specific resources (e.g. tree hollows) and overall vegetation quality. The habitat was assessed according to the categories in Table 9.

Table 9: Fauna Habitat Value

Habitat Value	Description
High Quality Fauna Habitat	These areas closely approximate the vegetation mix and quality that would have been in the area prior to any disturbance. The habitat has connectivity with other habitats and is likely to contain the most natural vertebrate fauna assemblage.
Very Good Fauna Habitat	These areas show minimal signs of disturbance (e.g. grazing, clearing, fragmentation, weeds) and generally retain many of the characteristics of the habitat if it had not been disturbed. The habitat has connectivity with other habitats and fauna assemblages in these areas are likely to be minimally affected by disturbance.
Good Fauna Habitat	These areas showed signs of disturbance (e.g. grazing, clearing, fragmentation, weeds) but generally retain many of the characteristics of the habitat if it had not been disturbed. The habitat has connectivity with other habitats and fauna assemblages in these areas are likely to be affected by disturbance.
Disturbed Fauna Habitat	These areas showed signs of significant disturbance. Many of the trees, shrubs and undergrowth are cleared. These areas may be in the early succession and regeneration stages. Areas may show signs of significant grazing, contain weeds or have been damaged by vehicle or machinery. Habitats are fragmented or have limited connectivity with other fauna habitats. Fauna assemblages in these areas are likely to differ significantly from what might be expected in the area had the disturbance not occurred.
Highly Degraded Fauna Habitat	These areas often have a significant loss of vegetation, an abundance of weeds, and a large number of vehicle tracks or are completely cleared. Limited or no fauna habitat connectivity. Faunal assemblages in these areas are likely to be significantly different to what might have been in the area pre-disturbance.

From: Coffey Environments, 2009

The Open Woodland habitat in the Structure Plan Area is fragmented and much is impacted by invasive weeds and tracks. The habitat has limited connectivity and is considered to be Good to Disturbed Fauna habitat. The cleared areas are Highly Degraded Fauna Habitat.

There is likely to be a paucity of native mammals present as has been the case for most fragmented urban bushland remnants.

3.10.2 Conservation Significant Species

The species that are identified as possibly present on the site by Emerge (2018) are:

- Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) (Endangered);
- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) (Endangered);
- Forest Red-tailed Black Cockatoos (*Calyptorhynchus banksii naso*) (Vulnerable);
- Rainbow Bee-eater (*Merops ornatus*) (Marine);
- Woollybush Bee (*Hylaeus globuliferus*) (Priority 3);
- Black-striped Snake (*Neelaps calonotos*) (Priority 3);
- Southern Brown Bandicoot, Quenda (*Isoodon fusciventer*) (Priority 4);
- Western Brush Wallaby (*Notamacropus irma*) (Priority 4); and
- Graceful Sun-moth (*Synemon gratiosa*) (Priority 4).

Priority fauna species are not protected under State or Commonwealth environmental legislation. However, the general principle is to protect habitat where possible for these species in any new development.

Endangered and Vulnerable species are protected under the EPBC Act and EP Act. The Endangered and Vulnerable species which have habitat on the site are the three species of Black Cockatoos. Habitat for Black Cockatoos includes 'Foraging habitat' as is determined from the plant species that are present on the study area and evidence of feeding such as direct observation of birds or by chewed nuts and cones. Foraging plants utilised by each species of Black Cockatoo varies, with Carnaby's Black Cockatoo foraging on Eucalypts, pines and proteaceous species, whereas Forest Red-tailed Cockatoos prefer Eucalypts and Allocasuarina and many exotic species and Baudin's prefer mostly seeds of Marri and Jarrah, also Allocasuarina cones (DAWE, 2022).

'Breeding habitat' is defined as trees of species known to support breeding within the range of the species which either have a suitable nest hollow OR have a DBH of 500mm or greater (DAWE, 2022).

Past studies have found that on average hollow openings are 25 cm x 27 cm (Saunders *et al.,* 1982, Saunders and Dawson, 2017) and 30 cm x 34 cm (Johnstone *et al*., 2013). The height of a hollow entrance off the ground is on average 19.384 m (Johnstone *et al*., 2013). Nearly all hollows that are used for nesting by Black Cockatoos are located in the main trunk and have a vertical aspect (Johnstone *et al*., 2013, Saunders and Dawson, 2017). Black Cockatoos are large birds with shoulders that are about 100 mm wide, therefore they require hollows with an entrance bigger than this (as shown above they are typically much larger), but the internal dimensions (depth and floor base) need to be much larger in order for it to be suitable to lay eggs in and for adults to be able to move around.

Previous research has found for Carnaby's Black Cockatoo a mean depth of 1.2 m and a floor diameter of 40 cm is required in order for it to be suitable to lay eggs in and for adults to be able to move around (Johnstone *et al*., 2013, Saunders and Dawson 2017).

The Black Cockatoo Referral Guidelines define trees of certain species with a DBH of 300 to 500mm or greater, dependent on the tree species, as breeding habitat regardless of the presence or not of

hollows. The theory behind this definition is the concept that while the trees may not currently contain hollows, they are mature enough that in the next 50 years or so a hollow might form and be of use to Black Cockatoos for the purposes of breeding. In Precinct 8 the trees that may be potential breeding habitat are generally Jarrah and Marris which require a DBH of 500mm to be considered potential breeding habitat.

'Roosting habitat' is usually evident due to the presence of Black Cockatoos in the survey area in the evening and early morning and if there are scats or moulted feathers under the roosting area. Black Cockatoos utilise a wide range of native and non-native trees, situated within a variety of land-use types. Roosting habitat is generally in tall (average of > 25 m) tree species that have relatively thick trunks (average DBH of 1 m) and medium foliage density (average of 50%), and that are not too densely forested amongst other trees (average tree crown connectivity of 20 %) (Le Roux, 2017). Black cockatoos rely upon the availability of suitable night roosting sites in proximity to foraging resources, and particularly access to water within 2 km of the roost site (SEWPaC, 2012).

No roosting or breeding by Black Cockatoo species has been recorded on the site (DoP, 2011; National Map, 2023). The nearest roosting is recorded approximately 1.4km to the north-east and 1.7km to the south-west.

Most of the native vegetation outside of the Lakes contains quality foraging habitat for Black Cockatoos. The pine plantation on Lot 21 Pinelake Trail is also considered foraging habitat. Figure 8 shows area that contain habitat for Black Cockatoos. A total of 58.3ha of foraging habitat occurs in the Structure Plan area.

