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COWARAMUP - STRUCTURE PLAN

Lot 500 Wirring Road, Cowaramup

Project YOLHA 24001002D | Scale 1:4000 @ A3 | Date: 13 Nov 2024

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Environmental Assessment Report

Lot 500 Wirring Road, Cowaramup

4 August 2022

Prepared for:

R.W. Duggan



Limitations Statement

This report has been prepared in accordance with the Agreement between Ecosystem Solutions Pty Ltd and R.W. Duggan (**"Client"**). It has been solely prepared for a Local Planning Scheme Amendment Request at Lot 500 Wirring Road, Cowaramup (**"Site"**).

Information

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Document Control

R.W. Duggan

Lot 500 Wirring Road, Cowaramup

Version	Revision	Purpose	Author	Reviewer	Submitted	
					Form	Date
Report	Rev A	Initial Report	DP/LD	GM	Electronic (email)	5/04/2022
Report	Rev B	Amendments	HD	KL	Electronic (email)	26/04/2022
Report	Rev C	MM Comments	DC	GM	Electronic (email)	09/06/2022
Report	Rev D	MM Comments	KL	GM	Electronic (email)	04/08/2022
Report	Rev E	Final Concept Plan	HD	GM	Electronic (email)	05/08/2022

Filename: z:\projects\221273 part lots 51 and 304 wirring road, cowaramup bmp and f&f\reports\lot 500 wirring road, cowaramup - flora and fauna significance report rev d.docx

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1 Introduction

Ecosystem Solutions were contracted by R.W Duggan to survey Lot 500 Wirring Road, Cowaramup (hereafter called the "Site") within the Shire of Augusta-Margaret River. A survey was undertaken to assess the vegetation condition and document the presence and distribution of flora and fauna on the Site to support a request to amend the Shire of Augusta-Margaret River Local Planning Scheme No.1 and subsequent Structure Plan of the Site. This will ultimately facilitate residential subdivision of the site, generally as envisaged on the attached Concept Plan (Figure 1).

The fauna species specifically targeted are the Western Ringtail Possum (*Pseudocheirus occidentalis*) and signs or suitable habitat for Black Cockatoo Species (*Calyptorhynchus baudinii*, C. *latirostris and C. banksii subsp. naso*) as well as any other conservation significant fauna likely to occur within the Site.

The flora elements specifically targeted include Threatened and Priority species and Threatened and Priority Ecological Communities. However, a flora survey was not conducted in the optimal time for all plant identification and there is a potential for conservation significant annual species to be present that have not been recorded.

This flora and fauna assessment was limited to observing species present during the time of the surveys.



Figure 1 Concept Plan for Lot 500 Wirring Road, Cowaramup

2 Site Details

The Site is zoned as 'General Agriculture' under the Shire of Augusta-Margaret River Local Planning Scheme 1 and 'Future Urban', under the Local Planning Scheme 2020. The land is currently operated as a rural farming operation. This report is prepared in support of a request to amend the zoning of the Site to 'Urban Development'.

The Lot is 40.82 ha in area and includes a predominately cleared area of vegetation with scattered trees. The vegetated area in the north-west corner of the Lot and the scattered trees on the central northern area are envisaged to be retained in an area of Public Open Space (POS A & POS C). The trees in the northern area of the Site will be retained within the proposed lots. There are also scattered trees within the development footprint which will require removal.

The surrounding landscape includes farming operations to the north-east, east, south, and south-east of the Lot. These operations are low intensity agriculture including cattle grazing, and therefore no separation distances are required (DWER, 1986; EPA, 2005). Rural residential lots and pockets of remanent vegetation are to the west and north of the Lot, which make up parts of the Cowaramup townsite. A Water Corporation lot is to the south-east of the Site.

The Site sits at approximately 140 m AHD in the south-east with a gentle slope down to 135 m AHD to the south-west, north-west and north-east. The Site is located to the north-east of Wirring Road and east of Bussell Highway.

3 Flora and Vegetation

3.1 Desktop analysis

The desktop investigation used datasets available from government sources and Ecosystem Solutions own databases to map environmental parameters onto the study area. Information sourced included the following:

- Department of Biodiversity Conservation and Attractions' NatureMap for Threatened and Priority Flora and wetland mapping
- Department of Agriculture, Water and of the Environments', Environment Protection and Biodiversity Conservation (EPBC) Protected Matters Search Tool
- Department of Primary Industries and Regional Developments', Soil Subsystem mapping
- Department of Water and Environmental Regulations', Acid Sulphate Soils risk (DWER_052) and environmentally sensitive areas mapping
- Department of Planning, Lands and Heritages', Aboriginal Heritage Places mapping.

Environmental aspects included in this investigation are as follows:

- Soil landscape systems
- Presence of potential acid sulphate soils (ASS)
- Regional vegetation complexes
- Presence of environmentally sensitive areas (ESA's)
- Hydrology and categorised wetlands
- Presence of conservation significant flora
- Presence of threatened and priority ecological communities
- Presence of Aboriginal heritage sites

3.1.1 Soil Landscape

Soil-Landscape systems are areas with recurring patterns of landforms, soils and vegetation and are used by the Department of Agriculture to maintain a consistent approach to land resource surveys.

The Site is located within the Cowaramup Uplands System with the Wilyabrup Valleys System located to the east of the Lot (Department of Primary Industries and Regional Development, 2021):

- Cowaramup Uplands System (216Co) – Lateritic plateau, in the Leeuwin Zone. Sandy gravel, loamy gravel and grey sandy duplex. Jarrah-marri forest.

These soil systems are further divided into mapping units. There are two Phases in the Lot with Cowaramup flats Phase comprising the greatest area of the Site (Figure 2):

- Cowaramup flats Phase (216CoCO1) - Flats (0-2% gradient) with gravelly duplex (Forest Grove) and pale grey mottled (Mungite) soils.
- Cowaramup wet flats Phase (216CoCOw) - Poorly drained flats and slight depressions with pale grey mottled (Mungite).

The following unit is located in close proximity to the Lot (Figure 2):

- Cowaramup wet vales Phase (216CoCOvw) - Small, broad U-shaped drainage depressions with swampy floors. Gravelly duplex (Forest Grove) soils on sideslopes and poorly drained alluvial soils on valley floor.

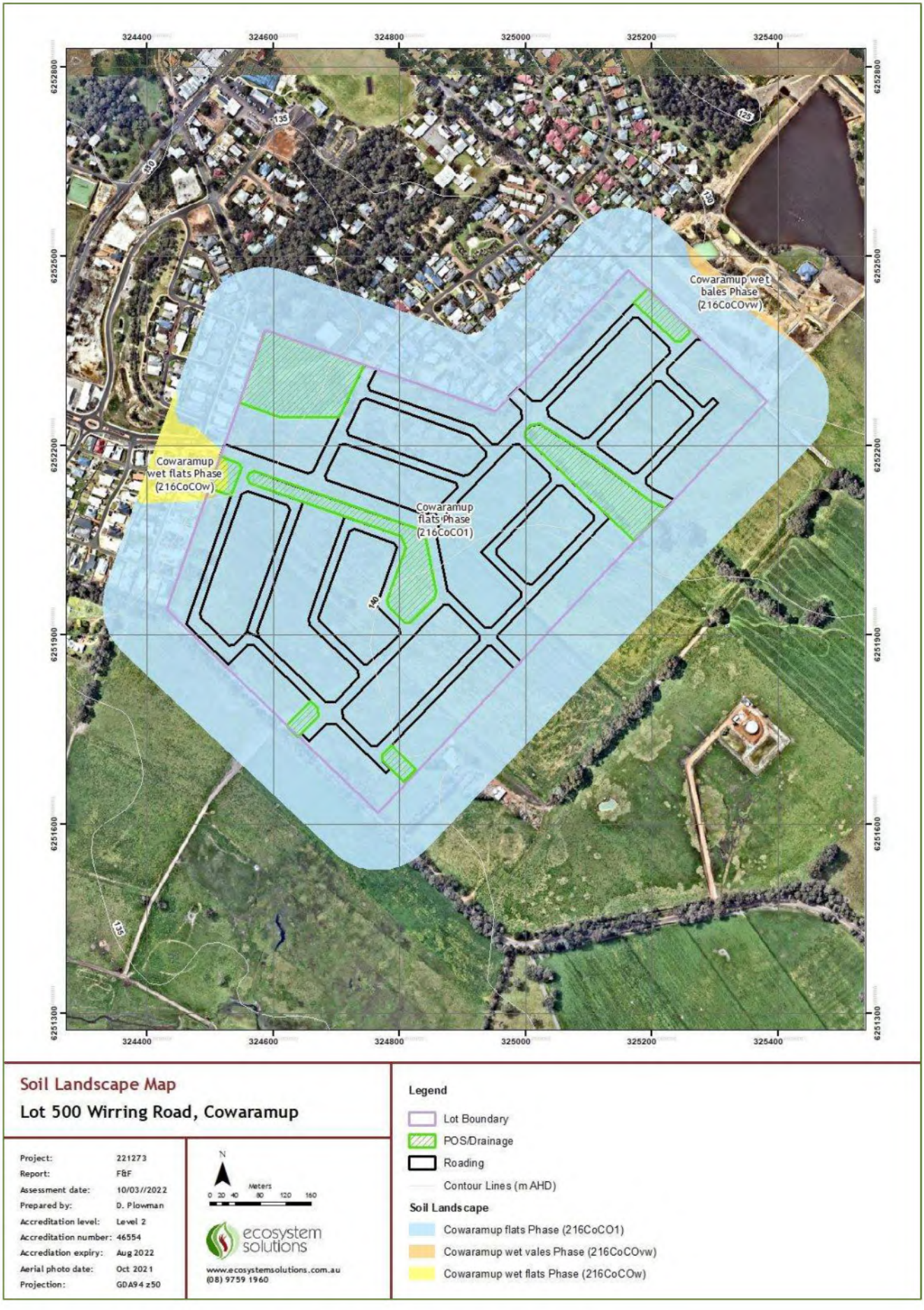


Figure 2 Soil Landscape for Lot 500 Wirring Road, Cowaramup

3.1.2 Acid Sulfate Soils

Acid sulfate soils (ASS) are naturally occurring soils, sediments and peats that contain iron sulphides. When exposed to air (oxygen), these sediments can form sulfuric acid and release metals (including arsenic) into the soil profile. The release of these substances have potential to cause significant environmental and economic impacts by contaminating soil and groundwater. These soils are predominantly found in low-lying land bordering the coast, estuarine or saline wetlands, and freshwater ground water dependent wetlands throughout the State.

The Department of Water and Environmental Regulation (2017) developed a map, *Acid Sulfate Soil Risk Map (DWER-052)* indicating risk level of ASS materials based on the likelihood of ASS materials occurring within soil profiles.

This mapping indicates an area of Risk Class 2 (1,270m^2 / 0.127ha) on the western edge of the Site that encroaches on one lot and Drainage Basin. Risk Class 2 indicates a moderate to low-risk likelihood of ASS occurring within 3m of natural soil surface but a high to moderate risk of ASS beyond 3m of natural soil surface (DWER-052).

If there is any disturbance greater than 100m^3 required of the Risk Class 2 area, with excavation proposed below the water table, than an Acid Sulfate Soil Management Plan should be prepared and implemented with actions to mitigate the potential impacts provided in the 'Treatment and management of soils and water in acid sulfate soil landscapes' (DER 2015).

There are a further two areas of ASS Risk Class 2 outside the Lot Boundary. One, located 165m northeast of the Lot Boundary and another 115m to the South.

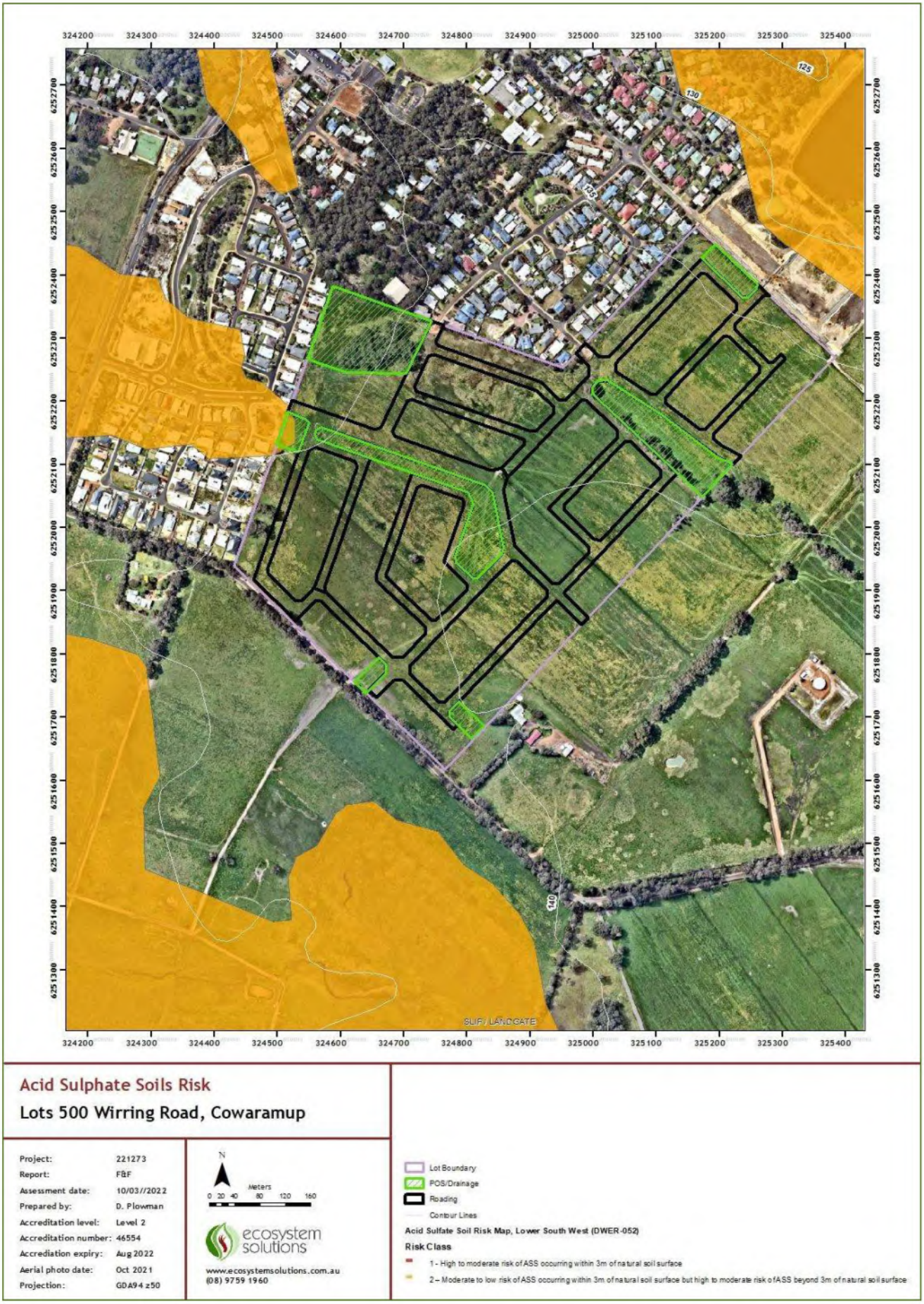


Figure 3 Potential Acid Sulphate Soil Risk for Lot 500 Wirring Road, Cowaramup

3.1.3 Regional Vegetation

The vegetation complexes of the Southwest Forest region have been mapped by Havel and Mattiske (2000). This dataset identifies Cowaramup Complex as the only complex within the Site (Figure 4):

- Cowaramup Uplands (C2) - Open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Banksia grandis* on lateritic uplands in peri humid and humid zones.

The 2018 South West Vegetation Complex Statistics (Government of Western Australia, 2018) for the Cowaramup Uplands (C2) complex is shown in Table 1.

The National Objectives and Targets for Biodiversity Conservation (DEH, 2001) intends to retain and protect those vegetation communities with less than 30% extent remaining. The Cowaramup Uplands (C2) complex narrowly achieves this target, having 32.45% remaining with 4.83% in secure tenure.

The vegetation that is mapped as Cowaramup Uplands is intended to be retained in an area of Public Open Space.

Table 1 Vegetation Complex Statistics (2018)

Vegetation Complex	Pre-European Extent	Current Extent	Extent Remaining	Vegetation Complex Extent within Lands Protected for Conservation (IUCN I-IV)
Cowaramup Uplands	13,692.45 ha	4,442.60 ha	32.45%	4.83%



Figure 4 Vegetation Complex for Lot 500 Wirring Road, Cowaramup

3.1.4 Environmentally Sensitive Areas

Environmentally sensitive areas (ESAs) are classes or areas of native vegetation, where the exemptions for clearing vegetation under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (Clearing Regulations) do not apply. ESA's include but are not limited to declared World Heritage properties, defined wetlands and buffer area, threatened flora and buffer, Threatened Ecological Communities, a Bush Forever Site and lakes, wetlands and fringing native vegetation covered under Environmental Protection Policies (e.g., Swan Coastal Plain Lakes).

A search of the Department of Water and Environmental Regulation's Clearing Regulations - Environmentally sensitive areas mapping indicated that there is no ESA within or around the Site (DWER-046).

3.1.5 Hydrology and Wetlands

Wetlands include areas of seasonally or permanently waterlogged soils, or inundated land, with fresh or saline, flowing or static water (Wetlands Advisory Committee, 1977). They are important as they support a large proportion of the States flora and fauna.

DBCA manages and protects Ramsar wetlands, which are of international importance, listed under the Ramsar Convention. There are no Ramsar wetlands within proximity to the Site (DBCA-012)

The Site is located within the upper catchment of Wilyabrup Brook (Figure 5), which is a minor river located north and south of the Site (DWER-031). Wilyabrup Brook has a total stream length of nearly 20 km, commencing within 1 km east of the Site, flowing northwest to an estuary located between Yallingup and Gracetown (Green & Donohue, 2015).

A minor local waterway is located within the Site, in an area designated to become a Drainage Basin, shown in Figure 5.



Figure 5 Hydrology for Lot 500 Wirring Road, Cowaramup

3.1.6 Threatened and Priority Flora

Extracts from the following databases have been obtained, using a 10 km buffer, to determine if records of any conservation listed flora species are known within the boundary or surrounding the Site:

- NatureMap database showing listed species under the *Biodiversity Conservation (BC) Act 2016* managed by Department of Biodiversity, Conservation and Attractions (DBCA), provided in Appendix A.
- Protected Matters Search Tool (PMST) showing species listed under the commonwealth *Environmental Protection and Biodiversity Conservation (EPBC) Act 1999* (Appendix B).

Flora species are protected based on their conservation status. DBCA recognises threats of extinction and consequently applies regulations towards population and species protection. Protected species are gazetted under the *Biodiversity Conservation Act (2016)*, and it is an offence to "take" or damage rare flora without Ministerial approval. The act defines "to take" as "… to gather, pick, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means" (Government of Western Australia, 2010).

Appendix C presents the definitions for conservation status under the *BC Act* 2016, which was previously the *Wildlife Conservation Act 1950*, and *EPBC Act 1999*.

3.1.7 Threatened and Priority Ecological Communities

An ecological community is a naturally occurring biological assemblage that occurs in a particular type of habitat. A Threatened Ecological Community (TEC) is one which is found to fit into one of the following categories: Presumed Totally Destroyed; Critically Endangered; Endangered, or Vulnerable.

Possible TECs that do not meet survey criteria are added to the Department of Parks and Wildlife's Priority Ecological Community Lists, under Priority 1, 2 and 3. These are ranked in order of priority for survey and/or definition of the community type and evaluation of its conservation status.

The PMST report has identified the following TEC as likely to occur (within the buffer area only):

- Banksia woodlands of the Swan Coastal Plain ecological community (Endangered)
- Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community (Critically Endangered)

3.1.8 Aboriginal Heritage

Department of Planning, Lands and Heritage (DPLH) developed a data set containing places within Western Australia that have been reported to the Registrar of Aboriginal Sites as possible sites within the meaning of the *Aboriginal Heritage Act 1972* (AHA). This includes Registered Sites (those that meet criteria of Section 5 of AHA), Lodged places (those yet to be formally assessed against Section 5 criteria) and Stored data (places to which Section 5 of AHA does not apply). This data is the same as that accessed through the Aboriginal Heritage Inquiry System (AHIS).

A search of the Aboriginal Heritage Places (DPLH-001) dataset showed no Aboriginal sites, within the Site. The nearest known Aboriginal sites are located 640m to the north-west of the Site and named Place 25909 - Cowaramup Sale Yards Camp and Corroboree Grounds, located 640m to the north-west of the Site.

The DPLHs' Aboriginal Heritage Survey dataset (DPLH-080) was also accessed to determine if the Site was included in Aboriginal Heritage Survey Area information from Heritage Survey Reports submitted to the department.

The search identified the Site as an area covered under an Aboriginal Heritage survey (Report ID 101971, *National Estates Grants Programme Aboriginal Sites in the Lower Southwest Heritage Study*. July 1995.). The study area of this archaeological and ethnographic survey encompassed approximately 5,600 km^2 bounded by Capel River to the north, the Indian Ocean to the west, the Vasse Hwy to the east and the Donnelly River and Southern Ocean to the South.

3.2 Field Survey

The Site was surveyed on 9 March 2022 by Kelly Lamp (B.Sc Hons. Nat Rs Mgmt., FB62000182 / TFL 54-2021) and Lorraine Duffy (B.Sc Env Biology, B. Arts Geo, FB62000280) from Ecosystem Solutions.

The Site was walked in a systematic manner to cover the entire area. Zones with consistent vegetation structure and composition were noted and the main species in each of the strata were identified. Due to the small area and disturbed condition of the vegetation, only one relevé was completed (Figure 4, Appendix D). The condition of the vegetation based on Keighery (1994) was also recorded across the Site (Figure 5).

3.3 Results

3.3.1 Threatened, Priority and Significant Flora

A total of 12 Threatened (T) species and 23 Priority (P) species have been identified within a 10 km radius of the Site according to the BC Act. Two are considered Critically Endangered (CE) species, seven Endangered (E) species and three vulnerable (V) species under the EPBC Act. (Appendix A & B). The results for all database searches are summarised in Table 2.

The likelihood of the species occurring within the Site is determined based on known distribution, last known records and the habitat expected within the Site or buffer area.

There were no Threatened flora species recorded during the field surveys. While the flora survey was not conducted during the optimal time for plant identification (Spring), the Site has been heavily grazed and has a very sparse understorey and so it is unlikely conservation significant species are present that have not been recorded.

Table 2 Conservation significant flora species recorded within 10 km of the Site

Species	Conservation status*	Life Form	Habitat / Known Distribution	Likelihood of occurrence within the Site
Caladenia lodgeana	T/CE	Herb	Seasonally moist wet clay /sand on laterite or margin of granite outcrops in low scrub or open forest with low scrub. Known from populations near Augusta and south east of Collie. Population south west of Margaret River extinct.	Unlikely
Grevillea brachystylis subsp. grandis	T/CE	Shrub	Narrow band, 10 km long, of degraded habitat at the base of Whicher Scarp. Brown lateritic clay loam soils in Marri woodland.	Unlikely
Banksia nivea subsp. uliginosa	T/E	Shrub	Sandy clay, gravel. Occurs in two areas, near Busselton and Scott River Plain on clay over laterite in thick scrub, in winter wet southern ironstones.	Unlikely
Caladenia excelsa	T/E	Herb	White, grey or brown sands, sandy loams, loam, clay, laterite and granite. Hilltops, ridges, slopes, swales and low plains in deep pale yellow or grey sandy soils.	Possible
Caladenia hoffmanii	T/E	Herb	Clay, loam, laterite, granite. Rocky outcrops and hillsides, ridges, swamps and gullies. All known populations are located north of Geraldton.	Unlikely
Caladenia huegelii	T/E	Herb	Grey or brown sand, clay loam. Current distribution confined to Dunsborough and north of Busselton.	Possible
Eucalyptus x phylacis	T/E	Tree	Mallee-heath or woodland on lateritic soils. Known from a single clonal population in Meelup Regional Park, Dunsborough.	Unlikely
Gastrolobium papilio	T/E	Shrub	Sandy clay over ironstone and laterite. Flat plains. Species is restricted to Hithergreen and Walsall area in Busselton.	Unlikely

Species	Conservation status*	Life Form	Habitat / Known Distribution	Likelihood of occurrence within the Site
Lambertia echinata subsp. occidentalis	T/E	Shrub	White sandy soils over laterite, orange/brown-red clay over ironstone. Flats to foothills, winter wet sites.	Unlikely
Banksia squarrosa subsp. argillacea	T/E	Shrub	White/grey sand, gravelly clay or loam. Winter -wet flats, clay flats. Confined to the western base of the Whicher scarp, east of Busselton.	Unlikely
Daviesia elongata subsp. elongata	T/V	Shrub	Jarrah forest or woodland, on sandy soil, laterite.	Unlikely
Drakaea micrantha	T/V	Herb	White - grey sand.	Possible
Netrostylis sp. Nannup (P.A. Jurjevich 1133)	P1	Herb	Lowland areas, pale yellow-grey sand, laterite/rock.	Possible
Gastrolobium whicherense	P2	Shrub	Red-grey sandy clay over quartzite. Steep westerly slopes.	Unlikely
Leptomeria furtiva	P2	Shrub	Grey or black peaty sand. Winter-wet flats.	Possible
Xyris maxima	P2	Shrub	Seasonally wet black peaty sand -brown sandy loam, drainage flats.	Possible
Acacia inops	P3	Shrub	Grey-Black peaty sand, clay, swamps, creeks. Grows along watercourses and swamps.	Unlikely
Boronia anceps	P3	Herb	White sand, gravelly laterite. Seasonally swampy heaths. Known from populations in Augusta and Scott River region.	Unlikely
Boronia tetragona	P3	Herb	White/grey or black sand or brown sandy loam. Winter wet flats, swamps, hillslopes.	Possible
Chamaescilla gibsonii	P3	Herb	Clay to sandy clay, winter wet flats, shallow water-filled claypans.	Unlikely

Species	Conservation status*	Life Form	Habitat / Known Distribution	Likelihood of occurrence within the Site
Dampiera heteroptera	P3	Herb/ Shrub	Sandy - Grey sandy clay/grey-brown sandy loam soils. Swampy areas.	Possible
Gastrolobium formosum	P3	Shrub	Clay brown loams, along river backs or in swamps.	Unlikely
Grevillea brachystylis subsp. brachystylis	P3	Shrub	Black sand/brown sandy loam/ sandy clay/white-grey clay sand. Seasonally inundated/swampy situations.	Possible
Grevillea bronwenae	P3	Shrub	White -Grey sand over laterite/brown sand/loam, lateritic loams. Hillslopes, seasonally inundated/creekline areas. Known location <0.8km from the Site.	Possible
Grevillea manglesioides subsp. ferricola	P3	Shrub	Red sandy clay over ironstone/gravelly grey, brown sandy loam/brown clay to sandy clay. Winter wet flats.	Possible
Johnsonia inconspicua	P3	Herb	White-grey or black sand. Sedgeland and banksia or jarrah woodland. Low dunes, winter-wet flats.	Unlikely
Lasiopetalum laxiflorum	P3	Shrub	Grey-brown clayey loam occasionally over laterite/gravel	Possible
Pimelea ciliata subsp. longituba	P3	Shrub	Grey sand over clay, loam.	Possible
Pultenaea pinifolia	P3	Shrub	Loams or clay, floodplains, swampy areas. Known location <0.6km from the Site.	Possible
Synaphea decumbens	P3	Shrub	Sand over laterite. Known location < 1.5km from the Site.	Possible
Acacia flagelliformis	P4	Shrub	Sandy soils and winter-wet areas.	Possible
Acacia tayloriana	P4	Shrub	Grey or yellow/orange sandy soils, lateritic gravel, clay loam. Winter wet areas.	Possible

Species	Conservation status*	Life Form	Habitat / Known Distribution	Likelihood of occurrence within the Site
Chamelaucium erythrochlorum	P4	Shrub	Variable soil, sand/ brown sandy loams/ white clayey sands on slopes and flats. Ridge/creek embankments.	Possible
Drosera fimbriata	P4	Herb	White/grey/black sand/ granite. Hillslope/flat	Unlikely
Franklandia triaristata	P4	Shrub	Variable soil, brown-grey clay over white or grey sand, white /grey sand or brown gravel soils common on slope but also found on flats. Known locations in Margaret River, east of Busselton, Nannup and South of Bunbury.	Possible
Thysanotus isantherus	P4	Herb	Granite/ dry grey loam over laterite/ clay-loam on granite/ grey sand over gneiss. Jarrah/Marri woodland/ open mixed shrubland/heath. Known locations predominantly coastal granite locations.	Unlikely

* BC Act: T = Threatened, P = Priority; / EPBC Act: CE = Critically Endangered, E= Endangered, V = Vulnerable

3.3.2 Vegetation Communities

A relevé was completed within the only area of remnant vegetation on Site which has understorey vegetation (Figure 4, Appendix D).

During the Site assessment, vegetation within the relevé was observed to comprise of a single vegetation community (described according to Keighery, 1994, adapted Muir, 1977, and Aplin, 1979, Table 2 below):

- *Corymbia calophylla, Eucalyptus marginata* open forest over *Corymbia calophylla, Eucalyptus marginata* low open woodland over *Xylomelum occidentale, Banksia grandis* scattered tall shrubs over *Xylomelum occidentale, *Solanum linnaeanum, Corymbia calophylla* scattered low shrubs over scattered herbs and grasses.

The species identified within the relevé are characteristic of the Cowaramup Uplands (C2) vegetation complex as described by Havel and Matiske (2000) as;

- Cowaramup Uplands (C2) - Open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Banksia grandis* on lateritic uplands in perhumid and humid zones.

The Site does not have characteristics of any Threatened Ecological Communities including the Banksia woodlands and Tuart Threatened Ecological Communities listed within the PMST report for the area (Appendix B).

3.3.3 Vegetation Condition

Using the scale of condition developed by Keighery (1994, Table 4), vegetation within the Site was ranked from Degraded to Completely Degraded (Figure 5).

Completely degraded vegetation represents the greatest area of the Site at 40 ha (39,9415 m^2) or 97% of the Site. This area has been cleared of almost all native vegetation with a few isolated trees remaining over sown pasture grass species. Currently the area is being used for grazing.

An area of degraded vegetation represents less than 3% of the total Site at 1 ha (9,912 m^2) or 97% of the Site. This area contains an area of remnant forest/woodland vegetation that has been largely cleared of native understory with a few native shrub species remaining and several areas of native trees planted in single/double rows.

Table 3 Keighery Condition Scale (Keighery 1994)

Category	Description
Pristine	Pristine or nearly so, no obvious signs of destruction.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. For example, damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle track.
Very Good	Vegetation structure altered, No 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 disturbances. Retains basic vegetation structure or ability to regenerate to 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 in no longer intact and the area is completely or almost completely without native species. These areas are often described as "parkland cleared" with the flora composing weed or crop species with isolated native trees or shrubs.

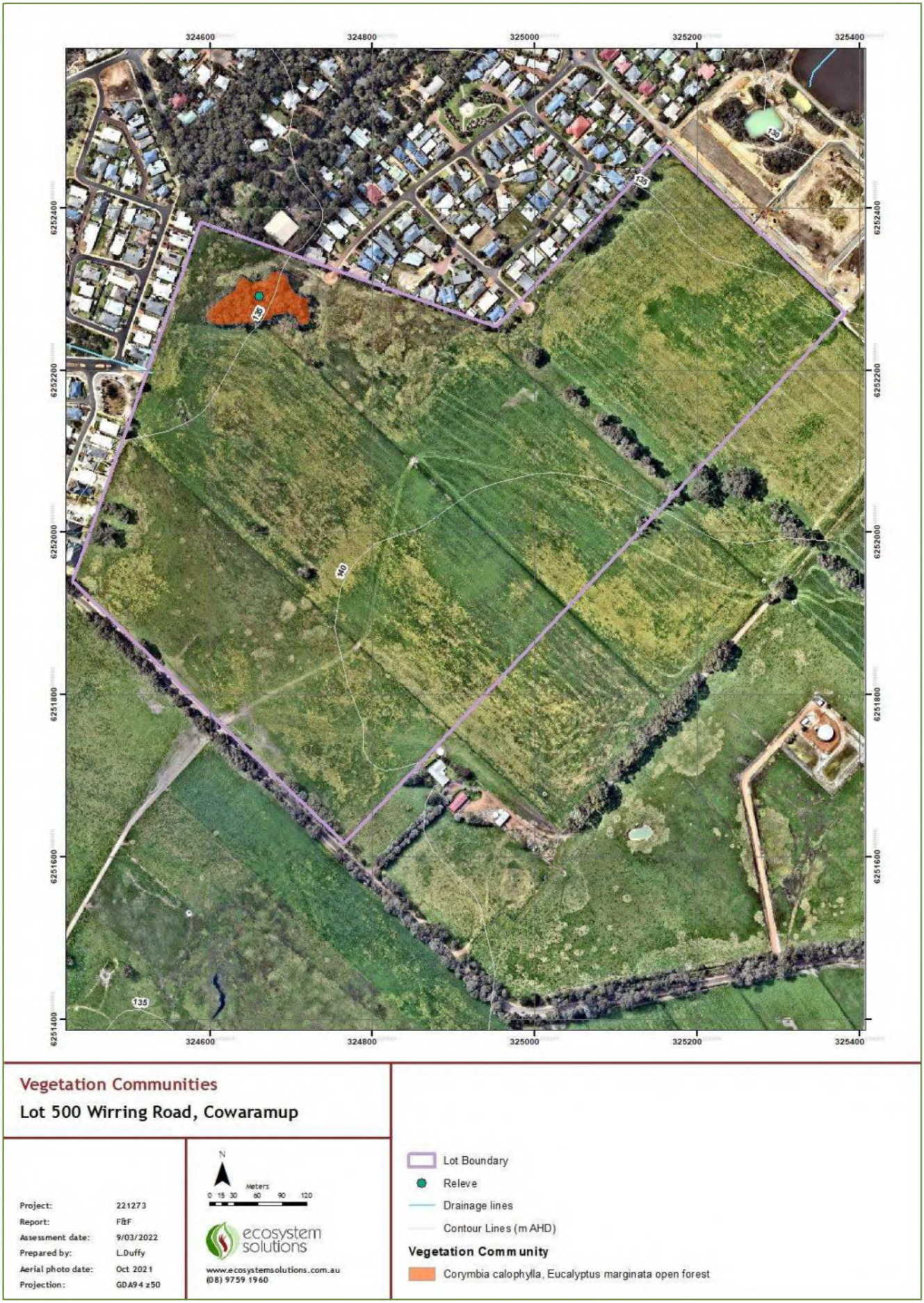


Figure 6 Vegetation Communities for Lot 500 Wirring Road, Cowaramup



Figure 7 Vegetation Condition for Lot 500 Wirring Road, Cowaramup

4 Fauna

4.1 Desktop Analysis

The conservation status of fauna within WA is determined by two acts of legislation, the *Commonwealth Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) and the State *Western Australian Biodiversity Conservation Act 2016* (WA) (BC Act). The conservation codes for fauna under the *BC Act* are presented in Appendix C. These categories are consistent with the International Union for Conservation of Nature (IUCN) classifications and link into a global ranking system for taxa at risk of extinction.

A desktop study and analysis of the records of NatureMap and the Protected Matters Search Tool (Appendix A & B) were made to determine the presence or likely presence of fauna or fauna assemblages within the Site. The analysis primarily targeted terrestrial threatened vertebrate species listed under the *Biodiversity Conservation Act 2016* (WA) and *Environmental Protection Biodiversity Conservation Act 1999* (Commonwealth). A list of fauna expected to occur within a 10-kilometre radius of the Site was compiled from searches conducted on the DBCA database (NatureMap) and the Commonwealth EPBC Protected Matters Search Tool (Table 5).

Marine species and freshwater fish have been excluded due to the location of the Site. Invertebrates have also been excluded as this is a specialist area not covered under the Scope of this report.

The NatureMap Database identified seven Threatened (T) species, which are rare or are likely to become extinct, three Priority (P) listed species and one other Specifically Protected (S) species within a 10 km radius of the Site. The Protected Matters Search Tool identified eight Threatened (T) species, within a 10 km radius of the Site. One of which is a Critically endangered (CE) species, four Endangered (E) species and three Vulnerable (V) species.

Review of the database searches and the expected vegetation communities and vegetation condition of the Site indicate the conservation significant fauna species likely to be within or utilising the Site include *Pseudocheirus occidentalis* (Western Ringtail Possum).

The three Black Cockatoo species, *Calyptorhynchus banksii* naso (Forest Red-tailed Black Cockatoo), *Calyptohrynchus baudinii* (Baudin's Cockatoo) and *Calyptorhynchus latirostris* (Carnaby's Cockatoo) or habitat of the species are also likely to occur within the area.

Other conservation significant fauna may use the Site however these have not been targeted under the scope of this report.

Table 4 Conservation significant fauna species recorded within 10 km of the Site

Species	Conservation Status*	Habitat	Likelihood of occurrence within the Site
Pseudocheirus occidentalis Western Ringtail Possum	T/CE	Coastal Areas of Peppermint woodland and peppermint woodland and peppermint / tuart associations.	Likely
Bettongia penicillata ogilbyi Woylie	T/E	Open forest and woodland with low understory of woody scrub. Woodlands and adjacent heaths with a dense understorey of shrubs. Tall eucalypt forest and woodland, dense myrtaceous shrubland, kwongan or mallee heath.	Possible
Botaurus poiciloptilus Australasian Bittern	T/E	Wetlands with tall, dense vegetation, favours permanent and seasonal freshwater habitats, dominated by sedges rushes and reeds, growing over a muggy or peaty substrate.	Possible
Calyptorhynchus baudinii Baudin's Cockatoo	T/E	Dense Jarrah, Karri and Marri forests. Species nest in large hollows in these species.	Likely
Calyptorhynchus latirostris Carnaby's Cockatoo	T/E	Dense Jarrah, Karri and Marri forests. Species nest in large hollows in these species.	Likely
Calyptorhynchus banksii subsp. naso Forest Red-tailed Black Cockatoo	T/V	Dense Jarrah, Karri and Marri forests. Species nest in large hollows in these species.	Likely
Dasyurus geoffroii Western Quoll, Chuditch	T/V	Variety, most dense in riparian jarrah forests. Require large, unfragmented habitats.	Possible

Species	Conservation Status*	Habitat	Likelihood of occurrence within the Site
Setonix brachyurus *Quokka*	T/V	Mainly dense riparian vegetation, other areas with dense vegetated understory with proximity to freshwater.	Possible
Psophodes nigrogularis subsp. *nigrogularis* Western Whipbird	T	Occurs in heath-like thicket associations on coastal dunes and in low, dense mallee woodland or shrubland with understorey of dense, stunted shrubs. Preferred habitat is thicket, 2-3m high of varied floristic composition.	Possible
Falco hypoleucos Grey Falcon	V	Areas where annual rainfall is less than 500 mm. Timbered lowland plains and acacia shrublands crossed by tree lined water courses.	Possible
Hydromys chrysogaster Rakali	P4	Found near permanent fresh or brackish waters.	Possible
Isoodon fusciventer Quenda	P4	Forest, woodland, shrub, and heath, usually in sandy soils with dense healthy vegetation in lower stratum.	Possible
Notamacropus irma Western Brush Wallaby	P4	Some areas of mallee and heathland. Uncommon in wet sclerophyll forests.	Possible
Phascogale tapoatafa subsp. *wambenger* South-western Brush-tailed Phascogale	S	Highly arboreal, prefers open forest with sparse groundcover.	Possible

* BC Act: T = Threatened, P = Priority; EPBC Act: CE = Critically Endangered, E= Endangered, V = Vulnerable, S = Other Specially Protected Fauna

4.2 Field Survey

With these species in mind, a field study of the site was conducted. The approach adopted for this survey was:

- A Satellite Image of the Site was acquired.
- A daytime visual inspection of the property and adjoining vegetation for any signs of fauna (e.g., scats, diggings, dreys, nests, burrows, feeding signs) was conducted.
- Hollow bearing trees or trees suitable for Black Cockatoos (>50cm Diameter at Breast Height (DBH)) were recorded.
- Direct observations of fauna and signs of fauna were recorded using a Trimble Global Positioning System (GPS) and ArcPad© (Version 8- ESRI).
- Two dawn and two dusk surveys were conducted to determine Black Cockatoo and Western Ringtail Possum activity. A 40 w LightForce hand-held spotlight was used with white light to observe nocturnal mammals. Observations were recorded using GPS and ArcPad©.
- Field observations were analysed and mapped with ArcGis (ArcMap V10.6.1©).

The Site was inspected via a walked transect and the trees were inspected via a physical inspection for hollows or signs of fauna usage.

All trees with large hollows were inspected for any signs of use by cockatoos. These include wear around the hollow, chewing, scarring and scratch marks on the trunks or branches. Old or recent evidence of cockatoo's feeding or roosting sites (feathers, droppings etc.) were also searched for.

This type of survey has minimal impact on the fauna within the property and provides sufficient data on the presence and relative abundance and distribution of taxa. During the field surveys, the habitat at the site was assessed to determine its potential suitability to host any of the anticipated threatened or rare species. This approach is consistent with a Level 1 survey under the EPA's Technical Guidance: Sampling methods for Terrestrial vertebrate fauna (2016) which specifies a minimum requirement of a desktop study to gather information on the subject site and a reconnaissance survey to verify the accuracy of the background study and delineate fauna and faunal assemblages.

The survey's protocol is also consistent with the requirements outlined in the Development Planning Guidelines for Western Ringtail Possums (CALM 2003, now DBCA).

The draft referral guideline for the three threatened black cockatoo species (Department of Environment and Energy, 2017) outline requirements for appropriate level of surveys for these species. This survey's intensity and design comply with these guidelines.

4.3 Results

The Site was surveyed for fauna over two days, two dusk and two night surveys from Thursday 24th March 2022 to Sunday 27th March 2022 by Ecosystem Solutions Gary McMahon (B.Sc. M. Env Mgmt).

Kelly Lamp (B.Sc Hons. Nat Rs Mgmt), Dani Cuthbert (Dip Bus & Dip TM) and Lorraine Duffy (B.Sc Env Biology, B. Arts Geo) conducted day surveys on the 8th and 9th March 2022. The Site was traversed in a systematic manner, focussing on the vegetated areas.

Dawn and dusk surveys were conducted by Gary McMahon for any sign of Black Cockatoos, Western Ringtail Possums or other conservation listed species, as described in Table 5.

Table 5 Fauna survey times and observations

Survey Type	Date and Time	Sunrise / Sunset Time	Observations
Dawn	25 March 2022 5:20 am to 7:35 am	First Light 6:01 am Sunrise 6:26 am	No animals observed.
Dawn	27 March 2022 5:30 am to 7:30 am	First Light 6:03 am Sunrise 6:27 am	No animals observed.
Dusk/Nocturnal	24 March 2022 5:30 pm to 8.45 pm	Sunset 6:26 pm Last light 6:51 pm	No animals observed.
Dusk/Nocturnal	27 March 2022 5.30 pm to 8.00 pm	Sunset 6:22 pm Last light 6:46 pm	No animals observed.
Daytime surveys	8 March 2022 9 March 2022	N/A	No animals or dreys observed.

4.3.1 Black Cockatoos

There were no observations of Black Cockatoos during the day, dawn or dusk surveys indicating they are not likely to be using the Site currently.

All trees on the Site with a diameter at breast height (DBH) over 50cm, of a suitable species known to support breeding (i.e., Karri, Marri) and having the capacity to support nesting of any Black Cockatoo species were recorded (Figure 6). A total of 142 trees were identified within or on the Lot boundary while a further 4 trees with hollows and an additional 4 with potential hollows were recorded immediately outside the Lot boundary.

Of the 142 Identified Trees (>50cm DBH) within or on the Lot boundary, 9 trees contained a hollow, 1 tree contained 2 hollows and 7 trees had potential hollows (Figures 6 & 7).

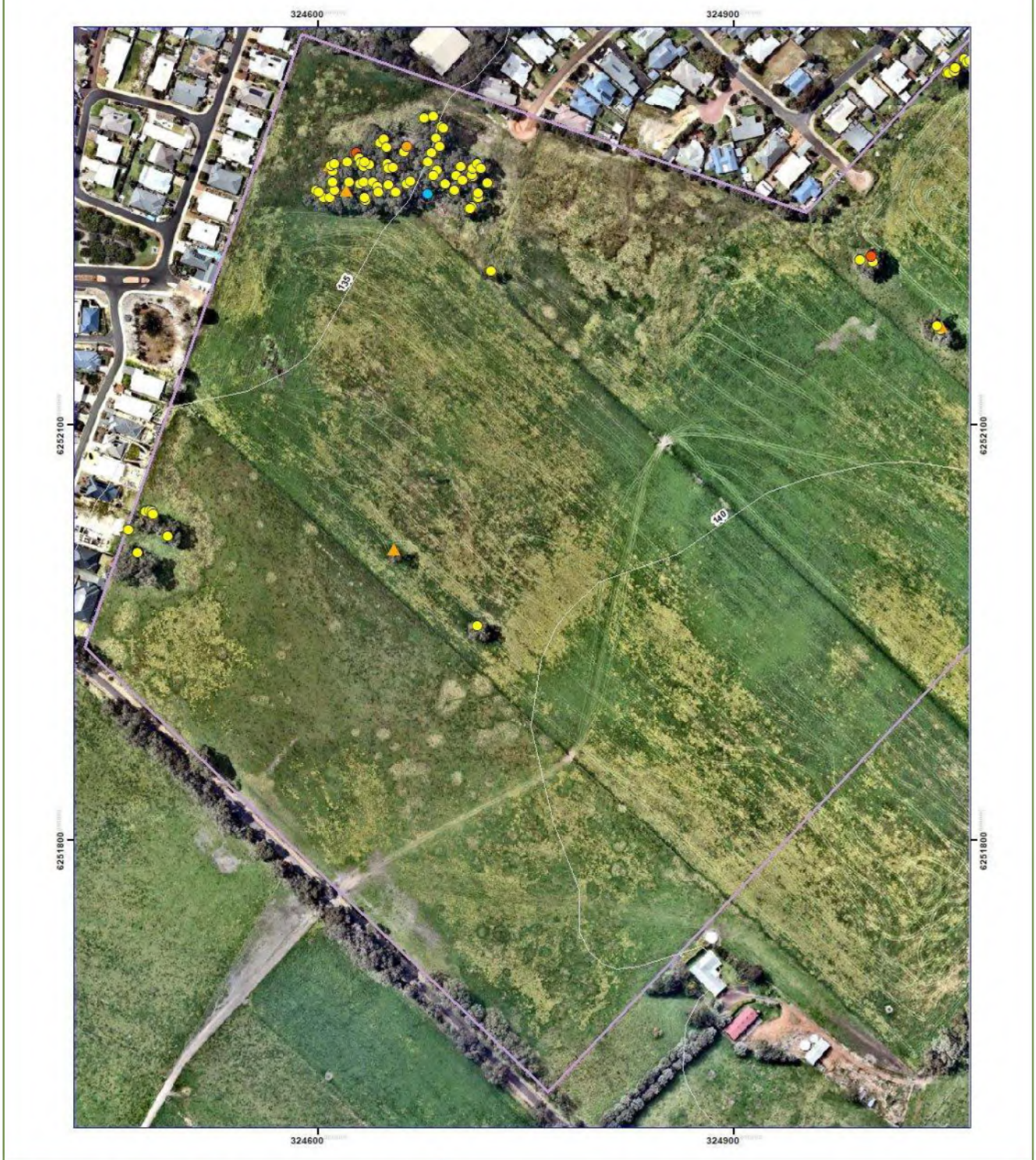
All local species of Black Cockatoos can forage over extensive areas (up to 15 – 20 km from their nesting sites (Saunders, 1980)) and given that there are large areas of preferred habitat within their range, it could be assumed that Black Cockatoo species are not reliant on the Site for nesting or roosting habitat. Table 8 and Table 9 discuss the and impact on Black Cockatoos in relation to significance criteria under the EPBC Act.

4.3.2 Western Ringtail Possums

There were no observations of Western Ringtail Possums during the day, dawn or dusk surveys indicating they are not likely to be using the Site currently.

During day surveys on 8th March 2022, the canopy of the vegetation within the Site was also thoroughly inspected and no dreys were observed. (Figure 6).

Table 8 discusses further the likely presence and impact on Western Ringtail Possums relative to EPBC significance criteria.



Identified Trees - Map 1

Lot 500 Wirring Road, Cowaramup

Project:	221273
Report:	BMP & F&F
Assessment date:	9/03/2022
Prepared by:	L.Duffy
Aerial photo date:	Oct 2021
Projection:	GDA94 z50

N

Meters
0 10 20 40 60 80

ecosystem solutions
www.ecosystemsolutions.com.au
(08) 9759 1960

Identified Tree Hollows (>50cm)

- No Hollow
- Hollows x 2
- Potential Hollow
- Hollow
- Chimney Hollow
- Contour Lines
- Lot Boundary

Figure 8 Identified Trees (Map 1), Lot 500 Wirring Road, Cowaramup



Figure 9 Identified Trees (Map 2), Lot 500 Wirring Road, Cowaramup

5 Survey Constraints

Survey limitations are summarised in Table 6 and 7 below:

Table 6 Summary of flora survey limitations

Constraint	Impact	Comment
Availability of contextual information at a regional and local scale	Nil	Broad scale vegetation and soil mapping data were available. DBCA, NatureMap and PMST database extracts for conservation significant flora and ecological communities were obtained. A search of relevant databases also occurred.
Competency / experience of the survey team	Nil	The ecologist leading the field survey has conducted numerous flora and fauna surveys across the southwest of WA and has over 10 years' experience. The ecologist completing the flora identifications has over 10 years' experience identifying Western Australian and specialising in southwest flora, with any potential conservation significant flora being submitted to the Western Australian Herbarium for identification.
Proportion of flora recorded and/or collected, any identification issues	Nil	A focus was placed on identifying any potential conservation significant flora species, with specimens all identified to species level. Specimens that were not potentially conservation significant species have been identified to genus level, or species where this is easily ascertained.
Was the appropriate area fully surveyed (effort and extent)	Nil	A relevé was conducted within the only remaining area of remnant vegetation on the Site which contained an understorey. Other remnant vegetation included scattered trees only. All areas of remnant vegetation were surveyed on foot for Conservation Significant vegetation communities and flora species.
Access restrictions within the survey area	Nil	All parts of the Site were accessible by vehicle and foot.

Constraint	Impact	Comment
Survey timing, rainfall, season of survey	Moderate	The survey was conducted in Autumn which is not the optimal time to observe all conservation significant flora species. Given the heavily grazed and modified nature of the remnant vegetation, it is considered unlikely that any conservation significant flora species will be located within the proposed clearing area.
Inconsistent flowering habit of some species	Moderate	Some species do not flower every season and may require environmental triggers to promote flowering such as rainfall, fire, presence of suitable pollinators etc.
Disturbance that may have affected the results of the survey, such as fire, flood or clearing	Nil	There were no recent disturbances that constrained the survey of the Site.

Table 7 Summary of fauna survey limitations

Constraint	Impact	Comment
Availability of data and information	Nil	DBCA, NatureMap and PMST database extracts for conservation significant fauna were obtained.
Competency / experience of the survey team, including experience in the bioregion surveyed	Nil	The ecologist leading the field surveys has conducted numerous fauna surveys across the southwest of Western Australia and has over 20 years' experience.
Scope of the survey, e.g., where faunal groups were excluded from the survey	Minor	This survey focussed on birds, mammals and other vertebrate species. Aquatic species were not included as habitat was not present. Invertebrates were not included in the scope of this survey.
Timing, weather and season	Minor	The surveys were conducted in Autumn, with September being an optimum time for bird and mammal surveys in the southwest. Weather conditions did not impact surveys.
Timing Western Ringtail Possums (WRP) may arise from rest sites & likelihood of rest sites being located outside the Site	Moderate	As WRP use up to 2-7 rest sites at any one time and up to 20 throughout the year there is potential that they are not observed on Site at time of survey even though they are utilising the Site. The time WRP arise from a rest Site is also variable and may prevent WRP being observed during survey.
Disturbance that may have affected results, e.g., fire, flood	Nil	There were no disturbances that constrained the survey of the Site.
The proportion of fauna identified, recorded or collected	Nil	Any potential conservation significant fauna species observed during the surveys have been identified.
Determination of hollow suitability from the ground	Nil	Factors including entrance size, hollow depth, floor, and orientation of the hollow are important factors to nesting hollow suitability and which are difficult to assess from the ground. Therefore, there is potential for the number of hollows recorded to be an over estimation of those suitable as nesting hollows.

Constraint	Impact	Comment
Adequacy of the survey intensity and proportion of survey achieved, e.g., the extent to which the area was surveyed	Nil	All areas of remnant vegetation of the Site were surveyed on foot for Conservation Significant fauna species, during day, dawn and dusk / nocturnal surveys.
Access problems	Nil	All parts of the Site were accessible by vehicle and foot.

6 Significance

Under the EPBC Act, an action that has, will have, or is likely to have, a significant impact on a matter of national environmental significance, requires approval from the Minister. A significant impact is defined as an impact which is important or of consequence, having regard for its context or intensity (Commonwealth of Australia, 2009).

Matters of environmental significance include listed threatened species and ecological communities. For this proposal, there is a limited potential for impact on threatened species. Significant Impact Guidelines 1.1 (Commonwealth of Australia, 2009) lists significant impact criteria for the assessment for activities which may impact on threatened species.

Table 8 and Table 9 discuss the referral triggers and the likely presence and impact on Black Cockatoos and Western Ringtail Possums.

Table 8 Significant Impact Criteria for Key Protected Species

Significant Impact Criterion	Discussion		Meets Criterion
	Black Cockatoo Species	Western Ringtail Possum	
Lead to a long-term decrease in the size of an important population[1] of a species	Unlikely. No Cockatoos were observed foraging, nesting or roosting within the Site. No observable signs of foraging were evident.	Unlikely. No WRP or observable signs (Dreys, droppings) of WRP were observed on the Site. It is unlikely this proposal will lead to a long-term decrease of the species.	No
Reduce the area of occupancy of an important population	Unlikely. No Cockatoos were observed foraging, nesting or roosting within the Site. No observable signs of foraging were evident.	Unlikely. No WRP or observable signs (Dreys, droppings) of WRP were observed on the Site. It is unlikely this proposal will lead to a long-term decrease of the species.	No
Fragment an existing important population into two or more populations	Unlikely. No Cockatoos were observed foraging, nesting or roosting within the Site. No observable signs of foraging were evident.	Unlikely. No WRP or observable signs (Dreys, droppings) of WRP were observed on the Site. It is unlikely this proposal will lead to a long-term decrease of the species.	No

[1] *An 'important population' is a population that is necessary for a species' long-term survival and recovery.*

Adversely affect habitat critical to the survival of a species	Unlikely. No Cockatoos were observed foraging, nesting or roosting within the Site. No observable signs of foraging were evident.	Unlikely. No WRP or observable signs (Dreys, droppings) of WRP were observed on the Site. It is unlikely this proposal will lead to a long-term decrease of the species.	No
Disrupt the breeding cycle of an important population	Unlikely. No Cockatoos were observed foraging, nesting or roosting within the Site. No observable signs of foraging were evident.	Unlikely. No WRP or observable signs (Dreys, droppings) of WRP were observed on the Site. It is unlikely this proposal will lead to a long-term decrease of the species.	No
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely. No Cockatoos were observed foraging, nesting or roosting within the Site. No observable signs of foraging were evident.	Unlikely. No WRP or observable signs (Dreys, droppings) of WRP were observed on the Site. It is unlikely this proposal will lead to a long-term decrease of the species.	No
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely. No Cockatoos were observed foraging, nesting or roosting within the Site. No observable signs of foraging were evident.	The Site does not appear to contain WRP. It is unlikely that further introduction of invasive species will impact the species.	No
Introduce disease that may cause the species to decline	Highly unlikely to occur.	Highly unlikely to occur.	No

Interfere substantially with the recovery of the species.	Unlikely. The clearing of on-Site vegetation will not impact significantly on the recovery of the species.	Unlikely. The clearing of vegetation within the Site will not impact significantly on the recovery of the species.	No

Referral guidelines for the three threatened Black Cockatoo species (Commonwealth of Australia. 2011) uses a decision tree and a set of criteria to determine whether actions significantly impact on Black Cockatoos. These are set out in Table 9, based on the details of the development and the data obtained from the surveys. Notes on the flow chart follow.

Table 9 Assessment of Significant Impact to Black Cockatoo

Question	Answer
1. Could the impacts of your action occur within the modelled distribution of the Black Cockatoos?	Yes – Action occurs within the modelled distribution area of all three species.
2. Could the impacts of your action affect any Black Cockatoo habitat or individuals?	No.
3. Have you surveyed for Black Cockatoos using the recommended methods?	Yes.
4. Is Black Cockatoo habitat present?	Yes.
5. Is your impact mitigation best practice so that it may reduce the significance of your impacts on Black Cockatoos?	Yes - Majority of the vegetation and foraging habitat will be conserved within the Site.
6. Could your action require a referral to the federal environmental Minister for significant impact on Black Cockatoos?	No - As the area for clearing is relatively small. It is unlikely that the species is dependent on the Site.

Using the flow chart and criteria it is determined that there is a low risk of actions resulting in an impact upon Black Cockatoos and Western Ringtail Possums within the Site.

It is recommended that a referral pursuant to the *EPBC Act* is not required for the Site, as actions involved do not constitute a significant impact on any of the threatened species present.

7 Summary and Recommendations

7.1 Conservation Significant Flora

- There were no Threatened Flora or conservation significant flora identified within the Site
- This proposal will not impact on any potential conservation significant species present within the highly vegetated areas as remnant vegetation of the Site will be conserved. A referral under the EPBC Act is not recommended.

7.2 Vegetation

- There were no Threatened Ecological Communities observed within the Site.
- One vegetation community was identified within the Site (Figure 4):

  Cowaramup Uplands (C2) - Open Forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Banksia grandis* on lateritic uplands in peri humid and humid zones.

- Completely degraded vegetation represents the greatest area of the Site at 40 ha (39,9415 m ^{2}) or 97% of the Site (Figure 5). This area has been cleared of almost all native vegetation with a few isolated trees remaining over sown pasture grass species. The Site is being used for grazing.
- An area of degraded vegetation represents less than 3% of the total Site at 1 ha (9,912 m ^{2}) or 97% of the Site. This area contains an area of remnant forest/woodland vegetation, largely cleared of native understory with a few native shrub species remaining and a further three areas of native trees planted in single/double rows. Two of these areas are intended to be retained in an area of Public Open Space, while the rows of trees on the north-western boundary will be retained within the Lots.

7.3 Acid Sulfate Soils

- An area of Acid Sulfate Soil Risk Class 2 is present on the western edge of the Site that encroaches on one lot and a drainage reserve. Risk Class 2 indicates a moderate to low-risk likelihood of ASS occurring within 3m of natural soil surface but a high to moderate risk of ASS beyond 3m of natural soil surface (DWER-052).
- If there is any disturbance greater than 100m^3 required of the Risk Class 2 area, with excavation proposed below the water table, than an Acid Sulfate Soil Management Plan should be prepared and

implemented with actions to mitigate the potential impacts provided in the 'Treatment and management of soils and water in acid sulfate soil landscapes' (DER 2015).

7.4 Black Cockatoos

- No Black Cockatoos were observed on the Site. No signs of nesting or roosting were evident at the time of survey.
- A total of 142 trees with a diameter at breast height >50cm were identified on the Site. 9 trees contained a hollow, 1 tree contained 2 hollows and 7 trees had potential hollows (Figure 8 & 9).
- Of the 142 Identified Trees (>50cm DBH) within or on the Lot boundary, 9 trees contained a hollow, 1 tree contained 2 hollows and 7 trees had potential hollows (Figures 6 & 7).
- As the area of remnant vegetation to be cleared is small, it is unlikely this proposal will significantly impact the local Black Cockatoo population. A referral under the EPBC Act is not recommended.

7.5 Western Ringtail Possum

- No Western Ringtail Possums or dreys were observed within the Site.
- As WRP were not observed on Site and the area of remnant vegetation to be cleared is small, it is unlikely this proposal will significantly impact WRP populations. A referral under the EPBC Act is not recommended.

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Appendix A NatureMap Extract

NatureMap
Mapping Western Australia's biodiversity

42-0322NM Flora 10km Buffer Report

Created By Guest user on 03/03/2022

Kingdom Plantae
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 06' 26" E,33° 51' 25" S
Buffer 10km
Group By Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	571	1056
Priority 1	1	1
Priority 2	3	3
Priority 3	14	34
Priority 4	6	8
Rare or likely to become extinct	1	10
TOTAL	**596**	**1112**

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
Rare or likely to become extinct					
1.	13619	*Caladenia excelsa*		T	
Priority 1					
2.	33282	*Tetraria sp. Nannup (P.A. Jurjevich 1133)*		P1	
Priority 2					
3.	20474	*Gastrolobium whicherense*		P2	
4.	17702	*Leptomeria furtiva*		P2	
5.	17481	*Xyris maxima*		P2	
Priority 3					
6.	3386	*Acacia inops*		P3	
7.	16313	*Boronia anceps*		P3	
8.	17804	*Boronia tetragona*		P3	
9.	19338	*Chamaescilla gibsonii*		P3	
10.	7446	*Dampiera heteroptera*		P3	
11.	20504	*Gastrolobium formosum*		P3	
12.	14011	*Grevillea brachystylis subsp. brachystylis*		P3	
13.	12219	*Grevillea bronwenae*		P3	
14.	18436	*Grevillea manglesioides subsp. ferricola*		P3	
15.	1296	*Johnsonia inconspicua*		P3	
16.	45084	*Lasiopetalum laxiflorum*		P3	
17.	12077	*Pimelea ciliata subsp. longituba*		P3	
18.	4179	*Pultenaea pinifolia*		P3	
19.	16937	*Synaphea decumbens*		P3	
Priority 4					
20.	3339	*Acacia flagelliformis*		P4	
21.	3571	*Acacia tayloriana*		P4	
22.	35657	*Chamelaucium sp. Yoongarillup (G.J. Keighery 3635)*		P4	
23.	3096	*Drosera fimbriata (Manypeaks Sundew)*		P4	
24.	1945	*Franklandia triaristata (Lanolme Bush)*		P4	
25.	1336	*Thysanotus isantherus*		P4	
Non-conservation taxon					
26.	15429	*Acacia alata var. alata*			
27.	3233	*Acacia barbinervis*			
28.	3247	*Acacia browniana*			
29.	11731	*Acacia browniana var. browniana*			
30.	3307	*Acacia divergens*			
31.	3331	*Acacia extensa (Wiry Wattle)*			
32.	3347	*Acacia gilbertii*			
33.	3374	*Acacia huegelii*			

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
34.	3410	*Acacia lateriticola*			
35.	3424	*Acacia littorea*			
36.	3448	*Acacia mooreana*			
37.	3453	*Acacia myrtifolia*			
38.	3464	*Acacia obovata*			
39.	3502	*Acacia pulchella (Prickly Moses)*			
40.	15481	*Acacia pulchella var. glaberrima*			
41.	15483	*Acacia pulchella var. pulchella*			
42.	30036	*Acacia saligna subsp. stolonifera*			
43.		*Acacia sp.*			
44.	3557	*Acacia stenoptera (Narrow Winged Wattle)*			
45.	3567	*Acacia subracemosa*			
46.	3588	*Acacia uliginosa*			
47.	3591	*Acacia urophylla*			
48.	15487	*Acacia varia var. varia*			
49.	6203	*Actinotus glomeratus*			
50.	14970	*Adenanthos barbiger*			
51.	1790	*Adenanthos meisneri*			
52.	1791	*Adenanthos obovatus (Basket Flower)*			
53.	28281	*Adenanthos sp. Whicher Range (G.J. Keighery 9736)*			
54.	5316	*Agonis flexuosa (Peppermint, Wonil)*			
55.	17202	*Agonis flexuosa var. flexuosa*			
56.	23474	*Agrostocrinum hirsutum*			
57.	185	*Aira cupaniana (Silvery Hairgrass)*	Y		
58.	1728	*Allocasuarina fraseriana (Sheoak, Kondil)*			
59.	1732	*Allocasuarina humilis (Dwarf Sheoak)*			
60.	1734	*Allocasuarina microstachya*			
61.	1739	*Allocasuarina thuyoides (Horned Sheoak)*			
62.	1489	*Amaryllis belladonna (Belladonna Lily)*	Y		
63.	4585	*Amperea ericoides*			
64.	13101	*Amperea simulans*			
65.	194	*Amphipogon amphipogonoides*			
66.	197	*Amphipogon debilis*			
67.	198	*Amphipogon laguroides*			
68.	20184	*Amphipogon laguroides subsp. laguroides*			
69.	1058	*Anarthria gracilis*			
70.	1062	*Anarthria prolifera*			
71.	1063	*Anarthria scabra*			
72.	6306	*Andersonia caerulea (Foxtails)*			
73.	6312	*Andersonia involucrata*			
74.	6317	*Andersonia micrantha*			
75.	1407	*Anigozanthos flavidus (Tall Kangaroo Paw)*			
76.	11261	*Anigozanthos manglesii subsp. manglesii*			
77.	1416	*Anigozanthos viridis (Green Kangaroo Paw, Kurulbardang)*			
78.	7411	*Anthotium humile (Dwarf Anthotium)*			
79.	202	*Anthoxanthum odoratum (Sweet Vernal Grass)*	Y		
80.	3688	*Actus gracillima*			
81.	3689	*Actus intermedia*			
82.	1117	*Aphelia cyperoides*			
83.	7838	*Arctotheca calendula (Cape Weed, African Marigold)*	Y		
84.	46393	*Arctotheca calendula x populifolia*	Y		
85.	26484	*Areschougia ligulata*			
86.	64	*Asplenium trichomanes (Maidenhair Spleenwort)*			
87.	20350	*Astartea affinis (West-coast Astartea)*			
88.	45213	*Astartea pulchella*			
89.	4401	*Asterolasia squamuligera*			
90.	6323	*Astroloma ciliatum (Candle Cranberry)*			
91.	6334	*Astroloma pallidum (Kick Bush)*			
92.	20013	*Axonopus fissifolius*	Y		
93.	1800	*Banksia attenuata (Slender Banksia, Piara)*			
94.	49039	*Banksia dallanneyi subsp. dallanneyi*			Y
95.	32577	*Banksia dallanneyi subsp. dallanneyi var. mellicula*			
96.	32616	*Banksia dallanneyi subsp. sylvestris*			
97.	1819	*Banksia grandis (Bull Banksia, Pulgarla)*			
98.	1822	*Banksia ilicifolia (Holly-leaved Banksia)*			
99.	32315	*Barbula calycina*			
100.	739	*Baumea acuta (Pale Twig-rush)*			
101.	5392	*Beaufortia sparsa (Swamp Bottlebrush)*			
102.	3157	*Billardiera floribunda (White-flowered Billardiera)*			
103.	25798	*Billardiera fusiformis (Australian Bluebell)*			

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
104.	3159	*Billardiera laxiflora*			
105.	3165	*Billardiera variifolia*			
106.	11503	*Boronia crenulata subsp. crenulata var. crenulata*			
107.	17653	*Boronia crenulata subsp. pubescens*			
108.	4414	*Boronia cymosa (Granite Boronia)*			
109.	4415	*Boronia defoliata*			
110.	4417	*Boronia dichotoma*			
111.	4422	*Boronia gracilipes (Karri Boronia)*			
112.	4428	*Boronia megastigma (Scented Boronia)*			
113.	4429	*Boronia molloyae (Tall Boronia)*			
114.	4442	*Boronia stricta*			
115.	20392	*Boronia tenuior*			
116.	1267	*Borya constricta*			
117.	14396	*Bossiaea aquifolium subsp. aquifolium*			
118.	3708	*Bossiaea disticha*			
119.	3713	*Bossiaea linophylla*			
120.	3714	*Bossiaea ornata (Broad Leaved Brown Pea)*			
121.	3718	*Bossiaea rufa*			
122.	245	*Briza minor (Shivery Grass)*	Y		
123.	250	*Bromus hordeaceus (Soft Brome)*	Y		
124.		*Bryum sp.*			
125.	12770	*Burchardia congesta*			
126.	1385	*Burchardia multiflora (Dwarf Burchardia)*			
127.	13853	*Caladenia arrecta*			
128.	15332	*Caladenia attingens subsp. attingens*			
129.	1580	*Caladenia cairnsiana (Zebra Orchid)*			
130.	15341	*Caladenia citrina*			
131.	1581	*Caladenia corynephora*			
132.	1590	*Caladenia ferruginea (Rusty Spider Orchid)*			
133.	1597	*Caladenia infundibularis*			
134.	15366	*Caladenia longicauda subsp. merrittii*			
135.	1603	*Caladenia longiclavata (Clubbed Spider Orchid)*			
136.	15503	*Caladenia paludosa*			
137.	10830	*Caladenia rhomboidiformis*			
138.		*Caladenia sp.*			
139.	18040	*Caladenia thinicola*			
140.	45758	*Calectasia demarzii (Demarz's Tinsel Lily)*			
141.	10861	*Callistachys lanceolata (Wonnich)*			
142.	26536	*Callophycus oppositifolius*			
143.	35163	*Calothamnus planifolius var. pallidifolius*			
144.	5429	*Calothamnus sanguineus (Silky-leaved Blood flower, Pindak)*			
145.	5439	*Calytrix angulata (Yellow Starflower)*			
146.	5458	*Calytrix flavescens (Summer Starflower)*			
147.	32338	*Campylopus introflexus*	Y		
148.	2951	*Cassytha flava (Dodder Laurel)*			
149.	2952	*Cassytha glabella (Tangled Dodder Laurel)*			
150.	2957	*Cassytha racemosa (Dodder Laurel)*			
151.	11242	*Cassytha racemosa forma pilosa*			
152.	26556	*Caulerpa cactoides*			
153.	6542	*Centaurium tenuiflorum*	Y		
154.	7367	*Centranthus ruber (Red Valerian)*	Y		Y
155.	1128	*Centrolepis fascicularis*			
156.	1133	*Centrolepis pilosa*			
157.	18156	*Chamaecytisus palmensis (Tagasaste)*	Y		
158.	1280	*Chamaescilla corymbosa (Blue Squill)*			
159.	31	*Cheilanthes austrotenuifolia*			
160.	2494	*Chenopodium murale (Nettle-leaf Goosefoot)*	Y		
161.	762	*Chorizandra cymbaria (Heron Bristle Rush)*			
162.	3754	*Chorizema diversifolium*			
163.	3757	*Chorizema glycinifolium*			
164.	12765	*Chorizema nanum*			
165.	3760	*Chorizema reticulatum (Showy Flame Pea)*			
166.	3761	*Chorizema rhombeum*			
167.	14586	*Chorizema spathulatum*			
168.	2929	*Clematis pubescens (Common Clematis)*			
169.	4550	*Comesperma calymega (Blue-spike Milkwort)*			
170.	4551	*Comesperma ciliatum*			
171.	4564	*Comesperma virgatum (Milkwort)*			
172.	16875	*Conospermum caeruleum subsp. debile*			
173.	16854	*Conospermum capitatum subsp. capitatum*			

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
174.	16853	*Conospermum capitatum subsp. glabratum*			
175.	16847	*Conospermum paniculatum*			
176.	1418	*Conostylis aculeata (Prickly Conostylis)*			
177.	11826	*Conostylis aculeata subsp. aculeata*			
178.	1438	*Conostylis laxiflora*			
179.	11597	*Conostylis setigera subsp. setigera*			
180.	17104	*Corymbia calophylla (Marri)*			
181.	17105	*Corymbia haematoxylon (Mountain Marri)*			
182.	7945	*Cotula coronopifolia (Waterbuttons)*	Y		
183.	13354	*Craspedia variabilis*			
184.	13484	*Cryptandra arbutiflora var. tubulosa*			
185.	768	*Cyathochaeta avenacea*			
186.	769	*Cyathochaeta clandestina*			
187.	7444	*Dampiera hederacea (Karri Dampiera)*			
188.	7454	*Dampiera linearis (Common Dampiera)*			
189.	5508	*Darwinia citriodora (Lemon-scented Darwinia)*			
190.	1218	*Dasypogon bromeliifolius (Pineapple Bush)*			
191.	1219	*Dasypogon hookeri (Pineapple Bush)*			
192.	6218	*Daucus glochidiatus (Australian Carrot)*			
193.	19747	*Daviesia decurrens subsp. decurrens*			
194.	18560	*Daviesia divaricata subsp. divaricata*			
195.	3815	*Daviesia horrida (Prickly Bitter-pea)*			
196.	3817	*Daviesia inflata*			
197.	3819	*Daviesia longifolia*			
198.	17691	*Desmocladus fasciculatus*			
199.	299	*Deyeuxia quadriseta (Reed Bentgrass)*			
200.	7487	*Diaspasis filifolia (Thread-leaved Diaspasis)*			
201.	6616	*Dichondra repens (Kidney Weed)*			
202.	20367	*Dillwynia laxiflora*			
203.	4757	*Dodonaea ceratocarpa*			
204.	1640	*Drakaea glyptodon (King-in-his-carriage)*			
205.	11156	*Drakaea livida*			
206.	3094	*Drosera dichrosepala (Rusty Sundew)*			
207.	3095	*Drosera erythrorhiza (Red Ink Sundew)*			
208.	3109	*Drosera menziesii (Pink Rainbow)*			
209.	3118	*Drosera pallida (Pale Rainbow)*			
210.	3123	*Drosera platystigma (Black-eyed Sundew)*			
211.	3124	*Drosera pulchella (Pretty Sundew)*			
212.	13385	*Drosera stelliflora*			
213.	3131	*Drosera stolonifera (Leafy Sundew)*			
214.	33480	*Dysphania pumilio (Clammy Goosefoot)*			
215.	340	*Echinopogon ovatus (Hedgehog Grass)*			
216.	349	*Ehrharta longiflora (Annual Veldt Grass)*	Y		
217.	1067	*Empodisma gracillimum*			
218.	15412	*Eriochilus dilatatus subsp. multiflorus*			
219.	15414	*Eriochilus helonomos*			
220.	5605	*Eucalyptus cornuta (Yate, Yeid)*			
221.	5625	*Eucalyptus diversicolor (Karri)*			
222.	5628	*Eucalyptus drummondii (Drummond's Gum)*			
223.	5708	*Eucalyptus marginata (Jarrah, Djara)*			
224.	13547	*Eucalyptus marginata subsp. marginata (Jarrah)*			
225.	5739	*Eucalyptus patens (Swan River Blackbutt, Dwuda)*			
226.	19088	*Euchiton collinus*			
227.	15137	*Euchiton sphaericus*			
228.	3876	*Eutaxia epacridoides*			
229.	20214	*Eutaxia myrtifolia*			
230.	3879	*Eutaxia parvifolia*			
231.	834	*Evandra aristata*			
232.	10765	*Exocarpos sparteus (Broom Ballart, Djuk)*			
233.	8850	*Fallopia convolvulus*	Y		
234.	900	*Gahnia aristata*			
235.	902	*Gahnia decomposita*			
236.	3891	*Gastrolobium bilobum (Heart Leaf Poison)*			
237.	20475	*Gastrolobium capitatum*			
238.	19733	*Gastrolobium retusum*			
239.	3936	*Genista linifolia (Flaxleaf Broom)*	Y		
240.	18143	*Genista monspessulana*	Y		
241.	17043	*Glyceria declinata*	Y		
242.	3948	*Gompholobium capitatum*			
243.	10909	*Gompholobium confertum*			

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
244.	19216	*Gompholobium cyaninum*			
245.	3950	*Gompholobium knightianum*			
246.	3951	*Gompholobium marginatum*			
247.	3954	*Gompholobium polymorphum*			
248.	3955	*Gompholobium preissii*			
249.	11083	*Gompholobium scabrum*			
250.	3957	*Gompholobium tomentosum (Hairy Yellow Pea)*			
251.	11115	*Gompholobium villosum*			
252.	16746	*Gonocarpus benthamii subsp. benthamii*			
253.	29362	*Goodenia coerulea*			
254.	13165	*Goodenia pusilla*			
255.	1967	*Grevillea brachystylis (Short-styled Grevillea)*			
256.	15990	*Grevillea pulchella subsp. ascendens*			
257.	2112	*Grevillea trifida*			
258.	908	*Gymnoschoenus anceps*			
259.	1465	*Haemodorum discolor*			
260.	1468	*Haemodorum laxum*			
261.	2128	*Hakea amplexicaulis (Prickly Hakea)*			
262.	2137	*Hakea ceratophylla (Horned Leaf Hakea)*			
263.	2170	*Hakea lasianthoides*			
264.	2175	*Hakea lissocarpha (Honey Bush)*			
265.	2191	*Hakea oleifolia (Dungyn)*			
266.	2203	*Hakea ruscifolia (Candle Hakea)*			
267.	2212	*Hakea sulcata (Furrowed Hakea)*			
268.	2214	*Hakea trifurcata (Two-leaf Hakea)*			
269.	26900	*Haloplegma preissii*			
270.	6855	*Hemigenia humilis*			
271.	6865	*Hemigenia podalyrina*			
272.	6866	*Hemigenia pritzelii*			
273.	26925	*Heterocladia caudata*			
274.	5109	*Hibbertia amplexicaulis*			
275.	5114	*Hibbertia commutata*			
276.	5117	*Hibbertia cuneiformis (Cutleaf Hibbertia)*			
277.	5118	*Hibbertia cunninghamii*			
278.	20051	*Hibbertia diamesogenos*			
279.	5126	*Hibbertia furfuracea*			
280.	5132	*Hibbertia grossularifolia*			
281.	45534	*Hibbertia hypericoides subsp. hypericoides*			
282.	5137	*Hibbertia inconspicua*			
283.	19687	*Hibbertia notibractea*			
284.	5159	*Hibbertia pulchra*			
285.	5161	*Hibbertia quadricolor*			
286.	5169	*Hibbertia serrata (Serrate Leaved Guinea Flower)*			
287.	1294	*Hodgsoniola junciformis*			
288.	445	*Holcus setiger (Annual Fog)*	Y		
289.	5816	*Homalospermum firmum*			
290.	3964	*Hovea chorizemifolia (Holly-leaved Hovea)*			
291.	3965	*Hovea elliptica (Tree Hovea)*			
292.	3967	*Hovea stricta*			
293.	3968	*Hovea trisperma (Common Hovea)*			
294.	5218	*Hybanthus debilissimus*			
295.	452	*Hyparrhenia hirta (Tambookie Grass)*	Y		
296.	5182	*Hypericum perforatum (St John's Wort)*	Y		
297.	31234	*Hypericum perforatum subsp. veronense (St John's Wort)*	Y		
298.	5817	*Hypocalymma angustifolium (White Myrtle, Kudjid)*			
299.	5818	*Hypocalymma cordifolium*			
300.	5819	*Hypocalymma ericifolium*			
301.	5825	*Hypocalymma robustum (Swan River Myrtle)*			
302.	9352	*Hypochaeris radicata (Flat Weed, Cats-ear)*	Y		
303.	1070	*Hypolaena exsulca*			
304.	1531	*Iris germanica (Flag Iris)*	Y		
305.	912	*Isolepis cyperoides*			
306.	10831	*Isolepis prolifera (Budding Club-rush)*	Y		
307.	2237	*Isopogon sphaerocephalus (Drumstick Isopogon)*			
308.	7396	*Isotoma hypocrateriformis (Woodbridge Poison)*			
309.	1532	*Ixia maculata (Yellow Ixia)*	Y		
310.	8092	*Ixiolaena viscosa (Sticky Ixiolaena)*			
311.	4017	*Jacksonia horrida*			
312.	1295	*Johnsonia acaulis*			
313.	1297	*Johnsonia lupulina (Hooded Lily)*			

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
314.	8328	*Juncus amabilis*			
315.	1177	*Juncus articulatus (Jointed Rush)*	Y		
316.	1180	*Juncus capitatus (Capitate Rush)*	Y		
317.	1184	*Juncus holoschoenus (Jointleaf Rush)*			
318.	11922	*Juncus kraussii subsp. australiensis*			
319.	1186	*Juncus microcephalus*	Y		
320.	1190	*Juncus planifolius (Broadleaf Rush)*			
321.	1195	*Juncus subsecundus (Finger Rush)*			
322.	4036	*Kennedia carinata*			
323.	4037	*Kennedia coccinea (Coral Vine)*			
324.	15674	*Kunzea ciliata*			
325.	5835	*Kunzea micrantha*			
326.	5841	*Kunzea recurva*			
327.	14776	*Kunzea rostrata*			
328.	3669	*Labichea punctata (Lance-leaved Cassia)*			
329.	18585	*Lagenophora huegelii*			
330.	467	*Lagurus ovatus (Hare's Tail Grass)*	Y		
331.	48345	*Lasiopetalum occidentale*			
332.	6879	*Lavandula stoechas (Italian Lavender)*	Y		
333.	11464	*Laxmannia sessiliflora subsp. australis*			
334.	7568	*Lechenaultia biloba (Blue Leschenaultia)*			
335.	7572	*Lechenaultia expansa*			
336.	8099	*Leontodon saxatilis (Hairy Hawkbit)*	Y		
337.	42741	*Lepidosperma apricola*			
338.	929	*Lepidosperma carphoides (Black Rapier Sedge)*			
339.	932	*Lepidosperma effusum (Spreading Sword-sedge)*			
340.	934	*Lepidosperma gracile (Slender Sword Sedge)*			
341.	940	*Lepidosperma pubisquameum*			
342.	20398	*Lepidosperma sp. Blackwood (R. Davis 7696)*			
343.	29150	*Lepidosperma sp. Margaret River (B.J. Lepschi 1841)*			
344.	46376	*Leptocarpus denmarkicus*			
345.	1080	*Leptocarpus scariosus*			
346.	46379	*Leptocarpus thysananthus*			
347.	2342	*Leptomeria cunninghamii*			
348.	2355	*Leptomeria squarrulosa*			
349.	6358	*Leucopogon assimilis*			
350.	6360	*Leucopogon australis (Spiked Beard-heath)*			
351.	6367	*Leucopogon capitellatus*			
352.	6375	*Leucopogon cordatus*			
353.	6396	*Leucopogon glabellus*			
354.	6402	*Leucopogon hirsutus*			
355.	33380	*Leucopogon interstans*			
356.	6425	*Leucopogon oxycedrus*			
357.	6427	*Leucopogon parviflorus (Coast Beard-heath)*			
358.	6428	*Leucopogon pendulus*			
359.	6439	*Leucopogon pulchellus (Beard-heath)*			
360.	19662	*Leucopogon sp. Margaret River (J. Scott 207)*			
361.	6451	*Leucopogon tenuis*			
362.	6454	*Leucopogon verticillatus (Tassel Flower)*			
363.	7676	*Levenhookia pusilla (Midget Stylewort)*			
364.	49103	*Levenhookia sp. Whicher Range (J.A. Wege 2090)*			
365.	7677	*Levenhookia stipitata (Common Stylewort)*			
366.	59	*Lindsaea linearis (Screw Fern)*			
367.	36180	*Liparophyllum latifolium*			
368.	9289	*Lobelia anceps (Angled Lobelia)*			
369.	7402	*Lobelia gibbosa (Tall Lobelia)*			
370.	6515	*Logania vaginalis (White Spray)*			
371.	9356	*Logfia gallica*	Y		
372.	475	*Lolium multiflorum (Italian Ryegrass)*	Y		
373.	1222	*Lomandra brittanii*			
374.	1223	*Lomandra caespitosa (Tufted Mat Rush)*			
375.	1225	*Lomandra drummondii*			
376.	1228	*Lomandra hermaphrodita*			
377.	1229	*Lomandra integra*			
378.	1234	*Lomandra nigricans*			
379.	1238	*Lomandra pauciflora*			
380.	1243	*Lomandra sericea (Silky Mat Rush)*			
381.	1244	*Lomandra sonderi*			
382.	4059	*Lotus angustissimus (Narrowleaf Trefoil)*	Y		
383.	8564	*Lotus subbiflorus*	Y		

