



# Attachment 8

Wetland Buffer and Foreshore Strategy





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# EAST WANNEROO PRECINCT 8

## WETLAND BUFFER ASSESSMENT AND FORESHORE STRATEGY

Prepared for: Qube  
 Report Date: 6 March 2024  
 Version: 2  
 Report No. 2024-813



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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 precinct 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.

### 1.2 Wetlands in Precinct 8

East Wanneroo Precinct 8 contains two lakes that have been identified as being significant environmental features within the Precinct, ie. Mariginiup Lake and Little Mariginiup Lake. Both lakes are within Bush Forever Site 147 'Mariginiup Lake and Adjacent Bushland, Mariginiup'. The northern part of Mariginiup Lake is included in the Structure Plan and Little Mariginiup Lake is wholly within the Structure Plan Area (Figure 2).

### 1.3 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 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, including Mariginiup Lake and Little Mariginiup Lake.

A Structure Plan for Precinct 8 to further facilitate the urban development has been prepared (Appendix 1).

The requirements for a Structure Plan in the Precinct include the definition of appropriate buffers in a Wetland Buffer Assessment and prepare a Foreshore Strategy for Mariginiup Lake and Little Mariginiup Lake. The definition of the Foreshore Strategy, in accordance with the District Structure Plan (DSP) is:

*A foreshore strategy details the proposed functions, broad development layout and conservation areas within the foreshore reserve (WAPC, 2021).*

### 1.4 Scope of Works

#### 1.4.1 Wetland Buffer Assessment

The Wetland Buffer Assessment will address the following:

- Description of the wetlands within the Precinct;
- Description of the area adjacent to the wetlands within the Precinct;
- Assessment of the potential risk to the wetlands from future urban development; and
- Assessment and determination of a suitable wetland buffer using guidance material from the EPA Guidance Statement No. 33.

#### 1.4.2 Foreshore Strategy

The Foreshore Strategy will address the following:

- Identification of parts of the foreshore that need to be protected, ie. areas of good quality native vegetation or fauna habitat;
- Identification of the likely land uses required in the foreshore/buffer next to residential development; and
- A description of the proposed land uses within the foreshore including public recreation, stormwater drainage potential, revegetation strategy.



## 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 Structure Plan area is currently mostly zoned 'Urban Deferred', with a small area of Rural and the Bush Forever site reserved as Parks and Recreation in the Metropolitan Region Scheme (MRS) (National Map, 2023) 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.

#### 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.

Bush Forever Site 147 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).

#### 2.2.3 Environmental Protection Authority Guidance Statement No 33 Environmental Guidance for Planning and Development (EPA 2008)

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.

The purpose of Part B4: Wetlands relating to wetlands is of relevance to this project where it relates to the lakes that could potentially be impacted by the proposed development of Precinct 8. Guidance Statement 33 outlines the principles for the protection of wetlands including identification, mitigation and management.

#### 2.2.4 Water Notes, Wetland Buffers (WRC 2000)

This document was produced by the Waters and Rivers Commission (WRC) as part of a series of information fact sheets. It discusses the importance of buffers around wetlands to ensure that healthy wetland ecosystems are maintained and protected. The width for wetland buffers depends on the purpose for separation and includes objectives such as:

- maintain ecological processes and major food-webs
- protection from nuisance insects
- reduce nutrient inputs
- pollution protection (heavy metals)
- protection from rising salinity
- minimise sedimentation
- protection of groundwater.



The buffer widths provided are only guidelines and do not represent statutory requirements of the Commission.

**2.2.5 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.

**2.2.6 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.

**2.2.7 Protocols For Proposing Modification to the ‘Geomorphic Wetlands Swan Coastal Plain’ Dataset (DEC, 2006)**

This document outlines the DEC protocol for updating the Geomorphic Wetlands Swan Coastal Plain dataset. The dataset is identified and utilised by the OEPA and DPI as a basis to guide planning and decision making (DEC 2006).

**3 EXISTING ENVIRONMENT**

**3.1 Wetland Management Category**

The two lakes in the Structure Plan area, Mariginiup Lake (Unique Feature Identifier (UFI) 7953) and Little Mariginiup Lake (UFI 8161) (Figure 5) are both mapped as Conservation Category wetlands. Conservation Category wetlands are considered the highest priority wetlands (EPA, 2008). The EPA’s objective for these wetlands is to preserve and protect the existing conservation values of the wetlands through various mechanisms including:

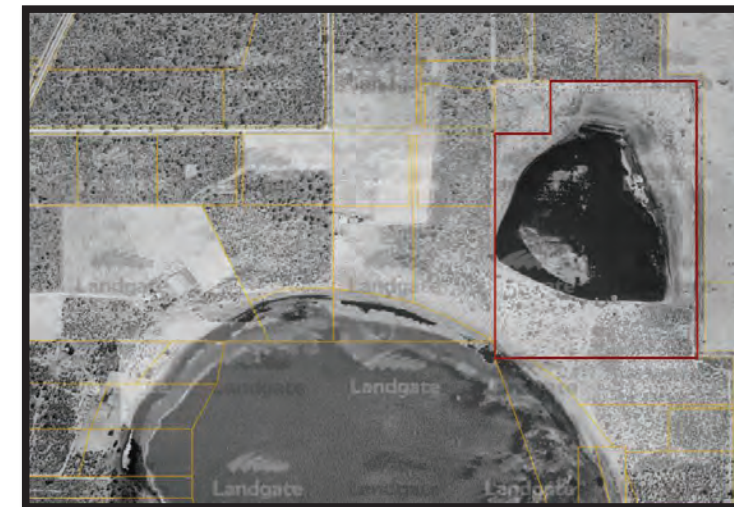
- Reservation in National Parks,
- Crown reserves and State owned land,
- Protection under Environmental Protection Policies, and
- Wetland covenanting by landowners (EPA, 2008).

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

**3.2 Land Use**

Earliest available aerial photography for the site from 1965 shows that the site contains a mix of cleared and vegetated areas along the margins of both lakes (Plate 2) (Landgate, 2024). The outer edge of Mariginiup Lake has been cleared of native trees and shrubs. Both lakes contain surface water in the 1965 aerial photograph.

**Plate 2: Historical Aerial Photograph from 1965**



Source: Landgate, 2024

In the aerial from 1983 Little Mariginiup Lake appears to be much drier and is likely to have been drained into Mariginiup Lake from the south-western corner. Little Mariginiup Lake is completely cleared (Plate 3). The buffer area around Mariginiup Lake remains partly cleared and partly vegetated.

The main body of Mariginiup Lake is predominantly an open waterbody with very little to no emergent reeds.



Plate 3: Historical Aerial Photograph from 1983



Source: Landgate, 2024

Little Mariginiup Lake is contained within Lot 802 Mariginiup Road (Plate 4). The lot is predominantly cleared and contains Kikuyu Grass on the lake bed and some clumps of trees around the margin of the lake and some poor quality native vegetation at the southern end. The photo shows a man-made drain connecting Little Mariginiup Lake to Mariginiup Lake to the south-west. Little Mariginiup Lake has rarely if ever contained above-ground water in the last 20 years.

Plate 4: Lot 802 with Little Mariginiup Lake



The northern portion of Mariginiup Lake within the Structure Plan area is mostly contained in Lot 14328 Pinjar Road with the margins of the lake contained in several fringing lots that extend into the lake (Plate 5). The main body of the lake has areas of open water as well as dense native sedges. The

sedges and reeds have increased in the body of the lake over time from very little to none in 2000 to more than half at the northern end of the lake in 2023. Flooded Gum trees occur around the perimeter of the lake.

Plate 5: Lot 14328 and Mariginiup Lake



Current Land use of the lots that fringe the two lakes is shown in Table 5.

Table 5: Land Use adjacent to the Lakes

Lot	Land Use
42 Pinjar Road	Mostly cleared with some native trees
302 Pinjar Road	Cleared
303 Pinjar Road	Vegetated with a central cleared strip with sandy path
1 Pinjar Road	Mostly sheds and cleared areas
39 Pinjar Road	Cleared with some trees
11142 Ranch Road	Cleared with some native Flooded Gums
5 Ranch Road	Southern portion partially vegetated
6 Ranch Road	Southern portion with native vegetation
11 Ranch Road	Three-quarters with native vegetation, one quarter cleared
10 Ranch Road	Mostly native vegetation

There is currently very little to no public use of the lake areas due to the private ownership of lots in and around the lakes preventing ready access for the public. Mariginiup Road that borders the eastern side of Little Mariginiup Road is unconstructed and is only accessible to 4WD vehicles.



### 3.3 Heritage

#### 3.3.1 Aboriginal Heritage

There is one Aboriginal Heritage Site mapped in the Structure Plan Area being Site 3741, Mariginiup Lake (DPLH, 2023) (Appendix 3). There is also a Lodged Heritage Site mapped on the boundary of the Structure Plan area, which is Place 28616 Mariginiup Lake Scarred Tree, located on the southern boundary of the Structure Plan area on the western side of Mariginiup Lake (Appendix 3). The Heritage Place as been lodged but is not yet assessed under Section 5 of the *Aboriginal Heritage Act 1972*.

#### 3.3.2 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).

### 3.4 Topography

The lakes are flat with an elevation of 42m Australian Height Datum (AHD) (Figure 2). The buffers slope up to 46 mAHD and then the upland vegetation to be retained as part of the buffers to the lakes in Bush Forever Site 147 is at a maximum of 56mAHD (Figure 2).

### 3.5 Geology and Soils

#### 3.5.1 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).

#### 3.5.2 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, 2024), mapped in upland areas in the buffer to the lakes;
- Spearwood seasonal swamps Phase (211Sp\_Ws) which are depressions with free water in winter made up of humus podzols and peat (DPIRD, 2024) 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, 2024) associated with Mariginiup Lake.