4 PROPOSED STRUCTURE PLAN

The proposed Structure Plan for Wanneroo Precinct 8 has been designed to retain the key environmental features identified in the District Structure Plan and refined during subsequent studies within the area. The Structure Plan includes residential areas, a Primary School, associated roads, drainage reserves, Public Open Space (POS), Parklands and areas for conservation (Appendix 1). The locations of the Parkland areas are generally consistent with the East Wanneroo District Structure Plan.

The Structure Plan includes the following key environmental factors:

- Bush Forever Site 147 Mariginiup Lake and Adjacent Bushland, Mariginiup which is 32.6% of the Structure Plan area is to be designated for Conservation. The Bush Forever site will protect:
  - The portion of Mariginiup Lake within the Structure Plan Area;
  - Lot 802 Ranch Road which contains Little Mariginiup Lake;
  - Vegetation in Lot 10 Ranch Road which protects upland vegetation representative of the Banksia Woodland TEC and likely to be in at least Very Good condition;
  - Fringing lake vegetation in Lots 42, 301, 302 and 1142 Ranch Road; and
  - Upland and lake fringing vegetation in part of Lot 39 Pinjar Road and Lots 5 and 6 Ranch Road which, although impacted by previous clearing with areas that are completely cleared provide opportunities for restoration and environmental enhancement.
- Three areas of Parklands that will retain native vegetation within the Structure Plan area as follows:
  - Vegetation on Lot 2 Ranch Road which is in Excellent condition, representative of FCT 20a, listed as a TEC in Western Australia as well as being part of the Banksia Woodland TEC;
  - Vegetation in the northern part of Lot 5 Coogee Road which is vegetation representative of FCT 20a TEC and part of the Banksia Woodland TEC and in Very Good to Excellent condition; and
  - Vegetation in Lot 6 Pinelake Trail.
- Three areas of POS that that will retain native vegetation as follows:
  - Bushland on Lot 5 and Lot 6 Ranch Road in mostly Very Good condition that is also representative of the Banksia Woodland TEC;
  - Vegetation on Lot 39 Pinjar Road in mostly Good to Very Good condition that is representative of the Banksia Woodland TEC; and
  - Vegetation on Lot 251 is mostly Very Good condition that is representative of the Banksia Woodland TEC.
- Fourteen other POS areas that provide outdoor amenity and may provide opportunities to retain trees and provide internal ecological linkages;
- A North-south linkage that provides an ecological corridors between Mariginiup Lake, Little Mariginiup Lake and Lake Adams to the north; and
- Wide road reserves that will also be able to accommodate tree retention.

5 ENVIRONMENTAL ASSESSMENT

5.1 Land Use

There are no registered contaminated sites in the Structure Plan area. Previous and existing market garden areas may need a Preliminary Site Investigation to assess whether there are any areas of chemical contamination in the soil.

5.2 Heritage

The *Aboriginal Heritage Act 1972* (AH Act) protects all Aboriginal sites whether or not they are known and registered under the AH Act. Aboriginal Site 3741, Lake Mariginiup and Aboriginal Heritage Place 28616 Lake Mariginiup Scarred Tree are located within Bush Forever Site 147 as such will not be impacted by development.

The City of Wanneroo District Sense of Plan Policy acknowledges that Aboriginal heritage across the East Wanneroo is strongly linked to the wetland system that needs to be protected.

The policy encourages plans to consider and reference sites, people, and landscapes and reflect these through interpretation, amenity and local aesthetic throughout the public realm, including landscape design, public art and parkland links. Accordingly, to recognise Aboriginal cultural heritage and the significance of place, the Precinct 8 Mariginiup Local Structure Plan has provided for the representative planning and design of the following elements, noting that protection of Lake Mariginiup is assured within a state reservation:

- Definition of a cultural trail linking little Lake Mariginiup to Lake Adams
- Alignment of a cultural learning and interpretation trail and way finding
- Meeting places along the trail
- Naming of places
- Landscaping plans inclusive of expression of the local aesthetic in the public realm including parkland links and endemic plant species.

The proposed Structure Plan has been prepared with ongoing consultation with Traditional Owners.

5.3 Geology and Soils

5.3.1 Geology

The Spearwood geological unit is not a constraint for development.

5.3.2 Soils

The soils on the site do not provide an environmental impediment to the development of the site and have a low risk of acid sulphate soils. The areas of Spearwood seasonal swamps Phase and Spearwood permanent lakes and swamps phase are all contained within areas that are not proposed to be developed. The area that will be developed is on the Karrakatta Sand Yellow Phase

Although the areas to be developed do not have a mapped risk of Acid Sulphate Soils an investigation to the depth of any proposed excavation or dewatering may require Investigation and possibly a Management Plan at subdivision.

The soils of the development area have a high risk of being susceptible to wind erosion and therefore dust controls will be required during construction. The area proposed to be developed is not susceptible to water erosion, waterlogging, flooding or risk of salinity.

5.4 Hydrology

Groundwater and stormwater management will be required to be addressed in accordance with *Better Urban Water Management* (WAPC, 2008). The Local Water Management Strategy (LWMS) is has been prepared for the Structure Plan and an Urban Water Management Plan (UWMP) will be required at the subdivision stage. The key objectives of the LWMS are:

- *Landscape packages which adopt Waterwise principles will be encouraged.*
- *Detailed landscape plans for POS areas will be provided at subdivision stage which detail the proposed landscape treatments, plantings, community facilities and integration of drainage areas with the POS landscape design.*
- *The first 15 mm of rainfall to be infiltrated close-to-source or treated in bioretention basins within each catchment to mimic predevelopment conditions.*
- *The site consists of trapped and discharging catchments.*
- *Runoff generated in trapped catchments is managed via retention basins which are sized to infiltrate up to the 1% AEP event.*
- *The first 15 mm of runoff generated in discharging catchments will be treated in bioretention basins. Runoff in larger events will be conveyed to Little Mariginiup Lake or Lake Mariginiup.*
- *Given the separation between the design surface and the proposed Controlled Groundwater Level (CGL), it is not anticipated that subsoil drainage is a significant design constraint for Precinct 8.*
- *Subsoils may be installed beneath parts of the project area as a contingency against rising groundwater levels.*
- *The monitoring completed captured a single winter peak for 2021, with a total of five months monitoring completed.*
- *Quarterly groundwater levels and quality monitoring will be undertaken for a period of 18 months following practical completion, with a review after 18 months.*
- *Quarterly surface water levels and quality monitoring will be undertaken for a period of 18 months following practical completion, with a review after 18 months.*
  Section 8 provides details of UWMP requirements and the roles and responsibilities related to implementation of the LWMS (Pentium Water, 2023).

The LWMS provides guidance to ensure that the use of water in the development is best practice with water wise gardening. The surface water and groundwater quality and quantity will be managed in accordance with Better Urban Water Management as outlined in the LWMS with further details being provided at subdivision in Urban Water Management Plans (UWMPs).