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
384.	1092	*Loxocarya cinerea*			
385.	15835	*Loxocarya striata*			
386.	1198	*Luzula meridionalis (Field Woodrush)*			
387.	1097	*Lyginia barbata*			
388.	18049	*Lyginia imberbis*			
389.	1656	*Lyperanthus serratus (Rattle Beak Orchid)*			
390.	36373	*Lysimachia minima*	Y		
391.	34736	*Lysinema pentapetalum*			
392.	5281	*Lythrum hyssopifolia (Lesser Loosestrife)*	Y		
393.	85	*Macrozamia riedlei (Zamia, Djiridji)*			
394.	17630	*Marianthus tenuis*			
395.	13273	*Melaleuca incana subsp. incana*			
396.	5952	*Melaleuca preissiana (Moonah)*			
397.	5980	*Melaleuca thymoides*			
398.	5987	*Melaleuca viminea (Mohan)*			
399.	953	*Mesomelaena graciliceps*			
400.	957	*Mesomelaena tetragona (Semaphore Sedge)*			
401.	485	*Microlaena stipoides (Weeping Grass)*			
402.	4090	*Mirbelia dilatata (Holly-leaved Mirbelia)*			
403.	37440	*Monopsis debilis var. depressa*	Y		
404.	2412	*Muehlenbeckia adpressa (Climbing Lignum)*			
405.	12778	*Myosotis discolor*	Y		
406.	492	*Neurachne alopecuroidea (Foxtail Mulga Grass)*			
407.	27103	*Nuytsia floribunda (Christmas Tree, Mudja)*			
408.	2401	*Nuytsia floribunda (Christmas Tree, Mudja)*			
409.	2365	*Olax benthamiana*			
410.	7346	*Opercularia echinocephala (Bristly Headed Stink Weed)*			
411.	7348	*Opercularia hispidula (Hispid Stinkweed)*			
412.	7354	*Opercularia volubilis (Twining Stinkweed)*			
413.	46316	*Orianthera serpyllifolia subsp. angustifolia*			
414.	46315	*Orianthera serpyllifolia subsp. serpyllifolia*			
415.	4114	*Ornithopus pinnatus (Slender Serradella)*	Y		
416.	7122	*Orobanche minor (Lesser Broomrape)*	Y		
417.	1537	*Orthrosanthus laxus (Morning Iris)*			
418.	11749	*Orthrosanthus laxus var. laxus (Morning Iris)*			
419.	4358	*Oxalis purpurea (Largeflower Wood Sorrel)*	Y		
420.	29834	*Ozothamnus diosmifolius*	Y		
421.	7117	*Pandorea pandorana*			
422.	2966	*Papaver somniferum (Opium Poppy)*	Y		
423.	527	*Paspalum dilatatum*	Y		
424.	1542	*Patersonia babianoides*			
425.	1546	*Patersonia juncea (Rush Leaved Patersonia)*			
426.	1548	*Patersonia limbata*			
427.	1550	*Patersonia occidentalis (Purple Flag, Koma)*			
428.	30472	*Patersonia occidentalis var. occidentalis*			
429.	11550	*Patersonia umbrosa var. xanthina (Yellow Flags)*			
430.	4343	*Pelargonium capitatum (Rose Pelargonium)*	Y		
431.	6245	*Pentapeltis peltigera*			
432.	16477	*Pericalymma ellipticum var. ellipticum*			
433.	11020	*Persicaria hydropiper*			
434.	2262	*Persoonia elliptica (Spreading Snottygobble)*			
435.	2267	*Persoonia longifolia (Snottygobble)*			
436.	2273	*Persoonia saccata (Snottygobble)*			
437.	2293	*Petrophile diversifolia*			
438.	2299	*Petrophile linearis (Pixie Mops)*			
439.	2309	*Petrophile serruriae*			
440.	551	*Phalaris minor (Lesser Canary Grass)*	Y		
441.	18529	*Philotheca spicata (Pepper and Salt)*			
442.	1478	*Phlebocarya ciliata*			
443.	5231	*Pimelea angustifolia (Narrow-leaved Pimelea)*			
444.	5232	*Pimelea argentea (Silvery Leaved Pimelea)*			
445.	5249	*Pimelea hispida (Bristly Pimelea)*			
446.	18117	*Pimelea rosea subsp. rosea*			
447.	5264	*Pimelea spectabilis (Bunjong)*			
448.	12041	*Pimelea suaveolens subsp. suaveolens*			
449.	5269	*Pimelea sylvestris*			
450.	88	*Pinus radiata (Radiata Pine)*	Y		
451.	16322	*Pittosporum undulatum*	Y		
452.	7303	*Plantago lanceolata (Ribwort Plantain)*	Y		
453.	6249	*Platysace compressa (Tapeworm Plant)*			

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454.	6253	*Platysace filiformis*			
455.	11160	*Platysace haplosciadia*			
456.	6259	*Platysace tenuissima*			
457.	577	*Poa poiformis (Coastal Poa)*			
458.	578	*Poa porphyroclados*			
459.	86	*Podocarpus drouynianus (Wild Plum, Kula)*			
460.	2905	*Polycarpon tetraphyllum (Fourleaf Allseed)*	Y		
461.	4690	*Poranthera huegelii*			
462.	1683	*Prasophyllum triangulare (Dark Leek Orchid)*			
463.	44527	*Pterostylis erubescens*			
464.	44526	*Pterostylis karri*			
465.	1693	*Pterostylis recurva (Jug Orchid)*			
466.		*Pterostylis sp.*			
467.	18655	*Pterostylis sp. crinkled leaf (G.J. Keighery 13426)*			
468.	1698	*Pterostylis vittata (Banded Greenhood)*			
469.	20195	*Pultenaea brachytropis*			
470.	4181	*Pultenaea reticulata*			
471.	48316	*Quercus suber*	Y		Y
472.	2932	*Ranunculus colonorum (Common Buttercup)*			
473.	2933	*Ranunculus muricatus (Sharp Buttercup)*	Y		
474.	18547	*Rhadinothamnus anceps*			
475.	2578	*Rhagodia baccata (Berry Saltbush)*			
476.	13300	*Rhodanthe citrina*			
477.	4695	*Ricinocarpos glaucus*			
478.	16243	*Rosa canina*	Y		
479.	32426	*Rosulabryum campylothecium*			
480.	20506	*Rubus anglocandicans*	Y		
481.	2429	*Rumex acetosella (Sorrel)*	Y		
482.	2430	*Rumex brownii (Swamp Dock)*	Y		
483.	40431	*Rytidosperma acerosum*			
484.	40425	*Rytidosperma caespitosum*			
485.	40426	*Rytidosperma occidentale*			
486.	7602	*Scaevola calliptera*			
487.	7613	*Scaevola glandulifera (Viscid Hand-flower)*			
488.	7624	*Scaevola microphylla (Small-leaved Scaevola)*			
489.	984	*Schoenus curvifolius*			
490.	992	*Schoenus grandiflorus (Large Flowered Bogrush)*			
491.	1005	*Schoenus obtusifolius*			
492.	1020	*Schoenus sublateralis*			
493.	6	*Selaginella gracillima (Tiny Clubmoss)*			
494.	8203	*Senecio diaschides*			
495.	7362	*Sherardia arvensis (Field Madder)*	Y		
496.	8225	*Siloxerus humifusus (Procumbent Siloxerus)*			
497.	10920	*Soliva sessilis (Jo-jo, Onehunga Weed)*	Y		
498.	8230	*Sonchus asper (Rough Sowthistle)*	Y		
499.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
500.	1558	*Sparaxis bulbifera*	Y		
501.	17551	*Sphaerolobium drummondii*			
502.	4207	*Sphaerolobium medium*			
503.	4209	*Sphaerolobium racemulosum*			
504.	31952	*Sphenotoma gracilis (Swamp Paper-heath)*			
505.	31951	*Sphenotoma parviflora*			
506.	14917	*Sporadanthus rivularis*			
507.	6930	*Stachys arvensis (Staggerweed)*	Y		
508.	20537	*Stachystemon virgatus*			
509.	7684	*Stylidium amoenum (Lovely Triggerplant)*			
510.	30278	*Stylidium androsaceum*			
511.	39880	*Stylidium angustifolium subsp. glaucifolium*			
512.	7688	*Stylidium barleei (Tooth-leaved Triggerplant)*			
513.	7708	*Stylidium crassifolium (Thick-leaved Triggerplant)*			
514.	7713	*Stylidium dichotomum (Pins-and-needles)*			
515.	7718	*Stylidium diversifolium (Touch-me-not)*			
516.	7719	*Stylidium ecorne (Foot Triggerplant)*			
517.	19251	*Stylidium eriopodum*			
518.	7733	*Stylidium glaucum (Grey Triggerplant)*			
519.	25801	*Stylidium hesperium*			
520.	25829	*Stylidium neurophyllum (Coastal Plain Triggerplant)*			
521.	7774	*Stylidium piliferum (Common Butterfly Triggerplant)*			
522.	7785	*Stylidium repens (Matted Triggerplant)*			
523.	7787	*Stylidium rhynchocarpum (Black-beaked Triggerplant)*			

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
524.		*Stylidium sp.*			
525.	7799	*Stylidium spathulatum (Creamy Triggerplant)*			
526.	1260	*Stypandra glauca (Blind Grass)*			
527.	6476	*Styphelia tenuiflora (Common Pinheath)*			
528.	16883	*Synaphea damopsis*			
529.	2323	*Synaphea gracillima*			
530.	12911	*Synaphea obtusata*			
531.	2324	*Synaphea petiolaris (Synaphea)*			
532.	16863	*Synaphea petiolaris subsp. triloba*			
533.	32437	*Syntrichia antarctica*			
534.	15827	*Taraxis grossa*			
535.	20114	*Taxandria fragrans*			
536.	20135	*Taxandria linearifolia*			
537.	20133	*Taxandria parviceps*			
538.	4256	*Templetonia retusa (Cockies Tongues)*			
539.	1034	*Tetraria capillaris (Hair Sedge)*			
540.	1036	*Tetraria octandra*			
541.	35579	*Tetraria sp. Jarrah Forest (R. Davis 7391)*			
542.	667	*Tetrarrhena laevis (Forest Ricegrass)*			
543.	48341	*Tetratheca hirsuta subsp. viminea*			
544.	4544	*Tetratheca setigera*			
545.	1707	*Thelymitra flexuosa (Twisted Sun Orchid)*			
546.	11143	*Thelymitra graminea*			
547.	18248	*Thelymitra granitora*			
548.	11053	*Thelymitra macrophylla*			
549.	1710	*Thelymitra mucida (Plum Orchid)*			
550.	20731	*Thelymitra vulgaris*			
551.	5080	*Thomasia foliosa*			
552.	5087	*Thomasia macrocarpa (Large Fruited Thomasia)*			
553.	5091	*Thomasia paniculata*			
554.	5092	*Thomasia pauciflora (Few Flowered Thomasia)*			
555.	5097	*Thomasia rhynchocarpa*			
556.	1339	*Thysanotus multiflorus (Many-flowered Fringe Lily)*			
557.		*Thysanotus sp.*			
558.	1354	*Thysanotus tenellus*			
559.	8248	*Tolpis barbata (Yellow Hawkweed)*	Y		
560.	6280	*Trachymene pilosa (Native Parsnip)*			
561.	4547	*Tremandra diffusa*			
562.	4548	*Tremandra stelligera*			
563.	1485	*Tribonanthes violacea (Violet Tiurndin)*			
564.	8251	*Trichocline spathulata (Native Gerbera)*			
565.	17541	*Trifolium incarnatum var. incarnatum*	Y		
566.	4302	*Trifolium ligusticum (Ligurian Clover)*	Y		
567.	35016	*Trihaloragis hexandra subsp. integrifolia*			
568.	34965	*Trihaloragis hexandra subsp. serrata*			
569.	4737	*Tripterococcus brunonis (Winged Stackhousia)*			
570.	11665	*Trymalium ledifolium var. ledifolium*			
571.	13479	*Trymalium ledifolium var. rosmarinifolium*			
572.	33438	*Trymalium odoratissimum subsp. trifidum*			
573.	4317	*Ulex europaeus (Gorse)*	Y		
574.	38388	*Ursinia anthemoides subsp. anthemoides*	Y		
575.	33537	*Vallisneria australis*	Y		
576.	7665	*Velleia trinervis*			
577.	8257	*Vellereophyton dealbatum (White Cudweed)*	Y		
578.	15618	*Verticordia plumosa var. plumosa*			
579.	4325	*Viminaria juncea (Swishbush, Koweda)*			
580.	6575	*Vinca major (Blue Periwinkle)*	Y		
581.	7388	*Wahlenbergia multicaulis*			
582.	18118	*Watsonia meriana var. meriana*	Y		
583.	1569	*Watsonia versfeldii*	Y		
584.	1394	*Wurmbea dioica (Early Nancy)*			
585.	20737	*X Cyanthera glossodioides*			
586.	1253	*Xanthorrhoea gracilis (Graceful Grass Tree, Mimidi)*			
587.	1256	*Xanthorrhoea preissii (Grass tree, Palga)*			
588.	6284	*Xanthosia candida*			
589.	6289	*Xanthosia huegelii*			
590.	19330	*Xanthosia tasmanica*			
591.	2331	*Xylomelum occidentale (Woody Pear, Djandin)*			
592.	15819	*Xyris atrovirida*			
593.	1145	*Xyris gracillima*			

NatureMap
Mapping Western Australia's biodiversity

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
594.	1146	*Xyris inaequalis*			
595.	1150	*Xyris lanata*			
596.	1049	*Zantedeschia aethiopica (Arum Lily)*	Y		

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

NatureMap
Mapping Western Australia's biodiversity

42-0322NM Fauna 10km Buffer Report

Created By Guest user on 03/03/2022

Kingdom Animalia
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 06' 26" E,33° 51' 25" S
Buffer 10km
Group By Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	231	1684
Other specially protected fauna	1	24
Priority 3	1	1
Priority 4	3	15
Rare or likely to become extinct	13	171
TOTAL	**249**	**1895**

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
Rare or likely to become extinct					
1.	34110	*Austroassiminea letha (Cape Leeuwin Freshwater Snail)*		T	
2.	24731	*Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black Cockatoo)*		T	
3.	24733	*Calyptorhynchus baudinii (Baudin's Cockatoo, White-tailed Long-billed Black Cockatoo)*		T	
4.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)*		T	
5.	48400	*Calyptorhynchus sp. (white-tailed black cockatoo)*		T	
6.	25335	*Caretta caretta (Loggerhead Turtle)*		T	
7.	24092	*Dasyurus geoffroii (Chuditch, Western Quoll)*		T	
8.	33945	*Engaewa pseudoreducta (Margaret River Burrowing Crayfish)*		T	
9.	33946	*Engaewa reducta (Dunsborough Burrowing Crayfish)*		T	
10.	24166	*Pseudocheirus occidentalis (Western Ringtail Possum, ngwayir)*		T	
11.	24388	*Psophodes nigrogularis subsp. nigrogularis (Western Whipbird (western heath))*		T	
12.	24145	*Setonix brachyurus (Quokka)*		T	
13.	34113	*Westralunio carteri (Carter's Freshwater Mussel)*		T	
Other specially protected fauna					
14.	48070	*Phascogale tapoatafa subsp. wambenger (South-western Brush-tailed Phascogale, Wambenger)*		S	
Priority 3					
15.	34030	*Geotria australis (Pouched Lamprey)*		P3	
Priority 4					
16.	24215	*Hydromys chrysogaster (Water-rat, Rakali)*		P4	
17.	48588	*Isoodon fusciventer (Quenda, southwestern brown bandicoot)*		P4	
18.	48022	*Notamacropus irma (Western Brush Wallaby)*		P4	
Non-conservation taxon					
19.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
20.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
21.	24262	*Acanthiza inornata (Western Thornbill)*			
22.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
23.		*Acariformes sp.*			
24.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
25.	25536	*Accipiter fasciatus (Brown Goshawk)*			
26.		*Acritoptila globosa*			
27.		*Aeshnidae sp.*			
28.		*Aetapcus maculatus*			
29.		*Alotanypus dalyupensis*			
30.		*Amphisopodidae sp.*			
31.		*Aname mainae*			
32.		*Aname tepperi*			

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
33.	24312	*Anas gracilis (Grey Teal)*			
34.	24313	*Anas platyrhynchos (Mallard)*			
35.	24316	*Anas superciliosa (Pacific Black Duck)*			
36.		*Ancylidae sp.*			
37.	47414	*Anhinga novaehollandiae (Australasian Darter)*			
38.	24088	*Antechinus flavipes subsp. leucogaster (Yellow-footed Antechinus, Mardo)*			
39.	24561	*Anthochaera carunculata (Red Wattlebird)*			
40.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
41.	24285	*Aquila audax (Wedge-tailed Eagle)*			
42.		*Archaeosynthemis leachii*			
43.		*Archaeosynthemis occidentalis*			
44.		*Archaeosynthemis spiniger*			
45.		*Archichauliodes sp.*			
46.	25558	*Ardea ibis (Cattle Egret)*			
47.		*Arkys walckenaeri*			
48.		*Arrenuridae sp.*			
49.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
50.		*Aturidae sp.*			
51.		*Austracantha minax*			
52.		*Austroaeschna anacantha*			
53.		*Austrochiltonia sp.*			
54.		*Baetidae sp.*			
55.		*Barnardius zonarius*			
56.		*Bibulmena kadjina*			
57.	24319	*Biziura lobata (Musk Duck)*			
58.		*Botryocladius freemani*			
59.	25716	*Cacatua sanguinea (Little Corella)*			
60.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
61.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
62.		*Caenidae sp.*			
63.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
64.		*Ceratopogonidae sp.*			
65.		*Cercophonius sulcatus*			
66.	24186	*Chalinolobus gouldii (Gould's Wattled Bat)*			
67.	24187	*Chalinolobus morio (Chocolate Wattled Bat)*			
68.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
69.	33939	*Cherax calnii (Marron)*			
70.		*Cherax destructor*			
71.		*Cherax quinquecarinatus*			
72.		*Chironominae sp.*			
73.		*Chironomus aff. alternans (V24) (CB)*			
74.		*Chironomus tepperi*			
75.	24980	*Christinus marmoratus (Marbled Gecko)*			
76.		*Cladocera (non-daphniidae)*			
77.		*Cladocera (unident.)*			
78.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
79.	24399	*Columba livia (Domestic Pigeon)*	Y		
80.		*Copepoda sp.*			
81.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
82.		*Cordulidae sp.*			
83.		*Corixidae sp.*			
84.		*Cormocephalus aurantiipes*			
85.	25592	*Corvus coronoides (Australian Raven)*			
86.		*Corydalidae sp.*			
87.	25595	*Cracticus tibicen (Australian Magpie)*			
88.	25596	*Cracticus torquatus (Grey Butcherbird)*			
89.		*Cricotopus 'parbicinctus'*			
90.	25398	*Crinia georgiana (Quacking Frog)*			
91.	25399	*Crinia glauerti (Clicking Frog)*			
92.	25401	*Crinia pseudinsignifera (Bleating Froglet)*			
93.		*Culicidae sp.*			
94.		*Curculionidae sp.*			
95.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*	Y		
96.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
97.		*Dicrotendipes sp. A (V47) (SAP)*			
98.		*Dugesiidae sp.*			
99.		*Dytiscidae sp.*			
100.	25096	*Egernia kingii (King's Skink)*			
101.	25100	*Egernia napoleonis*			
102.		*Egretta novaehollandiae*			

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
103.		*Emertonella maga*			
104.		*Empididae sp.*			
105.		*Enchytraeidae sp.*			
106.		*Eolophus roseicapillus*			
107.	24652	*Eopsaltria georgiana (White-breasted Robin)*			
108.		*Ephydridae sp.*			
109.	25621	*Falco berigora (Brown Falcon)*			
110.	25622	*Falco cenchroides (Australian Kestrel, Nankeen Kestrel)*			
111.	34028	*Galaxias occidentalis (Western Minnow)*			
112.	25530	*Gerygone fusca (Western Gerygone)*			
113.		*Glossiphoniidae sp.*			
114.	24443	*Grallina cyanoleuca (Magpie-lark)*			
115.		*Gripopterygidae sp.*			
116.		*Gyrinidae sp.*			
117.		*Harrisius sp. B (SFM)*			
118.	25410	*Heleioporus eyrei (Moaning Frog)*			
119.		*Hemicorduliidae sp.*			
120.	25118	*Hemiergis peronii subsp. tridactyla*			
121.	47965	*Hieraaetus morphnoides (Little Eagle)*			
122.	24491	*Hirundo neoxena (Welcome Swallow)*			
123.		*Hydraenidae sp.*			
124.		*Hydrometridae sp.*			
125.		*Hydrophilidae sp.*			
126.		*Hydroptilidae sp.*			
127.		*Hyriidae sp.*			
128.		*Isopeda leishmanni*			
129.		*Kiefferulus intertinctus*			
130.		*Lampona cylindrata*			
131.		*Lectrides parilis*			
132.		*Lepidoptera (non-pyralid)*			
133.		*Leptoceridae sp.*			
134.		*Leptoperla australica*			
135.		*Leptophlebiid genus S sp. AV1*			
136.		*Leptophlebiidae sp.*			
137.		*Libellulidae sp.*			
138.	25661	*Lichmera indistincta (Brown Honeyeater)*			
139.	25415	*Limnodynastes dorsalis (Western Banjo Frog)*			
140.	41416	*Liopholis pulchra subsp. pulchra (South-western Rock Skink, Spectacled Rock Skink)*			
141.	25378	*Litoria adelaidensis (Slender Tree Frog)*			
142.	25388	*Litoria moorei (Motorbike Frog)*			
143.		*Lycosa gilberta*			
144.	25650	*Malurus elegans (Red-winged Fairy-wren)*			
145.	25654	*Malurus splendens (Splendid Fairy-wren)*			
146.		*Megaloptera sp.*			
147.		*Megapodagrionidae sp.*			
148.	24598	*Merops ornatus (Rainbow Bee-eater)*			
149.		*Mesoveliidae sp.*			
150.		*Microcarbo melanoleucos*			
151.		*Microvelia (Austromicrovelia) australiensis*			
152.		*Microvelia sp.*			
153.	25240	*Morelia spilota subsp. imbricata (Carpet Python)*			
154.	25191	*Morethia lineocellata*			
155.		*Naididae sp.*			
156.		*Nannoperca vittata*			
157.		*Neboissophlebia occidentalis*			
158.		*Nematoda sp.*			
159.		*Neophargidae sp.*			
160.		*Newmanoperla exigua*			
161.		*Notalina sp.*			
162.		*Notalina sp. AV15 (PSW)*			
163.	25252	*Notechis scutatus (Tiger Snake)*			
164.		*Notonectidae sp.*			
165.		*Notoperata tenax*			
166.		*Nousia sp. AV16*			
167.		*Nunciella aspera*			
168.	24194	*Nyctophilus geoffroyi (Lesser Long-eared Bat)*			
169.		*Nyungara bunni*			
170.		*Ochthebius sp.*			
171.		*Oligochaeta sp.*			
172.		*Oniscidae sp.*			

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
173.		*Orthocladiinae 'woodminer' (SAP)*			
174.		*Orthocladiinae sp.*			
175.		*Ostracoda (unident.)*			
176.		*Oxidae sp.*			
177.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
178.		*Palaemonidae sp.*			
179.		*Paralimnophyes pullulus (V42)*			
180.		*Paramerina levidensis*			
181.		*Parastacidae sp.*			
182.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
183.	25682	*Pardalotus striatus (Striated Pardalote)*			
184.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
185.		*Perthiidae sp.*			
186.	48061	*Petrochelidon nigricans (Tree Martin)*			
187.	48066	*Petroica boodang (Scarlet Robin)*			
188.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
189.	25699	*Phalacrocorax varius (Pied Cormorant)*			
190.	24409	*Phaps chalcoptera (Common Bronzewing)*			
191.		*Phreatoicidae sp.*			
192.		*Phreodrilidae sp.*			
193.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
194.		*Planorbidae sp.*			
195.	25720	*Platycercus icterotis (Western Rosella)*			
196.	25703	*Podargus strigoides (Tawny Frogmouth)*			
197.		*Polypedilum nr. convexum (SAP)*			
198.		*Polypedilum watsoni*			
199.	25722	*Polytelis anthopeplus (Regent Parrot)*			
200.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
201.		*Purpureicephalus spurius*			
202.		*Pyralidae sp.*			
203.	24245	*Rattus rattus (Black Rat)*	Y		
204.		*Rheotanytarsus sp. (SFM)*			
205.		*Rheotanytarsus trivittatus*			
206.		*Rheotanytarsus underwoodi*			
207.	48096	*Rhipidura albiscapa (Grey Fantail)*			
208.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
209.		*Richardsonianidae sp.*			
210.		*Riekoperla occidentalis*			
211.		*Riethia v4*			
212.		*Sciomyzidae sp.*			
213.		*Scirtidae sp.*			
214.		*Scolopendra laeta*			
215.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
216.		*Servaea spinibarbis*			
217.		*Simulidae sp.*			
218.		*Skusella/"V12 ex-WA" (Cranston)*			
219.		*Sphaeriidae sp.*			
220.		*Spinicrus minimus*			
221.	24645	*Stagonopleura oculata (Red-eared Firetail)*			
222.		*Staphylinidae sp.*			
223.		*Sternopriscus sp.*			
224.	25655	*Stipiturus malachurus (Southern Emu-wren)*			
225.	25597	*Strepera versicolor (Grey Currawong)*			
226.		*Styloniscidae sp.*			
227.		*Synthemistidae sp.*			
228.		*Tabanidae sp.*			
229.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
230.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
231.		*Tanypodinae sp.*			
232.		*Tanytarsus aff manleyensis*			
233.		*Tanytarsus nr K5*			
234.		*Tanytarsus palmatus*			
235.		*Tasmanocoenis tillyardi*			
236.		*Telephlebiidae sp.*			
237.		*Temnocephalidea sp.*			
238.		*Thienemanniella sp. (V19) (SAP)*			
239.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
240.		*Tipulidae sp.*			
241.	25723	*Trichoglossus haematodus (Rainbow Lorikeet)*			
242.	25521	*Trichosurus vulpecula (Common Brushtail Possum)*			

NatureMap
Mapping Western Australia's biodiversity

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
243.	24158	*Trichosurus vulpecula subsp. vulpecula (Common Brushtail Possum)*			
244.		*Triplectides sp. AV1 (SFM)*			
245.		*Triplectides sp. AV21 (SFM)*			
246.		*Urodacus novaehollandiae*			
247.		*Velildae sp.*			
248.	24206	*Vespadelus regulus (Southern Forest Bat)*			
249.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Appendix B Protected Matters Search Tool Extract

Australian Government
Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 14-Mar-2022

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	42
Listed Migratory Species:	20

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	5
Commonwealth Heritage Places:	None
Listed Marine Species:	25
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	17
Regional Forest Agreements:	1
Nationally Important Wetlands:	None
EPBC Act Referrals:	13
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area	In buffer area only
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community may occur within area	In buffer area only

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area	In feature area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area	In buffer area only
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area	In feature area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area	In feature area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Zanda baudinii listed as Calyptorhynchus baudinii Baudin's Black-Cockatoo, Long-billed Black-cockatoo [87736]	Endangered	Breeding known to occur within area	In feature area
Zanda latirostris listed as Calyptorhynchus latirostris Carnaby's Black Cockatoo, Short-billed Black-cockatoo [87737]	Endangered	Species or species habitat known to occur within area	In feature area
CRUSTACEAN			
Cherax tenuimanus Hairy Marron, Margaret River Hairy Marron, Margaret River Marron [78931]	Critically Endangered	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Engaewa pseudoreducta Margaret River Burrowing Crayfish [82674]	Critically Endangered	Species or species habitat known to occur within area	In buffer area only
Engaewa reducta Dunsborough Burrowing Crayfish [82675]	Critically Endangered	Species or species habitat known to occur within area	In feature area
FISH			
Nannatherina balstoni Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
FROG			
Geocrinia alba White-bellied Frog, Creek Frog [26181]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
MAMMAL			
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat known to occur within area	In feature area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area	In feature area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area	In feature area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat may occur within area	In buffer area only
OTHER			
Westralunio carteri Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area	In feature area
PLANT			
Banksia nivea subsp. uliginosa Swamp Honeypot [82766]	Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Banksia squarrosa subsp. argillacea Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Caladenia excelsa Giant Spider-orchid [56717]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Caladenia hoffmanii Hoffman's Spider-orchid [56719]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat may occur within area	In feature area
Caladenia lodgeana Lodge's Spider-orchid [68664]	Critically Endangered	Species or species habitat known to occur within area	In buffer area only
Daviesia elongata subsp. elongata Long-leaved Daviesia [64883]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area	In feature area
Eucalyptus x phylacis Meelup Mallee [87817]	Endangered	Species or species habitat may occur within area	In buffer area only
Gastrolobium papilio Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area	In feature area
Grevillea brachystylis subsp. grandis Large-flowered Short-styled Grevillea [85001]	Critically Endangered	Species or species habitat likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Lambertia echinata subsp. occidentalis Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within area	In buffer area only
REPTILE			
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area	In buffer area only
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area	In buffer area only
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding likely to occur within area	In buffer area only

Listed Migratory Species		[Resource Information]	
Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area	In buffer area only
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Thalassarche steadi			
White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Migratory Marine Species			
Caretta caretta			
Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area	In buffer area only
Chelonia mydas			
Green Turtle [1765]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Dermochelys coriacea			
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area	In buffer area only
Natator depressus			
Flatback Turtle [59257]	Vulnerable	Breeding likely to occur within area	In buffer area only
Migratory Terrestrial Species			
Motacilla cinerea			
Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Calidris acuminata			
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris canutus			
Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area	In buffer area only
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Calidris melanotos			
Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat may occur within area	In buffer area only
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area	In buffer area only
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area	In buffer area only

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State	Buffer Status
Unknown		
Commonwealth Land - [50382]	WA	In buffer area only
Commonwealth Land - [51992]	WA	In buffer area only
Commonwealth Land - [51103]	WA	In buffer area only
Commonwealth Land - [51990]	WA	In buffer area only
Commonwealth Land - [50383]	WA	In buffer area only

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Ardenna carneipes as Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area	In buffer area only
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area overfly marine area	In buffer area only
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat may occur within area	In buffer area only
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area	In buffer area only
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area	In buffer area only
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thinornis cucullatus as Thinornis rubricollis Hooded Dotterel, Hooded Plover [87735]		Species or species habitat known to occur within area overfly marine area	In buffer area only
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area overfly marine area	In buffer area only
Reptile			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area	In buffer area only
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area	In buffer area only
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding likely to occur within area	In buffer area only

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Bramley	National Park	WA	In buffer area only
Leeuwin-Naturaliste	National Park	WA	In buffer area only
NTWA Bushland covenant (0003)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0037)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0044A)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0044B)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0044C)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0065A)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0065B)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0130)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0148)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0149)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0152)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0164)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0168)	Conservation Covenant	WA	In buffer area only
Walburra	Nature Reserve	WA	In buffer area only

Protected Area Name	Reserve Type	State	Buffer Status
Yelverton	National Park	WA	In buffer area only

Regional Forest Agreements

[Resource Information]

Note that all areas with completed RFAs have been included.

RFA Name	State	Buffer Status
South West WA RFA	Western Australia	In feature area

EPBC Act Referrals

[Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Lot 32 Tom Cullity Drive, Wilyabrup	2020/8866	Controlled Action	Proposed Decision Comment	In buffer area only
Not controlled action				
Bussell Highway (Bramley Section) SLK Upgrade	2012/6511	Not Controlled Action	Completed	In buffer area only
Busselton to Flinders Bay Rails to Trails Project, WA	2013/6835	Not Controlled Action	Completed	In buffer area only
Busselton to Margaret River Transmission Line	2008/3964	Not Controlled Action	Completed	In buffer area only
Construction of the Margaret River bypass road	2012/6677	Not Controlled Action	Completed	In buffer area only
Geo-science Investigations	2005/2069	Not Controlled Action	Completed	In buffer area only
Gloucester Park Precinct-expansion of ovals and community facilities, Margaret River, WA	2017/7985	Not Controlled Action	Completed	In buffer area only
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed	In feature area
Residential Development Riverslea Estate Stage 8, Margaret River, WA	2014/7227	Not Controlled Action	Completed	In buffer area only
West's gravel pit development, Cowaramup, WA	2015/7586	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
Clearing of understorey vegetation for fire management purposes	2010/5788	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action (particular manner)				
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval	In feature area

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix C Conservation Codes for WA Flora and Fauna

CONSERVATION CODE	CATEGORY
Threatened species (T)	Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under Section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act). ***Threated fauna*** is that subset of 'Specially Protected Fauna' listed under Schedules 1 to 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for Threatened Fauna. ***Threatened flora*** is that subset of 'Rare Flora' listed under schedules 1 to 3 of the *Wildlife Conservation (Rare Flora) Notice 2018* for Threated Flora. The Assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below
Critically endangered species (CR)	Threatened species considered to be *"facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the criteria set out in the ministerial guidelines"*. Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.
Endangered species (EN)	Threatened species considered to be *"facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines"*. Listed as endangered under Section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.

CONSERVATION CODE	CATEGORY
Vulnerable species (VU)	Threatened species considered to *be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines".* Listed as endangered under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for vulnerable fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for vulnerable flora.
Extinct species (EX)	Species where *"there is no reasonable doubt that the last member of the species has died",* and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.
Extinct in the wild species (EW)	Species that *"is known only to survive in cultivation, captivity or as a naturalised population well outside its part range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form",* and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threated fauna or flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.
Specially protected species	Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection. Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

CONSERVATION CODE	CATEGORY
Migratory species (MI)	Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (Section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and the Republic of Korea (ROKAMBA), and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements of treaties, excluding species that are listed as Threated species. Published as migratory birds protected under an international agreement under schedule 5 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.
Species of special conservation interest (conservation dependent fauna) (CD)	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.
Other specially protected species (S)	Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Published as other specially protected fauna under schedule 7 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

CONSERVATION CODE	CATEGORY
Priority species (P)	Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Assessment of Priority codes in based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.
Priority 1 (P1) – Poorly-known species	Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g., agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases, or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
Priority 2 (P2) – Poorly-known species	Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g., national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

CONSERVATION CODE	CATEGORY
Priority 3 (P3) – Poorly-known species	Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4 (P4) – Rare, Near Threatened and other species in need of monitoring	(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Appendix D Relevé Field Sheet

STRUCTURAL VEGETATION, FLORA – Relevé			SITE_ID: R01
Date: 09/03/2022	**GPS Location**	**E**	
		N	
Recorder: KL	**Structural Community Type**	**Marri – Jarrah Open Forest over Marri – Jarrah Low Open Woodland over Woody Pear – Bull Banksia scattered tall shrubs over Woody Pear, *Apple of Sodom and Marri Scattered Low Shrubs over scattered herbs and grasses**	
Location: Lot 500 Wirring Road, west of Villiers Street, Cowaramup			

Condition: Degraded	
Aspect: NW	**Slope:** Gentle
Geology: Laterite/rock	**Rock:** <2%
Soil Colour: Grey/Brown	**Soil Type:** Sandy Loam + gravel
Litter (% cover & depth): 95%, 3cm, dried grass + leaves	**Bare Ground (% cover):** <2%
Hydrology: Good drainage	**Topographic position:** Flat

Layer	Height (m)	Cover	Plant Species (Dominant 3 first)
Tree (T2)	10-30	30-70%	*Corymbia calophylla, Eucalyptus marginata*
Tree (T3)	< 10	2-10%	*Corymbia calophylla, Eucalyptus marginata*
Shrub (S1)	> 2	<2%	*Xylomelum occidentale, Banksia grandis*
Shrub (S2)	1-2	N/A	N/A
Shrub (S3)	0-1	<2%	*Xylomelum occidentale, *Solanum linnaeanum, Corymbia calophylla*
Sedge/Rush (VR)		N/A	N/A
Herb (H)		<2%	**Sonchus asper*
Grass (G)		2-10%	**Kikuyu*
Other (climbers) (C)		N/A	N/A

Cover Codes: D >70% M 30-70% S 10-30% V 2-10% VV <2% E <5% Emergent * = Introduced

Surrounding Plants: High density (>70%) of dead annual grasses (e.g., **Avena* sp., **Briza maxima*)

Appendix E Identified Trees (>50cm DBH)

ID No.	DBH (cm)	Species	Height (m)	Hollows/s	Easting	Northing
1000	>50	Marri	16	No Hollow	325326	6251996
1001	>50	Marri	20	No Hollow	325320	6252003
1002	71	Marri	16	Potential Hollow	325316	6252004
1003	>50	Marri	16	No Hollow	325315	6252006
1004	>50	Marri	18	No Hollow	325313	6252009
1005	>50	Marri	5	Hollow	325310	6252011
1006	>50	Marri	18	Potential Hollow	325308	6252013
1007	>50	Marri	10	No Hollow	325305	6252015
1008	56	Marri - Dead	10	Potential Hollow	325301	6252023
1009	>50	Marri	14	No Hollow	325296	6252030
1010	>50	Karri	12	No Hollow	325256	6252057
1011	>50	Karri	20	No Hollow	325257	6252060
1012	>50	Karri	15	No Hollow	325253	6252060
1013	>50	Karri	18	No Hollow	325252	6252062
1014	>50	Karri	18	No Hollow	325247	6252064
1015	>50	Karri	18	No Hollow	325244	6252067
1016	>50	Karri	20	No Hollow	325253	6252068
1017	159	Karri	22	Hollows x 2	325208	6252061
1018	145	Karri	20	Hollow	325205	6252056
1019	161	Karri	20	Hollow	325207	6252078
1020	>50	Marri	20	No Hollow	325171	6252044
1021	>50	Marri	18	No Hollow	325173	6252050
1022	>50	Marri	18	No Hollow	325175	6252051
1023	>50	Marri	16	No Hollow	325168	6252060
1024	>50	Marri	12	No Hollow	325153	6252080
1025	>50	Marri	14	No Hollow	325149	6252081
1026	>50	Marri	12	No Hollow	325147	6252079
1027	>50	Marri	14	No Hollow	325145	6252082
1028	>50	Marri	14	No Hollow	325143	6252085
1029	91	Marri	10	Hollow	325140	6252083
1030	>50	Marri	12	No Hollow	325138	6252092
1031	>50	Marri	20	No Hollow	325120	6252104
1032	77	Marri	14	Hollow	325112	6252110
1033	>50	Marri	16	No Hollow	325111	6252113
1034	55	Marri	10	Hollow	325107	6252115
1035	>50	Marri	14	No Hollow	325104	6252117
1036	>50	Marri	12	No Hollow	325104	6252117
1037	>50	Marri	14	No Hollow	325106	6252122
1038	>50	Marri	18	No Hollow	325104	6252127
1039	>50	Marri	18	No Hollow	325097	6252126

ID No.	DBH (cm)	Species	Height (m)	Hollows/s	Easting	Northing
1040	>50	Marri	18	No Hollow	325092	6252129
1041	>50	Marri	18	No Hollow	325087	6252128
1042	>50	Marri	18	No Hollow	325085	6252139
1043	>50	Marri	16	No Hollow	325085	6252138
1044	>50	Marri	16	No Hollow	325050	6252169
1045	90	Karri	16	Potential Hollow	325050	6252172
1046	>50	Marri	12	No Hollow	325047	6252171
1047	>50	Marri	16	No Hollow	325001	6252218
1048	92	Marri	18	Hollow	324999	6252222
1049	>50	Marri	14	No Hollow	324991	6252219
1050	>50	Marri	8	No Hollow	325054	6252354
1051	>50	Marri	14	No Hollow	325055	6252356
1052	>50	Marri	14	No Hollow	325055	6252355
1053	>50	Marri	14	No Hollow	325059	6252356
1054	>50	Marri	12	No Hollow	325060	6252359
1055	>50	Marri	10	No Hollow	325067	6252365
1056	>50	Marri	10	No Hollow	325069	6252363
1057	>50	Marri	12	No Hollow	325071	6252364
1058	>50	Marri	14	No Hollow	325076	6252370
1059	>50	Marri	16	No Hollow	325076	6252372
1060	>50	Marri	10	No Hollow	325073	6252374
1061	>50	Marri	14	No Hollow	325079	6252383
1062	>50	Marri	14	No Hollow	325078	6252385
1063	>50	Marri	14	No Hollow	325080	6252385
1064	>50	Marri	12	No Hollow	325092	6252387
1067	87	Marri	10	Hollow	325110	6252407
1068	>50	Marri	12	No Hollow	325109	6252405
1069	>50	Marri	10	No Hollow	325110	6252411
1070	>50	Jarrah	12	No Hollow	325102	6252409
1071	>50	Marri	14	No Hollow	325122	6252422
1072	>50	Marri	14	No Hollow	325124	6252423
1073	>50	Jarrah	12	No Hollow	325141	6252441
1074	>50	Marri	12	No Hollow	325142	6252445
907	>50	Marri	18	No Hollow	325350	6276990
908	>50	Marri	18	No Hollow	325350	6276990
909	>50	Marri	18	No Hollow	325350	6276990
910	>50	Marri	18	No Hollow	325350	6276990
911	>50	Marri	16	No Hollow	325350	6276990
912	>50	Marri	15	No Hollow	324462	6252024
913	>50	Marri	14	No Hollow	324469	6252007
914	>50	Marri	10	No Hollow	324475	6252037
915	>50	Marri	12	No Hollow	324478	6252038

ID No.	DBH (cm)	Species	Height (m)	Hollows/s	Easting	Northing
916	>50	Marri	14	No Hollow	324480	6252037
917	>50	Marri	14	No Hollow	324481	6252035
918	>50	Marri	16	No Hollow	324491	6252020
919	>50	Marri	15	No Hollow	324715	6251955
920	96	Marri	16	Potential Hollow	324655	6252010
921	>50	Marri	15	No Hollow	324603	6252265
922	>50	Marri	8	No Hollow	324598	6252270
923	>50	Marri	10	No Hollow	324600	6252268
924	>50	Marri	14	No Hollow	324608	6252264
925	>50	Marri	12	No Hollow	324612	6252270
926	>50	Marri	14	No Hollow	324610	6252276
927	>50	Marri	16	No Hollow	324610	6252284
928	78	Jarrah	6	Potential Hollow	324608	6252289
929	>50	Marri	12	No Hollow	324609	6252288
930	>50	Marri	10	No Hollow	324611	6252289
931	>50	Marri	18	No Hollow	324621	6252290
932	69	Marri	7	Hollow	324627	6252297
933	>50	Marri	16	No Hollow	324629	6252293
934	>50	Marri	12	No Hollow	324629	6252293
935	>50	Marri	14	No Hollow	324631	6252290
936	>50	Marri	14	No Hollow	324633	6252287
937	>50	Marri	14	No Hollow	324622	6252276
938	58	Marri	12	Potential Hollow	324620	6252269
939	>50	Marri	12	No Hollow	324630	6252275
940	>50	Marri	16	No Hollow	324637	6252289
941	>50	Marri	16	No Hollow	324637	6252288
942	>50	Marri	12	No Hollow	324633	6252276
943	>50	Marri	10	No Hollow	324634	6252262
944	>50	Marri	12	No Hollow	324633	6252265
945	>50	Marri	14	No Hollow	324639	6252276
946	>50	Marri	15	No Hollow	324642	6252272
947	>50	Marri	12	No Hollow	324643	6252268
948	>50	Marri	16	No Hollow	324650	6252274
949	>50	Marri	16	No Hollow	324656	6252269
950	>50	Jarrah	14	No Hollow	324725	6252211
951	>50	Marri	14	No Hollow	324645	6252304
952	>50	Marri	12	No Hollow	324647	6252307
953	>50	Marri	14	No Hollow	324633	6252290
954	>50	Marri	15	No Hollow	324649	6252301
955	>50	Marri	18	No Hollow	324650	6252289
956	>50	Marri	10	No Hollow	324650	6252286
957	>50	Marri	12	No Hollow	324654	6252286

ID No.	DBH (cm)	Species	Height (m)	Hollows/s	Easting	Northing
958	>50	Marri	14	No Hollow	324662	6252297
959	87	Marri	10	Chimney Hollow	324664	6252301
960	>50	Marri	12	No Hollow	324676	6252322
961	>50	Marri	12	No Hollow	324683	6252324
962	>50	Marri	14	No Hollow	324689	6252316
963	>50	Marri	14	No Hollow	324690	6252315
964	>50	Marri	12	No Hollow	324685	6252307
965	>50	Marri	14	No Hollow	324682	6252297
966	>50	Marri	14	No Hollow	324688	6252301
968	>50	Marri	12	No Hollow	324664	6252275
969	>50	Marri	14	No Hollow	324666	6252277
970	>50	Marri	14	No Hollow	324679	6252290
971	>50	Marri	18	No Hollow	324686	6252284
972	>50	Marri	12	No Hollow	324683	6252281
973	73	Marri	10	Hollows x 2	324679	6252267
974	>50	Marri	18	No Hollow	324692	6252275
975	>50	Marri	12	No Hollow	324699	6252280
976	>50	Marri	12	No Hollow	324703	6252287
977	>50	Marri	12	No Hollow	324704	6252277
978	>50	Marri	12	No Hollow	324698	6252270
979	>50	Marri	10	No Hollow	324711	6252280
980	>50	Marri	14	No Hollow	324711	6252281
981	>50	Marri	14	No Hollow	324711	6252285
982	>50	Marri	10	No Hollow	324715	6252289
983	>50	Marri	8	No Hollow	324718	6252286
984	>50	Marri	8	No Hollow	324722	6252275
985	>50	Marri	12	No Hollow	324716	6252265
986	>50	Marri	12	No Hollow	324716	6252268
987	>50	Marri	12	No Hollow	324711	6252258
988	>50	Marri	14	No Hollow	324709	6252257
989	>50	Marri	12	No Hollow	325143	6252017
990	84	Marri	12	Potential Hollow	325140	6252011
991	>50	Marri	10	No Hollow	325138	6252010
992	86	Marri	12	Potential Hollow	325130	6252004
993	>50	Marri	10	No Hollow	325130	6251997
994	62	Marri	10	Potential Hollow	325164	6252039
995	>50	Marri	10	No Hollow	325163	6252037
996	78	Marri	12	Hollow	325168	6252040
997	120	Marri	18	Potential Hollow	325332	6251997
998	>50	Marri	18	No Hollow	325328	6252000
999	>50	Marri	18	No Hollow	325327	6251997

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LOCAL WATER MANAGEMENT STRATEGY

Lot 500 Wirring Road, Cowaramup

AU213002398.001
Rev 1
23 June 2023

rpsgroup.com

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
Draft A	Draft for client review	AngFil/JoySie	ShaMcS	NA	04/07/2022
Rev 0	Final for issue	AngFil/JoySie	AmiHed	SteRol	28/07/2022
Rev 1	Final for issue	JoySie	DavSim	SteRol	23/06/2023

Approval for issue

S. Rolls	23 June 2023

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Appendix F : DWER/Shire correspondence
Appendix G : Groundwater quality
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Appendix I : Engineering service report

NOTE REGARDING DESIGN STORM TERMINOLOGY

In accordance with the most recent edition of Australian Rainfall and Runoff (ARR), the terminology used to describe the design level (frequency of occurrence) of a rainfall or storm event has recently been revised. This report refers to both the new and old terminology for clarity, Table 1 describes how the new terminology "EY – exceedances per year" and "AEP – annual exceedance probability" relate to the previous terminology "ARI – average recurrence interval"

Table 1: Design storm terminology

Relative Frequency	ARI years (previously used terminology)	AEP %	AEP (1 in x)	EY (exceedances per year)	Currently used adopted terminology
Most frequent	1	63.21	1.58	1	1EY
	4.48	20	5	0.22	20% AEP
	5	18.13	5.52	0.2	20% AEP
Less frequent	100	1	100	0.01	1% AEP

The new (post-2016) design rainfall datasets provide intensity-frequency-duration (IFD) data for a design level of 20% AEP, which equates to 4.48 years ARI. Conversely, the previous (pre-2016) design rainfall dataset provided IFD data for a design level of 5 years' ARI, which equates to 18.13% AEP. For simplicity, this report adopts "20% AEP" as the equivalent to the previously used "5-year ARI" design level, with the two terms considered interchangeable.

EXECUTIVE SUMMARY

This Local Water Management Strategy (LWMS) has been prepared to support the Local Structure Plan (LSP) by demonstrating that the site can support urban development and will achieve sustainable urban water management outcomes. The landowner (Rod Duggan c/o PGPM Pty Ltd) is proposing to develop Lot 500 Wirring Road, Cowaramup (referred herein as "the site"). The site is located approximately 260 kilometres (km) south-south-west of Perth and 12 km north of Margaret River.

The LWMS details the integrated water management strategies to facilitate future urban water management planning. A summary of the site conditions governing the design and key design strategies are presented in Table 2.

Table 2: Summary of existing site conditions and key design strategies

Item	Summary
Existing site characteristics	
Topography Section 2.1	• Site elevations range from approximately 140 metres Australian Height Datum (m AHD) in the south-east to 134 m AHD in the north-west
Geology and soils Section 2.2	• Across the site, there is generally sand/clayey sand to depths of 0.3 m overlying sandy clay/ gravelly clay and shallow basement rock.
Acid sulfate soils Section 2.2.2	• Regional acid sulfate soils (ASS) mapping indicates a small portion of the west border is classified as a moderate to low risk of ASS occurring within 3 m of the natural surface.
Wetlands Section 2.4	• No Geomorphic wetlands are mapped within the site.
Surface water hydrology Section 2.3	• No surface water features are located within the site. • Surface water drainage from the northern portion of the site naturally drains through the existing Lakeview Estate development and into the dam (on Wilyabrup Brook) located in Symphony Waters Estate.
Groundwater hydrology Section 2.3.3	• Groundwater monitoring bores present at the site and in the surrounding area typically indicate that the static water level is around 1.9 m to 2.3 m below the ground level. • Pre-development groundwater quality monitoring shows evidence of elevated nutrients, and total metals (Cu, Cr, Pb, and Zn).
Water conservation	
Water efficiency initiatives Section 3	• 4-star WELS water efficient fixtures and fittings to be installed in all new buildings • Mandatory requirement to install rainwater tanks (required spare capacity will be specified in the land sale contract). Either 2,500 L or 5,000 L will be required. An S70A Notification will be imposed on titles regarding the need to comply with the rainwater tank requirement.
Landscaping and irrigation Section 3.1	• The landscape master plan aims to retain existing native vegetation where possible and provide amenity in public open space areas in conjunction with the retained vegetation. The POS locations (three in total) have generally aimed to respond and capture the existing vegetation on site and provide a drainage function in most cases. A small amount of turf is proposed within each POS for active recreation. • The development's POS areas will have a likely irrigation demand of between 15,000 and 20,000 kL/yr. • Groundwater is limited underlying the site and local area. • The irrigation source is proposed to be the constructed dam to the north where non-potable water is currently sourced for irrigation of Cowaramup.
Stormwater management	
Small event (15 mm) Section 4.2	• The site will aim to retain run-off from the small (15 mm) storm event through the use of on-lot rainwater tanks, basins and swales.
Minor event (20% AEP) Section 4.2	• Flows will be conveyed via piped drainage system or via overland flow into detention basins. • Rural run-off from external rural catchments will be managed through structural controls (i.e. bunds at the rear of lots) to manage flow to detention basins prior to discharge (at pre-development flow rates) through existing stormwater infrastructure.

Item	Summary
Major event (1% AEP) Section 4.3	• Stormwater flows will be detained in drainage basins or swales and through existing infrastructure capacity to maintain pre-development flow rates. • Flows will be discharged to basins and swales prior to discharge into the three points of discharge at Wirring Road, Roy Earl Drive and Waverley Road. • Minimum habitable floor levels to provide a minimum separation of – 0.3 m above the 1% AEP water level in local stormwater storages
Water quality Section 4	• Stormwater which may infiltrate into the ground will still receive some form of treatment via the strong ability of the clayey soil to adsorb phosphorus. • Non-structural controls such as minimising fertiliser and pesticide application and maintaining well-established vegetation in drainage areas will also assist in groundwater quality protection
Groundwater levels Section 5	• Inter-allotment drainage will be provided for all lots to ensure excess roof run-off can connect to a free-flowing outlet to reduce perched groundwater recharge. • Subsoil drainage located within road reserves and along some lot boundaries to control potential groundwater rise.
Groundwater quality Section 5.1	• Subsoil drainage from the subdivision will be discharged into the vegetated detention basin/s, prior to discharge offsite. • High PRI (>10) soil media will be used in the vegetated treatment areas to provide phosphorus treatment • Vegetation will be selected based on their nutrient uptake ability
Monitoring	
Post-development monitoring Section 6	• No post-development monitoring is proposed.
Roles and responsibilities	
Roles and responsibilities Section 7	• Outlined in Table 9

1 INTRODUCTION

1.1 Background

The landowner (Rod Duggan c/o PGPM Pty Ltd) is proposing to develop Lot 500 Wirring Road, Cowaramup (referred herein as "the site"). The site is located approximately 260 kilometres (km) south-south-west of Perth and 12 km north of Margaret River (Figure 1).

The site is currently cleared and undeveloped, with some access tracks across the site. Some mature trees are present, particularly at a cluster at the north of the site. Land to the east and south of the site are zoned 'Priority Agriculture' under Local Planning Scheme (LPS) 1, and land to the north and the west of the site is zoned 'Residential' and 'Future Residential'. The site is bordered by the existing developments of Lakeview Estate to the northeast and Country Vines Estate to the west.

The structure plan for the site is included in Appendix A, as well as an indicative staging plan for the development.



Figure 1: Site location

1.2 Planning background

Rowe Group on behalf of the owner has submitted a Town Planning Scheme Amendment to initiate the rezoning of the site from "General Agriculture" to "Future Development" under the Shire of Augusta Margaret River Local Planning Scheme No. 1.

1.2.1 Shire of Augusta-Margaret River Local Planning Strategy

The Shire of Augusta-Margaret River Local Planning Strategy was prepared by the Shire and endorsed by the Western Australian Planning Commission on 18 January 2022, setting out the strategic framework for development within the Shire municipality to 2036.

The site is identified within the Strategy as Future Urban Growth Area and contained within Planning Precinct C5. The Strategy sets out a target lot yield of 300 lots at residential densities between R10–R30, in addition to the required public open space reserves.

The Strategy sets out the following key planning matters to be addressed:

- Opportunity to create road linkages with existing network
- Stands of remnant vegetation located on site shall be retained
- Need to provide attractive entrance to Cowaramup from the south and buffers to adjoining agricultural land
- Sufficient buffers to surrounding agricultural properties such that their operations are not prejudiced.

These key considerations have been the drivers of the design of the future Structure Plan (Appendix A at rear of report) for the site, which proposes the following:

- 372 single residential lots (ranging from R10 to R30)
- A retirement village
- Five public open space/drainage reserves (total 5.12 ha)
- Associated access roads.

This Local Water Management Strategy (LWMS) has been prepared to support the Local Structure Plan (LSP) by demonstrating that the site is capable of supporting urban development and will achieve sustainable urban water management outcomes.

1.3 Design objectives

The LWMS is in accordance with State Planning Policy 2.9: Water Resources (Government of WA 2007) and has been developed with reference to the following guidance documents:

- General Requirements for Stormwater Drainage Disposal (AMRS 2012)
- Standards and Specifications for Subdivisions and Developments (AMRS 2006).
- Better Urban Water Management (Western Australian Planning Commission 2008)
- Interim: Developing a Local Water Management Strategy (Department of Water 2008)
- Western Australian State Water Plan (Government of Western Australia 2007)
- Stormwater Management Manual for Western Australia (Department of Water 2004–2007)
- Liveable Neighbourhoods (Western Australian Planning Commission 2007).

The LWMS will detail the integrated water management strategies for the LSP to facilitate future urban water management planning. The LWMS will achieve integrated water management through the following design objectives:

- Minimise irrigation requirements for public open space and other landscaping components.
- Effectively manage the risk to human life, property damage and environmental degradation from water contamination and stormwater flooding.
- Maintain and if possible, improve water quality within the development in relation to pre-development water quality.
- Implement best management practices in regard to stormwater management.
- Incorporate where possible, low maintenance, cost-effective landscaping and stormwater treatment systems.

1.4 Previous studies

- Geotechnical Study – Proposed residential subdivision, part of Lot 304 & 51 Wirring Road, Cowaramup (Galt Geotechnics 2021)
- Ecosystem solutions. (2022a). Bushfire Management Plan, Lot 500 Wirring Road, Cowaramup
- Ecosystem solutions. (2022b). Environmental Assessment Report, Lot 500 Wirring Road, Cowaramup. 09 June 2022.

2 EXISTING ENVIRONMENT

2.1 Topography

The site is gently undulating. Elevations range from approximately 140 metres Australian Height Datum (m AHD) in the south-east to 134 m AHD in the north-west (Figure 2).

2.2 Geology

The Busselton sheet of the 1:50,000 scale Environmental Geology series map indicates that the area is underlain by laterite and associated quartz sand (undifferentiated) (Figure 2).



Figure 2: Topography and geology

2.2.1 Geotechnical Investigation

A Geotechnical Investigation was undertaken by Galt Geotechnics at the site in December 2021. The investigation results, pertaining to subsurface geology and soil permeability/infiltration are summarised below. A summary of the groundwater findings from this investigation can be found in Section 2.3.3.

The subsurface conditions generally comprise:

- Sand/Clayey Sand– typical thickness of 0.5 m to 1 m, with variable fines and gravel content overlying
- Clayey SAND/Sandy CLAY/Gravelly CLAY – fines typically low to medium plasticity, with some high plasticity areas, variable gravel content, present to the maximum investigated depth of 3 m
- Shallow rock (laterised /conglomerate rock) may be present as either relatively shallow rock or large boulders. This is based on irregular refusal of test pits/boreholes on inferred very hard rock layers. This was encountered at depths as shallow as 0.3 m (though, typical encountered depth of ~ 1 m)
- The natural soils have a very low permeability based on the results of the field and laboratory testing. There are no soils at the site that we would consider to be consistently "free draining".

The Geotechnical report is provided in Appendix B.

2.2.2 Acid sulfate soils

According to the Acid Sulfate Soil (ASS) Risk Map – Swan Coastal Plain (DWER-055), most of the site is not classed within a potential ASS risk area. However, there is a small area of "moderate to low" risk of encountering ASS within three metres of the natural soil surface, but "high to moderate" risk of ASS beyond three metres along Roy Earl Drive, which intersects the north-west boundary of the site. The site is closely surrounded by "moderate to low" ASS risk areas on all boundaries, which are associated with the natural drainage depressions in these areas (Figure 3)

In accordance with relevant guidelines, any dewatering or soil disturbance, compaction or lateral displacement in the ASS risk areas will require a Preliminary Site Investigation to determine whether or not ASS is present. Consequently, ASS investigations prior to any soil or groundwater disturbance may be required in future stages of planning if disturbance to the soil or dewatering in the immediate area of the "moderate to low" risk soils is required.

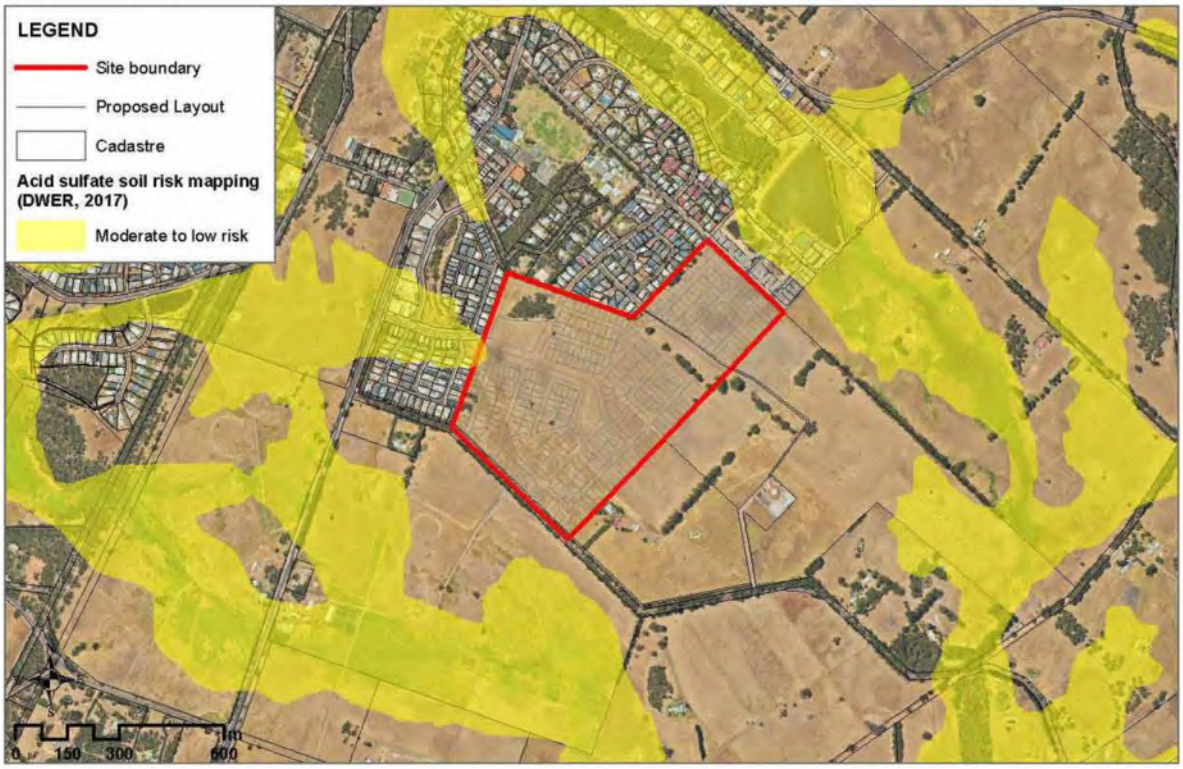


Figure 3: ASS risk map

2.3 Hydrology

2.3.1 Surface water drainage

The site is located in the Wilyabrup Brook catchment, which covers an area of 89.2 km^2. The brook is almost 20 km in length. It runs through both the Shire of Busselton and the Shire of Augusta-Margaret River. The main branch of the Wilyabrup Brook starts east of the Cowaramup town site and flows in a north-westerly direction. The north branch and the main branch meet east of Caves Road. The brook then flows westward to the Indian Ocean (DoW 2007).

There are no surface water features within the site. Review of the National Map (as of 13 June 2022) indicated there are no Geomorphic Wetlands or Significant Wetlands within or in immediate vicinity of the site.

Surface water drainage from the northern portion of the site naturally drains through the existing Lakeview Estate development and into the dam (Wilyabrup Brook) located in Symphony Waters Estate. For the remainder of the site, a portion of the drainage travels west through the swale located in the existing Country Vines Estate, or down to the south into the drainage line to the southwest of the site (Figure 4). All receiving waterways are tributaries of Wilyabrup Brook.

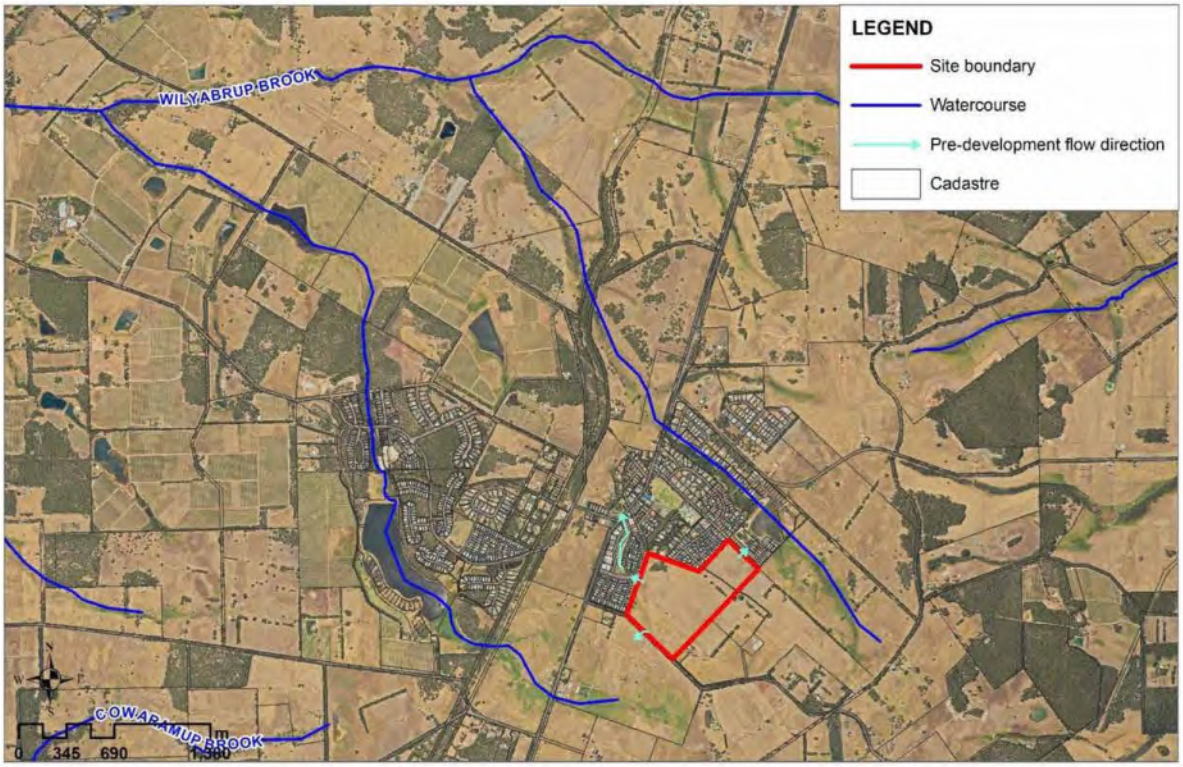


Figure 4: Regional surface water drainage

2.3.2 Pre-development drainage modelling

RPS has developed a hydrological model in XP-SWMM for the external rural catchments to assess pre-development drainage catchments, flow directions, and pre-development flow rates. The XP-SWMM modelling has been used to simulate the 20% and 1% AEP external catchment inflows to the site and from the site. RPS' model used the detailed on-site feature survey and external contour information to develop an accurate pre-development model. Previous assessments and studies were also used to inform existing development outcomes based their analysis on coarse topography data. In summary, the pre-development catchments have been slightly revised based on on-site feature survey and remodelled. There were some modest changes compared to the previous assessments. The pre-development drainage catchments, flow direction and existing drainage infrastructure are illustrated in Figure 5.

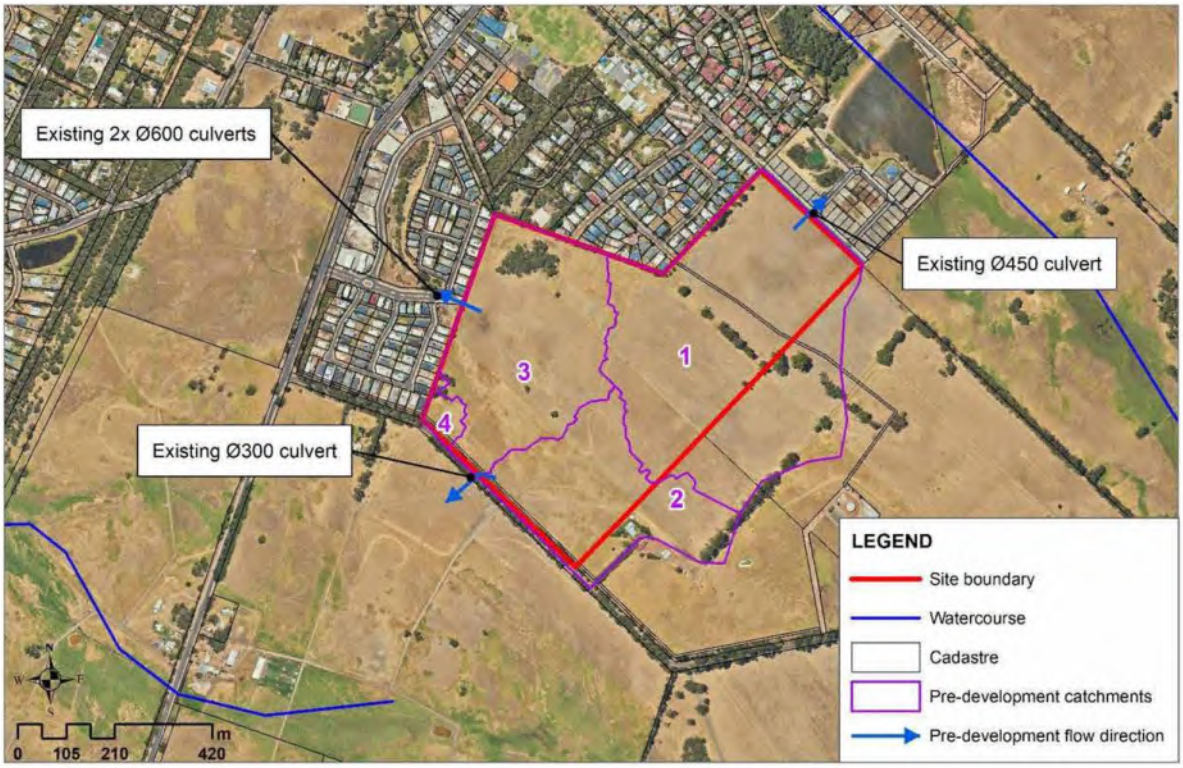


Figure 5: Pre-development surface water catchments and flow directions

The pre-development flow rates, drainage infrastructure details and catchment information are presented in Table 3. The catchments in Table 3 correspond with catchment numbers illustrated in Figure 5 above.

Table 3: Pre-development flows

Catchment	1	2	3	4
Discharge point	Waverley Rd	Wirring Rd	Roy Earl Dr	-
Revised catchment area (ha)	27.33	11.08	14.37	0.82
Catchment area to discharge point in previous studies (ha)	15.51*	0	28.71#	0
Revised pre-development flow rates				
20% AEP critical duration (hours)	0.75	4.5	4.5	No discharge from site
20% AEP peak flow (m^3/s)	0.51	0.12	0.21	No discharge from site
1% AEP critical duration (hours)	3	3	2	No discharge from site
1% AEP peak flow (m^3/s)	0.99	0.54	0.75	No discharge from site
Flow rates allowed by downstream infrastructure				
20% AEP peak flow (m^3/s)	0.20 m^3/s at existing Ø450 culvert (Additional 0.02 m^3/s capacity via pit B2 further east*)	0.12	Controlled by 2x Ø600 culverts (~1.6 m^3/s)#	-
1% AEP peak flow (m^3/s)	Overland flow	Overland flow	Controlled by 2x Ø600 culverts (~1.6 m^3/s)#	-

* Refer to Waverley Rd drainage details in Appendix C # Refer to Roy Earl Dr drainage details in Appendix D

Further details and supporting information relating to previously assumed catchments and constructed downstream infrastructure at Roy Earl Drive and Waverley Road are provided in Appendices C and D, respectively.

2.3.3 Groundwater

2.3.3.1 Groundwater levels

RPS has undertaken monthly groundwater level monitoring at six bores on the site (MW13 to MW18) from May to November 2021. The groundwater bore locations are presented in Figure 6. This monitoring program has captured the 2021 winter peak, with the data indicating that the site is frequently boggy in winter with a perched water table. The monitoring results are consistent with the groundwater findings from the Geotechnical report (summarised below) and in combination have been used to better understand the localised groundwater conditions.

As previously discussed, Galt Geotechnics undertook a site investigation in December 2021. A summary of the groundwater conditions is provided as follows:

- The critical water levels at the site are likely to be governed by perched water overlying impermeable layers. Noting the presence of relatively shallow farm soaks in the vicinity of the site that would confirm this.
- Registered bores present at the site and in the surrounding area typically indicate that the static water level is around 1.9 m to 2.3 m below the ground level.
- The groundwater level should be assumed to be at the top of any impermeable clay layer to allow for seasonal perched water.

The Geotechnical Report (Appendix B) and groundwater level monitoring data (Appendix E) have been presented to the Department of Water and Environmental Regulation (DWER) and the Shire of Augusta Margaret River (AMRS). The DWER and AMRS have confirmed that they are satisfied with the above investigations to enable an informed decision on groundwater management at the site. As such, no further pre-development groundwater level monitoring is required. DWER/AMRS correspondence is provided in Appendix F.



Figure 6: Groundwater monitoring bore locations

2.3.3.2 Groundwater quality

RPS has undertaken quarterly groundwater quality monitoring (April, July and October 2021) from the network of six bores on the site. Water was sampled for a standard suite of nutrients, metals and field parameters. Water quality was compared with the ANZECC (2000) freshwater guidelines (FWG) for lowland rivers in south-west Australia.

Table 4 provides average nutrient and metal concentrations from groundwater over the three-month period. Appendix G provides the water quality results and laboratory certificates.

The ANZECC FWG guideline was exceeded for total nitrogen and total phosphorus in all bores. Nitrogen was predominantly in the form of dissolved inorganic NOx-N. Dissolved inorganic phosphorus concentrations were however low. The elevated nitrogen concentrations observed at the site is expected to be due to the semi-rural/agricultural land use in the catchment.

The ANZECC FWG guideline was exceeded for dissolved copper at MW14, MW16 and MW17. All dissolved copper exceedances occurred during a single monitoring round (20 July 2021); concentrations during the other two monitoring rounds were below detection limit.

Table 4: Pre-development average groundwater quality April, July, and October 2021

Sample ID	Date	Trigger	Dissolved Metals								Nutrients					
			Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Total Nitrogen	Total Kjeldahl Nitrogen	NOx as N	Ammonia as N	Total Phosphorus	Phosphate
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
		FWG	0.013	0.0002	0.001^	0.0014	0.00034	0.00006	0.011	0.008	0.75	-	0.045	0.04	0.03	0.03
		LOR	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.001	0.1	0.1	0.005	0.005	0.05	0.005
MW13																
	Average		0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.002	0.6	0.2	0.39	0.012	0.05	0.005
MW14																
	Average		0.001	0.000	0.001	0.002	0.001	0.00005	0.001	0.001	0.800	0.167	0.600	0.006	0.050	0.005
MW15																
	Average		0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.002	2.3	0.35	1.98	0.053	0.055	0.005
MW16																
	Average		0.001	0.0001	0.001	0.002	0.001	0.00005	0.001	0.005	3.80	1.10	2.69	0.11	0.16	0.005
MW17																
	Average		0.001	0.0001	0.001	0.002	0.001	0.00005	0.001	0.003	1.13	0.37	0.76	0.15	0.05	0.005
MW18																
	Average		0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.003	2.3	0.7	1.61	0.016	0.08	0.005

*LOR (Limits of Reporting), FWG (Freshwater Guidelines for south-west WA lowland river ecosystems)

2.4 Wetlands

A search of DWER online database indicated that there are no geomorphic wetlands within the site. There are two unreviewed geomorphic wetlands Leeuwin Naturaliste Ridge and Donnybrook to Nannup (DBCA-043) located immediately north-east of the site and about 500 m south-west of the site.

2.5 Significant flora and fauna

The site was surveyed by Ecosystem Solutions for fauna over two days (24 March 2022 to 27 March 2022). The survey results indicated no observation of animals, black cockatoos and western ringtail possum. There were no Threatened flora or conservation significant flora identified within the site (Ecosystem Solutions 2022b).

2.6 Bushfire risk

The site is identified as 'Bushfire Prone Area' by the Department of Fire and emergency services ('DFES') Map of Bushfire Prone Areas. The Bushire Management Plan (BMP) has been prepared by Ecosystem Solutions and has confirmed the risk of bushfire onsite is capable of being mitigated to comply with associated guidelines for planning in Bushing Prone areas (Ecosystem solutions 2022a).

2.7 Contamination

DWER's Contaminated Sites database did not identify any registered contaminated sites within the site (DWER 2022). The nearest contaminated site (ID no: 74121) is located about 1 km north of the site classified as remediated for restricted use due to presence of hydrocarbons in groundwater because of agriculture depot land use.

2.8 Vegetation and heritage

Pre-European settlement, vegetation in this area mainly consisted of jarrah and marri, however the site has previously been cleared for agricultural use. A cluster of native remnant vegetation (mostly mature trees) is present in the north of the site, which will be retained in public open space (Figure 7).

There are no Aboriginal Heritage or local European heritage sites identified within the site (Department of Planning Lands and Heritage – Aboriginal Heritage Inquiry System and Local Heritage Survey 2022).

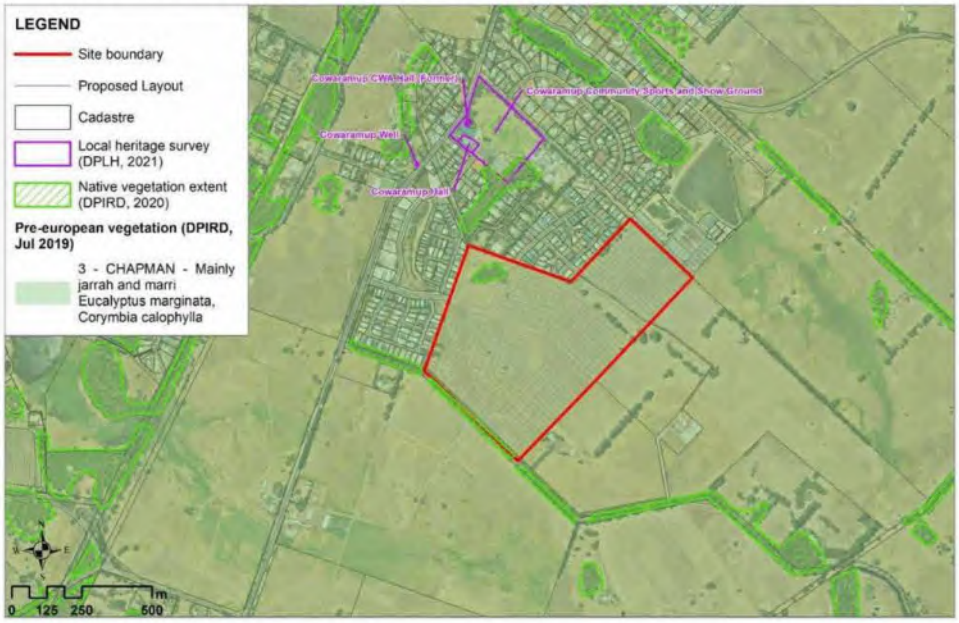


Figure 7: Extent of remnant native vegetation and local European heritage

3 WATER CONSERVATION STRATEGY

3.1 Landscaping and irrigation requirements

The landscape master plan aims to retain existing native vegetation where possible and provide amenity in public open space areas in conjunction with the retained vegetation. The POS locations have generally aimed to respond and capture the existing vegetation on site and provide a drainage function in most cases. A small amount of turf is proposed within each POS for active recreation. The development connects to the existing residential areas of Cowaramup by the footpath network, tying the development into the fabric of the town.

The landscape masterplan has been developed by SW Landscape Collective and is provided in Appendix H.

The street tree vegetation will be an extension of the existing Country Vines estate to the west and comprise a mixture of the following species:

- *Fraxinus raywoodii* – claret ash
- *Agonis Flexuosa* – WA peppermint
- *Corymbia calophylla* – grafted varieties
- *Lagerstroemia indica 'Natchez* – crepe myrtle.

The current landscape master plan (Appendix H) including the turf areas is likely to have a total irrigation demand of between 15,000 and 20,000 kL/yr.

Groundwater is limited beneath the site and the underlying hydrogeology consists of shallow surficial deposits overlaying granite basement rock. The deeper, higher yielding sedimentary Leederville and Yarragadee aquifers are not located beneath the site and are situated further east overlaying the Vasse Shelf and Bunbury Trough. Based on the geotechnical investigation and the groundwater drilling undertaken to support the installation of groundwater monitoring bores, it was established that there is a shallow perched groundwater system beneath the site but that this is likely to largely dry out or not have sufficient aquifer yields to support an irrigation bore(s) water supply for irrigation of POS throughout the year.

Given the unavailability of groundwater, the proposed irrigation water source is surface water and specifically the proposed source is the dam immediately to the north on the Wilyabrup watercourse. The dam was constructed in 2006, with the intention that it could be used as a secure, long-term water supply to meet irrigation requirements for the existing Cowaramup townsite and future development of public open space (DWER, pers. comm. 2022).

3.2 Potable water

3.2.1 Potable water supply

The development will be provided with a reticulated potable water supply. There are two existing water mains terminating at the site boundary in Roy Earl Drive and Duggan Drive. There are two existing DN 250 water distribution mains that traverse the site to the south-west border and to the north-east portion of the site (in proximity to the north-east POS).

It is understood that the water distribution mains on site will remain in place within the appropriate easements and proposed road reserves.

3.2.2 Education and information packages

The objective of the water supply for the development is to minimise the use of potable water, where potable water use is not essential. To achieve this objective, the proponent will provide education and information packages to each dwelling within the development that outline the importance of water efficiency and encourage the implementation of water saving initiatives. Emphasis will be placed on the mandatory requirement for all houses to have an under-eave rainwater tank (with slow-release outlets) to be plumbed into the home.

