Lot 9001 Brockman Highway, Karridale
Local Structure Plan

P12011/M020

Prepared for
Juventus Pty Ltd August 2014

Modified

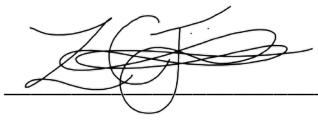
February 2025

ENDORSEMENT

IT IS CERTIFIED THAT AMENDMENT NO. 1 TO THE LOT 9001 BROCKMAN HIGHWAY, KARRIDALE LOCAL STRUCTURE PLAN WAS APPROVED BY RESOLUTION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION ON:

24 March 2025

Signed for and on behalf of the Western Australian Planning Commission



an officer of the Commission duly authorised by the Commission pursuant to section 24 of the *Planning and Development Act 2005* for that purpose.

Date of Expiry: 24 MARCH 2035

Table of Amendments

Amendment No.	Summary of Amendment	Amendment Type	Date approved by the WAPC
1	Provide for residential R5/2.5 subdivision and development in K3 Planning Precinct in accordance with 2022 Local Planning Strategy		24 March 2025

Executive Summary

The 2014 Structure Plan for (then) Lot 100 Brockman Highway, Karridale comprised 88.6 hectares of land situated adjacent to the intersection of Bussell Highway and Brockman Highway, adjoining the Karridale Crossroads general store. In 1998 the Western Australian Planning Commission adopted the Leeuwin Naturaliste Ridge Statement of Planning Policy (LNRSPP) which recommended that Karridale be expanded as a hamlet to a population of 500 people. In May 2011 the Shire adopted the Karridale Hamlet Settlement Strategy (KHSS) as the townsite strategy for the town's expansion.

The Structure Plan was endorsed by the WAPC in November 2014.

The design of the 2014 Structure Plan was informed by the KHSS, LNRSPP, the Shire's Rural Hamlet Design Guidelines and various WAPC policies, strategies and guidelines. In support of the Structure Plan an acoustic assessment, local water management strategy, visual assessment, traffic assessment, fauna assessment, vegetation and flora survey and servicing report were undertaken. All consultants' assessments concluded that the Site is suitable, indeed quite unconstrained, for development, and the findings from these reports informed the Structure Plan design and are attached as appendices. This Structure Plan provides the detailed planning framework to guide the subdivision and development of (then) Lot 100. The table below provides a summary of the land uses proposed the 2014 Structure Plan.

2014 Structure Plan Summary Table

Item	Area
Total area covered by the structure plan:	88.6 hectares
Area of specific land uses:	
Residential (R5)	17.2376 hectares
Residential (R2.5)	5.4603 hectares
Rural Residential	10.7326 hectares
General Agriculture	43.5857 hectares
Parks and Recreation (Public Local Open Space)	2.53 hectares
Retained Lot (MacDonald's Farm)	2.122 hectares
Roads, Road Widening and Services	6.6518 hectare

Subsequent to the endorsement of the 2014 Structure Plan, the subject site has been progressively subdivided and developed for residential purposes ("Hamelin Grove") in accordance with that plan. As of writing, a total of 59 lots have been created and sold, as well as approximately 2.4 hectares of land being ceded to the Crown and vested in the Shire of Augusta Margaret River as Public Open Space. A further 26 residential lots are

under construction and contract of sale.

The endorsed Structure Plan identifies the northern portion of the Structure Plan area as a 'General Agriculture' lot of 43.5857 hectares. In January 2022, the Shire of Augusta Margaret River's Local Planning Strategy was endorsed by the Western Australian Planning Commission. The LPS identifies this 'General Agriculture' lot as a 'Planning Precinct', being 'K3'. The identified use for Planning Precinct K3 is 'Residential R2.5 – 5', 'Rural Residential' and 'Parks and Recreation'. The estimated lot yield for the K3 Planning Precinct is 83 lots.

Accordingly, the 2014 Structure Plan is to be modified to reflect the recommendations of the Shire's Local Planning Strategy by providing the framework for the continuation of the Hamelin Grove estate into the northern portion of the Structure Plan Area.