There are no hydrological impediments to development of Precinct 8 that cannot be appropriately managed.

5.5 Wetlands

Mariginiup Lake and Little Mariginiup Lake are significant wetlands that are included in the structure plan, partially or wholly. The lakes and associated buffers form part of Bush Forever Site 147 and as such already have a measure of protection. These areas are also zoned as Parks and recreation. The wetland and associated buffers will be retained as natural areas in the Structure Plan.

The buffers to the lakes are the subject of a Buffer Assessment that has been prepared in conjunction with the Structure Plan. The Buffer Assessment identifies risks to the environmental values of the lakes and the role of the buffer to mitigate the risks.

A Foreshore Strategy has been developed to guide any development or provision of amenity within the buffer areas to ensure that the lakes remain a natural asset to the public while ensuring that management measures are in place to protect and enhance the wetland values of the lakes. The Foreshore Strategy broadly addresses:

- Management of the area during construction;
- Management of public access;
- Paths and amenities such as picnic tables;
- Landscaping and/or rehabilitation; and
- Ecological linkage.

5.6 Flora and Vegetation

A total of 17.4ha of native vegetation has been retained within the Structure Plan Area in Parklands, POS and the upland areas of Bush Forever Site 147. The high amount of Degraded vegetation retained is associated with Mariginiup and Little Mariginiup Lakes.

Table 10: Condition of Vegetation to be Retained/Cleared

Vegetation Condition	Total Area (ha)	Area Retained (ha)	% Retained	Area Cleared (ha)	% Cleared
Excellent	13.0	4.8	37	8.2	63
Excellent – Very Good	3.1	3.1	100	0	0
Very Good	10.8	3.2	30	7.6	70
Good – Very Good	4.4	0.4	9	4.0	91
Good	7.4	1.6	22	5.8	78
Good – Degraded	6.0	4.3	72	1.7	28
Degraded	33.8	29.3	87	4.5	13

The Structure Plan proposes to retain 14.32ha of the 24.82ha of the Banksia Woodland TEC on the site (58%) and 4.8ha of the 8.5ha of FCT20a (56%).

5.7 Fauna

The Structure Plan protects 19.3ha of the 58.3ha of Black Cockatoo foraging habitat, or 33%. The location of Parklands and POS also form habitat corridors that link vegetation in the Structure Plan Area from Bush Forever Site 147 through to Lake Adams to the north.

The retained vegetation will also provide habitat for the six Priority fauna species that are possible present on the site.

Trees retained in POS areas and in road reserves will provide fauna habitat values for birds and small reptiles.

Remaining impacts to native fauna can be managed through the standard Vegetation and Fauna Management Plan as required as a condition of subdivision. The Vegetation and Fauna Management Plans will include management measures for trapping and the relocation of terrestrial fauna prior to commencement of clearing and fencing of Parklands and vegetated POS areas to protect fauna. The management plan will include protocols and management measures to protect any nesting fauna such as Rainbow Bee-eaters and other small birds as well as the relocation of fauna disturbed during any clearing works.

5.8 Ecological Linkage

The Structure Plan retains vegetation with the highest environmental values, however due to past clearing these retained areas are in a highly fragmented landscape. Consultation during the development of the Structure Plan determined that retaining linkage from Mariginiup Lake, through Little Mariginiup Lake to Lake Adams provided an ecological linkage between areas. The linkage includes areas of natural vegetation in the Parklands on Lot 6 Pinelake Trail, areas of POS and trees to be retained in a widened road reserve.

5.9 Commonwealth Approvals

Any proposal or plan that is likely to have a significant impact on a Matter of National Environmental Significance requires referral under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) for a level of assessment to be determined.

A development of a Lifestyle Village on Lot 4 Mornington Drive and Lot 5 Coogee Road has been referred under the EPBC Act (EPBC 2011/6020) and assessed as a 'Controlled Action'. Development on Lot 4 Coogee Road has also been referred (EPBC 2019/8452) and has a 'Not a Controlled Action' decision. Development of Lot 3 Coogee Road was referred in 2017 (EPBC 2017/8011) and also was assessed as 'Not a Controlled Action'.

For the future development of the balance of the Structure Plan area, the relevant Matters of National Environmental Significance include fauna listed under the EPBC Act, more specifically the three Black Cockatoos and the presence of vegetation that is part of the Banksia Woodland of the Swan Coastal Plain TEC. Using published criteria for levels of significance, the complete clearing of the vegetation outside of existing approvals would constitute a significant impact on any of these matters.

Referral of a proposal under the EPBC Act can occur at any stage of a development, ie rezoning, structure planning or subdivision. Referral of the whole Structure Plan area (less those areas already referred) would result in a 'Controlled Action' decision meaning the proposal to clear would need to go through a full environmental assessment at Commonwealth level.

The outcome of a proposal to clear individual sites, rather than the whole of Precinct 8, is uncertain and would depend on the amount of vegetation proposed to be cleared. The outcome can be 'Not a Controlled Action' which is an approval under the act to undertake the 'Action' in the manner as referred or a 'Controlled Action' which requires assessment under the EPBC Act. Given that the main vegetation type in the Structure Plan area to be cleared is Banksia Woodland that is a TEC and also provides Black Cockatoo habitat, most if not all referrals are likely to get a Controlled Action decision.

6 CONCLUSION

The Environmental Assessment of the East Wanneroo Precinct 8 Structure Plan concludes that the Structure Plan retains the key environmental issues in the Precinct which are Bush Forever Site 147, remnant vegetation that is representative of FCT 20a and vegetation that meets the criteria as Banksia Woodland TEC. The retained vegetation also provides habitat for Black Cockatoos.

Specifically the Structure Plan protects the following values:

- Mariginiup Lake and Little Mariginiup Lake and associated buffers;
- Protection of 35% of vegetation that is in Good condition or better;
- Protection of 56% of TEC FCT20a;
- Protection of 58% of the Banksia Woodland TEC;
- Protection of 33% of Black Cockatoo Habitat;
- Preservation of ecological linkage between Mariginiup Lake, Little Mariginiup Lake and Lake Adams; and
- Improved stormwater management and groundwater protections, potentially improving the hydrological regimes and water quality in Mariginiup Lake and Little Mariginiup Lake, by implementing the LWMS;

Residual impacts can be mitigated by:

- Retention of trees and native vegetation within POS and road reserves to be identified through subdivision design;
- Management and enhancement of Parklands and vegetated POS areas to maintain and improve the vegetation within these areas;
- Management of the Lake buffers in accordance with the Foreshore Strategy; and
- Potential rehabilitation of Degraded and Completely Degraded areas within Bush Forever Site 147.