Packages will also include initiatives to minimise the use of fertilisers and promote the use of native plants in the garden to protect the water quality and conservation values of nearby waterways.

The sales office will be supplied with the above information packages to distribute to new and potential homebuyers.

3.2.3 Reticulated main sewer

Water Corporation operates a gravity sewerage network in the surrounding area of the site. The existing gravity sewerage network is located to the north-north-east, and west of the site. There is no existing sewerage pipe connection to the south and east of the site.

It should be noted that sewer stub lines have previously been extended across the site and there are three potential connection locations, i.e. two to the north-east border of the site (one is in proximity to Lions Drive) and to the west border of the site and in proximity to the Roy Earl Drive.

The existing reticulated potable water and gravity sewerage network locations is provided in the engineering services report in Appendix I.

4 STORMWATER MANAGEMENT

4.1 Stormwater drainage design

The stormwater drainage concepts have been completed by Stantec Engineers and RPS, respectively. The proposed post-development stormwater management concept is provided in Figure A at the rear of this report.

4.2 Small rainfall event drainage system

The stormwater drainage design endeavours to provide treatment of the small (15 mm) rainfall events as close to source as possible and at vegetated detention basins within POS areas. It should be noted that infiltration at source is not being actively pursued at this site due to the shallow perched nature of the groundwater system and the risk that presents to properties. The opportunity for stormwater treatment is limited by the level constraints and existing outlet infrastructure. Water quality treatment will be promoted via a vegetated conveyance swale along Wirring Road as well as the vegetated detention basins at Wirring Road, Roy Earl Drive and Waverley Road (Figure A), which will discharge offsite to rural land, existing drainage infrastructure and existing infrastructure including Duggan's Dam respectively.

4.2.1 Lot scale

Due to the likely clayey soils at the site, soak wells will not be used, and at-source infiltration will not be pursued. Instead, it will be a mandatory requirement for all homebuyers to install an under-eave rainwater tank with a storage capacity of at least 2,500 litres between the overflow and the slow-release pipe, to be plumbed into the home. On the larger lot product (R10) adjacent to Wirring Road and adjoining the rural landholding to the east (Figure A), these properties will be required to install rainwater tanks with minimum 5,000 L of storage available between the overflow and the slow-release pipe. All rainwater tanks will have a slow-release outlet to allow for the tank to drain out to allow capacity for the next rain event as described above. A S70A Notification will be imposed on titles regarding the need to comply with the rainwater tank requirement. Additionally, the developer will offer a rebate to lot purchasers for the purchase of rainwater tanks to further encourage compliance.

4.3 Minor and major event drainage system

4.3.1 Rural run-off management

Stormwater flows for the minor 20% and major 1% AEP events from the external rural catchment will be managed by creating a bund and preferential flow path at the rear of the lots on the site's eastern boundary. The rear of these easternmost lots will have a landscape buffer to the rural area and the bund and flow path will be within this landscape buffer. Run-off from the rural catchments (XA1 in Figure A) will flow north along the preferential flow path directly to the existing creek line and dam to the north, bypassing the existing and proposed developments. Run-off from the rural catchments XA2 (Figure A) will flow north along the preferential flow path and be captured and detained in the drainage basin within a POS reserve. Run-off detained in this drainage area will subsequently be piped to a drainage basin in the POS adjoining the Waverley Road drainage infrastructure and eventually into Duggan's Dam at pre-development flow rates (See Section 2.3.2). Run-off from rural catchment XC (Figure A) will be directed south along the constructed bund and preferential flow path to another detention basin within urban catchment C1. The run-off will subsequently be piped to the drainage basin in C2 and then discharge to the extended roadside swale and ultimately discharge to the rural property to the south of Wirring Road via an existing culvert under Wirring Road.

Catchment D will remaining relatively consistent with its existing vegetated condition with the retention of the large stand of trees. Run-off from this vegetated area will not be managed and will remain in its pre-development condition with some overland flow predicted to be travel in a north-westerly direction with the natural grade.

4.3.2 Subdivision drainage management

The proposed Structure Plan area has been divided into three main catchments that align with three proposed stormwater discharge locations. The proposed post-development catchments have been informed by a detailed feature survey, urban design, preliminary earthworks design, and the pre-development hydrological assessment including surface water modelling as described in Section 2.3.2. The proposed post-development catchments and sub-catchments are illustrated in Figure A at the rear of this report and relate to the existing infrastructure illustrated in Figure A.

Each catchment relates to a proposed discharge location as follows:

- **Catchment A**: relates to stormwater that has a discharge point into the existing Waverley Road and adjoining subdivision (Lakeview Estate). Lakeview Estate contains a DN450 stormwater pipe that has capacity to accept 0.20 m^3/s of flow from the site in the 20% AEP event (drainage details in Appendix C). Catchment A has been split into two sub-catchments with the aim to attenuate flows within the POS/drainage reserve in each of the sub-catchments. It is intended for water quality treatment to be provided within Basin A1; this allows flexibility in the landscape treatment of Basin A2 to meet landscape and amenity objectives. This catchment ultimately drains to the existing dam to the east of the site.
- **Catchment B**: relates to stormwater that will discharge to an existing basin in the POS and then through the 2 x DN600 culverts under Roy Earl Drive and into the existing swale through the existing Cowaramup town site (drainage details in Appendix D). The existing basin is proposed to be enlarged to provide a single consolidated basin with sufficient detention volume for the site. Discharge rates will be controlled via the existing culverts. Sub-catchment B1, B2, and B3 will all be graded to the Roy Earl drainage basin. There is opportunity for flows from these sub-catchments to be conveyed via a living stream in the POS to reduce pipe infrastructure; this will be investigated at the Urban Water Management Plan (UWMP) stage.
- **Catchment C**: relates to stormwater that will discharge through the existing DN300 culvert under Wirring Road. Catchment C is a heavily constrained catchment due to the natural grade of the site and the minimal existing infrastructure to allow for post-development stormwater management. Sub-catchment C1 will drain to an internal basin for attenuation before entering the piped street drainage and discharge into a basin in sub-catchment C2. Due to the natural grade of sub-catchment C3, runoff will flow overland into a roadside swale along Wirring Road. This roadside swale will take detained stormwater from catchment C1, C2 and C3 and detain and convey the stormwater to the existing DN300 culvert under Wirring Road.
- **Catchment D** is being retained as POS with no significant hardstand areas being proposed and will therefore maintain current pre-development flow conditions.

Figure A presents the preliminary design for these stormwater catchments. Post-development surface water modelling has been used to verify the preliminary earthworks, swale and basin design function appropriately and can achieve the detention of flows to pre-development flow rates and ensure appropriate protection of properties and infrastructure.

Assessment of the proposed stormwater management concepts have been undertaken using an XP-SWMM hydrological model. Details of this model is presented in Section 4.4 below.

4.3.3 Impacts on surface water ecosystems

There are no major surface water ecosystems within the site, however as discussed previously stormwater from the site will flow into neighbouring waterways and ultimately the Wilyabrup Brook. Based on the Stormwater Management Strategy, which adopts Water-Sensitive Urban Design (WSUD) principles and Best Management Practices (BMPs), including vegetating the drainage basins/swales and minimising export of stormwater off site during the common, more stormwater events, it is not envisaged that the development of the site will impact the water quality of these downstream waterways.

4.4 Key structural controls

4.4.1 Bund in landscape buffer

A low bund (less than 0.5 m high) built within the 10 m wide landscape buffer at the back of the eastern lots (shown in Appendix G) will ensure flows from external catchments XA1, XA2, and XC (Figure A) are directed either north to the dam or south to Wirring Road without flowing through the subdivision's residential lots and roads.

4.4.2 Basins/swales and outlet configurations

Basins and swales will provide attenuation of stormwater before it is discharged from site, to ensure flows are being controlled to pre-development flow rates and to protect downstream infrastructure from flooding. Table 5 summarises the key design concepts for each basin and swale (locations are shown in Figure A).

Table 5: Basin/swale details

Basin/swale	Design concept	Outlet configuration
Basin A1	Detain up to the 1% AEP event. Vegetated to provide treatment for the small rainfall event.	Outlet set at basin invert, with an overflow grate set at the 20% AEP top water level for overflow of events greater than the 20% AEP. To connect into existing DN450 pipe in Waverley Road.
Basin A2	Main basin detains up to the 20% AEP event. Larger events up to the 1% AEP will spill out across a larger tier. Treatment for the small rainfall event is intended to be provided in the downstream Basin A1.	Pipe outlet set at basin invert
Basin B4 (Roy Earl Dr basin)	Existing Roy Earl Dr basin to be enlarged to provide sufficient volume to detain up to the 1% AEP event. Vegetated to provide treatment for the small rainfall event.	Existing 2 × DN600 culverts
Basin C1	Detain up to the 1% AEP event. Vegetated to provide treatment for the small rainfall event.	Pipe outlet set at basin invert
Basin C2	Detain up to the 1% AEP event. Vegetated to provide treatment for the small rainfall event.	Piped outlet set at basin invert, with a spillway into the Wirring Rd swale for the 1% AEP event.
Wirring Rd swale	To convey and detain up to the 20% AEP event. Will provide some detention for the 1% AEP event, however, has been designed to overtop Wirring Rd as in pre-development conditions. Proposed to have 2 m base width and 1:4 side slopes.	Existing DN300 culvert for the 20% AEP event. Will overtop Wirring Road in the 1% AEP event.

4.5 Surface water modelling

RPS has developed a hydrological model in XP-SWMM for the external rural catchments and the proposed subdivision. The XP-SWMM modelling has been used to simulate the 20% and 1% AEP external catchment inflows to ensure that the proposed drainage infrastructure is appropriately designed to accommodate these major events, as well as assess the on-site drainage design and the requirement to manage post-development flow rates to be within the pre-development flow rates and ensure the risk to infrastructure and downstream properties is not increased.

4.5.1 Modelling parameters

The infiltration loss parameters adopted in the model have been summarised in Table 6.

Table 6: Infiltration loss parameters

Parameters	Adopted value	Notes
Rural	IL – 20 mm CL – 4.9 mm Manning's n – 0.073	Initial and continuing loss rates from ARR 2016 Data Hub (reduced to account for storm pre-bursts not being included).
Lot roofs	IL – 7.4 mm CL – 0 mm Manning's n – 0.015	Assumed to be 50% of all non-R10 lot area. All lots to have rainwater tanks with 2,500 L of storage between the overflow and slow-release pipe.
R10 lot roofs	IL – 11.5 mm CL – 0 mm Manning's n – 0.015	Assumed to be 40% of R10 lots. R10 lots to have rainwater tanks with 5,000L of storage between the overflow and slow-release pipe.
Lot yards	IL – 0 mm CL – 40% Manning's n – 0.5	Assumed to be 50% to 60% of lot area.
Road reserve	IL – 1 mm CL – 1.9 mm Manning's n – 0.02	Continuing loss is based on a 40% pervious area and 0.08 m/day permeability.
Public Open Space (POS) & Public Access Walkway (PAW)	IL – 20 mm CL – 4.9 mm Manning's n – 0.03	Initial (excluding pre-burst) and continuing loss rates from ARR 2016 Data Hub.
Drainage basins	IL – 2.8 mm CL – 0 mm Manning's n – 0.012	A standardised loss factor of 0.14 has been applied to an IL of 20 mm to estimate the reduced IL in the wettest catchment condition (ARR 2016).

* IL: Initial loss, CL: Continuing loss

The post-development land use areas assumed in the model are shown in Figure A at the rear of the report and catchment areas are summarised in Table 7.

Table 7: Modelled land use areas (hectares)

Sub-catchment	Lots	R10 lots	Road	POS & PAW	Drainage	Rural	Total
A1	4.398	1.264	1.921	-	0.415	-	7.999
A2	4.208	1.411	1.672	1.262	-	-	8.553
B1	1.634	0.305	1.091	0.681	-	-	3.710
B2	4.139	-	2.044	0.594	0.000	-	6.778
B3	3.811	0.726	1.217	0.178	-	-	5.932
B4	1.620	-	0.295	-	0.206	-	2.121
C1	0.001	0.911	0.290	-	0.149	-	1.352
C2	1.273	0.000	0.499	-	0.131	-	1.903
C3	-	0.856	-	-	-	-	0.856
D	-	-	-	1.636	-	-	1.636
External catchments							
XA1						4.994	4.994
XA2						3.508	3.516
XC						3.709	3.710

4.5.2 Modelling results

The post-development drainage basin modelling results are presented in Table 8 and are associated with the post-development catchments illustrated on Figure A.

Table 8: Drainage basin modelling results

Catchment	A1	A2	B	C1	C2
Basin details					
Base invert (mAHD)	131.20	136.20	131.87	135.60	134.84
Base area (m^2)	1100	1200	1400	420	434
Flood tier invert (mAHD)	-	136.90	-	-	-
Flood tier area (m^2)	-	3840	-	-	-
Side slopes	1:6	1:6	1:6	1:6	1:6
Outlet invert (mAHD)	131.20	136.20	131.87	135.60	134.84
Outlet size (mm)	Ø380 orifice plate	Ø300	2x Ø600	Ø375*	300 x 300 box culvert
1% AEP spillway/overflow invert (mAHD)	132.00	-	-	-	135.24
15 mm (~1 EY 25 min)					
Max depth (m)	0.31	0.22	0.35	0.11	0.18
Top water level elevation (mAHD)	131.51	136.42	132.22	135.71	135.02
Inundation area (m^2)	1553	1500	1728	483	539
Storage volume (m^3)	404	294	544	49	90
20% AEP					
Critical duration (hours)	4.5	3	0.5	4.5	1.5
Max depth (m)	0.79	0.60	0.54	0.25	0.34
Top water level elevation (mAHD)	131.99	136.80	132.41	135.85	135.18
Inundation area (m^2)	2324	2054	1928	570	636
Storage volume (m^3)	1338	967	903	123	182
Peak outflow (m^3/s)	0.20	0.15	0.96	0.09	0.12
1% AEP					
Critical duration (hours)	4.5	3	0.75	3	1.5
Max depth (m)	1.20	1.01	1.05	0.97	0.53
Top water level elevation (mAHD)	132.40	137.21	132.92	136.57	135.37
Inundation area (m^2)	3027	4945	2469	1106	760
Storage volume (m^3)	2426	2773	2017	722	311
Peak outflow (m^3/s)	0.38	0.21	1.54	0.15	0.36

4.5.3 Rainwater tank risk analysis

The stormwater management strategy includes the use of rainwater tanks on all residential lots to assist in managing rainfall events at-source. Rainwater tanks are to be fitted with a slow-release outlet to allow water to drain out to free up capacity to capture the next rain event. An overflow pipe will allow flows exceeding the capacity of the rainwater tank to enter the street drainage system.

A risk analysis was undertaken to assess the impacts on the subdivision's drainage system if rainwater tanks on private lots were not installed or non-compliant (i.e. if the slow-release outlet that ensures the tank empties for the next rain event were removed or blocked).

The following scenario was modelled:

- 90% of R10 lots will have rainwater tanks with a slow-release outlet which will allow a minimum capacity of 5,000 L to empty after a rain event (compliant)
- 90% of non-R10 lots will have rainwater tanks with a slow-release outlet which will allow a minimum capacity of 2,500 L to empty after a rain event (compliant)

- 10% of all lots assumed to have only 600 L capacity in rainwater tanks for capturing rainfall (non-compliant). This is based on the slow-release outlet being removed or blocked, and an estimated daily household water consumption of 0.6 m^3/day.

The impact of a 10% non-compliance in rainwater tank requirements is summarised in Table 9. There is generally minimal impact on the drainage basins. Maximum water depths only increased by 1 cm and there is generally no change in the peak discharge rates. The greatest impact to storage volumes was for the small 15 mm event (a maximum 5% increase), which does not pose a risk to the development. Storage volumes in the 20% and 1% AEP events only increased by a maximum of 2%.

Table 9: Drainage impact of 10% non-compliance in rainwater tanks

Basin	A1	A2	B	C1	C2
15 mm (~1 EY 25 min)					
Change in depth (Δm)	0.01	0.01	0.01	0	0
Change in storage volume (Δm^3)	16	14	16	2	0
Change in storage volume (%)	4%	5%	3%	4%	0%
20% AEP					
Change in depth (Δm)	0.01	0	0.01	0	0
Change in storage volume (Δm^3)	10	6	18	1	2
Change in storage volume (%)	1%	1%	2%	1%	1%
Change in peak outflow (m^3/s)	0	0	0.01	0	0
1% AEP					
Change in depth (Δm)	0	0	0.01	0	0
Change in storage volume (Δm^3)	8	9	19	-1	1
Change in storage volume (%)	0%	0%	1%	0%	0%
Change in peak outflow (m^3/s)	0	0	0	0	0

4.6 Pre- and post-development flows

Revised pre-development flows are presented in Section 2.3.2. As a detailed feature survey was not available when the downstream developments were built, design of the downstream drainage infrastructure was based on coarse topographical data available at the time. There are some modest changes in the revised pre-development flow rates compared to previous assessments. Discharge from the site is therefore constrained by the existing infrastructure. Flow rates from the site allowed by the downstream infrastructure are summarised in Table 3 in Section 2.3.2.

Due to these constraints, discharge rates have been rebalanced across the site, with some catchments discharging less and others discharging more compared to predevelopment flow rates. Post-development 1% AEP peak flow rates are less than pre-development 1% AEP peak flow rates at the discharge points at Waverley Road (0.70 m^3/s vs 0.99 m^3/s respectively) and Wirring Road (0.36 m^3/s vs 0.54 m^3/s respectively. The 1% AEP peak flow rate at Roy Earl Drive is higher in the post-development scenario (1.57 m^3/s) than in the pre-development scenario (0.75 m^3/s), however this includes flow diverted from the site's other constrained catchments and external flow from the existing Country Vines estate to the west (0.29 m^3/s). Additionally, the existing Roy Earl Drive basin outlet was designed and sized as part of the Country Vines development which also provides further attenuation downstream via a swale and detention basin prior to discharge under Bussell Highway.

The post-development modelled flow rates at each discharge point are provided in Table 10 below.

Table 10: Post-development catchment flows

Catchments Discharge point	A Waverley Road	XA1^ Duggan's Dam	B Roy Earl Drive	C Wirring Road
20% AEP critical duration (hours)	3	3	0.5	1.5
20% AEP peak flow (m^3/s)	0.20	0.09	0.96#	0.12
1% AEP critical duration (hours)	2	2	1	1.5
1% AEP peak flow (m^3/s)	0.38^	0.32^	1.54#	0.36*

^ Catchment XA1 is an external catchment with an off-site discharge point. It has been included to allow comparison to the pre-development flow rates. The combined 1% AEP discharge from Catchments A and XA1 is 0.70 m^3/s, less than the equivalent pre-development Catchment 1 flow rate of 0.99 m^3/s.

Includes flow from an external catchment downstream of the site

* 0.15 m^3/s through existing culvert under Wirring Rd and 0.21 m^3/s will overtop Wirring Rd

4.7 Non-structural controls

4.7.1 Landscaping and fertiliser applications

Educational material will be distributed to all new homeowners to emphasise the importance of appropriate fertiliser application and encourage current best practice to minimise stormwater run-off pollutants at the lot scale.

The landscaping vision for the development is to retain and blend the site into the natural vegetated surroundings. As such, landscaped areas predominantly comprise of native endemic plant species and minimal turf. Minimal to no fertiliser application at the precinct scale will therefore be required. Any fertiliser application will utilise phosphate free products and be applied by manual methods to increase control and prevent overapplication.

4.7.2 Vegetation

The conveyance swale on Wirring Road and detention basins will incorporate native rushes and sedges to help prevent erosion, restrict flows and remove pollutants, particularly nutrients.

A list of species and proposed planting densities to be used in the drainage areas will be provided within a subsequent UWMP and landscape plans. Consultation with the AMRS regarding site specific species and landscape designs will be undertaken by a suitably qualified landscape architect concurrent with the UWMP assessment.

5 GROUNDWATER MANAGEMENT

Site specific groundwater level data combined with the geotechnical investigation indicates that there is localised groundwater perching across the site. The groundwater level is therefore assumed to be at the top of any impermeable clay layer, with levels rapidly rising in response to winter rainfall, making some areas of the site susceptible to groundwater inundation.

A combination of the following design mechanisms is proposed to eliminate the risk of potential groundwater inundation and protect the structural integrity of infrastructure:

- Inter-allotment drainage for all lots is to be provided, which will enable excess roof run-off to connect into a free-flowing outlet and reduce point recharge of the upper granular soil layer and water table within lots.
- Subsoil drainage will be installed within road reserves and along some lot boundaries to control any groundwater level rise to the perched aquifer recharging in response to rainfall. Subsoils will discharge into the drainage basins prior to discharge to the environment.

Further assessments will be conducted as part of the detailed design phase to ascertain which areas of the site may require the installation of subsoil drainage to ensure the timely removal of groundwater from this perched layer.

5.1 Groundwater quality

The dominant hydrological regime at the site is characterised by overland flow. Rainfall run-off will be captured in vegetated detention basins and swales and is likely to infiltrate into the surficial soils above the clay. Infiltrated stormwater will receive some form of treatment via the strong ability of the clayey soil to adsorb phosphorus both in the basins and in the underlying soils and sediments.

Non-structural controls such as minimising fertiliser and pesticide application and maintaining well-established vegetation in drainage areas will also assist in groundwater quality protection.

Considering the above factors, the development does not pose a risk to groundwater quality underlying the site. Therefore, no post-development groundwater quality monitoring is proposed for this site.

6 MONITORING AND REPORTING

6.1 Pre-development

As previously discussed in Section 2.3.3.1 DWER and the AMRS have confirmed that they are satisfied with the groundwater/geotechnical investigations to enable an informed decision regarding groundwater management at the site. Consequently, no further pre-development groundwater level monitoring is required.

6.2 Post-development

As has been previously documented, the pre-development bores are to be removed by the current landowner and the Shire and DWER have indicated their support for this. The perched nature of the groundwater beneath the site indicates that it is not a groundwater resource that has nearby users from a water supply perspective and there are no local Groundwater Dependent Ecosystems that will be impacted by changes in perched groundwater quality aside from the springs and dam to the north adjacent to the Waverley subdivision that is already subject to post-development monitoring. Therefore, no post-development groundwater quality monitoring is proposed for this site.

The stormwater drainage system encourages the collection of stormwater at source and incorporates a series of vegetated drainage basins/swales that will allow for adequate sediment control and water quality treatment prior to water leaving the site, therefore post-development surface water monitoring is also not deemed necessary.

Visual inspection of the drainage basins/swales and designated discharge points will be carried out on a routine basis during both summer and winter months to ensure that the drainage system is functioning as per the design.

7 IMPLEMENTATION

The effectiveness of this LWMS will rely on the system's regular maintenance. The operation and maintenance program is proposed in Table 11 below.

Table 11: Roles and responsibilities

Principles	Role	Responsibility	Time-scale
Subdivision management	UWMP preparation	The proponent	Following subdivision application. DWER has recommended that the UWMP covers the entire structure plan area.
	Construction and site works management	The proponent	As required during construction until hand over to the AMRS.
	Waste and pollution management	The proponent	As required during construction until hand over to the AMRS.
	Erosion control	The proponent	As required during construction
POS and landscaped community areas	Maintenance of drainage infrastructure	The proponent	As specified within the POS design documentation until hand over to the AMRS.
	Fertiliser application	The proponent	As specified within the POS design documentation until hand over to the AMRS.
	Irrigation systems	The proponent	As specified within the POS design documentation until hand over to the AMRS.
Subsoil drainage system	Maintenance of subsoil drainage in road reserves	The proponent	Subsoil drainage system will be inspected prior to handover to the AMRS and flushed as required. To be maintained by AMRS thereafter.
	Maintenance of subsoil drainage on private property	Land owner	On purchase of lot.

8 REFERENCE

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LOCAL WATER MANAGEMENT STRATEGY ADDENDUM – LOT 500 WIRRING ROAD, COWARAMUP

1 INTRODUCTION

Yolk Property Group (the proponent), propose to develop Lot 500 Wirring Road, Cowaramup (herein referred to as 'the site'), for residential purposes. The site is approximately 40.84 ha and is approximately 1 km southeast of the Cowaramup town centre, within the Shire of Augusta Margaret River (SAMR). The site is bounded by Waverley Road to the northeast, existing residential development to the northwest, existing rural land to the southeast and Wirring Road to the southwest.

Development of the site has to date been guided by the currently approved local structure plan (LSP), provided in **Attachment A**. This LSP was supported by a local water management strategy (LWMS) prepared by RPS in 2023 (RPS 2023) which has been endorsed by the SAMR and the Department of Water and Environmental Regulation (DWER). The proponent is seeking to amend the approved LSP to incorporate a revised layout across the site which includes residential, retirement living and public open space land uses. The (proposed) amended LSP is provided in **Attachment B.**

The purpose of this LWMS Addendum is to summarise the implications to water management across the site resulting from the LSP amendment, and to demonstrate that the water management criteria approved in the LWMS can still be achieved. This addendum should be read in conjunction with the approved LWMS.

2 PROPOSED AMENDMENTS TO THE LSP

The proposed land uses detailed in the amended LSP include sporting facilities and clubrooms, public open space (POS), road reserve and residential lots (R10, R15/20 and R60). A summary of the land use areas within the proposed LSP are summarised in **Table 1** and shown in **Attachment B**.

Table 1: Summary of land use areas within the proposed local structure plan

Area (ha)	Approved LSP area (ha)	Proposed LSP area (ha)	Variance (ha)
Road reserve	9.03	8.13	-0.90
Residential lots (R10)	5.47	4.55	-0.92
Residential lots (R15/20)	19.73	10.97	-8.67
Residential lots (R60)	1.35	6.10	+4.75
Public open space	5.25	9.75	+4.50
Sports precinct	-	1.33	+1.33
Total	40.84	40.84	-

The major variance is the increase of the high-density residential lots (R60) and POS area and the reduction of the standard residential R15/20 lots. This change has resulted in an increase in runoff in catchment B due to the lot assumption that the high density lots will provide no stormwater lot retention and discharge directly into the stormwater network. The stormwater management

strategy detailed below further discusses how this will be managed and achieve the previously accepted criteria.

The north eastern portion of the LSP (stage 1) has received conditional subdivision approval (Western Australian Planning Commission reference 200656) and encompasses a portion of the LSP amendment area as shown in **Figure 1**. Water management designs and measures for this subdivision approval area are detailed in the Lot 500 Wirring Road, Cowaramup – Stage 1 Urban Water Management Plan (UWMP) (Emerge Associates 2024).

3 WATER MANAGEMENT OBJECTIVES

The water management objectives for the site are detailed in the approved LWMS (RPS 2023) and the Lot 500 Wirring Road, Cowaramup – Stage 1 UWMP (Emerge Associates 2024) as described above. The design criteria are not proposed to be modified in this LWMS Addendum and therefore this LWMS Addendum presents an assessment of updated spatial requirements for surface water management within the development.

4 STORMWATER MANAGEMENT STRATEGY AND DESIGN CRITERIA

The principle behind the stormwater management strategy is to ensure that the pre-development hydrology of the site is maintained, on the basis that post-development peak flow rates and discharge locations are consistent with the pre-development environment. This will be achieved by ensuring runoff is first treated as close to the source as possible by the use of a treatment train approach (i.e. treatment through interaction with vegetation within the flood storage areas (FSAs) and then runoff up to a 1% AEP rainfall event will also be detained within the FSAs before discharging off site at flow rates which mimic the existing hydrology.

Surface water runoff modelling using XPSWMM was completed to support the original LSP, and this has been updated to incorporate the proposed amendments to demonstrate that the revised LSP can still meet the requirements of the stormwater management strategy for the site. The results of the modelling and resulting size of stormwater assets are illustrated in **Figure 2**, and within the Modelling Assumptions Report provided in **Attachment C**.

The water sensitive urban design (WSUD) measures proposed to achieve the stormwater management strategy include:

- Rainwater tanks (RWTs)
- Vegetated swales
- Bio-retention areas (BRAs)
- FSAs/detention basins.

These features are consistent with the LWMS (RPS 2023) and collectively, they will ensure that the stormwater management objectives will be achieved.

Due to the low infiltration capacity across the majority of the parental soils identified within the site, at-lot infiltration will not be mandated. Rather, the requirement is for lot owners to install under-eave RWTs with a storage capacity of at least 2,500 L for standard sized lots and minimum 5,000 L for larger (R10) lots. These will need to achieve a dedicated air space between the overflow and the slow-release pipe. Additional capacity may be plumbed into the house to supplement non-potable needs.

An appropriate level of fill will also be implemented to ensure that lots have the intended functionality. This will be supported by lot connection pits, which will convey runoff into the road drainage network. Lot connections will be designed to comply with the SAMR policy for stormwater management (SAMR 2023) and these will be implemented by the proponent as part of subdivision works. Runoff from lots and roads will then be conveyed to the nearest downstream WSUD measure/feature where it will be treated and detained prior to discharging offsite.

The road drainage network has been sized to convey runoff up to the 20% event, thereby ensuring roads remain passable in storm events up to the 20% AEP event. In events greater than the 20% event and up to the 1% AEP event, runoff will be conveyed by the pipe network and road pavement to the downstream BRAs/FSAs where detention will be provided. The BRAs will be vegetated at the base to provide treatment through the interaction with vegetation known for nutrient uptake and contact with soils. Outlets will be installed at the inverts of the BRAs to provide conveyance downstream and to discharge stormwater off site at rates equal to or lower than the capacity of the allowable downstream infrastructure. The outlets installed at the inverts of the basin will allow stormwater to drain between storm events in order to avoid creating mosquito habitat. It is noted that an overall design requirement for open spaces (including BRAs/FSAs) is that any unirrigated turfed areas are no steeper than 1:6.

The depths, top water level areas (TWLs) and storage volumes required are summarised in **Table 2**, with catchment boundaries and indicative locations of proposed stormwater infrastructure illustrated in **Figure 2** which demonstrates that the assigned land has capacity to manage these events up to the 1% AEP event.

Table 2: Stormwater runoff detention requirements

Catchment	Storage type	Small event (15 mm)			Minor event (2% AEP)			Major event (1% AEP)		
		Depth (m)	TWL surface area (m^2)	Volume retained (m^3)	Depth (m)	TWL surface area (m^2)	Volume retained (m^3)	Depth (m)	TWL surface area (m^2)	Volume retained (m^3)
A	A1.2 – FSA	0.27	347	77	0.57	496	205	1.19	880	623
	A1.4 – FSA	0.16	819	122	0.55	1,109	497	1.07	1,560	1,183
	A1.5 – FSA	0.19	168	27	0.99	510	286	1.00	515	290
	A2.1 – FSA	0.13	2,048	257	0.48	2,449	1,048	1.19	3,359	3,088
	A2.1 – FSA 2	0.11	647	66	0.28	760	190	1.19	1,474	1,180
	A2.2 – FSA	0.04	551	22	0.57	888	397	1.18	1,383	1,091
	A2.3 – BRA	0.16	1,307	204	0.33	1,406	432	0.49	1,504	666
B	B1.2 – FSA	0.36	2,237	730	0.65	2,586	1,445	1.20	3,295	3,044
	B1.3 – FSA	0.22	402	76	0.65	636	298	1.19	1,007	739
	B1.4 – BRA	0.13	1,914	244	0.22	1,975	410	0.49	2,175	982
C	C1.1 – Swale	*0.12 - 0.17	**65	15	*0.17 - 0.72	**385	250	*0.41 - 0.95	**890	770
	C1.2 - FSA	0.38	92	21	0.77	204	77	1.20	380	200

**C1.1 – Swale includes weirs and therefore has varying flood depths at different points along the structure.*

***C.1.1 – Swale TWLs have been approximated and will be revised in future UWMPs which will include a detailed design of the structure.*

The ultimate location and configuration of the WSUD features will be confirmed at detailed design stage and presented in future UWMP documents, or via minor updates to the relevant UWMPs where these already exist.

The updated modelling demonstrates the post-development peak discharge rates from the site do not exceed the allowable flow rates provided by downstream infrastructure during the 20% AEP event as shown in **Table 3**.

Table 3: Existing infrastructure 20% AEP outflow rates vs post-development peak outflow rates

Outflow	Infrastructure capacity 20 % AEP event (m^3/s)	Post-development flow rate during 20 % AEP event (m^3/s)
Outflow 1	0.20	0.20
Outflow 2	0.03*	0.03
Outflow 3	1.6	1.09
Outflow 4	0.12	0.11

** Estimated capacity*

Whilst the post-development peak flow at Outflow 2 is compared to an *estimate of outflow pipe capacity, it is a reasonable approach given that the pipe already services the relevant portion of Waverley Road, and individual lots will provide more at-lot retention than currently occurs via the use of RWTs with dedicated air space.

As described in the LWMS (RPS 2023), discharge locations from the site should be consistent with the pre-development environment and the pre-development drainage of the SP area has three key discharge locations. The runoff from catchment A discharges into the roadside swale along Waverley Road which is directed into the existing adjacent development drainage via a bubble in pit and ultimately discharging into the dam (Wilyabrup Brook) located in Symphony Waters Estate. As part of the design of Stage 1, the stormwater discharge regime adopted is consistent with the existing pre-development location. The existing roadside swale along Waverley Road will be replaced with an underground pit and pipe network to convey runoff from A1.2 – FSA and A1.5 – FSA into the existing DN450 stormwater pipe infrastructure. Pre-development runoff from Catchment B discharges into the existing basin located adjacent to Roy Earl Drive and has remained consistent with the LWMS addendum; this requires a slight increase in the basin size to accommodate the additional runoff from this catchment. Pre-development runoff from Catchment C discharges into a roadside swale along Wirring Road and through an existing 300 mm diameter culvert which allows the flows to discharge into the adjacent southern lot as per existing conditions.

Upstream flows that enter the site have been considered and provided with flow pathways to ensure the runoff is adequately managed within the development and consistent with the pre-development flow pathways. Two upstream catchments (XA1 and XA2) have been identified upstream of Catchment A and flow downstream towards Waverley Road. Catchment XA1 is proposed to be bunded along the south eastern boundary to ensure the runoff does not enter private lots within Stage 1 but still ultimately discharges towards the dam (Wilyabrup Brook). Runoff from Catchment XA2 has been assumed to enter Catchment A2 where it will be directed and detained in the FSAs and ultimately discharging towards the dam (Wilyabrup Brook). Runoff from Catchment XC will be directed towards the proposed C1.1 – Swale where the stormwater will be treated and detained before flowing downstream towards Wirring Road. Runoff from Catchment XB is currently directed to the existing basin located on the corner of Noreuil Circuit and Roy Earl Drive and will be resized and reshaped to accommodate the additional runoff from Catchment B.

5 SUMMARY AND CLOSING

This LWMS Addendum has demonstrated that the proposed LSP is capable of achieving the water management objectives for the site and has assessed the conceptual stormwater management approach under the proposed layout.

Future stages of the development will require Urban Water Management Plans (UWMPs) and detailed civil designs which will include WSUD feature specifications and these will be supported by landscape concepts demonstrating the design intent. These will be prepared in accordance with Better Urban Water Management and relevant Shire of Augusta-Margaret River policies and guidelines.

Should you have any queries or concerns regarding any of the content of this LWMS Addendum please do not hesitate to contact the undersigned.

Yours sincerely,



David Coremans
DIRECTOR, PRINCIPAL ENVIRONMENTAL CONSULTANT – HYDROLOGY TEAM LEADER

cc: Sheldon Day, Yolk Property Group
Tao Burton, Yolk Property Group

Encl: **Figure 1:** Site Location
Figure 2: Stormwater Management Strategy
Attachment A: Existing Local Structure Plan
Attachment B: Proposed Local Structure Plan
Attachment C: Modelling Assumptions Report

General References

Emerge Associates 2024, Wirring Road, Cowaramup – Stage 1 Urban Water Management Plan, EP24-092(03)—JSD Stage 1 UWMP.

RPS 2023, Local Water Management Strategy Lot 500 Wirring Road, Cowaramup

Figures

Figure 1: Site Locality

Figure 2: Stormwater Management Strategy

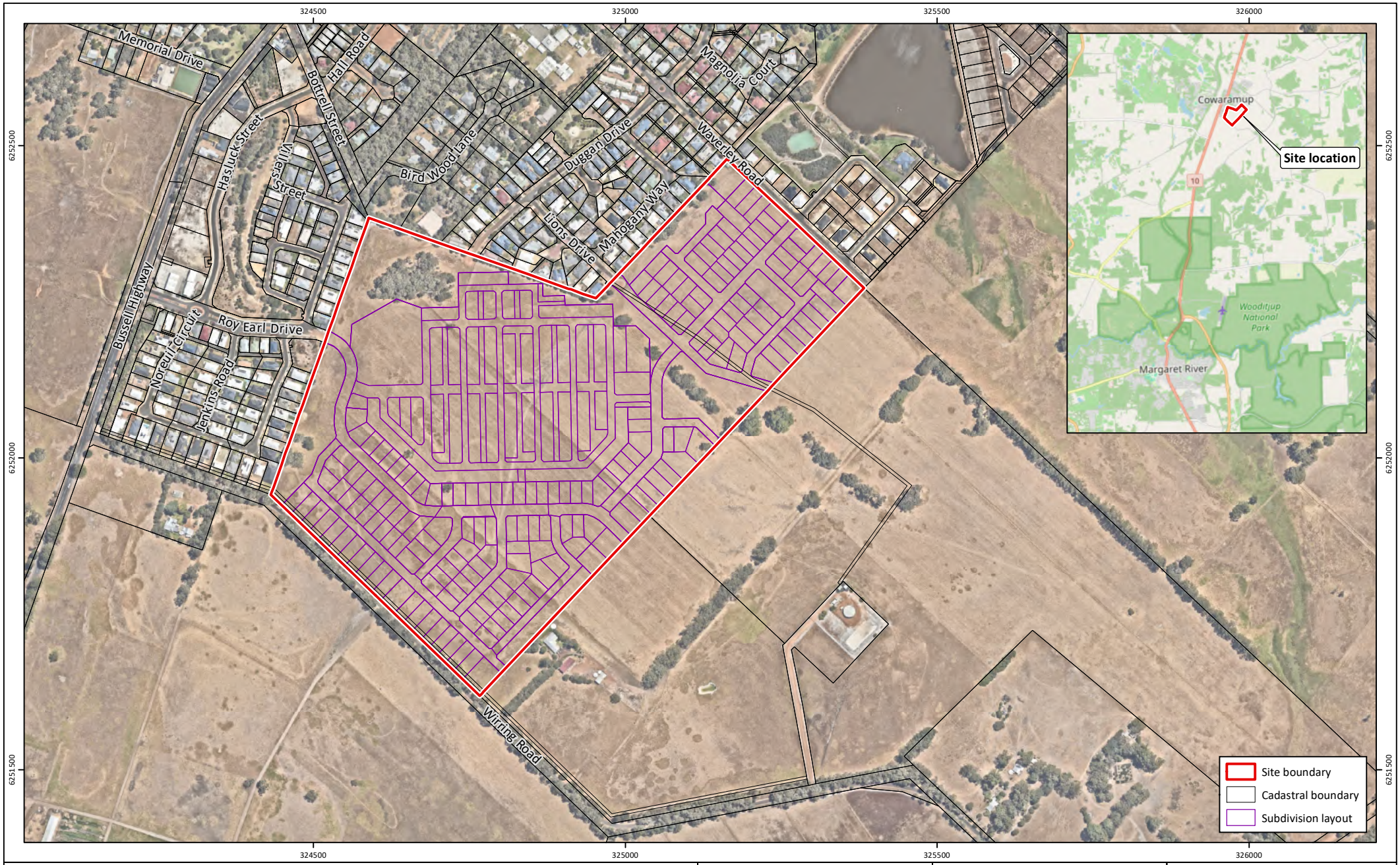


Figure 1: Site Location

Project:	Local Water Management Strategy Addendum Lot 500 Wirring Road, Cowaramup
Client:	Yolk Property Group

Plan Number:
EP24-092(06)--F16a

Drawn:	GAR
Date:	10/12/2024
Checked:	JSD
Approved:	DPC
Date:	17/12/2024

N

0 125 250
Metres

Scale: 1:8,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
©Landgate (2024). Nearmap Imagery date: 01/02/2024

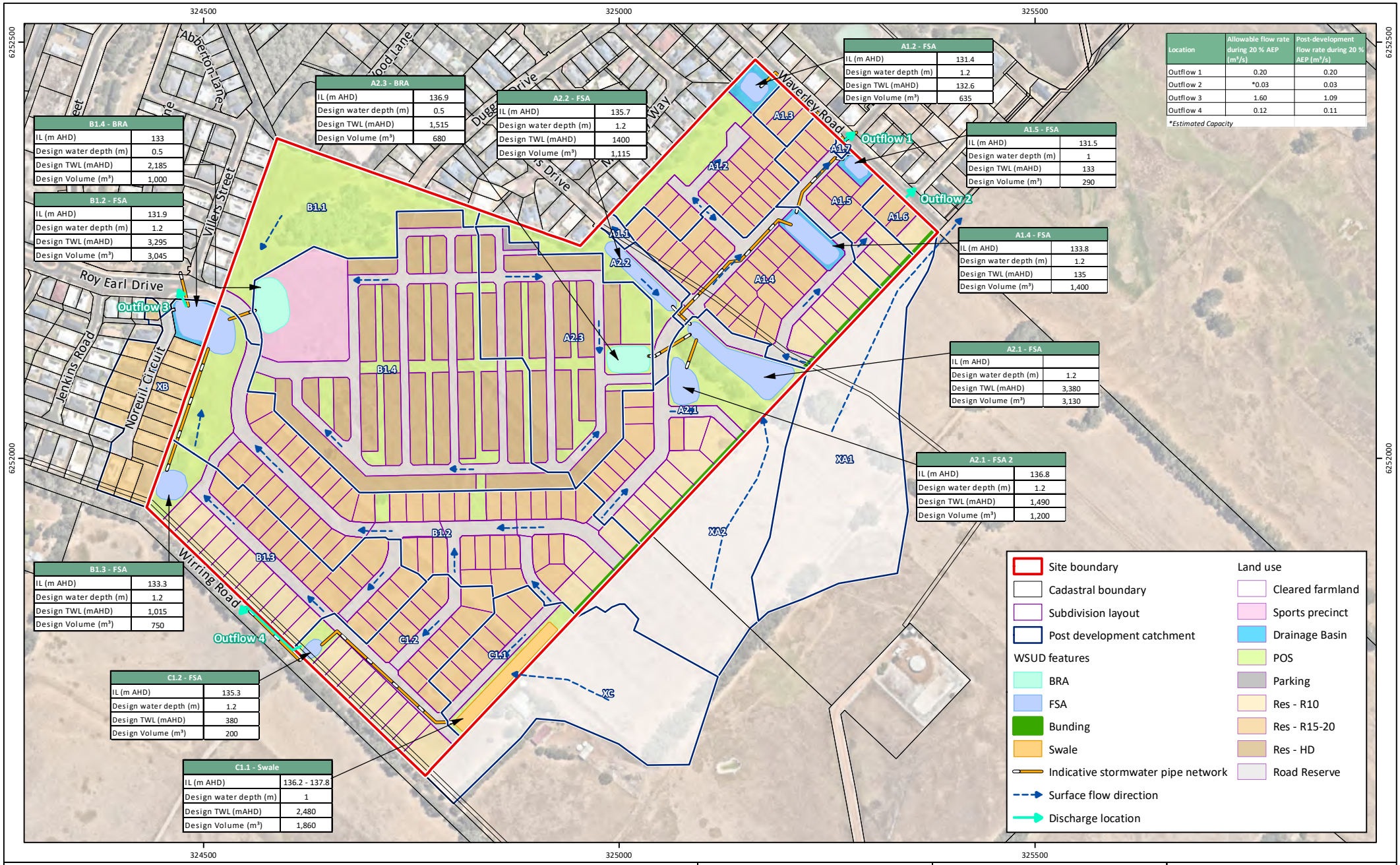


Figure 2: Stormwater Management Strategy

Project: Local Water Management Strategy Addendum
Lot 500 Wirring Road, Cowaramup

Client: Yolk Property Group

Plan Number:
EP24-092(06)--F17a
Drawn: GAR
Date: 10/12/2024
Checked: JSD
Approved: DPC
Date: 17/12/2024

N

0 100 200
Metres
Scale: 1:6,000@A4
GDA2020 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
©Landgate (2024). Nearmap Imagery date: 01/02/2024

Attachment A

Existing Local Structure Plan



STRUCTURE PLAN MAP (PLAN 1)

LOT 500 WIRRING ROAD
COWARAMUP

N

0 100 m

SCALE @ A3: 1:4000

9449-LSP-01-I

DRAWN: VR
DATE CREATED: 2024.06.28
PROJECTION: MGA50 GDA94
CADASTRE: LANDGATE
SURVEY: SURVEY SOUTH - 28/03/22
AERIAL: 15/10/2021

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ROWE GROUP DESIGN

Attachment B

Proposed Local Structure Plan



N

24001002C

0m 50 100 200

COWARAMUP - CONCEPT PLAN

Lot 500 Wirring Road, Cowaramup

Project YOLHA 24001002DLL | Scale 1:4000 @ A3 | Date: 13 Nov 2024

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Attachment C

Modelling Assumptions Report

Modelling Assumptions Report

LWMS Addendum - Lot 500 Wirring Road, Cowaramup

Project No: EP24-092(06)

Prepared for Yolk Property Group
December 2024



Document Control

Doc name:	Modelling Assumptions Report LWMS Addendum - Lot 500 Wirring Road, Cowaramup				
Doc no.:	EP24-092(06)--006				
Version	**Date**	**Author**		**Reviewer**	
1	December 2024	Jarrod Diermajer	JSD	Dave Coremans	DPC
	Prepared to support the LWMS Addendum				

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Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
AR& R	Australian Rainfall and Runoff
BOM	Bureau of Meteorology

Table A2: Abbreviations – General terms

General terms	
AEP	Annual exceedance probability
AHD	Australian height datum
ARI	Average recurrence interval
CL	Continuing loss
IFD	Intensity, frequency and duration
IL	Initial loss
UWMP	Urban Water Management Plan

Table A3: Abbreviations – units of measurement

Units of measurement	
ha	Hectare
m	Metre
m AHD	Metres in relation to the Australian height datum
m/day	Metres per day
m^2	Square metre
m^3	Cubic metre
m^3/s	Cubic metre per second
mm	Millimetre
mm/hr	Millimetres per hour
%	Percentage

Table A4: Terminology - design rainfall

Equivalent average recurrence interval (ARI) terminology	Average exceedance probability (AEP) terminology utilised
1 in 1 year ARI event	63.2% AEP event
1 in 5 year ARI event	20% AEP event
1 in 100 ARI event	1% AEP event

1 Purpose of Report

This report provides a summary of the detailed hydrological and hydraulic modelling that was undertaken to inform the Lot 500 Wirring Road, Cowaramup Local Water Management Strategy (LWMS) addendum and to support the Stage 1 Urban Water Management Plan (UWMP) and future UWMPs. The LWMS addendum demonstrates that the development is capable of managing the detention requirements for up to the major (1% annual exceedance probability (AEP)) rainfall event whilst not exceeding the pre-development outflows.

The development is approximately 40.84 ha in size and is approximately 1 km southeast of the Cowaramup town centre, within the Shire of Augusta Margaret River (SAMR). The development is bounded by Waverley Road to the northeast, existing residential development to the northwest, existing rural land to the southeast and Wirring Road to the southwest.

2 Methodology.

XPSWMM hydrological and hydraulic modelling software was used to calculate the surface water runoff volumes generated within the existing environment and post-development scenario. The hydrological component of the software uses the Laurenson non-linear runoff-routing method to simulate runoff from design storm events. Key assumptions regarding the hydrological model include:

- Runoff is proportional to slope, area, infiltration and percentage imperviousness of a catchment.
- Sub-catchment areas and slopes are determined from surveyed topographical data and earthworks plans.
- Infiltration rates and percentage imperviousness have been selected based on experience with model preparation for similar soil conditions.

Runoff from each sub-catchment is routed through the catchment using the hydraulic component of XPSWMM. Generally, assumptions associated with the hydraulic component of the model include:

- Virtual links (i.e. purely for model construction, not equivalent to flow path onsite) between nodes within a sub-catchment are given a length of 10 m and slope of 0.05 to minimise the lag time of conveying the water from a sub-catchment node to a 'storage' node, a 'dummy intermediate' node or a conduit/link.
- Links between sub-catchment storages act as conveyance channels (e.g. sheet flow within roads in a 1% average exceedance probability (AEP) event). These links are given lengths and slopes that are representative of the site conditions and actual pathway lengths between catchments.
- All channels are designed with a width of 5 m, roughness of 0.015 (Manning's n) and are trapezoidal in shape. This allows for easy conveyance and represents concrete pipes and road surfaces within the model.
- Where relevant, bio-retention areas (BRAs), and flood storage areas (FSAs) are modelled as nodal-reservoirs with infiltration depth-rating curves to account for differential infiltration rates with changing depth.

2.1 Rainfall

The ensemble temporal patterns obtained from the Australian Rainfall and Runoff (AR&R) Data Hub (AR&R 2019) were used for the rainfall analysis.

Up to eight durations ranging between 1 hour and 72 hours were tested, with the peak flood elevation and/or peak flow rate being assessed as the determining result.

Following the process suggested by AR&R (Ball J *et al.* 2019), the highest mean duration was selected as the critical duration for every catchment. AR&R also recommends that when it is not practical to run the entire ensemble array, the ensemble that produces the result closest to the mean (for the critical duration) should be adopted. The critical duration analysis results are further discussed in **Section 4**.

3 Pre-development

Pre-development modelling was undertaken and detailed in the *Lot 500 Wirring Road – Cowaramup LWMS* (RPS 2023) which identified four catchments across the development.

Runoff from the central and eastern portion of the site (Catchment 1) flows north due to the existing topography, eventually discharging from the site into the existing roadside swale along Waverley Road. This flows into the existing stormwater infrastructure (a 450 mm diameter culvert with an allowable 1% AEP flow rate of 0.20 m^3/s) and into a downstream dam (online within Wilyabrup Brook) located in Symphony Waters Estate. Runoff from the southern portion of the site (Catchment 2) flows southwest via overland flow and discharges the site and enters a 300 mm diameter culvert (with an allowable 1% AEP flow rate of 0.12 m^3/s) underneath Wirring Road and into Lot 11 Bussel Highway. Runoff from the western portion of the site (Catchment 3) flows west and discharges from the site at Roy Earl Drive via 2 x 600 mm diameter culverts (with an approximate allowable 1% AEP flow rate of 1.6 m^3/s) while runoff from Catchment 4 is a minor catchment which is retained within the site.

3.1 Pre-development model

Pre-development modelling was undertaken and detailed in the *Lot 500 Wirring Road – Cowaramup LWMS* (RPS 2023) with the pre-development parameters, catchment areas and results provided in the report.

The pre-development discharges that were determined from the LWMS modelling for the 20% AEP and 1% AEP events are shown in **Table 1**.

Table 1: Pre-development discharges

Catchment	Pre-development discharge (m^3/s)	
	20% AEP event	1% AEP event
1	0.51	0.99
2	0.12	0.54
3	0.21	0.75
4	No discharge from site	No discharge from site

4 Post Development

The critical duration storm events for each catchment were based on the peak flow rate at the three outflow locations for each catchment. The results of the critical duration analysis are provided in **Table 2**.

Table 2: Critical duration analysis

Catchment	63.2 % AEP event	20 % AEP event	1 % AEP event
A	FLTW_63.2pct_1hr_3	FLTW_20pct_4.5hr_3	FLTW_1pct_4.5hr_7
B	FLTW_63.2pct_1hr_7	FLTW_20pct_1hr_2	FLTW_1pct_1hr_6
C	FLTW_63pct_1hr_1	FLTW_20pct_2hr_4	FLTW_1pct_1hr_3

4.1 Post development model

An initial loss-continuing loss model was adopted to account for post-development catchment losses. The post-development catchment area and land types were based on the structure plan design, typical infiltration rates for the soils which occur onsite and based on project team experience. The infiltration loss parameters were based on the adopted values provided in the approved *LWMS* (RPS 2023) and are summarised in **Table 3**.

Table 3: Post-development parameters

Land type	Initial loss (IL) (mm)	Continual loss (CL) (mm)	Roughness	Notes
Rural	20	4.9	0.073	-
Lot roofs (R15/20)	7.4	0	0.015	Assumed to be 50% of all non-R10 lot areas. All lots to have rainwater tanks with 2.5 kL of storage between the overflow and slow-release pipe.
R10 Lot roofs	11.5	0	0.015	Assumed to be 40% of R10 lot areas. All lots to have rainwater tanks with 5 kL of storage between the overflow and slow-release pipe.
Lot yards (R10 – R20)	0	40%	0.5	Assumed to be 50% to 60% of lot area
Residential (R60) – Impervious	1	0.1	0.02	-
Residential (R60) – Pervious	15	1.5	0.05	-
Road Reserve	1	1.9	0.02	Continuing loss is based on a 40% pervious area and 0.08 m/day permeability

Table 3: Post-development parameters (continued)

Land type	Initial loss (IL) (mm)	Continual loss (CL) (mm)	Roughness	Notes
Public open space (POS) & public access walkway (PAW)	20	4.9	0.03	-
Drainage Basins	2.8	0	0.012	-
Impervious surface	1	0.1	0.02	-

The post-development catchment areas and land use types for the sub-catchments are detailed in **Table 4**.

Table 4: Post-development catchment areas

Catchment	Slope	Total area (ha)	Road reserve (ha)	Residential – R10		Residential – R15/20		Residential – R60		POS (ha)	Drainage basin (ha)	Impervious surface (ha)	Cleared farmland (ha)
				Roof (ha)	Lot yard (ha)	Roof (ha)	Lot yard (ha)	Impervious (ha)	Pervious (ha)				
A1.1	0.02	0.083	0.083	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A1.2	0.02	2.270	0.229	0.000	0.000	0.555	0.555	0.000	0.000	0.715	0.216	0.000	0.000
A1.3	0.02	0.280	0.000	0.000	0.000	0.140	0.140	0.000	0.000	0.000	0.000	0.000	0.000
A1.4	0.02	3.357	0.776	0.240	0.360	0.860	0.860	0.000	0.000	0.000	0.261	0.000	0.000
A1.5	0.02	1.417	0.276	0.122	0.182	0.379	0.379	0.000	0.000	0.000	0.078	0.000	0.000
A1.6	0.02	0.346	0.000	0.052	0.078	0.108	0.108	0.000	0.000	0.000	0.000	0.000	0.000
A1.7	0.02	0.031	0.031	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A2.1	0.02	3.362	0.633	0.355	0.532	0.302	0.302	0.000	0.000	1.238	0.000	0.000	0.000
A2.2	0.02	0.956	0.278	0.000	0.000	0.000	0.000	0.000	0.000	0.678	0.000	0.000	0.000
A2.3	0.02	4.153	0.993	0.000	0.000	0.000	0.000	1.730	0.433	0.738	0.000	0.258	0.000
B1.1	0.02	2.591	0.134	0.000	0.000	0.000	0.000	0.000	0.000	2.457	0.000	0.000	0.000
B1.2	0.02	6.302	1.458	0.201	0.302	1.647	1.647	0.000	0.000	1.048	0.000	0.000	0.000
B1.3	0.02	3.384	0.561	0.440	0.660	0.679	0.679	0.000	0.000	0.364	0.000	0.000	0.000
B1.4	0.02	8.373	1.860	0.000	0.000	0.000	0.000	3.157	0.789	1.227	0.000	1.340	0.000
C1.1	0.02	1.359	0.245	0.000	0.000	0.316	0.316	0.000	0.000	0.483	0.000	0.000	0.000
C1.2	0.02	2.656	0.529	0.421	0.631	0.513	0.513	0.000	0.000	0.050	0.000	0.000	0.000
XA1	0.02	4.792	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.792
XA2	0.02	3.615	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.615
XB	0.02	1.911	0.310	0.000	0.000	0.685	0.685	0.000	0.000	0.000	0.230	0.000	0.000
XC	0.02	3.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.578

The catchment layout and runoff storage locations are shown in **Figure 2** of the *LWMS Addendum - Lot 500 Wirring Road, Cowaramup (Emerge Associates 2024)*.

The following assumptions were incorporated into the post-development model for the site:

- Lots
  - Residential lots (R10) are assumed to be 40% roof and 30% lot yard.
  - Residential lots (R15/20) are assumed to be 50% roof and 50% lot yard.
  - Residential lots (R60) are assumed to be 80% roof and 20% lot yard.
  - Residential lots will have little slope (i.e. will be flat) and pockets of storage are likely. This will effectively increase the initial loss (storage) and overall infiltration rate (continual loss).
  - Garden areas in lots will have higher infiltration rates than existing soils as it is likely that sand-based landscape mix or mulch will be used.
- Road reserve
  - There will be no infiltration on roads, pavements and driveways. There will however be some minor absorption storage loss which is accounted for in the initial and continuing loss values.
  - The road reserve contains 40% pervious verge and 60% impervious bitumen/paved areas for all catchments.
- POS area
  - POS are assumed to be 100% pervious.
  - POS will likely contain dense vegetation or turf over a sand-based landscape mix.
- Storage areas
  - Depth and size of storage areas are based on the existing topography, given the site is proposed to mimic/maintain the pre-development levels where possible, and POS areas proposed in the local structure plan.
  - Surface runoff will be conveyed through the development using a treatment train approach, where swales will provide treatment and conveyance to bioretention areas (BRAs) and when maximum capacity is exceeded, flows will either continue to fill a collocated basin or will be further conveyed to the flood storage areas (FSAs) for flood detention.
  - Areas and depths of FSAs are based on available POS area provided in the structure plan and have a maximum depth of 1.2 m.
- Infiltration
  - No infiltration has been accounted for the BRAs/FSAs.
- Evapotranspiration

  Volumes leaving the system through evapotranspiration were assumed to be negligible when compared to the total runoff volume and since the duration of the model run was comparatively short. XPSWMM default evapotranspiration assumptions are therefore used.
- Discharges
  - Pre-development discharge will not be exceeded for site discharges in the post development scenario.

5 References

5.1 General references

Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M and Testoni I (Editors) 2019, *Australian Rainfall and Runoff: A Guide to Flood Estimation*, Commonwealth of Australia (Geoscience Australia).

Emerge Associates 2024, *LWMS Addendum - Lot 500 Wirring Road, Cowaramup*, EP24-092(06)--006, 1.

RPS 2023, *Lot 500 Wirring Road, Cowaramup - Local Water Management Strategy*, AU213002398.001, 1.

5.2 Online references

Bureau of Meteorology (BoM) 2021a, *Climate Data Online*, viewed 23 October 2024, Available from, < http://www.bom.gov.au/climate/data/>.

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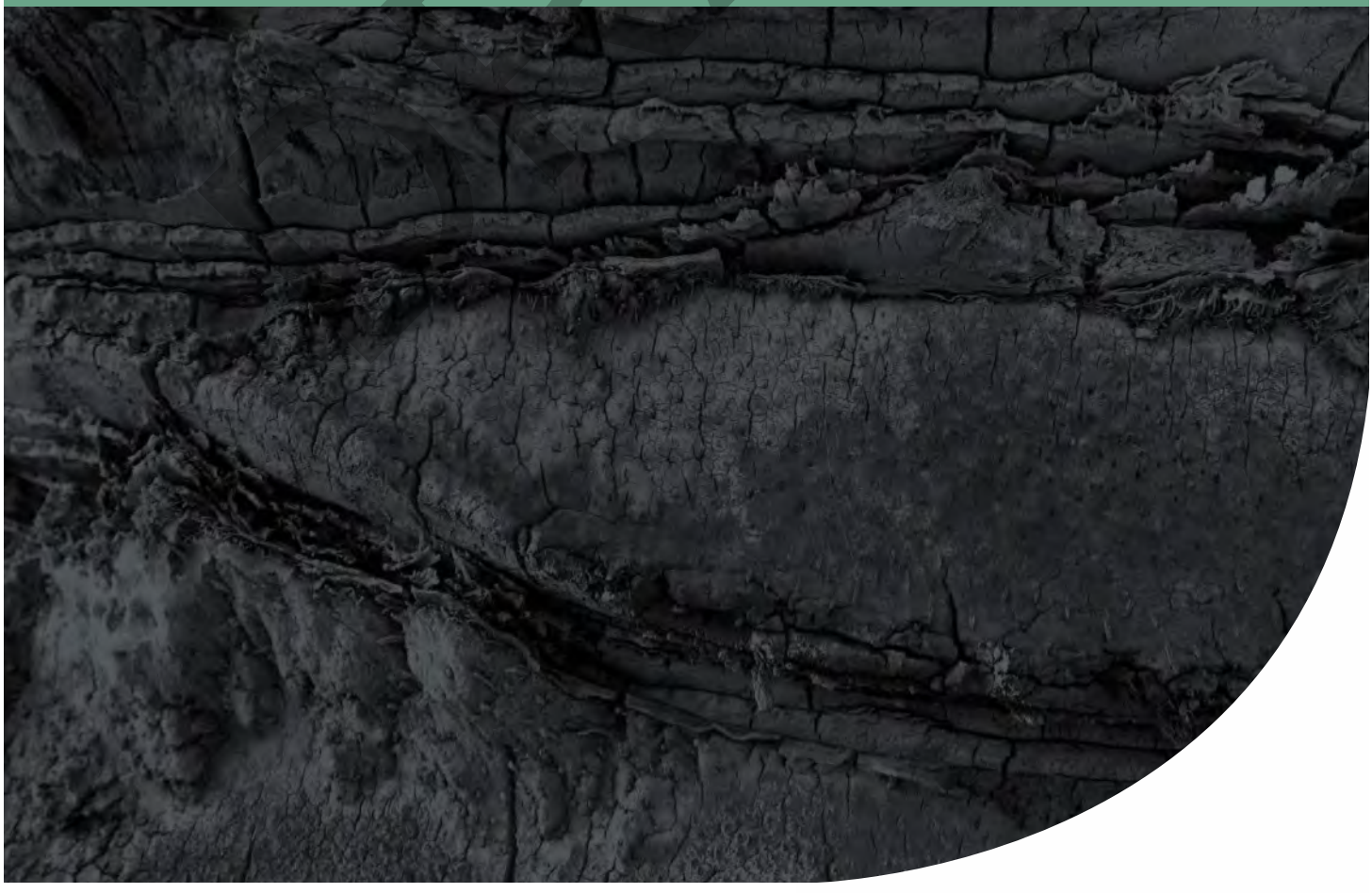
Bushfire Management Plan

Lot 500 Wirring Road, Cowaramup

Project No: EP24-092(05)

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Prepared for Yolk Property Group
December 2024



Document Control

Doc name:	Bushfire Management Plan Lot 500 Wirring Road, Cowaramup				
Doc no.:	**EP24-092(05)--002 CSR**				
Version	**Date**	**Author**		**Reviewer**	
1	December 2024	Claire Rogers	CSR	Kirsten Knox	KK
				Anthony Rowe	
	Report issued for client review.				

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This document has been prepared primarily to consider the layout of development and/or the appropriate building construction standards applicable to development, where relevant. The measures outlined are considered to be prudent minimum standards only based on the standards prescribed by the relevant authorities. The level of bushfire risk mitigation achieved will depend upon the actions of the landowner or occupiers of the land and is not the responsibility of the author. The relevant local government and fire authority (i.e. Department of Fire and Emergency Services or local bushfire brigade) should be approached for guidance on preparing for and responding to a bushfire.

Notwithstanding the precautions recommended in this document, it should always be remembered that bushfires burn under a wide range of conditions which can be unpredictable. An element of risk, no matter how small, will always remain. The objective of the Australian Standard AS 3959:2018 is to "prescribe particular construction details for buildings to reduce the risk of ignition from a bushfire" (Standards Australia 2018). Building to the standards outlined in AS 3959 does not guarantee a building will survive a bushfire or that lives will not be threatened by the effects of bushfire attack.

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Executive Summary

Yolk Property Group (the proponent) is progressing a structure plan amendment for Lot 500 Wirring Road, Cowaramup (herein referred to as 'the site)' to facilitate residential development. The original structure plan was approved by the WAPC on 10 July 2024. The amendment is related to a revision to the road layout and proposed land uses. The site is located within the Shire of Augusta Margaret River, approximately 10 km north of Margaret River and is approximately 41 hectares (ha) in size. It is generally bounded by existing urban development to the north and west, Wirring Road to the south with agricultural land extending further to the south and east of the site.

The site is zoned 'Future Development' under the *Shire of Augusta-Margaret River Scheme No.1* and adjoins an area of existing residential development to the north.

The entire site is located within an 'Area 2' bushfire prone area as designated under the state-wide *Map of Bush Fire Prone Areas* prepared by the Office of Bushfire Risk Management (OBRM 2024). The identification of a site within an area declared as bushfire prone necessitates a further assessment of the determined bushfire risk affecting the site in accordance with *Australian Standard 3959:2018 Construction of buildings in bushfire prone areas* (AS 3959), and the satisfactory compliance of the proposal with the policy measures described in *State Planning Policy 3.7 Bushfire* (SPP 3.7) (WAPC 2024b) and the *Planning for Bushfire Guidelines* (the Guidelines) (WAPC 2024a)

The purpose of this bushfire management plan (BMP) is to assess the bushfire hazards affecting the site (risk) and identify the 'management' strategies (risk treatments) required to ensure the development can achieve the intent of SPP 3.7 which is "*to implement effective, risk-based land use planning and development which in the first instance avoids the bushfire risk, but where unavoidable, manages and/or mitigates the risk to people, property and infrastructure to an acceptable level. The preservation of life and the management of bushfire impact are paramount.*"

A Bushfire Attack Level (BAL) assessment involving the classification of vegetation and topography within 150 m of the site has been undertaken. As part of assessing the long-term bushfire risk to the site, vegetation classifications (in accordance with AS 3959) have been detailed for the post-development scenario. The following bushfire hazards were identified as applicable to the site following development:

- Forest (Class A) vegetation, which was identified external to the south and north of the site. The vegetation to the south is associated with a narrow strip of remnant vegetation within Wirring Road reserve and will remain in the long-term. The forest vegetation to the north is associated with an existing public open space area that contains remnant vegetation and is assumed to remain in its current condition long term .
- Woodland (Class B) vegetation has been identified within the northern side of the Wirring Road reserve.
- Scrub (Class D) vegetation has been identified in existing public open space areas to the west and north of the site. These areas are associated with unmanaged patches of vegetation up to 6 m in height, surrounded by managed vegetation, and are assumed to remain in the current condition long term.

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- Shrubland vegetation has been identified in an existing drainage reserve to the west of the site, where the predominant vegetation is less than 2 m in height. This area was not well managed and is assumed to remain a bushfire hazard.
- Grassland (Class G) vegetation, which was identified to the south and east of the site and is associated with agricultural pastures. All of these grassland vegetation areas are assumed to remain in their current condition long term.

The post development scenario for the site has assumed that existing classified vegetation (small patches of existing woodland vegetation, associated with remnant trees) within proposed public open space (POS) areas will be converted to low threat vegetation in accordance with Section 2.2.3.2 of AS 3959. Existing trees can be retained, and management would be as simple as managing long grasses under the trees and removing built up fuels (dead branches and similar) to enable these areas to achieve low threat. This has been considered as part of the landscape concept plan prepared for the structure plan. All classified vegetation outside the site is assumed to remain in its existing condition and therefore pose a bushfire risk to the site in the long-term.

Compliance Assessment

The bushfire protection criteria provided in the Guidelines represent the risk treatments applicable to achieving the intent and the objectives listed in SPP 3.7. Specific bushfire protection criteria are outlined for different purposes including strategic planning, structure plans and subdivision applications, residential development, commercial and industrial development and vulnerable developments. Each criteria is divided into four subsystems (elements). Each subsystem is provided with an intent and solution methods, either outcomes or acceptable solution (predetermined solution). Compliance with each subsystem (as a risk treatment) is required to demonstrate to the decision maker that the risk is within acceptance.

The BMP has identified that as development progresses, it will comply with the 'acceptable solution' for each of the elements under Bushfire Protection Criteria 5: Structure plans and subdivision applications outlined in the Guidelines.

This includes:

- **Location**: As the location of this structure plan amendment has already been determined to be appropriate in the original structure plan approval that was granted when assessed under the bushfire framework (SPP 3.7), reconsideration of the structure plans location is not required.
- **Siting and Design**: Al of lots contain sufficient development sites that can achieve a radiant heat impact not exceeding BAL-29. However, there are a number of lots that have incursions of BAL-40 and BAL-FZ at the rear of lots (where adjacent to Wirring Road and the agricultural land to the east). These incursions will need to be managed with Asset Protection Zones (APZs). Along Wirring Road an APZ of 11 m will need to be maintained within the lot where forest vegetation occurs within the southern Wirring Road verge, while a 14 m-wide APZ will need to be maintained where woodland vegetation adjoins the site in the northern Wirring Road verge. The development cells are large enough to accommodate these setbacks. Along the eastern interface of the site, an 8 m APZ will need to be maintained in the lots and is able to be accommodated (and is no different to the existing approved structure plan). A 5 m-wide area of landscape planting is proposed along the eastern boundary within the lots but is able to achieve low threat.

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The amendment to the structure plan avoids clearing of native vegetation, with the majority of the vegetation (except a number of isolated paddock trees) retained in public open space areas. The site is in a degraded state with only scattered trees over pasture grasses remaining.

- **Vehicular Access**: The structure plan provides for multiple connections to the existing public road network with access provided to Roy Earl Drive to the west, Lions Drive in the west and north and Waverley Road in the north. Six no through roads are proposed within the structure plan amendment, four of which are to facilitate connections to future developments to the east. The remaining no-through roads will be located in a BAL-LOW area when the site is fully developed. All no-through roads are no longer than 150 m from an intersection providing two way access. No perimeter road or fire service access way is required for this proposal given the surrounding road accesses and the adjacent classified vegetation being grassland.
- **Water**: the development will be provided with a permanent and reticulated water supply to support onsite firefighting requirements.

The management/mitigation measures to be implemented through the proposed development of the site have been outlined as part of this BMP, and through these, the site can appropriately manage risk in accordance with SPP 3.7 and the Guidelines. The acceptable solutions under Bushfire Protection Criteria 5: Structure plans and subdivision applications outlined in the Guidelines can be satisfied.

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Appendices

Appendix A

Concept Plan

Appendix B

Landscape Masterplan

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List of Abbreviations

Table A1: Abbreviations – General terms

General terms	
AS	Australian Standard
APZ	Asset Protection Zone
BAL	Bushfire Attack Level
BMP	Bushfire Management Plan
BPAD	Bushfire Planning and Design
ESA	Environmentally sensitive area
FDI	Fire Danger Index
FZ	Flame Zone

Table A2: Abbreviations – Organisations

Organisations	
SoAMR	Shire of Augusta Margaret River
DBCA	Department of Biodiversity, Conservation and Attractions
DWER	Department of Water and Environmental Regulation
DFES	Department of Fire and Emergency Services
DPLH	Department of Planning, Lands and Heritage
OBRM	Office of Bushfire Risk Management
WAPC	Western Australian Planning Commission

Table A3: Abbreviations – Legislation and policies

Legislation	
AS 3959	*Australian Standard 3959-2018 Construction of buildings in bushfire prone areas*
Guidelines	*Guidelines for Planning in Bushfire Prone Areas version 1.4* (WAPC 2024a)
SPP 3.7	*State Planning Policy 3.7 Planning in Bushfire Prone Areas* (WAPC 2024b)

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Table A4: Abbreviations – Planning and building terms

Planning and building terms	
LMP	Landscape Master Plan
LPS	Local Planning Scheme

Table A4: Abbreviations – units of measurement

Units of measurement	
ha	Hectare
m	Metre
mm	Millimetres
m AHD	m in relation to the Australian height datum

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1 Introduction

1.1 Background

Yolk Property Group (the proponent) is progressing a structure plan amendment for Lot 500 Wirring Road, Cowaramup (herein referred to as 'the site)' to facilitate residential development. The original structure plan was approved by the WAPC on 10 July 2024. The amendment is related to a revision to the road layout and proposed land uses and is shown in **Appendix A**. The site is located within the Shire of Augusta Margaret River (SoAMR) and is approximately 10 km north of Margaret River town and is approximately 41 hectares (ha) in size. It is generally bounded by existing urban development to the north and west, Wirring Road to the south with agricultural land extending further to the south and east of the site. The location of the site is shown in **Figure 1**.

The entire site is located within an 'Area 2' bushfire prone area as designated under the state-wide *Map of Bush Fire Prone Areas* prepared by the Office of Bushfire Risk Management (OBRM 2024) and shown in **Plate 1**. The identification of a site within an area declared as bushfire prone necessitates a further assessment of the determined bushfire risk affecting the site in accordance with *Australian Standard 3959:2018 Construction of buildings in bushfire prone areas* (AS 3959), and the satisfactory compliance of the proposal with the policy measures described in *State Planning Policy 3.7 Bushfire* (SPP 3.7) (WAPC 2024b) and the *Planning for Bushfire Guidelines* (the Guidelines) (WAPC 2024a)

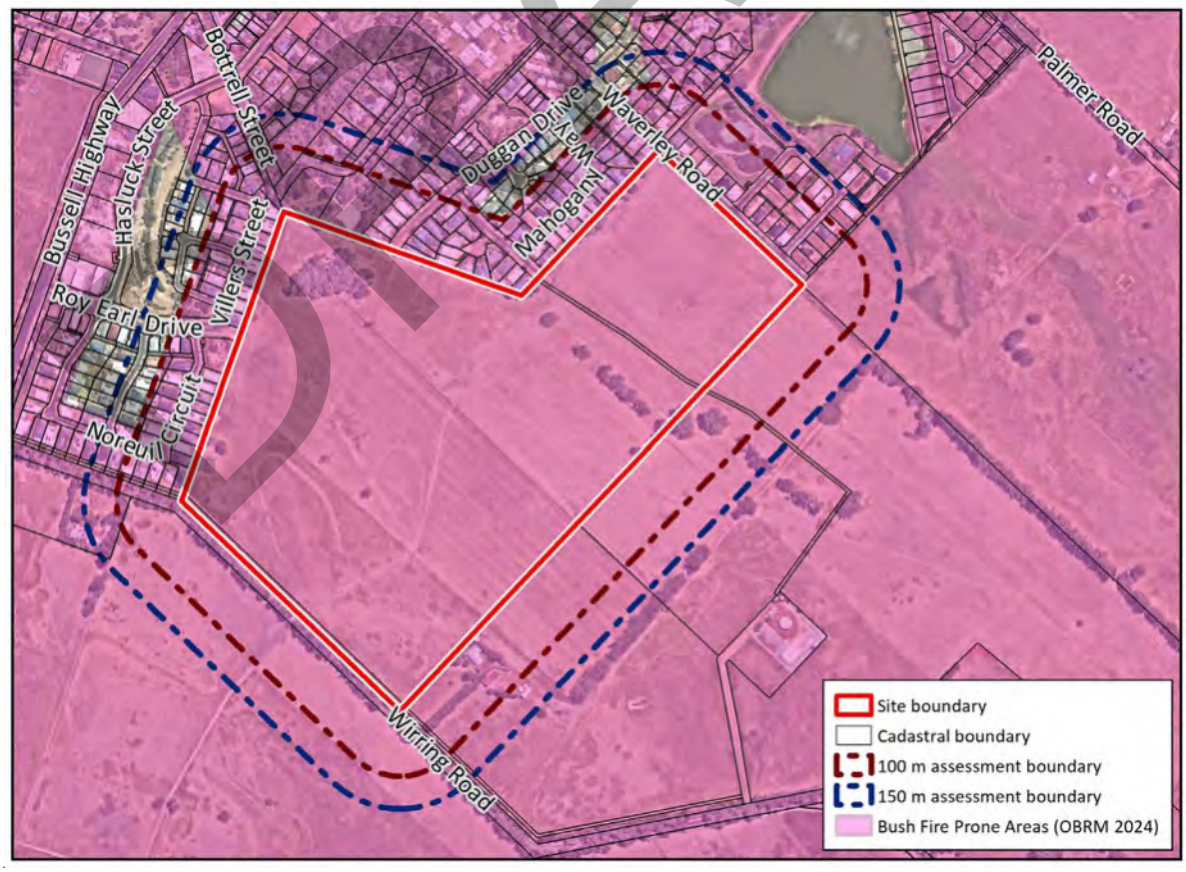


Plate 1: Areas within and surrounding the site identified as ' Area 2 bushfire prone areas' (as indicated in purple) under the state-wide Map of Bush Fire Prone Areas (OBRM 2024).

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The purpose of SPP 3.7 and its policy intent is to effectively implement, risk-based land use planning that manages and/or mitigates the bushfire risk to people, property and infrastructure to an acceptable level. SPP 3.7 aims to "*to implement effective, risk-based land use planning and development which in the first instance avoids the bushfire risk, but where unavoidable, manages and/or mitigates the risk to people, property and infrastructure to an acceptable level. The preservation of life and the management of bushfire impact are paramount*. Importantly, it is risk-based, requiring a methodical approach to identify and evaluate the hazards and provide the treatments to ameliorate these hazards to an acceptable level. SPP 3.7 requires that the determining authority, where compliance with the acceptable solution is not achieved, give consideration to the alternative bushfire management measures that may be able to satisfy the outcomes of the policy (outcomes based approach).

1.2 Aim of this report

The purpose of this bushfire management plan (BMP) is to assess bushfire hazards both within the site and nearby and demonstrate that the threat posed by any identified hazards can be appropriately mitigated and managed.

This BMP has been prepared to support the proposed structure plan amendment of the site and addresses the requirements of SPP 3.7 (WAPC 2024b), the Guidelines (WAPC 2024a) and AS 3959 (Standards Australia 2018). The document includes:

- An assessment of the existing classified vegetation in the vicinity of the site (within 150 m) and consideration of bushfire hazards that will exist in the post development scenario (**Section 3**).
- Commentary on how the future development can achieve the bushfire protection criteria outlined within the Guidelines including an indication of BAL ratings likely to be applicable to future development areas (**Section 5**).
- An outline of the roles and responsibilities associated with implementing this BMP (see **Section 6**).

1.3 Statutory policy and framework

The following key legislation, policies and guidelines are relevant to the preparation of a bushfire management plan:

- *Bush Fires Act 1954*
- *Fire and Emergency Services Act 1998*
- *Planning and Development Act 2005* and associated regulations
- *Building Act 2011* and associated regulations
- *State Planning Policy 3.7 Planning in Bushfire Prone Areas* (WAPC 2024b)
- *Guidelines for Planning in Bushfire Prone Areas Version 1.4* (WAPC 2024a)
- *Australian Standard AS 3959 – 2018 Construction of buildings in bushfire prone areas* (Standards Australia 2018)

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1.4 Description of the proposed development

A Local Structure Plan (LSP) concept plan has been prepared for the site and is provided in **Appendix A**. The LSP provides a framework for the provision of future land use and will facilitate subdivision and development within the site. The following land uses are proposed within the site:

- Residential areas.
- Public open space (POS) areas, which will be a mix of well managed open space used for recreation purposes and retained remnant trees which will be able to achieve low threat through management of paddock grasses and removal of built up fallen branches and similar.
- A retirement/lifestyle village.
- Development of an internal road network with connections to Roy Earl Drive to the west, Lions Drive to the north and Waverley Road to the north.

The site is zoned 'Future Development' under the Shire of Augusta-Margaret River Scheme No.1. The current structure plan was approved 10 July 2024, and the proposed amendment is not a major variation to that proposed. The main change is the inclusion of the lifestyle village in the western portion of the site.

1.5 Description of land characteristics

Based on a review of publicly available aerial photography large portions of the site have been historically disturbed (vegetation cleared) as part of extensive agricultural land uses prior to 1996 (earliest available public aerial imagery).

Land uses surrounding the site include:

- Developed urban/suburban areas to the north and west of the site, which are part of the existing Cowaramup townsite.
- Agricultural grazing areas to the east and south of the site

The site is generally flat and is approximately 134 m Australian Height Datum (m AHD) across the site except in the eastern portion of the site where it rises to 138 m AHD. Topography across the site and surrounds is shown in **Figure 1**.

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2 Environmental Considerations

In accordance with the *Bushfire Management Plan (BMP) Manual* (DPLH and WAPC 2024), this BMP has considered whether there are any environmental values that may require specific consideration through either protection, retention or revegetation. To support this, a review of publicly available databases has been undertaken and existing information prepared to support the structure plan, with particular reference to the Shared Location Information Platform (SLIP) databases. A summary of the search results has been provided in **Table 1**.

The site includes small areas remnant native trees and pasture grasses. As a result, the site contains limited environmental values. The trees can be retained and still achieve low threat, given management of the underlying paddock grasses and removal of built up dead branches and similar will satisfy low threat.

Table 1: Summary of potential environmental considerations that may be associated with the site (based on a search of the SLIP databases)

Key environmental feature (information in brackets refers to mapping data source)	Yes / no / potentially occurring within the site	If yes / potentially, describe value that may be impacted
Conservation category wetlands and buffer (Geomorphic Wetlands Leeuwin Naturaliste Ridge and Donnybrook to Nannup - Unreviewed (DBCA-043))	No	A palusvale wetland occurs to the northeast and the southwest of the site. These wetlands do not cross into the site boundary and do not have a management category over them. No buffer has been applied to these wetlands and has no bearing on the bushfire management considerations.
RAMSAR wetlands (DBCA-010)	No	No RAMSAR wetlands are identified within the mapping as occurring within the site or in close proximity.
Swan Bioplan Regionally Significant Natural Areas 2010 (DWER-070)	No	Not applicable. No Regionally Significant Natural Areas are identified within the site.
Threatened and priority flora (DBCA-036)	No	Due to the heavily disturbed nature of the site and the continual use for agriculture it is unlikely that there is any threatened or priority flora within the site.
Threatened and priority fauna (DBCA-037) (Ecosystem Solutions 2022)	No	Western ringtail possums and the three species of black cockatoo have the potential to occur within the site, associated with the remnant trees. In surveys associated with structure planning it was determined that development will not significantly impact either the western ringtail possums or the black cockatoo species.
Threatened Ecological Communities (TEC) (DBCA-038)	No	There are no threatened ecological communities indicated to occur within or near the site.
Bush Forever areas (DPLH-019)	No	No Bush Forever sites are present in the site. This is a Perth metropolitan consideration. No other conservation reserves are within the site or nearby.
Clearing regulations – Environmentally Sensitive Areas (DWER-046)	No	No environmentally sensitive areas occur across the site.
DBCA controlled lands or waters (DBCA-011)	No	Not applicable

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2.1 Native vegetation – modification and clearing

Within the site

As outlined above, portions of the site have previously been cleared and the site predominantly comprises a mix of non-native paddock grasses, non-vegetated areas and patches of remnant native trees. These patches of remnant native trees are indicated to be retained in areas of POS across the site as shown in the proposed concept plan (**Appendix A).** It is assumed that existing vegetation within the proposed POS areas will be modified and managed to a low threat standard whilst retaining as many trees as possible. Management would include regular mowing of grasses (or permanent removal and replacement with mulch or similar) and removal of existing built up dead branches and the like.