The modifications to the existing structure plan have been informed by updated, and up to date, revisions of the previously undertaken assessments, including to the Bushfire Management Plan, Servicing Strategy, Traffic Impact Assessment and Land Capability report.

The following table provides a summary of the land uses proposed under the modified Structure Plan.

Modified Structure Plan (2024) Summary Table

Item	Data	Structure Plan Ref (section no.)
Total area covered by the structure plan	87.2863 hectares	1
Area of each land use proposed • Residential • Commercial • Industrial • Rural Residential	 54.0056 hectares Nil Nil 8.1539 hectares	3.4
Total estimated lot yield	180 lots	3.4
Estimated site density	2 lots per hectare	3.4
Estimated population	450 persons	3.4
Number of high schools	Nil	NA
Number of primary schools	Nil	NA
Estimated commercial floorspace	Nil	NA

Estimated area and percentage of public open space given over to: Regional open space District open space Neighbourhood parks Local parks	 Nil Nil 6.03 hectares 1 park 3.79 hectares 3 parks	3.3
Estimated percentage of natural area	1.3 hectares 12.68%	3.3

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PART ONE – IMPLEMENTATION

1 Structure Plan Area

This Local Structure Plan (Hamelin Grove Estate) is applicable to the land, and lots, generally bound by Bussell Highway to the west, Brockman Highway to the south east, the southern boundary of Lot 52 Bussell Highway to the north and the western boundary of Lot 1553 Brockman Highway to the east, within the locality of Karridale, consisting of all land contained within the inner edge of the line denoting the Structure Plan Boundary on the Local Structure Plan Map (Appendix A).

2 Operation

The date this local structure plan comes into effect is the date the local structure plan is approved by the WAPC.

3 Staging

The further implementation of the Local Structure Plan will progress generally from the south to the north, as a logical continuation of the lots, internal road system and services already created and developed under the current Local structure Plan and commensurate with market. The availability of service infrastructure will not be an impediment to the progressive staging of development.

3.1 Provision of Infrastructure

Reticulated water and sewerage infrastructure is not available to the Local Structure plan area. Accordingly domestic water supply to residences will be provided by the mandatory installation of a 130,000 litre rainwater tank at the time of house construction.

Water for fire fighting purposes is provided for by the provision of strategically located water tanks to be supplied and installed by the developer at the time of subdivision, in accordance with an endorsed Bushfire Management Plan. In addition, the domestic water tanks are to provide a minimum of 10,000 litres of water exclusively for fire fighting purposes, as required by the Local Development Plan adopted the Shire for the Hamelin Grove Estate.

Disposal of domestic effluent will be by self contained systems installed at the time of house construction by the individual lot owner. The system of disposal shall be consistent with the requirements of the Government Sewerage Policy 2019.

Two overhead Western Power high-voltage transmission lines traversing the local structure plan area provide for the power requirements of future (and existing) residents. This infrastructure will continue to be progressively relocated underground as part of subdivisional works.

All lots within the local structure plan area will be provided with telecommunication services in accordance with the Federal Government policy “Telecommunications in New Developments”. The local structure plan area is eligible for NBN connection via the SkyMuster Satellite Service.

The existing Telstra fixed line communication infrastructure within the local structure plan area can be extended

to provide voice services in accordance with Telstra's Universal Service Obligation mandates.

3.2 Road Construction/Upgrade

The implementation of the 2014 Local Structure Plan, involving the first stages of Hamelin Grove, excised and ceded land requirements for the upgrading of the Bussell and Brockman Highways intersection, together with the road widening requirements of Brockman Highway to accommodate the internal access road system of the development.

Both of the road accesses (Sawmill Loop) to the Local Structure Plan Area from Brockman Highway have been constructed.

Bussell Highway, Brockman Highway and the existing internal road system are constructed to a high standard, and the implementation of the Local Structure Plan can be progressed in a logical and orderly fashion.

4 Interpretation and Relationship with the Scheme

Unless otherwise specified in this part, the words and expressions used in this Local Structure Plan shall have the respective meanings given to them in the Shire of Augusta-Margaret River Local Planning Scheme No.1 (the Scheme) including any amendments gazetted thereto.