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FIGURES

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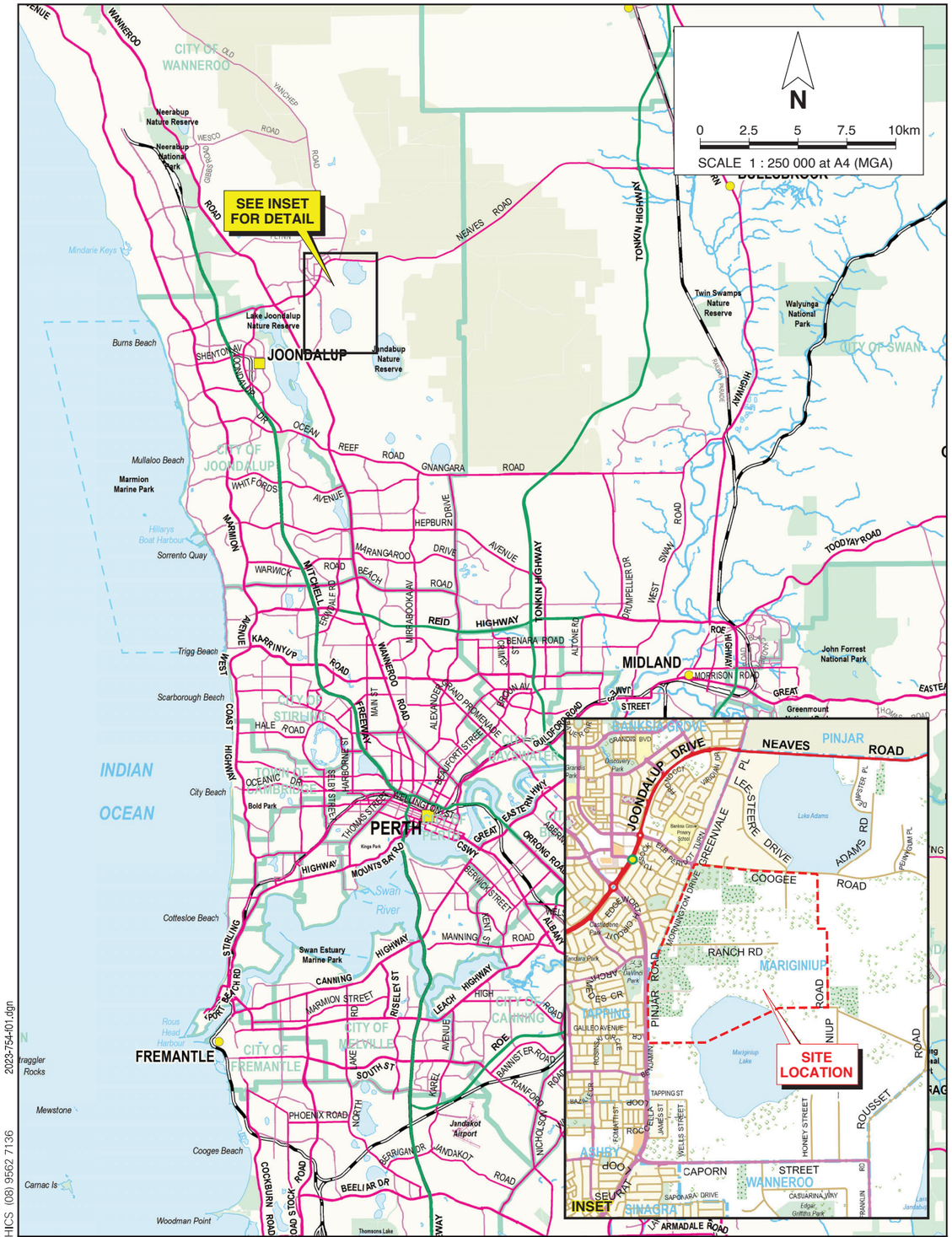

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pgv ENVIRONMENTAL

Qube
ENVIRONMENTAL ASSESSMENT REPORT
EAST WANNEROO PRECINCT

Drawn: J. Cabot	Date: 11 Oct 2023
Job: 10458 Rpt: 2023-754	Revision: A

SITE BOUNDARY AND TOPOGRAPHY

Figure 1

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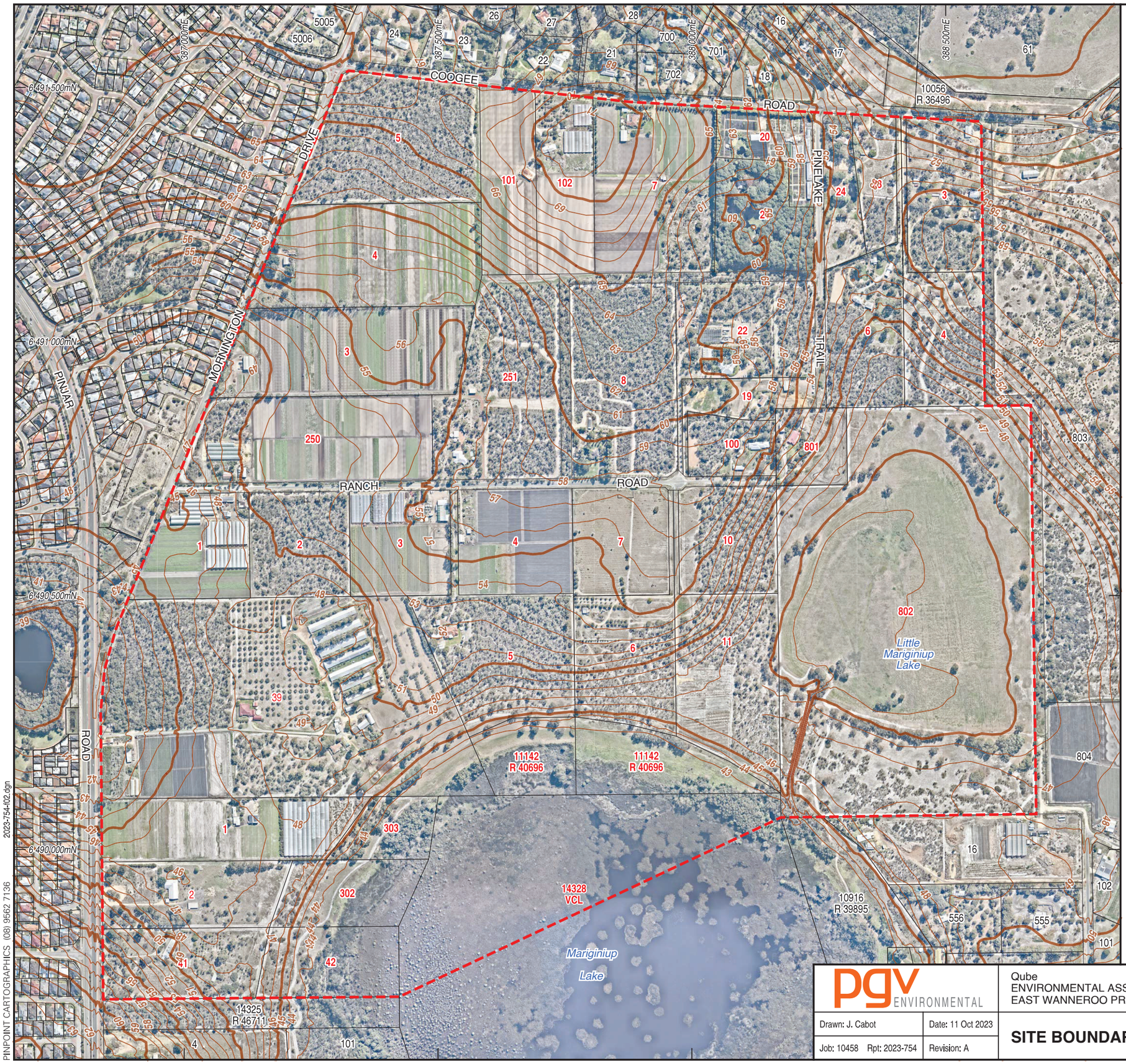