Some clearing of native vegetation may be required for bushfire management purposes as part of implementing this BMP (such as installing lots and roads). Where clearing of native vegetation is undertaken in accordance with a subdivision approval under the *Planning and Development Act 2005*, it is exempt from requiring a clearing permit under Schedule 6 of the *Environmental Protection Act 1986* (EP Act), even when identified within an environmentally sensitive area. Additionally, a clearing permit will not be required where other exemptions exist pursuant to the *Environmental Protection Act 1986*, such as Section 33 of the *Bush Fires Act 1954*, or the Environmental Protection (Clearing of Native Vegetation) Regulations 2004.

Outside the site

All vegetation outside the site is assumed to remain in its existing condition. This BMP assumes any classified vegetation external to the site will remain and this has been factored into the bushfire attack level (BAL) assessment for the future development of the site.

2.2 Revegetation and landscape plans

A Landscape Master Plan (LMP) has been prepared for the site and outlines the proposed landscape treatments and proposed retention of existing vegetation which can be seen in **Appendix B**.

Road reserves and areas of POS are proposed to be landscaped as part of future development, and their treatment will achieve low threat (and include retention of trees). Landscape screening within lots along Wirring Road and the eastern boundary of the site are also proposed and will achieve low threat. These areas will be designed or modified to achieve a low threat condition in accordance with Section 2.2.3.2 of AS 3959. Future verges and areas of turf and low shrub planting will be maintained and irrigated (if possible). The management of the POS and road reserves will be the responsibility of the proponent initially prior to the handover to the Shire of Augusta Margaret River. Ongoing management is likely to include:

- Irrigation of grass and garden beds (where achievable and where required).
- Regular removal of weeds and built up dead material (such as fallen branches, leaf litter etc.)
- Low pruning of trees (branches below 2 m in height removed where appropriate).
- Application of ground/surface covers such as mulch or non-flammable materials as required.
- Regular mowing/slashing of grass to less than 100 mm in height.

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3 Bushfire Assessment Results

Bushfire risk for the site has been appropriately considered both in the context to the development of the site and potential impact upon the site using AS 3959 and the Guidelines.

The objective of AS 3959 is to reduce the risk of ignition and loss of a building to bushfire. It provides a consistent method for determining a radiant heat level (radiant heat flux) as a primary consideration of bushfire attack. AS 3959 measures the Bushfire Attack Level (BAL) as the radiant heat level (kW/m^2) over a distance of 100 m (however assessment of vegetation is undertaken within 150 m of a site). AS 3959 also prescribes deemed-to-satisfy construction responses that can resist the determined radiant heat level at a given distance from the fire. It is based on six Bushfire Attack Level (BAL) ratings: BAL-LOW, BAL-12.5, BAL-19, BAL-29, BAL-40 and BAL-FZ.

A BAL contour plan for the site has been prepared in accordance with Appendix A of the Guidelines and Method 1 of AS 3959 to determine the BAL ratings likely to be applicable to future buildings. This has been based on the vegetation classifications and the effective slope under the vegetation.

3.1 Assessment inputs

A site visit was conducted on 23 October 2024 to determine the bushfire hazards within 150 m of the site. The site and surrounds were traversed on foot and by vehicle and notes and photos of the relevant vegetation were collected.

3.1.1 Inputs and assumptions

The BAL assessment is based on the following inputs and assumptions:

- **Designated FDI**: 80.
- **Flame temperature**: 1090 K.
- **Effective slope beneath classified vegetation**: flat/upslope, downslope 0-5º (**Figure 2**).
- Trees to be retained within the site in future POS areas will be modified and/or managed to meet the exclusion criteria of Section 2.2.3.2 of AS 3959 and will be maintained in perpetuity.
- Areas of low threat vegetation outside the site will continue to be managed and/or considered to achieve low threat (in accordance with Section 2.2.3.2 of AS 3959) based on the existing maintenance regimes, and/or as per the SoAMR Fire Hazard Reduction Notice.
- Classified vegetation that has been identified outside of the proponent's landholdings has been assumed to remain in its current state (unless stated otherwise) and will therefore continue to be a bushfire hazard to development within the site.
- Areas of grassland can include up to 10% foliage cover from shrubs and trees, as per AS 3959.

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3.1.2 Vegetation classification

Assessing bushfire hazards takes into account the vegetation classifications and exclusions within the site and surrounding area for a minimum of 100 m (but as outlined is considered up to 150 m away in order to provide context), in accordance with AS 3959 and the Guidelines. The assignment of vegetation classifications is based on an assessment of vegetation structure, which includes consideration of the various fuel layers of different vegetation types, as outlined in **Plate 3**. All vegetation within 150m of the site was classified in accordance with Section 2.2.3 of AS 3959. Each distinguishable vegetation plot is described in **Table 2** and shown in **Figure 2**.

Not all vegetation is a classified bushfire risk. Vegetation and ground surfaces that are exempt from classification as a potential hazard are identified as a low threat under Section 2.2.3.2 of AS 3959. Low threat vegetation includes the following:

a. *Vegetation of any type that is more than 100 m from the site.*
b. *Single areas of vegetation less than 1 ha in area and not within 100 m of other areas of vegetation being classified.*
c. *Multiple areas of vegetation less than 0.25 ha in area and not within 20 m of the site, or each other or of other areas of vegetation being classified.*
d. *Strips of vegetation less than 20 m in width (measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20 m of the site or each other, or other areas of vegetation being classified.*
e. *Non-vegetated areas, that is, areas permanently cleared of vegetation, including waterways, exposed beaches, roads, footpaths, buildings, and rocky outcrops.*
f. *Vegetation regarded as low threat due to factors such as flammability, moisture content or fuel load. This includes grassland managed in a minimal fuel condition, mangroves, and other saline wetlands, maintained lawns, golf courses (such as playing areas and fairways), maintained public reserves and parklands, sporting fields, vineyards, orchards, banana plantations, market gardens (and other non-curing crops), cultivated gardens, commercial nurseries, nature strips and wind breaks.*

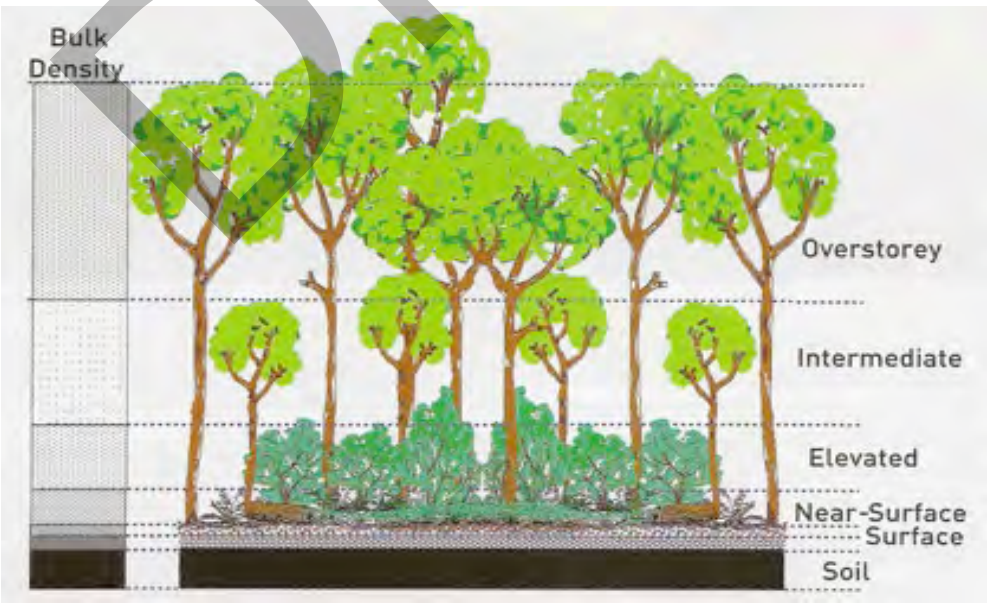


Plate 2: The five fuel layers in a forest environment that could be associated with fire behavior (Gould et al. 2007)

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*Table 2: AS 3959 Vegetation classification and effective slope (refer to **Figure 2**)*

Photo ID:	1	**Plot:**	1
Vegetation Classification or Exclusion Clause and effective slope			
Forest (Class A) – Flat/upslope			
Description / Justification for Classification			
Forest vegetation has been identified in parts of the Wirring Road reserve to the south of the site. This vegetation is comprised of trees 10 m to 20 m in height, with a foliage cover of greater than 30% and a dense understorey. This is shown on the right of the photo with Wirring Road central. The road reserve on the left is classified as grassland in Plot 8 and the site is beyond the fence.			
Photo ID:	2	**Plot:**	1
Vegetation Classification or Exclusion Clause and effective slope			
Forest (Class A) – Flat/upslope			
Description / Justification for Classification			
Forest vegetation has been identified in parts of the Wirring Road reserve to the south of the site. This vegetation is comprised of trees 10 m to 20 m in height, with a foliage cover of greater than 30% and a dense understory. This photo shows the southern edge of the plot and the grassland of the adjacent Plot 9			
Photo ID:	3	**Plot:**	1
Vegetation Classification or Exclusion Clause and effective slope			
Forest (Class A) – Flat/upslope			
Description / Justification for Classification			
Forest vegetation has been identified in parts of the Wirring Road reserve to the south of the site. This vegetation is comprised of trees 10 m to 20 m in height, with a foliage cover of greater than 30% and a dense understory. This photo is taken from the eastern most point of the site looking south east along Wirring Road where both sides of the road reserve are classified as forest vegetation.			

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*Table 2: AS 3959 Vegetation classification and effective slope (refer to **Figure 2**) (continued)*

Photo ID:	4	**Plot:**	2
Vegetation Classification or Exclusion Clause and effective slope			
Forest (Class A) – Downslope 0-5º			
Description / Justification for Classification			
Forest vegetation has been identified to the north of the site and is associated with remnant vegetation in an area of POS and residential lots and surrounding road reserves. This vegetation includes trees taller than 15 m in height, with a foliage cover of greater than 30% and a dense understorey consisting of shrubs and grasses. This photo shows the POS to the north of the site.			
Photo ID:	5	**Plot:**	2
Vegetation Classification or Exclusion Clause and effective slope			
Forest (Class A) – Downslope 0-5º			
Description / Justification for Classification			
Forest vegetation has been identified to the north of the site and is associated with remnant vegetation in an area of POS and residential lots and surrounding road reserves. This vegetation includes trees taller than 15 m in height, with a foliage cover of greater than 30% and a dense understorey consisting of shrubs and grasses. This photo shows an example of a residential lot containing forest vegetation within this plot.			
Photo ID:	6	**Plot:**	2
Vegetation Classification or Exclusion Clause and effective slope			
Forest (Class A) – Downslope 0-5º			
Description / Justification for Classification			
Forest vegetation has been identified to the north of the site and is associated with remnant vegetation in an area of POS and residential lots and surrounding road reserves. This vegetation includes trees taller than 15 m in height, with a foliage cover of greater than 30% and a dense understorey consisting of shrubs and grasses. This photo shows the POS to the north of the site.			

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*Table 2: AS 3959 Vegetation classification and effective slope (refer to **Figure 2**) (continued)*

Photo ID:	7	**Plot:**	2
Vegetation Classification or Exclusion Clause and effective slope			
Woodland (Class B) – Flat/upslope			
Description / Justification for Classification			
Woodland vegetation has been identified in the eastern portion of the northern verge of the Wirring Road reserve. This well-spaced vegetation consists of trees with a sparse understorey containing mostly grass. This photo shows the woodland vegetation on the left with the site beyond the fence, Wirring Road centrally and the forest vegetation of Plot 1 on the right.			
Photo ID:	8	**Plot:**	3
Vegetation Classification or Exclusion Clause and effective slope			
Woodland (Class B) – Flat/upslope			
Description / Justification for Classification			
Woodland vegetation has been identified along the eastern portion of the northern Wirring Road verge. This vegetation consists of trees with a sparse understorey containing mostly grass. This photo shows the woodland vegetation within Wirring Road in the foreground and the site in the background beyond the fence.			
Photo ID:	9	**Plot:**	4
Vegetation Classification or Exclusion Clause and effective slope			
Shrubland (Class C) – Downslope 0-5°			
Description / Justification for Classification			
Shrubland vegetation has been identified within a drainage basin to the west of the site. The vegetation contains mostly sedges with shrubs and trees predominantly below 2 m tall (taller vegetation is less than 10% foliage cover). This patch of vegetation has been determined to be unmanaged.			

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*Table 2: AS 3959 Vegetation classification and effective slope (refer to **Figure 2**) (continued)*

Photo ID:	10	**Plot:**	4
Vegetation Classification or Exclusion Clause and effective slope			
Shrubland (Class G) – Downslope 0-5º			
Description / Justification for Classification			
Shrubland vegetation has been identified within a drainage basin to the west of the site. The vegetation contains mostly sedges with shrubs and trees predominantly below 2 m tall (taller vegetation is less than 10% foliage cover). This patch of vegetation has been determined to be unmanaged.			
Photo ID:	11	**Plot:**	5
Vegetation Classification or Exclusion Clause and effective slope			
Scrub (Class D) – Downslope 0-5º			
Description / Justification for Classification			
A small patch of unmanaged scrub vegetation has been identified to the northwest of the site within a POS area. This plot contains dense vegetation between 2-4 m tall. This patch of vegetation has also been determined to be unmanaged unlike the remainder of the POS.			
Photo ID:	12	**Plot:**	5
Vegetation Classification or Exclusion Clause and effective slope			
Scrub (Class D) – Downslope 0-5º			
Description / Justification for Classification			
A small patch of unmanaged scrub vegetation has been identified to the northwest of the site within a POS area. This plot contains dense vegetation between 2-4 m tall. This patch of vegetation has also been determined to be unmanaged. The grass in the foreground is part of the remaining POS determined to be managed (Plot 10).			

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*Table 2: AS 3959 Vegetation classification and effective slope (refer to **Figure 2**) (continued)*

Photo ID:	13	**Plot:**	6
Vegetation Classification or Exclusion Clause and effective slope			
Scrub (Class D) – Downslope 0-5º			
Description / Justification for Classification			
A small patch of unmanaged scrub vegetation has been identified to the north of the site within a POS area. This plot contains dense vegetation between 2-4 m tall. This patch of vegetation has also been determined to be unmanaged unlike much of the surrounding vegetation. This photo shows the scrub in the background with managed vegetation and non-vegetated areas in the foreground and on the right. If grassland areas to the north are regularly managed, this area could be excluded.			
Photo ID:	14	**Plot:**	6
Vegetation Classification or Exclusion Clause and effective slope			
Scrub (Class D) – Downslope 0-5º			
Description / Justification for Classification			
A small patch of unmanaged scrub has been identified to the north of the site within a POS area. This plot contains dense vegetation between 2-4 m tall. This patch of vegetation has also been determined to be unmanaged unlike much of the surrounding vegetation. This photo shows the scrub on the right of the photo with managed vegetation and residential areas to the left. If grassland areas to the north are regularly managed, this area could be excluded.			
Photo ID:	15	**Plot:**	6
Vegetation Classification or Exclusion Clause and effective slope			
Scrub (Class D) – Downslope 0-5º			
Description / Justification for Classification			
A small patch of unmanaged scrub vegetation has been identified to the north of the site within a POS area. This plot contains dense vegetation between 2-4 m tall. This patch of vegetation has also been determined to be unmanaged unlike much of the surrounding vegetation. This photo shows the scrub in the background with managed vegetation in the foreground. If grassland areas to the north are regularly managed, this area could be excluded.			

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*Table 2: AS 3959 Vegetation classification and effective slope (refer to **Figure 2**) (continued)*

Photo ID:	16	**Plot:**	7
Vegetation Classification or Exclusion Clause and effective slope			
Grassland (Class G) – Flat/upslope			
Description / Justification for Classification			
Grassland vegetation has been identified in the Wirring Road reserve. This area contains unmanaged grasses with sparse trees (when compared to the area classified as woodland). This photo shows the plot of grassland centrally, with the site beyond the fence to the left and Wirring Road and forest vegetation from Plot 1 to the right.			
Photo ID:	17	**Plot:**	8
Vegetation Classification or Exclusion Clause and effective slope			
Grassland (Class G) – Flat/upslope			
Description / Justification for Classification			
Grassland vegetation has been identified to the south and east of the site. This plot is associated with agricultural pasture grasses that are unmanaged (although subject to cropping and grazing at times). This photo is taken south of Wirring Road facing south.			
Photo ID:	18	**Plot:**	8
Vegetation Classification or Exclusion Clause and effective slope			
Grassland (Class G) – Flat/upslope			
Description / Justification for Classification			
Grassland vegetation has been identified to the south and east of the site. This plot is associated with agricultural pasture grasses that are unmanaged(although subject to cropping and grazing at times). This photo is taken east of Waverley Road.			

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*Table 2: AS 3959 Vegetation classification and effective slope (refer to **Figure 2**) (continued)*

Photo ID:	19	**Plot:**	9
Vegetation Classification or Exclusion Clause and effective slope			
Exclusion clause 2.2.3.2(e) (Non-vegetated)			
Description / Justification for Classification			
Areas surrounding the site to the north and west have been broadly identified as non-vegetated areas. These areas are associated with the existing residential lots and include existing road pavement and residential buildings have been excluded as non-vegetated under clause 2.2.3.2 (e) of AS 3959. The residential gardens within this plot have been excluded as managed vegetation under clause 2.2.3.2 (f) of AS 3959 but shown as exclusion € for ease of reference.			
Photo ID:	20	**Plot:**	10
Vegetation Classification or Exclusion Clause and effective slope			
Exclusion clause 2.2.3.2(f) (Low threat vegetation)			
Description / Justification for Classification			
Areas of low threat vegetation have been identified surrounding the site. These areas are managed by either local government or private landholders to achieve low threat. This photo shows a POS with managed grass cut to below 100 mm. The scrub on the left of the picture is part of Plot 5. Plot 10 has been excluded as low threat vegetation under clause 2.2.3.2 (f) of AS 3959.			
Photo ID:	21	**Plot:**	10
Vegetation Classification or Exclusion Clause and effective slope			
Exclusion clause 2.2.3.2(f) (Low threat vegetation)			
Description / Justification for Classification			
Areas of low threat vegetation have been identified surrounding the site. These areas are managed by either local government or private landholders to achieve low threat. This photo shows a POS with managed grass cut to below 100 mm. The scrub on the right of the picture is part of Plot 6. Plot 10 has been excluded as low threat vegetation under clause 2.2.3.2 (f) of AS 3959.			

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*Table 2: AS 3959 Vegetation classification and effective slope (refer to **Figure 2**) (continued)*

Photo ID:	22	**Plot:**	10
Vegetation Classification or Exclusion Clause and effective slope			
Exclusion clause 2.2.3.2(f) (Low threat vegetation)			
Description / Justification for Classification			
Areas of low threat vegetation have been identified surrounding the site. These areas are managed by either local government or private landholders to a low threat status. This photo shows the managed driveway of a private landholding to the south of the site. Grassland vegetation of Plot 9 exists outside the managed portion of the landholding beyond the fences to the left and right in this photo. Plot 10 has been excluded as low threat vegetation under clause 2.2.3.2 (f) of AS 3959.			



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3.2 Assessment outputs

The vegetation classifications determined in **Section 3.1** are summarised in **Table 3** and incorporate the known changes to vegetation post-development within the site and the determined effective slope. The resultant BALs are shown in **Figure 3**.

The BAL ratings are based on the minimum distances outlined in Table 2.5 of AS 3959, which have been summarised in **Table 4** for ease of reference**.**

Table 3: AS 3959 vegetation classification and effective slope

Plot	Applied vegetation classification	Effective slope
1	Class A – Forest	Flat/upslope
2	Class A – Forest	Downslope 0-5º
3	Class B – Woodland	Flat/upslope
4	Class C – Shrubland	Downslope 0-5º
5	Class D – Scrub	Downslope 0-5º
6	Class D – Scrub	Downslope 0-5º
7	Class G – Grassland	Flat/upslope
8	Class G – Grassland	Flat/upslope
9	Exclusion 2.2.3.2(e)	N/A
10	Exclusion 2.2.3.2(f)	N/A

The BAL assessment completed for the site indicates that a BAL rating of BAL 29 or less can be achieved for the majority of the site (see Figure 3). Areas of BAL-40 and BAL-FZ extends into:

- Lots backing onto Wirring Road where forest vegetation occurs on the southern verge of Wirring Road. Wirring Road is between lots and the forest vegetation, but an 11 m setback is still required at the rear of lots to achieve BAL-29.
- Lots backing onto Wirring Road where woodland vegetation occurs in the northern verge of Wirring Road reserve. A 14 m will be needed at the rear of a small number of lots to achieve BAL-29 (an additional 3 m setback compared to that required for the forest vegetation described above).
- Lots adjacent to the eastern boundary, where grassland occurs in adjacent agricultural land. An 8 m setback is required at the rear of lots to achieve BAL-29.

Notwithstanding this, appropriate setback distances can be provided within the future lots (due to the depth of the development cells) to ensure development sites (where habitable buildings are located) achieve a BAL rating of BAL-29 or below and are discussed further in **Section 5**.

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Table 4: Setback distances based on vegetation classification and effective slope and Table 2.5 of AS 3959, as determined by the method 1 BAL assessment

Plot number (see Figure 2)	Vegetation classification (see Figure 2)	Effective slope (see Figure 2)	Distance to vegetation (from Table 2.5 of AS 3959)	BAL rating (see Figure 3)
Plot 1	Forest (Class A)	Flat/upslope	< 16 m	BAL-FZ
			16 - < 21 m	BAL-40
			21 - < 31 m	BAL-29
			31 - < 42 m	BAL-19
			42 - < 100 m	BAL-12.5
			> 100 m	BAL-LOW
Plot 2	Forest (Class A)	Downslope > 0-5	< 20 m	BAL-FZ
			20 - < 27 m	BAL-40
			27 - < 37 m	BAL-29
			37 - < 50 m	BAL-19
			50 - < 100 m	BAL-12.5
			> 100 m	BAL-LOW
Plot 3	Woodland (Class B)	Flat/upslope	< 10 m	BAL-FZ
			10 - < 14 m	BAL-40
			14 - < 20 m	BAL-29
			20 - < 29 m	BAL-19
			29 - < 100 m	BAL-12.5
			> 100 m	BAL-LOW
Plot 4	Shrubland (Class C)	Downslope > 0-5	< 7 m	BAL-FZ
			7 - < 10 m	BAL-40
			10 - < 15 m	BAL-29
			15 - < 22 m	BAL-19
			22 - < 100 m	BAL-12.5
			> 100 m	BAL-LOW
Plot 5 and Plot 6	Scrub (Class D)	Downslope > 0-5	< 11 m	BAL-FZ
			11 - < 15 m	BAL-40
			15 - < 22 m	BAL-29
			22 - < 31 m	BAL-19
			31 - < 100 m	BAL-12.5
			> 100 m	BAL-LOW

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Table 4: Setback distances based on vegetation classification and effective slope and Table 2.5 of AS 3959, as determined by the method 1 BAL assessment (continued)

Plot number (see Figure 2)	Vegetation classification (see Figure 2)	Effective slope (see Figure 2)	Distance to vegetation (from Table 2.5 of AS 3959)	BAL rating (see Figure 3)
Plot 7	Grassland (Class G)	Downslope > 0-5	< 7 m	BAL-FZ
			7 - < 9 m	BAL-40
			9 - < 14 m	BAL-29
			14 - < 20 m	BAL-19
			20 - < 50 m	BAL-12.5
			> 50 m	BAL-LOW
Plot 8 and Plot 9	Grassland (Class G)	Flat/upslope	< 6 m	BAL-FZ
			6 - < 8 m	BAL-40
			8 - < 12 m	BAL-29
			12 - < 17 m	BAL-19
			17 - < 50 m	BAL-12.5
			> 50 m	BAL-LOW

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4 Identification of Bushfire Hazard Issues

From a bushfire hazard management perspective, based on the requirements of SPP 3.7 and the Guidelines, the key issues that are likely to require management and/or consideration as part of future development within the site include:

- Provision of appropriate separation distance from bushfire hazards to ensure a BAL rating of BAL-29 or less can be achieved at future habitable buildings (built form). Impacts from temporary hazards within the site will be managed through staging or through forward management of grassland hazards (where in the proponent's ownership) to enable BAL-29 or less to be achieved.
- Ensuring site access is designed, constructed and managed to enable safe access and egress for fire fighting vehicles and occupants. This includes managing construction so that multiple accesses are available as part of staged development.
- Ensuring that any landscaped areas including POS areas and public road reserves within the site are appropriately designed, implemented and managed to achieve low threat standards (including relevant exclusion clauses) to reduce the risk of fires starting onsite. As outlined, trees can be retained and minimal management is required to enable these areas to achieve low threat.
- Ensuring that the provision of water for firefighting is sufficient and accessible by firefighting services.

4.1 Permanent hazards

All classified vegetation external to the site including that associated with Wirring Road, existing drainage basins and POS areas are assumed to remain and be a bushfire hazard in the long-term. Grassland vegetation in adjacent rural pastures surrounding the site to the east and south are also assumed to be bushfire hazards.

The areas to the east of the site may eventually be developed, with road connections proposed to enable extension further east from the site. This is not yet approved and could be a significant amount of time away, so the vegetation is assumed to remain in its current condition long-term.

4.2 Temporary hazards

As part of staged development within the site, the proponent will manage grassland vegetation that is within 100 m (or the minimum distance to achieve BAL-29) of proposed lots as part of implementing the subdivision works, to minimise impacts of temporary BAL ratings.

4.3 Vegetation management and landscaping

Public open space areas within the site, including retained trees, have been assumed to be able to achieve a low threat condition.

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Future landscaping plans will need to ensure that all vegetation within the site can comply with Section 2.2.3.2 of AS 3959 and be low threat due to management or applicable exclusions (e.g. size of vegetation). The development proposes to retain existing mature trees (as feasible following health assessments etc.) with all understorey and ground cover vegetation (currently paddock grasses) removed or modified and managed to a minimal fuel condition.

An example of the current vegetation to be retained in the north of the site is shown in **Plate 3** below. In Its current condition this vegetation would be classified as woodland (Class B) vegetation but in the post development scenario it will be exclusion clause 2.2.3.2(f) (low threat vegetation). This vegetation will be managed through the removal of dead limbs, the management of the understorey (e.g. mowing or permanent removal of grass and replaced with mulch and low garden planting) and the removal of low (within 2m of the ground) hanging limbs.



Plate 3: Example of vegetation to be retained with maintenance and management to be applied to achieve and maintain low threat vegetation.

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4.4 Vehicle access

The proposed LSP includes multiple vehicle access points into the site via Roy Earl Drive to the west, Lions Drive to the north and Waverley Road to the northwest, as shown in **Figure 4**. Access to the east has also been accommodated, if further development is progressed.

4.5 Vulnerable land use

The definition of a vulnerable land use is where occupants are less able to respond in an emergency. The types of land uses considered vulnerable include *"a land use which is designed to accommodate people who are less physically or mentally able and likely to present evacuation challenges; and/or due to the building design or use, or the number of people accommodated, likely to present*

evacuation challenges; and/or involves visitors who are unfamiliar with the surroundings." The identification of a land use as vulnerable is at the discretion of the decision maker.

No vulnerable land uses are proposed as part of the development. The lifestyle village within the site is for an over 55s, where people will be able to self-manage evacuation and similar responses in a bushfire event and are not considered a vulnerable land use.

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5 Assessment Against the Bushfire Protection Criteria

5.1 Bushfire protection criteria

The bushfire protection criteria provided in the Guidelines represent the risk treatments applicable to achieving the intent and the objectives listed in SPP 3.7. The bushfire protection criteria vary depending upon the stage of the planning process and development type and are divided into four subsystems (elements). Each subsystem is provided with outcome and acceptable solution method (predetermined solution). Compliance with each subsystem (as a risk treatment) is required to demonstrate to the decision maker that the risk is within acceptance.

The bushfire protection criteria identified in the Guidelines and addressed as part of this BMP are:

- Element 1: Location of the development
- Element 2: Siting and design of the development
- Element 3: Vehicular access
- Element 4: Water supply

Bushfire Protection Criteria 5 (BCP 5): Structure plans and subdivision applications have been applied for the proposed structure plan for the site. The assessment demonstrates that the future development can achieve the objectives of SPP 3.7 and addresses BCP 5 through acceptable solutions detailed in the Guidelines, as summarised in **Table 5.** The key measures have also been summarised in **Figure 4**.

Table 5: Assessment against the bushfire protection criteria for structure plans from the Guidelines

Bushfire protection criteria	Proposed bushfire management strategies
Element 1: Location	
A1.1a and b Broader Landscape Type A and Type B	Not applicable. As the location of this structure plan amendment has already been determined to be appropriate in the original structure plan approval (10 July 2024) which was granted in accordance with SPP 3.7 (in place at the time), reconsideration of the structure plan location is not required.
Element 2: Siting and design	
A2.1 Siting and design	All proposed lots contain sufficient development sites that can achieve a radiant heat impact not exceeding BAL-29. While a number of lots have BAL-40 and BAL-FZ extending into the lots (shown in **Figure 3**), setbacks can be accommodated within the lots to achieve BAL-29 or less 9and range from 8 m where adjacent to grassland to 14 m where adjacent to woodland). The proposal complies with **A2.1**.

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Table 5: Assessment against the bushfire protection criteria for structure plans from the Guidelines

Bushfire protection criteria	Proposed bushfire management strategies
A2.2 Asset Protection Zone (APZ)	All lots are able to provide a development site that achieves BAL-29 or less. This will be through the application of APZs that incorporate: • Low threat public open space • Low threat road reserves (noting nature strips are excluded as low threat, where formally managed or not) • Lots being managed to achieve low threat, through building, hardstand and garden areas. As outlined in response to **A2.2** and discussed in **Section 3.2**, lots along Wirring Road and the eastern boundary (adjacent the agricultural areas) will have BAL-40 and BAL-FZ extend into the lots. The following setbacks will need to be accommodated within lots and will be managed as an APZ: • Lots backing onto Wirring Road where forest vegetation occurs on the southern verge of Wirring Road. Wirring Road is between lots and the forest vegetation, but an 11 m setback is still required at the rear of lots to achieve BAL-29. • Lots backing onto Wirring Road where woodland vegetation occurs in the northern verge of Wirring Road reserve. A 14 m setback will be needed at the rear of a small number of lots to achieve BAL-29 (an additional 3 m setback compared to that required for the forest vegetation described above). • Lots adjacent to the eastern boundary, where grassland occurs in adjacent agricultural land. An 8 m setback is required at the rear of lots to achieve BAL-29. These are shown in **Figure 3**. The location of the APZ is to be contained wholly within the boundaries of the site except where existing low threat vegetation exclusions exist (e.g. existing residential areas). All APZ's are to be managed in accordance with Table 9 – APZ technical requirements of the Guidelines or an alternative standard as gazetted in a local planning scheme. The proposal complies with **A2.2**
A2.3 Clearing of native vegetation	The site is in a degraded state with only scattered trees over pasture grasses remaining. All trees present within the site are proposed to be retained in POS areas and can remain when the areas are modified/design/implemented to achieve low threat. The retention of vegetation has been prioritised within the structure plan and through consideration of landscape design and bushfire requirements. This proposal complies with **A2.3**
Element 3: Vehicular access	
A3.1 Public roads	The existing roads surrounding the site, in addition to the proposed new public roads within the site, as shown in **Figure 4**, do and/or will comply with the minimum standards outlined in Appendix B.3 of the Guidelines (Table 10, column 1)(see **Plate 4** below). The proposal complies with **A3.1**.
A3.2 Access routes	The structure plan maintains multiple connection to the existing public road network, as per the current approved version. The site connects to Roy Earl Drive to the west of the site connecting directly to Bussell Highway; Lions Drive in the north and west (connecting to Bussell Highway via Duggan Drive and Waverley Road) and Waverley Road in the north, connecting directly to Bussell Highway. There is also an emergency access way further north connecting to Symphony Waters Estate and Treeton Road. The multiple connections to Bussell Highway, which is a Regional Distributor Road, provides access to Cowaramup townsite, Vasse in the north and Margaret River in the south. All roads are/ will be of a suitable all weather surface (bitumen). This proposal complies with **A3.2**

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Table 5: Assessment against the bushfire protection criteria for structure plans from the Guidelines

Bushfire protection criteria	Proposed bushfire management strategies
A3.3a No-through roads	Six no through roads are proposed within the structure plan, four of which a temporary no-through roads that have been included to facilitate connections to future development to the east (as per the current structure plan). The remaining no-through roads will be located in a BAL-LOW area when the site is fully developed. All no-through roads are no longer than 150 m from an intersection providing two way access as shown in **Figure 4**. This proposal complies with **A3.3a.**
A3.3b No-through road requirements	The no-through roads (temporary and permanent) will comply with the minimum requirements outlined in Appendix B.3 of the Guidelines (unless the exceptions apply), including the requirements of a public road and the provision of an appropriate turn-around area. Where temporary no through-roads are required as part of staged development, these should also comply with Appendix B.3 of the Guidelines or as agreed with the Shire of Augusta Margaret River. The proposal is able to comply with **A3.3b.**
A3.4 Emergency access ways	This is not applicable as the proposal complies with **A3.2** and **A2.3**. As part of staged development, if required, temporary emergency access ways will meet the technical requirements of the Guidelines of as agreed with the Shire of Augusta Margaret River.
A3.5a Perimeter roads	Proposed lots that back onto classified vegetation on the southeast of the site adjoin Grassland vegetation therefore a perimeter road is not required there. Any other lot adjoining permanent classified vegetation is provided with frontage to a public road proposed in the structure plan amendment. The proposal complies with **A3.4a**.
A3.5b Fire service access routes	The proposed lots on the eastern boundary of the site do not require a fire service access route as they are adjacent to grassland vegetation. Lots backing on to Wirring Road are already provided with public road access and the bushfire hazard is associated with narrow strips of unmanaged vegetation within the road verges that do not fit the nature strip definition. A fire service access route is not required as Wirring Road provides access to the classified vegetation. This proposal complies with **A3.5b**
3.6 Battle-axe access legs	Not applicable. No battle-axe access legs are proposed.
Element 4: Water	
A4.1 Water supply for structure plans	The site will be serviced by reticulated water supply and will be installed to the specifications of Water Corporation and DFES. Evidence of reticulated water supply will be displayed at subdivision and/or development application stage. Existing hydrant locations near the site are shown in **Figure 4** and this network is to be extended into the site. The proposal complies with **A4.1**.
A4.2 Water supply for subdivision applications	Not applicable. Would be addressed the same as that stated for A4.1.
A4.3 Water supply for existing habitable building(s)	Not applicable. No existing habitable buildings are present within the site.

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Table 10: Vehicular access technical requirements

	1		2		3		4		5	
TECHNICAL REQUIREMENTS	**PERIMETER ROADS**		**PUBLIC ROADS**		**EMERGENCY ACCESS WAY[3]**		**FIRE SERVICE ACCESS ROUTE[3]**		**BATTLE-AXE & PRIVATE DRIVEWAYS[1]**	
MAP OF BUSH FIRE PRONE AREAS DESIGNATION	**Area 2**	**Area 1**	**Area 2**	**Area 1**	**Area 2**	**Area 1**	**Area 2**	**Area 1**	**Area 2**	**Area 1**
Minimum horizontal clearance (metres)	12	8	See note 5		10	6	10	6	6	
Minimum vertical clearance (metres)	4.5									
Minimum weight capacity (tonnes)	15									
Maximum grade unsealed road[2]	See note 5		See note 5		1:10 (10% or 6°)					
Maximum grade sealed road[2,4]					1:7 (14.3% or 8°)					
Maximum average grade sealed road					1:10 (10% or 6°)					
Minimum inner radius of road curves (metres)					8.5					

Notes:
1. Driveways and battle-axe legs to comply with the Residential Design Codes and Development Control Policy 2.2 Residential Subdivision where not required to comply with the widths in this Appendix or the Guidelines.
2. Dips must have no more than a 1 in 8 (12.5% - 7.1 degrees) entry and exit angle.
3. To have crossfalls between 3 per cent and 6 per cent.
4. For sealed roads only the maximum grade of no more than 1 in 5 (20 per cent) (11.3 degrees) for no more than 50 metres is permissible, except for short constrictions to 3.5 metres for no more than 30 metres in length where an obstruction cannot be reasonably avoided or removed.
5. As outlined in the Institute of Public Works Engineering Australasia (IPWEA) subdivision guidelines, Liveable Neighbourhoods, Austroads Standards Main Roads standard, supplement, policy or guideline and/or any applicable or relevant local government standard or policy.

Plate 4: Excerpt of Table 10 from The Guidelines

5.2 Additional management strategies

5.2.1 Future approval considerations

A BAL assessment has been prepared for the site to demonstrate that best practice management strategies can be adopted through future planning and implementation stages to ameliorate the bushfire hazards (i.e. habitable buildings can be located in areas of BAL-29 or less) that would otherwise impact upon its future development.

Depending upon the staging boundary or if the layout changes significantly, a BMP may be required to support future subdivisions for the site. As a minimum, a BAL contour plan specific to the subdivision stage may be required, to demonstrate how BAL-29 or less is achieved, and areas to be managed by the proponent.

Where proposed to be constructed and within a designated bushfire prone area, future Class 1, 2, 3 and 10a buildings in an area subject to a BAL rating of BAL-12.5 or higher will need to satisfy higher construction standards in accordance with the National Construction Code (NCC) (i.e. AS 3959 or the National Association for Steel-framed Housing (NASH) Standard).

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5.2.2 Landscape management

5.2.2.1 Within the site

Future lots

All lots, including the lifestyle village and proposed landscape screening along the southern and western boundaries of the site, will be managed to achieve low threat in accordance with Section 2.2.3.2 of AS 3959 and the APZ principles in Appendix B.3 of the Guidelines.

Public open space and public road reserves

Areas of POS and public road reserves within the site will be designed and maintained to achieve low threat vegetation in accordance with Section 2.2.3.2 of AS 3959, as shown in **Figure 2** and **Figure 4**, and will initially be the responsibility of the proponent and subsequently that of the SoAMR. Modification and future management of POS areas identified as low threat will likely include the following:

- Removal of existing grass and weed understorey vegetation and existing built up dead material, including under/around retained trees. Unhealthy trees will be remove as required, based on health assessments and as per agreed civil and landscape drawings.
- Low pruning of trees (branches below 2 m in height removed where appropriate)
- Regular maintenance including removal of weeds and dead material
- Application of ground covers such as mulch or non-flammable materials.
- Irrigation of grass and garden beds (where required).
- Regularly mowing/slashing of grass to less than 100mm in height.

Staged development

The development of the structure plan area may occur over multiple stages and potentially across multiple subdivision approvals. To ensure that bushfire hazards are satisfactorily managed at all stages of development, the minimum area within the proponent landholding, and outside the subdivision area, is required to be managed to achieve BAL-29 or less at habitable buildings.

5.2.2.2 Surrounding the site

Public open space and road reserves

Areas of existing public open space will continue to achieve the outlined classifications or exclusions, and where managed these areas will continue to be maintained by the Shire of Augusta Margaret River in accordance with the existing maintenance regimes.

Within private landholdings

The private landholdings surrounding the site are assumed to be managed by the applicable landowners in accordance with the Shire's firebreak notice and existing maintenance regimes.

Where identified as a bushfire hazard (classified vegetation), no ongoing management has been assumed.

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5.2.3 Shire of Augusta Margaret River Fire Hazard Reduction Notice

The SoAMR releases a Fire Hazard Reduction Notice annually (or as required) to provide a framework for bushfire management within the Shire. The SoAMR is able to enforce this order in accordance with Section 33 of the *Bush Fires Act 1954* and the proponent / future landowners will need to ensure compliance with the fire control notice, as published, or any directions provided by the SoAMR.

Once future subdivision occurs, all landholders of residential landholdings will be required to comply with the requirements of the SoAMR Fire Hazard Reduction Notice relevant to their block size and the notice should be referred to for specific details.

5.2.4 Public education and preparedness

Community bushfire safety is a shared responsibility between individuals, the community, government and fire agencies. DFES has an extensive Community Bushfire Education Program including a range of publications, a website and Bushfire Ready Groups. The Department of Emergency Services (DFES) website (https://www.dfes.wa.gov.au/bushfire/prepare/) provides a range of materials to help the community prepare for and survive the bushfire season.

The SoAMR provides bushfire safety advice to residents available on their website. Professional, qualified consultants also offer bushfire safety advice and relevant services to residents and businesses in high-risk areas in addition to that provided in this BMP.

In the case of a bushfire in the area, advice would be provided to residents by DFES and/or the SoAMR on any specific recommendations with regard to responding to the bushfire, including evacuation if required. However, it is recommended residents make themselves aware of their responsibilities with regard to preparing for and responding to a potential bushfire that may impact the area.

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6 Responsibilities for Implementation and Management of Bushfire Measures

Following endorsement of the LSP amendment, development within the site will be implemented through subdivision and development applications.

Table 6 outlines the future responsibilities of the proponent (developer) and the SoAMR associated with implementing this BMP with reference to bushfire risk mitigation measures to be accommodated as part of subdivision (in particular, consideration of spatial layout requirements). These responsibilities will need to be considered as part of the subsequent planning process.

Additional bushfire mitigation responsibilities will be required at the subdivision for the residential development of the site, including responsibilities for future lot owners.

Table 6: Responsibilities for the implementation of this BMP

Proponent – to support implementation of future subdivision	
No.	Implementation and management actions
1	Where applicable, as part of the subdivision process, make spatial provisions for: • A suitable public road network that provides egress to at least two different destinations and meets the technical requirements of Table 10 within Appendix B.3 of the Guidelines (see **Plate 4**) (or as otherwise determined by a bushfire consultant and relevant approval authority). This includes making provision for temporary emergency access ways where these are required. • Where possible, avoid no through roads and battle-axe lots as part of the spatial layout. If these are proposed as part of future development, these will need to be justified from a planning/development perspective and be consistent with the minimum requirements outlined in the Guidelines, including the exceptions and/or length or 200 m or less. Suitable turn-around areas will need to be accommodated. • Ensure future development sites (habitable buildings) are able to be located in an area subject to BAL-29 or less. The minimum separation distances between habitable buildings and classified vegetation to achieve BAL-29 should be in accordance with **Table 4**Error! Reference source not found. in this BMP or as specified in subsequent BAL assessments. These separation distances can be accommodated by locating public roads and/or managed POS between the habitable building/s and classified vegetation and/or ensuring proposed residential lots are adequately sized to ensure in-lot setbacks can be accommodated to achieve BAL-29 at the future habitable buildings. • Provide for a water supply dedicated to firefighting purposes in the form of a reticulated network of water hydrants.
Shire of Augusta Margaret River	
No.	Management action
1	Maintaining fuel loads in existing public road reserves and public open space (under their management) to appropriate standards to minimise fuel loads based on current regimes.

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7 Applicant Declaration

7.1 Accreditation

This assessment has been prepared by Emerge Associates who have been providing bushfire risk management advice for more than 10 years, undertaking detailed bushfire assessments (and associated approvals) to support the land use development industry. Emerge Associates have a number of team members who have undertaken Bushfire Planning and Design (BPAD) Level 1 and Level 2 training and are Fire Protection Association of Australia (FPAA) accredited practitioners (or are progressing).

Anthony Rowe is a FPAA Level 3 BPAD accredited practitioner (BPAD No. 36690) in accordance with clause 9.10 of the Guidelines.

7.2 Declaration

I declare that the information provided is true and correct to the best of my knowledge.

Signature:

Name: Anthony Rowe

Company: Emerge Associates /Envision Bushfire Protection

Date:

BPAD Accreditation: Level 3 BPAD no. 36690

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8 References

8.1 General references

The references listed below have been considered as part of preparing this document.

Department of Biodiversity, Conservation and Attractions (DBCA) 2017, *Ramsar Sites (DBCA-010)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2022a, *Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)*, Western Australia, <https://catalogue.data.wa.gov.au/dataset/geomorphic-wetlands-swan-coastal-plain>.

Department of Biodiversity, Conservation and Attractions (DBCA) 2022b, *Threatened Ecological Communities (DBCA-038)*, Perth, Western Australia <https://catalogue.data.wa.gov.au/dataset/threatened-ecological-communities>.

Department of Planning, Lands and Heritage (DPLH) 2019, *Bush Forever Areas 2000 (DPLH-019)*, <https://catalogue.data.wa.gov.au/org/department-of-planning-lands-and-heritage>.

DPLH and WAPC 2024, *Bushfire Management Plan (BMP) Manual*, Planning.wa.gov.au.

Department of Water and Environmental Regulation (DWER) 2021a, *Clearing Regulations - Environmentally Sensitive Areas (DWER-046)*, <https://catalogue.data.wa.gov.au/dataset/clearing-regulations-environmentally-sensitive-areas-dwer-046>.

Department of Water and Environmental Regulation (DWER) 2021b, *Water Register*, Perth, <https://maps.water.wa.gov.au/#/webmap/register>.

Ecosystem Solutions 2022, *Environmental Assessment Report Lot 500 Wirring Road, Cowaramup*.

Gould, J., McCaw, W., Cheney, N., Ellis, P. and Matthews, S. 2007, *Field Guide: Fuel Assessment and Fire Behaviour Prediction in Dry Eucalypt Forest*, CSIRO and Department of Environment and Conservation, Perth, Western Australia.

Office of Bushfire Risk Management (OBRM) 2024, *Map of Bush Fire Prone Areas*, Landgate, https://maps.slip.wa.gov.au/landgate/bushfireprone/.

Standards Australia 2018, *AS 3959:2018 Construction of buildings in bushfire-prone areas*, Sydney.

W. A. P. Commission (WAPC) 2024a, *Planning for Bushfire Guidelines*, Western Australia.

W. A. P. Commission (WAPC) 2024b, *State Planning Policy 3.7 Busfire*, Western Australia.

8.2 Online references

The online resources that have been utilised in the preparation of this report are referenced in **Section 8.1**, with access date information provided in **Table R-1**.

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Table R 1 Access dates for online references

Reference	Date accessed	Website or dataset name
(DWER 2021b)	October 2024	Landgate Map Viewer Plus
(OBRM 2024)	October 2024	Bush Fire Prone Areas
(DBCA 2022a)	October 2024	Geomorphic Wetlands, Swan Coastal Plain
(DBCA 2017)	October 2024	Ramsar Sites
(DBCA 2022b)	October 2024	Threatened ecological communities
(DWER 2021a)	October 2024	Environmentally Sensitive Areas
(DPLH 2019)	October 2024	Bush Forever areas

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Figures

Figure 1: Site Location and Topographic Contours

Figure 2: AS 3959 Vegetation Classifications and Effective Slope

Figure 3: Bushfire Attack Level Contour Plan

Figure 4: Spatial Representation of Bushfire Management Strategies

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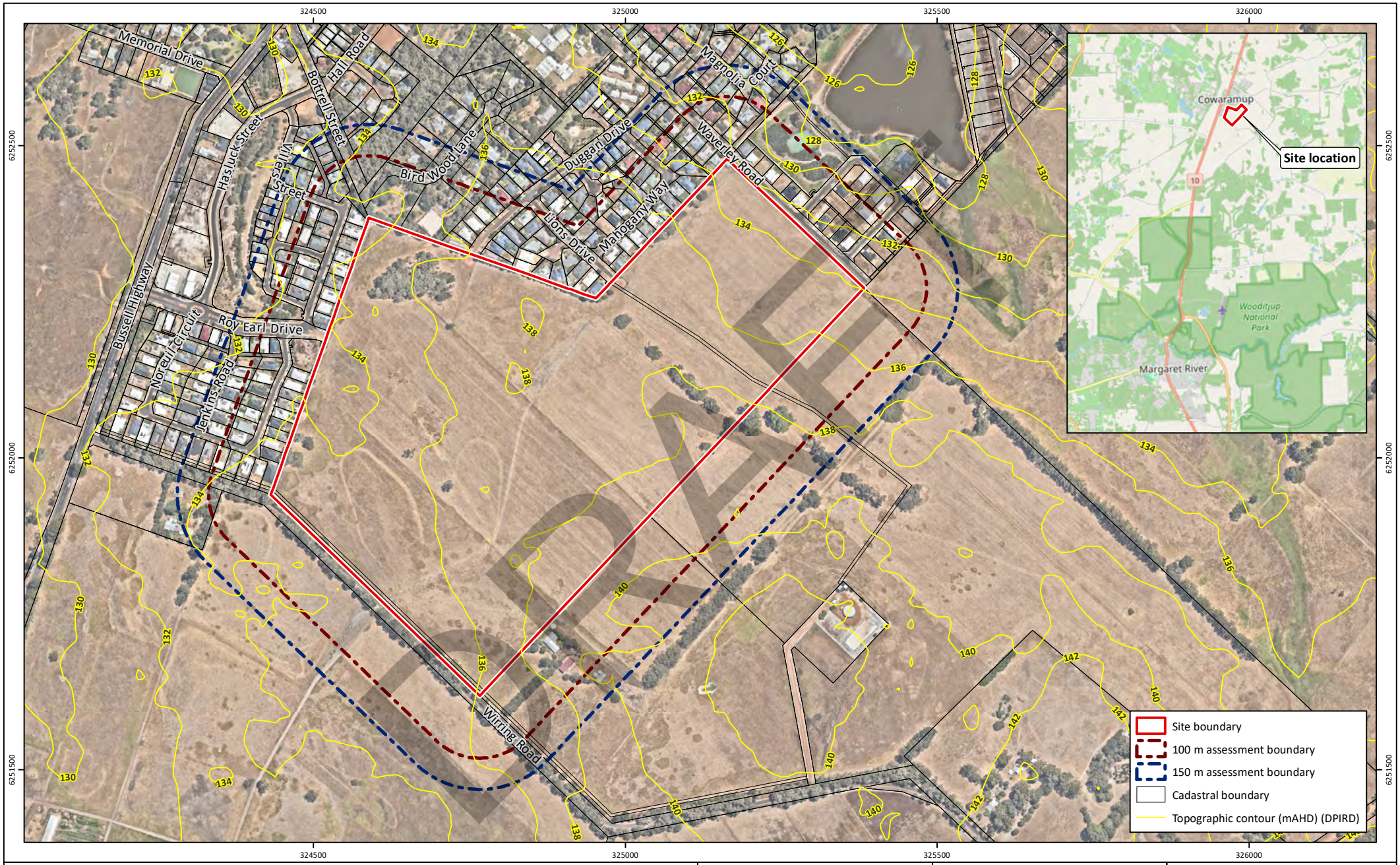


Figure 1: Site Location and Topogaphic Contours

Project:	Bushfire Management Plan Lot 500 Wirring Road, Cowaramup
Client:	Yolk Property Group

Plan Number:
EP24-092(05)--F04

Drawn:	GAR
Date:	28/10/2024
Checked:	CSR
Approved:	KK
Date:	13/12/2024

N

0 125 250
Metres

Scale: 1:8,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
©Landgate (2024). Nearmap Imagery date: 01/02/2024

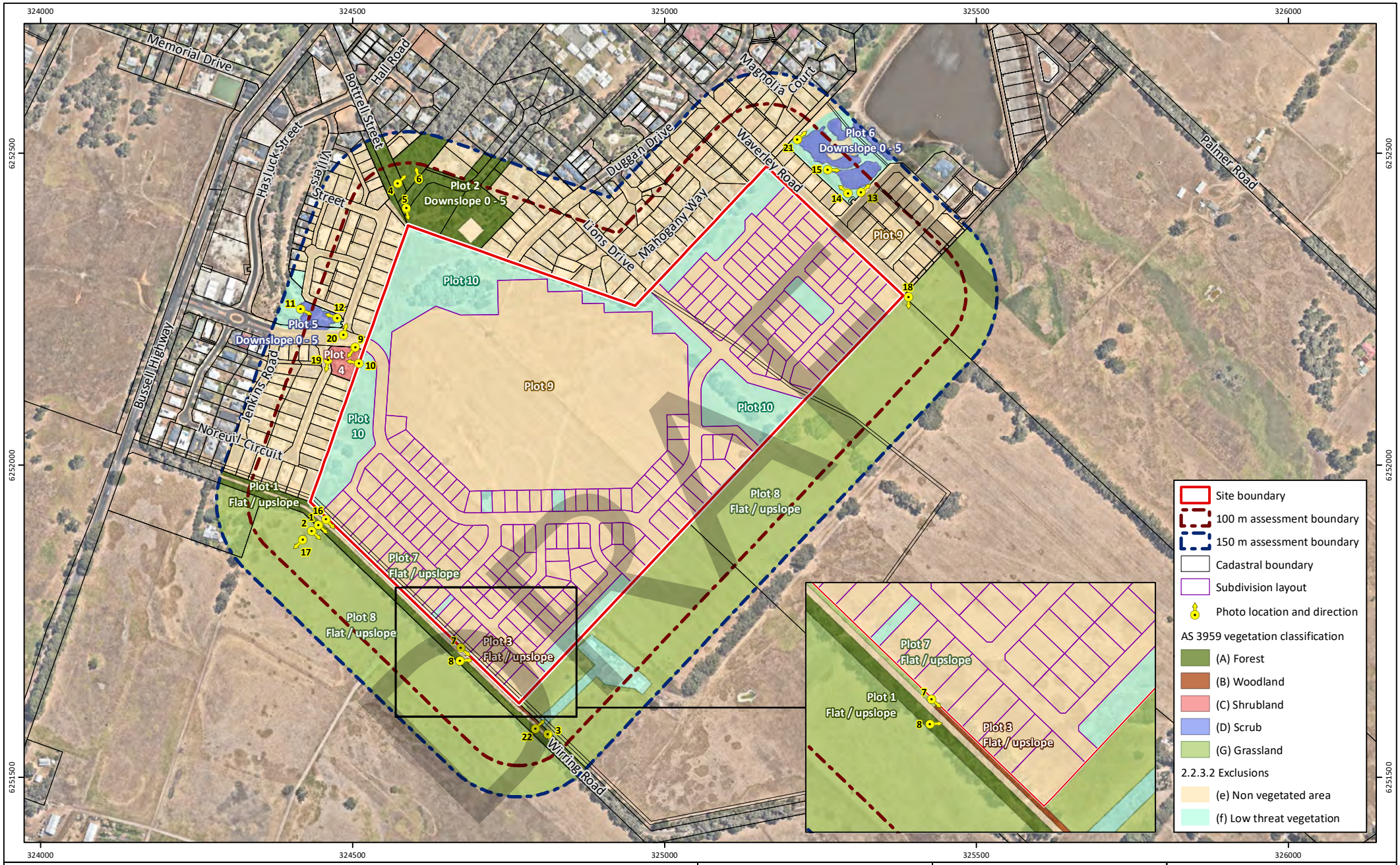


Figure 2: AS3959 Vegetation Classification and Effective Slope

Project:	Bushfire Management Plan Lot 500 Wirring Road, Cowaramup
Client:	Yolk Property Group

Plan Number:
EP24-092(05)--F05

Drawn:	GAR
Date:	28/10/2024
Checked:	CSR
Approved:	KK
Date:	13/12/2024

N

0 100 200 300
Metres

Scale: 1:8,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

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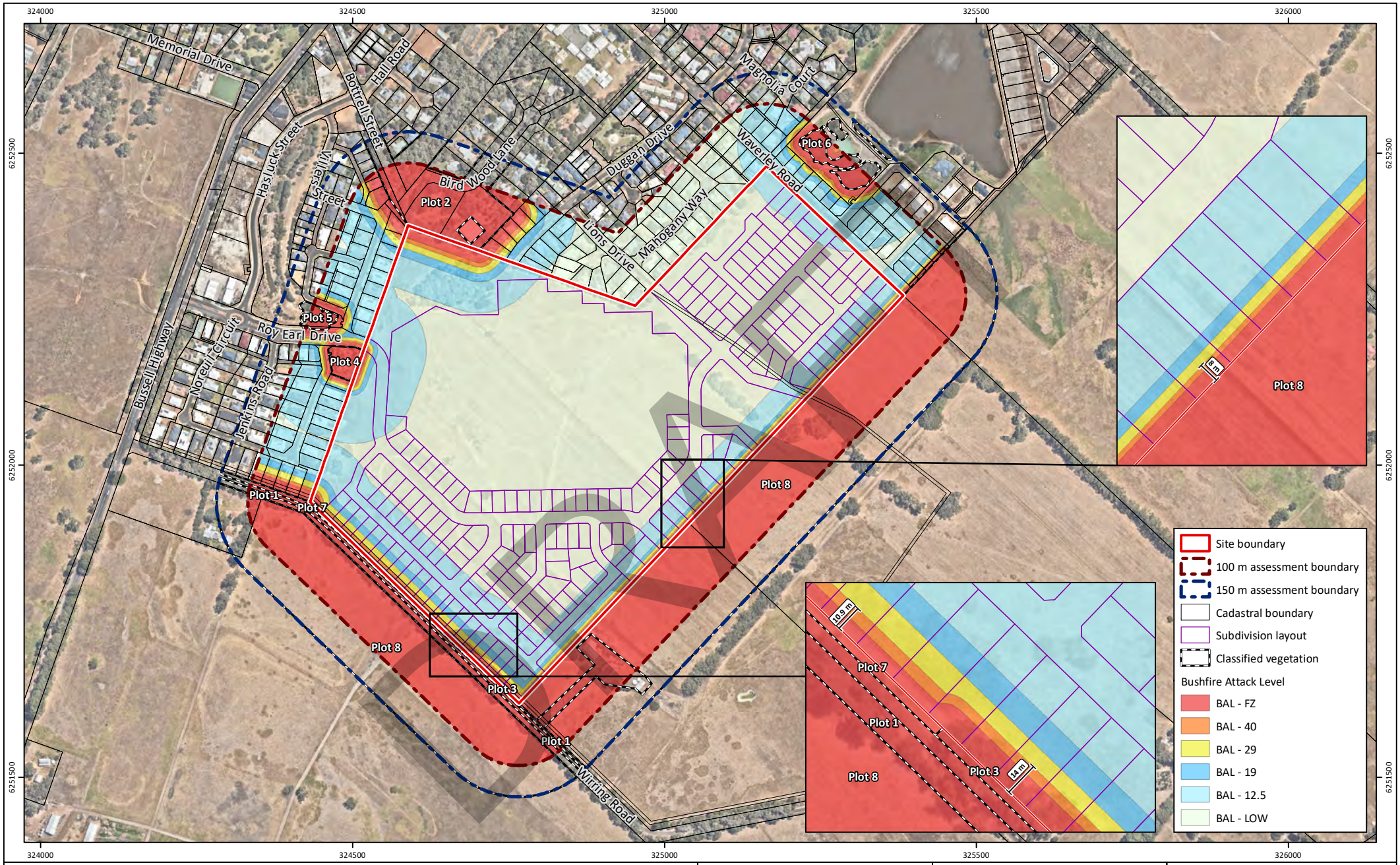


Figure 3: Bushfire Attack Level Contour Plan

Project: Bushfire Management Plan
Lot 500 Wirring Road, Cowaramup
Client: Yolk Property Group

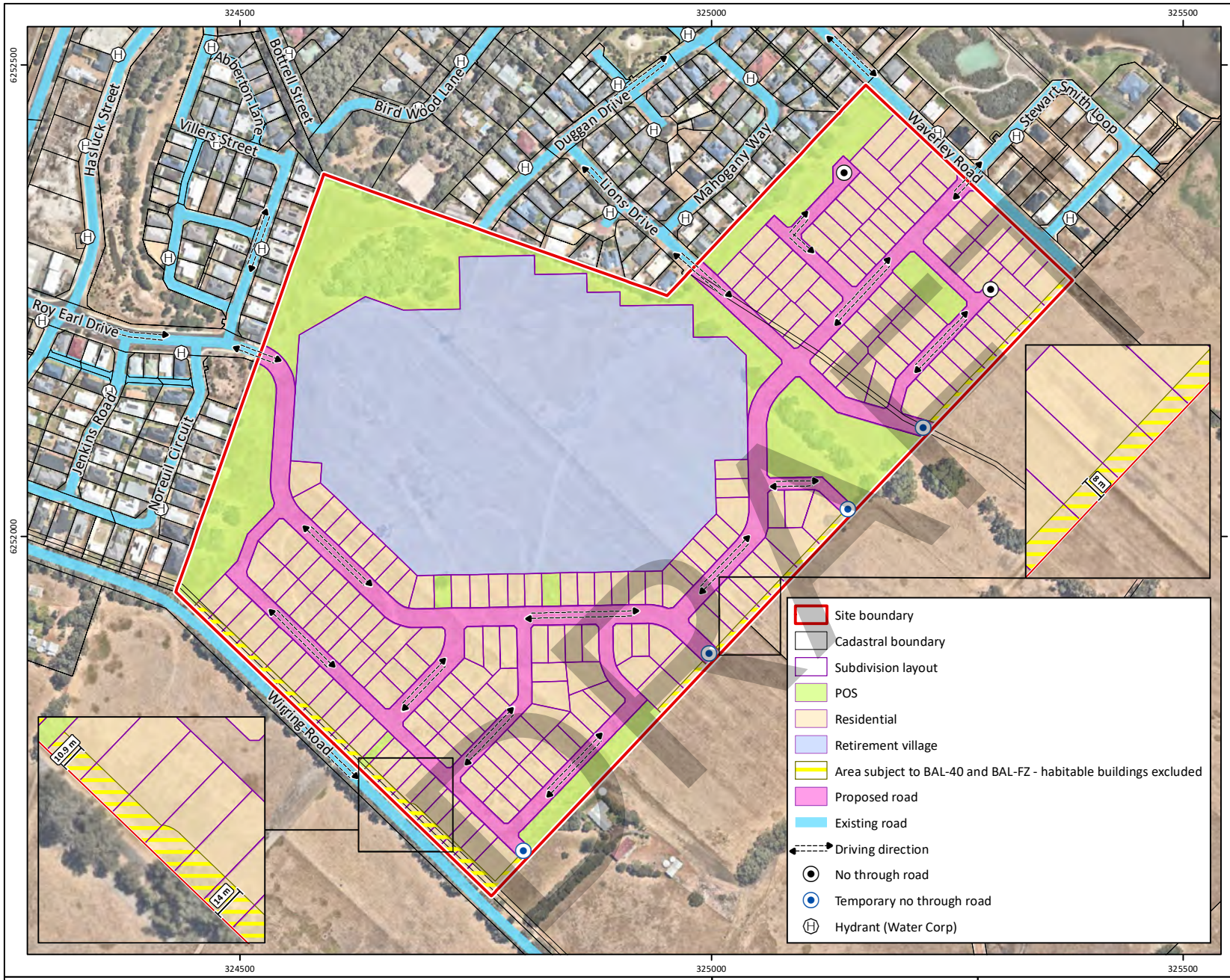
Plan Number:
EP24-092(05)--F06
Drawn: GAR
Date: 28/10/2024
Checked: CSR
Approved: KK
Date: 13/12/2024

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0 100 200 300
Metres
Scale: 1:8,000@A4
GDA2020 MGA Zone 50

emerge ASSOCIATES

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Development Location

Future development sites (habitable buildings) will be located to achieve BAL-29 or less. The proposed road reserves, public open space areas and lot layout can accommodate the required separation. Subdivision is to ensure setbacks and be addressed in lot or in managed public land.

Asset Protection Zone

The entire site (lots, lifestyle village, public open space and road reserves) is to be managed as an Asset Protection Zone and achieve low threat in accordance with Section 2.2.3.2 of AS 3959 and the principles in Appendix B.3 of the Guidelines.

Mature trees can be retained in the public open space areas and still achieve low threat. Maintenance is to include regular mowing of grass and/or reapplication of mulch (where present), garden planting, removal of dead built up material and pruning of low branches.

Vehicle access

Access to multiple suitable destinations is to be provided as part of staged development, and if required can use temporary emergency access ways. All proposed public roads within the site are to satisfy the technical requirements in Table 10 column 1 of the Guidelines.

Where no through roads are required (temporary or permanent), these are to meet the exemptions under the Guidelines or be no longer than 200 m, unless agreed otherwise with the Shire of Augusta Margaret River. No through roads are to meet the public road standards and be provided with suitable turning areas.

Water supply

Reticulated fire hydrants exist within adjacent road reserves. A connection to the reticulated scheme water supply is to be provided within the site as part of subdivision and to meet water authority requirements.

Figure 4: Spatial Representation of Bushfire Management Strategies

Project: Bushfire Management Plan
Lot 500 Wirring Road, Cowaramup
Client: Yolk Property Group

Plan Number:
EP24-092(05)--F07
Drawn: GAR
Date: 28/10/2024
Checked: CSR
Approved: KK
Date: 13/12/2024

N

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Metres
Scale: 1:2,000@A4
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Appendix A

Concept Plan

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24001002A

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COWARAMUP - DRAFT STRUCTURE PLAN AMENDMENT

Lot 500 Wirring Road, Cowaramup

Project YOLHA 24001003 | Scale 1:4000 @ A3 | Date: 10 Sept 2024

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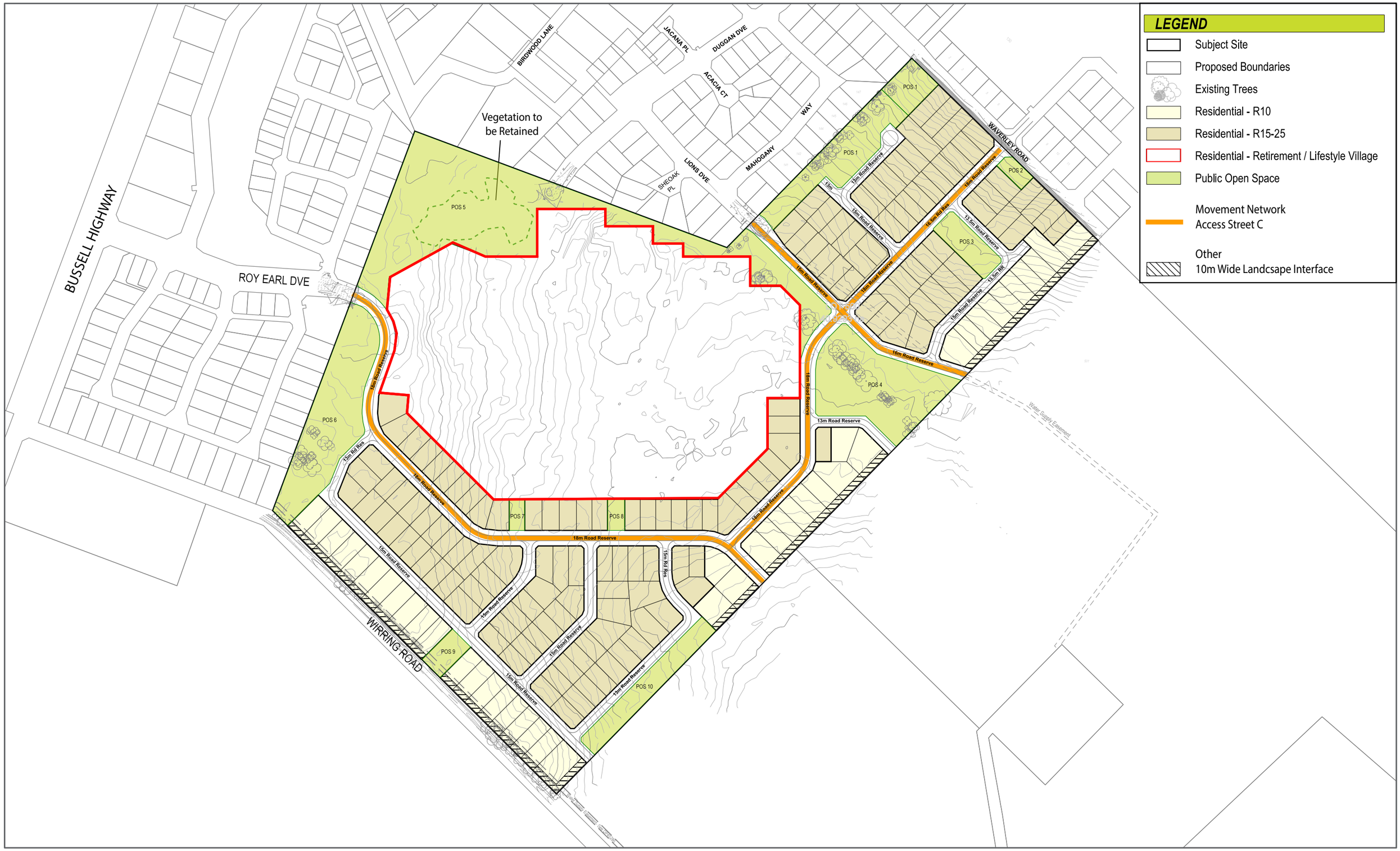
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Appendix B

Landscape Masterplan

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24001002C

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COWARAMUP - STRUCTURE PLAN

Lot 500 Wirring Road, Cowaramup

Project YOLHA 24001002D | Scale 1:4000 @ A3 | Date: 13 Nov 2024

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24001002C

0m 50 100 200

COWARAMUP - STRUCTURE PLAN

Lot 500 Wirring Road, Cowaramup

Project YOLHA 24001002D | Scale 1:4000 @ A3 | Date: 13 Nov 2024

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July 2024

Cowaramup, Western Australia

Land Lease Community - Market Potential Assessment

Prepared for Yolk Property Group

locationiq.com.au

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Executive Summary

The key points to note regarding this assessment of the market potential for a Land Lease Community (LLC) at Lot 500 Wirring Road in Cowaramup, are summarised as follows:

i. The town of Cowaramup is located within the Shire of Augusta-Margaret River Local Government Area, approximately 12 km north of Margaret River and around 260 km south of Perth. Cowaramup is an established rural locality known for its vibrant community and agricultural businesses.

ii. The site encompasses 40.9 hectares and is the subject of rezoning via a Local Structure Plan that is currently with the Western Australian Planning Commission (WAPC) awaiting finalisation. The site is easily accessible to the local and wider region population and is well located within a developing area of the South West region.

iii. Yolk Property Group intends to amend the current structure plan to facilitate the development of a 250-dwelling Land Lease Community and residential uses. As part of the revised structure plan process, this document evaluates the market potential and supportability of the LLC.

iv. The study area likely to be served by the Cowaramup LLC has been defined taking into consideration a range of factors, and encompasses the Shire of Augusta Margaret River, as well as the Shire of Busselton Local Government Areas (LGAs) – which together make up 'The Capes Region' of the South West.

v. Retirement living developments have historically focused on transitioning older individuals into specialised housing options. With the population enjoying better health and longevity outcomes than previous generations, however, there is a growing demand for more active retirement lifestyles.

vi. Land Lease Communities have emerged as a response to these changes as well as the Australian housing market and other external drivers. LLCs are estates where residents own their physical homes but pay ongoing site fees for the land. These communities are typically situated on the outskirts of cities or in regional areas, offering a spectrum of housing choices ranging from affordable options to premium resort-style residences. The younger target demographic encompasses not only retirees but also empty nesters and pre-retirees - who seek active and community-oriented living environments, as well as stability through long-term site agreements.

vii. Research indicates that LLCs represent around one-third of retirement living dwellings in Australia and are expected to become the majority by 2046, driven by factors such as an aging population, housing affordability, retiree migration to coastal and regional areas, lifestyle preferences, increased awareness, regulatory support, and more.

viii. The proposed Cowaramup development aligns with several emerging industry trends that make it an appropriate and considered concept. The scale (250 dwellings) also aligns with contemporary LLC projects across Western Australia and beyond - which average around 223 homesites across 10 hectares (also equating to 21 dwellings per hectare). The scale of the project will help to attract a critical mass of residents necessary to establish and sustain social connections, as well as enabling it to accommodate a range of complementary facilities and amenities.

ix. Land Lease Communities also help to combat housing affordability, availability, and diversity issues – which have been a hallmark of the South West region and broader Western Australia market for several years. As a rural residential area, the composition of local dwellings is dominated by three-and-four-bedroom houses that are primarily targeted at young families. Further, the median house prices and rental trends indicate a market that has experienced strong growth post-Covid, reaching record-high sales and rental prices – coupled with record low vacancy rates. This highlights a significant gap for more compelling, smaller options in Cowaramup - and LLCs can deliver specialised services and pricing structures that better cater to seniors, especially those considering downsizing.

x. As a guide, current prices advertised across the comparable LLC stock in the study area range from $350,000 - $500,000, or 40% - 60% of the median house price for Cowaramup. Weekly site fees are observed to be around $200 for singles and $220 for couples ($70 – $100 per week lower for those qualifying for Commonwealth Rental Assistance), which is also significantly lower than the median weekly rent across Cowaramup ($780).

xi. The Cowaramup study area population is currently estimated at 63,700 (2024) and is projected to increase to 96,700 by 2046, representing an average annual growth rate of 1.9% over the forecast period (1,500 persons) - driven by a range of residential developments and greenfield land supply throughout the region. This is a demonstrably conservative rate of growth (lower than official projections), reflecting a cautious approach to demand modelling.

xii. There is currently an estimated 22,817 persons aged 55+ years across the study area (almost doubled in number since 2011). Over the period to 2046, the number of residents aged 55+ is projected to reach 38,492, reflecting an average growth of 713 persons per year, or 2.4%.

xiii. Retiree migration tends to preference coastal and regional areas, also influenced by familiarity, climate preferences, and lifestyle choices. Historical migration patterns for residents aged 55+ in the study area reflect this, denoting widespread internal movement within the South West and that residents prefer to age in place. The Cowaramup site provides this tranquil and rural location, while still enjoying proximity to major services, and wellbeing data also demonstrates that residents are generally healthier and more independent.

xiv. The study area includes four Land Lease Community (LLC) sites and nine traditional retirement villages, across a total of 842 existing dwellings. Future and ongoing developments outside of the subject site are expected to add up to 975 additional dwellings over the forecast period. Reflecting the maturity of the local market, LLC stock makes up 53% of existing dwellings, and 81% of the known pipeline.

xv. Existing retirement living facilities are generally concentrated within neighbouring towns and urban areas to the north (Busselton) and south (Margaret River). Cowaramup possesses many of the attributes that make these areas popular and suitable for retirement living, and the absence of such facilities at Cowaramup could therefore impact the local community by necessitating that older residents relocate to other towns. Retirees often contribute to the social fabric of a community through volunteerism, local initiatives, and cultural activities. Without retirement facilities, these contributions could diminish, affecting the overall social and cultural vitality of Cowaramup.

xvi. Section 5 of this report quantifies future demand to determine whether the study area's needs will be adequately met over the forecast period. This analysis assesses whether the planned developments will be sufficient to cater for anticipated, growing demand, or if there will be an undersupply requiring additional initiatives.

xvii. Overall, there is estimated to be demand for an additional 1,306 retirement living dwellings over the period to 2046, or an average of almost 60 net new dwellings per year. Based on the existing and future supply pipeline, this is projected to reflect an undersupply of 405 retirement living dwellings within the study area over the period to 2046.

xviii. This modelling should also be considered conservative, given it reflects a situation whereby the maximum projected supply pipeline (all known projects - including those only mooted) is unable to service projected demand (based on cautious population projections). Even allowing for the subject development (250 dwellings) and the restrained demand and supply modelling detailed above, there would still be an indicative undersupply by 2046.

xix. Therefore, there is sufficient capacity to support the Cowaramup LLC development, which will service just a fraction (19%, or around four years) of future projected demand across the region over the period to 2046.

xx. This analysis indicates that there is likely to be strong potential for the Cowaramup Land Lease Community development. The proposed scale and composition of the project, its location within a growing urban area, alignment with emerging industry trends, as well as in-depth market analysis, each denote the Cowaramup proposal as a promising development poised to meet growing demand and help Cowaramup benefit from opportunities within the thriving Land Lease Community sector and South West market.

xxi. The proposed Cowaramup Land Lease Community represents not only a strategic development within the Shire of Augusta-Margaret River but is also a reflection of emerging trends in retirement living that aligns perfectly with evolving preferences and demand.

Introduction

This report presents an independent assessment of the market potential for a Land Lease Community as part of a Structure Plan Amendment at Lot 500 Wirring Road in Cowaramup, in the South West Region of Western Australia.

The site encompasses 40.9 hectares and is the subject of rezoning via a Local Structure Plan, which has progressed through the Shire of Augusta Margaret River and is currently with the Western Australian Planning Commission (WAPC) awaiting finalisation.

Yolk Property Group intends to amend the current structure plan to facilitate the development of both retirement living (a Land Lease Community) and residential uses. As part of the revised structure plan process, this document evaluates the market potential and supportability of the Land Lease Community at Cowaramup and is intended to accompany a structure plan amendment application.

The report is structured and presented in **five (5) sections** as follows:

- **Section 1** details the location of the proposed Cowaramup site and discusses the regional context. The proposed development scheme and structure plan is also outlined at a high level.
- **Section 2** summarises the retirement living industry in Australia, including the types of facilities available, as well as relevant benchmarks.
- **Section 3** includes an overview of the Land Lease Community (LCC) concept, covering the model, market dynamics, and emerging trends.
- **Section 4** provides a review of the market within which the prospective LLC facility at Cowaramup would operate, both now and in the future. This includes the current and projected population levels across the study area (and broader State), as well as at the socio-economic profile and aged resident demographic. The residential market is also examined at both a study area level and broader level.
- **Section 5** applies the key findings of this report to the proposed Cowaramup Land Lease Community and provides an overview of the market potential for the development, including an assessment of the projected level of demand for retirement living, which is then compared against the known level of supply and future pipeline.

1 Local Context & Planned Development

This section of the report reviews the regional and local context of the proposed Cowaramup site and provides an overview of the planned development scheme.

1.1. Regional and Local Context

i. The town of Cowaramup is within the Shire of Augusta-Margaret River Local Government Area (LGA), approximately 12 km north of the Margaret River township and around 260 km south of Perth (refer Map 1.1).

ii. Cowaramup is an established rural locality known for its vibrant community and agricultural businesses. Cowaramup is also the closest town to the Margaret River region, which is a renowned tourist destination courtesy of its many beaches, wineries, surf breaks, and other attractions.

iii. The town occupies a high-profile location along Bussell Highway, which is a major route connecting Perth with the South West region. Based on a review of the most recent traffic counts provided by Main Roads Western Australia, an average of 8,623 vehicles travel along the Bussell Highway (north of Memorial Drive) on an average day (2021/22 figures). This equates to around 3.15 million vehicles each year.

iv. The Bunbury Outer Ring Road and the Bussell Highway widening (to the north of Busselton) are set for completion by the end of 2024 – and will alleviate traffic congestion and enhance travel efficiency between Perth and the South West. The Bunbury Outer Ring Road, a $1.35 billion investment, will streamline travel to Margaret River by bypassing 13 traffic lights and reducing travel time by 11-18 minutes. The City of Busselton, in conjunction with the Department of Planning, are also finalising a planning study to confirm the alignment for the future Busselton Outer Bypass (BOB) – which will facilitate similar expedited travel to the region.

v. The subject land is at Lot 500 Wirring Road, immediately south-east of the Cowaramup Town Centre, 300 metres west of the Bussell Highway. The site encompasses some 40.9 hectares, between Wirring Road and Waverley Road, and is highlighted on Map 1.2, with other nearby points of interest including:

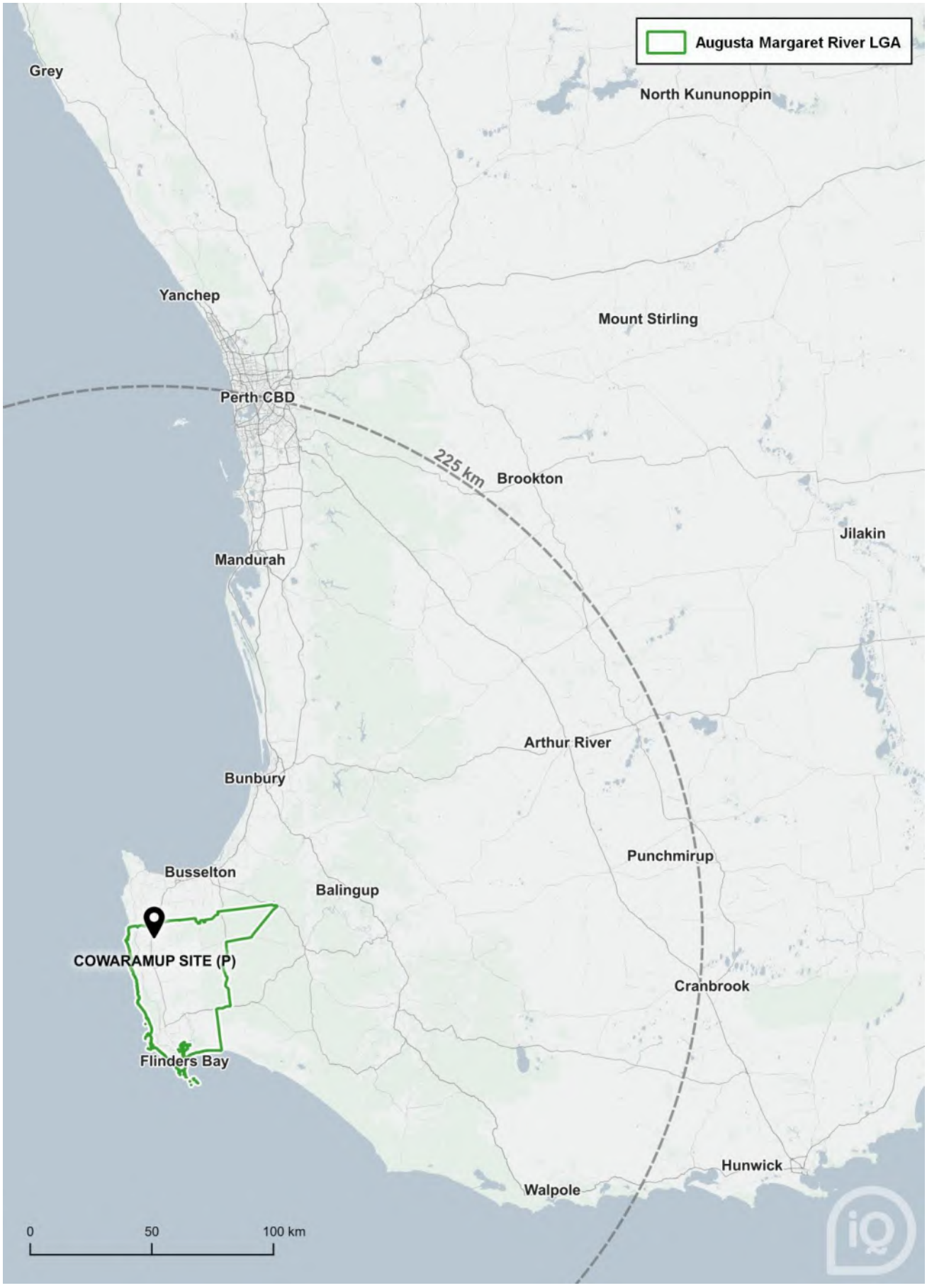
- The retail offer within Cowaramup is provided within a traditional main street (Bussell Highway) town centre format and consists of several local stores that provide basic goods and services. Various boutique produce and giftware stores are also within the precinct to service visitors and tourists. Council approved a small supermarket-based development on undeveloped commercial land immediately south of the existing town centre in 2019. The proposed development was planned to include a small supermarket of 1,331 sq.m, liquor, and around four specialty shops – across a total GLA of 4,150 sq.m. The site was subsequently listed for sale but has since been withdrawn from the market.