The Local Structure Plan Map (Plan 1) outlines land use, zones and reserves applicable within the Structure Plan Area. The zones and reserves designated under this structure plan apply to the land within it as if the zones and reserves were incorporated into the Scheme.

Pursuant to clause 6.2.9.2 of the Scheme:

If a Local Structure Plan imposes a classification on the land included in it by reference to reserves, zones, or Residential Design Codes then:

a) The provisions, standards and requirements specified under Part One of this Local Structure Plan shall have the same force and effect as if they were a provision, standard or requirement of the Scheme and are binding and enforceable in the same way as provisions incorporated in the Scheme. In the event of there being any inconsistencies or conflict between the provisions, standards or requirements of the Scheme and the provisions, standards or requirements of this Local Structure Plan, then the provisions, standards or requirements of this Structure Plan shall prevail; and

b) Part Two of this Local Structure Plan and all appendices are to be used as a reference only to clarify and guide interpretation and implementation of Part One.

Where terms are not defined in the Scheme, the meanings shall be as set out within Part One of the Local Structure Plan.

In this Local Structure Plan, unless the context otherwise requires:

> **'Scheme**' means the Shire of Augusta-Margaret River Local Planning Scheme No.1.
> **'Structure Plan**' means the Local Structure Plan for Lot 9001 et al (Hamelin Grove) Brockman Highway, Karridale.

5 Land Use and Subdivision

The Local Structure Plan Map (Appendix A) outlines land use, zones and reserves applicable within the Structure Plan area. The zones and reserves designated under this Structure Plan apply to the land within it as if the zones and reserves were incorporated into the Scheme.

5.1 Land Use Permissibility

Land use permissibility within the Structure Plan Area shall be in accordance with the corresponding zone or reserve identified on the Local Structure Plan Map (Plan1).

Notwithstanding the Scheme's Zoning Table and land use definitions within Schedule 1 of the Scheme, the following variations apply to the Structure Plan Area:

a) Home Business is permitted to be carried out ancillary to an existing dwelling in a separate building.

b) Within the Rural Residential zone, Home Based Trade is an 'A' use and is defined as follows:

Home Based Trade means a business, service or profession carried out in a dwelling or separate building or on land around a dwelling by an occupier of the dwelling which:

i. is located on a property greater than 1.0ha;

ii. does not employ more than 2 people not members of the occupiers household;

iii. will not cause injury to or adversely affect the amenity of the neighbourhood;

iv. does not occupy an area greater than 200 square metres;

v. does not involve the retail sale, display or hire of goods of any nature;

vi. in relation to vehicles and parking, does not result in traffic difficulties as a result of the inadequacy of parking or an increase in traffic in the neighbourhood;

vii. does not involve the use of an essential service of greater capacity than normally required in the zone;

viii. does not involve the parking or storing of freezer/refrigerated type vehicles that require the cooling system to be operational; and

ix. does not involve the paring of more than one truck for each employee/employer with a total of more than two trucks at any one time.

5.2 Subdivision

1. The following matters shall be addressed prior to the issuance of any subdivision approval and the Local Government will not recommend approval to any subdivision unless these matters have been addressed to its satisfaction:

a) A 'Servicing Plan', for the Structure Plan Area, which demonstrates that each lot has a suitable minimum site area requirement for on-site effluent disposal. In regard to the on-site effluent disposal assessment required as part of the 'Servicing Plan', a detailed geotechnical assessment will be required for land identified in the Local Water Management Strategy as having groundwater levels within 0.5m of the ground surface.

b) The subdivider, demonstrating to the satisfaction of the Western Australian Planning Commission, that issues associated with the power transmission lines that traverse the Structure Plan Area (i.e., the proposed retention and undergrounding of these lines or alternatively their relocation) have been resolved in consultation with Western Power.

c) The preparation of a 'Shared Paths and Footpaths Plan', which addresses the requirements of 'Liveable Neighbourhoods' and is to the specifications and satisfaction of the Local Government.

d) Preparation of a Visual Impact Assessment demonstrating management of visual impact to Bussell Highway and Brockman Highway.