N

0 50 100 150 200 250m

SCALE 1 : 7 500 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Topographic Contour

CADASTRAL SOURCE: Landgate, August 2023.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown April 2023
CONTOUR SOURCE: Rowe Group, Dwg No. 8903-CON-13-B, 31-07-2023.

pgv ENVIRONMENTAL

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ENVIRONMENTAL ASSESSMENT REPORT
EAST WANNEROO PRECINCT

Drawn: J. Cabot | Date: 11 Oct 2023
Job: 10458 Rpt: 2023-754 | Revision: A

SITE BOUNDARY AND TOPOGRAPHY

Figure 2

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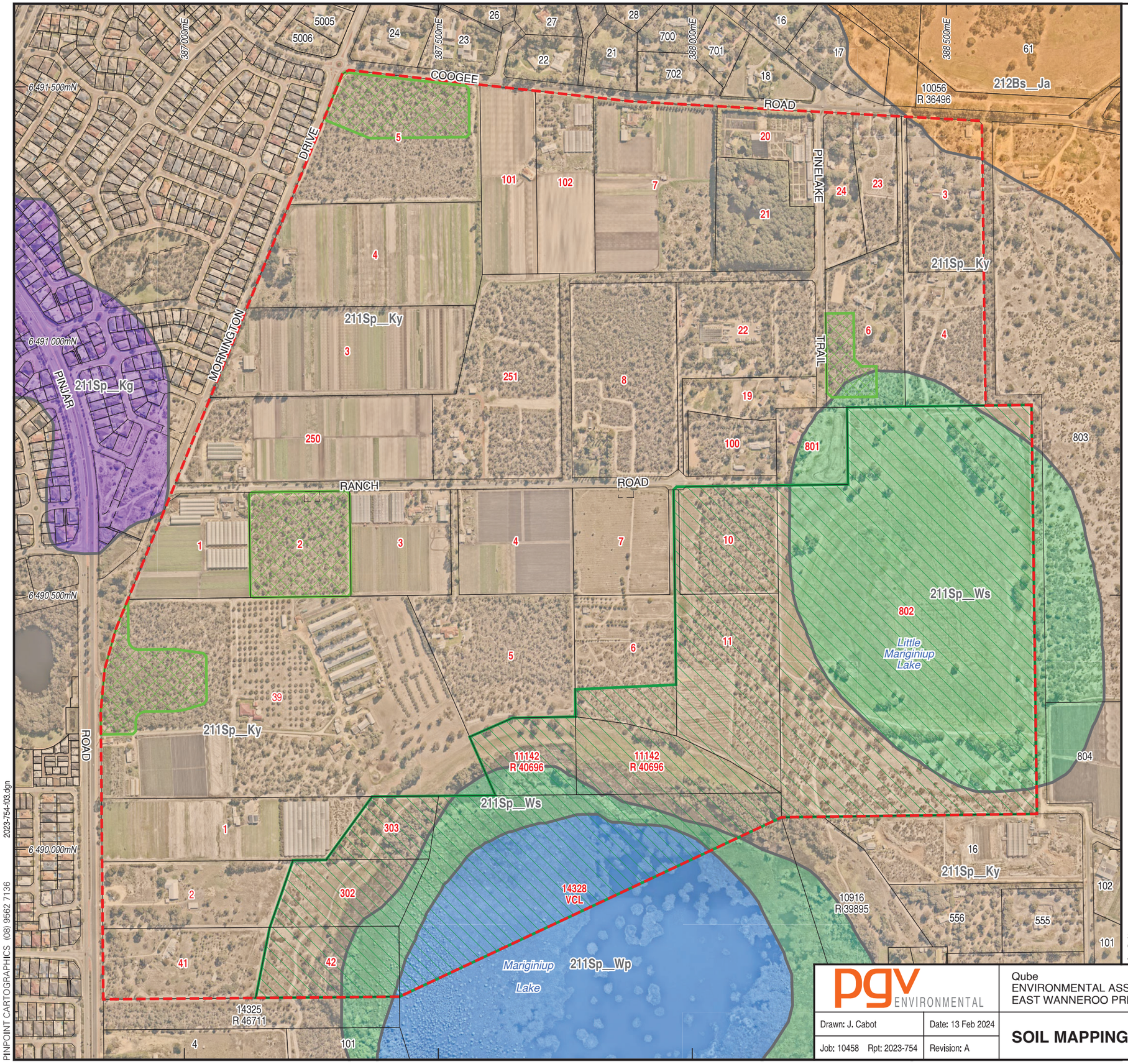

N

0 50 100 150 200 250m

SCALE 1 : 7 500 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Bush Forever Site 147

Soil Types

- **211Sp__Kg** Karrakatta Sand Grey Phase
- **211Sp__Ky** Karrakatta Sand Yellow Phase
- **211Sp__Wp** Spearwood permanent lakes and swamps Phase
- **211Sp__Ws** Spearwood seasonal swamps Phase
- **212Bs__Ja** Bassendean, Jandakot Phase