- Cowaramup Primary School is on Waverley Road and has an enrolled student population of 356.

- There are a range of civic and community facilities including the Cowaramup District Social Club and Cowaramup District Hall.
- Sporting and recreation facilities include Cowaramup Oval, Cowaramup Skate Park & Playground, the Bowling Green, as well as other open space, parkland, and walking tracks.
- Accommodation is also available through a hotel or bed and breakfast facilities within Cowaramup, in addition to private Air BnB rentals (or similar).
- A range of medical services are available in the town, as well as the Cowaramup Volunteer Fire Station.

vi. Overall, the proposed Cowaramup site enjoys a high-profile location with exposure to a major traffic route. The site is easily accessible to the local and wider region population and is well located within a developing area and community of the South West region.

MAP 1.1. COWARAMUP REGIONAL CONTEXT



MAP 1.2. COWARAMUP LOCAL CONTEXT



1.2. Planning Context & Proposed Development Scheme

i. The subject site is at 500 Wirring Road in Cowaramup and comprises Lot 501 – which is 40.9 hectares in size. This section provides a high-level review of the planning context of the site, as well as the development composition and uses that are proposed.

1.2.1. Planning Context

i. The site is the subject of rezoning via a Local Structure Plan, which has progressed through the Shire of Augusta Margaret River and is currently with the Western Australian Planning Commission (WAPC) awaiting finalisation. Key information regarding this process is summarised as follows:

Shire of Augusta Local Planning Scheme No. 1 (Amendment No. 76) & Local Planning Strategy 2036 (LPS)

- The land is currently zoned 'General Agriculture' under the Local Planning Scheme No.1 (LPS 1) and is in the process of being rezoned to 'Future Development' via Amendment No.76 to the Scheme.
- The Local Planning Strategy (LPS) sets a framework for logical and phased expansion of the town site in a coordinated manner. The Augusta Margaret River LPS was adopted in May 2021 (with endorsement by WAPC in 2023) and is a key planning document to guide land use and population change across the region through to 2036.
- The subject site is identified as 'Future Urban Growth – C5' by the Strategy, which acknowledges that the development of the site is in accordance with the town site's planned expansion, and that rezoning of the subject site to 'Future Development' will enable the progression of a Structure Plan to guide the development of the site.

Current Local Structure Plan (LSP) – Pending Approval

- The rezoning of the site to 'Future Development' (via Amendment No.76) requires the preparation of a Local Structure Plan – which has been prepared and submitted for approval (refer Figure 1.1)
- The LSP completed advertising in 2022 and has been recommended for approval by the Shire at the full Council meeting on the 13 September 2023. The Structure Plan is currently with the WAPC for determination, which is expected in the coming months.

Revised Local Structure Plan (LSP)

- Yolk Property Group intends to amend the current structure plan to facilitate the development of both retirement living (a Land Lease Community) and residential lots.
- A key aspect of the proposed change will be the expansion of the Land Lease Community (LLC) site, which will increase from 1.2 hectares (under the current LSP) to 12.0 hectares (proposed LSP) to yield a total of 250 dwellings, as well as associated facilities and amenities.
- The revised structure plan will be subject to advertising and consideration by both the Shire and the WAPC.

1.2.2. Proposed Development

i. The planning proposal for Lot 500 Wirring Road, Cowaramup, aims to develop the site in-line with the Shire's Local Planning Strategy, as well as other regional planning goals.

ii. The revised Local Structure Plan concept will include two key components, as follows:

- **Residential:** A total of 184 residential lots across a combined 14.76 hectares and a range of parcel sizes:
  - Less than 800 sq.m: 123 lots (67%)
  - 1,000 to 1,250 sq.m: 61 lots (33%)
- **Retirement Living:** A Land Lease Community comprising 250 dwellings across 12.0 hectares

iii. Figures 1.2 – 1.3 provide a preliminary 'Concept Plan', which has been prepared for information purposes only and is subject to caveats (property of Hex Design & Planning).

iv. The final composition and lot mix, as well as design will also be subject to detailed technical investigations, discussions with the landowners, and the ultimate vision for the site. All yields will also be subject to structure planning and subdivision approval, as well as approval form other relevant statutory agencies.

v. As part of the revised structure plan process, the remainder of this document evaluates the market potential and supportability of the Land Lease Community at Cowaramup and is intended to accompany a structure plan amendment application.

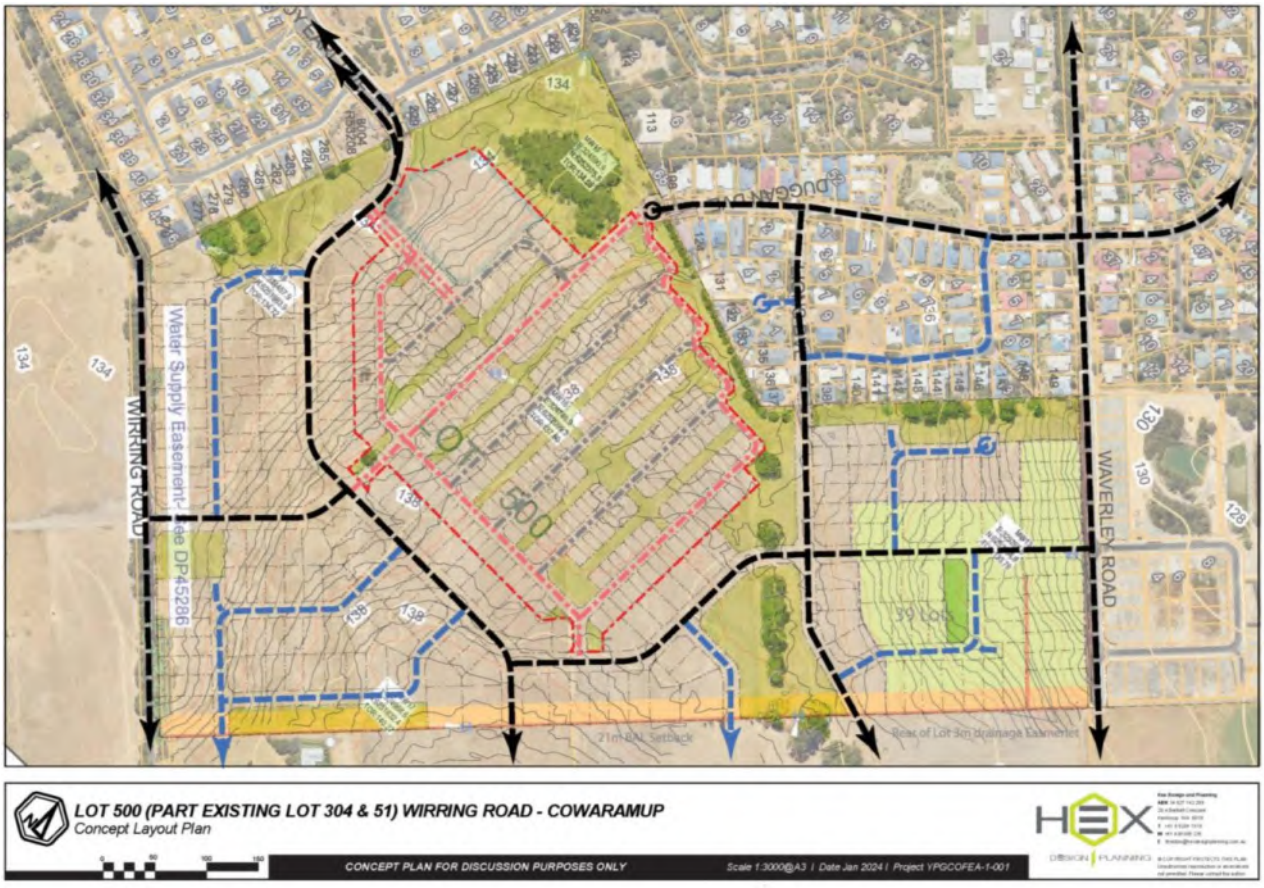
FIGURE 1.1. LOT 500 WIRRING ROAD - CURRENT LOCAL STRUCTURE PLAN



FIGURE 1.2. LOT 500 WIRRING ROAD - REVISED LOCAL STRUCTURE PLAN



FIGURE 1.3. LOT 500 WIRRING ROAD CONCEPT PLAN LAYOUT



2 Retirement Living

This section of the report summarises the retirement living industry in Australia, including the types of facilities available, as well as relevant benchmarks.

2.1. Overview

i. Retirement living generally refers to housing options and communities specifically designed for older individuals who are transitioning from their family homes. These options cater to people aged 55 and over, who seek support, community, and simplified living arrangements.

> *"Retirement living is a general term for downsizing to structured communities that provide safe homes for ageing, reduced costs of living and neighbours that provide companionship. The operator provides ongoing management of the community."*
>
> *- Aged Care 101*

ii. Australia's ageing population has significantly impacted the demand for retirement living accommodation – driven by longer life expectancy and lower birth rates. As a result, there are enormous challenges in how to care for and house an ever-increasing ageing population. Retirement villages have a significant role to play as they:

- Enable people to downsize and live affordably as they age.
- Allow people to live in a purpose-built community facility with full-scale infrastructure.
- Enable residents to age in place, maintaining networks and social connections.
- Provide a communal and supportive living environment.
- Reduce the economic burden across all levels of Government in support for older people.

iii. Traditionally, retirement living and residential aged care facilities have operated separately from each other. As the average age of people entering these environments increases, however, the co-location of independent living units, serviced apartments (assisted living), residential aged care facilities, and other services - has resulted in integrated communities where people can age in place.

iv. The regulatory landscape for retirement living varies by State. In Western Australia, the Retirement Villages Act (1992) regulates retirement villages and aims to safeguard the rights of both residents and village owners. Fair Trading (Retirement Villages Code) Regulations (2022) complement the Act, providing additional guidelines for operators and residents. Together, they provide guidelines for the industry, covering aspects such as contracts, dispute resolution, resident well-being, moving-into and living in communities, and dispute resolution.

v. At a national level, the Retirement Living Code of Conduct sets standards for marketing, selling, and operating retirement communities – including all aspects of resident experience. The purpose of the code is to promote and protect residents' independence, privacy, dignity, safety, and security.

2.2. Types of Retirement Living

i. The growing demand for seniors' living arrangements and the diverse needs of prospective residents have led to a wide range of facilities and financial structures within the retirement living industry.

- **Retirement Villages** are residential, multi-dwelling complexes typically organised in a horizontal 'campus' style (with single-level or low-rise villas set amidst landscaped grounds) or in low-high rise unit developments (known as vertical villages). People opt for retirement villages for physical and financial security, as well as the companionship and support network they offer.

  Retirement villages offer a variety of ancillary amenities such as health, leisure, and support services and are the most popular form of retirement living.

- **Land Lease Communities (LLCs)** provide affordable housing along with varying resort-style facilities. Sometimes (historically) referred to as Manufactured Home Estates and Resort Communities, LLCs have a unique home ownership model where residents own their physical homes but rent the land they occupy. This arrangement significantly reduces home ownership costs, and pensioners can receive Centrelink support for land rental expenses.

  Manufactured home estates or 'land lease communities' originated from caravan parks and operate under a similar business model, with the operator owning the land and leasing individual sites to residents who own a 'relocatable' home. These homes are typically single-level and situated on spacious grounds with communal leisure facilities.

- **Serviced Apartments** offer a more curated service, ideal for individuals living alone that find daily chores challenging. Residents of serviced apartments remain part of a village community, but also have the option to receive meals, cleaning, and other care services as needed.

- **Home Care Retirement Living** is a similar serviced concept whereby residents can stay in their own homes even as their health declines - receiving care and medical support without the need to relocate.

- **Rental Estates** offer a non-upfront alternative, with recurring weekly or fortnightly rental payments. These villages often include meal services, as well as linen and cleaning – but can also form a designated component of traditional (owner/purchaser) estates.

- **Hybrid or Co-located Villages** combine traditional retirement living and aged care facilities within the same development and commonly operated by Not-For-Profit (NFP) organisations. This appeal of this concept lies in facilitating ageing in place, and providing certainty as care needs escalate. This prevents relocation separation of couples.

ii. The key differences (including pros and cons) between these types of retirement living options generally come down to following key factors:

- **Type of Dwelling**: the physical structure of the accommodation, whether it's at-home, a standalone villa, apartment, or unit – as well as the estate or village type.

- **Level of Care:** the support and services available - ranging from independent living with minimal assistance to full-time care for those with more complex needs.

- **Amenities:** the range of amenities within the developments themselves also varies greatly, including features such as meal areas, pools, bowling greens, and more.
- **Financial Operation:** the ownership model and payment structure, including options such as owning the property outright, leasing the land, paying ongoing rental fees – or a combination. Other financial considerations include the implications for pension and Centrelink support payments.

iii. From an investor or developer perspective, the financial viability of retirement living projects is paramount. Major considerations and variables between retirement living offers include initial investment costs, ongoing operational expenses, and potential revenue streams such as rental income and service fees.

iv. Managing risks associated with retirement living investments is also crucial, and some formats provide greater diversification options or mitigation strategies. For example, investors often benefit from partnerships with experienced operators or developers in the sector – as well as healthcare providers, builders, and more.

v. The diversity of retirement living options reflects the evolving needs and preferences of seniors, providers, and investors alike. Each type of retirement living offers unique advantages and challenges, however, ultimately the goal is to deliver living solutions that meet both the practical needs of residents, while also aligning with sustainable financial practices.

2.3. Retirement Living Benchmarks

i. Across Australia, a total of 218,773 retirement living dwellings were recorded as at the 2021 Census across both retirement villages and 'manufactured home estates'.

ii. It is important to note that the ABS definition of manufactured home estates (self-contained dwellings built off-site and installed in specific estates), does not directly align with the Land Lease concept. Therefore, the figures for manufactured home estates should be considered alongside retirement village dwellings.

iii. Across Australia, accepted benchmarks indicate an average of 1.3 residents per dwelling across villages, and 1.6 persons per dwelling across traditional manufactured home estates. This represents total capacity for around 287,200 persons in retirement living facilities at the time (refer Table 2.1).

iv. It is therefore estimated that there is capacity for approximately 3.91% of persons aged 55 years or older to reside in retirement living facilities, which represents the national penetration rate (up from 3.48% in 2011).

v. Across Western Australia, the penetration rate is higher, at 3.97%, but having decreased marginally since 2011 (4.47%). For the Rest of Western Australia, the penetration rate is 3.13% (2021), down from 3.27% in 2011.

vi. In addition to the ABS Census, PWC and The Property Council undertake a *Retirement Census* each year, with the latest 2023 results published in July 2024. Key findings from that report include (refer Table 2.2):

- The average age of residents in a retirement village is 80 years, with 75 years being the average age of residents entering villages (74 across Western Australia).
- The average tenure of ILU residents across Australia was 8.7 years, and 10.1 years in Western Australia.
- The most common reason for exiting retirement living across Australia was entering aged care (55%).

- The average vacancy rate was 5% across Australia, 2% across Perth, and 2% across the Rest of Western Australia.
- The average two-bedroom independent living unit price across Australia is 57% of the median house price in the same postcode. The Rest of Western Australia average ILU is 65% of the median house price.
- The average monthly service is $570 nationally, and lower across the Rest of Western Australia ($470).

vii. It is important to note that the ABS Census penetration rates for retirement living stock pre-date the rise of the Land Lease concept and other more contemporary living arrangements and are therefore considered to be more reflective of demand for traditional retirement living stock.

viii. It is assumed that demand (the penetration rate) will continue to rise over the forecast period to 2046, given the nature and composition of the market continues to evolve – including a greater reliance-on and demand for the Land Lease Community format.

TABLE 2.1. RETIREMENT LIVING PENETRATION RATE BENCHMARKS, 2011 - 2021 CENSUS (AGED 55+)

Metric	Rest of WA			Western Australia			Australia		
	2011	2016	2021	2011	2016	2021	2011	2016	2021
Population									
Persons Aged 55+	117,938	143,587	164,880	527,127	622,687	735,459	5,514,909	6,390,426	7,346,532
Retirement Villages (All)									
Dwellings	2,961	3,123	3,930	18,080	20,219	22,350	145,313	176,763	218,773
Residents	3,859	4,093	5,163	23,553	26,359	29,169	192,103	231,605	287,200
• Persons per Dwelling (Weighted Ave.)	*1.30*	*1.31*	*1.31*	*1.30*	*1.30*	*1.31*	*1.32*	*1.31*	*1.31*
Penetration Rate (%)	3.27%	2.85%	3.13%	4.47%	4.23%	3.97%	3.48%	3.62%	3.91%

Sources: ABS Census 2011 - 2021

TABLE 2.2. PWC RETIREMENT LIVING CENSUS SUMMARY, 2023

Metric	Benchmarks		Australia
	Rest of WA	WA	
Village by Type and Ownership Structure			
Village by Type			
• Horizontal / Single Level / Broadacre	-	-	71%
• Vertical / Multi-level	-	-	15%
• Combination	-	-	14%
Occupancy			
• Residents per Unit	-	1.29	1.26
• Vacancy Rate	2.0%	-	5.0%
New Devs With Aged Care Provided (%)	-	-	44.0%
Residents			
Average Age Upon Entry	-	74.0	75.0
Average Tenure (Years)			
• ILU	-	10.1	8.7
• Serviced Apartments	-	16.5	5.2
Most Common Reason for Exiting			
• Entered Aged Care	-	-	55%
• Passed away / In hospital	-	-	20%
• Entered Another Village	-	-	4%
• Other	-	-	21%
Pricing (2-bed ILU)			
Avg. Price compared to Median House Price (Postcode)	65.0%	-	57.0%
Avg. Monthly Service Fees	$470	-	$597

Sources: PWC Retirement Living Census 2023

3 Land Lease Communities

This section provides an overview of the Land Lease Community (LCC) concept, covering the model, market dynamics, major operators, and emerging trends.

3.1. Overview

i. Retirement living developments have historically focused on transitioning older individuals into specialised housing options. With the population enjoying better health and longevity outcomes than previous generations, however, there is a growing demand among older Australians for more active retirement lifestyles. This includes maintaining social connections, community engagement, and an active lifestyle.

ii. Land Lease Communities (LLCs) have emerged as a response to these changes within the sector, as well as the Australian housing market, and other external demands.

iii. LLCs are estates where residents own their physical homes but pay ongoing site fees for the land. These communities are typically situated on the outskirts of cities or in regional areas, offering a spectrum of housing choices ranging from affordable options to premium resort-style residences.

iv. The LLC sector in Australia is significant in terms of both market size and impact on the housing industry. Recent data[1] indicates that the LLC sector comprises over 130,000 residents across Australia and is valued at approximately $12 billion. The size of the sector and rapid growth highlight its importance and underlying demand.

v. The LLC sector presents a distinct alternative to traditional retirement living options, particularly in terms of its target demographic and ownership model. Unlike traditional villages that primarily focus on seniors aged 65 and above, LLCs broaden their appeal by targeting individuals aged 55 - 85. This younger and broader age range encompasses not only retirees but also empty nesters and pre-retirees - who seek active and community-oriented living environments.

vi. Another distinguishing feature of LLCs is their ownership model – under which residents own their physical homes but lease the land on which it is situated. This differs from traditional retirement villages where residents may have the option to lease or purchase the entire property, including the land. This approach can offer several advantages, including reduced upfront costs for residents, greater flexibility, and greater lifestyle amenities.

vii. As demographic trends, lifestyle preferences, and regulatory frameworks continue to evolve, the LLC sector is poised to remain a key player in Australia's housing landscape, providing innovative solutions and community-centric living environments for residents across a wide demographic band.

[1] *Source: Financial Review (Nov-2023); Chadwick Property Valuers (2023)*

3.2. The LLC Model

3.2.1. Process

i. The LLC model varies slightly between operators, but generally includes a structured process that involves several key steps, from acquisition to residency:

- **Operator Acquires Site & Builds Homes:** the LLC operator acquires land suitable for development and constructs the necessary infrastructure, including community amenities and individual dwellings.
- **Residents Purchase Homes**: prospective residents can purchase homes within the LLC, either opting for newly constructed properties or choosing from resale options. This purchase marks their entry into the community and is accompanied by a long-term site agreement that outlines rights, responsibilities, and lease terms.
- **Operator Retains Ownership of Land**: while residents own their individual homes, the operator retains ownership of the land on which the community and facilities are situated.
- **Resident Rents Land**: as part of the lease agreement, residents pay site rent to the LLC owner/operator for the use of the land where their home is located. This rental arrangement is a fundamental aspect of the LLC model and enables access to amenities and services.
- **Operator Maintains Facilities**: the LLC operator assumes responsibility for maintaining and managing the land, infrastructure, and community facilities. This includes landscaping, upkeep of common areas, and ensuring the functionality and safety of amenities such as recreational areas, clubhouse facilities, and security systems. This structure ensures continuity, as well as efficient management and maintenance.
- **Resident Sells Home:** residents have the flexibility to sell their homes within the LLC and generally retain all capital gains realised from the sale. Upon selling, any outstanding rents owed to the LLC owner are settled, ensuring a seamless transition for both the seller and the incoming resident.

ii. The long-term site agreements offered in LLCs provide residents with stability and predictability in their housing arrangements. Unlike traditional rental agreements that may have shorter terms or uncertainty around renewals, the extended tenure of LLC agreements offers residents peace of mind and security of tenure.

iii. LLC operators also adhere to regulatory requirements and industry standards, which will continue to grow and evolve with the sector, ensuring consumer protection and fair practices. This includes transparency in lease agreements, dispute resolution mechanisms, adherence to building codes and safety regulations, as well as other compliance frameworks.

iv. This structured approach fosters a balanced relationship between operators and residents, offering home ownership benefits coupled with the convenience and community-oriented lifestyle factors, as well as security.

3.2.2. Pricing Benchmarks

i. As outlined previously, the main differences between LLCs and traditional retirement villages are the type of contractual and financial arrangements that are in place, and their level of affordability.

ii. LLCs generally have two key fee components that apply to residents, as follows:

- **Purchase Price:** the entry cost for an LLC is the purchase price of the dwelling or 'above ground improvements'. Generally, the purchase price of LLC dwellings is broadly comparable with that of traditional retirement living stock (ILUs). This reflects new stock being in the LLC space (as compared with ILU), as well the range of additional fees within retirement villages that can mirror LLC site fees.

  As outlined previously, across Australia, the average two-bedroom ILU unit was priced at 57% of the median house price (within same postcode). For the Rest of Western Australia, this figure averaged 65%.

  For Land Lease Communities, typical benchmarks highlight that residents pay around 60% to 70% of what the dwelling (same composition) would cost as a freehold property in the same area. This was echoed by Rob Nichols (Tasman Capital Partners / Serenitas) in June 2023, who indicated that Serenitas typically observe a retention of 35% of equity value when residents transition into LLCs (65% price comparison).

- **Site Fees:** Land Lease Community site fees refer to the ongoing costs paid by residents to lease the land on which their home is located. These fees typically cover the use of communal facilities and services provided by the operator/management.

  Typical benchmarks for LLC site fees in Australia can range from around $100 to $400 per week, although these figures can vary significantly - depending on factors such as location, amenities offered, and more.

  Site fee increases are typically aligned with either CPI or a fixed rate. As a guide, across Stockland's LLC portfolio - more than 95% of sites have fee increase linked to CPI – and typical increases are 3% - 5%.

- **Exit Fees:** Land Lease Communities do not typically charge exit fees when an occupier decides to sell the home. This is in keeping with the financial benefits often advertised as part of these communities, where capital gains are kept, and no stamp duty is paid. For example, Stockland Halcyon, Mirvac (Serenitas), and Providence do not charge exit fees and the purchaser retains all capital gains.

  Some Land Lease Communities use a model whereby occupants pay a reduced weekly site fee and pay the difference when the home is sold, this is often referred to as Selected Rent. This may be calculated as a percentage of the sale price and the duration of time lived at the community.

iii. The variability in both purchase price and site fees reflects the diverse offerings of LLCs, alongside local factors like market pricing, supply, and competition.

3.3. Major Operators & Greenfield Developers

i. Despite being a fledgling concept in Australia (as compared with overseas markets such as the US), the Land Lease Community sector is generally a fragmented asset class.

ii. There are currently nine major operators that are estimated to control more than half of the known LLC sites across the country, including Ingenia Communities, Stockland Halcyon, Hometown Australia Communities, Palm Lake Resort, Lifestyle Communities, Mirvac, Gemlife, Hampshire Villages, and Lincoln Place.

iii. Institutional investors continue to acquire LLC assets, in the form of both individual site and development transactions, as well as large-scale portfolio acquisitions.

iv. The geographic focus for LLCs in Australia has historically been South-East Queensland and along the New South Wales coastline – where communities marketed based on a quintessential relaxed, coastal lifestyle in areas that are already popular with retirees. More recently, however, LLC operators have started to expand into greenfield growth areas across the major capital cities.

v. The market for LLCs in Western Australia remains largely untapped, with just three of the top nine operators currently established in the State – and Mirvac hold the largest LLC portfolio (around 3,000 existing and planned dwellings).

vi. Like New South Wales and Queensland, Western Australia boasts a sunny climate and coastal lifestyle that provides an ideal setting for these communities to be promoted.

vii. The presence of many key demand drivers for LLCs, and attractive investment conditions, provide a strong indication that the LLC market will continue to grow significantly across Western Australia.

viii. Growth across the State has also been (and will continue to be) fuelled by a steady supply of greenfield land.

ix. This implies that future LLC sites and opportunities will naturally integrate into large residential estates and land releases such as the subject site. Since major developers like Stockland, Lendlease, and other local groups already operate their own Land Lease Communities, new LLC facilities will continue as a core and complementary component of greenfield development in the future.

3.4. Market Size, Penetration Rate & Share

i. Research by Chadwick[2] estimates that in 2023, approximately 130,000 Australians resided in Land Lease Communities, spanning some 400 sites and 82,000 dwellings. This would equate to a penetration rate for LLC living of 1.67%, representing the proportion of individuals aged 55 and over who live in an LLC development.

ii. Based on industry projections and the development pipeline, the penetration rate for LLC dwellings is expected to more than double by 2046. This projection aligns with other industry sources:

- Chadwick estimates that the sector makes up housing for 2.5% - 3.0% of the population aged 50 – 84 (this would represent around 2.3% - 3.2% of the population aged 55+). In the US, the penetration rate for residents aged 50 – 84 is more than 6.0%.
- Colliers[3] estimates that the current penetration rate for the over 55-year-old demographic is 1.34%.
- Stockland[4] estimate that the LLC penetration rate for persons 50+ reached 0.9% in 2022 (1.1% for 55+), up from 0.7% in 2017.
- Ingenia[5] (2020) estimated that the LLC penetration rate was 2.1% for persons 65+ at the time and could increase to 3.0% by 2026 (1.8% of 55+).

iii. Land Lease Communities are therefore estimated to represent up to one-third of existing retirement living dwellings in Australia. Based on the known pipeline, which comprises closer to 50% LLC developments, this figure is expected to increase rapidly and see LLCs make up most of the retirement living stock by the end of the forecast period (2046).

iv. The LLC sector in Western Australia is relatively new, historically dominated by National Lifestyle Villages, which was acquired by Serenitas in 2018 and then by Mirvac in 2021.

v. Currently, there are an estimated 3,400 LLC dwellings in WA, representing around 15% of retirement living stock. Recently, several new LLC market entrants have emerged, with numerous sites in the pipeline expected to yield a combined 3,500 additional LLC dwellings (50% of known developments). This would more than double the existing LLC provision increasing LLC stock to more than one-quarter (25%) of the market, upon delivery in the short-medium term.

vi. The LLC market is expanding rapidly across Western Australia and the country, poised to become the dominant source of retirement living in the future. This rise highlights the importance of planning and facilitating the development of new sites, as well as understanding how these communities can integrate seamlessly with surrounding areas, infrastructure, and services.

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[2] *Chadwick Property Valuers, Australian Land Lease Communities (2023)*
[3] *Colliers, Healthcare & Retirement Living - Land Lease Communities (2024)*
[4] *Stockland, Land Lease Communities Investor Update (April 2023)*
[5] *Ingenia Communities Group, Citigroup Global CEO Conference (2020)*

3.5. Key Drivers & Trends

i. Land Lease Communities (LLCs) are influenced by similar trends as the retirement living sector, however, some specific drivers that have shaped their demand dynamics include:

- **Ageing Population & Increased Life Expectancy:** Australia's ageing population and improved life expectancy contribute to the demand for senior's living arrangements. LLCs, however, offer active and community-oriented lifestyles suitable for a younger senior demographic, driving their popularity as a longer-term, alternate living arrangement.
- **Housing Affordability & Supply:** LLCs cater to different income demographics by offering both affordable and premium options. Factors such as entry prices relative to local markets determine affordability, making but make them attractive to individuals seeking downsizing or reduced housing expenses.
- **Geographic Shifts:** Retiree migration towards coastal and regional areas is influenced by familiarity, climate preferences, and lifestyle choices. LLCs are predominantly located in these regions – but still near to major services.
- **Lifestyle & Amenity Preferences:** Amenities offered by LLCs drive market penetration, with benefits such as recreational facilities, social activities, and maintenance-free living.
- **Increased Awareness & Brand Effect:** The increasing prevalence and popularity of LLCs, as well as operators with strong brand awareness have increased market penetration and sales inquiries. National operators with a successful track record tend to have an impact on market on demand – in particular as LLCs are more commonly integrated as part of greenfield estates.
- **Regulatory Environment:** LLCs operate within a regulated framework ensuring fairness, consumer protection, and responsible practices. Ongoing regulatory updates contribute to industry stability and transparency. Further, residents can also retain rent assistance packages and other benefits.
- **Attractive Investment Profile:** the straightforward operating model, strong margins, and tight yields have made the sector an appealing investment vehicle for established retirement living operators and new market entrants alike.
- **Greenfield Sites:** recent trends include a focus on greenfield LLC sites that are co-located with (or within) traditional residential estates.

ii. As LLCs continue to evolve, they have become a widely accepted form of retirement living. With demand likely to increase over time, LLCs may become the new normal in retirement living, and further distance themselves from the traditional affiliation with caravan and manufactured home parks.

4 Study Area Profile

This section of the report provides an overview of the market that the prospective LLC at Cowaramup would operate, both now and in the future. This is referred to as the Study Area throughout the remainder of the report.

4.1. Study Area Definition

i. The study area likely to be served by the Cowaramup LLC has been defined taking into consideration:

- Regional and local accessibility.
- The pattern of urban development throughout the region.
- Significant physical barriers.
- The draw of existing greenfield and retirement living communities in the region, as well as comparable rural areas around Australia.
- The historic migration pattern of over 50's residents into the region.

ii. As above, discussions with existing LLC operators indicate that these facilities typically service or target a catchment area around 30 km, depending on the regional and local accessibility of each site. Given the rural location of Cowaramup, the site is expected to have a more significant draw.

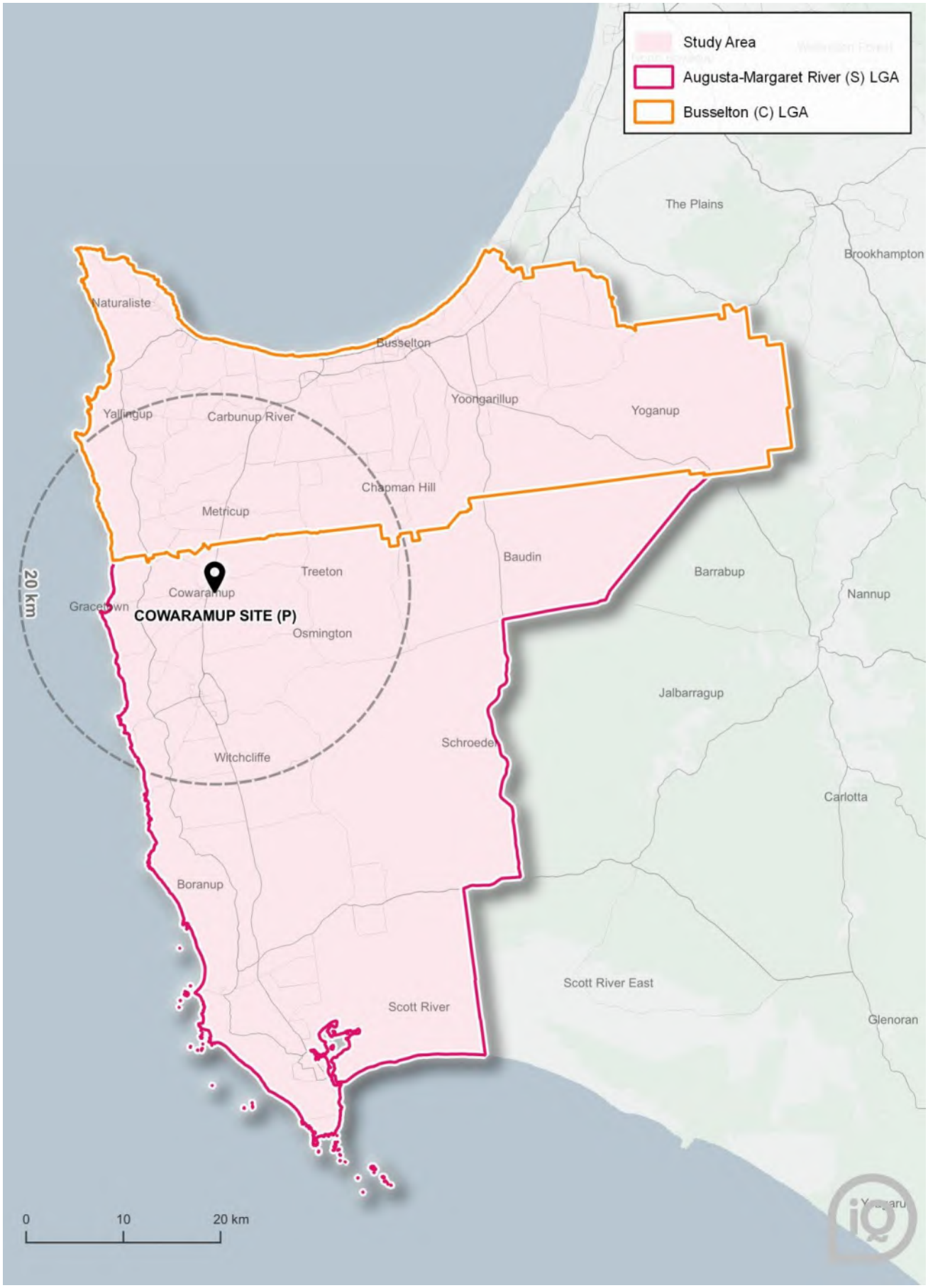
iii. Based on the information above, the defined study area for the Cowaramup LLC development has been defined to encompass the Shire of Augusta Margaret River, as well as the Shire of Busselton Local Government Areas (LGAs) – which together make up 'The Capes Region' of the South West.

iv. As illustrated in Map 4.1, the study area extends 10 - 60 km around the subject site and is limited by the coastline to the west. It is common for residents relocating from the metropolitan area to the South West to consider a range of localities throughout the region, given the similar attributes of each, and traversability.

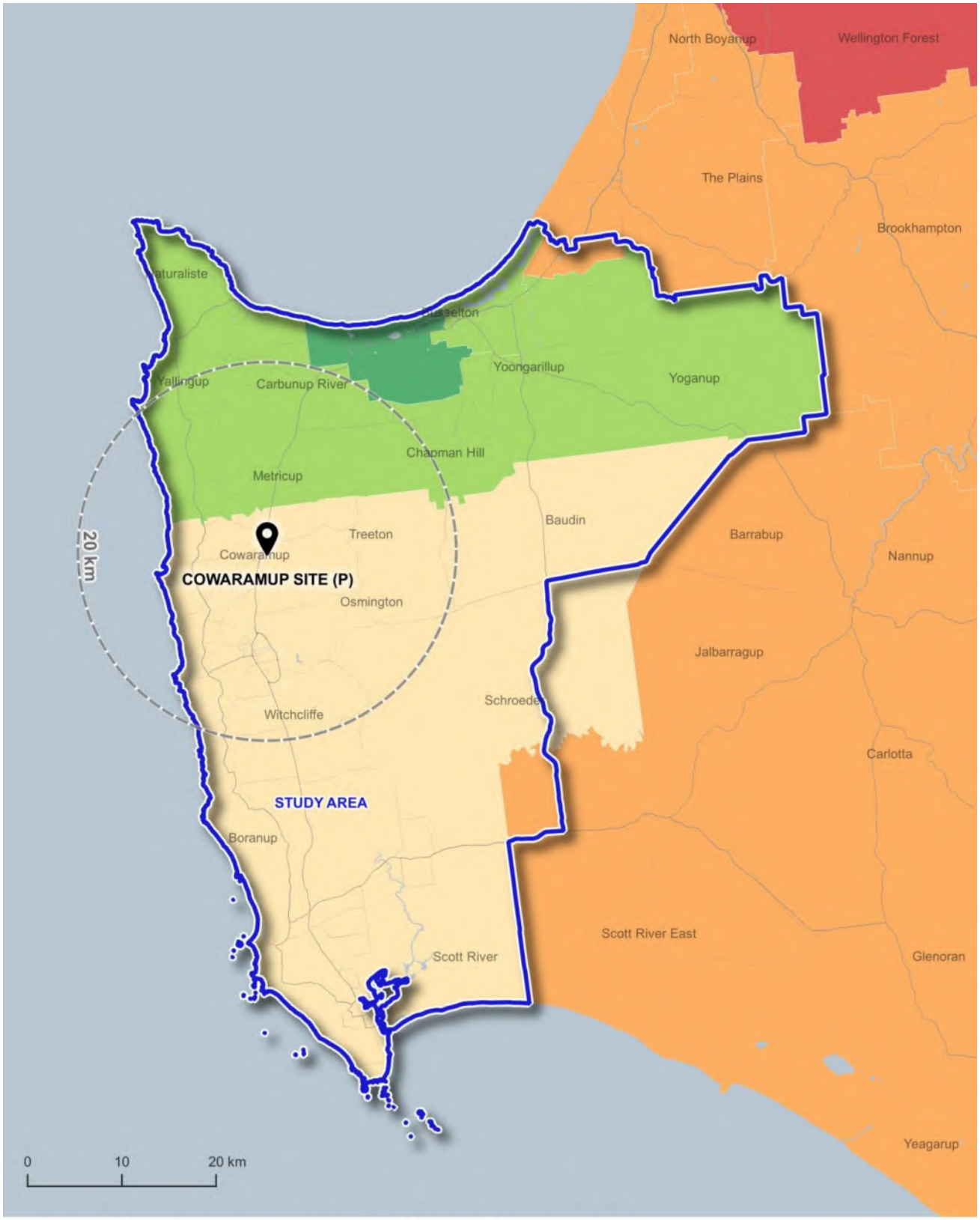
v. Historical migration patterns for residents aged 55+ to the study area (SA2s) as at the 2021 Census (refer Map 4.2) also highlight widespread internal movement. Most of the migration within the age cohort originated from within the study area – and in particular in the northern portions around Busselton. This highlights that study area residents typically prefer to age in place and remain within the region.

vi. The defined study area provides a market in which to examine the key drivers and factors likely to influence the potential for a Land Lease Community at Cowaramup.

MAP 4.1. DEFINED STUDY AREA



MAP 4.2. HISTORIC MIGRATION PATTERN OF RESIDENTS AGED 55+



4.2. Study Area Population

i. Table 4.1 details the current and projected population levels for the study area over the period to 2046, based on the following:

- The 2011, 2016, and 2021 Census of Population and Housing undertaken by the ABS.
- Official State government projections of population and households by WA Tomorrow (SA2 & LGA level) in 2019, as well as broader WA Tomorrow State Population Forecasts published in early 2024.
- New dwelling approvals statistics from the ABS from 2011/12 to 2022/23 (refer Chart 4.2). As shown, an average of 663 new dwellings were approved annually across the study area over this period.
- Investigations by this office into new residential developments in the area.

ii. The Cowaramup study area population is currently estimated at 63,700 (2024), having increased from 43,703 persons as at the 2011 Census (at an average of around 1,538 persons per year). The study area population is projected to increase to 96,700 by 2046, representing an average annual growth rate of 1.9% over the forecast period (1,500 persons annually).

iii. This is higher than the both the Rest of Western Australia and National rates over the same period but could also be considered somewhat conservative when compared against the most recent available population projections by WA Tomorrow (2019) at an LGA level (Chart 4.1).

iv. The medium series forecast (Band C) is considered most accurate and appropriate, having modelled a population of 60,000 persons by 2021 (actual Census population reached a similar figure of 59,200), and some 82,940 persons by 2031 (Location iQ projections model 74,200 by this time).

WA Tomorrow Medium-Term Sub-State Population Forecasts by age and sex for 2022 to 2036 (Statistical Area Level 2 (SA2) and Local Government Area (LGA) are anticipated to be released by mid-2024.

v. In this sense, Location iQ have adopted a more conservative and sustainable rate of population growth based on known residential developments, take up rates, and land supply throughout the region, including (refer Map 4.3):

- **Cowaramup** incorporates numerous growth pockets. **Cowaramup Estate** will be provided between Parkwater and Symphony Waters and is planned to yield some 253 lots. Siteworks have also begun at the **Hideaway Estate**, which will contain 39 lots.

  The Revised Local Structure Plan for the **subject site** would accommodate a combined 434 dwellings, including a total of 184 residential lots and a Land Lease Community of 250 dwellings.

- Like Cowaramup, **Witchcliffe** continues to grow through development, with construction at **The Leeuwin** underway for 250 lots (upon completion). **Witchcliffe Ecovillage** is planned to yield 416 lots in combination, with approximately 100 completed since 2021.

- Within **Margaret River**, **Rapids Landing** is mid-development and has 170 (of a total 570) homes remaining. Further expansion to the north-west of the estate is awaiting development approval, whilst expansion to the south will occur after current development stages are completed. Siteworks have

commenced at **Spindrift Estate** which will yield 423 lots and plans for **Margaret River Estate** (located further south) have also progressed on another 470 dwellings.

- **Vasse Estate** encompasses a 370-hectare landholding with an ultimate yield of 2,100 residential dwellings (6,000 persons), as well as a 208-lot National Lifestyle Village (retirement living). Based on information from developers, some 1,000 lots remain within the Estate, with residential development assumed to proceed at a rate of 100 dwellings per annum until scheduled completion by around 2032.
- **Dunsborough Lakes** contains some 750 homes, and is approaching completion, with current plans showing approximately 200 homes remaining in the south of the estate.
- **Cape Rise**, to the north of Dunsborough Lakes, is currently delivering first homes (23 lots sold). The estate is planned to encompass some 650 residential lots in the medium-to-long term.
- **Naturaliste Heights**, adjacent to Cape Rise, is also anticipated to contain some 200 homes.
- **Embark Busselton (Provence) Estate** is a master planned residential estate that has been under construction for over 10 years (originally developed by Satterley). To date, approximately 725 homes have been built. Yolk Property Group, in conjunction with Banner Asset Management, acquired 136 hectares of the Provence Estate development and anticipate that the future stages will yield a combined 790 lots (2,240 persons), at an average rate of 60 dwellings per year to 2035. In addition, a retirement living village of 300 units is also planned.
- **Willow Grove** has sold out the first stage of a potential 150-lot yield adjacent to Embark Estate. Development is projected to proceed at a rate of 25 lots per annum from 2024.
- **Stonebridge Estate** is being developed by QUBE and is positioned along the Busselton Bypass. The development will yield a total of 57 dwelling upon completion in 2025, with most homes already having been constructed since 2021.
- **Newport Geographe** is a residential project by Aigle on the Geographe Marina that is planned to include up to 728 lots. Development is assumed to proceed at a rate of 50 lots per year from 2024.
- **Peppermint Park Estate** is nearing completion with approximately 10 of 60 homes remaining.
- **Bovell** is located to the south of Busselton and currently has a population of approximately 500 persons. The City of Busselton Local Planning Strategy notes it as a future urban growth area (in the medium term) with a potential population of some 6,600 persons. This would require approximately 3,000 net additional homes to be delivered – and the Local Planning Strategy states that further infrastructure is required at Bovell before growth can occur.

vi. It is important to note that the population projections in this report are based on current market conditions and the latest available information that has been sourced by this office. If market conditions change, this would impact population and sales projections outlined in this assessment.

vii. Given the population projections detailed in this assessment are demonstrably conservative, the overall level of assessed demand and need can also be considered restrained or cautious. This approach ensures that the projections remain pragmatic, accounting for potential variations in market conditions and the pace of residential development.

TABLE 4.1. STUDY AREA POPULATION FORECAST, 2011 - 2046

Population	Actual			Forecast						Change
	2011	2016	2021	2024	2026	2031	2036	2041	2046	2024-46
Study Area	43,703	52,510	59,200	63,700	66,700	74,200	81,700	89,200	96,700	*33,000*

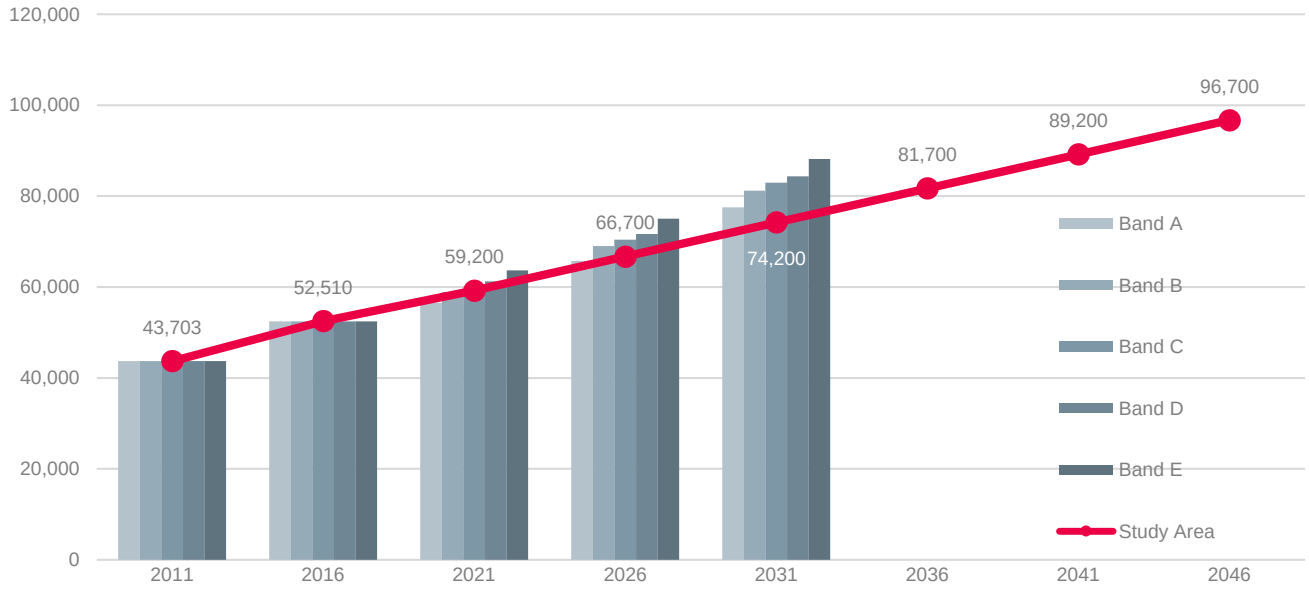
Average Annual Change (No.)	Actual		Forecast						Change
	2011-16	2016-21	2021-24	2024-26	2026-31	2031-36	2036-41	2041-2046	2024-46
Study Area	1,761	1,338	1,500	1,500	1,500	1,500	1,500	1,500	*1,500*

Average Annual Change (%)	Actual		Forecast						Change
	2011-16	2016-21	2021-24	2024-26	2026-31	2031-36	2036-41	2041-2046	2024-46
Study Area	3.7%	2.4%	2.5%	2.3%	2.2%	1.9%	1.8%	1.6%	*1.9%*
Rest of WA	*0.6%*	*0.1%*	*2.2%*	*0.7%*	*0.8%*	*0.8%*	*0.8%*	*0.8%*	*0.8%*
Australian Average	*1.6%*	*1.2%*	*2.4%*	*1.6%*	*1.3%*	*1.2%*	*1.1%*	*1.1%*	*1.3%*

All figures as at June and based on 2021 SA1 boundary definition.

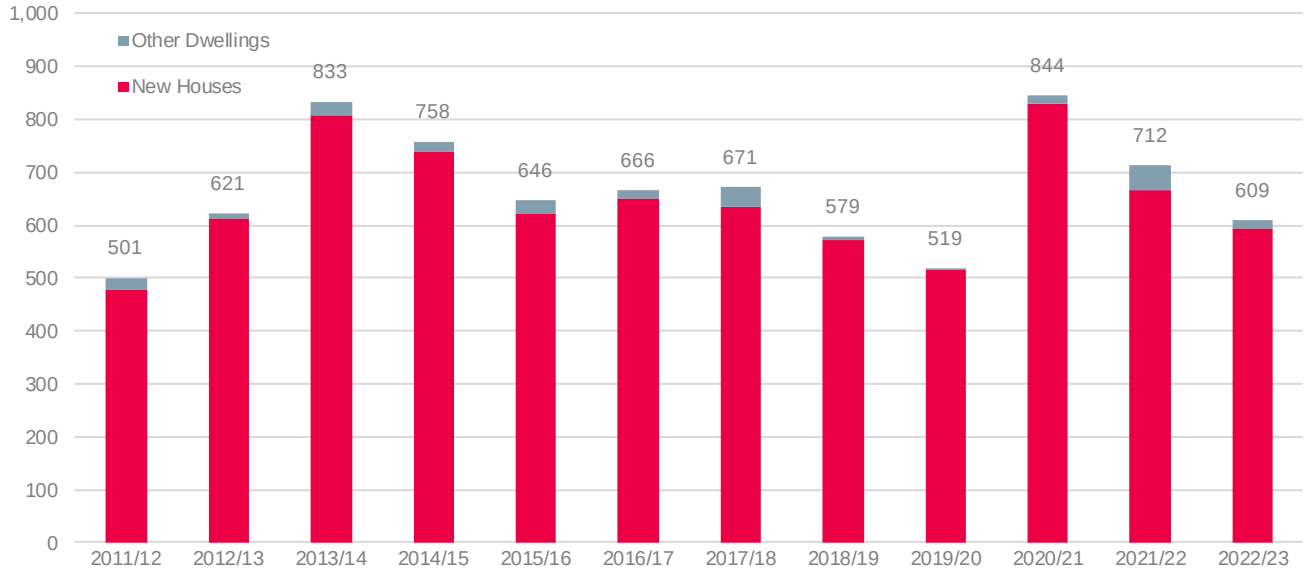
Sources : ABS; WA Tomorrow

CHART 4.1. STUDY AREA POPULATION PROJECITONS VS. WA TOMORROW (2019) PROJECTIONS (LGAS)



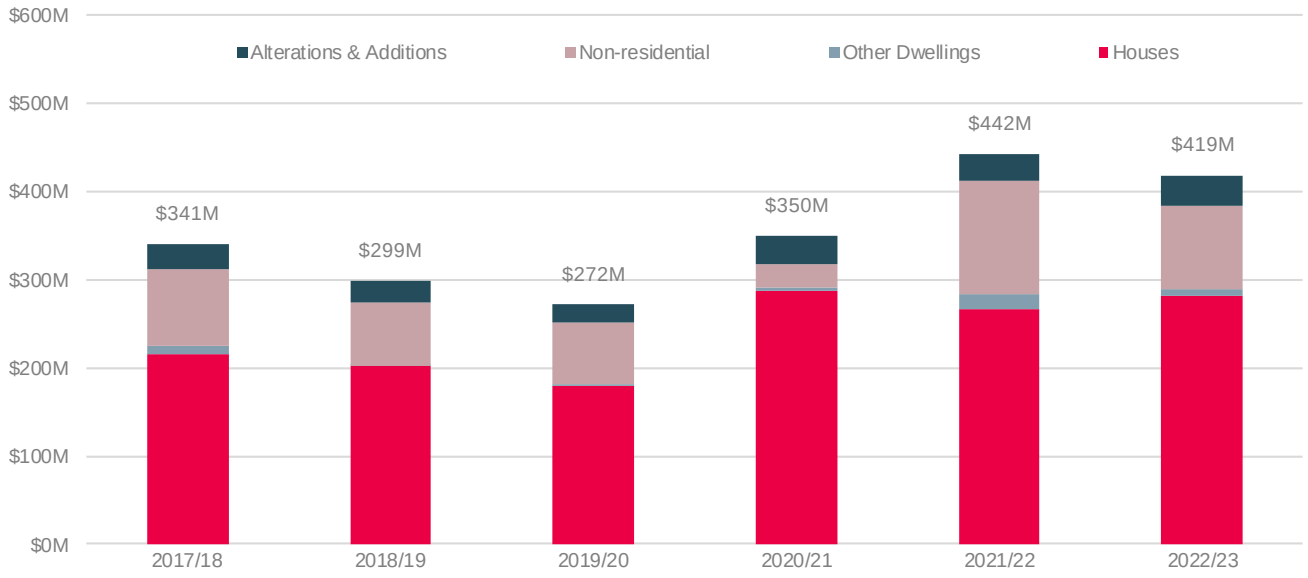
Source: Location iQ, WA Tomorrow (2019) LGAs

CHART 4.2. STUDY AREA NEW DWELLING APPROVALS (2011/12 – 2022/23)



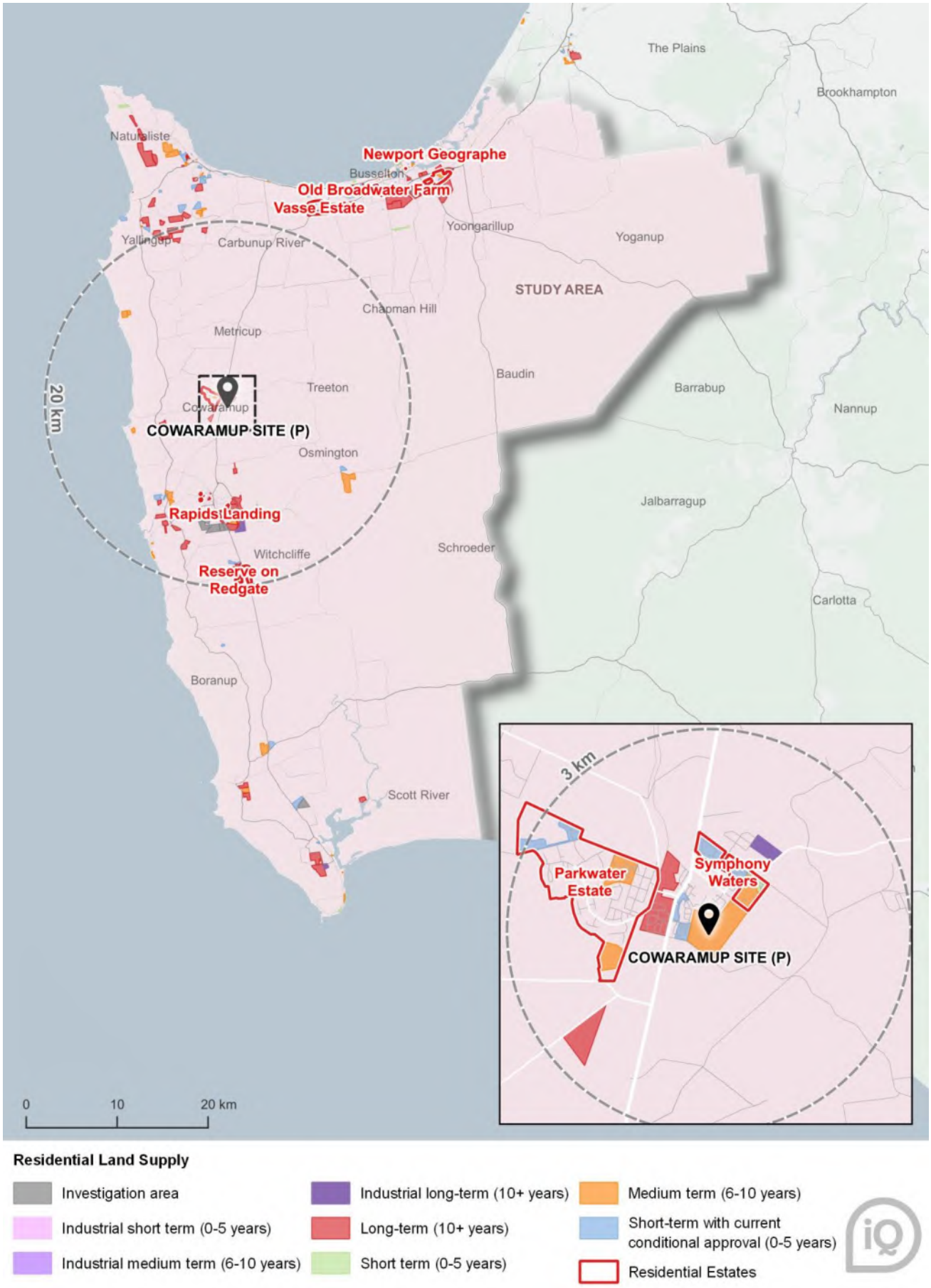
Source: ABS

CHART 4.3. STUDY AREA NEW DWELLING APPROVALS (2017/18 – 2022/23)



Source: ABS

MAP 4.3. RESIDENTIAL LAND SUPPLY & ESTATES



4.3. Socio-economic Profile

i. Table 4.2 details the socio-economic profile of the study area and Rest of Western Australia population – as compared with the Australian benchmark. This information is sourced from the latest 2021 Census of Population and Housing which is undertaken by the ABS. Key points to note regarding the socio-economic profile of the study area include:

- The average age of residents across the study area is 42.3 years, which is older than both the Rest of Western Australia (40.2) and Western Australia average (38.9). A total of 34.9% of the study area population are aged over 55 years, as compared with the benchmark levels (31.1% for Rest of Western Australia and 27.9% for Western Australia). This has risen from 27.8% in 2011 (Rest of Western Australia was 23.5%).
- The proportion of Australian-born residents across the study area (79.5%) generally aligns with the Rest of Western Australia average (81.6%), with more than half of the population born overseas (20.5%) being of European descent (11.4%).
- The average household composition across the study area includes a high proportion of traditional families (couples with dependent children - 43.3%), while 10.9% of households are lone persons. This is comparable with the benchmark for the Rest of Western Australia – 41.6% of households are made up of couples with dependent children, whilst 12.1% are lone persons.
- Residents across the study area generally earn income levels slightly lower than the Rest of Western Australia average. The average per capita income across the study area is $53,036, compared with the average across the Rest of Western Australia of $56,600.
- Study area residents predominantly own their home (73.6%) and reside within houses (90.0%) - with each metric being higher than the Rest of Western Australia benchmarks of 65.7% and 88.7%, respectively.

ii. The socio-economic profile of the study area is generally similar to that of Rest of Western Australia, and consists of an older, Australian-born, middle-income, family, downsizer, and retiree demographic.

iii. Table 4.3 provides a summary of the change in the socio-economic profile of the study area population between the 2011 and 2021 Census compared with the Rest of Western Australia benchmark. Key points to note include:

- The average age of residents increased faster than the benchmark levels.
- Average per capita and household income levels outpaced benchmark levels.
- Household ownership rates increased significantly faster than the benchmark.

iv. Rural greenfield development areas are likely to attract middle-income young families, and as residential development continues, the profile of the area is expected to follow a similar trend – comparable with the changes experienced in recent years. This pattern is unlikely to be reflected within Cowaramup unless downsizing and seniors living options are also provided amongst greenfield house and land packages that are targeted at young families. The proposed Cowaramup development will therefore offer a diversity of housing and choice for the ageing population and enable them to relocate or remain nearby to extended family.

TABLE 4.2. STUDY AREA SOCIO-ECONOMIC PROFILE, 2021 CENSUS

Characteristic	Study Area	Rest of WA Average	Western Australia Average	Australia Average
People				
Average Age	42.3	40.2	38.9	39.5
Age Distribution Detailed (% of Pop'n)				
Aged 0 - 55	65.1%	68.9%	72.1%	70.9%
Aged 55-59	6.4%	6.9%	6.1%	6.1%
Aged 60-64	6.9%	6.7%	5.7%	5.8%
Aged 65-69	6.6%	5.8%	5.0%	5.1%
Aged 70-74	6.4%	4.9%	4.3%	4.6%
Aged 75-79	3.9%	3.2%	2.9%	3.2%
Aged 80-84	2.5%	2.0%	2.0%	2.2%
Aged 85-89	1.4%	1.1%	1.1%	1.3%
Aged 90-94	0.6%	0.4%	0.5%	0.6%
Aged 95-99	0.2%	0.1%	0.1%	0.1%
Aged 100+	0.0%	0.0%	0.0%	0.0%
Birthplace (% of Pop'n)				
Australian	79.5%	81.6%	66.9%	72.0%
Overseas	20.5%	18.4%	33.1%	28.0%
• Asia	2.2%	3.5%	10.7%	12.1%
• Europe	11.4%	7.7%	12.0%	7.2%
• Other	6.9%	7.2%	10.3%	8.7%
Family				
Not married	35.7%	38.6%	40.4%	41.9%
Family Type (% of Pop'n)				
Couple with dep't children	43.3%	41.6%	45.5%	44.2%
Couple with non-dep't child.	5.3%	6.0%	7.1%	7.7%
Couple without children	29.2%	27.0%	23.6%	23.8%
Single with dep't child.	8.1%	9.2%	8.6%	8.6%
Single with non-dep't child.	2.6%	3.2%	3.5%	4.0%
Other family	0.5%	0.9%	1.0%	1.0%
Lone person	10.9%	12.1%	10.8%	10.8%
Employment				
Income Levels				
Average Per Capita Income	$53,036	$56,600	$58,431	$55,301
Per Capita Income Variation	-6.3%	n.a.	n.a.	n.a.
Average Household Income	$97,119	$102,007	$112,037	$109,594
Household Income Variation	-4.8%	n.a.	n.a.	n.a.
$4,000+ ($208,571+) (H)	8.8%	10.6%	14.1%	13.5%
Labour Force (% of Pop'n)				
% White Collar Occupations	62.6%	58.3%	67.1%	71.3%
% Blue Collar Occupations	37.4%	41.7%	32.9%	28.7%
Housing				
Tenure Type (% of Dwellings)				
Owned	73.6%	65.7%	70.6%	67.4%
• Outright	36.5%	33.0%	29.8%	31.7%
• With mortgage	37.1%	32.7%	40.8%	35.7%
Rented	23.6%	30.5%	27.4%	30.8%
• Real estate agent	11.1%	11.1%	15.4%	20.6%
• State or territory housing authority	2.6%	5.2%	2.9%	2.9%
• Community housing provider	0.4%	1.6%	0.7%	0.7%
• Person not in same household	8.1%	7.4%	6.8%	5.4%
• Other landlord	1.4%	5.1%	1.5%	1.1%
Other Tenure Type	2.7%	3.8%	2.0%	1.8%
Dwelling Type (% of Dwellings)				
House	90.0%	88.7%	80.0%	72.6%
Semi-detached	7.9%	8.1%	13.0%	12.6%
Apartment	0.4%	1.5%	6.4%	14.2%
Other Dwelling Type	1.7%	1.7%	0.6%	0.5%

Sources: ABS Census of Population and Housing 2021

TABLE 4.3. STUDY AREA SOCIO-ECONOMIC PROFILE COMPARISON, 2011 – 2021

Characteristic	Study Area			Change (%)			Rest of WA			Change (%)		
	2011	2016	2021	2011-16	2016-21	2011-21	2011	2016	2021	2011-16	2016-21	2011-21
People												
Average Age	38.7	40.2	42.3	0.8%	1.1%	0.9%	36.7	38.5	40.2	1.0%	0.8%	0.9%
Age Distribution Detailed (% of Pop'n)												
Aged 0 - 55	72.2%	68.7%	65.1%	-3.5%	-3.7%	-7.1%	76.5%	72.4%	68.9%	-4.1%	-3.5%	-7.7%
Aged 55-59	6.6%	6.5%	6.4%	0.0%	-0.1%	-0.1%	6.4%	7.0%	6.9%	0.6%	-0.1%	0.5%
Aged 60-64	6.0%	6.5%	6.9%	0.5%	0.4%	0.9%	5.5%	6.1%	6.7%	0.6%	0.6%	1.2%
Aged 65-69	4.7%	6.4%	6.6%	1.7%	0.2%	1.9%	3.9%	5.3%	5.8%	1.4%	0.5%	1.9%
Aged 70-74	3.6%	4.5%	6.4%	0.9%	1.9%	2.8%	2.9%	3.7%	4.9%	0.8%	1.3%	2.0%
Aged 75-79	2.9%	3.1%	3.9%	0.3%	0.8%	1.0%	2.1%	2.5%	3.2%	0.5%	0.6%	1.1%
Aged 80-84	2.2%	2.2%	2.5%	0.0%	0.3%	0.3%	1.5%	1.6%	2.0%	0.2%	0.4%	0.6%
Aged 85-89	1.2%	1.4%	1.4%	0.1%	0.0%	0.1%	0.8%	0.9%	1.1%	0.1%	0.1%	0.2%
Aged 90-94	0.5%	0.5%	0.6%	0.0%	0.1%	0.1%	0.3%	0.4%	0.4%	0.1%	0.1%	0.1%
Aged 95-99	0.1%	0.1%	0.2%	0.0%	0.1%	0.0%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%
Aged 100+	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Birthplace (% of Pop'n)												
Australian	80.9%	80.6%	79.5%	-0.3%	-1.1%	-1.4%	80.9%	81.5%	81.6%	0.6%	0.1%	0.7%
Overseas	19.1%	19.4%	20.5%	0.3%	1.1%	1.4%	19.1%	18.5%	18.4%	-0.6%	-0.1%	-0.7%
• Asia	1.5%	2.0%	2.2%	0.5%	0.2%	0.6%	2.4%	3.3%	3.5%	0.9%	0.2%	1.1%
• Europe	11.1%	11.3%	11.4%	0.2%	0.1%	0.2%	8.8%	8.1%	7.7%	-0.7%	-0.4%	-1.1%
• Other	6.4%	6.1%	6.9%	-0.3%	0.8%	0.5%	7.9%	7.1%	7.2%	-0.8%	0.1%	-0.7%
Family												
Average Household Size	2.5	2.5	2.4	-0.2%	-0.2%	-0.2%	2.6	2.5	2.4	-0.7%	-0.3%	-0.5%
Family Type (% of Pop'n)												
Couple with dep't children	46.1%	45.9%	43.3%	-0.2%	-2.6%	-2.8%	45.3%	43.9%	41.6%	-1.4%	-2.3%	-3.7%
Couple with non-dep't child.	5.2%	5.3%	5.3%	0.0%	0.0%	0.1%	5.9%	6.0%	6.0%	0.1%	0.0%	0.1%
Couple without children	27.0%	27.2%	29.2%	0.3%	2.0%	2.3%	25.5%	25.9%	27.0%	0.5%	1.0%	1.5%
Single with dep't child.	9.1%	8.8%	8.1%	-0.3%	-0.6%	-0.9%	9.6%	9.4%	9.2%	-0.1%	-0.2%	-0.3%
Single with non-dep't child.	2.2%	2.5%	2.6%	0.3%	0.1%	0.5%	2.6%	2.9%	3.2%	0.3%	0.3%	0.7%
Other family	0.4%	0.5%	0.5%	0.1%	0.0%	0.1%	0.8%	0.9%	0.9%	0.1%	0.0%	0.1%
Lone person	10.0%	9.8%	10.9%	-0.2%	1.1%	0.9%	10.3%	11.0%	12.1%	0.6%	1.1%	1.7%
Employment												
Income Levels												
Average Per Capita Income	$38,781	$45,540	$53,036	3.3%	3.1%	3.2%	$45,567	$51,744	$56,600	2.6%	1.8%	2.2%
Per Capita Income Variation	-14.9%	-12.0%	-6.3%	2.9%	5.7%	8.6%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Average Household Income	$71,114	$83,311	$97,119	3.2%	3.1%	3.2%	$81,049	$91,122	$102,007	2.4%	2.3%	2.3%
Household Income Variation	-12.3%	-8.6%	-4.8%	3.7%	3.8%	7.5%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Labour Force (% of Pop'n)												
% White Collar Occupations	61.3%	61.9%	62.6%	0.6%	0.7%	1.3%	56.4%	57.2%	58.3%	0.8%	1.1%	1.9%
% Blue Collar Occupations	38.7%	38.1%	37.4%	-0.6%	-0.7%	-1.3%	43.6%	42.8%	41.7%	-0.8%	-1.1%	-1.9%
Tenure Type (% of Dwellings)												
Owned	66.2%	70.8%	73.6%	4.6%	2.8%	7.4%	63.5%	64.4%	65.7%	0.9%	1.3%	2.2%
Rented	32.5%	28.0%	23.6%	-4.5%	-4.4%	-8.8%	35.4%	34.7%	30.5%	-0.7%	-4.2%	-4.9%
Other Tenure Type	1.3%	1.2%	2.7%	-0.1%	1.5%	1.5%	1.1%	0.9%	3.8%	-0.2%	2.9%	2.7%
Dwelling Type (% of Dwellings)												
House	88.9%	89.3%	90.0%	0.4%	0.7%	1.1%	87.6%	88.7%	88.7%	1.1%	0.0%	1.1%
Semi-detached	6.7%	7.2%	7.9%	0.5%	0.7%	1.2%	5.9%	7.1%	8.1%	1.2%	1.1%	2.3%
Apartment	2.5%	0.5%	0.4%	-2.0%	-0.1%	-2.1%	3.7%	2.0%	1.5%	-1.7%	-0.6%	-2.2%
Other Dwelling Type	1.8%	3.0%	1.7%	1.1%	-1.3%	-0.2%	2.9%	2.2%	1.7%	-0.6%	-0.5%	-1.2%

Source: ABS Census of Population and Housing 2011, 2016 & 2021

higher | lower than benchmark

4.4. Aged Residents (55+)

i. The population aged 55 years and older is the most relevant age group for LLC facilities, and so it is important to examine this cohort in more granular detail.

Population

- Table 4.4 provides a more detailed breakdown and projection of the resident population aged 55+ within the study area over the forecast period to 2046. This information is based on the existing and future population projections detailed in Section 4.2, as well as individual age bracket changes from official sources (such as WA Tomorrow and GEN Aged Care).
- There are currently an estimated 22,817 persons aged 55+ years across the study area, up from 12,152 persons as at the 2021 Census (almost double).
- Over the period to 2046, the total number of residents aged 55+ is projected to grow to 38,492, reflecting an average growth of 713 persons per year, or 2.4%.
- This would see the proportion of residents aged 55+ years make up 49.8% of the study area population by 2046 – up from 35.8% currently (2024), and 34.9% as at 2011. Charts 4.4 – 4.6 provide additional context for these assumptions, highlighting that the study area has historically comprised a higher proportion of older persons (55+), and that this figure has increased markedly since 2011. For the purposes of this assessment, growth in the proportion of aged persons is projected to stabilise (slow) but still exceed typical benchmarks over the forecast period.

Socio-economic Profile

- Charts 4.7 – 4.9 highlight key socio-economic metrics related specifically to the aged residents (55+ years) demographic within the study area.
- Generally, older residents of the study area (75+) have lower needs for assistance with core activities (55+); fewer long term health conditions; and less-commonly live alone (75+), as compared to the Rest of Western Australia average.
- The key implication is that residents are considered slightly more healthy and independent - and consequently could be more inclined to consider independent living options such as land lease communities (in contrast to assisted seniors living and aged care).

Existing Pockets & Migration

- Map 4.4 highlights the location of residents aged 55+ years throughout the study area and broader region as at the 2021 Census. As shown, there are several pockets of older persons throughout the region, including around Cowaramup, Margaret River, Witchcliffe, Busselton, Dunsborough, and Augusta. The previous Map 4.2 also showed that the highest migration for over 55's stemmed from similar areas to the north and highlights that study residents typically prefer to age in place (remain in the area if possible).
- Map 4.5 illustrates the location and density (by SA2) of residents that are recipients of the Age Pension. Currently, an estimated 7,107 study area residents receive the aged care pension, representing some 31% of the over-55 population (2021). The majority reside in and around the Busselton urban area.

ii. In summary, there is a growing number of residents aged 55+ years across the defined study area, who will likely consider retirement living options now or in the future – provided sufficient housing diversity is available.