2. The following matters will be addressed via recommended conditions of subdivision and the Local Government will not recommend clearance of subdivision conditions unless these matters have been addressed to its satisfaction:

    a) The subdivider is to prepare and implement an 'Urban Water Management Plan (UWMP)' to the satisfaction of the Local Government and Department of Water. The UWMP is to address total water cycle management, drainage reserves, road swales and bioretention areas where planting for nutrient stripping purposes is proposed. The UWMP is to include provision of details on water dependent ecosystems proposed within the subdivision to enhance degraded environments and to improve ecological function by providing fauna habitat. In particular detention basins, drainage reserves and roadside bioretention swales are to be addressed.

    b) The subdivider is to prepare and implement a 'Landscaping Management Plan'. The 'Landscaping Management Plan' is to be to the satisfaction and specifications of the Local Government and is to address the following:

        i. identification, protection and long term management of stands of remnant vegetation;

        ii. the type and extent of planting and vegetation to be protected within the Landscaping Buffer Areas and Public Open Space identified on the Local Structure Plan Map (Plan 1);

        iii. the proposed planting to comprise predominantly native species that require minimal watering, fertilizer application and ongoing management;

        iv. the visual screening of future development from Bussell Highway and Brockman Highway to mitigate visual impact and protect the function of these roads as travel route corridors;

        v. management of weeds and the spread of dieback;

        vi. protection of remnant vegetation in Brockman Highway and Bussell Highway reserves; and

vii. the provision of a landscaping buffer that minimizes the potential for land use conflict with adjacent rural lots.

c) The preparation and implementation of Design Guidelines, via a Local Development Plan, to address built form and integrated sustainability measures appropriate to the rural and historic context of Karridale.

d) Notifications on title advising prospective purchasers of 'Quiet House Design' lots that noise attenuation measures are required for dwellings as prescribed by the Structure Plan.

e) The subdivider implementing the requirements of the endorsed Fire Management Plan applicable to the Structure Plan.

f) Suitable arrangements being made for equitable contributions toward community infrastructure. The subdivider is encouraged to enter into a developer agreement with the local government, consistent with the Shire's Development Contribution Plan for Karridale.

3. Notifications on title advising prospective purchasers that the lot is subject to a Fire Management Plan which contains ongoing owner/occupier management responsibilities and that any dwelling needs to be constructed to AS3959.

4. The preparation of a 'Building Envelope Plan', which designates building envelopes on proposed 'Rural Residential' lots in locations to the satisfaction of the Local Government. Notwithstanding the generality of the foregoing, building envelopes shall not be located in areas subject to inundation or Development Setback areas.

5. Road intersections to Brockman Highway shall be designed and constructed to Main Roads WA standards.

6. The implementation of the 'Shared Paths and Footpaths Plan'.

7. The 'Parks and Recreation' reserves (Public Open Space) shown on the Structure Plan Map (Plan 1), are to be ceded free of cost by the subdivider without any payment of compensation by the Local Government or the Crown.

5.3 Residential

5.3.1 Density

The Local Structure Plan Map (Plan 1) defines the residential density applicable to specific areas within the Structure Plan Area.

5.3.2 Locational Criteria

The allocation of residential densities on the Local Structure Plan Map (Appendix 1) are in accordance with the following criteria:

a) To provide minimum lot sizes consistent with the lack of reticulated water and sewerage services to the land and the necessity to provide these services on-site;

b) To achieve the higher density land utilisation in the areas closest to the Village Centre;

c) To provide for graduated and increasing lot sizes in a transition from the south west of the Site, closest to the Village Centre to the north east; and

d) To retain a semi-rural ambience.

6 Development

6.1 Local Development Plan

A Local Development Plan, addressing those building and development requirements such as, but not limited to, dwelling orientation, fencing standards, suitable building materials, stormwater management and any other matter deemed necessary by the Shire shall be prepared by the developer as a condition of subdivision and adopted by the Council.