SOILS SOURCE: DPIRD, September 2022.
CADASTRAL SOURCE: Landgate, August 2023.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown April 2023

pgv ENVIRONMENTAL

Drawn: J. Cabot | Date: 13 Feb 2024

Job: 10458 Rpt: 2023-754 | Revision: A

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ENVIRONMENTAL ASSESSMENT REPORT
EAST WANNEROO PRECINCT

SOIL MAPPING

Figure 3

2023-754-I03.dgn

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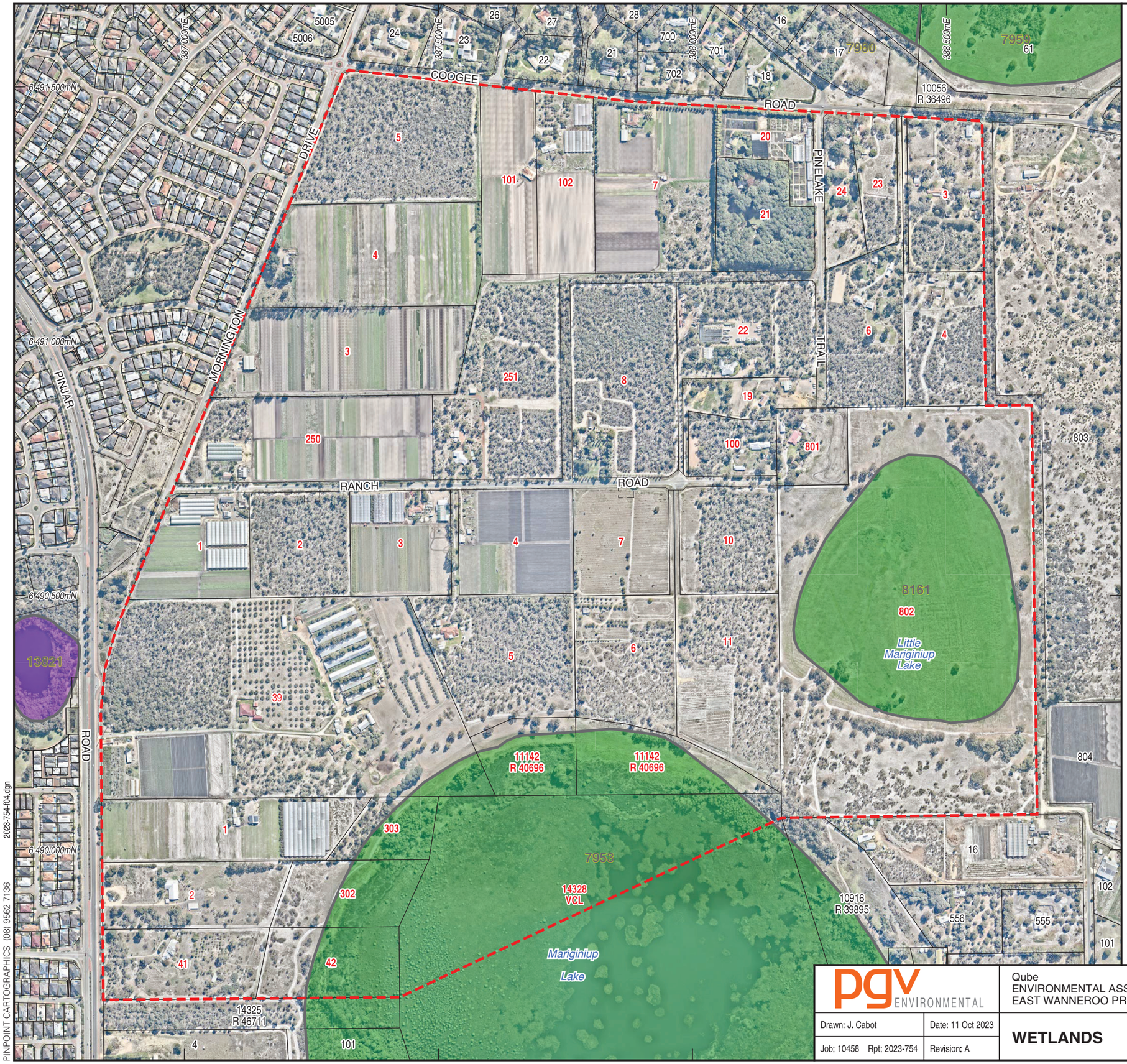

N

0 50 100 150 200 250m

SCALE 1 : 7 500 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary

Soil Types

- Conservation Category
- Resource Enhancement
- 8161 Wetland UFI Number

WETLANDS SOURCE: DBCA, November 2022.
CADASTRAL SOURCE: Landgate, August 2023.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown April 2023

PINPOINT CARTOGRAPHICS (08) 9562 7136 2023-754-I04.dgn

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ENVIRONMENTAL ASSESSMENT REPORT
EAST WANNEROO PRECINCT

Drawn: J. Cabot | Date: 11 Oct 2023
Job: 10458 Rpt: 2023-754 | Revision: A

WETLANDS

Figure 4

N

0 50 100 150 200 250m

SCALE 1 : 7 500 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Vegetation Type Boundary
- AfBa Vegetation Type

COOGEE ROAD
MORNINGTON DRIVE
PINJAR
PINELAKE TRAIL
RANCH ROAD
ROAD
6,491 500mN
6,491 000mN
6,490 500mN
6,490 000mN
387 000mE
387 500mE
388 000mE
388 500mE
10056 R 36496
11142 R 40696
14328 VCL
14325 R 46711
10916 R 39895

Legend

Af - *Allocasuarina fraseriana* Low Woodland over *Xanthorrhoea preissii/Hibbertia hypericoides* Low Open Shrubland

AfBaBm - *Allocasuarina fraseriana/Banksia attenuata/B. menziesii* Low Open Woodland over *Kunzea glabrescens* Tall Open Shrubland over *Xanthorrhoea preissii/Hibbertia hypericoides* Closed Low Heath

AfBa - *Allocasuarina fraseriana/Banksia attenuata* Low Open Woodland over *Xanthorrhoea preissii/Hibbertia hypericoides* Closed Low Heath

AfBaBmEmLOW - *Allocasuarina fraseriana/Banksia attenuata/B. menziesii/Eucalyptus marginata* Low Open Woodland

AfBEmHh - Low open forest *Allocasuarina fraseriana, Banksia attenuata, Banksia menziesii* and *Eucalyptus marginata* over open shrubland *Jacksonia sternbergiana* and *Hibbertia hypericoides* over open mixed non-native grassland over sparse rushland *Desmocladus flexuosus* and *Alexgeorgea nitens*

AfLW - *Allocasuarina fraseriana* Low Woodland

BaBm - *Banksia attenuata/B. menziesii* Low Open Woodland over *Hibbertia hypericoides* Low Shrubland over *Alexgeorgea nitens* Sedgeland

BaBm(Af) - *Banksia attenuata/B.menziesii/Allocasuarina fraseriana* Low Open Woodland over *Xanthorrhoea preissii/Hibbertia hypericoides* Low Shrubland over *Mesomelaena seudostygia/Alexgeorgea nitens* Sedgeland