#### 3.5.3 Acid Sulphate Soils

The soils of Mariginiup Lake and Little Mariginiup Lake are mapped as 'High to Moderate' risk <3m from the surface (Plate 6).

Plate 6: Acid Sulphate Soil Risk Mapping



Source: National Map, 2023

### 3.6 Vegetation

#### 3.6.1 Vegetation Complex

The vegetation on the lakes is mapped in the Pinjar Complex, 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 (Hedde et al., 1980).*

#### 3.6.2 Vegetation Types

Vegetation in the Lakes and buffer areas is described as:

- BF Lake: Lakebed is likely to be dominated by *Baumea articulata* with scattered *Corymbia calophylla* (Marri), *Eucalyptus rudis* (Flooded Gum) and *Melaleuca raphiophylla* (Paperbark) as per the description in Bush Forever (Government of Western Australia, 2000), associated with the Lakes;
- 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), associated with the uplands in Lot 802;



- 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), associated with the upland vegetation in Lots 10 and 11;
- 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), associated with upland vegetation on Lot 6; and
- Cleared areas in the remaining buffers to Lake Mariginiup (Figure 4).

### 3.6.3 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 1).

**Table 1: 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.

Due to previous clearing the Lakes and buffers are rated as Degraded and Completely Degraded. Parts that have regenerated do not have the diversity that would reflect the original vegetation and have a high level of weeds and is in Degraded condition. The remainder of the buffer that is cleared is Completely Degraded. The upland vegetation in Bush Forever site 147 is in Good to Degraded condition in Lot 11 and Very Good to Excellent in Lot 10.

## 3.7 Fauna

### 3.7.1 Habitat

The buffer and lake area contain cleared areas as well as vegetation that provides open woodland and sedgeland fauna habitats. The sedgeland habitat provide habitat for birds, amphibians and other

sedgeland species. Mariginiup Lake also contains open water that provides habitat to waders and other wetland species. Fauna habitat in upland areas is mostly cleared with some parkland cleared areas with *Eucalyptus rudis* (Flooded Gum) and some *Banksia* woodlands in the Bush Forever site west of Little Mariginiup Lake. The woodlands provide habitat for birds, kangaroos and small terrestrial fauna species (PGV Environmental, 2013; Emerge, 2018a).

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 2.

**Table 2: 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 and Sedgeland habitat in and round the lakes has limited connectivity and is considered to be Disturbed Fauna habitat. The Open Water habitat is generally protected by the wetland buffer and is considered to be Very Good Fauna Habitat. The cleared areas are Highly Degraded Fauna Habitat.

There is likely to be a paucity of native mammals present in buffer areas as has been the case for most fragmented urban bushland remnants. Mariginiup Lake, although impacted by clearing and high nutrient levels (Pentium Water, 2023), is likely to have significant habitat values for wetland bird species but Little Mariginiup Lake has been impacted by drainage and does not contain permanent water so is likely have highly impacted fauna habitat values.

### 3.8 Hydrology

Groundwater is at approximately 41 to 43m AHD which is approximately 11-21m below the surface and generally flows to the west (DWER, 2023b).

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 4). 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).

## 4 WETLAND BUFFER ASSESSMENT

### 4.1 Wetland Function Area

The Wetland Function Area is defined in the *Guideline for Development of Wetland Buffer Requirements* (WAPC, 2005) as “the spatial boundary of the wetland. It normally would include the wetland itself and the wetland vegetation”.

The wetland function area for Mariginiup Lake is well defined, however the function area for Little Mariginiup Lake is difficult to define, as the shoreline to the lake is somewhat diffuse. For the purposes of this Wetland Buffer Assessment the wetland function area is defined as the area mapped as wetland by the DBCA.

### 4.2 Role of the Buffer

Wetland buffers are defined as the transition zone between the wetland and the surrounding land use. Buffers are measured from the wetland boundary as shown in Figure 4.

The role of the wetland buffer is to maintain the ecological processes, values and functions of the wetland and to protect the wetland from potential adverse impacts (EPA, 2008). Buffers can help protect people from potential nuisance and disease-carrying insects including midges and mosquitoes.

### 4.3 Existing Wetland Buffers

Mariginiup Lake and Little Mariginiup Lake are within Bush Forever Site 147 ‘Mariginiup Lake and Adjacent Bushland, Mariginiup’. The boundary of the Bush Forever site provides a buffer of between 50m to greater than 200m to most of the lakes with the exception of a small area where Lot 801 Ranch Road is within 30m of Little Mariginiup Lake and Lot 1 Pinjar Road is just under 40m from the mapped wetland boundary.

The buffer to Mariginiup Lake is half cleared or completely degraded land and half with some native vegetation. The buffer around Little Mariginiup Lake is mostly cleared and completely degraded, with good quality native vegetation on upland areas on Lots 10 and 11 Ranch Road.

The adequacy of these existing buffers is assessed in Section 4.5.

### 4.4 Threats to the Wetlands

The following sections outline the potential threats to the overall environmental values and ecological function of the Lakes.

#### 4.4.1 Impact on Vegetation

Development of the Structure Plan area does not propose to clear any vegetation in the lakes or in the buffer areas. Therefore the wetland vegetation will not be directly impacted by the proposed adjoining development.



#### 4.4.2 Hydrological Impacts

##### 4.4.2.1 Groundwater Levels

Clearing and urban development typically gives rise to an increase in groundwater recharge and a decrease in evapotranspiration, leading to a rise in groundwater levels. The magnitude of this rise depends on local factors including the area and type of vegetation cleared. The LWMS prepared for the Precinct 8 Structure Plan models the cumulative impact of development in other precincts within the catchment of both lakes (Pentium Water, 2023). The modelling predicts that Mariginiup Lake and Little Mariginiup Lake both have capacity to reach a depth of greater than 2m without overtopping their banks and therefore will not present a flood risk to adjacent properties.

##### 4.4.2.2 Water Quality

Surface water occurs year round in Mariginiup Lake and is mostly to always absent in Little Mariginiup Lake. There is a risk from future development of overland stormwater flows transporting rubbish, nutrients and other contaminants into the lakes, impacting on water quality.

Additionally residential development can impact on groundwater quality with infiltration of nutrients and contaminants into the groundwater. However the direction of groundwater flow is from the east to the west, away from both lakes (Pentium Water, 2023). In addition, the LWM and Structure Plan provide for the management of runoff through bioretention basins that improve stormwater water quality close to source.

Studies undertaken for the LWMS indicate that the standing water in Lake Mariginiup is strongly acidic, with the average pH exceeding ANZECC (2000) Wetland guidelines for slightly – moderate disturbed ecosystems (Pentium Water, 2023). Additionally, nutrients such as Total Nitrogen and Total Phosphorus exceeded relevant guideline values (Pentium Water, 2023). The LWMS identifies groundwater monitoring and contingency measures as part of UWMPs.

##### 4.4.3 Acid Sulphate Soils

Acid sulphate soils (ASS) are wetland soils and unconsolidated sediments that contain iron sulphides which, when exposed to atmospheric oxygen in the presence of water, form sulphuric acid. ASS form in protected low energy environments such as barrier estuaries and coastal lakes and commonly occurs in low-lying coastal lands such as Holocene marine muds and sands. When disturbed, these soils are prone to produce sulphuric acid and mobilise iron, aluminium, manganese and other heavy metals. The release of these reaction products can be detrimental to biota, human health and built infrastructure (WAPC, 2011).

Acid Sulphate Soils are associated with the Lakebeds and may extent into buffer areas and if not treated appropriately may adversely impact on the Lake water quality, including the potential release of heavy metals.

##### 4.4.4 Access

Uncontrolled access through the wetland vegetation from the development can negatively impact on wetland values. Physical movement in the buffer and on the edge of the Lakes can impact on wetland vegetation and create compacted areas on informal paths. Mariginiup Lake is considered too wet and inhospitable (dense reeds and snakes) to attract the public to enter the body of the lake.

The wetland buffer and lakes have a significant weed burden at present and uncontrolled access may further increase weeds or introduce new invasive species.

##### 4.4.5 Edge Effects

Edge effects on wetlands and other bushland areas in the Perth region have traditionally been managed primarily by separation through the provision of buffers. The cause of edge effects include:

- Litter (windblown, casual littering and illegal dumping) impacting on vegetation;
- Weed vectors;
- Increased noise;
- Light pollution; and
- Human recreation.

Protection against many edge effects can be provided by means other than a wide buffer such as barriers (fences, swales etc.) and surveillance. The most effective protection from edge effects is considered to be a combination of distance separation and barriers.

##### 4.4.6 Weeds

The buffer around Mariginiup Lake contains a large amount of completely degraded dominated by weeds. Therefore the impact of development on increasing weeds into the lake is not likely to be exacerbated.

Weeds can be spread by wind, animals, humans (on footwear etc.), vehicles and by vegetative growth. Little Lake Mariginiup consists almost entirely of grassy weeds such as Kikuyu. Therefore, development around the lake will not increase the weed burden in the lake bed.

##### 4.4.7 Fire

Fire can increase with additional human access however the wetland is already in an exposed site near housing. The lakes have been subject to recent bushfires in November 2023. The fire started well to the east of the Structure Plan area.

##### 4.4.8 Feral Animals

The wetland vegetation is highly likely to already be home to an abundance of rabbits, mice, rats, feral cats and foxes.

The proposed development may increase the number of feral animals attracted to an increased number of rubbish bins within the future development.

The setback distance would not have any impact on cats, foxes or rabbits impacting on the wetland as these animals can roam over large distances.