6.2 Quiet House Design Requirements

Dwellings within the 'Quiet House Design' area, as shown on the Local Structure Plan Map (Plan 1), shall be designed and constructed to comply with the noise attenuation requirements of Quiet House Design – Package A – WAPC Statement of Planning Policy 5.4, or the equivalent at the time of house construction.

6.3 Residential Design Code Variations

Development setbacks to Brockman Highway and Bussell Highway will be required as prescribed on the Local Structure Plan Map (Appendix A).

6.4 General Development Requirements

1 Development shall comply with any Local Government Local Development Plan for the Structure Plan area.

2. Development shall comply with the endorsed Fire Management Plan for the Local Structure Plan.

3. All dwellings are to make provision for the catchment of potable water in accordance with the requirements of this Local Structure Plan, and a Local Development Plan adopted by the Shire for the Local Structure Plan area.

4. Notwithstanding any other provision of the Scheme, the disposal of liquid and solid waste shall be carried out by the installation of sewerage disposal systems to the satisfaction of the Local Government subject to:

a) Aerobic treatment units or an effluent disposal system capable of minimizing phosphorous movement from each lot shall be installed to provide treatment and disposal of effluent wastewater to the satisfaction of the Local Government.

b) A minimum separation of 50m is to be achieved between effluent wastewater disposal

sites and perennial water courses.

c) Grey water disposal and wastewater reuse systems are to be installed to the satisfaction of the Local Government and the Department of Health ("Health WA").

d) Pursuant to clause 4.22.2 and clause 5.10 of the Scheme, where a building envelope has been prescribed in the approved 'Building Envelope Plan', all development on the relevant lot shall be contained within that designated building envelope.

5. Notwithstanding any other provision of the Scheme or this Local Structure Plan, vegetation within the Landscaping Buffer Area identified on the Local Structure Plan is to be maintained by the lot owners and is to screen development from Bussell Highway and Brockman Highway to the satisfaction of the Local Government.

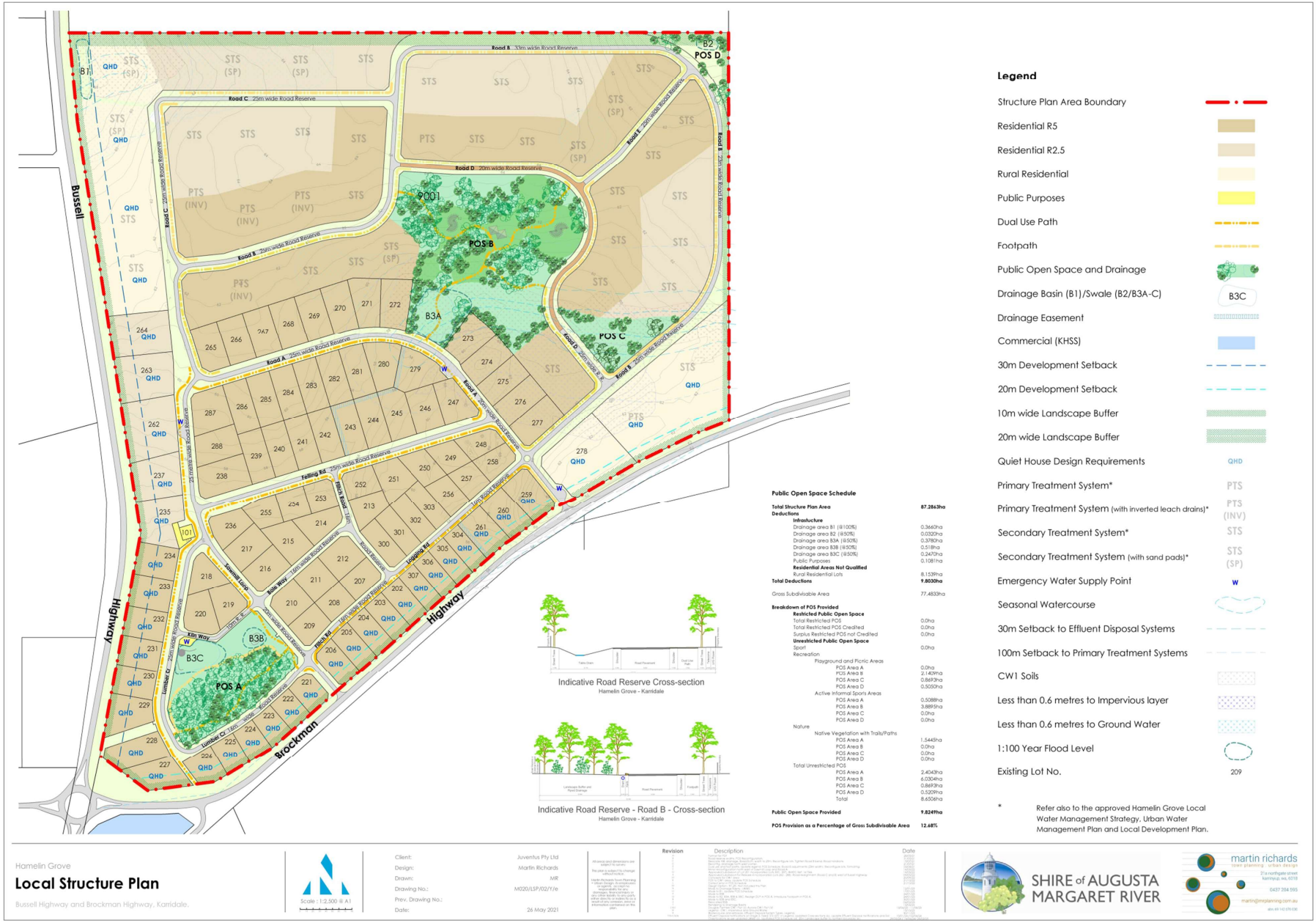
6. Future lot owners on properties 2000m² and greater are restricted from constructing boundary fencing other than post and rail and/or ring-wire rural type fencing to the satisfaction of the Shire of Augusta Margaret River. Privacy fencing of courtyards and private open space within the curtilage of dwellings is permitted.