TABLE 4.4. STUDY AREA POPULATION AGED 55+ YEARS, 2011 - 2046

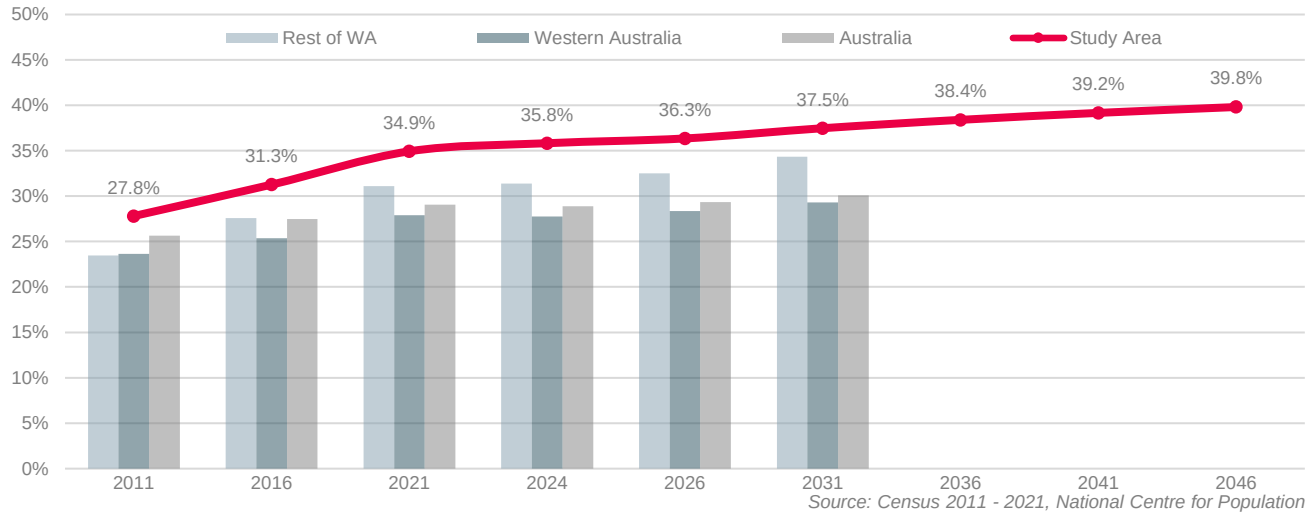
Metric	Actual			Current	Forecast					*Net Additional*
	2011	2016	2021	2024	2026	2031	2036	2041	2046	*(2024 - 2046)*
Study Area Population										
Persons Aged 55+	12,152	16,419	20,680	22,817	24,242	27,805	31,367	34,930	38,492	*15,675*
Proportion of Total Population	*27.8%*	*31.3%*	*34.9%*	*35.8%*	*36.3%*	*37.5%*	*38.4%*	*39.2%*	*39.8%*	*4.0%*

Average Annual Change (No.)	Actual		Forecast						*Change*
	2011-16	2016-21	2021-24	2024-26	2026-31	2031-36	2036-41	2041-46	*(2024 - 2046)*
Persons Aged 55+	853	852	713	713	713	713	712	713	*713*

Average Annual Change (No.)	Actual		Forecast						*Change*
	2011-16	2016-21	2021-24	2024-26	2026-31	2031-36	2036-41	2041-46	*(2024 - 2046)*
Persons Aged 55+	6.2%	4.7%	3.3%	3.1%	2.8%	2.4%	2.2%	2.0%	2.4%

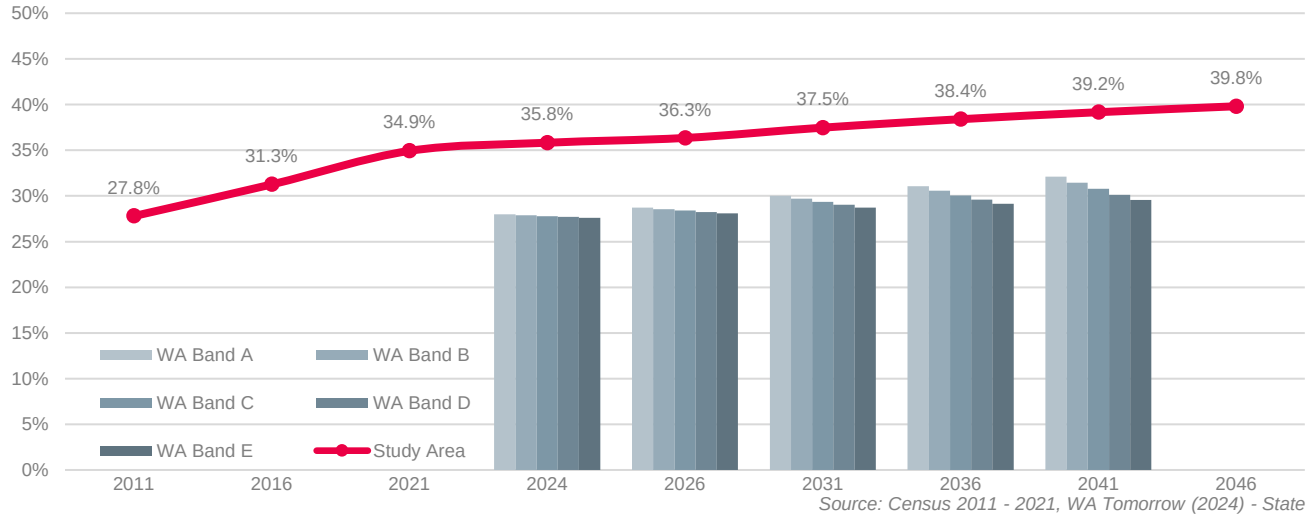
Sources : ABS; WA Tomorrow

CHART 4.4. POPULATION AGED 55+ (%) VS. CENTRE FOR POPULATION BENCHMARK PROJECTIONS



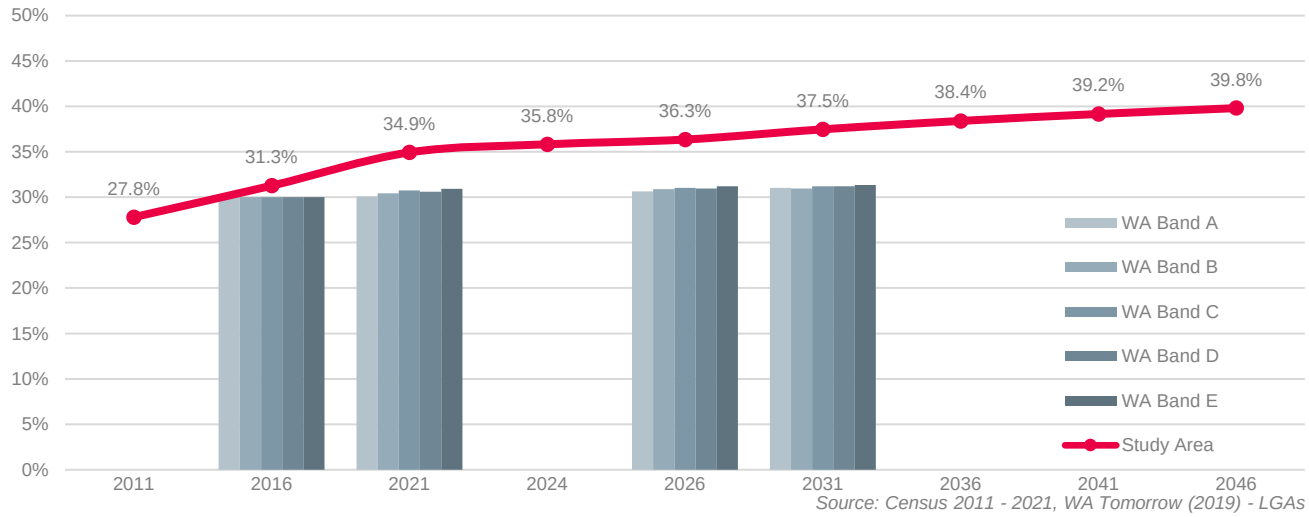
Source: Census 2011 - 2021, National Centre for Population

CHART 4.5. POPULATION AGED 55+ (%) VS. WA TOMORROW (2024) PROJECTIONS (STATE)



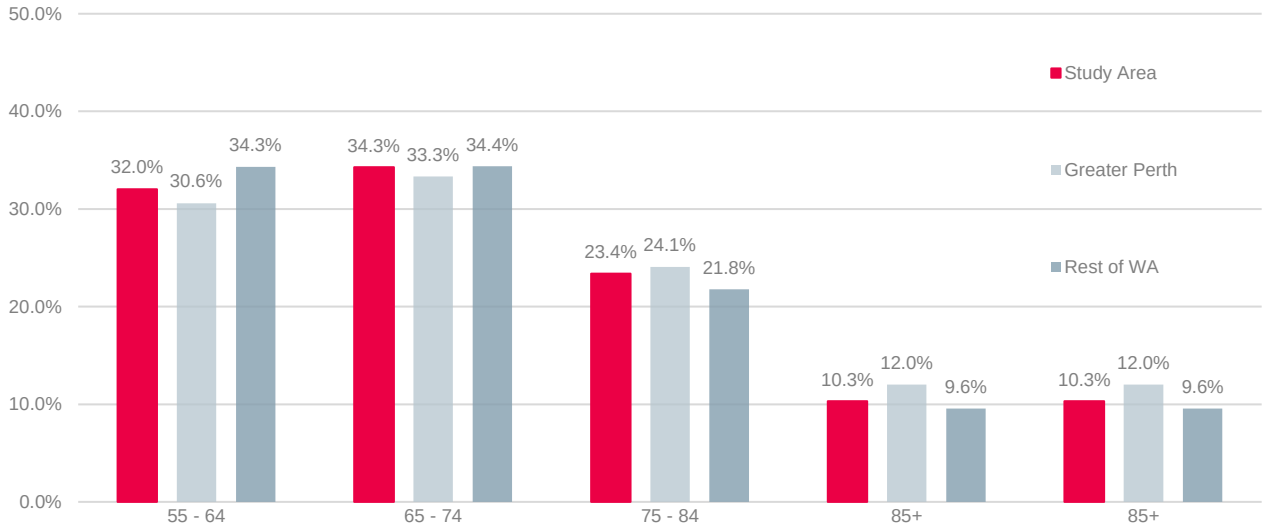
Source: Census 2011 - 2021, WA Tomorrow (2024) - State

CHART 4.6. POPULATION AGED 55+ (%) VS. WA TOMORROW (2019) LGA PROJECTIONS (STUDY AREA)



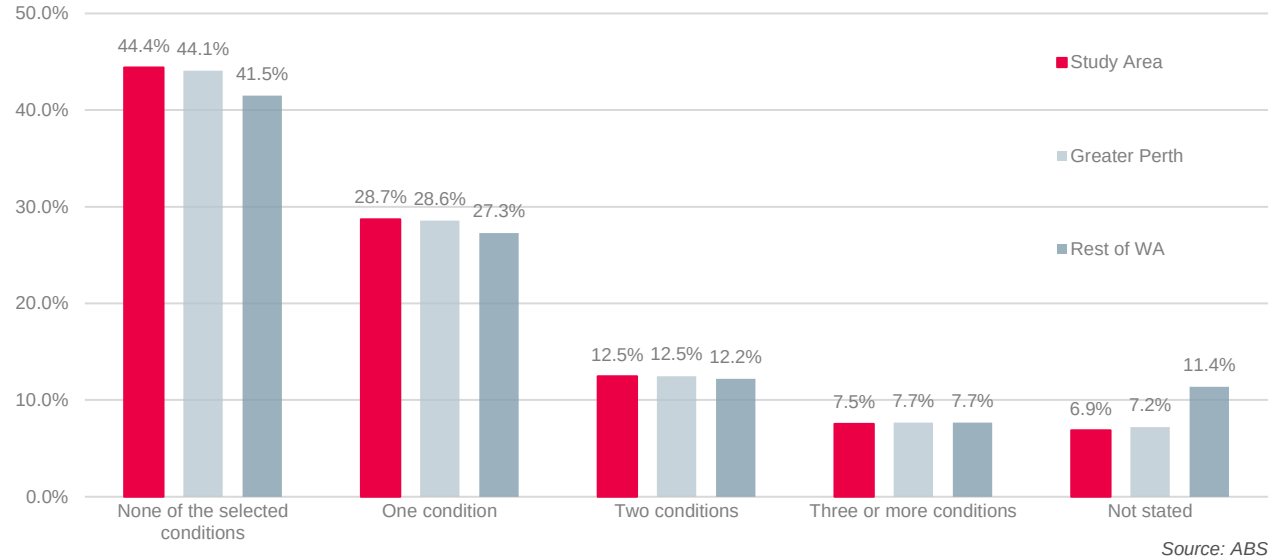
Source: Census 2011 - 2021, WA Tomorrow (2019) - LGAs

CHART 4.7. RESIDENTS AGED 55+ - CORE ACTIVITY NEED FOR ASSISTANCE (ASSNP)



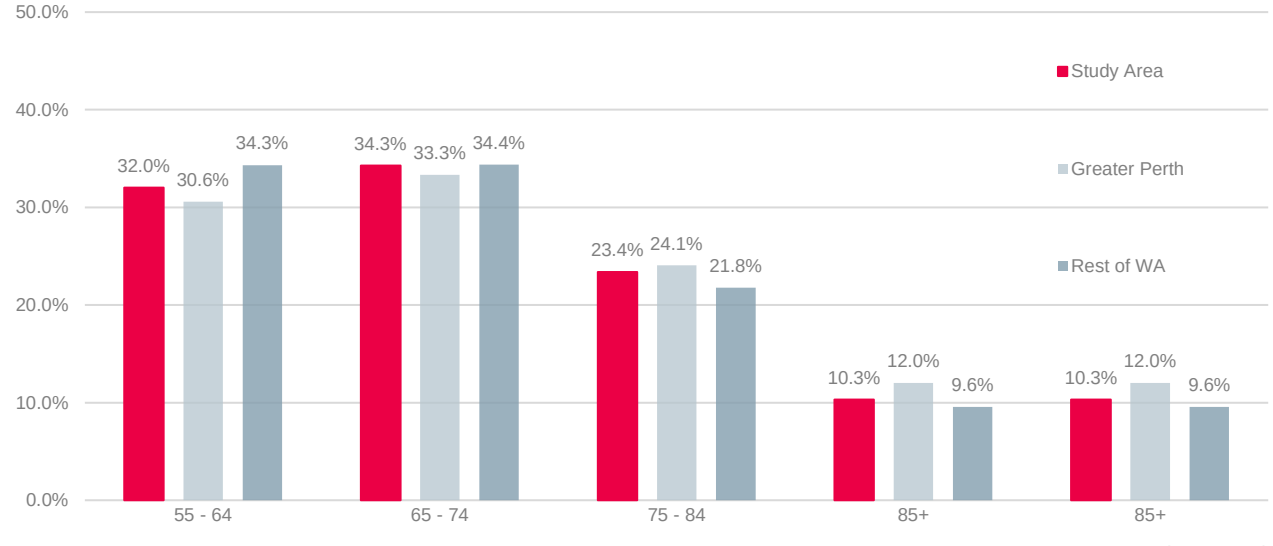
Source: ABS

CHART 4.8. RESIDENTS AGED 55+ - SELECTED LONG-TERM HEALTH CONDITIONS (2021)



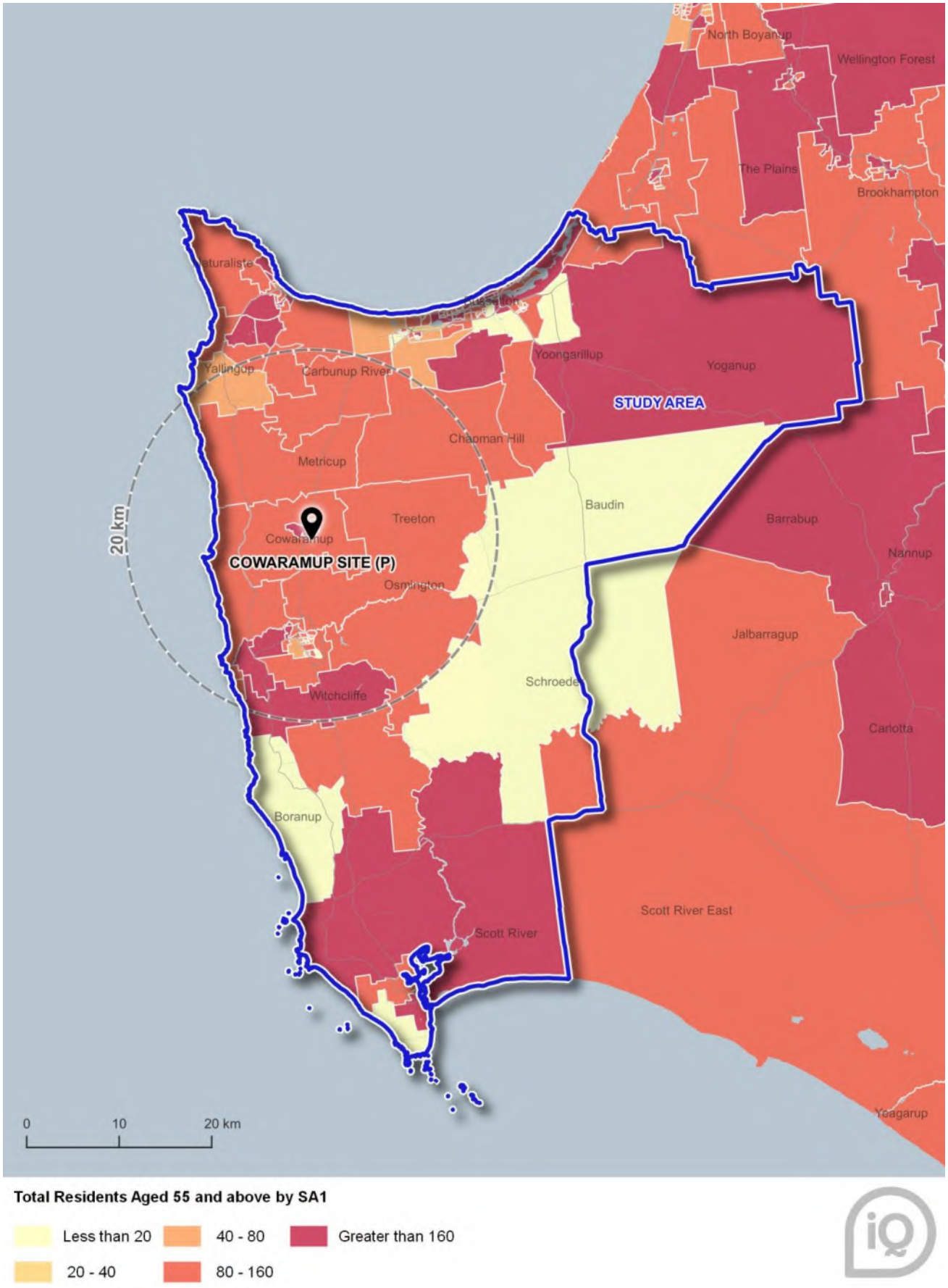
Source: ABS

CHART 4.9. RESIDENTS AGED 55 + - LONE PERSONS BY AGED BRACKET

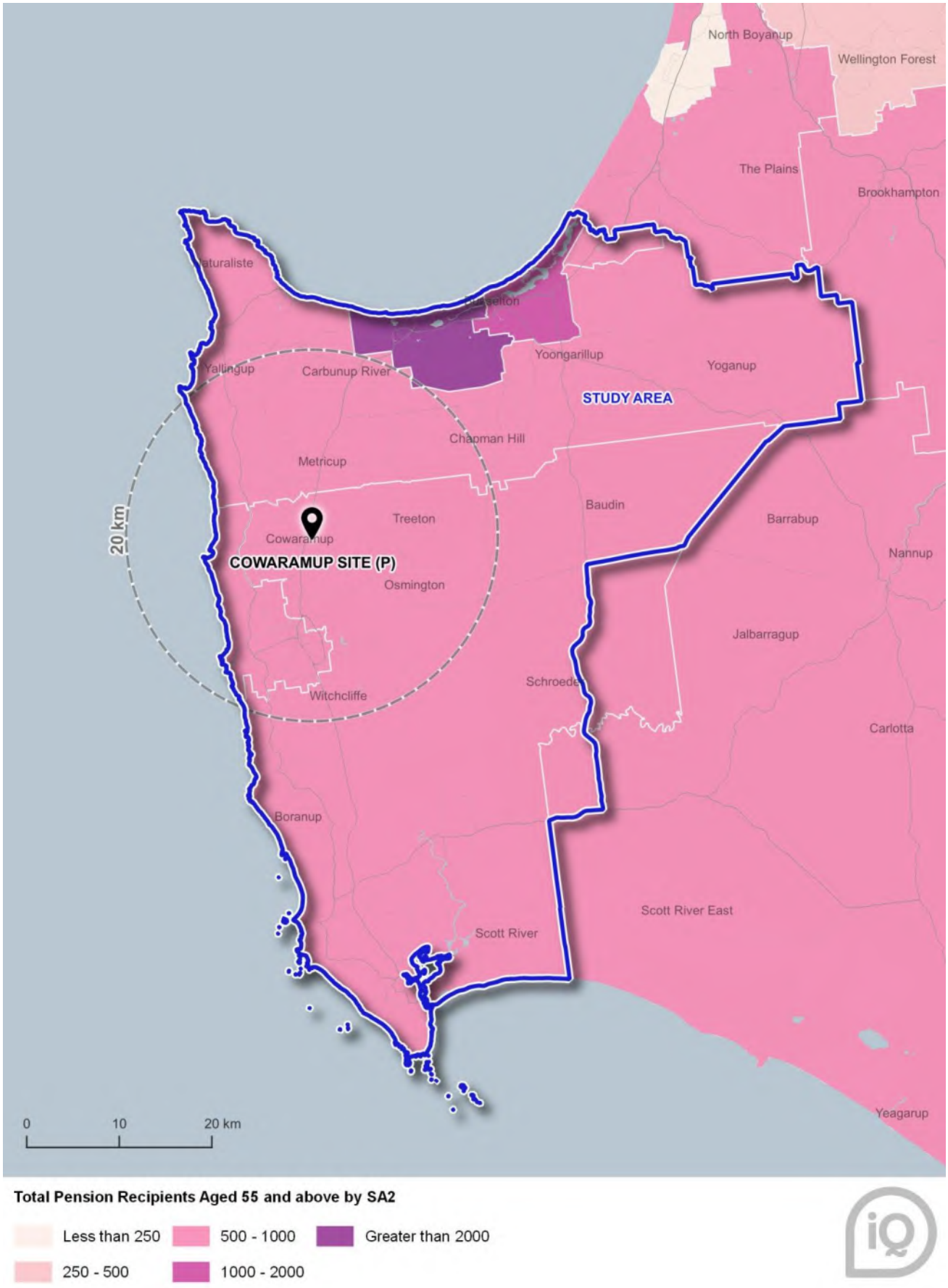


Source: ABS

MAP 4.4. RESIDENTS AGED 55+ YEARS



MAP 4.5. RESIDENTS AGED 55+ YEARS RECIPIENTS OF THE AGE PENSION



4.5. Residential Property Market

i. Western Australia is an attractive place to reside, and Perth is regularly ranked as one of the most liveable cities in the world (12th in 2023) – with a 'Mediterranean' climate that enjoys more hours of sunshine than any other capital city in Australia.

ii. Western Australia's economy is one of the strongest in the country, having outpaced (4.7% final demand) the national growth rate (2.3%) during 2022/23 - driven by business investment, household consumption, and government investment. The State economy is heavily export-oriented, representing around half of all National exports. According to the Institute of Public Affairs (IPA), Western Australia leads in key economic metrics such as low taxes, energy prices, and robust wage growth, and ranks second in jobs growth and business investment - making it the nation's top economic performer.

iii. This has coincided with a surge in overseas and interstate residents that saw Western Australia become the country's fastest-growing state in 2023. The net additional 93,800 persons over the year (reaching 2.93 million total) reflected annual growth of 3.3%.

iv. Growth has also led to a scarcity of homes, causing challenges for prospective buyers and renters, and maintaining upward pressure on property values and rental rates. Like other states, Western Australia faces a housing landscape marked by rapid growth and limited housing supply.

v. Across Western Australia, the metropolitan median dwelling price is currently $736,649 as at February 2024 (+22% year on year), and $504,106 across the non-metropolitan area (+14.8% for Rest of WA).

vi. Housing affordability has been a hallmark of the Western Australia market for many years, and (in-part) been attributable to the infamous urban sprawl (metropolitan area), as well as the supply of outer-suburban and rural greenfield land that provides attractive low-cost house and land options for migrants and first home buyers alike.

vii. While demand for traditional house-and-land packages continues to drive expansion, concerns have been raised about its sustainability. The Urban Development Institute (WA) is currently working with the State Government on ways of ensuring the best possible outcome for greater housing choice and supply is achieved. As Western Australia grapples with housing scarcity and affordability issues, there is a growing recognition of the need for diverse housing options beyond traditional greenfield house-and-land packages.

viii. Retirement living and LLCs in stand to benefit from the confluence of these factors, as well as other key drivers of demand for seniors living options examined throughout this report.

ix. The residential property market is a significant competitor for retirement living stock because both offer housing options for older adults. While retirement living and LLCs offer specialised services and amenities that cater to the unique needs of seniors, many older adults also consider traditional residential properties as an option for retirement living – particularly given the more diverse array of stock on the market that often targets downsizers. Consequently, it is important to understand the residential property market within which the Cowaramup development would operate, including existing and historical pricing trends.

x. As a historically rural residential area, there is generally limited transaction data available for the suburb of Cowaramup, so other geographies such as the postcode (6284), Study Area (Augusta Margaret River and Busselton LGAs), and South West Region – have also been examined:

Composition

- The dwelling composition of the study area is typical of Rest of Western Australia, comprising a significant proportion of three-and-four-bedroom houses, and a low proportion of other dwelling types such as semi-detached, apartments, and the like (Table 4.5 and Charts 4.10 – 4.11).
- Houses make up 90% of study area dwellings, which is higher than both the Rest of Western Australia average (89%) and State benchmark (80%). Most of the housing stock in the study area comprises three (37%) or four (42%) bedrooms (79% in combination). Two-bedroom stock makes up just 11% of all houses.

Median House Prices

- The median house price across Cowaramup was $863k in the six months of 2024, or $800k in 2023. This generally aligned with the composite study area LGAs, including Augusta Margaret River ($763k) and Busselton ($750k) (Chart 4.12).
- House prices across these areas had been somewhat stable over the previous decade but began to increase significantly from 2021 (post-Covid). The average growth over the 2020 to June 2024 period across the samples was +84% for Cowaramup, and +53% to +58% for the broader Augusta-Margaret River and Busselton LGAs.
- Sales volumes have also been at record highs during this period, as illustrated in Chart 4.13. This has been driven by greenfield development and land supply. Cowaramup recorded average annual sales of 49 dwellings over the past three years, which more than double historical rates (averaged 22 over the 2010 – 2020 period).

Rents

- The median weekly rent across the Cowaramup postcode (6284) is currently $780, which has increase from $404 just four years prior (2020), as illustrated in Chart 4.14. Across the broader South West region, median weekly rents are $610, which is up from $339 over the same period four years prior.
- Vacancy rates are at record lows (0.9%) across the South West region, including 0.0% in the Cowaramup postcode - and have remained low for the past several years (Chart 4.15). This mirrors the broader Perth and Western Australian market.

xi. The analysis of the housing market in the study area and other relevant regions, reveals several key implications for the Cowaramup development.

xii. With limited retirement living options throughout the region at present, traditional residential properties and estates are the main alternative. Retirement living and LLCs, however, offer specialised services and pricing structures that can better cater to seniors, especially those considering downsizing. This highlights the importance of understanding not just the retirement market, but also broader residential market trends and pricing dynamics.

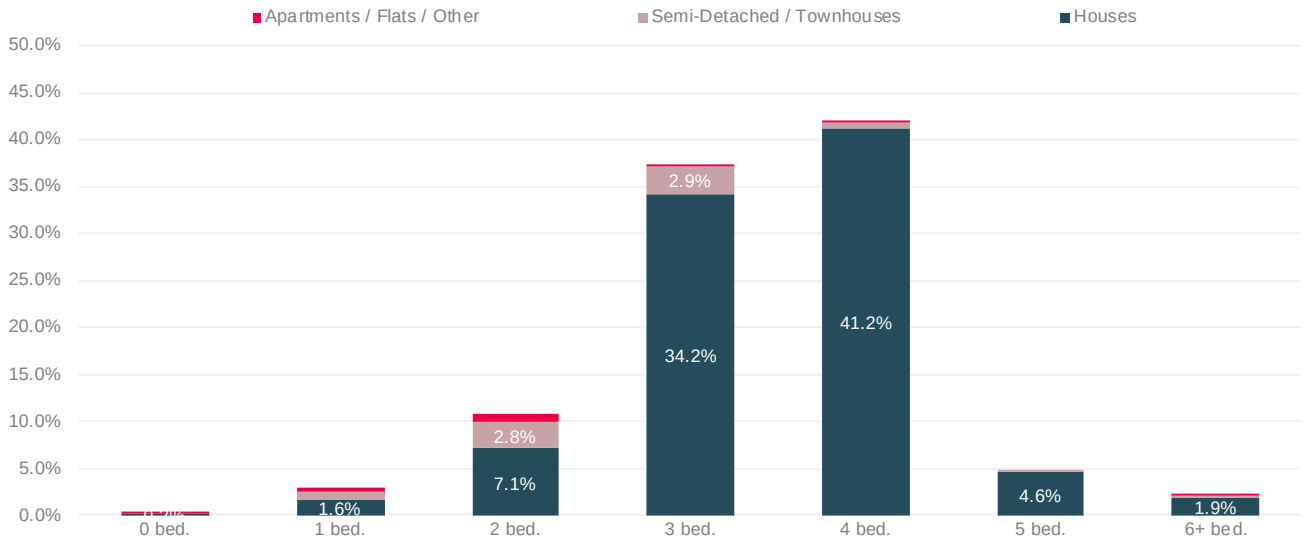
xiii. The historical context of Cowaramup and the South West are as a rural residential area in which the composition of dwellings is dominated by three-and-four-bedroom houses that are primarily targeted at young families. Further, the median house prices and rental trends also indicate a market that has experienced strong growth post-Covid, with record-high sales prices, volumes, and rents – coupled with record low vacancy rates. This highlights a significant gap for more compelling, smaller downsize options in Cowaramup.

TABLE 4.5. STUDY AREA DWELLINGS BY TYPE AND BEDROOM, 2021 CENSUS

No. of Bedrooms	Dwelling Type					
	Houses		Semi-Detached / Townhouses		Apartments / Flats / Other	
Study Area Total Dwellings	**19,272**		**1,595**		**381**	
0 bed.	37	0.2%	0	0.0%	31	0.1%
1 bed.	345	1.6%	185	0.9%	109	0.5%
2 bed.	1,508	7.1%	595	2.8%	169	0.8%
3 bed.	7,261	34.2%	624	2.9%	41	0.2%
4 bed.	8,752	41.2%	146	0.7%	19	0.1%
5 bed.	968	4.6%	20	0.1%	0	0.0%
6+ bed.	401	1.9%	25	0.1%	12	0.1%

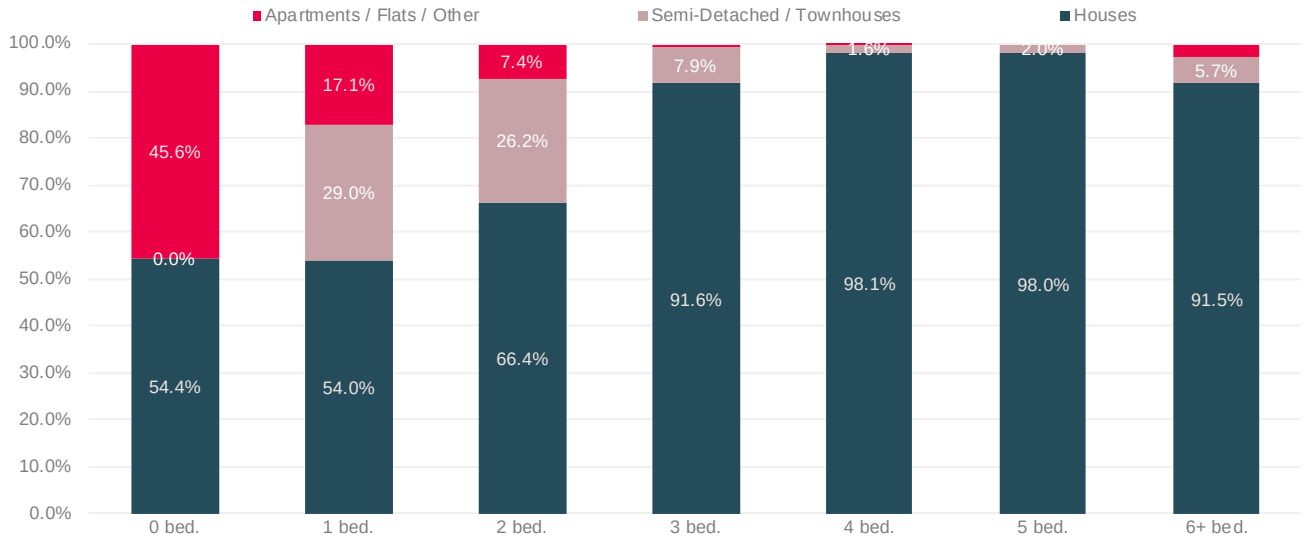
Source: ABS

CHART 4.10. STUDY AREA DWELLINGS BY TYPE AND BEDROOM, 2021 CENSUS



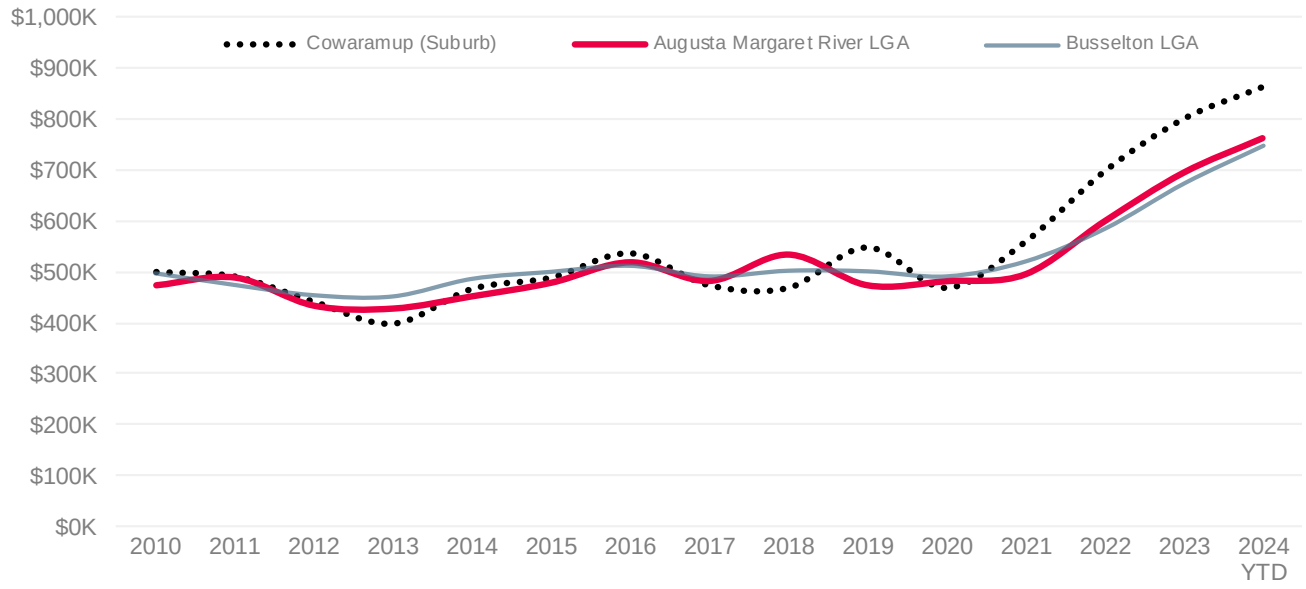
Source: ABS

CHART 4.11. STUDY AREA DWELLINGS BY TYPE AND BEDROOM, 2021 CENSUS



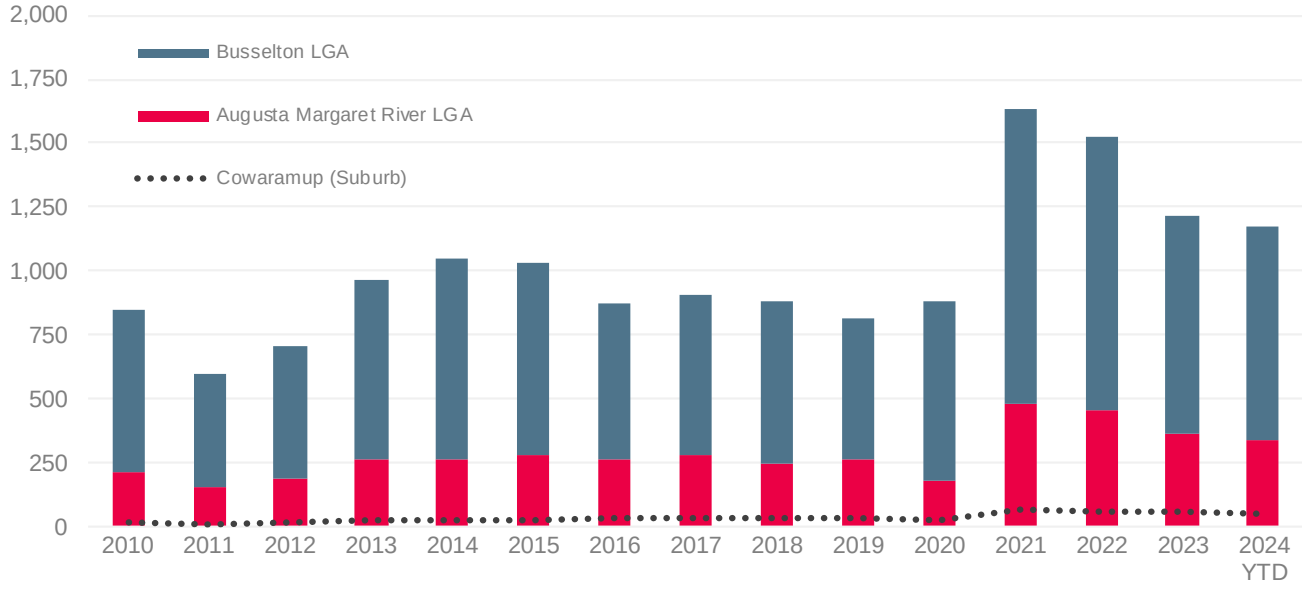
Source: ABS

CHART 4.12. MEDIAN HOUSE PRICE ($'000) – STUDY AREA LGAS



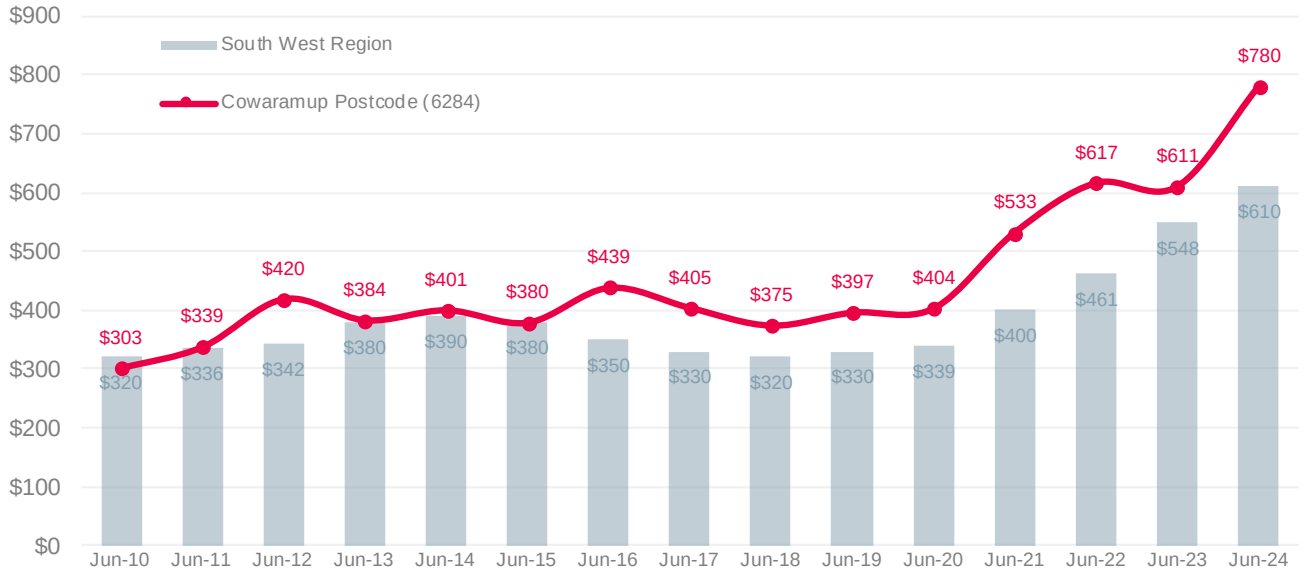
Source: Pricefinder

CHART 4.13. HOUSE SALES VOLUME (NO.) – STUDY AREA LGAS



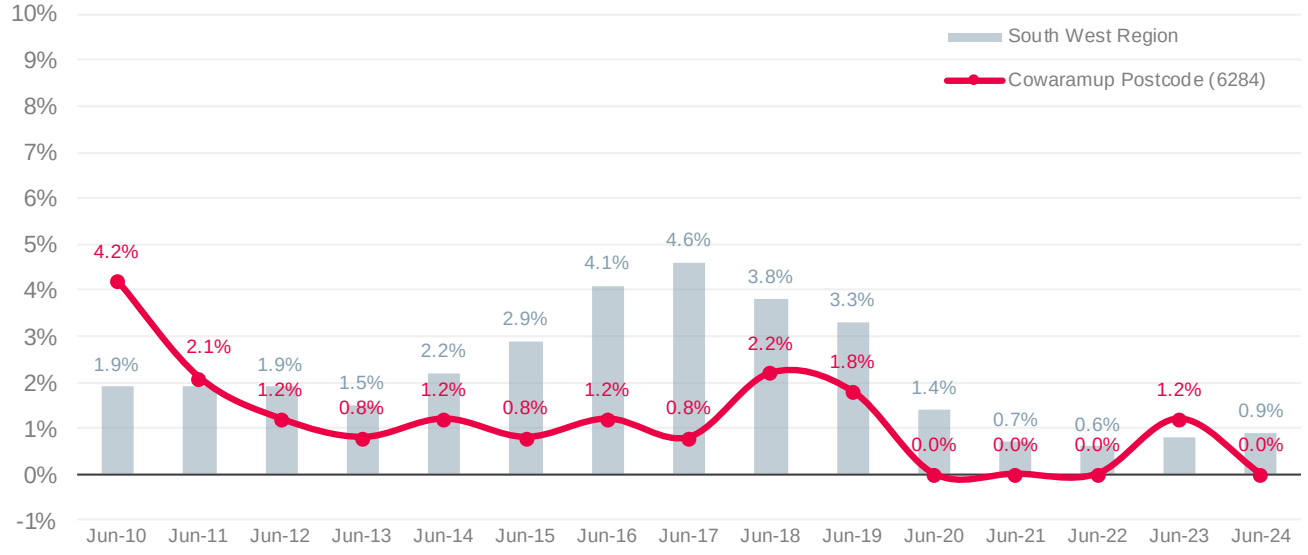
Source: Pricefinder

CHART 4.14. MEDIAN WEEKLY RENTS, HOUSES (COWARAMUP & SOUTH WEST REGION), 2010 - 2024



Source: SQM Research

CHART 4.15. VACANCY RATES, HOUSES (COWARAMUP & SOUTH WEST REGION), 2010 – 2024



Source: SQM Research

5 Cowaramup Land Lease Community Market Potential

This section applies the key findings of the previous sections to the proposed Cowaramup Land Lease Community and presents an overview of the market potential for the development.

5.1. Background & Development Concept

i. The regional and local context of the proposed Cowaramup site highlights a strategic location within the Shire of Augusta-Margaret River, as part of an established and growing rural locality known for its vibrant community. The town also occupies a high-profile location along Bussell Highway, making it easily accessible to the local and wider region population.

ii. The proposed Cowaramup Land Lease Community will be at 500 Wirring Road, and form part of a 40.9-hectare site that would also yield 184 residential lots, across a range of parcel sizes. The Land Lease Community component will comprise 250 dwellings across 12.0 hectares, which equates to 21 dwellings per hectare.

iii. The proposed Cowaramup development also aligns with several emerging industry trends that make it an appropriate and considered concept:

- **Land Lease Communities:** retirement living in Australia has shifted towards more active lifestyles for older adults, driven by improved health and longer life expectancy. LLCs have emerged to meet this demand and offer advantages like broader market appeal, lower upfront costs, flexibility, and enhanced amenities, making them a significant and innovative segment in Australia's housing market.
- **New Market Entrant:** LLCs have traditionally been developed and operated by private groups, institutional funds, and investment syndicates**.** Recently however, residential developers, not-for-profit groups, and private developers have entered the market and continue to explore new opportunities. A local and independent developer for the Cowaramup site would also be a key point of difference in the Western Australia market and allow for a tailored product.
- **Greenfield Development:** there has been a discernible trend towards greenfield development of LLCs, as developers strategically acquired large land parcels to convert them into communities. The strategy involves land acquisition and development of infrastructure (roads, utilities, and community facilities), as well engaging in the design and marketing of high-quality homes.
- **Location:** retiree migration preferences coastal and regional areas, and is also influenced by familiarity, climate preferences, and lifestyle choices. The Cowaramup site provides this tranquil and rural location, while still enjoying proximity to major services.

- **Size:** the scale (250 dwellings) aligns with comparable contemporary LLC projects across Western Australia (and beyond) which have an average 223 homesites across 10 hectares (also equating to 21 dwellings per hectare).

- **Incumbent Examples:** existing and planned LLCs around Margaret River and Busselton include a range of comparable developments such as Margaret River Lifestyle Village, Busselton Lifestyle Village, Embark Busselton, The Vantage at Vasse, and Edenlife Margaret River. Newer LLCs such as these include a greater range of amenities and facilities such as a community centre, pool, gymnasium, bowling green, workshop/men's shed, sauna, library, BBQ areas, and arts centres. These types of uses are generally not provided across smaller, traditional retirement living sites.

- **Housing Affordability & Supply:** LLCs cater to different income demographics by offering both affordable and premium options. Housing affordability has been a notable feature of the Western Australia market, however, in recent years the State (as well as Cowaramup and the South West region) has experienced a housing crisis, based on record high residential prices and rents, as well as unprecedented low supply and vacancy rates. As residents grapple with housing scarcity and affordability issues, there is a growing recognition of the need for diverse housing options beyond traditional greenfield house-and-land packages.

- **Dwellings:** the built form of LLC residences has improved markedly among contemporary developments, and many would be indistinguishable from permanent dwellings found in traditional villages. Developments typically comprise a mix of one, two and three-bedroom dwelling stock, however, newer, and interstate examples were primarily made up of two and three-bed dwellings.

- **Purchase Price & Fees:** prices advertised across the comparable LLCs in the study area typically range from $350,000 - $500,000, or 40% - 60% of the median house price for Cowaramup.

  Weekly site fees were observed to be around $200 for singles and $220 for couples, and occupiers who qualify for the Commonwealth Rental Assistance can also save between $70 – $100 per week. This is significantly lower than the median weekly rent across housing stock in Cowaramup ($780 per week).

- **Robust Investment:** the straightforward operating model, margins, and tight yields have made the sector an appealing and stable investment vehicle for retirement living operators and new market entrants alike.

iv. As LLCs continue to evolve, they have become a widely accepted form of retirement living. With demand likely to increase over time, Land Lease Communities are anticipated to become the new normal in retirement living.

v. The market for LLCs in Western Australia remains largely untapped, and the South West region boasts an ideal setting for these communities to be promoted. The growth, presence of key demand drivers, as well as attractive conditions, provide a strong indication that the LLC market will continue to grow significantly across the study area, and more broadly across the State.

vi. The proposed Cowaramup Land Lease Community represents not only a strategic development within the Shire of Augusta-Margaret River, but also a reflection of emerging trends in retirement living that aligns perfectly with evolving preferences and demand.

5.2. Study Area Resident Profile

i. The study area or catchment for the Cowaramup development has been defined taking into consideration a range of factors and data sources and extends beyond the typical draw of other LLCs to encompass the Shire of Augusta Margaret River, as well as the Shire of Busselton Local Government Areas (LGAs) – which together make up 'The Capes Region' of the South West.

ii. The Cowaramup study area population is currently estimated at 63,700 (2024) and is projected to increase to 96,700 by 2046, representing an average annual growth rate of 1.9% over the forecast period (1,500 persons).

iii. Population within the study area is focused throughout many towns such as Busselton, Dunsborough, Margaret River, Cowaramup, Augusta, and more – and future growth will be driven by a range of residential developments and greenfield land supply throughout the region.

iv. The socio-economic profile of the study area reflects an older, Australian-born, middle-income, family, downsizer, and retiree demographic. Future rural greenfield development areas are likely to attract middle-income young families, but it will also be important that downsizing and seniors living options are also provided amongst house and land packages. The proposed Cowaramup development will therefore offer a diversity of housing and choice for the ageing population and enable them to relocate or remain nearby to extended family members.

v. Historical migration patterns for residents aged 55+ to the study area (SA2s) also highlight widespread internal movement whereby most relocations came from within (and remain) in the South West – highlighting how residents prefer to age in place.

vi. The population aged 55+ years is the most relevant age group for LLC facilities, and there is currently an estimated 22,817 persons aged 55+ years across the study area (almost doubled in number since 2011). Over the period to 2046, the number of residents aged 55+ is projected to reach 38,492, reflecting an average growth of 713 persons per year, or 2.4%.

vii. Generally, older residents of the study area also have lower needs for assistance with core activities; fewer long term health conditions; and less-commonly live alone (as compared to the Rest of Western Australia).

viii. The growing number of residents aged 55+ across the study area are generally healthier and more independent, likely to have a strong preference for independent living options like Land Lease Communities. This demographic also highlights the robust and appropriate market demand for diverse housing solutions, with Cowaramup standing to benefit from this demographic trend by offering an opportunity to meet the needs of active ageing residents seeking housing variety and independence within the South West region.

5.3. Study Area Retirement Living Supply

i. Existing and planned retirement living facilities are depicted in Map 5.1 and detailed in Table 5.1.

ii. The study area includes four Land Lease Community (LLC) sites and nine traditional retirement villages, across a total of 842 existing dwellings. Future and ongoing developments outside of the subject site are expected to add up to another 975 dwellings over the forecast period.

iii. The current and planned retirement living communities indicate a mature and well-established market in the region, with LLC stock making up 53% of existing dwellings and 81% of the pipeline.

iv. Existing retirement living facilities are generally concentrated within neighbouring towns and urban areas to the north and south. Aside from the subject site (proposed development), there are no facilities within Cowaramup.

South (Margaret River / Witchcliffe)

- The nearest retirement living facilities are within Margaret River and surrounds, more than 13 km south of the subject site. This comprises some 118 existing and 469 future dwellings, including key sites such as:
  - **Baptistcare** operate the two closest retirement living facilities, namely **Mirrambeena Village** (10 dwellings) and **Silver Vines Village** (52 dwellings).
  - **Margaret River Lifestyle Village** (91 units) is currently under construction, with around 35 lots remaining, and will offer premium quality living and amenities – including an on-site vineyard and microbrewery. Construction is assumed for completion by 2036.
  - **Arbour Margaret River** (250 dwellings) is being developed by Everland and will form part of a 650-lot community that will feature forest trails, bike paths, a public primary school, and clubhouse facilities. Construction is yet to commence; however, development is assumed to proceed over the 2031 – 2046 period.
  - **Edenlife Margaret River** (159 units) is planned at the corner of Busselton Highway and John Archibald Drive and is expected to deliver first homes from 2025 and reach completion by 2041. The development is planned to include a clubhouse with modern amenities including a heated indoor swimming pool, private cinema, and more.
  - **Witchcliffe Eco Village** spans a 120-hectare site and will include 380 lots, including 20 aged/dependent care lots. Construction is assumed to proceed post-2031.

North (Busselton / Dunsborough / Vasse)

- A significant proportion of the retirement living options are provided in the northern portion of the study area within the Busselton urban area and neighbouring localities. This makes up a total of 724 existing and 506 future dwellings, including key sites such as:
  - Mirvac's **Busselton Lifestyle Village** (229 units) is the largest facility across the study area and is comparable in size to the subject development. The community finished construction in 2015 and includes modern amenities including an indoor swimming pool, gym, and bowling green.
  - **The Vantage at Vasse** is an LLC which is planned to include a total of 208 dwellings upon completion (around 50 remaining). The village is marketed as a premium offer, with modern clubhouse facilities constructed in 2021. Remaining homes are assumed to be delivered over the period to 2036.
  - **Embark Busselton** is a master planned estate which is proposed to include 300 LLC dwellings, in addition to 875 residential lots. No retirement living homes have been built to date, however, the

development is assumed to proceed from around 2031 and be completed within the forecast period.

- **Toby's Inlet Estate Dunsborough** (185 dwellings) first began construction in 2020, however, less than 30 homes have been constructed over the past four years. This partly exemplifies the shift in demand and preferences away from traditional retirement villages to LLCs. Final homes are assumed to be constructed over the period to 2041.
- Four other traditional retirement villages are provided elsewhere within the Busselton region, comprising a total of 130 dwellings of more limited competitive relevance.

v. Cowaramup possesses many of the attributes that make these areas (and the broader South West region) popular and suitable for retirement living, likely leading to significant demand for similar facilities. The absence of such facilities and housing diversity at Cowaramup could therefore impact the local community, necessitating older residents to relocate to other towns, thereby highlighting the need for diverse housing options within Cowaramup.

vi. Retirees often contribute to the social fabric of a community through volunteerism, local initiatives, and cultural activities. Without retirement facilities, these contributions could diminish, affecting the overall social and cultural vitality of Cowaramup.

vii. Retirement facilities are also known for fostering community engagement and social connections, allowing residents to form new friendships, participate in social and recreational activities, and expand their social networks, promoting a healthier lifestyle. This is evident in contemporary facilities throughout the region such as Margaret River Lifestyle Village and The Vantage at Vasse, which feature a broad array of ancillary facilities and community engagement initiatives including yoga classes, bowls tournaments, and social wine tastings, among others.

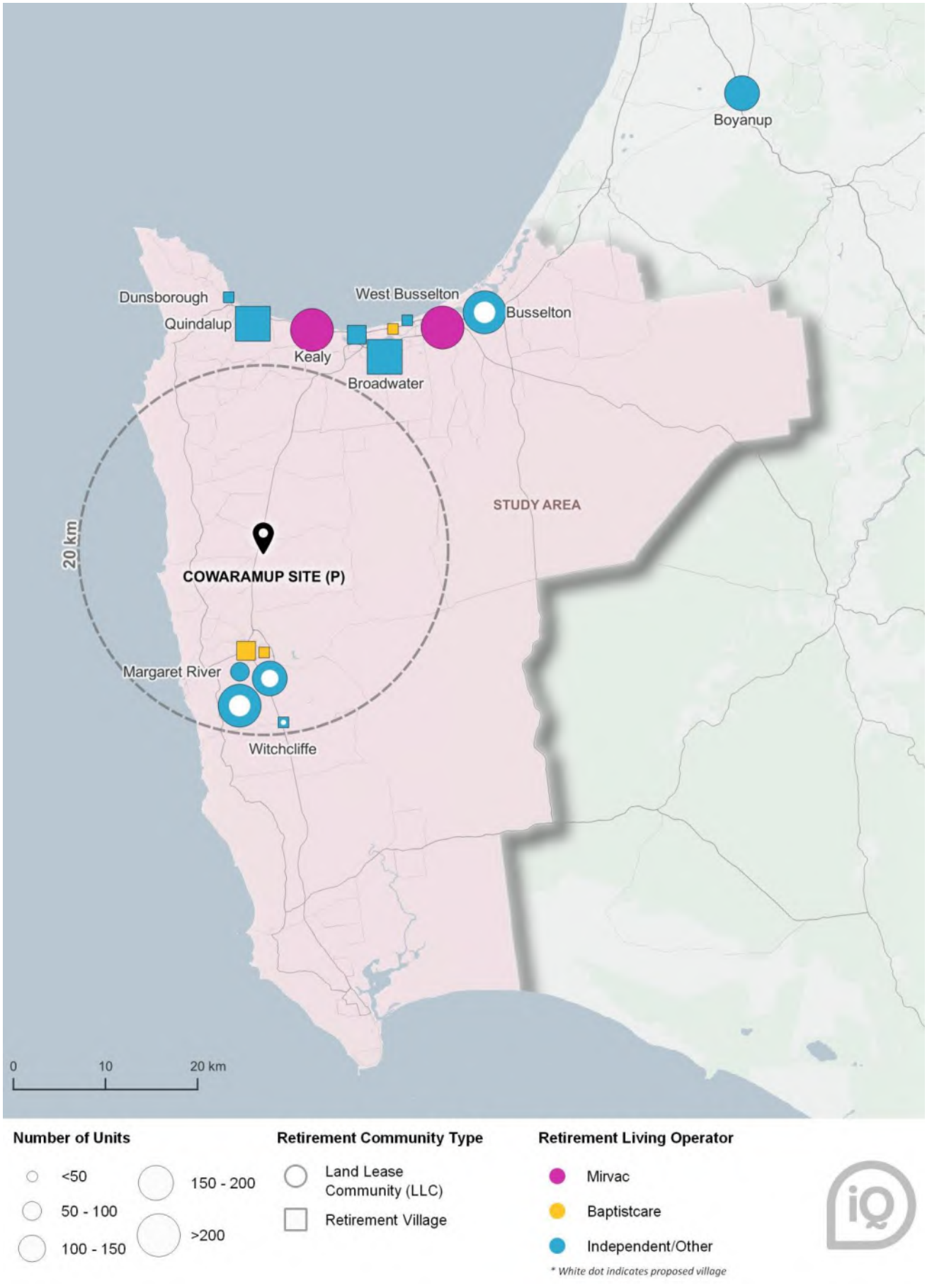
viii. Similarly, the proposed LLC development at Cowaramup would be of sufficient scale to attract a critical mass of residents necessary to establish and sustain these connections, as well as accommodate a range of complementary facilities and amenities.

TABLE 5.1. STUDY AREA RETIREMENT LIVING, EXISTING & FUTURE SUPPLY

Retirement Living Facility	Operator	Type (LLC/Village)	Suburb	Status	Dwellings			Distance From Site (km)
					Existing	Planned	Total	
Subject Site								
Cowaramup LLC (Subject Site)	**Everland Communities**	**LLC**	**Cowaramup**	**Planned**	**0**	**250**	**250**	**-**
Elsewhere Within Study Area								
Silver Vines Village	Baptistcare	Village	Margaret River	Existing	52	0	**52**	13.2
Mirrambeena Village	Baptistcare	Village	Margaret River	Existing	10	0	**10**	13.4
Margaret River Lifestyle Village	Margaret River Lifestyle Village	LLC	Margaret River	Existing	56	35	**91**	15.4
Edenlife Margaret River	Edenlife	LLC	Margaret River	Planned	0	159	**159**	15.6
Arbour Margaret River	Everland	LLC	Margaret River	Planned	0	250	**250**	16.0
Witchcliffe Eco Village	EcoVillage	Village	Witchcliffe	Planned	0	25	**25**	23.0
The Vantage at Vasse	Mirvac	LLC	Kealy / Vasse	Existing	159	49	**208**	27.2
Ray Village	Capecare	Village	Broadwater	Existing	67	0	**67**	30.5
Toby's Inlet Estate Dunsborough	Toby's Inlet Estate Management	Village	Quindalup	Existing	28	157	**185**	31.6
Nova Village Busselton	Nova Village Busselton	Village	Broadwater	Existing	178	0	**178**	31.9
William Carey Court Village	Baptistcare	Village	Busselton	Existing	19	0	**19**	32.4
Capecare Dunsborough	Capecare	Village	Dunsborough	Existing	21	0	**21**	33.7
Retirees WA Moore Street	Retirees WA	Village	West Busselton	Existing	23	0	**23**	36.1
Busselton Lifestyle Village	Mirvac	LLC	Busselton	Existing	229	0	**229**	38.3
Embark Busselton	Everland	LLC	Busselton	Planned	0	300	**300**	41.3
Subject Site					**0**	**250**	**250**	
Elsewhere Within Study Area					**842**	**975**	**1,817**	

Source: Location iQ

MAP 5.1. STUDY AREA RETIREMENT LIVING, EXISTING & FUTURE SUPPLY



5.4. Study Area Retirement Living Demand

i. Having understood the key demand drivers and existing supply within the study area, we can now quantify future demand to determine whether the study area's needs will be adequately met over the forecast period. This analysis helps to assess whether the planned developments will be sufficient to cater for anticipated, growing demand, or if there will be an undersupply requiring additional initiatives.

Population (Aged 55+)

- There are currently (2024) an estimated 22,817 persons aged 55+ years across the study area, which is projected to grow to 38,492 by 2026.
- This would reflect a net additional of some 15,675 persons within the cohort over the forecast period (+60%), or average annual growth of 713 persons (2.4%).
- It is also important to note that population forecasts detailed in this assessment are demonstrably conservative, with projections remaining pragmatic to account for potential variations in market conditions.

Supply (Retirement Living)

- The study area comprises a total of 842 retirement living dwellings currently (2024), and a future pipeline of some 975 approved, proposed, and planned additional lots (not including the subject site).
- For the purposes of this assessment, each dwelling is assumed to be delivered over the forecast period to 2046, across a staged rollout intended to reflect traditional take up rates.
- This will see the total number of dwellings reach 1,817 by 2046, which would accommodate approximately 2,339 persons aged 55 and over.
- This should also be considered a conservative assumption, as it presumes that all proposed, mooted, and planned projects will proceed within the forecast window and that all existing facilities will remain operational. Some projects are still in the early planning stages with uncertain futures, and older, dilapidated facilities often close over time. Consequently, this represents a scenario of maximum potential supply.

Demand (Retirement Living)

- Based on the existing population and supply, the penetration rate for retirement living across the study area is estimated at 4.75% for residents aged 55+. This is higher than the existing State (3.97%) and National benchmarks (3.91%) – and reflects the many attributes of the area that make it popular with retirees and appropriate for retirement living.
- ABS Census penetration rates for retirement living stock predate the rise of the Land Lease concept and other contemporary living arrangements (reflecting traditional retirement living demand). It is assumed that the penetration rate will increase over the forecast period to 2046, with industry projections and the development pipeline indicating that the penetration rate for LLC dwellings is expected to more than double by 2046.

- Applying this to the study area, the penetration rate for retirement living is projected to increase steadily, reaching 7.0% by 2046.
- Additionally, the introduction of contemporary new formats and projects, such as the subject site, has the potential to attract residents from beyond the study area. This includes individuals who might not have previously considered or been able to relocate to this region. This is expected to account for an estimated 5% increase in overall demand, both now and throughout the forecast period.
- Overall, this would represent net additional demand for a total of 1,306 retirement living dwellings over the period to 2046, or an average of almost 60 per year.

ii. Based on the above, there is projected to be an undersupply of around 405 retirement living dwellings within the study area over the period to 2046. This reflects a situation whereby the projected supply pipeline (maximum potential supply) is unable to service projected demand (conservative).

iii. If approved, the Cowaramup LLC development (subject site) is expected to deliver the first of the 250 homes to the market over the 2026 – 2031 period and reach completion before 2046.

iv. Even allowing for the subject development (250 dwellings) and the cautious demand and supply modelling detailed above, there would still be an indicative undersupply of approximately 155 dwellings by 2046.

v. Therefore, there is sufficient capacity to support the Cowaramup LLC development, which will service just a fraction (19%, or around four years) of future projected demand across the region over the period to 2046.

vi. This analysis indicates that there is likely to be strong potential for the Cowaramup Land Lease Community development.

vii. The proposed scale and composition of the project, its strategic location within a growing urban area, alignment with emerging industry trends, as well as in-depth market analysis, each denote the Cowaramup proposal as a promising development poised to meet growing demand and help Cowaramup benefit from opportunities within the thriving Land Lease Community sector and South West market.

TABLE 5.2. STUDY AREA RETIREMENT LIVING DEMAND, 2024 - 2046

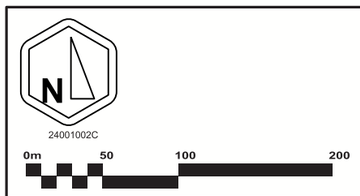
Metric	Actual			Current	Forecast					*Net Additional*
	2011	2016	2021	2024	2026	2031	2036	2041	2046	*(2024 - 2046)*
Study Area Population										
Persons Aged 55+	12,152	16,419	20,680	22,817	24,242	27,805	31,367	34,930	38,492	*15,675*
Proportion of Total Population	*27.8%*	*31.3%*	*34.9%*	*35.8%*	*36.3%*	*37.5%*	*38.4%*	*39.2%*	*39.8%*	*4.0%*
Supply - Retirement Living										
Dwellings (Existing & Future Supply)				842	895	1,165	1,455	1,692	1,817	*975*
Vacancy Rate (Rest of WA)				2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	*0.0%*
Residents (at 1.31 per dwelling)				1,084	1,152	1,500	1,873	2,178	2,339	*1,255*
Demand - Retirement Living										
Penetration Rate (%) Benchmark										
• Rest of WA	3.27%	2.85%	3.13%							
• Western Australia	4.47%	4.23%	3.97%							
• Australia	3.48%	3.62%	3.91%							
• Study Area Population Projected				4.75%	4.96%	5.47%	5.98%	6.49%	7.00%	*2.25%*
Projected Demand										
• Dwellings (at 1.31 per dwelling)				825	914	1,157	1,427	1,725	2,051	*1,226*
• Residents				1,084	1,201	1,520	1,875	2,267	2,694	*1,610*
Additional Demand from Beyond Study Area*										
• Proportion of Residents Aged 55+				5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	*0.0%*
• Net Additional Retirement Living Demand				54	60	76	94	113	135	81
Indicative Over / Undersupply (Occupied Retirement Living Dwellings)										
Supply - Retirement Living Dwellings				825	877	1,142	1,426	1,658	1,781	*956*
Demand - Retirement Living Dwellings				879	974	1,233	1,521	1,839	2,186	*1,306*
Total Indicative Under / Oversupply (Dwellings)				**-54**	**-97**	**-91**	**-95**	**-180**	**-405**	**-351**
Cowaramup LLC (Dwellings) & Development Rate				0	0	75	150	225	250	250
Total Indicative Under / Oversupply (Dwellings)				**-54**	**-97**	**-16**	**55**	**45**	**-155**	**-101**

**Accounts for existing/proposed facilities attracting prospective residents from beyond the study area - over and above baseline population projections.*

LocationIQ

Contact Us
(02) 8248 0100
Level 27 | 25 Martin Place
Sydney NSW 2000
locationiq.com.au





COWARAMUP - CONCEPT PLAN

Lot 500 Wirring Road, Cowaramup

Project YOLHA 24001002DLL | Scale 1:4000 @ A3 | Date: 13 Nov 2024

Hex Design and Planning
ABN 34 627 142 299
29 A Bartlett Crescent
Karrinyup WA 6018
T +61 8 9204 1518
M +61 438 000 235
E sheldon@hexdesignplanning.com.au

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LOT 500 WIRRING ROAD, Cowaramup

OVERALL SUBDIVISION - LANDSCAPE CONCEPT PLAN (STRUCTURE PLAN AMENDMENT SUBMISSION)

CLIENT: YOLK PROPERTY GROUP
REVISION: A
DATE: 28 DECEMBER 2024



LEGEND

- EXTENT OF PROJECT SITE
- POS DETAIL PLAN
- PROPOSED NEW LOTS
- NEW ASPHALT ROADS
- NEW CONCRETE PATHWAY
- VERGE LANDSCAPING BY LOT OWNERS
- OPEN SLASHED DRY GRASS AREA / UN-IRRIGATED LAWN
- LANDSCAPE PLANTING AREA WITH LOW SHRUBS AND GROUNDCOVERS TO COMPLY WITH APZ STANDARDS AND 'LOW THREAT' BUSHFIRE CLASSIFICATION
- DRAINAGE BASIN PLANTING CONSISTING OF LOW RUSHES AND SEDGES LESS THAN 1.0m IN HEIGHT
- MIN. 5.0m WIDE LANDSCAPE BUFFER TO REAR OF PRIVATE LOTS AT WIRRING RD AND AGRICULTURAL LAND INTERFACE
- ACCESSIBLE ADVENTURE PLAYGROUND AND NATURE PLAY AREA
- SAND SOFTFALL
- DOG FENCE FOR FULLY ENCLOSED DOG OFF-LEASH PARK
- EXISTING TREES TO BE RETAINED AND PROTECTED
- STREET TREE PLANT - WA PEPPERMINT
- STREET TREE PLANT - GRAFTED MARRI
- POS TREE PLANTING - VARIOUS NATIVE SPECIES TO BE USED FOR FAUNA HABITAT / FORAGING AND SHADE
- DRAINAGE BASIN TREE PLANTING - VARIOUS NATIVE SPECIES TO BE USED SUITABLE FOR WET SOILS AND NUTRIENT STRIPPING
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- PROPOSED PICNIC SETTING
- PROPOSED PICNIC SHELTER
- PROPOSED PLAYGROUND
- PROPOSED DOG OFF LEASH AREA
- PROPOSED ACTIVE KICK-ABOUT AREA
- PROPOSED EXERCISE STATION

LOT 500 WIRRING ROAD, COWARAMUP

STRUCTURE PLAN AMENDMENT - OVERALL CONCEPT PLAN

0 20 40 60 80 100 m

CLIENT: YOLK PROPERTY GROUP
DATE: JANUARY 2024
REVISION: A
DWG NO 092WIR-03-001

SCALE: 1:2000 @A1

SW LANDSCAPE COLLECTIVE



LEGEND

- EXTENT OF PROJECT SITE
- POS DETAIL PLAN
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- PROPOSED EXERCISE STATION

LOT 500 WIRRING ROAD, COWARAMUP

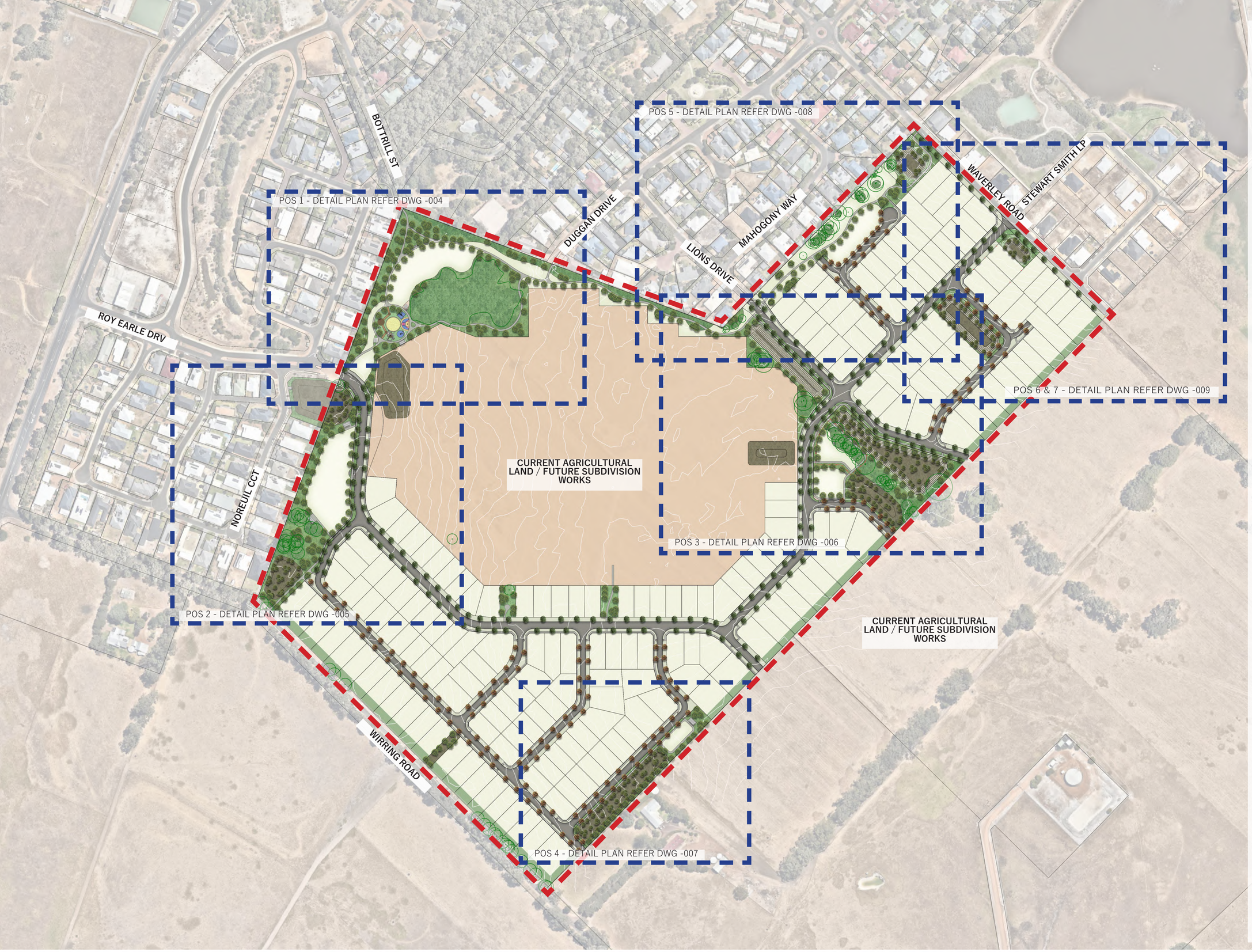
STRUCTURE PLAN AMENDMENT - OVERALL CONCEPT PLAN (TREE CANOPY REMOVED)

0 20 40 60 80 100 m

CLIENT: YOLK PROPERTY GROUP
DATE: JANUARY 2024
REVISION: A
DWG NO 092WIR-03-002

SCALE: 1:2000 @A1

SW LANDSCAPE COLLECTIVE



LEGEND

- EXTENT OF PROJECT SITE
- POS DETAIL PLAN
- PROPOSED NEW LOTS
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- PROPOSED PLAYGROUND
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- PROPOSED ACTIVE KICK-ABOUT AREA

LOT 500 WIRRING ROAD, COWARAMUP

STRUCTURE PLAN AMENDMENT - OVERALL CONCEPT PLAN (TREE CANOPY REMOVED)

0 20 40 60 80 100 m

CLIENT: YOLK PROPERTY GROUP
DATE: JANUARY 2024
REVISION: A
DWG NO 092WIR-03-003

SCALE: 1:2000 @A1

SW LANDSCAPE COLLECTIVE

BOTTRILL ST

IMPORTANT FOOTPATH CONNECTION TO EXISTING PEDESTRIAN NETWORK THROUGH BOTTRIL STREET LINKING TO THE TOWN CENTRE

RETAIN AND PROTECT ALL EXISTING TREES. INSTALL AREAS OF MULCH AND LOW NATIVE GROUNDCOVER PLANTING BENEATH TO COMPLY WITH APZ STANDARDS AND TO SOFTEN INTERFACE WITH EXISTING RESIDENTIAL AREA

EXERCISE NODES LOCATED ALONG CIRCUIT PATH SURROUNDING EXISTING STAND OF TREES WITH PATH PROVIDING MAINTENANCE SEPARATION FOR BAL SETBACKS

OPEN UN-IRRIGATED TURF AREA TO BE SLASHED REGULARLY TO PROVIDE LOW MAINTENANCE MEANDERING INFORMAL OPEN SPACE

DUGGAN DRIVE

FOOTPATH CONNECTION THROUGH TO EXISTING DUGGAN DRIVE PATHWAY

POS TREE PLANTING TO PROVIDE SHADE TO PATHWAY AND FORM EDGE TO OPEN INFORMAL ACTIVE RECREATIONAL

BENCH SEATING SET AMONGST GARDEN AND SHADE TREES AND FACING THE ACTIVE OPEN SPACE

CLUMPS OF NEW TREE PLANTING WITH MULCH AND LOW GROUNDCOVER UNDERSTOREY AS EXTENSION OF TREE CANOPY TO SOFTEN LANDSCAPE INTERFACE ALONG THE LINEAR POS AND TO PROVIDE SHADE TO THE PATHWAY

VILLERS STREET

INFORMAL ACTIVE KICK-ABOUT SPACE AS OVERFLOW AND EXTENSION OF ADVENTURE PLAYGROUND FACILITIES. TURF AREA TO BE IRRIGATED.

POS TREE PLANTING TO PROVIDE SHADE TO PATHWAY AND FORM EDGE TO OPEN INFORMAL ACTIVE RECREATIONAL AREA

POS 1 NEIGHBOURHOOD PARK PROVIDING KEY RECREATIONAL FACILITIES AT THE INTERFACE WITH THE LAND LEASE LIFESTYLE VILLAGE SITE INCLUDING UNIVERSALLY ACCESSIBLE ADVENTURE PLAYGROUND, NATURE PLAY ELEMENTS, SAND PIT, BASKETBALL HALF COURT, SHADE STRUCTURES AND BBQ FACILITIES TO ENCOURAGE INTERACTION OF ALL AGES AND ABILITIES

ALL EXISTING MATURE VEGETATION TO BE RETAINED AND PROTECTED. INFILL AND LOW UNDERSTOREY PLANTING TO OCCUR COMPLIANT TO BUSHFIRE MANAGEMENT PLAN REQUIREMENTS AND SETBACKS

EXERCISE NODES LOCATED ALONG CIRCUIT PATH SURROUNDING EXISTING STAND OF TREES WITH PATH PROVIDING MAINTENANCE SEPARATION FOR BAL SETBACKS

ROY EARLE DRIVE

GATED ENTRANCE AND SHELTER AS FEATURE CONNECTION THROUGH TO LAND LEASE / LIFESTLYE VILLAGE SITE

CURRENT AGRICULTURAL LAND / FUTURE SUBDIVISION WORKS

PROVIDE PARALLEL PARKING BAYS AT ENTRANCE TO POS 1 OFF ROY EARLE DRIVE

LAND LEASE / LIFESTYLE SITE INCORPORATING DRAINAGE BASIN B1.4
- INVERT LEVEL: 133.0m AHD
- DESIGN WATER DEPTH: 0.5m
- DESIGN TOP WATER LEVEL: 2,185m AHD
- DESIGN VOLUMES: 1000 cub m

PROVIDE BENCH SEATING AT POS ENTRANCE AS PICK UP AND DROP OFF POINT

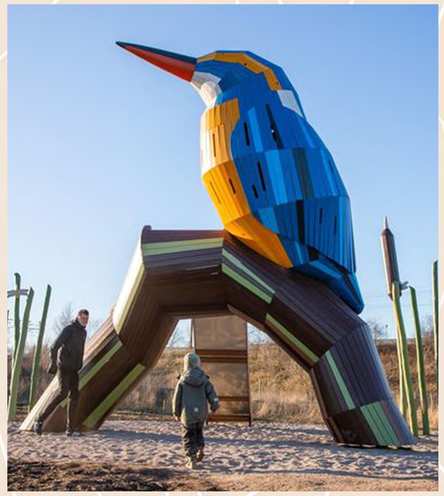


PHOTO EXAMPLE - BIRD INSPIRED ADVENTURE PLATSPACE. COWARA BIRD INSPIRATION FOR COWARAMUP AND USE OF BRIGHT COLOURS

LEGEND

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- PROPOSED PICNIC SHELTER
- PROPOSED PLAYGROUND
- PROPOSED ACTIVE KICK-ABOUT AREA
- PROPOSED EXERCISE STATION

LOT 500 WIRRING ROAD, COWARAMUP

STRUCTURE PLAN AMENDMENT - POS 1: DETAIL PLAN

0 5 10 15 20 25 m

CLIENT: YOLK PROPERTY GROUP
DATE: JANUARY 2024
REVISION: A
DWG NO 092WIR-03-004

SCALE: 1:500 @A1

SW LANDSCAPE COLLECTIVE

POS 2 INCORPORATING DRAINAGE BASIN B1.2
- INVERT LEVEL: 131.9m AHD
- DESIGN WATER DEPTH: 1.2m
- DESIGN TOP WATER LEVEL: 2,965m AHD
- DESIGN VOLUMES: 2,700 cub m

EXISTING DRAINAGE BASIN TO BE RETAINED AND EXTENDED AS BASIN B1.2 ABOVE

SHADE SHELTER AND PICNIC SETTING FACING NORTH OVER DRAINAGE BASIN AND LOOKING SOUTH TO ACTIVE POS AREA

CLUMPS OF NEW TREE PLANTING WITH MULCH AND LOW GROUNDCOVER UNDERSTOREY AS EXTENSION OF TREE CANOPY TO SOFTEN LANDSCAPE INTERFACE ALONG THE LINEAR POS AND TO PROVIDE SHADE EDGE OF THE ACTIVE POS TURF AREA

INFORMAL ACTIVE KICK-ABOUT SPACE AS OVERFLOW AND EXTENSION OF ADVENTURE PLAYGROUND FACILITIES. TURF AREA TO BE IRRIGATED.

BENCH SEATING PROVIDED IN PLANTING NODE FOR SHADE AND SHELTER OPPOSITE PROPOSED PARKING BAYS

RETAIN AND PROTECT ALL EXISTING TREES. INSTALL AREAS OF MULCH AND LOW NATIVE GROUNDCOVER PLANTING BENEATH TO COMPLY WITH APZ STANDARDS AND TO SOFTEN INTERFACE WITH EXISTING RESIDENTIAL AREA

SHADE SHELTER AND PICNIC SETTING FACING NORTH OVER ACTIVE POS AND PROTECTED FROM THE SOUTH BY EXISTING MATURE TREES

POS 2 INCORPORATING DRAINAGE BASIN B1.3
- INVERT LEVEL: 133.3m AHD
- DESIGN WATER DEPTH: 1.2m
- DESIGN TOP WATER LEVEL: 1,015m AHD
- DESIGN VOLUMES: 750 cub m

PROVIDE PARALLEL PARKING BAYS AT SOUTHERN END OF POS 2

LAND LEASE / LIFESTYLE SITE INCORPORATING DRAINAGE BASIN B1.4
- INVERT LEVEL: 133.0m AHD
- DESIGN WATER DEPTH: 0.5m
- DESIGN TOP WATER LEVEL: 2,185m AHD
- DESIGN VOLUMES: 1000 cub m

PROVIDE UNIVERSAL ACCESS TO ALL PICNIC SHELTERS AND SHADE STRUCTURES WITH CONCRETE PATHS

PROVIDE PARALLEL PARKING BAYS AT CENTRAL POINT OF POS 2 ALONG MAIN STRAIGHT OF ROY EARLE DRIVE

PROVIDE UNIVERSAL ACCESS TO ALL PICNIC SHELTERS AND SHADE STRUCTURES WITH CONCRETE PATHS

PROVIDE PARALLEL PARKING BAYS AT SOUTHERN END OF POS 2

DRAINAGE BASIN PLANTED WITH NATIVE RUSHES AND SEDGES BELOW 1.0m IN HEIGHT

CLUMPS OF NATIVE MELALEUCA PLANTING TO BATTERS OF DRAINAGE BASINS TO PROVIDE SHADE AND FAUNA HABITAT / FORAGING SPECIES

FUTURE FOOTPATH CONNECTION THROUGH TO WIRRING ROAD. PATH OFFSET FROM LOT BOUNDARY TO PROVIDE ADDITIONAL BUSHFIRE MANAGEMENT CONTROL SEPARATION

CURRENT AGRICULTURAL LAND / FUTURE SUBDIVISION WORKS



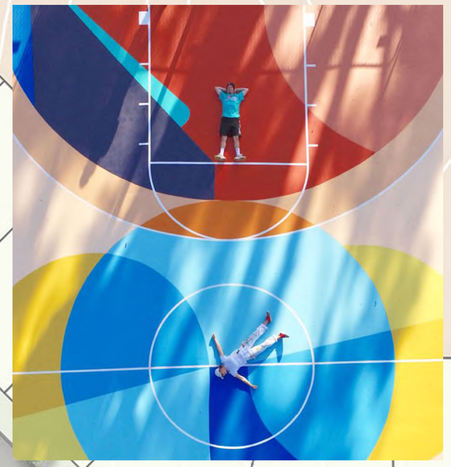


PHOTO EXAMPLE - BIRD INSPIRED ADVENTURE PLATSPACE. COWARA BIRD INSPIRATION FOR COWARAMUP AND USE OF BRIGHT COLOURS

LEGEND

- EXTENT OF PROJECT SITE
- POS DETAIL PLAN
- PROPOSED NEW LOTS
- NEW ASPHALT ROADS
- NEW CONCRETE PATHWAY
- VERGE LANDSCAPING BY LOT OWNERS
- OPEN SLASHED DRY GRASS AREA / UN-IRRIGATED LAWN
- LANDSCAPE PLANTING AREA WITH LOW SHRUBS AND GROUNDCOVERS TO COMPLY WITH APZ STANDARDS AND 'LOW THREAT' BUSHFIRE CLASSIFICATION
- DRAINAGE BASIN PLANTING CONSISTING OF LOW RUSHES AND SEDGES LESS THAN 1.0m IN HEIGHT
- MIN. 5.0m WIDE LANDSCAPE BUFFER TO REAR OF PRIVATE LOTS AT WIRRING RD AND AGRICULTURAL LAND INTERFACE
- EXISTING TREES TO BE RETAINED AND PROTECTED
- STREET TREE PLANT - WA PEPPERMINT
- STREET TREE PLANT - GRAFTED MARRI
- POS TREE PLANTING - VARIOUS NATIVE SPECIES TO BE USED FOR FAUNA HABITAT / FORAGING AND SHADE
- DRAINAGE BASIN TREE PLANTING - VARIOUS NATIVE SPECIES TO BE USED SUITABLE FOR WET SOILS AND NUTRIENT STRIPPING
- PROPOSED BENCH SEAT
- PROPOSED PICNIC SETTING
- PROPOSED PICNIC SHELTER
- PROPOSED ACTIVE KICK-ABOUT AREA

LOT 500 WIRRING ROAD, COWARAMUP

STRUCTURE PLAN AMENDMENT - POS 2: DETAIL PLAN

0 5 10 15 20 25 m

CLIENT: YOLK PROPERTY GROUP
DATE: JANUARY 2024
REVISION: A
DWG NO 092WIR-03-005

SCALE: 1:500 @A1

SW LANDSCAPE COLLECTIVE

DRAINAGE BASIN PLANTED WITH NATIVE RUSHES AND SEDGES BELOW 1.0m IN HEIGHT

CLUMPS OF NATIVE MELALEUCA PLANTING TO BATTERS OF DRAINAGE BASINS TO PROVIDE SHADE AND FAUNA HABITAT / FORAGING SPECIES

POS 3 INCORPORATING DRAINAGE BASIN A2.2
- INVERT LEVEL: 137.3m AHD
- DESIGN WATER DEPTH: 1.18m
- DESIGN TOP WATER LEVEL: 1,383m AHD
- DESIGN VOLUMES: 1,091 cub m

RETAIN AND PROTECT ALL EXISTING TREES. INSTALL AREAS OF MULCH AND LOW NATIVE GROUNDCOVER PLANTING BENEATH TO COMPLY WITH APZ STANDARDS AND TO SOFTEN INTERFACE WITH RESIDENTIAL AREA

ENCLOSED DOG OFF-LEASH PARK AREA INCORPORATING EXISTING MATURE TREES FOR SHADE AND IRRIGATED OPEN TURF AREA

LAND LEASE / LIFESTYLE VILLAGE SITE INCORPORATING DRAINAGE BASIN A2.3
- INVERT LEVEL: 136.9m AHD
- DESIGN WATER DEPTH: 0.5m
- DESIGN TOP WATER LEVEL: 1,515m AHD
- DESIGN VOLUMES: 680 cub m

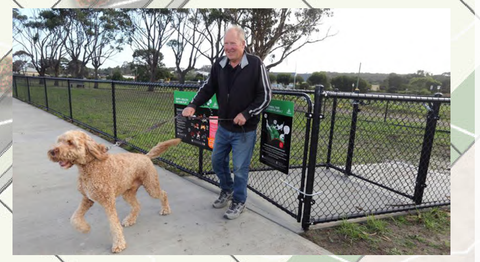
1.5m HIGH BLACK PVC COATED CHAINMESH FENCING TO ENCLOSE DOG OFF-LEASH PARK AREA AND CONTAIN PLANTING ON BOTH SIDES TO SOFTEN VISUAL AESTHETIC

PROPOSED OPEN ACTIVE TURF AREA SEPARATE TO DOG OFF-LEASH AREA FOR INFORMAL ACTIVE RECREATION. FOOTPATH NETWORK PROVIDES WALKING CIRCUITS CONNECTING TO THE GREATER SUBDIVISION PATHWAYS

PROVIDE PARALLEL PARKING BAYS OFF SECONDARY ROAD FOR ACCESS TO POS



PHOTO EXAMPLE - ENCLOSED DOG EXERCISE / OFF LEASH PARK



DRAINAGE BASIN PLANTED WITH NATIVE RUSHES AND SEDGES BELOW 1.0m IN HEIGHT

CLUMPS OF NATIVE MELALEUCA PLANTING TO BATTERS OF DRAINAGE BASINS TO PROVIDE SHADE AND FAUNA HABITAT / FORAGING SPECIES

5.0m WIDE PLANTED LANDSCAPE BUFFER TO INTERFACE WITH EXISTING AGRICULTURAL LAND

POS 3 INCORPORATING DRAINAGE BASIN A2.1
- INVERT LEVEL: 136.3m AHD
- DESIGN WATER DEPTH: 1.19m
- DESIGN TOP WATER LEVEL: 3.359m AHD
- DESIGN VOLUMES: 3,088 cub m

RETAIN AND PROTECT ALL EXISTING TREES. INSTALL AREAS OF MULCH AND LOW NATIVE GROUNDCOVER PLANTING BENEATH TO COMPLY WITH APZ STANDARDS AND TO SOFTEN INTERFACE WITH RESIDENTIAL AREA

POS 3 INCORPORATING DRAINAGE BASIN A2.1
- INVERT LEVEL: 136.0m AHD
- DESIGN WATER DEPTH: 1.19m
- DESIGN TOP WATER LEVEL: 1,474m AHD
- DESIGN VOLUMES: 1,180 cub m

LEGEND

- EXTENT OF PROJECT SITE
- POS DETAIL PLAN
- PROPOSED NEW LOTS
- NEW ASPHALT ROADS
- NEW CONCRETE PATHWAY
- VERGE LANDSCAPING BY LOT OWNERS
- OPEN SLASHED DRY GRASS AREA / UN-IRRIGATED LAWN
- LANDSCAPE PLANTING AREA WITH LOW SHRUBS AND GROUNDCOVERS TO COMPLY WITH APZ STANDARDS AND 'LOW THREAT' BUSHFIRE CLASSIFICATION
- DRAINAGE BASIN PLANTING CONSISTING OF LOW RUSHES AND SEDGES LESS THAN 1.0m IN HEIGHT
- MIN. 5.0m WIDE LANDSCAPE BUFFER TO REAR OF PRIVATE LOTS AT WIRRING RD AND AGRICULTURAL LAND INTERFACE
- DOG FENCE FOR FULLY ENCLOSED DOG OFF-LEASH PARK
- EXISTING TREES TO BE RETAINED AND PROTECTED
- STREET TREE PLANT - WA PEPPERMINT
- STREET TREE PLANT - GRAFTED MARRI
- POS TREE PLANTING - VARIOUS NATIVE SPECIES TO BE USED FOR FAUNA HABITAT / FORAGING AND SHADE
- DRAINAGE BASIN TREE PLANTING - VARIOUS NATIVE SPECIES TO BE USED SUITABLE FOR WET SOILS AND NUTRIENT STRIPPING
- PROPOSED BENCH SEAT
- PROPOSED PICNIC SETTING
- PROPOSED DOG OFF LEASH AREA
- PROPOSED ACTIVE KICK-ABOUT AREA

LOT 500 WIRRING ROAD, COWARAMUP

STRUCTURE PLAN AMENDMENT - POS 3: DETAIL PLAN

0 5 10 15 20 25 m

CLIENT: YOLK PROPERTY GROUP
DATE: JANUARY 2024
REVISION: A
DWG NO 092WIR-03-006

SCALE: 1:500 @A1

SW LANDSCAPE COLLECTIVE

SHADE SHELTER AND PICNIC SETTING FACING NORTH AND LOOKING SOUTH TO ACTIVE POS AREA

INFORMAL ACTIVE KICK-ABOUT SPACE AS MAIN ACTIVITY SPACE FOR THE SOUTHERN SUBDIVISION AREA. TURF AREA TO BE IRRIGATED.