##### 4.4.9 Domestic Pets

Domestic pets are likely to increase as a result of the development of the surrounding area. Domestic pets can impact on wildlife, particularly birds that frequent the Lakes for foraging and breeding. Outdoor domestic cats and feral cats are known predators and have a substantial impact on native birds, with statistics indicating that 546 million mammals, birds and reptiles are killed by outdoor pet cats in Australian every year (Legge et al., 2020).

Dogs, both off and on lead can also impact on wildlife by the following:

- Physical and temporal displacement:
  - The presence of dogs causes wildlife to move away, temporarily or permanently reducing the amount of available habitat in which to feed, breed and rest.
  - Animals become less active during the day to avoid dog interactions.
  - The scent of dogs repels wildlife and the effects remain after the dogs are gone.
- Disturbance and stress response
  - Animals are alarmed and cease their routine activities. This increases the amount of energy they use, while simultaneously reducing their opportunities to feed. Repeated stress causes long-term impacts on wildlife including reduced reproduction and growth, suppressed immune system and increased vulnerability to disease and parasites.
- Indirect and direct mortality
  - Dogs transmit diseases (such as canine distemper and rabies) to and from wildlife.
  - Loose dogs kill wildlife.
- Water quality impacts as dog waste can pollute water.

#### 4.5 Recommended Buffer Width

The proposed Structure Plan retains the buffers to the Lakes consistent with the Bush Forever Site 147 boundary. The majority of the Lakes have a 50m to 100m buffer with two small areas providing a 35-40m buffer (Appendix 2). The Structure Plan also shows roads around the perimeter of the buffers which provides additional separation from the development to the wetland.

The wetland buffer assessment in this report concludes that the buffers provided by the Bush Forever site are sufficient to avoid or mitigate any future threats to the wetland from the future development of the Structure Plan area.

## 5 FORESHORE STRATEGY

---

### 5.1 Objective

The Foreshore Strategy has been developed to guide the provision of amenity within the foreshore reserve areas while ensuring that management measures are in place to protect and enhance the wetland values of the lakes.

The Foreshore Strategy broadly provides overarching guidance for the management of the following:

- Retention of Native Vegetation
- Rehabilitation;
- Management of public access and amenity; and
- Provision of Ecological linkages.

### 5.2 Vegetation Retention

Vegetation within Mariginiup Lake will be retained in its current condition.

Native vegetation in the buffer to the lakes on Lots 303 Pinjar Road and Lots 5, 6 10 and 11 Ranch Road will be retained and fenced off to prevent uncontrolled public access. Pedestrian paths will be provided through areas of native vegetation as part of the public access network. The alignment of paths should follow existing firebreaks or sandy tracks rather than the clearing of any good quality native vegetation.

Interpretative signage should be installed around the boundary of areas of native vegetation to provide the public with information about the ecology of the area.

### 5.3 Rehabilitation

The foreshore area of both lakes and Little Mariginiup Lake itself provide many opportunities to improve the ecological values by rehabilitating with native vegetation. The areas selected for rehabilitation should focus on filling in the gaps between existing areas of native vegetation and the core lake areas as well as the bed of Little Mariginiup Lake. Rehabilitation should also focus on improving the north-south ecological linkage proposed in the Structure Plan.

Any proposed rehabilitation should not increase the bushfire hazard levels for existing and future residents of the area.

Details of rehabilitation should be provided in a Foreshore Management Plan to be prepared at subdivision stage. The FMP would address the following:

- Areas to be rehabilitated;
- Current site conditions including weeds, position in the landscape, existing vegetation and evidence of soil alteration/degradation;
- Any site preparation required including weed management, soil management (ie ripping in compacted areas) and feral pest management;



- Locally endemic species that are suited to the position in the landscape (ie if the rehabilitation is in the Lake, transitional zone to the Lakes or uplands);
- Planting plans with appropriate species;
- Proposed monitoring;
- Contingency plans; and
- Completion criteria.

#### 5.4 Public Amenity

The existing condition of the foreshore reserve areas provide an opportunity to create public amenity within the lake environment. Public amenity considered suitable for the area includes:

- Walking paths, boardwalks and cycleways within the buffers, located where possible on existing tracks;
- Provision of seating areas within view corridors for birdwatching;
- Grassed picnic areas within cleared areas in the buffer;
- Dog exercise areas off and on-lead;
- Educational signage along the pathways.

Little Mariginiup Lake provides a better opportunity for dog exercise as it is mostly a grassed area and there is very little native wildlife that dogs could impact on.

#### 5.5 Ecological Linkage

The Lakes are part of a north-south linkage proposed in the DSP and Precinct 8 Structure Plan that links the Lakes to Lake Adams to the north. The linkage should be considered when determining the location of rehabilitated areas to enhance the linkage.

The cleared south-west quarter of Lot 11 Ranch Road should be a focus for revegetation to improve the ecological linkage.

## 6 CONCLUSION

The Wetland Buffer Study concluded the following with regards to the current state of the Lakes and buffers:

- The Lakes and associated buffers have largely been cleared in the past with the exception of some upland vegetation;
- The body of Mariginiup Lake has changed from open water in 2000 to more than half with emergent sedges and reeds in 2023;
- Mariginiup Lake provides important habitat for waterbirds;
- Little Mariginiup Lake is mostly grassed parkland with very little to no surface water throughout the year; and
- The quality of the water in Lake Mariginiup is impacted by surrounding land use and has higher levels of nutrient and a higher pH than relevant guidelines.

The following threats to the wetlands have been considered:

- Direct impacts due to inadvertent clearing;
- Impacts on groundwater and surface water quality and quantity;
- Impacts due to uncontrolled access;
- Edge effects such as weed vectors, rubbish, noise and light;
- Weeds and increase weed vectors;
- Increased fire regimes;
- Impact of increased populations of feral animals; and
- Impacts of domestic pets.

The wetland buffer width proposed in the Structure Plan was assessed being sufficient to avoid or mitigate any future threats to the wetland from the future development of the Structure Plan area. The Structure Plan also provides for roads around most of the lakes and buffers to provide further separation of the Lakes from development.

The Foreshore Strategy will result in the retention and improvement of the lake environment as well as providing an important public amenity on the edge of an urban environment by addressing the following:

- The retention and management of areas of remnant native vegetation;
- Targeted rehabilitation of degraded areas including Little Mariginiup Lake;
- Provision of public access and amenity; and
- Maintenance and improvement of the north-south Ecological linkage.

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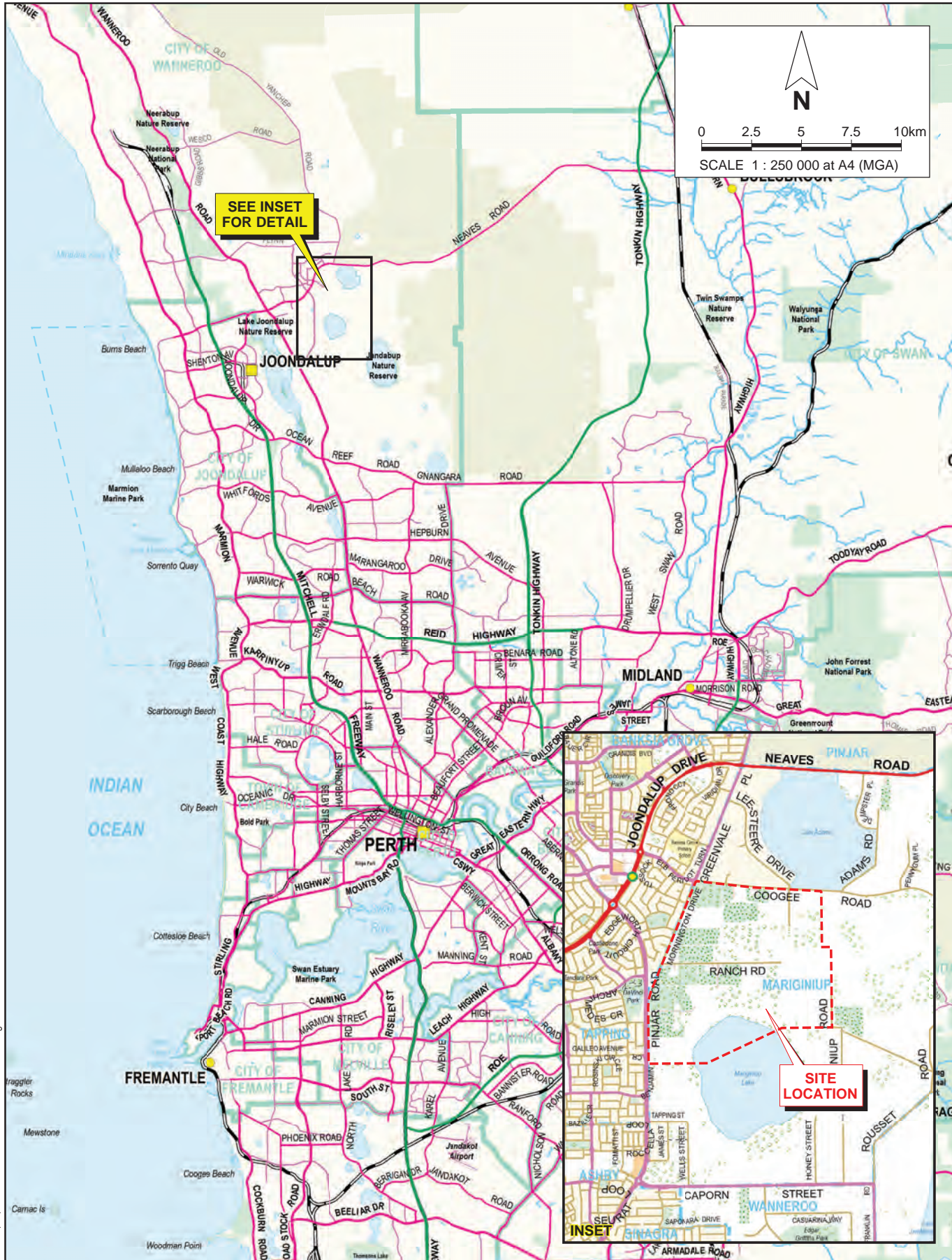
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## **FIGURES**