7. Land owners are responsible for the 'owner/occupier' responsibilities as prescribed in the endorsed Fire Management Plan.

8. Dwellings are to comply with AS3959 building standards as required by the applicable Fire Management Plan.

Appendix A

Local Structure Plan


Bussell
Highway
Brockman
Road A 25m wide Road Reserve
Road B 33m wide Road Reserve
Road C 25m wide Road Reserve
Road D 20m wide Road Reserve
Road E 25m wide Road Reserve
Telling Rd 25m wide Road Reserve
Bole Way 16m wide Road Reserve
Loggers Rd 16m wide Road Reserve
Hitch Rd 16m wide Road Reserve
Kiln Way 16m wide Road Reserve
Lumber Cr 16m wide Road Reserve
Joinery Loop 16m wide Road Reserve
9001
POS A
POS B
POS C
POS D
B1
B2
B3A
B3B
B3C
Indicative Road Reserve Cross-section
Hamelin Grove - Karridale
Indicative Road Reserve - Road B - Cross-section
Hamelin Grove - Karridale
Legend
Structure Plan Area Boundary
Residential R5
Residential R2.5
Rural Residential
Public Purposes
Dual Use Path
Footpath
Public Open Space and Drainage
Drainage Basin (B1)/Swale (B2/B3A-C)
Drainage Easement
Commercial (KHSS)
30m Development Setback
20m Development Setback
10m wide Landscape Buffer
20m wide Landscape Buffer
Quiet House Design Requirements
Primary Treatment System*
Primary Treatment System (with inverted leach drains)*
Secondary Treatment System*
Secondary Treatment System (with sand pads)*
Emergency Water Supply Point
Seasonal Watercourse
30m Setback to Effluent Disposal Systems
100m Setback to Primary Treatment Systems
CW1 Soils
Less than 0.6 metres to Impervious layer
Less than 0.6 metres to Ground Water
1:100 Year Flood Level
Existing Lot No.
Public Open Space Schedule
Total Structure Plan Area 87.2863ha
Deductions
Infrastructure
Drainage area B1 (@100%) 0.3660ha
Drainage area B2 (@50%) 0.0320ha
Drainage area B3A (@50%) 0.3780ha
Drainage area B3B (@50%) 0.518ha
Drainage area B3C (@50%) 0.2470ha
Public Purposes 0.1081ha
Residential Areas Not Qualified
Rural Residential Lots 8.1539ha
Total Deductions 9.8030ha
Gross Subdivisable Area 77.4833ha
Breakdown of POS Provided
Restricted Public Open Space
Total Restricted POS 0.0ha
Total Restricted POS Credited 0.0ha
Surplus Restricted POS not Credited 0.0ha
Unrestricted Public Open Space
Sport 0.0ha
Recreation
Playground and Picnic Areas
POS Area A 0.0ha
POS Area B 2.1409ha
POS Area C 0.8693ha
POS Area D 0.5050ha
Active Informal Sports Areas
POS Area A 0.5088ha
POS Area B 3.8893ha
POS Area C 0.0ha
POS Area D 0.0ha
Nature
Native Vegetation with Trails/Paths
POS Area A 1.5445ha
POS Area B 0.0ha
POS Area C 0.0ha
POS Area D 0.0ha
Total Unrestricted POS
POS Area A 2.4043ha
POS Area B 6.0304ha
POS Area C 0.8693ha
POS Area D 0.5209ha
Total 8.6506ha
Public Open Space Provided 9.8249ha
POS Provision as a Percentage of Gross Subdivisable Area 12.68%
* Refer also to the approved Hamelin Grove Local Water Management Strategy, Urban Water Management Plan and Local Development Plan.
Hamelin Grove
Local Structure Plan
Bussell Highway and Brockman Highway, Karridale.
Scale : 1:2,500 @ A1
Client: Juventus Pty Ltd
Design: Martin Richards
Drawn: MR
Drawing No.: M020/LSP/02/Y/e
Prev. Drawing No.:
Date: 26 May 2021
Revision
Description
Date
SHIRE of AUGUSTA MARGARET RIVER
martin richards
town planning · urban design