BaBmEm - *Banksia attenuata/B.menziesii/Eucalyptus marginata* Low Open Woodland

BaBmEt - *Banksia attenuata/B. menziesii/Eucalyptus todtiana* Low Open Woodland over *Hibbertia hypericoides* Low Shrubland

BEmAc - Isolated clumps of low trees *Banksia attenuata, B. menziesii* and *Eucalyptus marginata* over tall shrubland *Adenanthos cygnorum* subsp. *cygnorum* and *Jacksonia furcellata* over mixed native shrubland over open grassland **Ehrharta calycina* over rushland *Alexgeorgea nitens* and/or *Desmocladus flexuosus* (particularly where shrub cover is low)

BF Lake - Bush Forever Lake

BF Uplands - Bush Forever Uplands

BiLf - Low isolated trees of *Banksia ilicifolia* over shrubland *Lechenaultia floribunda* over sparse grassland *Ehrharta calycina* over sparse to dense rushland *Desmocladus flexuosus* and/or *Alexgeorgea nitens*

EmAf - *Eucalyptus marginata/Allocasuarina fraseriana* Low Open Woodland

EmAfBaBm - *Eucalyptus marginata/Allocasuarina fraseriana/Banksia menziesii/B. attenuata* Low Open Woodland over *Calytrix fraseri/Xanthorrhoea preissii/Hibbertia hypericoides/Mesomelaena pseudostygia* Closed Low Heath

EmKg - *Eucalyptus marginata* Low Woodland over *Kunzea glabrescens* Tall Shrubland

EmXp - *Eucalyptus marginata* Low Woodland over *Xanthorrhoea preissii* Shrubland

JfAc - *Jacksonia furcellata/Adenanthos cygnorum* Tall Open Scrub over *Verticordia densiflora* Closed Low Heath

JfPa - *Jacksonia furcellata* Parkland Cleared

Mp - *Melaleuca preissiana* Low Closed Forest over *Xanthorrhoea preissii/Hypocalymma angustifolium* Low Shrubland

Non-native - Heavily disturbed areas comprising weeds with occasional native shrubs, native trees and planted vegetation

PEm - Pine and *Eucalyptus marginata* trees

PP - Pine plantation

VT1 - *Banksia attenuata, Banksia menziesii* and *Eucalyptus marginata* woodland over *Jacksonia sternbergiana, Adenanthos cygnorum* and *Xanthorrhoea preissii* open scrub over *Hibbertia hypericoides, *Watsonia meriana* and *Stirlingia latifolia* low shrubland over **Ehrharta calycina, *Briza maxima* and **Avena barbata* open bunch grassland on sandy loam soils

VT2 - **Ehrharta calycina* open bunch grassland with emergent *Agonis flexuosa* and *Xanthorrhoea preissii*

Cleared

WETLANDS SOURCE: DBCA, November 2022.
CADASTRAL SOURCE: Landgate, August 2023.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown April 2023.
VEGETATION TYPES SOURCE: Mapping from various surveys as referenced in text.

PINPOINT CARTOGRAPHICS (08) 9562 7136 2023-754-105.dgn

pgv ENVIRONMENTAL

Qube
ENVIRONMENTAL ASSESSMENT REPORT
EAST WANNEROO PRECINCT

Drawn: J. Cabot | Date: 8 Feb 2024
Job: 10458 Rpt: 2023-754 | Revision: A

VEGETATION TYPES

Figure 5

N

0 50 100 150 200 250m

SCALE 1 : 7 500 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Vegetation Condition Boundary
- VG Vegetation Condition

Vegetation Conditions

- Ex Excellent
- VG-Ex Very Good to Excellent
- VG Very Good
- VG-G Very Good to Good
- G-VG Good to Very Good
- G Good
- G-D Good to Degraded
- D Degraded
- CD Completely Degraded

WETLANDS SOURCE: DBCA, November 2022.
CADASTRAL SOURCE: Landgate, August 2023.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown April 2023.
VEGETATION CONDITION SOURCE: Mapping from various surveys as referenced in text.

pgv ENVIRONMENTAL

Qube
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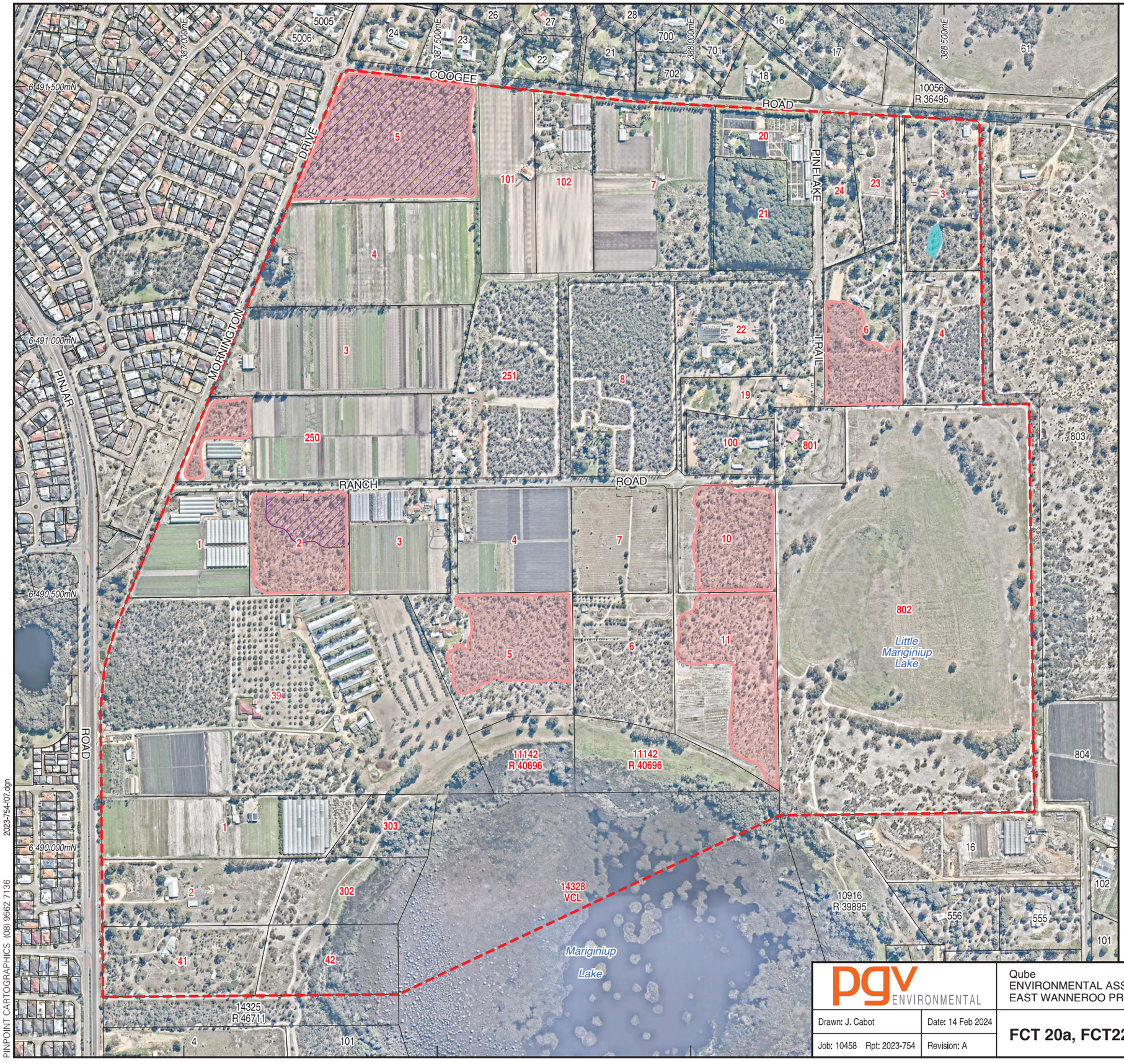
Job: 10458 Rpt: 2023-754 | Revision: A