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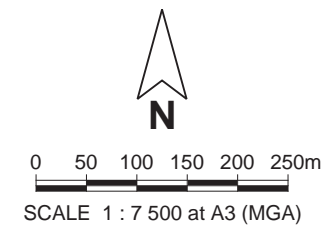
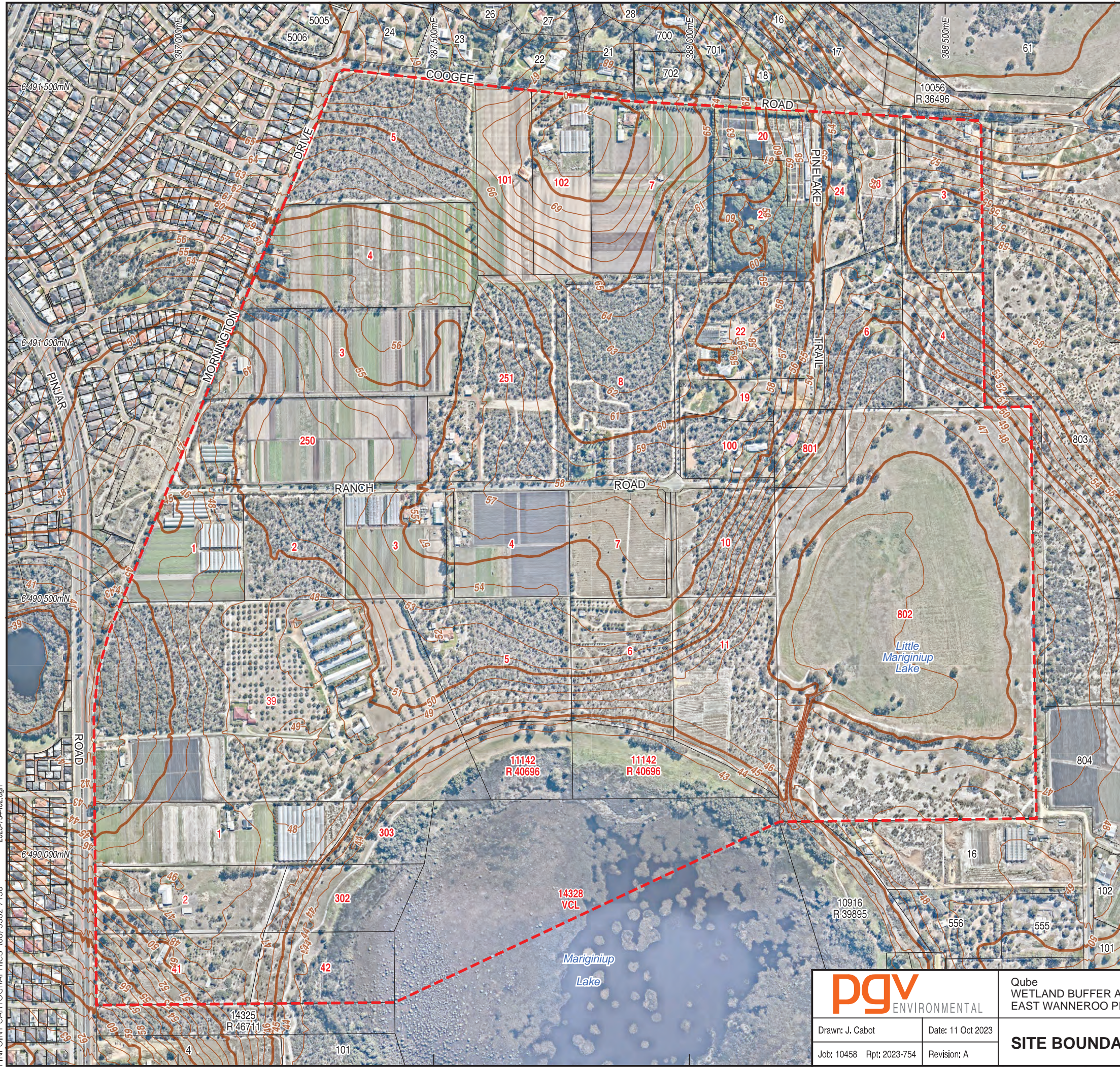
Qube  
WETLAND BUFFER ASSESSMENT AND FORESHORE STRATEGY  
EAST WANNEROO PRECINCT

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

**SITE BOUNDARY AND TOPOGRAPHY**

**Figure 1**





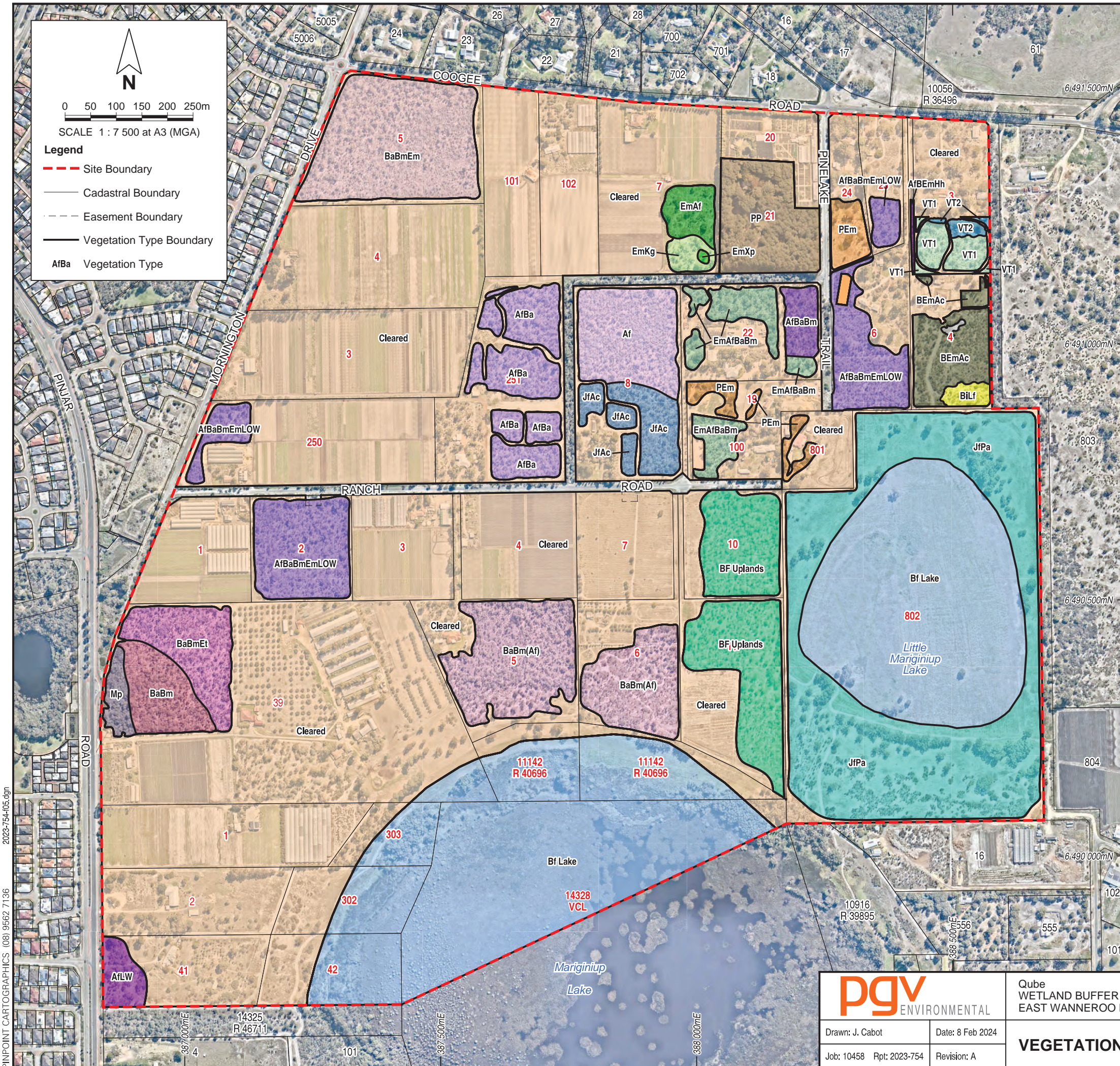
- Legend**
- - - Site Boundary
  - Cadastral Boundary
  - - - Easement Boundary
  - Topographic Contour

PINPOINT CARTOGRAPHICS (08) 9562 7136 2023-754-102.dgn

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.