BENCH SEATING PROVIDED IN PLANTING NODE FOR SHADE AND SHELTER

POS LANDSCAPE PLANTING TO SURROUNDS OF DRAINAGE BASINS AND CONSISTING OF NATIVE GROUNDCOVER PLANTING BENEATH NATIVE STREET TREES TO COMPLY WITH APZ STANDARDS AND TO SOFTEN INTERFACE WITH EXISTING RESIDENTIAL AREA. TREES AND PLANTS INSTALLED AT SPACINGS TO DETER VEHICLE ACCESS TO POS.

PROVIDE UNIVERSAL ACCESS TO ALL PICNIC SHELTERS AND SHADE STRUCTURES WITH CONCRETE PATHS

5.0m WIDE PLANTED LANDSCAPE BUFFER TO INTERFACE WITH EXISTING AGRICULTURAL LAND

CLUMPS OF NEW TREE PLANTING WITH MULCH AND LOW GROUNDCOVER UNDERSTOREY AS EXTENSION OF TREE CANOPY TO SOFTEN LANDSCAPE INTERFACE ALONG THE LINEAR POS AND TO PROVIDE SHADE EDGE OF THE ACTIVE POS TURF AREA

DRAINAGE BASIN PLANTED WITH NATIVE RUSHES AND SEDGES BELOW 1.0m IN HEIGHT

CLUMPS OF NATIVE MELALEUCA PLANTING TO BATTERS OF DRAINAGE BASINS TO PROVIDE SHADE AND FAUNA HABITAT / FORAGING SPECIES

POS 4 INCORPORATING DRAINAGE BASIN C1.1
- INVERT LEVEL: 136.2m AHD
- DESIGN WATER DEPTH: 1.00m
- DESIGN TOP WATER LEVEL: 2,480m AHD
- DESIGN VOLUMES: 1,860 cub m

10.0m WIDE PLANTED LANDSCAPE BUFFER TO INTERFACE WITH EXISTING WIRRING ROAD



PHOTO EXAMPLE - DRAINAGE BASINS WITH NATURAL ROCK BATTERS ON THE EDGE OF EXISTING BUSHLAND

LEGEND

- EXTENT OF PROJECT SITE
- POS DETAIL PLAN
- PROPOSED NEW LOTS
- NEW ASPHALT ROADS
- NEW CONCRETE PATHWAY
- VERGE LANDSCAPING BY LOT OWNERS
- OPEN SLASHED DRY GRASS AREA / UN-IRRIGATED LAWN
- LANDSCAPE PLANTING AREA WITH LOW SHRUBS AND GROUNDCOVERS TO COMPLY WITH APZ STANDARDS AND 'LOW THREAT' BUSHFIRE CLASSIFICATION
- DRAINAGE BASIN PLANTING CONSISTING OF LOW RUSHES AND SEDGES LESS THAN 1.0m IN HEIGHT
- MIN. 5.0m WIDE LANDSCAPE BUFFER TO REAR OF PRIVATE LOTS AT WIRRING RD AND AGRICULTURAL LAND INTERFACE
- EXISTING TREES TO BE RETAINED AND PROTECTED
- STREET TREE PLANT - WA PEPPERMINT
- STREET TREE PLANT - GRAFTED MARRI
- POS TREE PLANTING - VARIOUS NATIVE SPECIES TO BE USED FOR FAUNA HABITAT / FORAGING AND SHADE
- DRAINAGE BASIN TREE PLANTING - VARIOUS NATIVE SPECIES TO BE USED SUITABLE FOR WET SOILS AND NUTRIENT STRIPPING
- PROPOSED BENCH SEAT
- PROPOSED PICNIC SETTING
- PROPOSED PICNIC SHELTER
- PROPOSED ACTIVE KICK-ABOUT AREA

LOT 500 WIRRING ROAD, COWARAMUP

STRUCTURE PLAN AMENDMENT - POS 4: DETAIL PLAN

0 5 10 15 20 25 m

CLIENT: YOLK PROPERTY GROUP
DATE: JANUARY 2024
REVISION: A
DWG NO 092WIR-03-007

SCALE: 1:500 @A1

SW LANDSCAPE COLLECTIVE

POS 5 INCORPORATING DRAINAGE BASIN A1.2
- INVERT LEVEL: 131.4m AHD
- DESIGN WATER DEPTH: 1.2m
- DESIGN TOP WATER LEVEL: 132.6m AHD
- DESIGN VOLUMES: 635 cub m

RETAIN AND PROTECT ALL EXISTING TREES. INSTALL AREAS OF MULCH AND LOW NATIVE GROUNDCOVER PLANTING BENEATH TO COMPLY WITH APZ STANDARDS AND TO SOFTEN INTERFACE WITH EXISTING RESIDENTIAL AREA

POS TREE PLANTING TO PROVIDE SHADE TO PATHWAY AND FORM EDGE TO OPEN INFORMAL ACTIVE RECREATIONAL AREA

OPEN UN-IRRIGATED TURF AREA TO BE SLASHED REGULARLY TO PROVIDE LOW MAINTENANCE MEANDERING INFORMAL OPEN SPACE

BENCH SEATING PROVIDES PASSIVE RESTING SPACE BENEATH EXISTING TREES FOR SHADE AND BACKING ONTO GARDEN BED FOR PRIVACY

CONCRETE FOOTPATH CONNECTION TO EXISTING WAVERLEY ROAD SUBDIVISION AREA

NATIVE WA PEPPERMINT STREET TREE PLANTING TO WAVERLEY ROAD TO MATCH EXISTING STREET TREES

DRAINAGE BASIN A1.2 PLANTED WITH NATIVE RUSHES AND SEDGES BELOW 1.0m IN HEIGHT

CLUMPS OF NATIVE MELALEUCA PLANTING TO BATTERS OF DRAINAGE BASINS TO PROVIDE SHADE AND FAUNA HABITAT / FORAGING SPECIES

MULCH ONLY TREATMENT BETWEEN PATHWAY AND LOT BOUNDARY FENCING TO COMPLY WITH BUSHFIRE SETBACK REQUIREMENTS

POS LANDSCAPE PLANTING TO CONSIST OF TREE CLUMPS AND NATIVE GROUNDCOVER PLANTING BENEATH TO COMPLY WITH APZ STANDARDS AND TO SOFTEN INTERFACE WITH EXISTING RESIDENTIAL AREA. TREES AND PLANTS INSTALLED AT SPACINGS TO DETER VEHICLE ACCESS TO POS.

NATIVE STREET TREE PLANTING ALONG POS ROAD INTERFACE PROVIDING SHADE AND TO DETER VEHICLES FROM ACCESSING POS.

OPEN UN-IRRIGATED TURF AREA SUITABLE FOR INFORMAL ACTIVE RECREATION

POS LANDSCAPE PLANTING TO CONSIST OF TREE CLUMPS AND NATIVE GROUNDCOVER PLANTING BENEATH TO COMPLY WITH APZ STANDARDS AND TO SOFTEN INTERFACE WITH EXISTING RESIDENTIAL AREA. TREES AND PLANTS INSTALLED AT SPACINGS TO DETER VEHICLE ACCESS TO POS.

CLUMPS OF NEW TREE PLANTING WITH MULCH AND LOW GROUNDCOVER UNDERSTOREY AS EXTENSION OF TREE CANOPY AND SOFTEN LANDSCAPE INTERFACE ALONG THE LINEAR POS AND TO PROVIDE SHADE TO THE PATHWAY

MAHOGONY WAY

LIONS DRIVE

WAVERLEY ROAD

A

A



PHOTO EXAMPLE - RETENTION OF EXISTING TREES IN POS WITH NEW PLANTING ADDED AS UNDERSTOREY

LEGEND

- EXTENT OF PROJECT SITE
- POS DETAIL PLAN
- PROPOSED NEW LOTS
- NEW ASPHALT ROADS
- NEW CONCRETE PATHWAY
- VERGE LANDSCAPING BY LOT OWNERS
- OPEN SLASHED DRY GRASS AREA / UN-IRRIGATED LAWN
- LANDSCAPE PLANTING AREA WITH LOW SHRUBS AND GROUNDCOVERS TO COMPLY WITH APZ STANDARDS AND 'LOW THREAT' BUSHFIRE CLASSIFICATION
- DRAINAGE BASIN PLANTING CONSISTING OF LOW RUSHES AND SEDGES LESS THAN 1.0m IN HEIGHT
- MIN. 5.0m WIDE LANDSCAPE BUFFER TO REAR OF PRIVATE LOTS AT WIRRING RD AND AGRICULTURAL LAND INTERFACE
- EXISTING TREES TO BE RETAINED AND PROTECTED
- STREET TREE PLANT - WA PEPPERMINT
- STREET TREE PLANT - GRAFTED MARRI
- POS TREE PLANTING - VARIOUS NATIVE SPECIES TO BE USED FOR FAUNA HABITAT / FORAGING AND SHADE
- DRAINAGE BASIN TREE PLANTING - VARIOUS NATIVE SPECIES TO BE USED SUITABLE FOR WET SOILS AND NUTRIENT STRIPPING
- PROPOSED BENCH SEAT
- PROPOSED ACTIVE KICK-ABOUT AREA

LOT 500 WIRRING ROAD, COWARAMUP

STRUCTURE PLAN AMENDMENT - POS 5: DETAIL PLAN

0 2 4 6 8 10 m

CLIENT: YOLK PROPERTY GROUP
DATE: 28 NOVEMBER 2024
REVISION: A
DWG NO 092WIR-02-008

SCALE: 1:250 @A1

SW LANDSCAPE COLLECTIVE

STEWART SMITH LOOP

WAVERLEY ROAD

1.2m WIDE MULCH ONLY STRIP TO BACK OF ROAD EDGE WITH ALL PLANTING TO BE SETBACK MIN. 1.2m FROM KERBS AND PATHS, AND ALL POS TREES MINIMUM OF 2.0m.

MORTARED ROCK PITCHED CHANNEL BY CIVIL CONTRACTOR

DRAINAGE BASIN PLANTED WITH NATIVE RUSHES AND SEDGES BELOW 1.0m IN HEIGHT

1.2m WIDE MULCH ONLY STRIP TO BACK OF ROAD EDGE WITH ALL PLANTING TO BE SETBACK MIN. 1.2m FROM KERBS AND PATHS, AND ALL POS TREES MINIMUM OF 2.0m.

CLUMPS OF NATIVE MELALEUCA PLANTING TO BATTERS OF DRAINAGE BASINS TO PROVIDE SHADE AND FAUNA HABITAT / FORAGING SPECIES

POS 7 INCORPORATING DRAINAGE BASIN A1.5
- INVERT LEVEL: 131.5m AHD
- DESIGN WATER DEPTH: 1.0m
- DESIGN TOP WATER LEVEL: 132.5m AHD
- DESIGN VOLUMES: 290 cub m

POS LANDSCAPE PLANTING TO SURROUNDS OF DRAINAGE BASINS AND CONSISTING OF NATIVE GROUNDCOVER PLANTING BENEATH NATIVE STREET TREES TO COMPLY WITH APZ STANDARDS AND TO SOFTEN INTERFACE WITH EXISTING RESIDENTIAL AREA. TREES AND PLANTS INSTALLED AT SPACINGS TO DETER VEHICLE ACCESS TO POS.

CLUMPS OF NATIVE MELALEUCA PLANTING TO BATTERS OF DRAINAGE BASINS TO PROVIDE SHADE AND FAUNA HABITAT / FORAGING SPECIES

POS LANDSCAPE PLANTING TO SURROUNDS OF DRAINAGE BASINS AND CONSISTING OF NATIVE GROUNDCOVER PLANTING BENEATH NATIVE STREET TREES TO COMPLY WITH APZ STANDARDS AND TO SOFTEN INTERFACE WITH EXISTING RESIDENTIAL AREA. TREES AND PLANTS INSTALLED AT SPACINGS TO DETER VEHICLE ACCESS TO POS.

POS 6 INCORPORATING DRAINAGE BASIN A1.4
- INVERT LEVEL: 133.8m AHD
- DESIGN WATER DEPTH: 1.2m
- DESIGN TOP WATER LEVEL: 135m AHD
- DESIGN VOLUMES: 1,400 cub m

MORTARED ROCK PITCHED CHANNEL BY CIVIL CONTRACTOR

5.0m WIDE PLANTED LANDSCAPE BUFFER TO INTERFACE WITH EXISTING AGRICULTURAL LAND

EXISTING AGRICULTURAL LAND

A

B

C

LEGEND

- EXTENT OF PROJECT SITE
- POS DETAIL PLAN
- PROPOSED NEW LOTS
- NEW ASPHALT ROADS
- NEW CONCRETE PATHWAY
- VERGE LANDSCAPING BY LOT OWNERS
- OPEN SLASHED DRY GRASS AREA / UN-IRRIGATED LAWN
- LANDSCAPE PLANTING AREA WITH LOW SHRUBS AND GROUNDCOVERS TO COMPLY WITH APZ STANDARDS AND 'LOW THREAT' BUSHFIRE CLASSIFICATION
- DRAINAGE BASIN PLANTING CONSISTING OF LOW RUSHES AND SEDGES LESS THAN 1.0m IN HEIGHT
- MIN. 5.0m WIDE LANDSCAPE BUFFER TO REAR OF PRIVATE LOTS AT WIRRING RD AND AGRICULTURAL LAND INTERFACE
- EXISTING TREES TO BE RETAINED AND PROTECTED
- STREET TREE PLANT - WA PEPPERMINT
- STREET TREE PLANT - GRAFTED MARRI
- POS TREE PLANTING - VARIOUS NATIVE SPECIES TO BE USED FOR FAUNA HABITAT / FORAGING AND SHADE
- DRAINAGE BASIN TREE PLANTING - VARIOUS NATIVE SPECIES TO BE USED SUITABLE FOR WET SOILS AND NUTRIENT STRIPPING

LOT 500 WIRRING ROAD, COWARAMUP

STRUCTURE PLAN AMENDMENT - POS 6 & 7: DRAINAGE RESERVE DETAIL PLAN

0 2 4 6 8 10 m

CLIENT: YOLK PROPERTY GROUP
DATE: 28 NOVEMBER 2024
REVISION: A
DWG NO 092WIR-02-009

SCALE: 1:250 @A1

SW LANDSCAPE COLLECTIVE

EXISTING LAKEVIEW ESTATE PUMP STATION ON SMALL SPRING FED DAM TO BE UPGRADED AND MAINLINE EXTENDED TO SUPPLY NEW DEVELOPMENT WORKS

BOTTRILL ST

DUGGAN DRIVE

LIONS DRIVE

MAHOGONY WAY

STEWART SMITH LP

POS 1
IRRIGATED TURF AREA = 4,750sqm
IRRIGATED GARDEN AREA = 2,200sqm

POS 2
IRRIGATED TURF AREA = 4,470sqm
IRRIGATED GARDEN AREA = 0sqm

NOREUIL CCT

LAND LEASE - LIFESTYLE VILLAGE SITE

POS 5
IRRIGATED TURF AREA = 2,150sqm
IRRIGATED GARDEN AREA = 0sqm

POS 3
IRRIGATED TURF AREA = 2,350sqm
IRRIGATED GARDEN AREA = 1,750sqm

CURRENT AGRICULTURAL LAND / FUTURE SUBDIVISION WORKS

WIRRING ROAD

POS 4
IRRIGATED TURF AREA = 600sqm
IRRIGATED GARDEN AREA = 0sqm

LEGEND

- EXTENT OF PROJECT SITE
- PROPOSED IRRIGATION MAINLINE LOCATION TO CONNECT AREAS
- PROPOSED IRRIGATED TURF AREA WITH SPRAY IRRIGATION
- PROPOSED IRRIGATED GARDEN AREA WITH DRIP IRRIGATION
- EXISTING LAKEVIEW ESTATE PUMP STATION ON SMALL SPRING FED DAM TO BE UPGRADED AND MAINLINE EXTENDED TO SUPPLY NEW DEVELOPMENT WORKS

TOTAL IRRIGATION REQUIREMENT

IRRIGATED TURF AREA - 14,320sqm
IRRGATED GARDEN AREA - 3,950sqm

IRRIGATED TURF AREA - 9660 kL per year
IRRGATED GARDEN AREA - 2,670kL per year

LOT 500 WIRRING ROAD, COWARAMUP

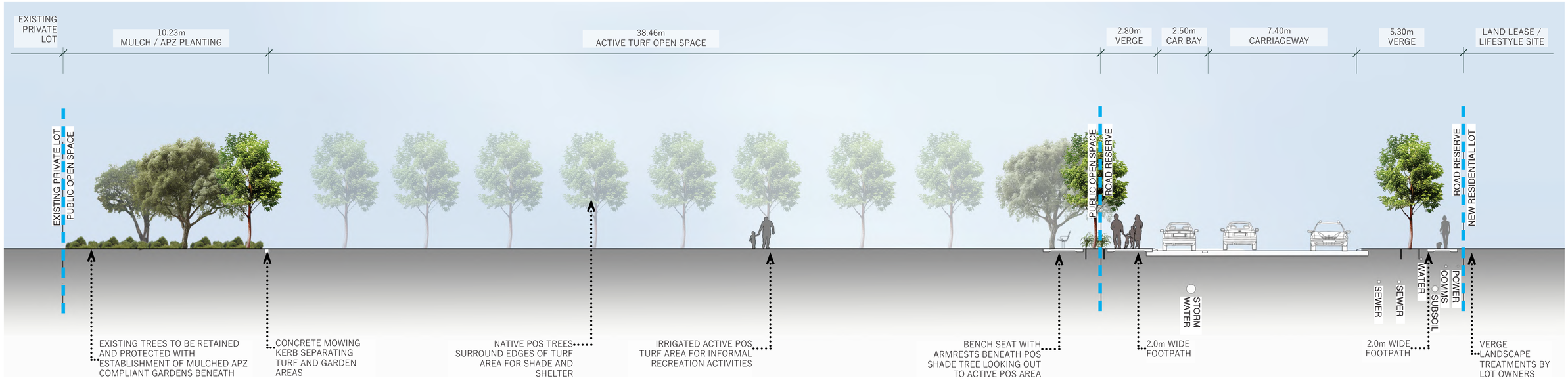
STRUCTURE PLAN AMENDMENT - IRRIGATION STRATEGY PLAN

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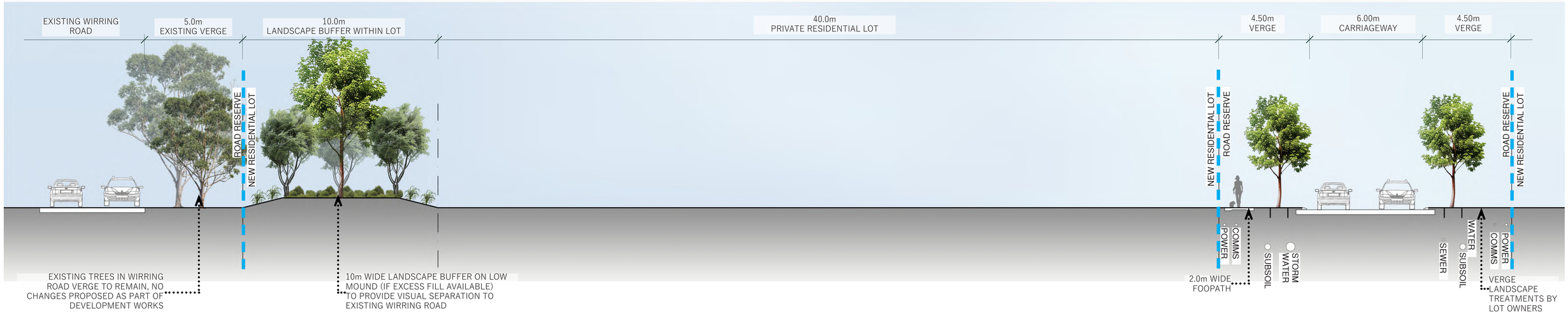
CLIENT: YOLK PROPERTY GROUP
DATE: 28 NOVEMBER 2024
REVISION: A
DWG NO 092WIR-02-010

SCALE: 1:2000 @A1

SW LANDSCAPE COLLECTIVE



SECTION A - POS 2: ROY EARLE DRIVE AND ACTIVE POS AREA



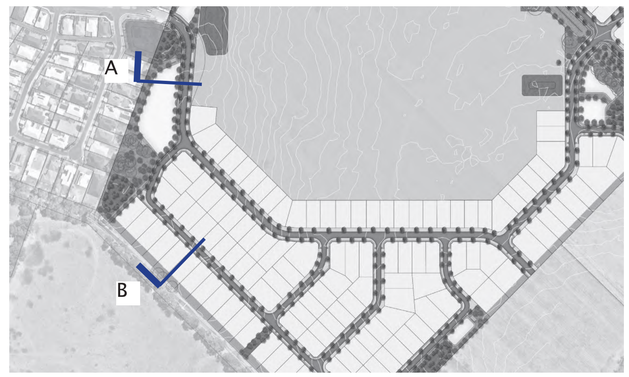
SECTION B - SECONDARY ROAD WITH 10m LANDSCAPE SCREEN WITHIN PRIVATE LOTS FRONTING WIRRING ROAD







PHOTO EXAMPLE - COLOURFUL TODDLER BIKE PATHS AS EXTENSION OF ADVENUTRE PLAYGROUND



SECTION LOCATION PLAN (NTS)

LOT 500 WIRRING ROAD, COWARAMUP

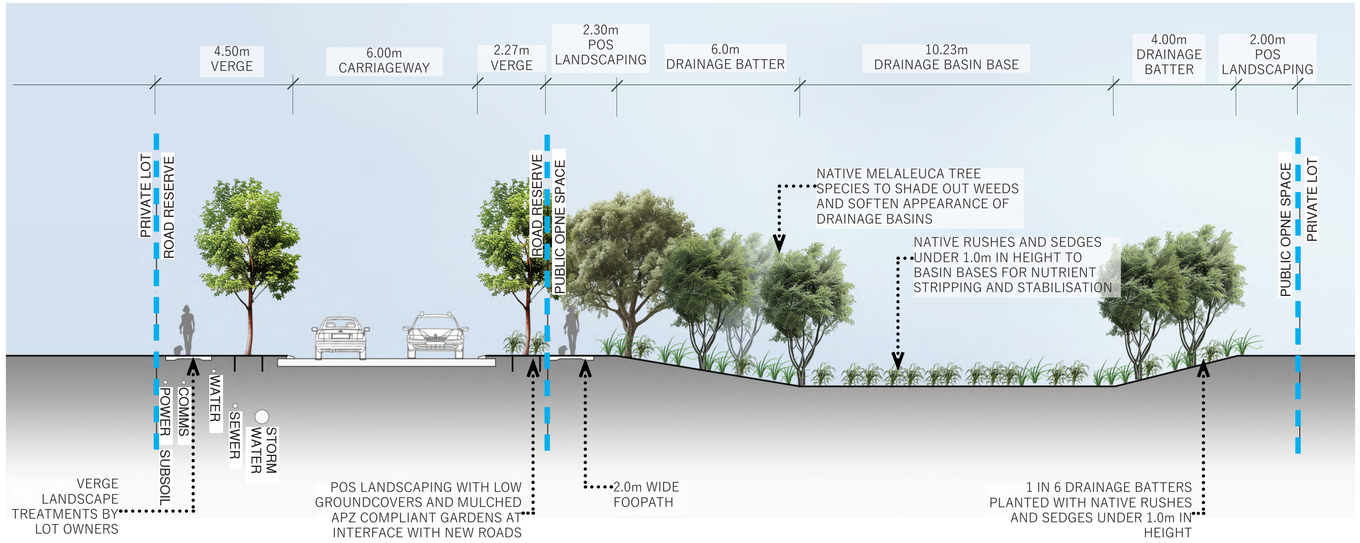
STRUCTURE PLAN AMENDMENT - TYPICAL SECTIONS A AND B

CLIENT: YOLK PROPERTY GROUP
DATE: 28 DECEMBER 2024
REVISION: A
DWG NO 092WIR-02-011

SCALE: 1:100 @A1

0 1 2 3 4 5 m

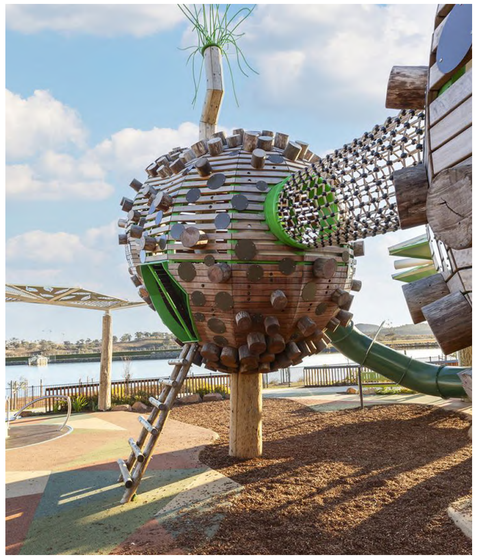
SW LANDSCAPE COLLECTIVE

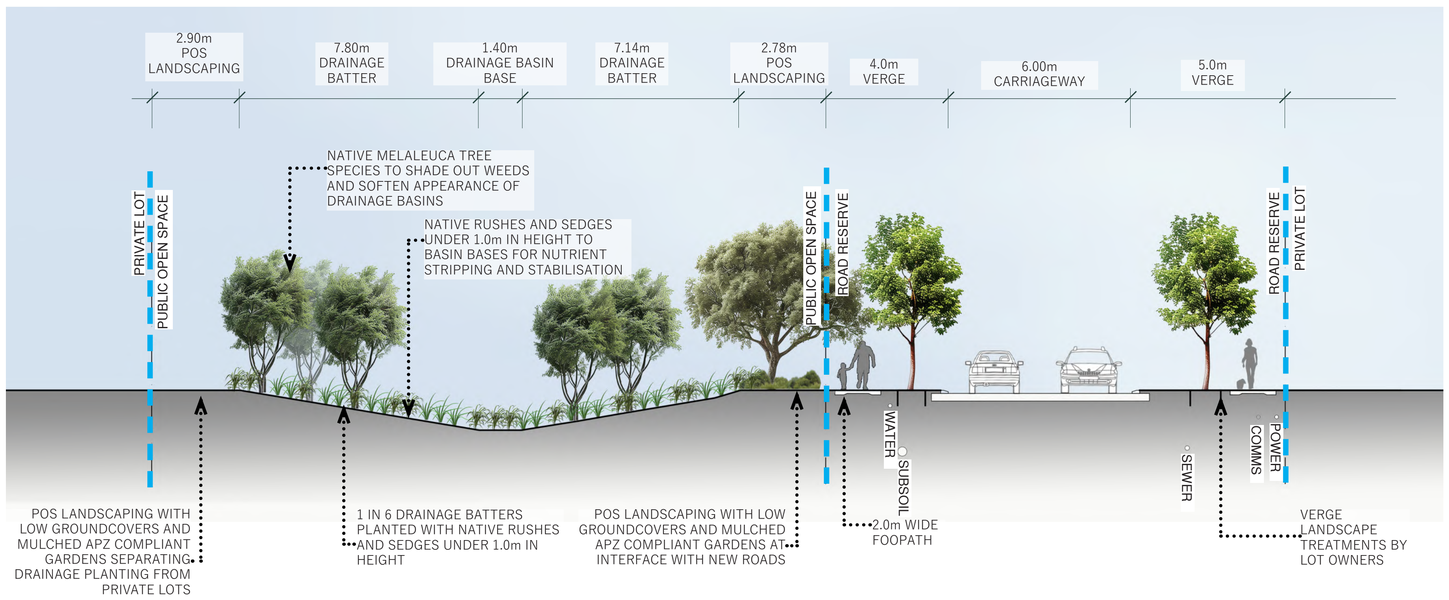


SECTION C - POS 4: SECONDARY ROAD AND DRAINAGE BASIN INTERFACE ALONG SOUTH EAST BOUNDARY



SECTION LOCATION PLAN (NTS)





SECTION D - POS 3: EXTENSION OF LIONS ROAD AND DRAINAGE BASIN

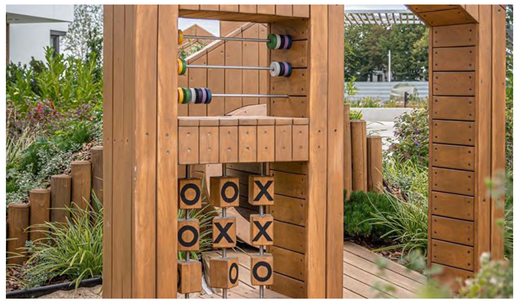




PHOTO EXAMPLE - OUTDOOR PUZZLES AND PROBLEM SOLVING SKILLS AS EXTENSION OF PLAY EQUIPMENT



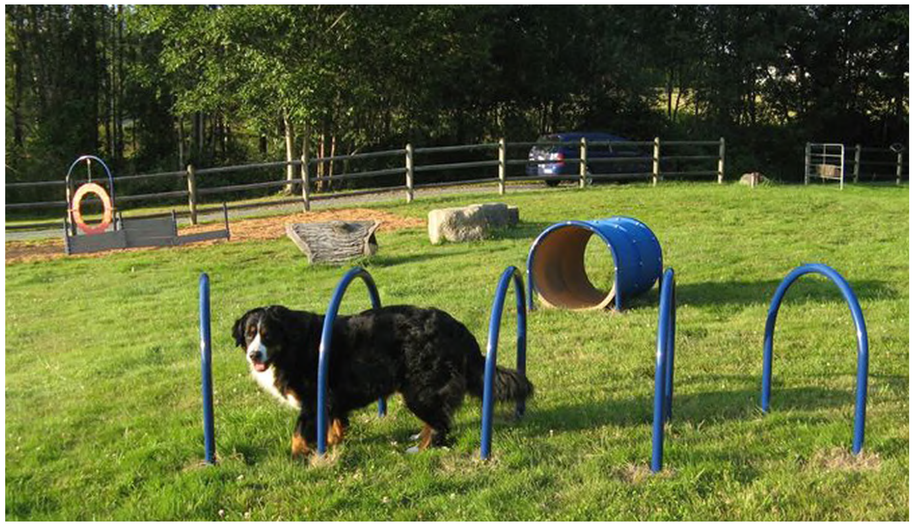


PHOTO EXAMPLE - ENCLOSED DOG EXERCISE / OFF LEASH PARK



LOT 500 WIRRING ROAD, COWARAMUP

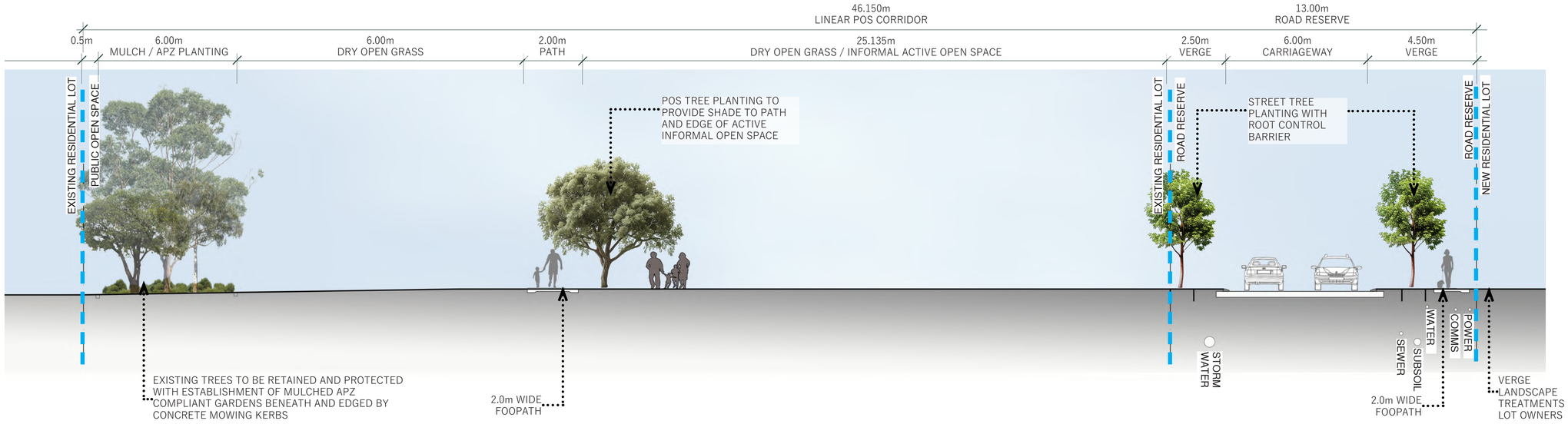
STRUCTURE PLAN AMENDMENT - TYPICAL SECTIONS C AND D

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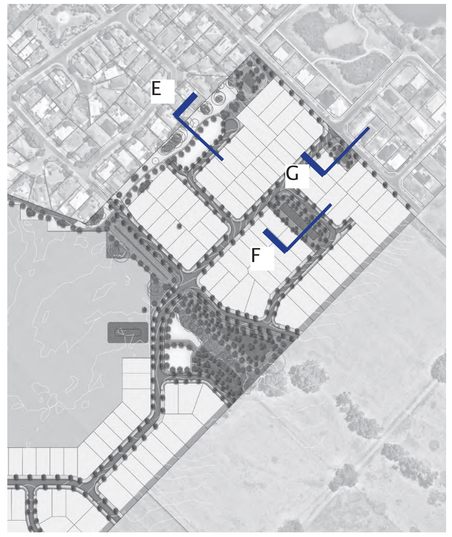
CLIENT: YOLK PROPERTY GROUP
DATE: 28 DECEMBER 2024
REVISION: A
DWG NO 092WIR-02-012

SCALE: 1:100 @A1

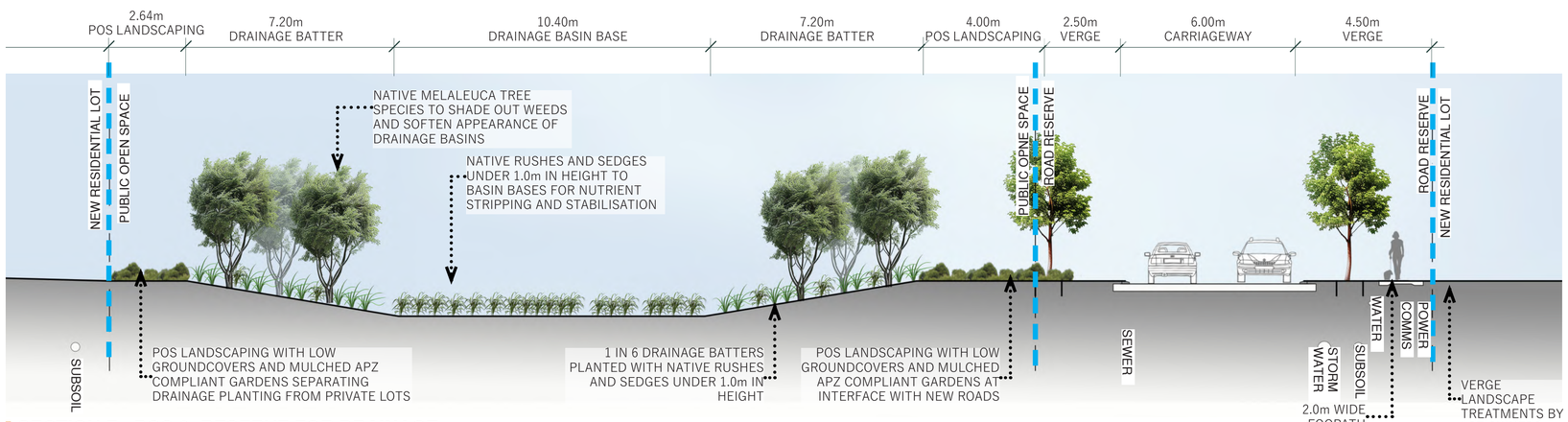
SW LANDSCAPE COLLECTIVE



SECTION E - POS 5: LINEAR PUBLIC OPEN SPACE ADJACENT EXISTING LOTS



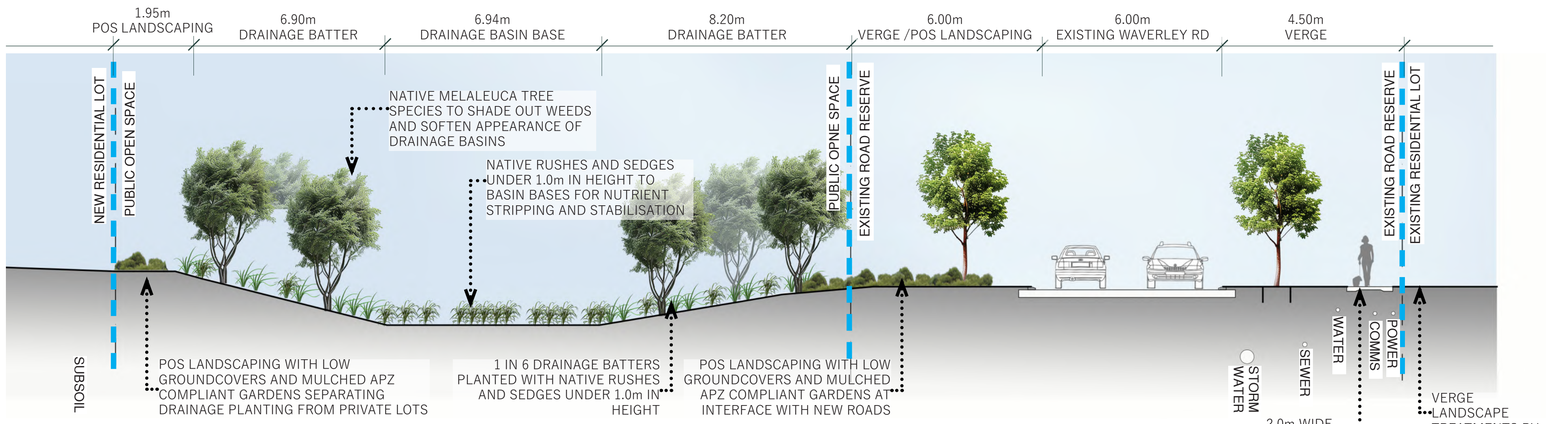
SECTION LOCATION PLAN (NTS)



SECTION F - POS 6: RESERVE FOR DRAINAGE



PHOTO EXAMPLE - PLANTED DRAINAGE BASIN WITH ROCK PITCHED BATTERS IF REQUIRED TO ACHIEVE FIRE SEPARATION



SECTION G - POS 7: RESERVE FOR DRAINAGE AND INTERFACE WITH EXISTING WAVERLEY ROAD



PHOTO EXAMPLE - RETENTION OF EXISTING TREES IN POS WITH NEW PLANTING ADDED AS UNDERSTOREY

LOT 500 WIRRING ROAD, COWARAMUP

STRUCTURE PLAN AMENDMENT - TYPICAL SECTIONS E, F AND G

CLIENT: YOLK PROPERTY GROUP
DATE: 28 DECEMBER 2024
REVISION: A
DWG NO 092WIR-02-013

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SCALE: 1:100 @A1

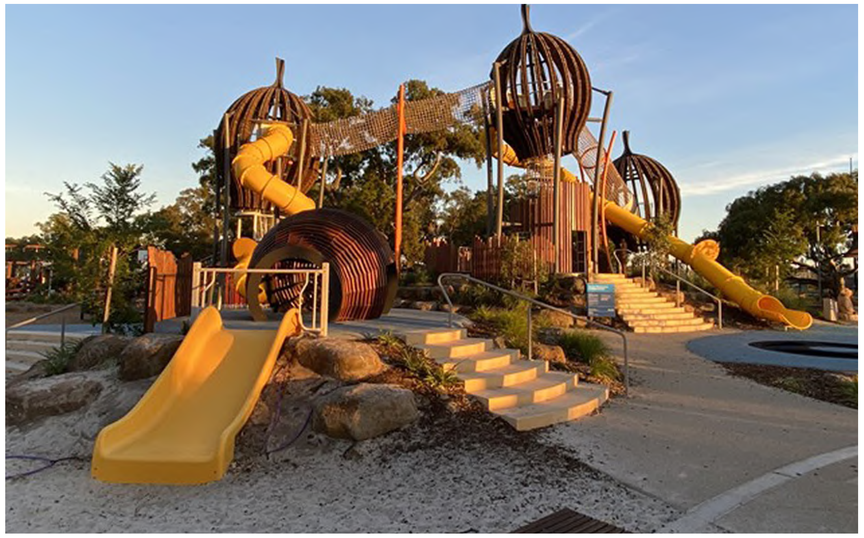
SW LANDSCAPE COLLECTIVE



EXAMPLE MULTIPURPOSE COURTS AND ALL AGES PLAY AREAS



EXAMPLE ALL AGES ADVENTURE PLAYSPACES





EXAMPLE ALL AGES ADVENTURE PLAYSPACES



EXAMPLE ALL AGES GAMES AND OUTDOOR ACTIVITIES



EXAMPLE ALL AGES ADVENTURE PLAYSPACES



EXAMPLE MULTIPURPOSE COURTS AND EXERCISE NODES

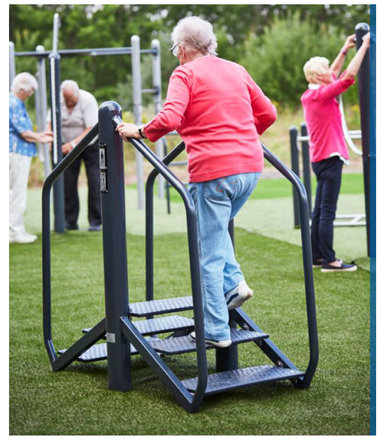


EXAMPLE ALL AGES GAMES AND OUTDOOR ACTIVITIES





EXAMPLE OUTDOOR FITNESS AND EXERCISE NODES



LOT 500 WIRRING ROAD, COWARAMUP

STRUCTURE PLAN AMENDMENT - ALL AGES ADVENTURE PLAYGROUND

CLIENT: YOLK PROPERTY GROUP
DATE: 28 DECEMBER 2024
REVISION: A
DWG NO 092WIR-02-014

SCALE: NTS

SW LANDSCAPE COLLECTIVE





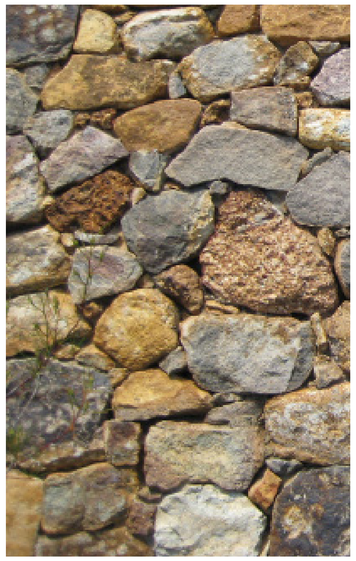
EXAMPLE PICNIC SHELTERS WITH NATURAL MATERIALS AND BURSTS OF COLOUR







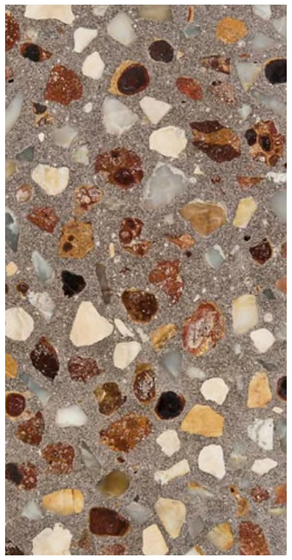
EXAMPLE NATURE PLAY ELEMENTS



COASTAL LIMESTONES GRANITE



CUSTOM SITE FURNITURE UTILISING RECYCLED TIMBER MATERIALS



EXPOSED AGG CONCRETE FEATURES



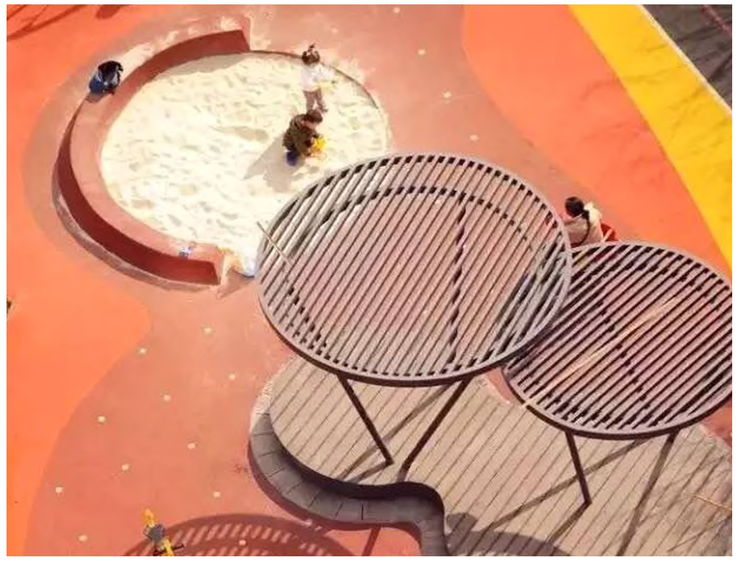
EXISTING SITE LOGS RECYCLED AS POS AND LANDSCAPE FEATURES



EXAMPLE ARTWORK / FEATURE / PLAY ITEMS



COMBINATION OF NATURAL MATERIALS IN SEATING NODES



COLOURFUL PICNIC SHELTERS AND PLAYSPACES



SITE LOGS FOR PLAYGROUND AND LANDSCAPE FEATURES

LOT 500 WIRRING ROAD, COWARAMUP

STRUCTURE PLAN AMENDMENT - HARDSCAPE MATERIAL PALETTE

CLIENT: YOLK PROPERTY GROUP
DATE: 28 DECEMBER 2024
REVISION: A
DWG NO 092WIR-02-015

SCALE: NTS

SW LANDSCAPE COLLECTIVE

TREE SPECIES

STREET TREES
Agonis flexousa - WA Peppermint
Corymbia calyphylla Grafted Varieties - Marri
Corymbia ficifolia - Red Flowering Gum
Eucalyptus torquata - Coral Gym
Eucalyptus patens - Blackbutt
Hakea laurina - Pin Cushion Hakea

PUBLIC OPEN SPACE TREES
Agonis flexousa - WA Peppermint
Banksia grandis - Bull Banksia
Corymbia calyphylla - Marri
Eucalyptus diversicolour - Karri
Eucalyptus marginata - Jarrah
Eucalyptus patens - Blackbutt
Eucalyptus rudis - River Gum
Melaleuca rhaphiophylla - Swamp Paperbark





Agonis flexuosa



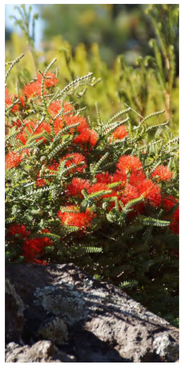
Anigozanthus manglessii



Atriplex cinerea



Banksia nivea



Beaufortia squarrosa

LOW THREAT FIRE RESISTANT PLANT SPECIES

SHRUBS AND GRASSES
Anigozanthus manglesii - Red and Green Kangaroo Paw
Atriplex cinerea - Grey Saltbush
Beaufortia squarrosa - Sand Bottlebrush
Calothamnus quadrifidus - Onesided Bottelbrush
Casuarina glauca - Cousin IT
Lepidosperma gladiatum - Coastal Sword Sedge
Olearia axillaris - Coastal Daisy Bush

GROUND COVERS
Banksia nivea - Honeypot Dryandra
Conostylis aculeata - Prickly Conostylis
Eremophila glabra - Emu Bush
Grevillea junipera - Juniper-leaved Grevillea
Hemiandra pungens - Snake bush
Kennedia coccinea - Running Postman
Myoporum parvifolium Creeping Boobialla
Pandorea jasminoides - Star Jasmin
Scaevola aemula - Fairy Fan Flower





Calothamnus quadrifidus



Casuarina Cousin IT



Conostylis aculeata



Ficinia nodosa

POS LANDSCAPE PLANTING SPECIES

TREES
Agonis flexuosa - WA Peppermint Tree
Banksia grandis - Bull Banksia
Hakea lauraina - Pin Cushion Hakea

SHRUBS
Adenanthos cuneatus - Kalbarri Carpet
Anigozanthis flavisua - Yellow Kangaroo Paw
Anigozanthus manglesii - Red and Green Kangaroo Paw
Billardiera fusiformis - Australian Bluebell
Beaufortia squarrosa - Sand Bottlebrush
Calothamnus quadrifidus - Onesided Bottelbrush
Casuarina glauca - Cousin IT
Grevillea olivacea - Olive-Leaved Grevillea
Lepidosperma gladiatum - Coastal Sword Sedge
Lepidosperma Twilight Green
Meebolidna scariosa - Velve Rush
Templetonia retusa - Cockiets Tongue

GROUND COVERS
Banksia nivea - Honeypot Dryandra
Conostylis aculeata - Prickly Conostylis
Grevillea GinGin Gem
Lomandra Seasprayt
Melaleuca heugelli - White Rambler
Myoporum parvifolium Creeping Boobialla
Scaevola crassifolia - Purple Fan Flower





Grevillea Gingin Gem



Grevillea olivacea



Hakea laurina



Juncus pallidus



Lepidosperma gladiatum

DRAINAGE BASIN AND SWALE PLANTING SPECIES

TREES
Melaleuca rhaphiophylla

GROUND COVERS
Baumea juncea
Carex appressa
Ficinia nodosa
Meeboldina scariosa
Juncus pallidus
Scheonoplectus validus











LOT 500 WIRRING ROAD, COWARAMUP

STRUCTURE PLAN AMENDMENT - PRELIMINARY PLANTING PALETTE

CLIENT: YOLK PROPERTY GROUP
DATE: 28 DECEMBER 2024
REVISION: A
DWG NO 092WIR-02-016

SCALE: NTS

SW LANDSCAPE COLLECTIVE



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COWARAMUP - CONCEPT PLAN

Lot 500 Wirring Road, Cowaramup

Project YOLHA 24001002DLL | Scale 1:4000 @ A3 | Date: 13 Nov 2024

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24001002C

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COWARAMUP - STRUCTURE PLAN

Lot 500 Wirring Road, Cowaramup

Project YOLHA 24001002D | Scale 1:4000 @ A3 | Date: 13 Nov 2024

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Engineering a better future for over 20 years!

Lot 500 Wirring Road, Cowaramup

Proposed Amended Structure Plan

Transport Impact Assessment

PREPARED FOR:
Youlk Property Group

January 2025

Document history and status

Author	Revision	Approved by	Date approved	Revision type
Mohammad Rasouli	r01	Behnam Bordbar	12/12/2024	Draft
Mohammad Rasouli	r01a	Behnam Bordbar	10/01/2024	Final

File name: t24.193.mr.r02a.docx

Author: Mohammad Rasouli

Project manager: Mohammad Rasouli

Client: Youlk Property Group

Project: Lot 500 Wirring Road

Document revision: r01a

Project number: t24.193

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1 Summary

This Traffic Impact Assessment (TIA) has been prepared by Transcore for Youlk Property Group regarding the proposed Amended Structure Plan (SP) at Lot 500 Wirring Road in Cowaramup, Shire of Augusta-Margaret River.

The amended SP will include 224 residential dwellings and 255 Land Lease Community (LLC) units, reducing the original plan's approximate 350 residential dwellings and a retirement village site. This reduction is expected to lower traffic generation, as the total number of dwellings has decreased by about 126, with LLC units generating significantly less traffic than traditional residential units.

Access to the amended SP will be via Waverley Road, Roy Earl Drive, and Lions Drive, with development traffic primarily directed to Bussell Highway through Waverley Road and Roy Earl Drive. No additional traffic is anticipated on Wirring Road, as the amended SP will not connect to this road.

The SIDRA analysis shows that all approaches to the Waverley Road/Bussell Highway and Roy Earl Drive/Bussell Highway intersections are expected to operate at Level of Service (LOS) A, with minimal delays and queues. While the right turn movements to Bussell Highway may reach LOS E and F during peak hours in longer term, the resulting queue lengths and delays are manageable, indicating that no upgrades are necessary at these intersections due to the proposed amended SP.

It is understood that, in the long term and as part of the proposed Structure Plan for Lot 102 Bussell Highway, upgrades to the intersection of Roy Earl Drive and Bussell Highway will be necessary. These upgrades may take the form of either a staggered Type A staged crossing or a single four-way roundabout at this location.

The proposed road hierarchy within the amended SP area aligns with the approved SP, with projected traffic volumes on the amended SP road network estimated to be less than 3,000 vehicles per day (vpd), allowing all roads to be classified as Access Streets.

2 Introduction and Background

This Traffic Impact Assessment (TIA) has been prepared by Transcore on behalf of Youlk Property Group for the proposed Amended Structure Plan (SP) at Lot 500 Wirring Road, Cowaramup, located in the Shire of Augusta-Margaret River.

The original Structure Plan for Lot 500 Wirring Road was approved in July 2024. A copy of the approved SP is provided in **Appendix A**.

The subject land comprises approximately 40.9 hectares of land located on the eastern edge of the Cowaramup Townsite, north of Wirring Road. The Structure Plan area is situated immediately southeast of the established Cowaramup Townsite, about 10 kilometers north of Margaret River and approximately 31 kilometers southwest of the Busselton Regional Centre. Bussell Highway is located roughly 300 meters west of the site, providing convenient access to the surrounding regions.

The location of the site is illustrated in **Figure 1**. The site is located between Waverley Road and Wirring Road and is the extension of the existing subdivisions towards east.

For the purpose of this TIA the following documents were sourced and reviewed:

- Lot 500 Wirring Road Structure Plan, ROWE Group Design, 28 June 2024; and,
- Lot 500 Wirring Road Structure Plan Traffic Impact Assessment, Stantec 20 July 2022.
- Cowaramup Integrated Transport Strategy, Stantec19 June 2024.



Figure 1: Location of the subject site

3 Proposed Amended Structure Plan

The proposed Amended Structure Plan is shown in **Appendix B**. The amended Structure Plan will comprise 224 residential dwellings and 255 Land Lease Community (LLC) units. In contrast, the original Structure Plan included approximately 350 residential dwellings along with a retirement village site.

It is anticipated that the proposed amended Structure Plan will generate less traffic than the original plan, as the total number of dwellings has been reduced by about 126. Additionally, the trip generation associated with the LLC units is significantly lower than that of traditional residential dwellings, further contributing to the expected decrease in overall traffic impact.

The Amended SP would gain access/ egress via Waverley Road, Roy Earl Drive and Lions Drive as shown in **Figure 2**. This figure also shows the potential future connections to the east of the amended SP area.

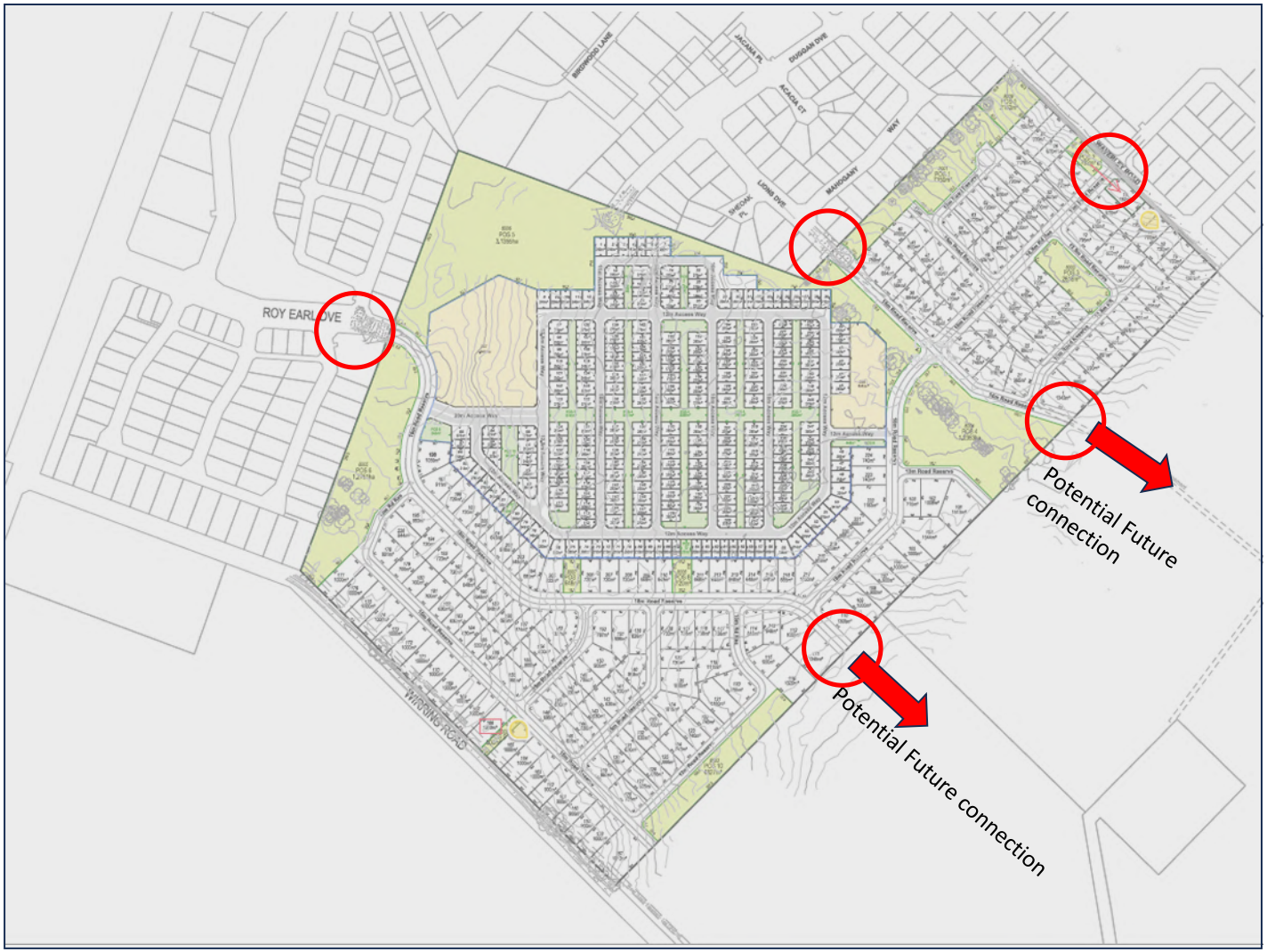


Figure 2: Proposed amended Local Structure Plan access points

4 Existing Situation

4.1 Existing Land Use

The site is currently vacant. Within the immediate surrounding area, the land uses consist of Priority Agriculture to the east and south of the site and residential dwellings to the north and west of the site.

4.2 Existing Road Network

The existing road network and its classification in the Main Roads WA functional road hierarchy is illustrated in **Figure 3**.



Figure 3: Existing road hierarchy

Bussell Highway west of the subject site, is a single carriageway, two-way undivided road which is classified as a Regional Distributor in Main Roads WA Functional Road Hierarchy to the east of Madigan Road and operates under the speed limit of 60km/h in the vicinity of the subject site.

The reported Weekday daily traffic on Bussell Highway south of Memorial Drive (2021/2022 period) is about 8,800 vehicles, with peak hours around 680-800 vehicles. Weekend daily traffic is about 7,800 vehicles, with the peak around 875 vehicles. Heavy vehicles account for 14-15% of weekday traffic, but only 9-10% of weekend traffic. The peak hours occur during the morning and afternoon commute times on weekdays, but are more spread out on weekends.

Waverley Road which forms the northern boundary of the site, is a single carriageway road with an 18m road reserve and a 6.2m carriageway in the vicinity of the subject site. It is classified as an Access Road in the Main Roads WA Functional Road Hierarchy and operates with 85th percentile and median operational speed of 42.3km/h and 37.7km/h respectively as shown in **Figure 4**.

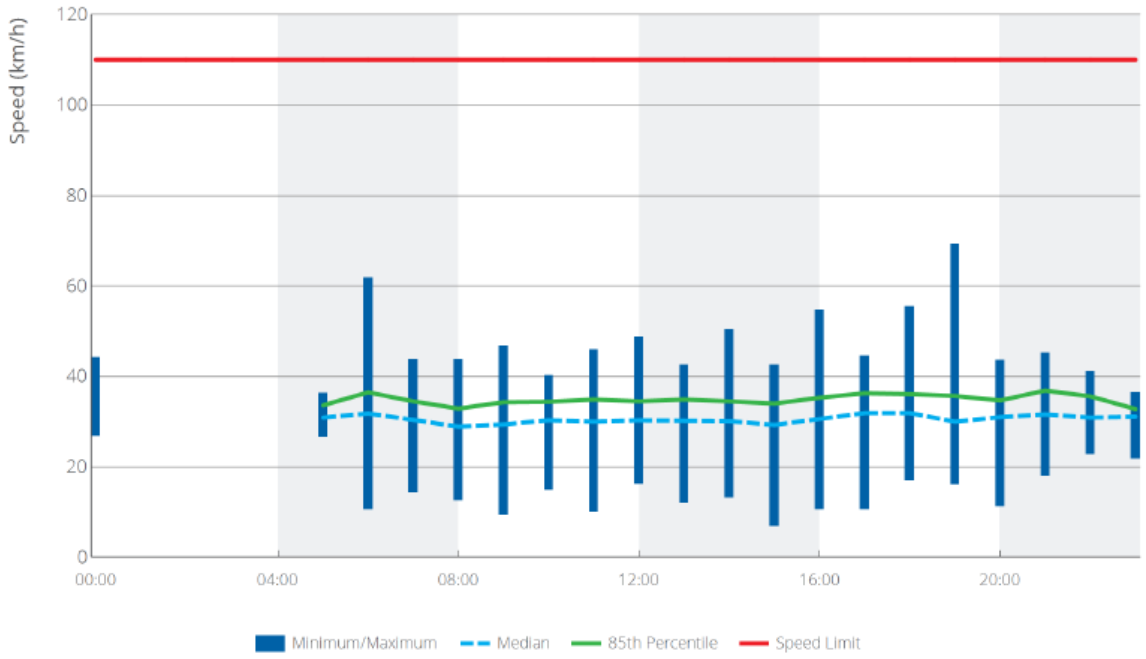


Figure 4: Existing operation speed limit on Waverley Road

The median speed of less than 40kmh, indicates that the majority of vehicles are traveling at fairly moderate speeds along this section of Waverley Rd. To further control speeding and improve safety and amenity for local residents, a Local Area Traffic Management (LATPM) measure in the form of a slow point with a 20km/h advisory speed limit is in place further north along Waverley Road (refer **Figure 5**).



Figure 5: Waverley Road looking west north of Duggan Drive

The reported traffic volume for Waverley Road (site 15258), east of Bussell Highway, are as follows:

Weekday (Monday to Friday) Traffic:

- The average two-way daily traffic volume was 1,893 vehicles.
- The AM peak hour was 8:15 AM, with a two-way volume of 291 vehicles.
- The PM peak hour was 3:00 PM, with a two-way volume of 262 vehicles.
- Heavy vehicles accounted for 9.1% of the total traffic.

Weekend (Saturday and Sunday) Traffic:

- The average two-way daily traffic volume was 1,572 vehicles.
- The peak hour was 12:00, with a two-way volume of 152 vehicles.
- Heavy vehicles accounted for 7.7% of the total traffic.

Figure 6 and **Figure 7** illustrate the existing standard of the intersection of Bussell Highway/ Waverley Road. As evident widening in the form of auxiliary right turn treatment (AUR) treatment is in place on Bussell Highway at the intersection with Waverley Road. The AUR treatment allows northbound traffic on Bussell Highway to bypass a stopped vehicle at the intersection that is waiting to turn right into Waverley Road.



Figure 6: Existing standard of the intersection of Waverley Rd/ Bussell Hwy



Figure 7: Bussell Highway looking west at the intersection with Waverley Road

Roy Earl Dr currently provides access/ egress to the existing residential dwellings to the north of the amended SP area and is constructed as a single carriageway road with a 30m road reserve and a 2 x 6m carriageway and a 3.5m solid median. It is classified as an Access Road in the Main Roads WA Functional Road Hierarchy and operates with build-up area speed limit of 50km/h.

The current standard of the existing intersection of Roy Earl Dr/ Bussell Highway entails left and right turn lanes on Bussell Highway as shown in **Figure 8**.



Figure 8: Existing standard of the intersection of Roy Earl Dr/ Bussell Hwy

Wirring Road forms the southern boundary of the amended SP area and is constructed as a single carriageway road with a 20m road reserve and a 5.5m carriageway. It is classified as an Access Road in the Main Roads WA Functional Road Hierarchy and operates with build-up area speed limit of 50km/h.

The current standard of the existing intersection of Wirring Road/ Bussell Highway entails left turn lane of about 150m including taper on Bussell Highway as shown in Figure 9.



Figure 9: Existing standard of the intersection of Wirring Rd/ Bussell Hwy

4.3 Existing Traffic Volumes

Existing average weekday traffic (AWT) volumes on surrounding roads have been obtained from Main Roads WA and are illustrated in Figure 10.

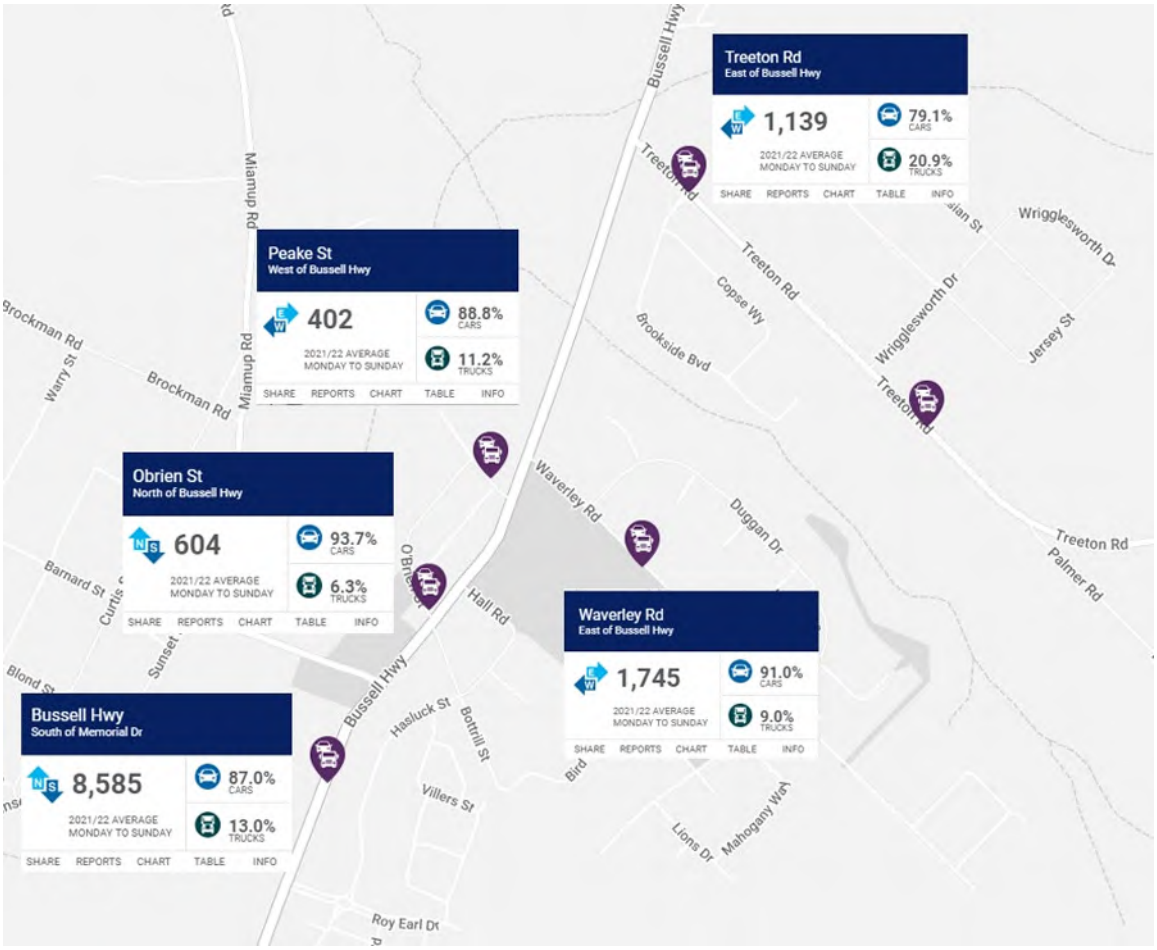


Figure 10: Existing traffic volumes

The 2024 peak hour turn counts at the intersection of Bussell Hwy/ Waverley Road and Bussell Highway/ Roy Earl Drive has been sourced from the Cowaramup Integrated Transport Strategy undertaken by Stantec in 19 June 2024 and is shown in **Figure 11**.

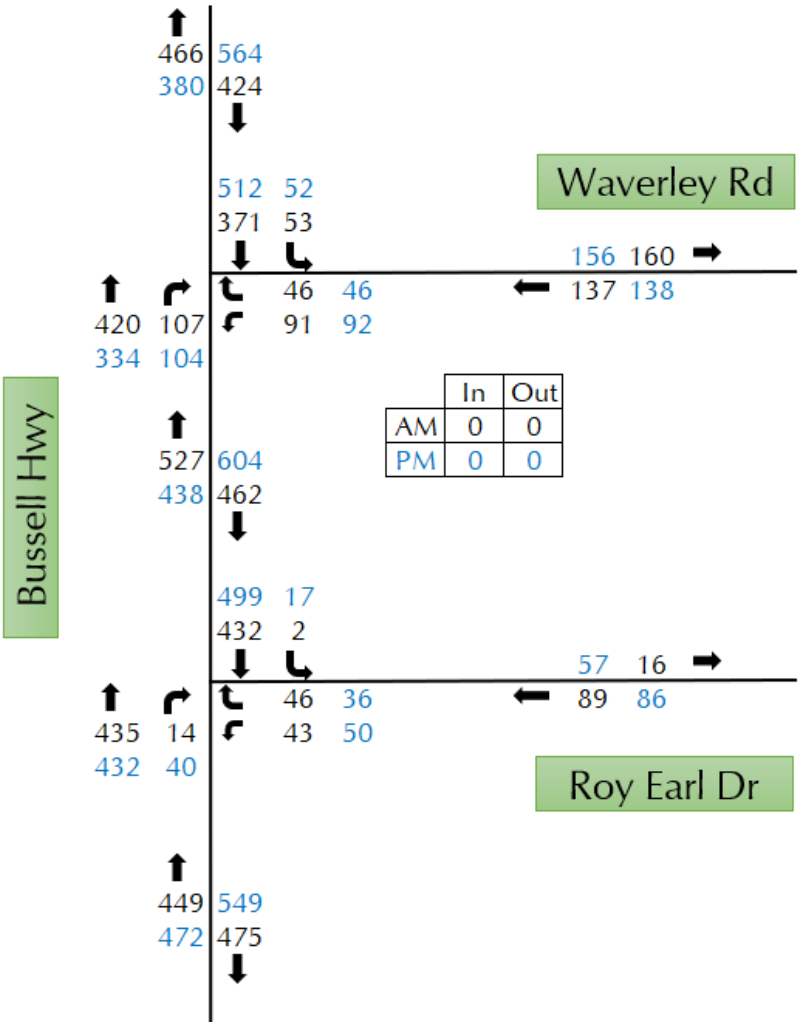


Figure 11: Existing traffic counts, AM and PM peak hours

4.4 Public Transport

There are currently no public transport services operating within the vicinity of the Site. The public transport options in Cowaramup are limited, with:

- TransWA offering coach services that connect to different regions of Western Australia, but with a very low frequency of a maximum of 2 services per day.
- School buses are the only other available public transport option within the Cowaramup town.

4.5 Pedestrian and Cyclist Facilities

Currently paths are in place along Waverley Road, Lions Drive and Roy Earl Drive. The proposed amended SP will provide 2.0-meter-wide footpath on one side of the streets and will be connected to the existing paths on the surrounding roads.

4.6 Changes to the surrounding road network

The proposed amended SP area would provide a full movement intersection on Waverley Road. The proposed SP area would also provide connections to the existing residential area to the west of the subject site via Lions Drive and Roy Earl Drive.

The proposed Structure Plan for Lot 102 Bussell Highway which is located to the other side of Bussell Highway shows a connection to the Bussell Highway in front of Roy Earl Drive which would result in a 4-way intersection at this location. The Structure Plan shows a roundabout intersection at this location (refer **Figure 12**).

However, transport modelling and analysis undertaken in the Cowaramup Integrated Transport Strategy by Stantec in June 2024 indicated that either a staggered type A staged crossing or a single 4-way roundabout would operate satisfactory at this location. The staggered type A staged crossing would entail a 7m median on Bussell Highway.



Figure 12: Lot 102 Bussell Highway, Cowaramup (C1) Structure Plan

4.7 Existing Crash data

Information available on the Main Roads WA website indicates the following crashes were recorded at the three intersections in the vicinity of the subject site during the five-year period ending December 2023:

- Bussell Highway/Roy Earl Dive intersection: No crashes reported.
- Bussell Highway/Waverley Road intersection
    - 1 crash total
    - 1 PDO major
    - 1 side swipe same direction

- Bussell Highway/Wirring Road intersection
    - 3 crashes total
    - 1 injury requiring medical treatment and 2 PDO major
    - 1 right angle and 2 rear end crashes

The limited number of incidents, particularly the absence of crashes at the Bussell Highway/Roy Earl Drive intersection and the relatively low frequency of crashes at the other intersections, combined with low-speed environment along Bussell Highway in the vicinity of the intersections suggests a generally safe traffic environment.

5 Proposed Internal Transport Network

5.1 Road Hierarchy

The proposed hierarchy of roads within the amended SP area is generally in line with the original approved SP and is illustrated in **Figure 8**. The proposed road hierarchy was based on traffic projections and the road classification of the WAPC Liveable Neighbourhoods guidelines (2007).

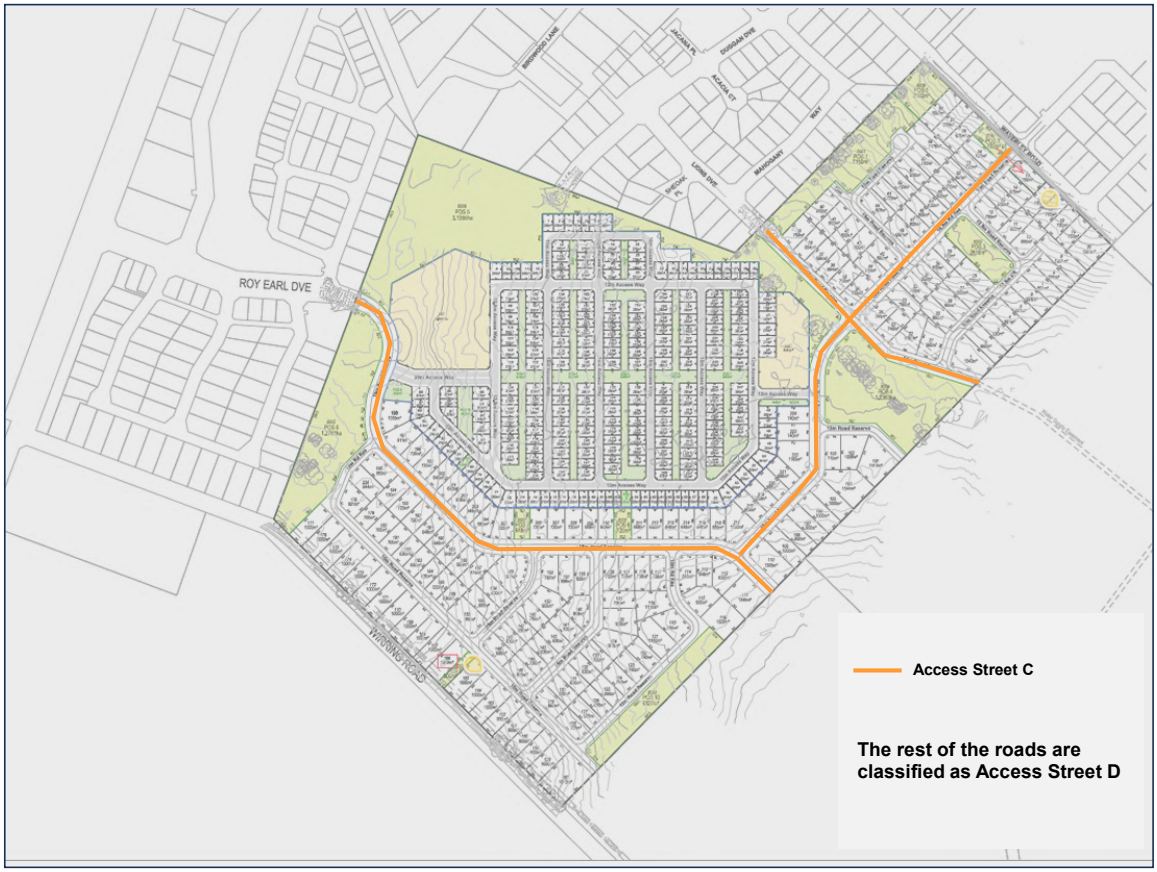


Figure 13: Proposed Road Hierarchy

The projected traffic volumes on all amended SP road network are estimated to be less than 3,000vpd and all amended SP roads can be classified as Access Streets.

The majority of the proposed amended SP internal roads are classified as Access Street D roads. The Access Street D typical cross section entails 4.5m verges on both sides, with embayed parking provided in the verges as appropriate, such as for visitor parking for rear loading lots. Access Street D classification is proposed for the local roads with less than 1,000vpd.

The proposed amended SP area has designated a wider road reserve width of approximately 18 metres for the main east-west and north-south roads within the

amended SP area. These roads will provide the key connections to the adjacent existing roads.

The continuation of Lions Drive through the proposed Amended SP area would have 16m road reserve in accordance with Access Street C standard.

5.2 Integration with Surrounding Area

The proposed land uses within the proposed amended SP area are residential and are in line with the approved SP. The road network of the proposed amended SP area is proposed to connect to the neighbouring landholding at a number of locations to improve permeability and facilitate connection to surrounding regional roads.

6 Analysis of the Transport Network

6.1 Assessment Period

The assessment year that has been adopted for this analysis is 2035, with the assumption of full development of the amended Structure Plan.

6.2 Traffic generation and distribution

The daily traffic generation rate used for this transport assessment is 8 vehicle trips per day (vpd) per dwelling, which corresponds to peak hour trip generation rates of 0.8vph per dwelling recommended in the Western Australian Planning Commission (WAPC) *Transport Impact Assessment Guidelines* (2016).

The proposed amended Structure Plan is expected to accommodate approximately 224 dwellings which would generate 1,790 trips per day or 179vph.

The trip generation for retirement units within the proposed LLC is typically expected to be significantly lower than that of normal residential dwellings. However, in order to provide a conservative approach a trip rate of 4 vehicle per day has been adopted for the proposed LLC units. For reference the upper daily trip rate of 2vpd per dwelling for "Housing for aged and disabled persons" is suggested as per Guide to Traffic Generating Developments (2002) and 2.1vpd per dwelling for "Housing for seniors" as per TDT 2013/04a. The peak hour trip rates for the LLC units are expected to be in the range of 0.27vph per units.

On this basis, the proposed 255 retirement units is expected to generate about 1,020vpd and about 69vph. These figures include both inbound and outbound vehicle movements. The AM and PM peak hour trip generation of the proposed amended SP area is also summarised in **Table 1**.

Table 1: The peak hour trip generation of the emended SP area

Land use	Quantity	AM trips	PM trips	AM		PM	
				IN	OUT	IN	OUT
Proposed subdivision	224	179	179	125	54	112	67
LLC Units	255	69	69	48	21	43	26
Total	479	248	248	174	74	155	93

The development traffic would be distributed to Bussell Highway via Waverley Road and Roy Earl Drive. No additional trips are expected on Wirring Rad as the amended

SP area would not connect to this road. The distribution of generated traffic on Waverley Road and Roy Earl Drive is assumed to be approximately 28% and 72% respectively as is illustrated in **Figure 15**.