PART TWO – EXPLANATORY SECTION

1 Planning Background

1.1 Introduction and Purpose

This Structure Plan has been prepared in accordance with the Planning and Development (Local Planning Schemes) Regulations 2015 – Structure Plan Framework, August 2015. This Structure Plan provides a comprehensive planning framework to guide future subdivision and development of Lot 100 Brockman Highway, Karridale. The design has considered and incorporated regional strategies, relevant state planning policies and Shire local planning controls and the outcomes of technical and environmental assessments of the subject land undertaken to inform the Structure Plan.

1.2 Land Description

1.2.1 Location

The Local Structure Plan area, herein referred to as 'the Site', is situated adjacent to the intersection of Bussell Highway and Brockman Highway, adjacent to the Karridale Crossroads general store. The Site is bounded by the Bussell Highway to the west and Brockman Highway to the south (Figure 1). The Site is located approximately 14 kilometres north of Augusta, 27 kilometres south of Margaret River Townsite and 110 kilometres south west of Bunbury.

1.2.2 Area and Land Use

The Site comprises approximately 87 hectares. The northern portion of the Site has previously been used for commercial tree production and is devoid of native vegetation. The tree plantation has recently been harvested.

The southern portion of the has been subdivided and developed for residential (R5) purposes, including sealed internal roads and an area of public open space containing a stand of remnant native vegetation. The southwestern portion of the Site also features Western Power infrastructure, a kiosk contained within Lot 101 Bussell Highway.