		Qube WETLAND BUFFER ASSESSMENT AND FORESHORE STRATEGY EAST WANNEROO PRECINCT	
		<b>SITE BOUNDARY AND TOPOGRAPHY</b>	
Drawn: J. Cabot	Date: 11 Oct 2023	<b>Figure 2</b>	
Job: 10458 Rpt: 2023-754	Revision: A		





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

- 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 *Desmodcladus 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 pseudostygia*/*Alexgeorgea nitens* Sedgeland
  - BaBmEm - *Banksia attenuata*/*B. menziesii*/*Eucalyptus marginata* Low Open Woodland
  - BaBmEt - *Banksia attenuata*/*B. menziesii*/*Eucalyptus tottiana* 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 *Desmodcladus 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 *Desmodcladus 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

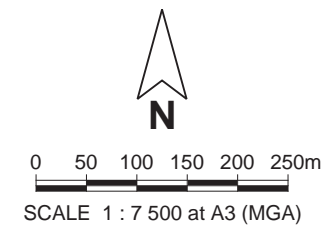
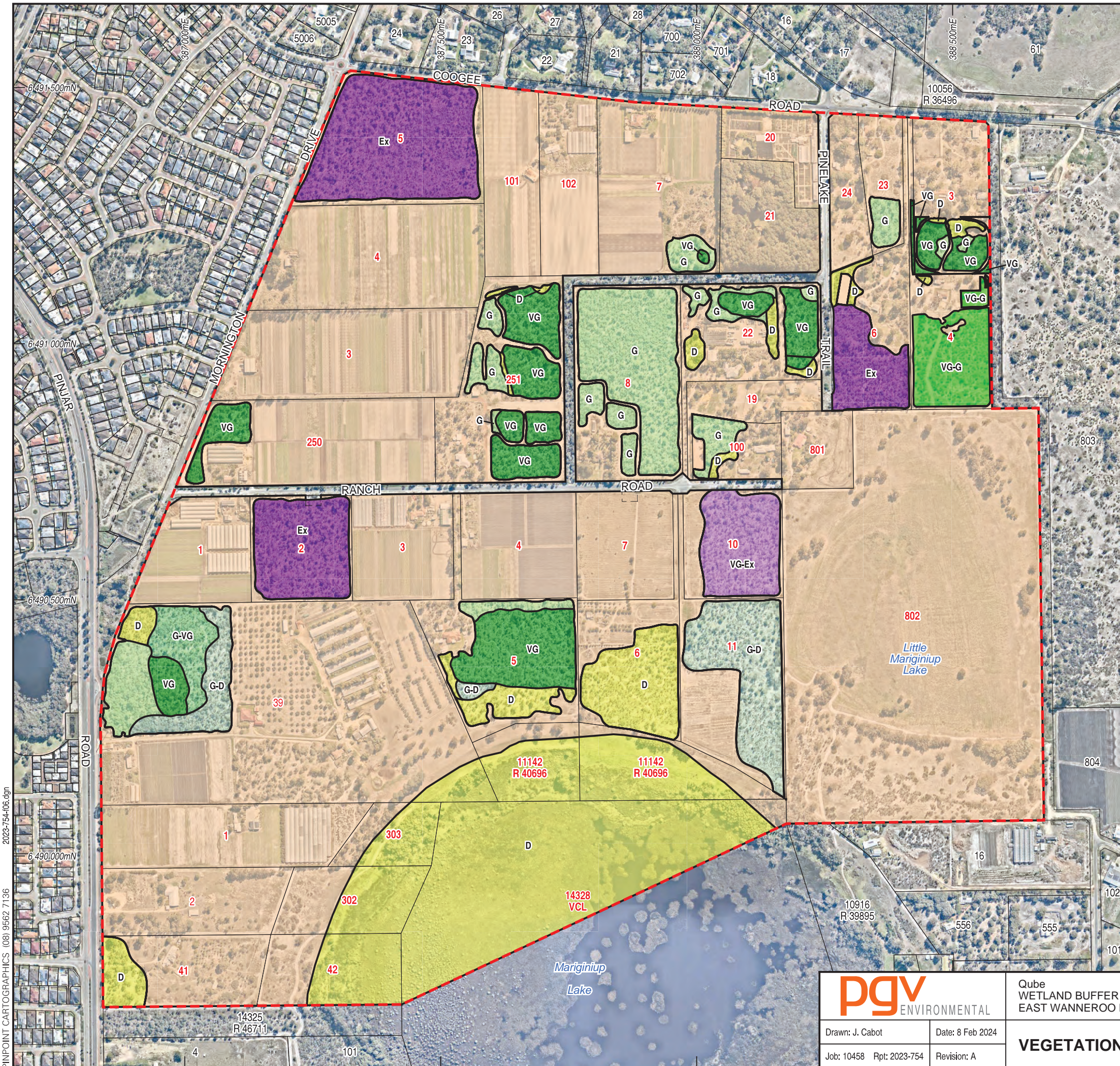
WETLANDS SOURCE: DBCA, November 2022.  
 CADASTRAL SOURCE: Landgate, August 2023.  
 AERIAL PHOTOGRAPH SOURCE: NearMap, flown April 2023.  
 VEGETATION TYPES SOURCE: Mapping from various surveys as referenced in text.

		Qube WETLAND BUFFER ASSESSMENT AND FORESHORE STRATEGY EAST WANNEROO PRECINCT	
Drawn: J. Cabot	Date: 8 Feb 2024	<b>VEGETATION TYPES</b>	
Job: 10458 Rpt: 2023-754	Revision: A		

Figure 3

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





- 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.



Qube  
 WETLAND BUFFER ASSESSMENT AND FORESHORE STRATEGY  
 EAST WANNEROO PRECINCT

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

**VEGETATION CONDITION**

**Figure 4**

PINPOINT CARTOGRAPHICS (08) 9562 7136 2023-754-106.dgn

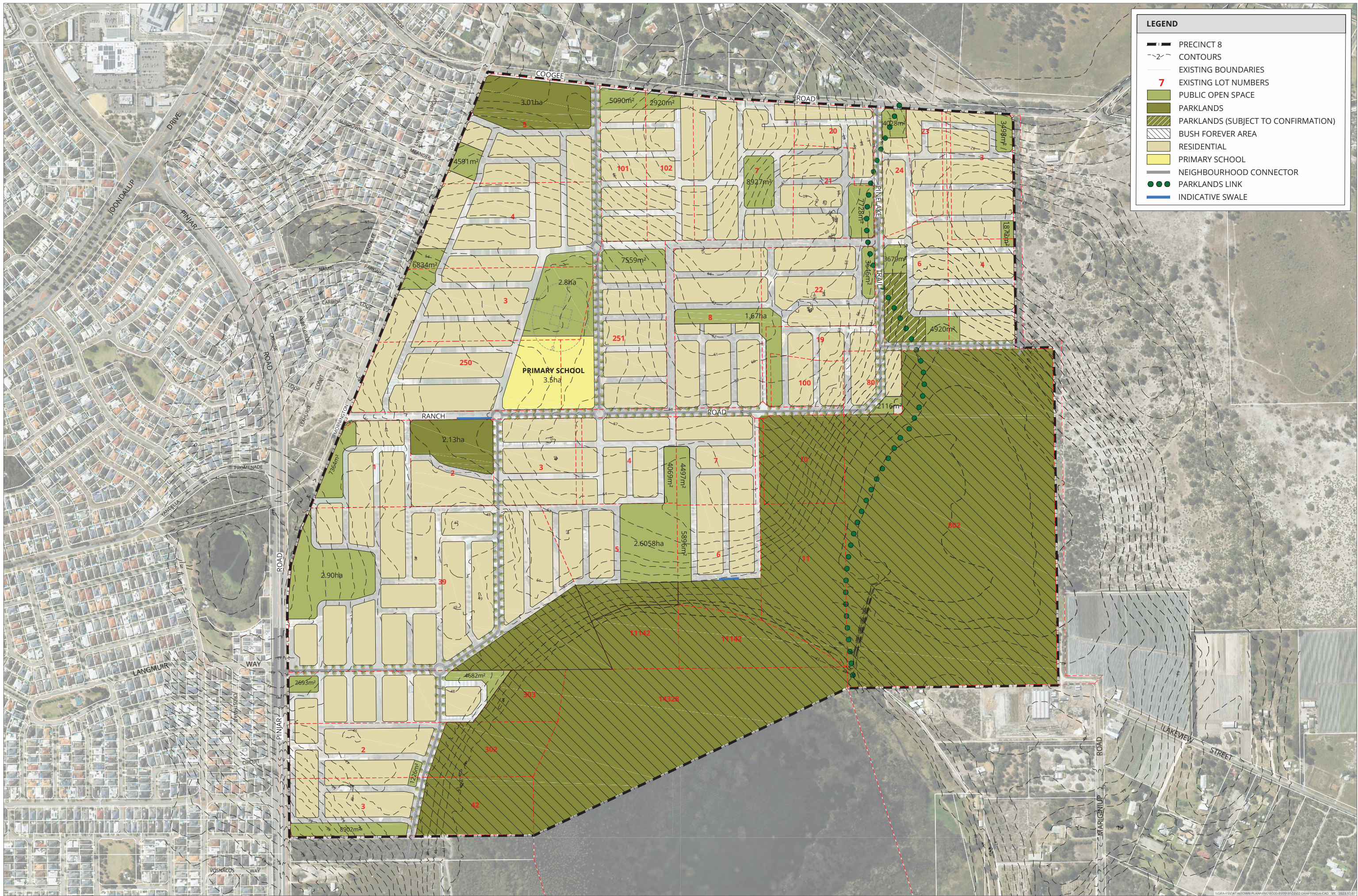


## **APPENDIX 1**

### **Proposed East Wanneroo Precinct 8 Structure Plan**

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**LEGEND**

- PRECINCT 8
- CONTOURS
- EXISTING BOUNDARIES
- EXISTING LOT NUMBERS
- PUBLIC OPEN SPACE
- PARKLANDS
- PARKLANDS (SUBJECT TO CONFIRMATION)
- BUSH FOREVER AREA
- RESIDENTIAL
- PRIMARY SCHOOL
- NEIGHBOURHOOD CONNECTOR
- PARKLANDS LINK
- INDICATIVE SWALE