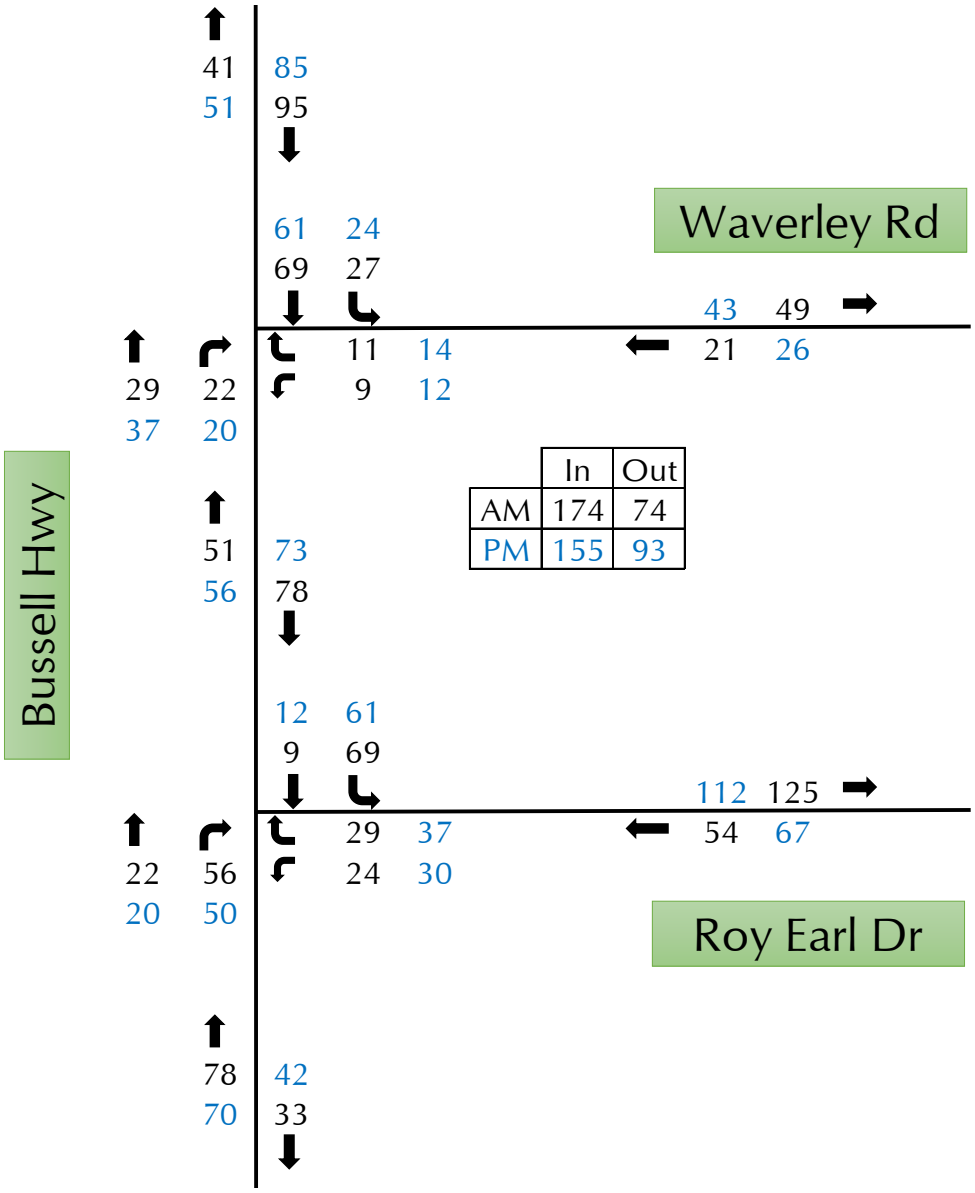


Figure 14: Traffic flows generated by the proposed amende SP area, AM/ PM peak hour

6.3 Traffic flow forecast on Surrounding roads

The peak hour traffic projections are illustrated in **Figure 15**. For through traffic on Bussell Highway a general 2% growth rate have been applied from 2024 to 2036 (12 years). The 2% growth is in line with the average of the annual growth rate calculated for the traffic station located at Bussell Highway north of Gardiner Road (refer **Figure 16**).

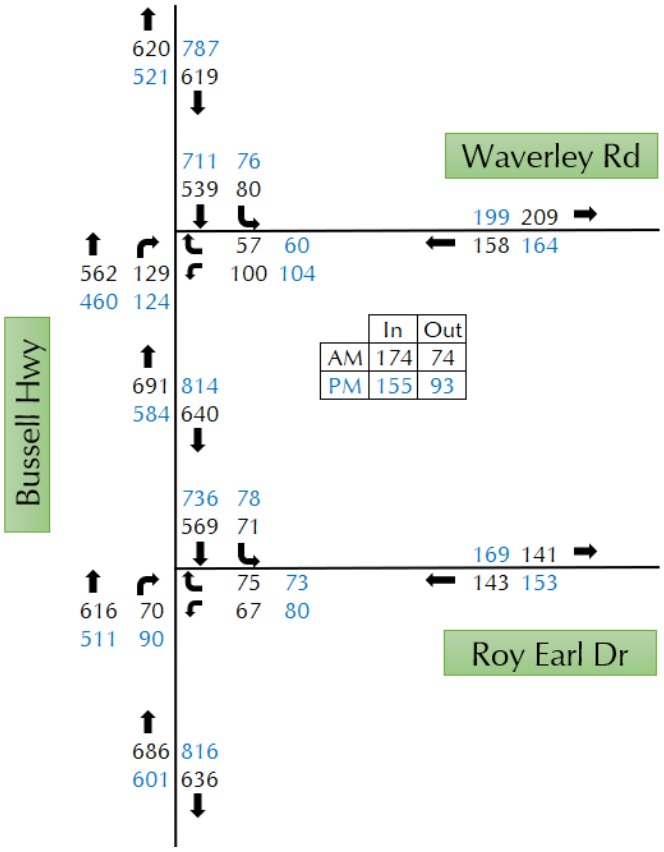


Figure 15: Total (2036) traffic, AM/ PM peak hour

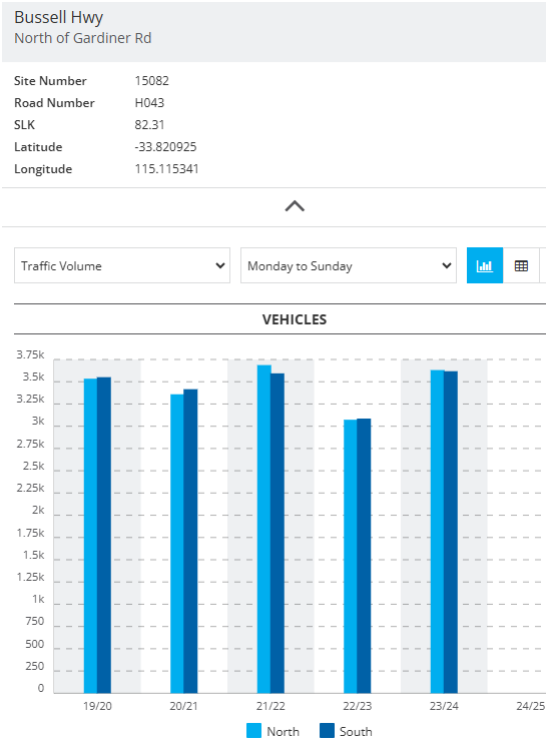


Figure 16: traffic counts reported on Bussell Highway north of Gardiner Road

6.4 Roads and Intersections

Figure 17 illustrates proposed intersection controls for key intersections within the amended SP area. There is a four-way intersection shown on the amended LSP on low-traffic-volume access streets. This intersection is recommended to be constructed as priority-controlled intersection with Give-Way control on the minor road approaches as suggested in Liveable Neighbourhoods document. Appropriate entry treatments are recommended on the side roads to help to alert drivers to the presence of the intersections and that traffic on the major road has priority.

The amended SP access intersection at Waverley Road will be in the form of a priority-controlled T-intersection.

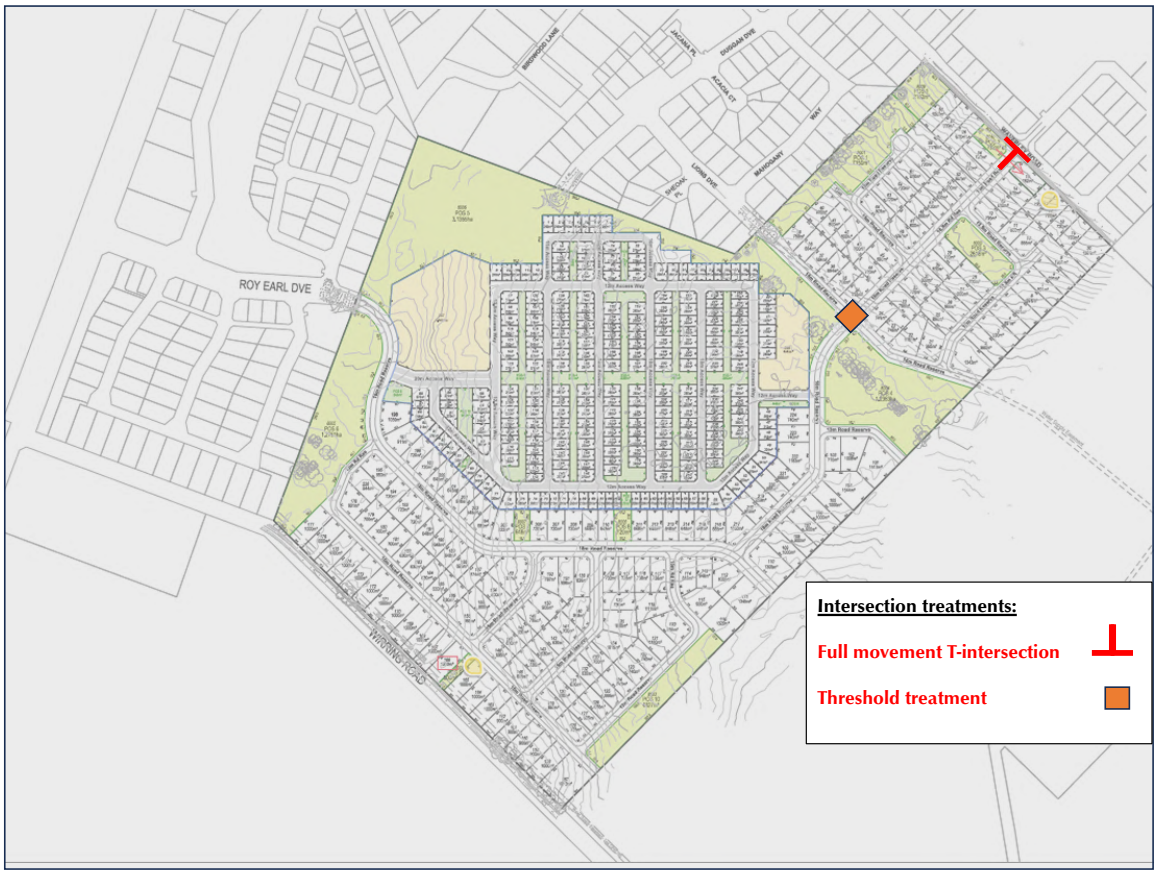


Figure 17: Proposed intersection treatments

6.5 Intersection Analysis

The operation of the Bussell Highway intersections with Waverley Road and Roy Earl Drive was analysed in SIDRA for the weekday AM and PM peak hours in 2036.

SIDRA outputs are presented in the form of Degree of Saturation, Level of Service, Average Delay and 95% Queue. These characteristics are defined as follows:

- **Degree of Saturation (DoS)**: is the ratio of the arrival traffic flow to the capacity of the approach during the same period. The Degree of Saturation ranges from close to zero for varied traffic flow up to one for saturated flow or capacity.
- **Level of Service (LoS)**: is the qualitative measure describing operational conditions within a traffic stream and the perception by motorists and/or passengers. In general, there are 6 levels of service, designated from A to F, with Level of Service A representing the best operating condition (i.e. free flow) and Level of Service F the worst (i.e. forced or breakdown flow).
- **Average Delay**: is the average of all travel time delays for vehicles through the intersection.
- **95% Queue**: is the queue length below which 95% of all observed queue lengths fall.

The results of the SIDRA analysis are attached in **Appendix C** and briefly discussed in the following paragraphs.

Waverley Road/ Bussell Highway intersection

The layout of the intersection modelled in SIDRA is illustrated in **Figure 18**. The analysis shows that all approaches of the Waverley Road/Bussell Highway intersection are expected to operate at Level of Service (LOS) A, with minimal delays and queues. The critical right turn movement out of Waverley Road to Bussell Highway would operate at LOS E and F with 95% queue of about13m and 18m for the AM and PM peak hour respectively. However, the LOS F is reported for the right turn movement out of Waverley Road during the PM peak hour, the associated queue lengths and delays are relatively low and are not expected to cause problematic conditions for traffic flow. Therefore, despite the LOS F designation, the impact on overall intersection performance and traffic operations is manageable.

Therefore, based on the SIDRA assessment, no upgrades are required at the Waverley Road/Bussell Highway intersection as a result of the proposed amended SP.

Roy Earl Drive/ Bussell Highway intersection

The layout of the intersection modelled in SIDRA is illustrated in **Figure 18**. The analysis shows that all approaches of the Roy Earl Drive/Bussell Highway intersection are expected to operate at Level of Service (LOS) A or B, with minimal delays and queues. The critical right turn movement out of Roy Earl Drive to Bussell Highway would operate at F with 95% queue of 46m and 100m for the AM and PM peak hour respectively. However, the LoS F is reported for the right turn movement out of Roy

Earl Drive during the PM peak hour, the associated queue lengths and delays are relatively minor and are not expected to cause problematic conditions for traffic flow. On this basis, despite the LOS F designation, the impact on overall intersection performance and traffic operations is manageable.

Therefore, based on the SIDRA assessment, no upgrades are required at the Roy Earl Drive/Bussell Highway intersection as a result of the proposed amended SP.

It is understood that, in the long term and as part of the proposed Structure Plan for Lot 102 Bussell Highway, upgrades to the intersection of Roy Earl Drive and Bussell Highway will be necessary. These upgrades may take the form of either a staggered Type A staged crossing or a single four-way roundabout at this location. The proposed upgrades will improve the traffic operation of the intersection.

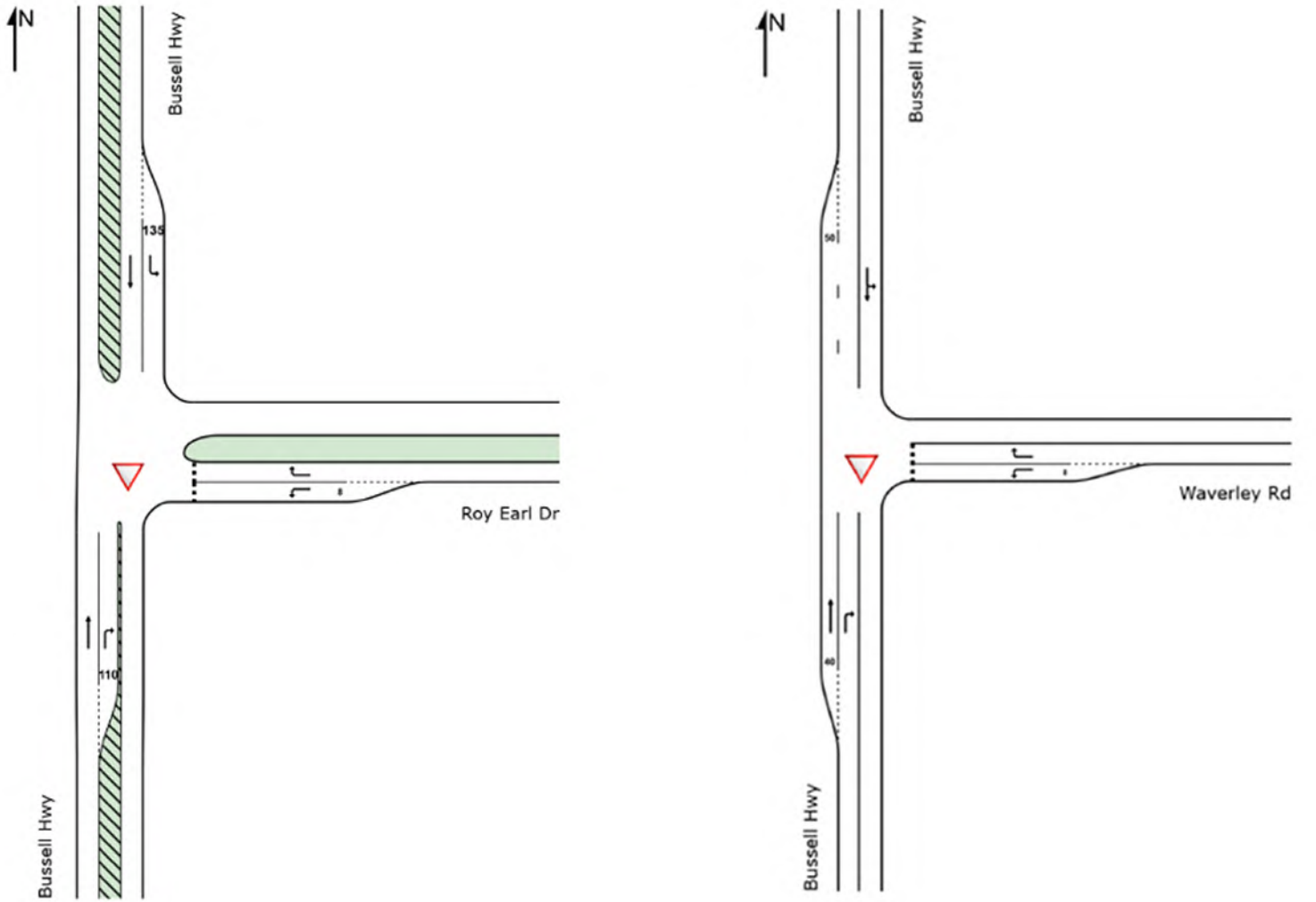


Figure 18: The intersection layout modelled in SIDRA

6.6 Access to Frontage Properties

The WAPC *Liveable Neighbourhoods* policy requires that "Development along integrator B and neighbourhood connector streets with ultimate vehicle volumes over 5000 vehicles per day should be designed either so vehicles entering the street can do so travelling forward, or are provided with alternative forms of vehicle access. Wider lots with paired driveways and protected reversing areas in the parking lane may be used on streets with up to 7000 vehicles per day."

All of the roads within the proposed amended SP area are expected to carry less than 5,000vpd, so no restriction on vehicular access is required.

6.7 Pedestrian/ Cycle Network

Pedestrian access to/from the proposed amended SP area will be provided via the existing paths along Waverley Road, Lions Drive and Roy Earl Drive.

Within the proposed amended SP itself, all access streets will have a 2.0-meter-wide footpath constructed on one side of the street.

6.8 Access to Public Transport

The current demand for public transport in the locality does not justify the provision of public transport services at this time. However, in the longer term, as demand increases and becomes justified, bus routes may be established along Bussell Highway to better serve the community.

7 Conclusion

This Traffic Impact Assessment (TIA) has been prepared by Transcore on behalf of Youlk Property Group for the proposed Amended Structure Plan (SP) at Lot 500 Wirring Road, Cowaramup, located in the Shire of Augusta-Margaret River.

The original Structure Plan for Lot 500 Wirring Road was approved in July 2024. The amended Structure Plan will include 224 residential dwellings and 255 Land Lease Community (LLC) units, a reduction from the original approved structure plan of approximately 350 residential dwellings and a retirement village site. This change is expected to result in lower traffic generation, as the total number of dwellings has decreased by about 126, and the trip generation from the LLC units is significantly less than that of traditional residential dwellings, contributing to a reduced overall traffic impact.

The Amended SP would gain access/ egress via Waverley Road, Roy Earl Drive and Lions Drive. The development traffic would be distributed to Bussell Highway via Waverley Road and Roy Earl Drive. No additional trips are expected on Wirring Rad as the amended SP area would not connect to this road.

The SIDRA analysis indicates that all approaches to the Waverley Road/Bussell Highway and Roy Earl Drive/ Bussell Highway intersections are expected to operate at Level of Service (LOS) A or B, with minimal delays and queues. Although the critical right turn movement from Waverley Road and Roy Earl Drive to Bussell Highway may operate at LOS E and F during peak hours in longer term, the associated queue lengths and delays are relatively low and are not expected to create significant traffic issues. Therefore, based on the SIDRA assessment, no upgrades are necessary at these intersections as a result of the proposed amended Structure Plan.

It is understood that, in the long term and as part of the proposed Structure Plan for Lot 102 Bussell Highway, upgrades to the intersection of Roy Earl Drive and Bussell Highway will be necessary. These upgrades may take the form of either a staggered Type A staged crossing or a single four-way roundabout at this location. The proposed upgrades will improve the traffic operation of the intersection.

The proposed hierarchy of roads within the proposed amended SP area is generally in line with the original approved SP. The projected traffic volumes on all amended SP road network are estimated to be less than 3,000vpd and all amended SP roads can be classified as Access Streets.

Appendix A

APPROVED STRUCTURE PLAN

transcore

Engineering a better future for over 20 years!



INDICATIVE CONCEPT PLAN
LOT 500 WIRRING ROAD
COWARAMUP

N
0 100 m
SCALE @ A3: 1:4000
9449-CON-05-A

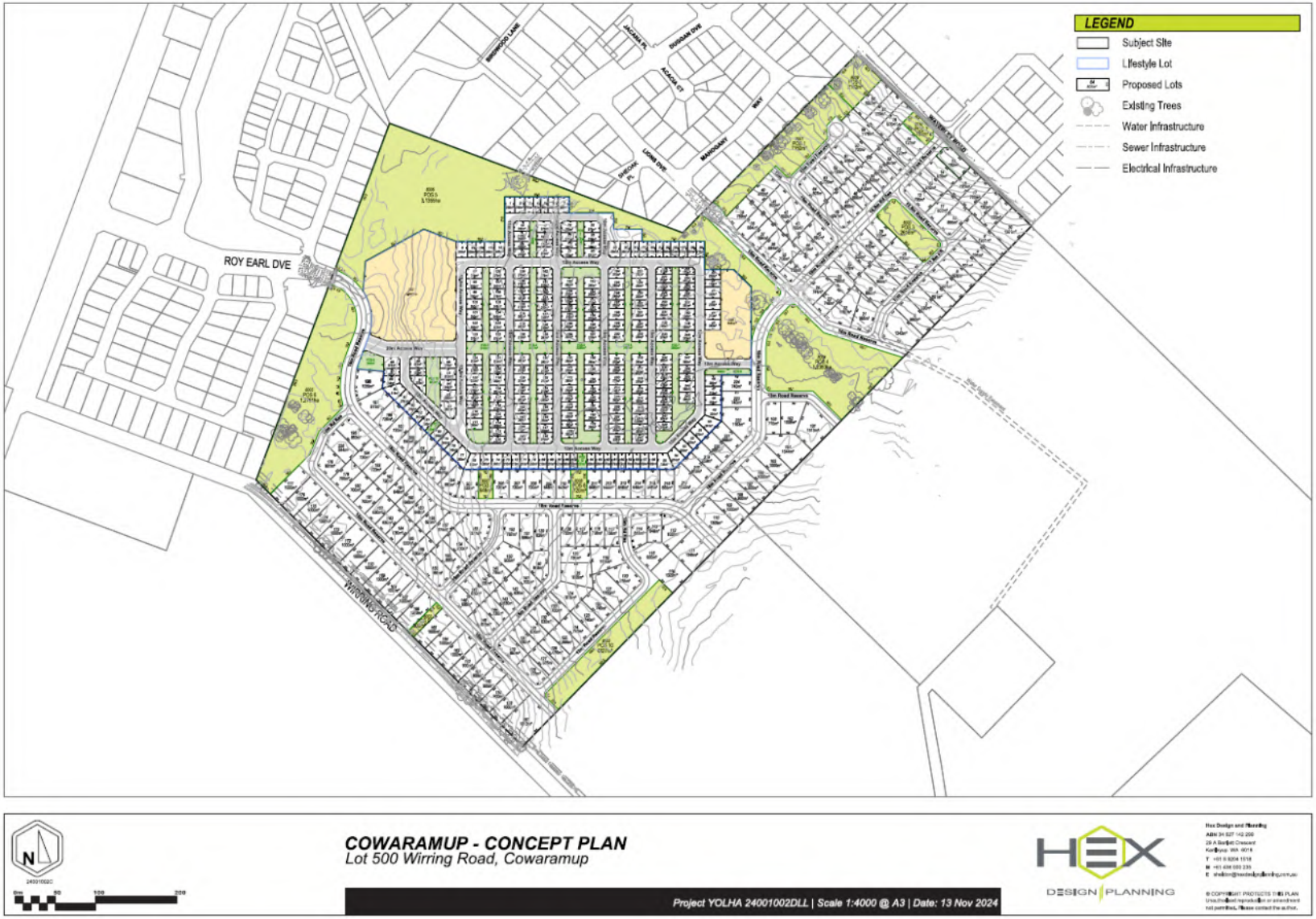
ROWE GROUP DESIGN

Appendix B

AMENDED STRUCTURE PLAN

transcore

Engineering a better future for over 20 years!


LEGEND
Subject Site
Lifestyle Lot
Proposed Lots
Existing Trees
Water Infrastructure
Sewer Infrastructure
Electrical Infrastructure
ROY EARL DVE
WIRRING ROAD
COWARAMUP - CONCEPT PLAN
Lot 500 Wirring Road, Cowaramup
Project YOLHA 24001002DLL | Scale 1:4000 @ A3 | Date: 13 Nov 2024
DESIGN | PLANNING

Appendix C

SIDRA ANALYSIS

Engineering a better future for over 20 years!

MOVEMENT SUMMARY

▽ Site: [Bussell Hwy & Roy Earl Dr - 2036 - AM (Site Folder: 2036)]

Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Bussell Hwy														
2	T1	616	24.3	648	24.3	0.429	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	59.6
3	R2	70	2.0	74	2.0	0.122	10.2	LOS B	0.4	3.4	0.60	0.83	0.60	45.0
Approach		686	22.0	722	22.0	0.429	1.2	NA	0.4	3.4	0.06	0.09	0.06	58.3
East: Roy Earl Dr														
4	L2	67	2.0	71	2.0	0.115	8.7	LOS A	0.4	2.9	0.56	0.79	0.56	45.0
6	R2	75	2.0	79	2.0	0.964	157.1	LOS F	6.0	45.7	1.00	1.49	2.78	11.5
Approach		142	2.0	149	2.0	0.964	87.1	LOS F	6.0	45.7	0.79	1.16	1.73	17.8
North: Bussell Hwy														
7	L2	71	2.0	75	2.0	0.042	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	50.3
8	T1	569	10.2	599	10.2	0.346	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
Approach		640	9.3	674	9.3	0.346	0.7	NA	0.0	0.0	0.00	0.06	0.00	58.9
All Vehicles		1468	14.5	1545	14.5	0.964	9.3	NA	6.0	45.7	0.11	0.18	0.20	50.9

MOVEMENT SUMMARY

▽ Site: [Bussell Hwy & Roy Earl Dr - 2036 - PM (Site Folder: 2036)]

Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Bussell Hwy														
2	T1	511	24.3	538	24.3	0.356	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
3	R2	90	2.0	95	2.0	0.219	13.6	LOS B	0.8	6.1	0.74	0.91	0.79	42.2
Approach		601	21.0	633	21.0	0.356	2.2	NA	0.8	6.1	0.11	0.14	0.12	57.3
East: Roy Earl Dr														
4	L2	80	2.0	84	2.0	0.191	11.6	LOS B	0.6	4.8	0.71	0.87	0.72	42.6
6	R2	73	2.0	77	2.0	1.206	323.0	LOS F	13.1	99.5	1.00	1.97	4.57	6.1
Approach		153	2.0	161	2.0	1.206	160.2	LOS F	13.1	99.5	0.85	1.39	2.56	11.1
North: Bussell Hwy														
7	L2	78	2.0	82	2.0	0.046	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	50.3
8	T1	736	10.2	775	10.2	0.447	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	59.6
Approach		814	9.4	857	9.4	0.447	0.7	NA	0.0	0.0	0.00	0.06	0.00	58.9
All Vehicles		1568	13.1	1651	13.1	1.206	16.8	NA	13.1	99.5	0.13	0.22	0.30	45.4

MOVEMENT SUMMARY

▽ Site: [Bussell Hwy & Waverley Rd - 2036 - AM (Site Folder: 2036)]

Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Bussell Hwy														
2	T1	562	24.3	592	24.3	0.405	0.3	LOS A	0.0	0.0	0.00	0.00	0.00	59.6
3	R2	129	2.0	136	2.0	0.167	9.1	LOS A	0.7	5.2	0.61	0.83	0.61	45.7
Approach		691	20.1	727	20.1	0.405	2.0	NA	0.7	5.2	0.11	0.15	0.11	57.4
East: Waverley Rd														
4	L2	100	2.0	105	2.0	0.123	7.4	LOS A	0.5	3.5	0.54	0.74	0.54	46.1
6	R2	57	2.0	60	2.0	0.464	43.3	LOS E	1.7	12.6	0.94	1.05	1.21	26.5
Approach		157	2.0	165	2.0	0.464	20.4	LOS C	1.7	12.6	0.69	0.85	0.78	36.4
North: Bussell Hwy														
7	L2	80	2.0	84	2.0	0.374	5.7	LOS A	0.0	0.0	0.00	0.08	0.00	55.9
8	T1	539	10.2	567	10.2	0.374	0.1	LOS A	0.0	0.0	0.00	0.08	0.00	59.0
Approach		619	9.1	652	9.1	0.374	0.9	NA	0.0	0.0	0.00	0.08	0.00	58.7
All Vehicles		1467	13.6	1544	13.6	0.464	3.5	NA	1.7	12.6	0.13	0.20	0.14	55.6

MOVEMENT SUMMARY

▽ Site: [Bussell Hwy & Waverley Rd - 2036 - PM (Site Folder: 2036)]

Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Bussell Hwy														
2	T1	460	24.3	484	24.3	0.332	0.3	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
3	R2	124	2.0	131	2.0	0.221	11.6	LOS B	0.9	6.7	0.72	0.90	0.76	43.8
Approach		584	19.6	615	19.6	0.332	2.7	NA	0.9	6.7	0.15	0.19	0.16	56.7
East: Waverley Rd														
4	L2	104	2.0	109	2.0	0.172	9.3	LOS A	0.6	4.7	0.65	0.83	0.65	44.5
6	R2	60	2.0	63	2.0	0.615	62.9	LOS F	2.3	17.3	0.96	1.10	1.39	21.6
Approach		164	2.0	173	2.0	0.615	28.9	LOS D	2.3	17.3	0.76	0.93	0.92	32.1
North: Bussell Hwy														
7	L2	76	2.0	80	2.0	0.476	5.7	LOS A	0.0	0.0	0.00	0.06	0.00	56.1
8	T1	711	10.2	748	10.2	0.476	0.2	LOS A	0.0	0.0	0.00	0.06	0.00	59.0
Approach		787	9.4	828	9.4	0.476	0.7	NA	0.0	0.0	0.00	0.06	0.00	58.8
All Vehicles		1535	12.5	1616	12.5	0.615	4.5	NA	2.3	17.3	0.14	0.20	0.16	54.7



SERVICING REPORT

"Birdwood"
Lot 500 Wirring Rd, Cowaramup

JDS242318.0 October 2024

Prepared for:

Yolk Property Group

JDSi
CONSULTING ENGINEERS

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DOCUMENT REVIEW				
Revision	**Date Issued**	**Issue Type**	**Written By**	**Approved By**
Rev A	31/10/24	Draft for Review	BWW	BJW

1 Executive Summary

JDSi Consulting Engineers has been engaged by Yolk Property Group to assess the infrastructure servicing requirements associated with the proposed development of Lot 500 Wirring Rd, Cowaramup (herein referred to as the Site). This report does not address the internal subdivisional, building services or built form development requirements.

In summary, the report has found that the land identified is suitable for future development with regards to critical infrastructure.

- Road access will be provided from four existing roads surrounding the site, notably Roy Earl Dr, Lions Dr, Wirring Rd and Waverley Rd.
- Stormwater drainage will be designed and managed in accordance with an Urban Water Management Plan (UWMP), which will be prepared prior to development and needs to be approved by the Shire of Augusta Margaret River, in conjunction with Department of Water and Environmental Regulation Authority requirements.
- Sewer infrastructure already extends inside the site boundary at 4 locations – Roy Earl Dr, Lions Dr, Duggan Dr and via the adjacent Lot 149 Waverley Rd. These connections will be extended to service the bulk of the proposed site. Additionally, several lots in the north of the site will connect to the existing sewer in Waverley Rd via road crossings and sewer extension. No pump stations are required to develop this site and all lots will be connected to gravity mains with no impediment.
- Water mains supply is available and the property has several surrounding, existing mains for connection within Wirring Rd, Roy Earl Drv, Lions Dr and Waverley Rd. The existing Cowaramup Supply Main, from the Wirring Road Supply Tank to the townsite, passes through the site. Direct connection of reticulation mains to this DN250 main will be allowed, however the supply main will require realignment along the internal subdivisional road prior to new reticulation mains being connected to and extended from it.
- Power infrastructure enquiries with Western Power indicate that the network has sufficient capacity to service the development. Prior to development, Western Power will provide updated advice with regards to capacity within the region and connection requirements. It is likely that power for the site will be provided from high voltage, underground power feeders that are present adjacent the property boundary.
- Communication mains are present adjacent the site and there are not expected to be any major constraints with servicing the site.
- Reticulated gas is not present within the region however this is not a critical service. Future lot owners will likely provide their own bottled supply if required,

The information within this report has been provided by relevant servicing Authorities and high-level investigations by the Project team. Actual capacities of networks and the availability of and connection to existing services, will be subject to application to service providers during the subdivisional design stage(s).

2 Introduction

Yolk Property Group (YPG) have requested JDSi to assess the engineering constraints and opportunities associated with development of Lot 500 Wirring Rd, Cowaramup (Figure 1).

The investigations are considered appropriate to support the Local Structure Plan amendment submission.

This report has been based on the Draft Structure Plan Amendment and the Concept Plan, as included in ***Appendix A***. Based on this layout and information provided by the Client, the Development will consist of 189 mixed density residential lots and 11 POS/PAW lots, which consists of the following yields:

- 188 singe residential dwellings
- 1 x Retirement/Lifestyle Village (yield to be confirmed)
- 11 POS/PAW lots

This report covers the engineering infrastructure requirements to service the proposed Development.

JDSi have considered roads, stormwater drainage, wastewater, potable water, power, communication and gas services, with a particular emphasis on the existing service capacity, potential connection locations and the potential infrastructure upgrades required to support the proposed development.

The report has been based on a desktop study of existing services information, aerial imagery, preliminary advice from various service authorities, industry standards/policies and JDSi's experience. The information is current as of October 2024 and may be subject to change as land development progresses in the area.



Figure 1: Site Location

3 Study Area

The Site is within the municipality of the Shire of Augusta Margaret River.

Lot 500 has a land area of 40.93 ha and is currently zoned “Future Development” under the Shire of Augusta / Margaret River ‘LPS 1’. The Structure Plan supporting this development (SPN 2369) has been endorsed, however this document has been prepared to support an application to amend SPN 2369.

The Site is bounded by Waverley Rd to the north, Wirring Rd to the south, Lots 501 and 502 Wirring Rd to the east and existing urban development to the west.

The Site consists of vacant land formerly used for agricultural (grazing) purposes. Isolated pockets of trees and vegetation are present across the site.

3.1 Topography

The Site is gently undulating, with surface elevations ranging from approximately 139.60m AHD in the southeast of the site to 133.80m AHD in the southwest of the site. The site falls gently north to 132.40m AHD. Surrounding land is higher to the east of the site, up to approximately 140m AHD, with the adjoining land to the west falling away.

The feature survey contours are provided in ***Appendix B.***

3.2 Acid Sulphate Soils

The Department of Water and Environmental Regulation (DWER) ASS Risk Mapping online database indicates “low to no known risk of acid sulphate soils occurring within 3m of the natural soil surface” for the very large majority of the site. A very small area of “moderate to low risk ASS” is mapped on the site at the lower laying ground at the southwest of site, adjacent existing development. If ASS is present, all construction will be in accordance with an approved environmental management plan.



Figure 2: Acid Sulphate Soil Risk Mapping (MNG Access)

3.3 Soils and Ground conditions

A geotechnical study was undertaken by Galt Geotechnics in December 2021, who summarise the site conditions as generally comprising:

- SAND/Clayey SAND 0.5m to 1.0m with variable fines and gravel content, overlying
- Clayey SAND/Sandy CLAY/Gravelly CLAY present to maximum depth of investigation (3.0m)

Shallow rock (likely to be lateritised/conglomerate rock) was encountered at various depths and locations across the site. Depths of refusal of test pits/boreholes was as shallow as 0.3m, though typically encountered at ~1.0m)

Groundwater was encountered at depths of between 1.2m and 2.2m below ground. Galt conclude that, for the purposes of design, seasonal, perched groundwater should be assumed to be at the top of the impermeable clay layer.

4 Roadworks

The surrounding road network is under the control of the Shire of Augusta Margaret River and as such all works on and abutting the public roads will be subject to their approvals. Entry points to the subdivision from existing roads will be the boulevard connection to Roy Earl Dr, extension of the 6m wide kerbed road along Lions Dr. and proposed intersection with Waverley Rd.

As typically conditioned in a WAPC subdivision approval, the roads fronting the development are required to provide suitable access and egress and be designed for the intended traffic volumes. Any new road network will need to be designed in accordance with Shire of Augusta Margaret River standards & guidelines and Local Government Guidelines for Subdivisional Development (IPWEA).

Road design will be consistent with standard residential developments including kerbed and asphalted pavements and road cross-sections designed to align with the existing landform. In all cases the road cross sections will be designed to cater for utility services on standard verge alignments and appropriate stormwater management strategies.

5 Stormwater Drainage

Stormwater drainage management for the development will need to be designed and constructed in accordance with Shire of Augusta Margaret River design guidelines and DWER Water Sensitive Urban Design (WSUD) guidelines.

Stormwater management for the development will likely require:

- Demonstration that post-development flow rates do not exceed pre-development flow rates
- Standard pit and pipe drainage systems within the road reserves to convey up to the 20% AEP (1 in 5 yr ARI)
- Clear overland flow path for events greater than the 20% AEP, with a minimum 300mm freeboard to habitable floors
- Detention storage areas (basins) in locations across the site to reduce peak flow rates to the capacity of downstream facilities
- Subsoil drainage system to be considered in any areas where Average Annual Maximum Groundwater Levels (AAMGL) are within 900mmm of road surface and/or 1200mm of lot pad levels
- Surface and groundwater quality will need to achieve pre-development levels

Drainage connections will be provided to every lot which will collect rainwater and convey runoff downstream to ultimate discharge locations throughout the site.

Due to the low permeability of the subsoil structure, it is envisaged that infiltration of stormwater will not be achieved, instead, any flows leaving the site will be detained and compensated in basins to achieve predevelopment flow rates.

6 Sewer Reticulation

Water Corporation operates a gravity sewerage network in the area surrounding the Site, with the locations of their existing infrastructure depicted in *Figure 3*. The existing gravity sewerage network is located to the north and west of the Site, with no existing sewerage infrastructure located to the east or south of the site.

There are four potential connection locations to the existing network where sewer stub lines have previously been extended into the site. Connections to the existing sewers on the northern side of Waverley Rd are also feasible.

Any connection into this system will need to be designed, approved and constructed in accordance with standard Water Corporation requirements. Any internal plumbing works on the Site will need to meet the requirements of AS3500 'Plumbing and drainage' as documented by the Building Services consultant.



Figure 3: Existing Sewer Layout and potential connection locations

Water Corporation planning for this area (Cowaramup SD242) shows the site straddling two WWPS catchments. The northern portion of the site drains northward to WWPS “PS1-242 - Bussell Hwy Cowaramup”. The southern portion of the site drains westward to WWPS “PS3-242 – Smokebush Court”. Refer *Figure 4* and ***Appendix C***.

Based on preliminary review, the Site can be serviced at its current ground level by the existing sewer network, via the existing stubs entering the Site. Water Corporation were contacted and confirmed that their existing assets are capable of servicing the proposed development. No external infrastructure upgrades, including WWPS(s), will be required.

Correspondence from Water Corporation is included in ***Appendix C***.

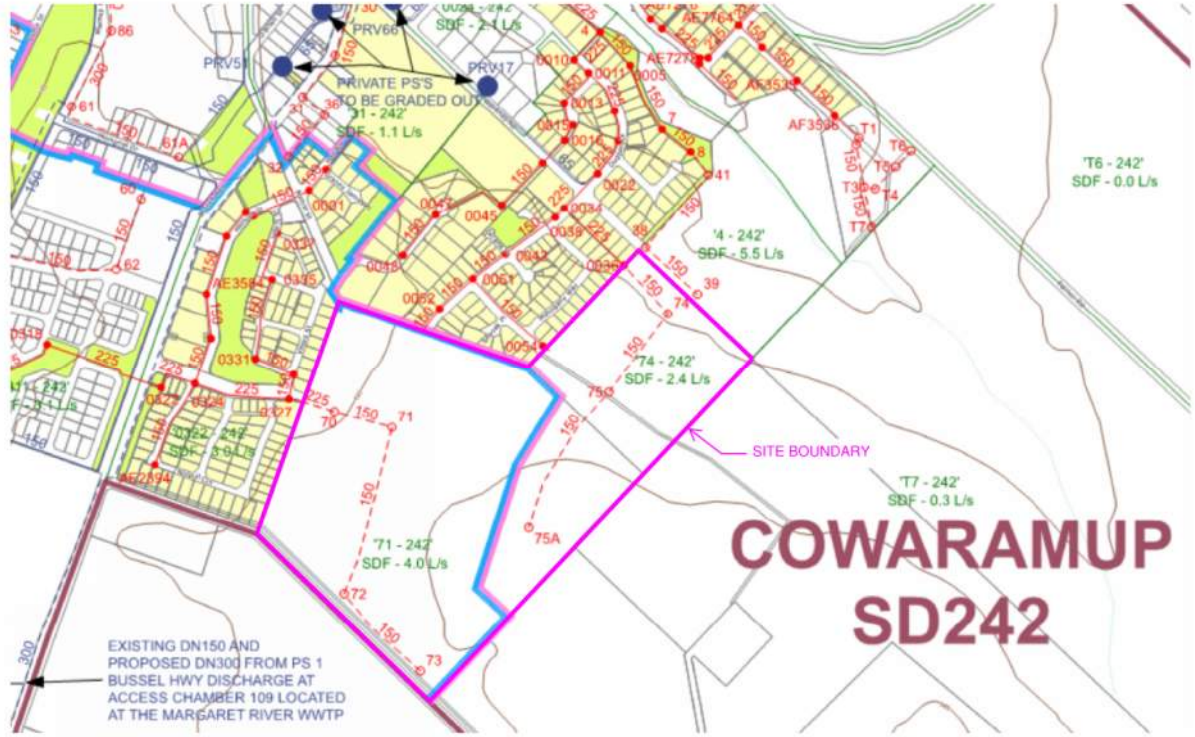


Figure 4: Water Corporation Wastewater Planning

7 Water Reticulation

The Water Corporation owns and maintains the potable water reticulation system in the vicinity of the Site. Any connection into this system will need to be designed, approved and constructed in accordance with standard Water Corporation requirements. It would be expected that a standard development condition addressing the above will be included on any WAPC approval.

The Water Corporation service the Cowaramup area via the supply main from Margaret River, which extends east along Wirring Road to the Wirring Road Supply Tank (*Figure 5*). This tank currently has a capacity of 1ML. The reticulation system for Cowaramup stems from the Wirring Road Tank with a DN250 main, that passes through the Site.

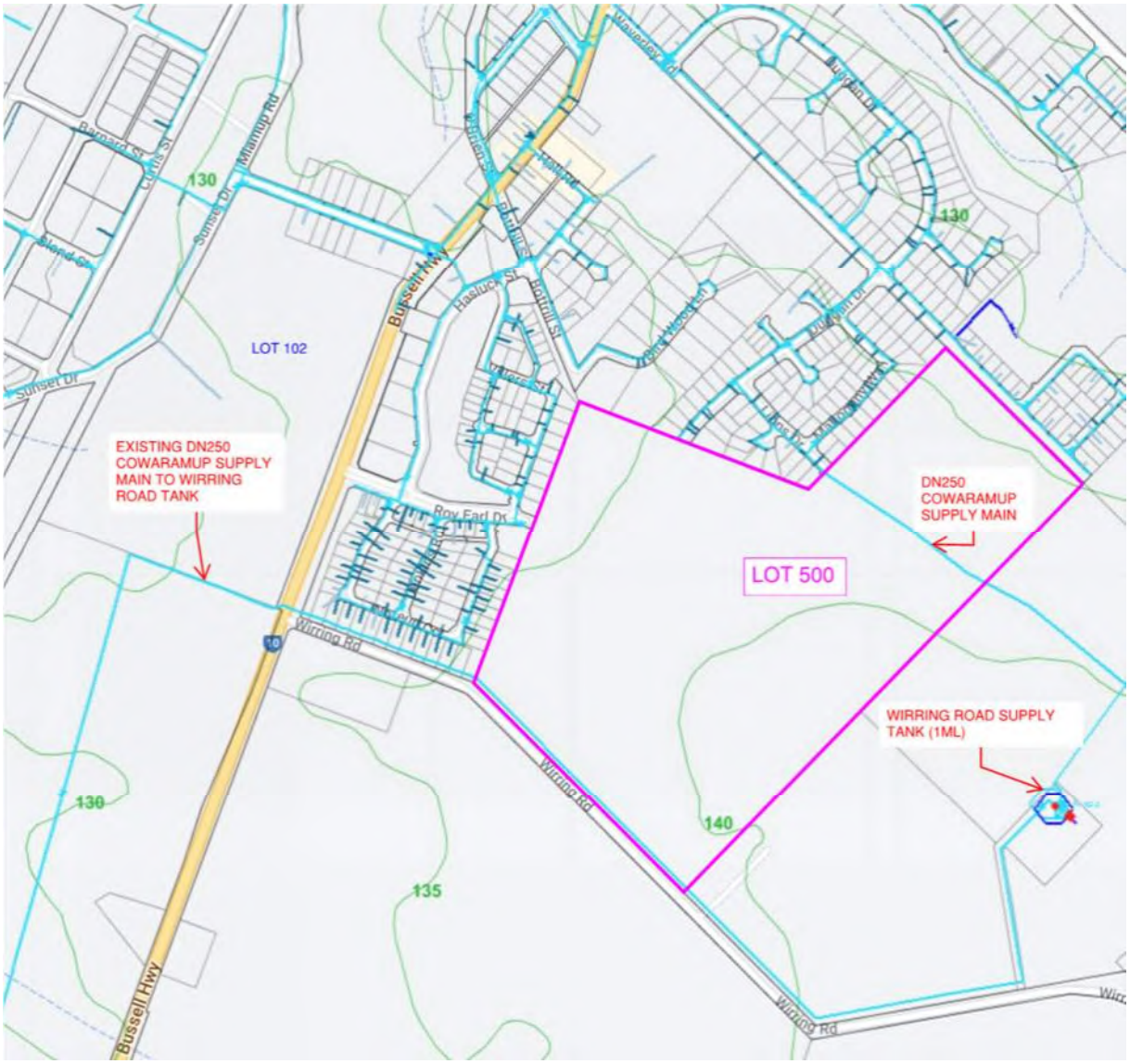


Figure 5: Existing Water Corporation water supply infrastructure (Esinet)

Planning advice received from Water Corporation is summarised below, with a full copy provided in ***Appendix C***.

- The existing water reticulation can support the proposed subdivision. There should be good pressure and existing pipe sizing is adequate for the flow.
- The proposed subdivision can connect to the existing reticulation network - DN150 main in Waverley Rd, DN250 mains in Lions Dr and Wirring Rd.

The existing Cowaramup Supply Main, from the Wirring Road Supply Tank to the townsite, passes through the site. Direct connection of reticulation mains to this DN250 main will be allowed, however the supply main will require realignment along the internal subdivisional road prior to new reticulation mains being connected to and extended from it.

All water main extensions required for the development site will be laid within the existing and proposed road reserves, on the correct alignment and in accordance with the Utility Providers Code of Practice and Water Corporations Water Reticulation Pipelines DN250 and Smaller (DS63).

8 Power Supply

Western Power owns and operates all electrical supply network assets within the development area and therefore all new electrical supply equipment and cables will need to be installed in accordance with Western Power, WAER (West Australian Electrical Requirements), AS3000 specifications and Standards.

The following advice is based on UPD desktop studies and supporting information obtained from the Western Power Network Capacity Mapping Tool (NCMT) online database.

8.1 Power Requirements

Based on the current structure concept plan, there are 44 residential lots & 3 POS lots in Stage 1. 145 residential lots, 5 POS & 3 PAW lots would be in the balance (Unstaged 2) area. All residential lots will be served with 3 phase power at 4.7kVA per lot. The power supplies for POS & PAW lots are yet to be determined. The proposed retirement village will be supplied by a sole use transformer with power requirement of 3.1 kVA per unit, including an additional allowance of 30 kVA for entertainment or club houses. Lot yield for the retirement village is still to be confirmed, however an estimate of 250 has been assumed.

The total load for the ultimate development has been estimated to be 1,693.3 kVA and has been calculated using Western Power's recommended Design After Diversity Maximum Demand (DADMD). The estimated loads are summarised below.

Table 1: Estimated loads.

Load Type	Volume	Load Allowance	kVA Allocated
Residential	189 Lots	4.7kVA/Lot	888.3 kVA
Lot 225	~250	3.1kVA/dwelling	805 kVA
POS & PAW	11	kVA / space TBD	TBD kVA
		Total DADMD	**1,693.3 kVA**

8.2 Feeder Capacity

Western Power's NCMT indicates that the Margaret River Substation will be the zone substation that feeds the subdivision area (Figure 6). The substation has a remaining capacity of 15 to 20 MVA as of 2025. This remaining capacity forecast of 15-20 MVA remains the same until the latest forecasting available in 2030. We do not envisage any significant HV upgrade. However, this information is unconfirmed by Western Power until such time as an application is being made to Western Power for connection.

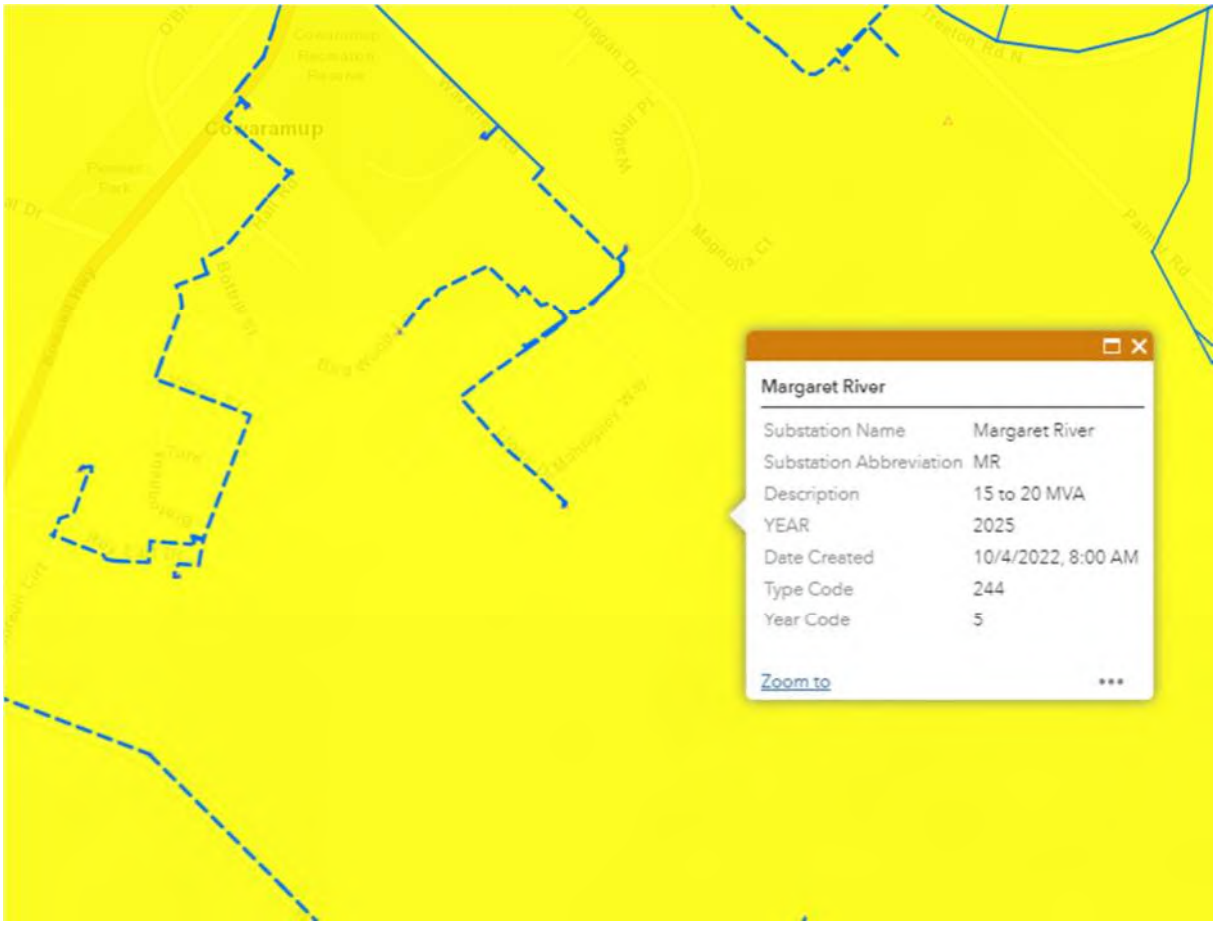


Figure 6: WP NCMT for surrounding area

8.3 Existing Distribution Power Network

The Western Power NCMT indicates that there are three-phase 22kV feeders servicing this development area, i.e. MR 550.0 (Figure 7).

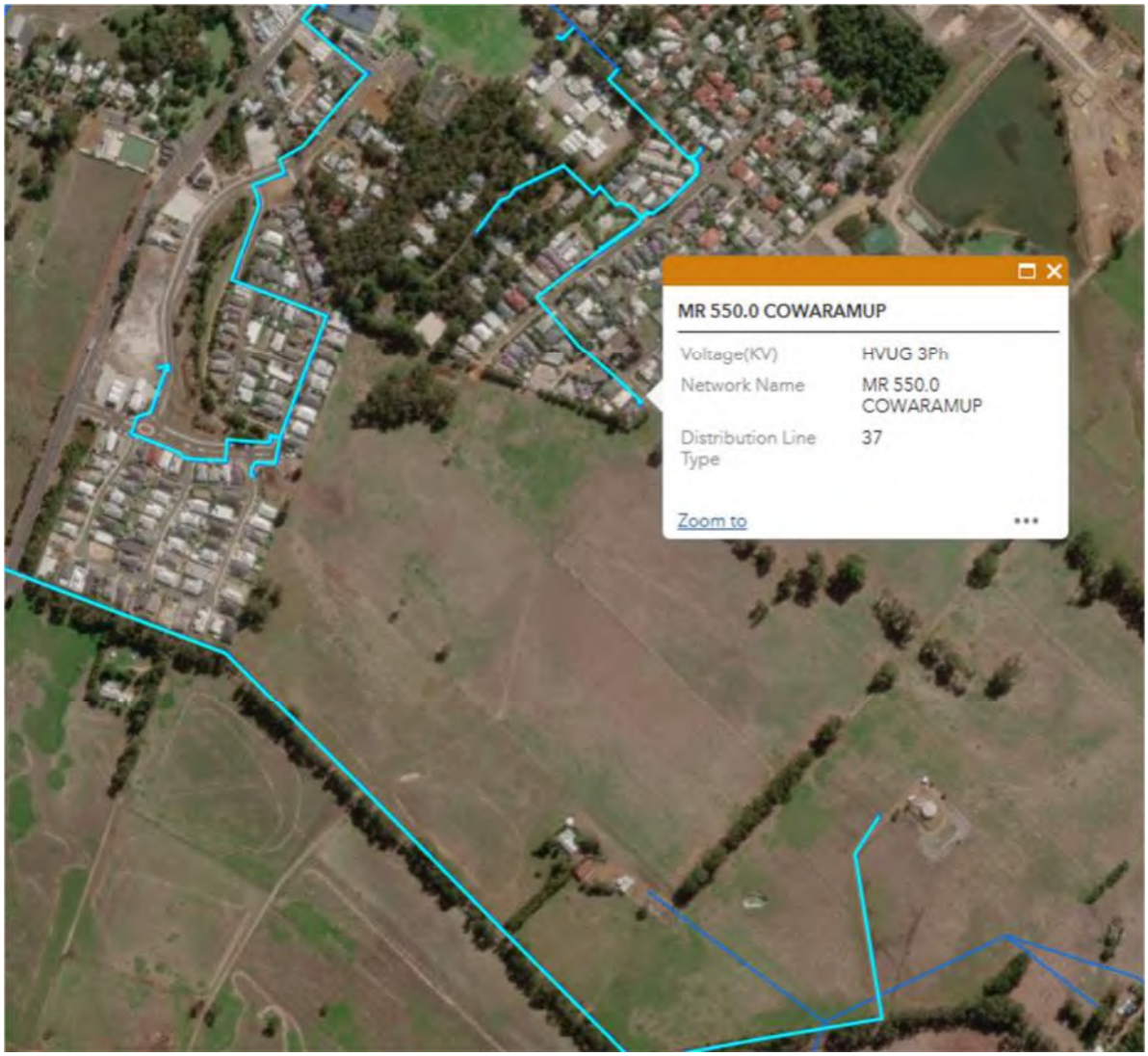


Figure 7: Western Power HV Network

There is an existing switchgear (SWGR) & 160 kVA transformer (TX) on Lions Dr, to the west of the development area. Two LV cables from the TX supply power to Lions Dr & Mahogany Way (Figure 8 from MNG Maps).





Figure 8: Western Power TX Site on Lions Dr

To the north of the new development on Waverley Rd, there are existing 95mm² high-voltage (HV) cables connected to a SWGR with a 315 kVA TX on Stewart Smith Loop.

A new SWGR and TX will be required to serve the proposed lots in Stage 1. This will require cutting into the existing 95mm² HV cables and extending them to supply the new substation.



Figure 9: Western Power HV cables

The extended HV cables will follow the proposed road into future stages and supply additional SWGRs & TXs. The same HV feeder (MR 550.0) along Roy Earl Dr and Wirring Road can provide additional interconnection points. Figure 10 shows indicative proposed HV cable routes and TX locations.

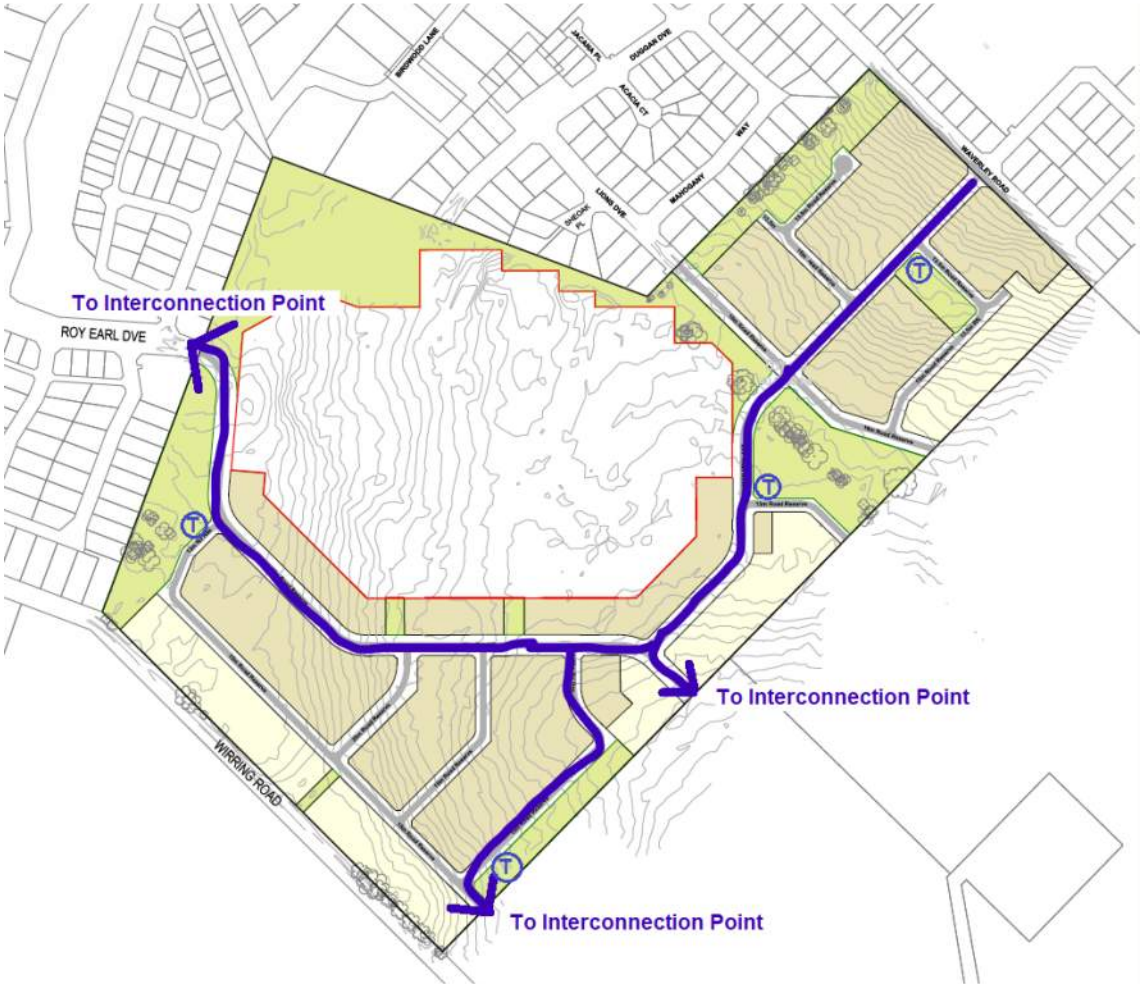


Figure 10: Proposed HV Cable & TX Locations for Future Stages (Indicative Only)

8.4 Fire Zones For Transformers

The development will require new HV Transformer Substation Sites which will need to be located away from any building to allow for the 4m fire zone around the Western Power site on all sides.

Under the Western Power Distribution Substation Plant Manual for zones around transformers, a 6m Restricted Covenant (RC) around the site is required, preventing any structure within this area without prior approval from Western Power.

8.5 Transmission Line Network

There are no Western Power transmission lines in the vicinity of this development.

9 Telecommunications

The proposed development will require a fibre ready pit and conduit network to be installed at the Developer's cost. The pit and conduit will be designed in accordance with the relevant providers standards and will be installed in the telecommunications alignment within the internal road reserves. Once installed and inspected, ownership of the pit and conduit network will be transferred to the relevant provider. The following providers appear to be viable options:

9.1 Opticomm

Opticomm would likely be interested in providing telecommunication services to the development as they have an extensive network of fibre infrastructure near the site. Further enquiries with Opticomm would be required to confirm.

9.2 NBN Co.

According to the NBN rollout map, surrounding area of the development is served by fixed wireless & fixed line services.

There are existing communication cables and ducts located on Lions Dr to the west of the new development, and Waverley Rd to the north of the development, which are currently servicing existing houses. Therefore, the site can be serviced with communications services.



Figure 11: NBN Rollout Map Showing Development Site

10 Gas

There is no gas infrastructure within the Cowaramup area.

General advice from ATCO with regards to development in the Cowaramup area was that the nearest, feasible tie-in to the reticulated network is 25km away, in Vasse. Provisional estimates provided by ATCO for this work is from $5.5M to $6.0M in good ground conditions, to approximately $12.0M if rock is encountered.

Reticulated gas is not considered to be an essential service and as such is generally not required as a condition of development. Based on the above there does not appear to be any feasible opportunity to providing reticulated gas infrastructure to the development and lot owners are likely to choose gas bottles for their own supply. However, an alternate option to bottled gas utilising internal reticulated LPG networks fed from an internally located storage vessel, could be considered.

11 Disclaimer

JDSi have undertaken this assessment based on a desktop study and liaison with relevant utility providers. Subsequently, assumptions have been made which, if incorrect, have potential to change the assessment and/or recommendations. Major cost implications exist through factors which cannot be assured at this time including upgrading and provision of utility services, WAPC conditions of development, Local Authority Scheme Requirements, ground conditions, timing of adjacent developments, etc.

While JDSi has taken all care in the preparation of the likely development requirements and has noted key assumptions, JDSi accepts no responsibility for the accuracy of this report and provides it only as an indicative summary of engineering requirements.

If any further information is required or should you wish to clarify any issue, please contact our office.

APPENDIX A

STRUCTURE PLAN AMENDMENT AND CONCEPT PLAN



N

24001002A

0m 50 100 200

COWARAMUP - DRAFT STRUCTURE PLAN AMENDMENT

Lot 500 Wirring Road, Cowaramup

Project YOLHA 24001003 | Scale 1:4000 @ A3 | Date: 10 Sept 2024

HEX DESIGN | PLANNING

Hex Design and Planning
ABN 34 627 142 299
29 A Bartlett Crescent
Karrinyup WA 6018
T +61 8 9204 1518
M +61 438 000 235
E sheldon@hexdesignplanning.com.au

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N

24001002A

0m 50 100 200

COWARAMUP - CONCEPT PLAN

Lot 500 Wirring Road, Cowaramup

Project YOLHA 24001002A | Scale 1:4000 @ A3 | Date: 10 Sept 2024

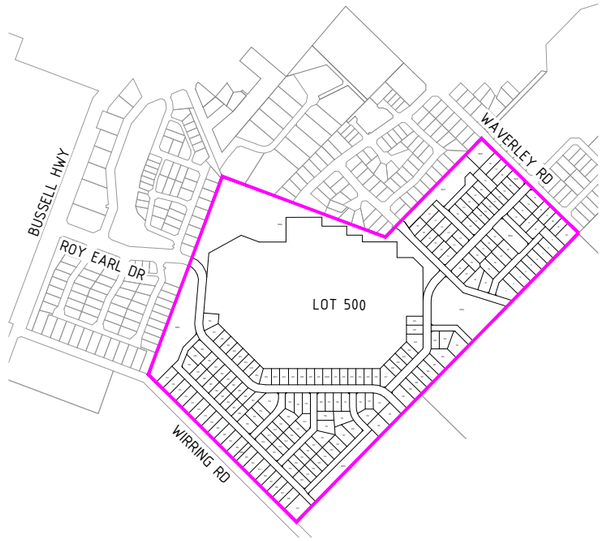
Hex Design and Planning
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E sheldon@hexdesignplanning.com.au

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APPENDIX B

EXISTING TOPOGRAPHY





LOCATION PLAN
NOT TO SCALE

0 20 40 80 120m
SCALE 1:2000 @ ORIGINAL SHEET SIZE A1

NOTES

1. GENERAL
1.1. LEVELS ARE REDUCED FROM A.H.D.

LEGEND:

- DEVELOPMENT BOUNDARY
- 500 EXISTING LOT NUMBER
- 225 PROPOSED LOT NUMBER
- 15.00 CONCEPT DESIGN CONTOURS (0.20m INTERVAL)

REV	DATE	DRAWN	CHECKED	APPROVED	
A		BWW	BWW	BJW	ISSUED FOR SERVICING REPORT

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NOTE
This drawing shall be preliminary only until it is Issued for Construction.

JDSi CONSULTING ENGINEERS
Certified Quality System to ISO 9001

CLIENT: Birdwood COWARAMUP • MASTERPLANNED COMMUNITY

PROJECT: BIRDWOOD COWARAMUP

DRAWING TITLE: SITE TOPOGRAPHY PLAN

DRAWN: B.WHITFIELD		WAPC No.	
DESIGNED: B.WHITFIELD		SCALE @ A1: 1:2000	
PROJECT MANAGER: B.WASHFOLD	DATUM: AHD71	CO-ORDS: MRCG94	
JDSI PROJECT No.: JDS242318.0	DRAWING No.: C102	REVISION: A	

Plotted By: BWhitfield Plot Date: 29/10/24 - 21:17 Cad File: C:\12dS\data\JDSI-12DSYN\JDS242318_247\JDS242318.0\CIVIL\Drawings\JDS242318.0_C102.dwg

APPENDIX C

WATER CORPORATION CORRESPONDENCE & SCHEME PLANNING

Ben Whitfield

From: Teeto Lombardo <Teeto.Lombardo@watercorporation.com.au>
Sent: Thursday, 10 October 2024 2:14 PM
To: Brenton Washfold
Subject: PIP415337 - Lot 500 Wirring Road, Cowaramup - Water & Sewer Service Feasibility
Attachments: 106459pr-001c.pdf; MyWorld printout - water.pdf; Cowaramup_SD242 _WW_Planning-Overall_Sewer_District_Plan.pdf; MyWorld printout - sewer.pdf

Hi Brenton

The water and sewer servicing requirements for your proposed subdivision (attachment 1) are as follows:

Water

The existing water reticulation can support the proposed subdivision. There should be good pressure and existing pipe sizing is adequate for the flow. Your proposed subdivision can connect to the existing reticulation network - DN150 main in Waverley Rd, DN250 mains in Lions Dr and Wirring Rd. (refer to attachment 2).

Sewer

Your proposed subdivision is within our sewer planning area SD242 – refer to attachment 3 and also refer to the existing sewer network on attachment 4

Please feel free if you require any clarification in regards to the above.

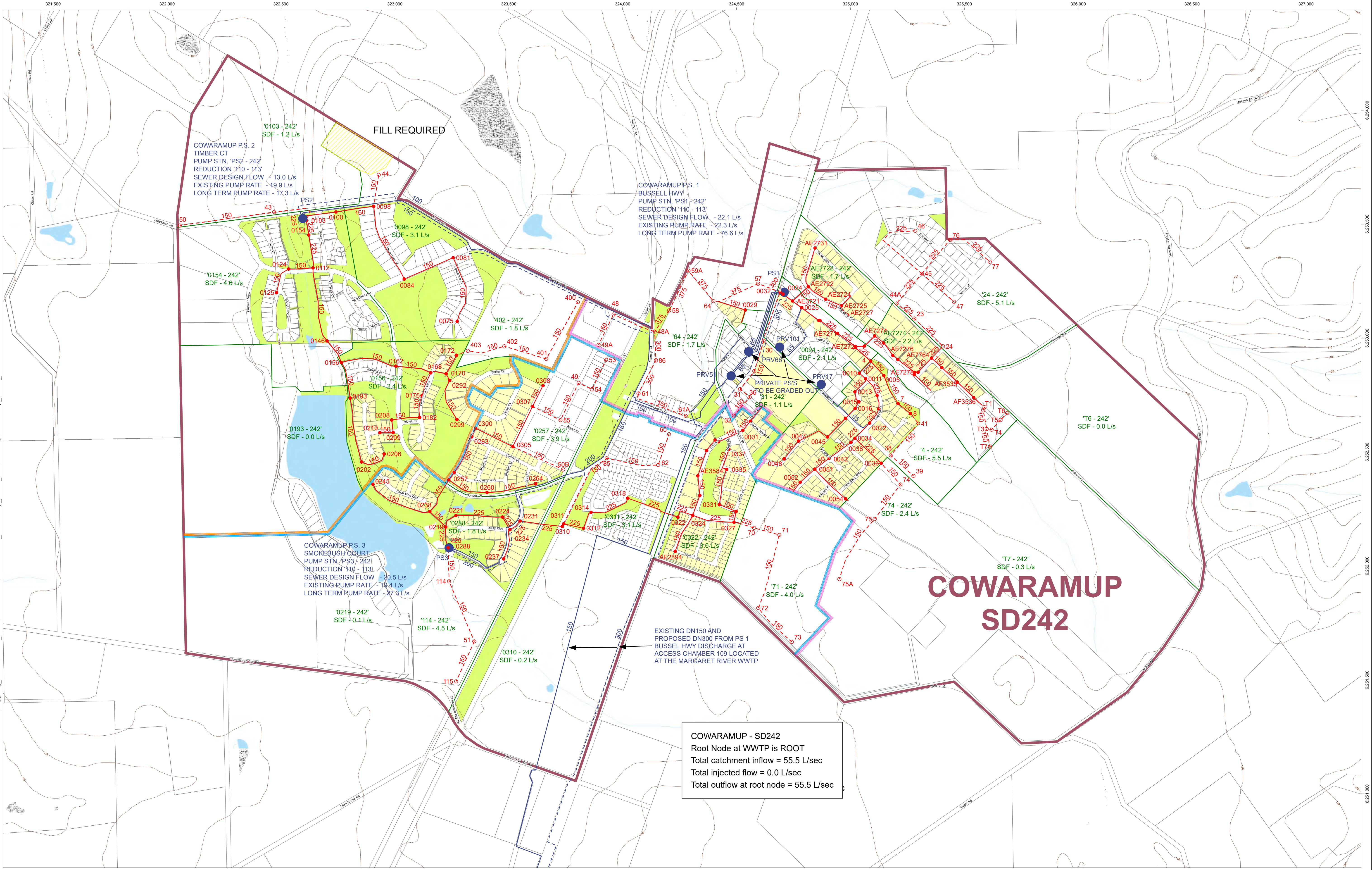
Thanks and kind regards

Teeto Lombardo

Snr Advisor – Greenfields Development
Development Services

E Teeto.Lombardo@watercorporation.com.au
T (08) 9420 3406

watercorporation.com.au



AUTHOR: DEMPSTGO FILE: J:\Mapping_Tasks\South_West\Wastewater\RITM0608780_Cowaramup_SD242_WWC\Working\Cowaramup_SD242_Overall.mxd COORDINATE SYSTEM: GDA 1994 MGA ZONE 50 VERTICAL DATUM: AHD

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THE INFORMATION ON THIS PLAN IS BASED ON THE BEST DATA AVAILABLE AT DATE OF PRINTING AND IS SUBJECT TO ONGOING REVIEW AND AMENDMENT. NO RESPONSIBILITY IS ACCEPTED BY THE WATER CORPORATION FOR ACCURACY OF DATA SUPPLIED BY EXTERNAL AGENCIES.

LEGEND

- Existing Access Chamber
- Proposed Access Chamber
- Existing Vacuum Chamber
- Proposed Vacuum Chamber
- Existing Pump Station
- Proposed Pump Station
- Existing Gravity Sewer
- Proposed Gravity Sewer
- Existing Vacuum Sewer
- Proposed Vacuum Sewer
- Existing Pressure Main
- Proposed Pressure Main
- Node Catchment
- PS and Sewer Catchments
- Sewer District / WWTP Catchment
- Existing Sewered Areas
- Sewered By Private PS
- Parks and Public Open Space
- Bush Forever
- Cut / Fill
- Floodway / Flood Fringe
- Flood Plain

NOTATION

SEWER DISTRICT NUMBER
CATCHMENT NODE
CATCHMENT '7001 - 121'
R15 - 108.4 @75% (W)
'R' CODE ZONING
GROSS AREA (ha)
% OF LAND DEVELOPMENT
(W) - WET CONDITIONS
(D) - DRY CONDITIONS

0 100 200 300 400 500 Metres

DATE	REVISION DESCRIPTION	DRN	APPD
XX/XX	XXXXXXXXXXXXXXXXXXXXXXX	XX	XX

SHEET INDEX

N

NEXUS No. 124256004
VERSION V1

WATER CORPORATION

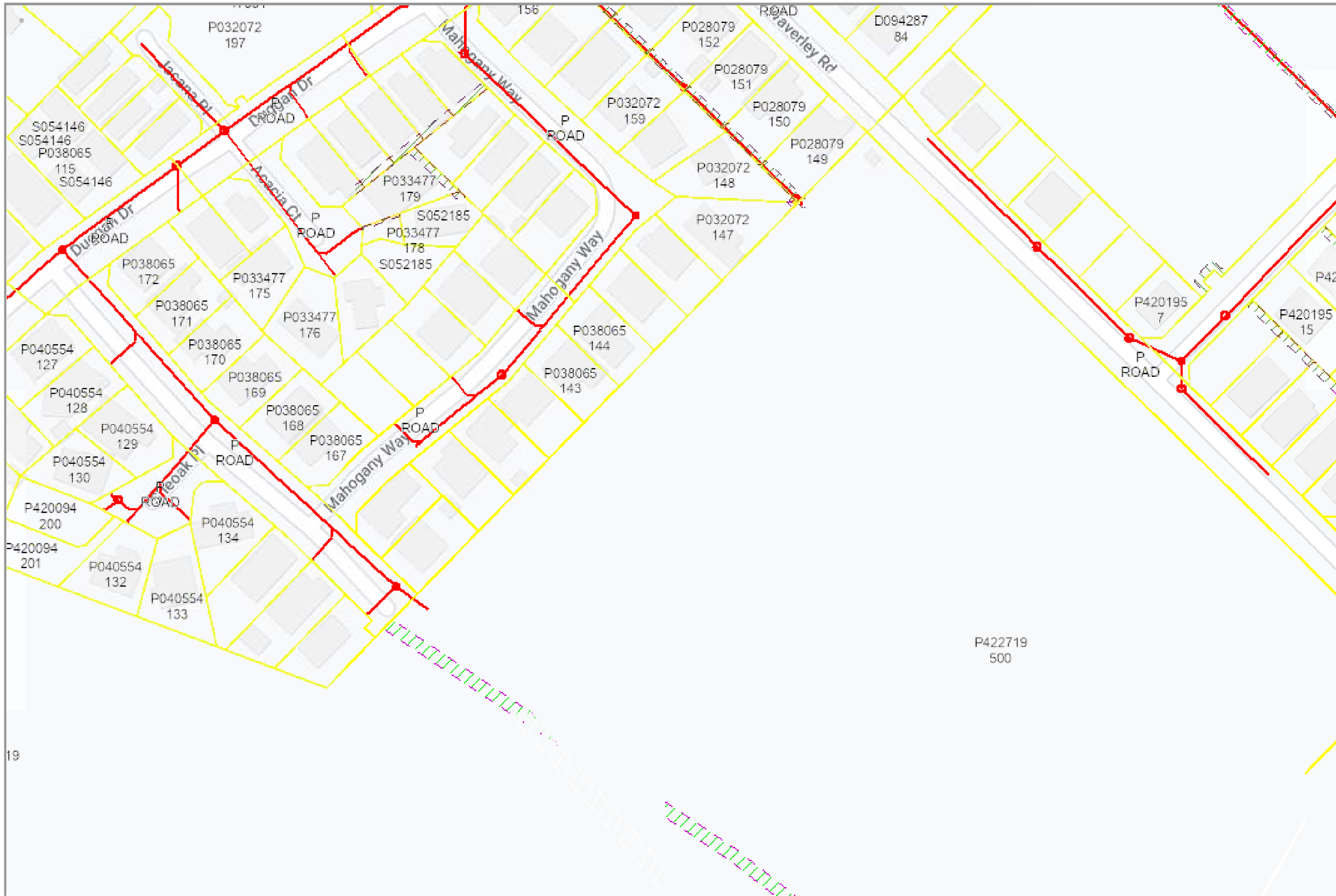
ISSUED WITH THE AUTHORITY OF THE MANAGER ASSET PLANNING GROUP
629 NEWCASTLE STREET, LEEDERVILLE 6007 WESTERN AUSTRALIA.
TELEPHONE (08) 9420 2420, FAX (08) 9420 3179

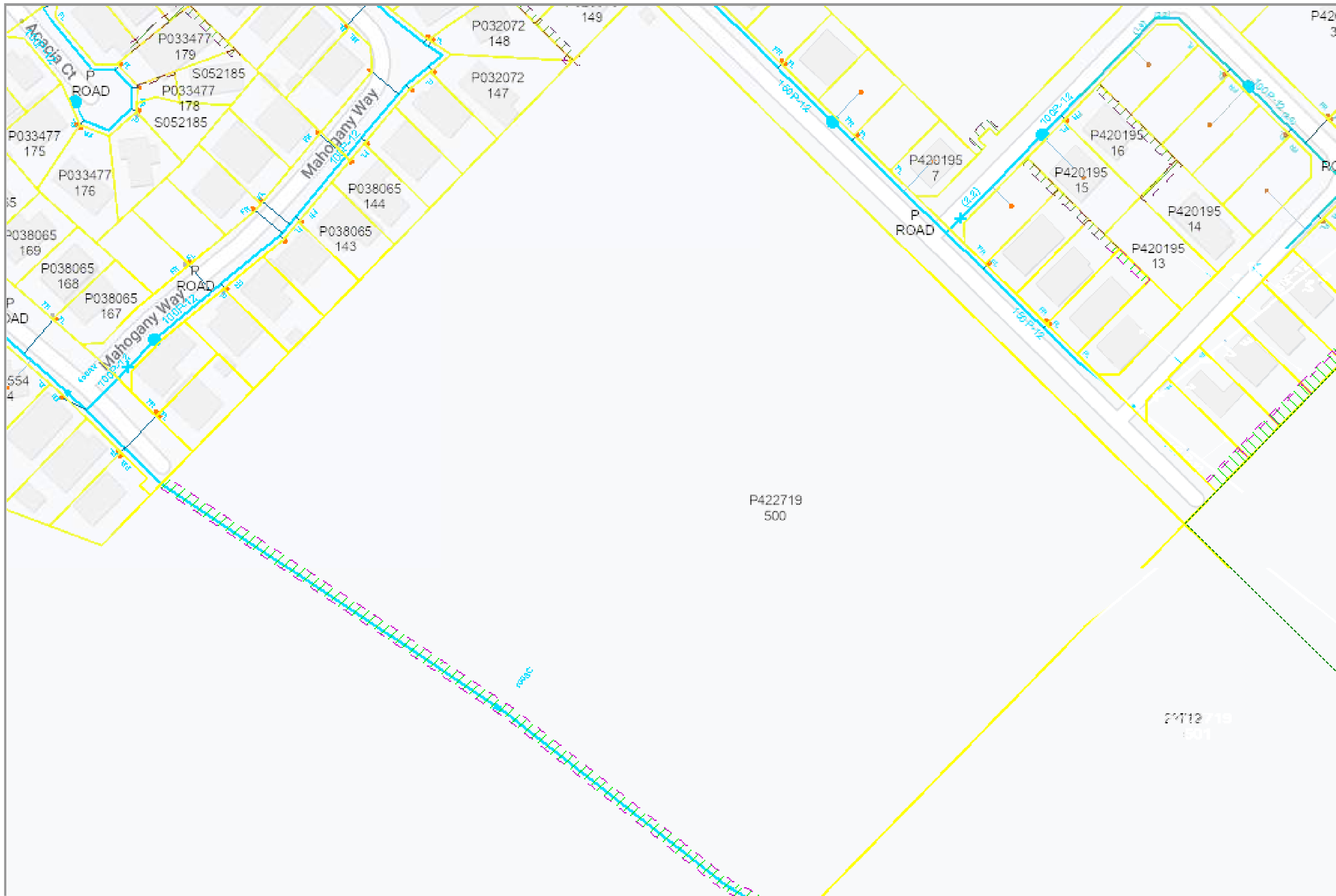
WASTEWATER SCHEME PLANNING SERIES

COWARAMUP - SD242

CONCEPTUAL PLANNING LONG TERM SCHEME

PLANNING BY	COMPILED BY	ACCEPTED BY	
APG PLANNERS	W. CALLANAN	C. DELPORT	
SCALE 1:7,500	FULL REVIEW NOVEMBER 2021	NEXUS FOLDER. 59244688	A1


P032072
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Mahogany Way
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P028079
152
ROAD
Waverley Rd
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P032072
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P028079
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