VEGETATION CONDITION

Figure 6

2023-754-106.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136



N

0 50 100 150 200 250m

SCALE 1 : 7 500 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Banksia Woodland TEC
- FCT20a
- FCT22

CADASTRAL SOURCE: Landgate, August 2023.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown April 2023
CONTOUR SOURCE: Rowe Group, Dwg No. 8903-CON-13-B, 31-07-2023.

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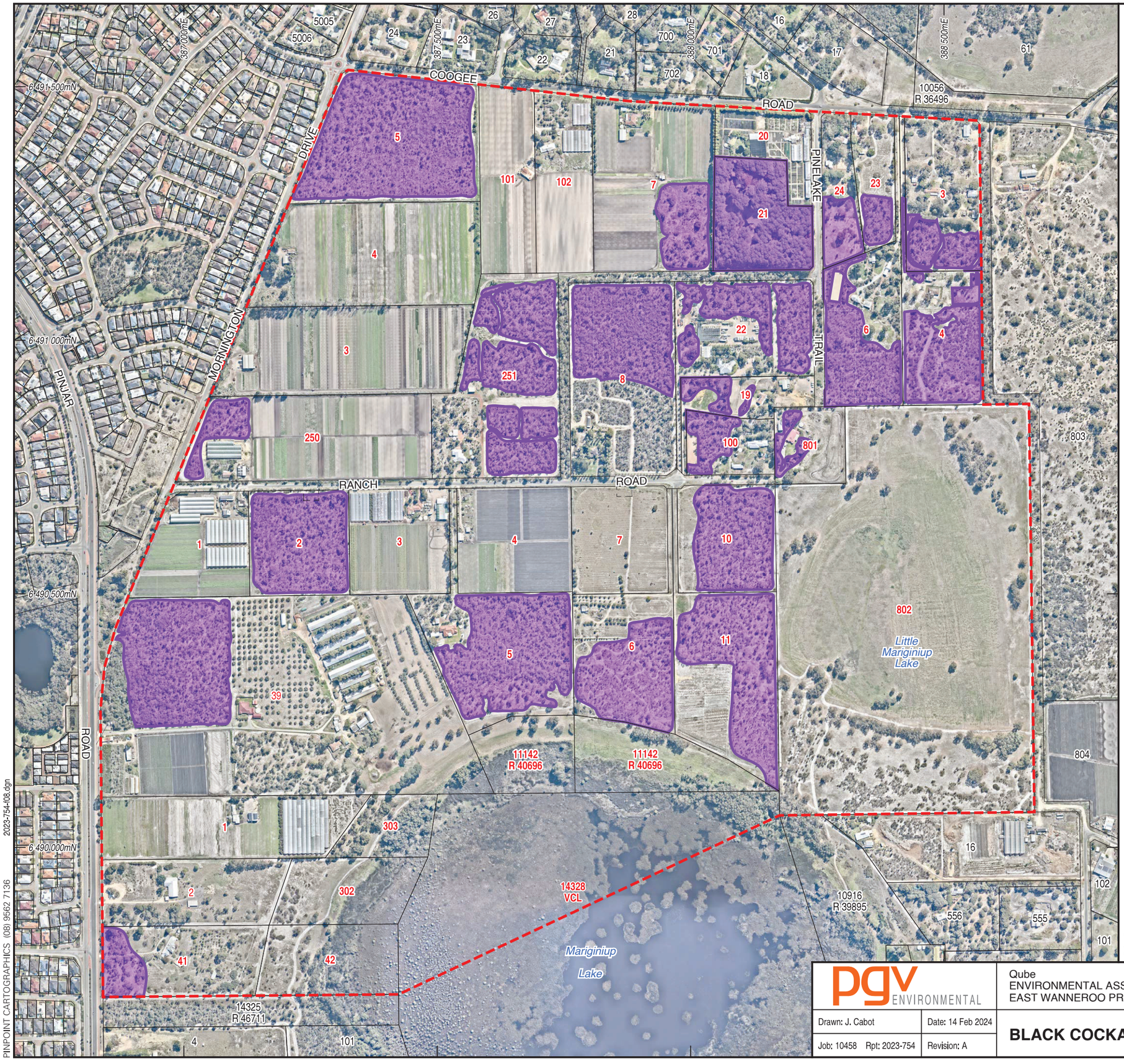
pgv ENVIRONMENTAL

Qube
ENVIRONMENTAL ASSESSMENT REPORT
EAST WANNEROO PRECINCT

Drawn: J. Cabot | Date: 14 Feb 2024
Job: 10458 Rpt: 2023-754 | Revision: A

FCT 20a, FCT22 AND BANKSIA WOODLAND TEC

Figure 7



N

0 50 100 150 200 250m

SCALE 1 : 7 500 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Black Cockatoo Habitat

CADASTRAL SOURCE: Landgate, August 2023.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown April 2023
CONTOUR SOURCE: Rowe Group, Dwg No. 8903-CON-13-B, 31-07-2023.

PINPOINT CARTOGRAPHICS (08) 9562 7136 2023-754-f08.dgn

pgv ENVIRONMENTAL

Qube
ENVIRONMENTAL ASSESSMENT REPORT
EAST WANNEROO PRECINCT

Drawn: J. Cabot | Date: 14 Feb 2024
Job: 10458 Rpt: 2023-754 | Revision: A

BLACK COCKATOO HABITAT

Figure 8