**PRECINCT 8 CONCEPT PLAN**  
 VARIOUS LOTS - PINJAR ROAD - COOGEE ROAD - RANCH ROAD - PINELAKE TRAIL  
 EAST WANEROO

**DRAFT**

SCALE @ A1: 1:4000  
 8903-CON-13J

DATE CREATED: 2023.12.07  
 PROJECTION: MGA50 GDA84  
 CADASTRE: LANDGATE  
 AERIAL: METROMAP 2023

DRAWN BY: [Name]  
 CHECKED BY: [Name]  
 APPROVED BY: [Name]

**ROWE GROUP DESIGN**

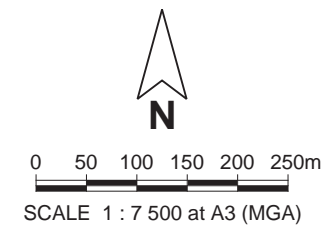
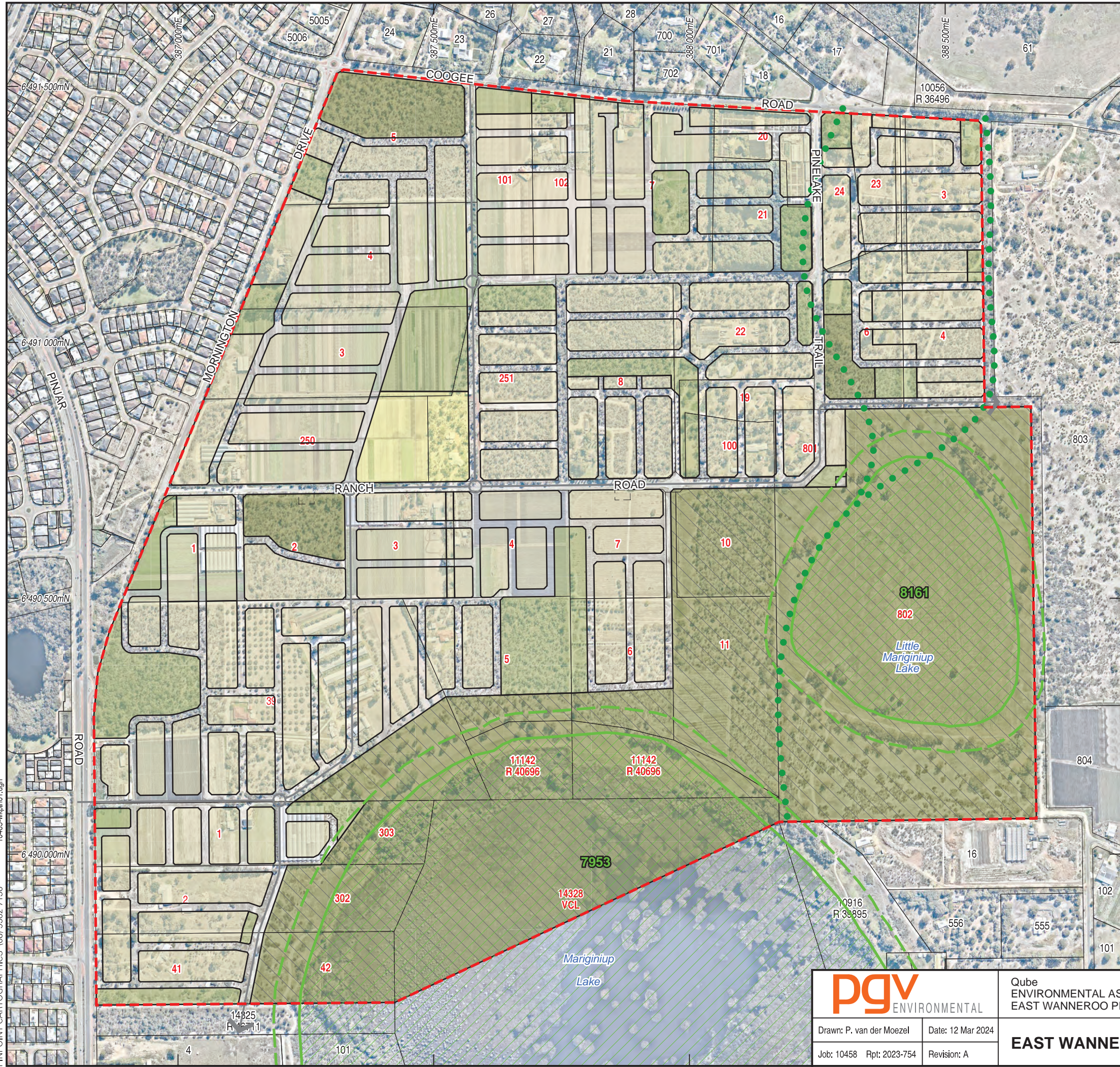


## **APPENDIX 2**

### **Wetland Boundary on Concept Plan**

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- Legend**
- - - Site Boundary
  - Cadastral Boundary
  - Easement Boundary
  - Conservation Category Wetland
  - 50m Wetland Buffer
- Precinct 8 Concept Plan**
- Public Open Space
  - Parklands
  - Bush Forever Area
  - Residential
  - Primary School
  - Neighbourhood Connector
  - ● ● Parklands Link

10485-wkpln01.dgn  
PINPOINT CARTOGRAPHICS (08) 9562 7136

CADASTRAL SOURCE: Landgate, August 2023.  
AERIAL PHOTOGRAPH SOURCE: NearMap, flown April 2023  
CONCEPT PLAN SOURCE: Rowe Group, Dwg No. 8903-CON-13-J, 07-12-2023.

		Qube ENVIRONMENTAL ASSESSMENT REPORT EAST WANNEROO PRECINCT	
Drawn: P. van der Moezel	Date: 12 Mar 2024	<h2 style="margin: 0;">EAST WANNEROO PRECINCT 8 WETLANDS</h2>	
Job: 10458 Rpt: 2023-754	Revision: A		
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## **APPENDIX 3**

### **Aboriginal Heritage Inquiry System Reports**

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## List of Aboriginal Cultural Heritage (ACH) Lodged

---

### Search Criteria

1 Aboriginal Cultural Heritage (ACH) Lodged in Custom search area - Polygon - 115.803545304302°E, 31.7237545545853°S (GDA94) : 115.803545304302°E, 31.7100282227481°S (GDA94) : 115.828779526714°E, 31.7100282227481°S (GDA94) : 115.828779526714°E, 31.7237545545853°S (GDA94) : 115.803545304302°E, 31.7237545545853°S (GDA94)

### Disclaimer

Aboriginal heritage holds significant value to Aboriginal people for their social, spiritual, historical, scientific, or aesthetic importance within Aboriginal traditions, and provides an essential link for Aboriginal people to their past, present and future. In Western Australia Aboriginal heritage is protected under the *Aboriginal Heritage Act 1972*.

All Aboriginal cultural heritage in Western Australia is protected, whether or not the ACH has been reported or exists on the Register.

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## List of Aboriginal Cultural Heritage (ACH) Lodged

### Terminology

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  - **No Gender / Initiation Restrictions:** *Anyone* can view the information.
  - **Men only:** Only *males* can view restricted information.
  - **Women only:** Only *females* can view restricted information.

#### Status:

- **Register:** Aboriginal cultural heritage places that are assessed as meeting Section 5 of the *Aboriginal Heritage Act 1972*.
- **Lodged:** Information which has been received in relation to an Aboriginal cultural heritage place, but is yet to be assessed under Section 5 of the *Aboriginal Heritage Act 1972*.
- **Historic:** Aboriginal heritage places assessed as not meeting the criteria of Section 5 of the *Aboriginal Heritage Act 1972*. Includes places that no longer exist as a result of land use activities with existing approvals.

**Place Type:** The type of Aboriginal cultural heritage place. For example an artefact scatter place or engravings place.

**Legacy ID:** This is the former unique number that the former Department of Aboriginal Sites assigned to the place.

### Coordinates

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## List of Aboriginal Cultural Heritage (ACH) Lodged

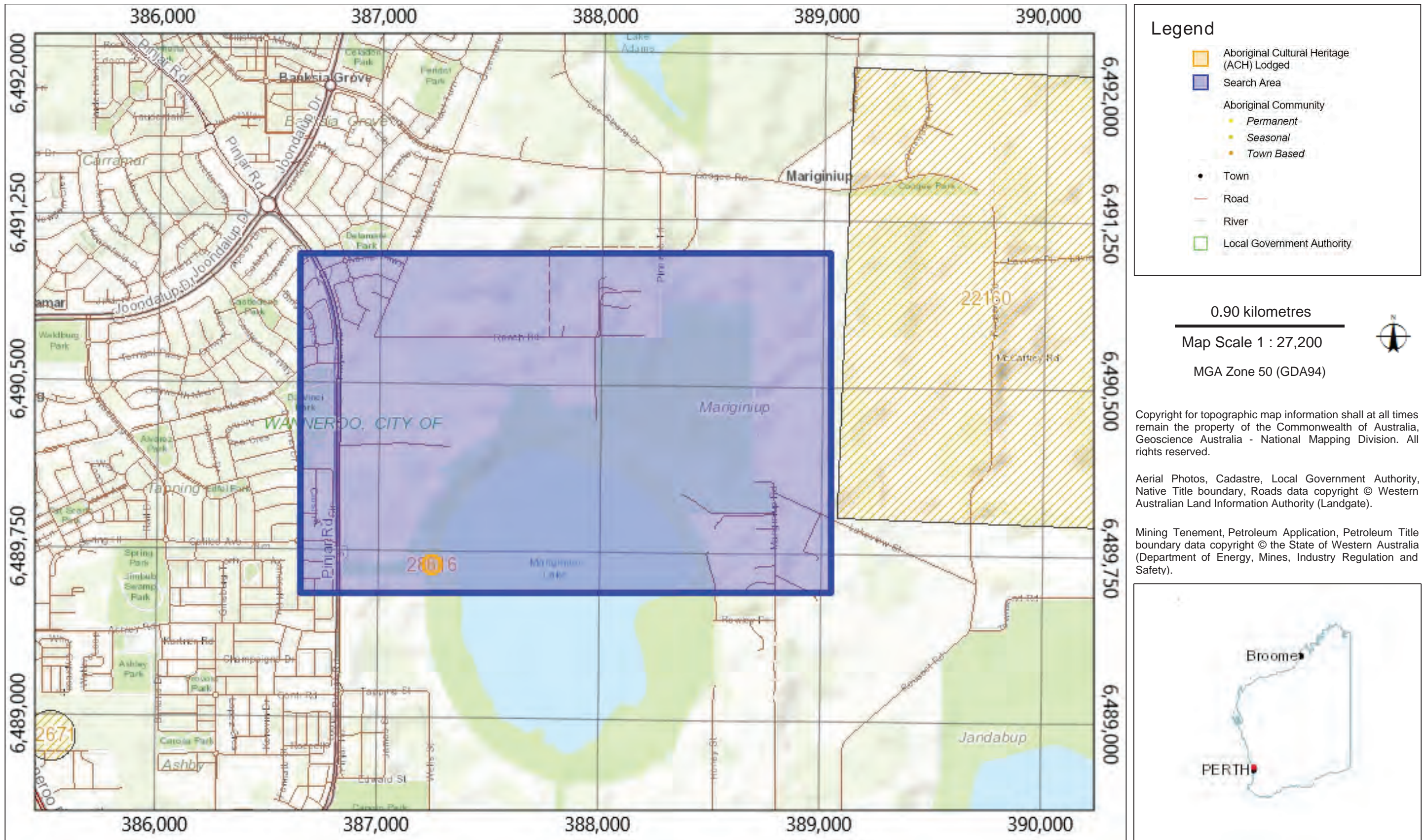
ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
28616		No	Yes	No	No Gender / Initiation Restrictions	Lodged	Modified Tree	*Registered Knowledge Holder names available from DPLH	



# Aboriginal Cultural Heritage Inquiry System

## Map of Aboriginal Cultural Heritage (ACH) Lodged

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## List of Aboriginal Cultural Heritage (ACH) Register

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### Search Criteria

1 Aboriginal Cultural Heritage (ACH) Register in Custom search area - Polygon - 115.803545304302°E, 31.7237545545853°S (GDA94) : 115.803545304302°E, 31.7100282227481°S (GDA94) : 115.828779526714°E, 31.7100282227481°S (GDA94) : 115.828779526714°E, 31.7237545545853°S (GDA94) : 115.803545304302°E, 31.7237545545853°S (GDA94)

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#### Status:

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- Lodged: Information which has been received in relation to an Aboriginal cultural heritage place, but is yet to be assessed under Section 5 of the Aboriginal Heritage Act 1972.
- Historic: Aboriginal heritage places assessed as not meeting the criteria of Section 5 of the Aboriginal Heritage Act 1972. Includes places that no longer exist as a result of land use activities with existing approvals.

Place Type: The type of Aboriginal cultural heritage place. For example an artefact scatter place or engravings place.

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# Aboriginal Cultural Heritage Inquiry System

## List of Aboriginal Cultural Heritage (ACH) Register

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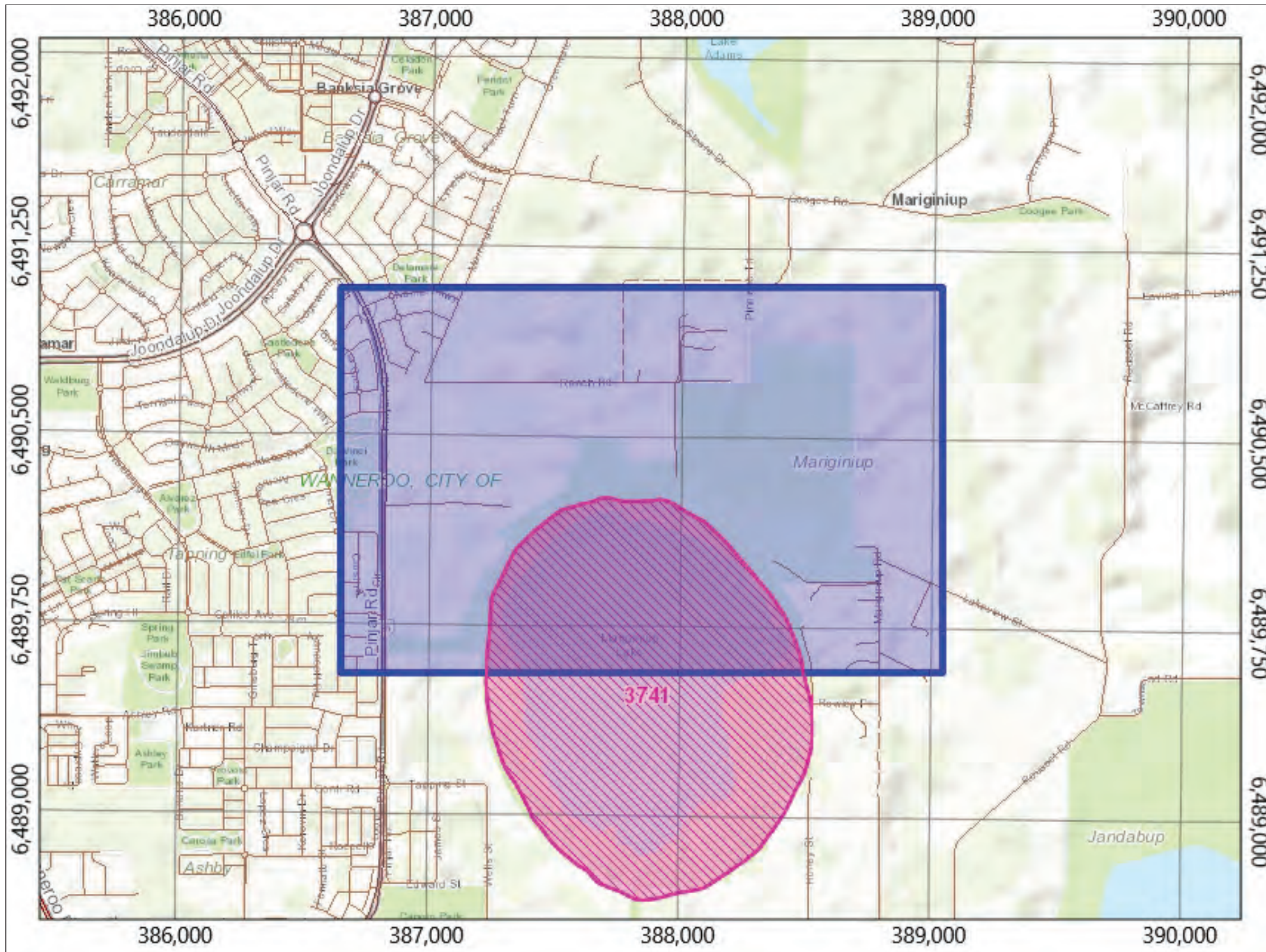
ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
3741	LAKE MARIGINIUP.	No	Yes	No	No Gender / Initiation Restrictions	Register	Creation / Dreaming Narrative; Hunting Place	*Registered Knowledge Holder names available from DPLH	S02188



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**Legend**

- Aboriginal Cultural Heritage (ACH) Register
- Search Area
- Aboriginal Community
  - Permanent
  - Seasonal
  - Town Based
- Town
- Road
- River
- Local Government Authority

0.90 kilometres  
 Map Scale 1 : 27,200  
 MGA Zone 50 (GDA94)

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### Search Criteria

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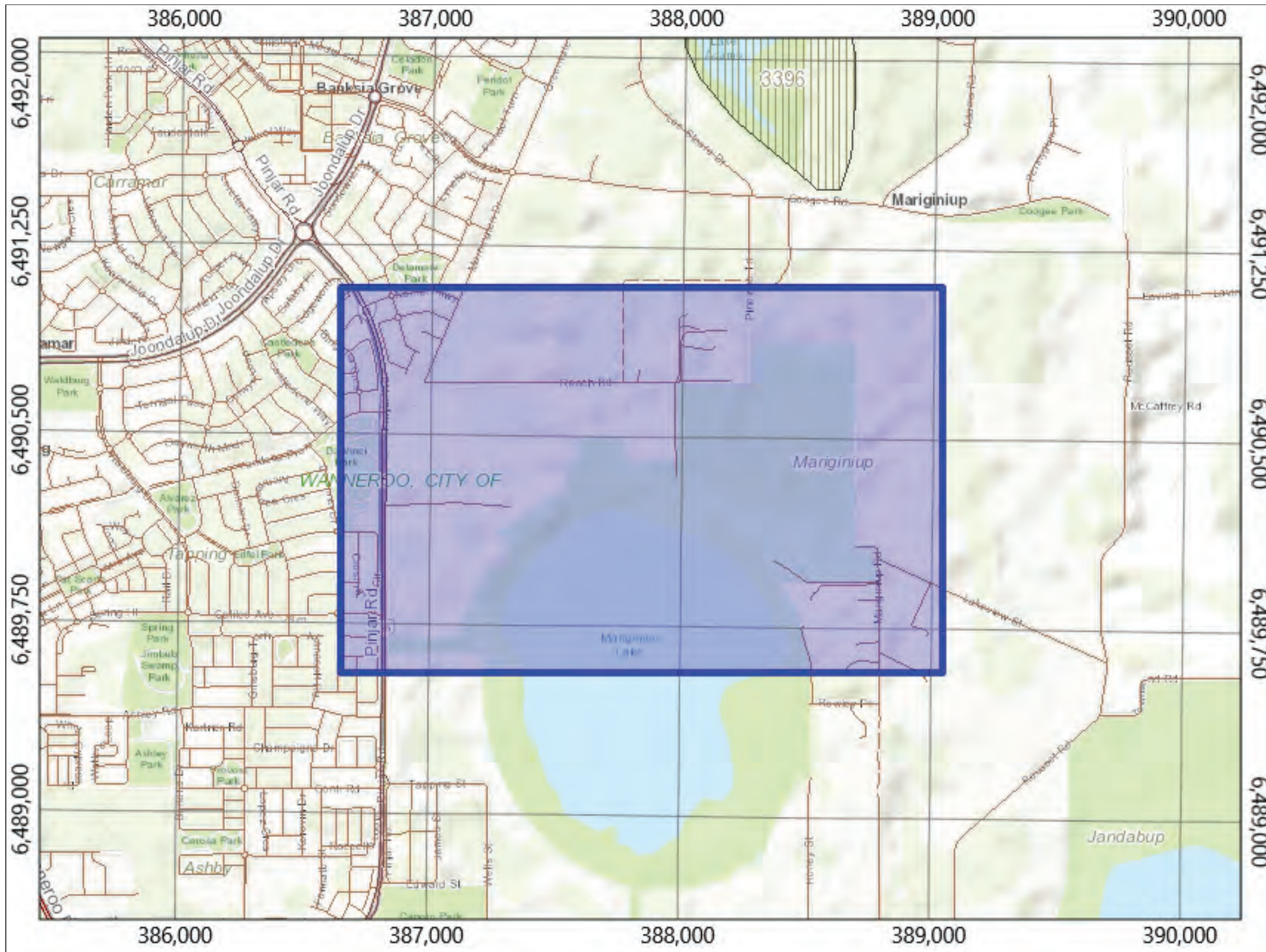
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## Map of Aboriginal Cultural Heritage (ACH) Historic



**Legend**

- Aboriginal Cultural Heritage (ACH) Historic
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- Aboriginal Community
  - Permanent
  - Seasonal
  - Town Based
- Town
- Road
- River
- Local Government Authority

0.90 kilometres  
 Map Scale 1 : 27,200  
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# APPENDIX 4

## Water Information Reporting

**Department of Water and Environmental Regulation**

HYPLOT V134 Output 13/08/2023

Period 22 Year 01/01/1978 to 01/01/2000

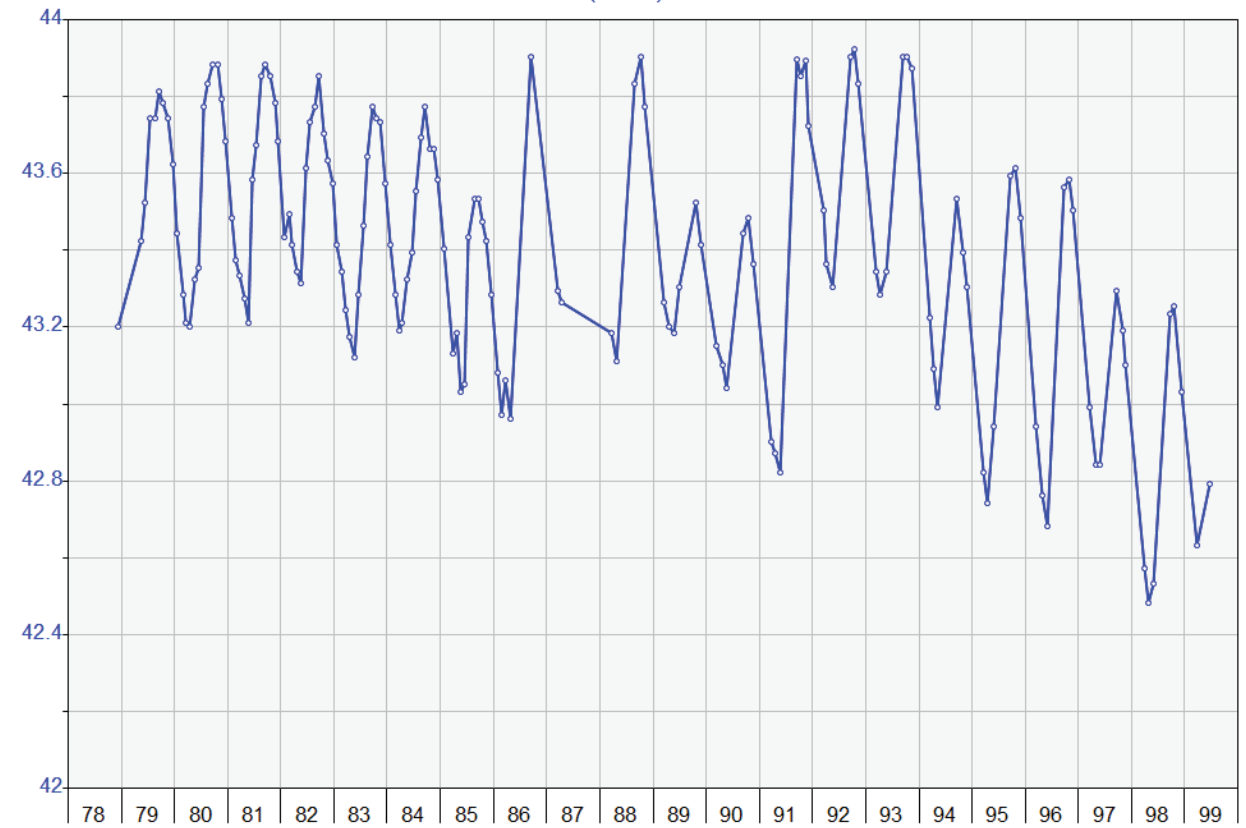
1978-99

61610748

MS2

Water Level (mAHD)

GW





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HYPLOT V134 Output 11/01/2024

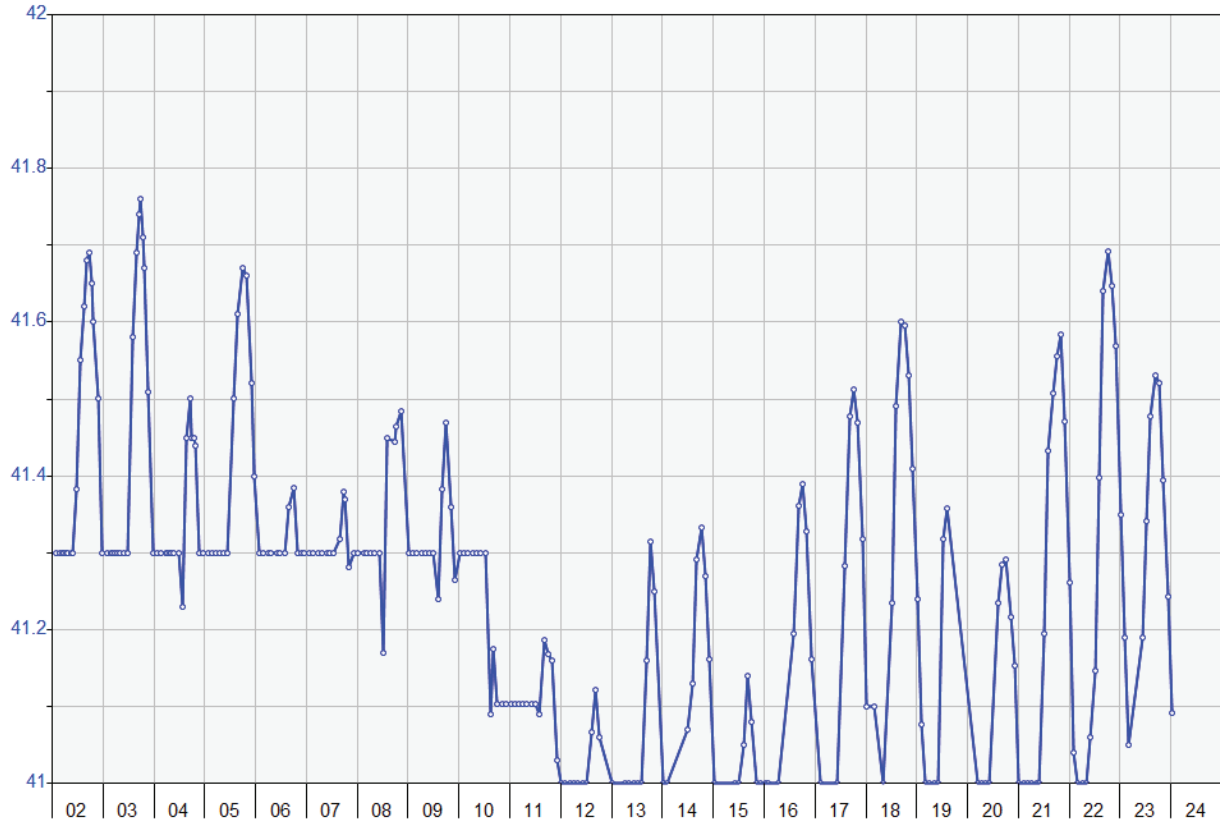
Period 23 Year 01/01/2002 to 01/01/2025

2002-24

↔ 6162577

Lake Mariginiup 1943 Water Level (mAHD)

GW



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