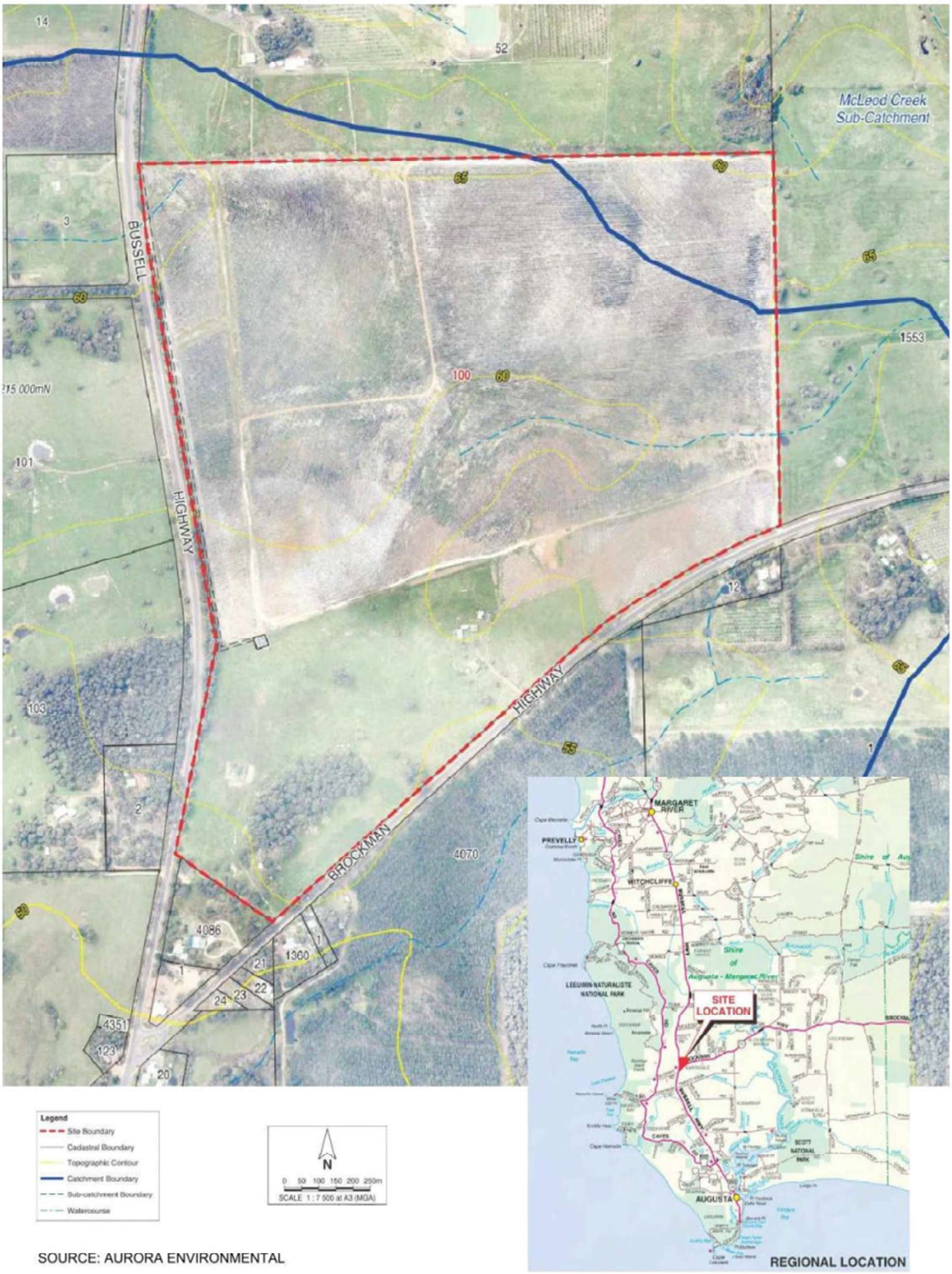
To the south of the Site, the surrounding uses adjacent to the crossroads consist of commercial and village centre uses which include a petrol station, a roadhouse and tavern as well as a general store with post office.

The land to the south of Brockman Highway is occupied by a large-scale commercial tree plantation.

The Karridale Primary School and Karridale Hall are located approximately 2 kilometres south of the Site, adjacent to Bussell Highway.

The land to the west of the Site is mostly cleared with some scattered remnant vegetation and has historically been used for grazing purposes. This land located on the western side of Bussell Highway, namely Lots 103 and 104 Bussell Highway, are the subject of a Structure Plan ("Bushby Rise") to provide for the development of around 80 residential lots.

Figure 1: Site Location and Context Plan.



The land adjoining the Site to the east is predominately cleared and has also been used for grazing purposes.

The land immediately to the north of the Site is used for broadacre agricultural and viticultural pursuits.

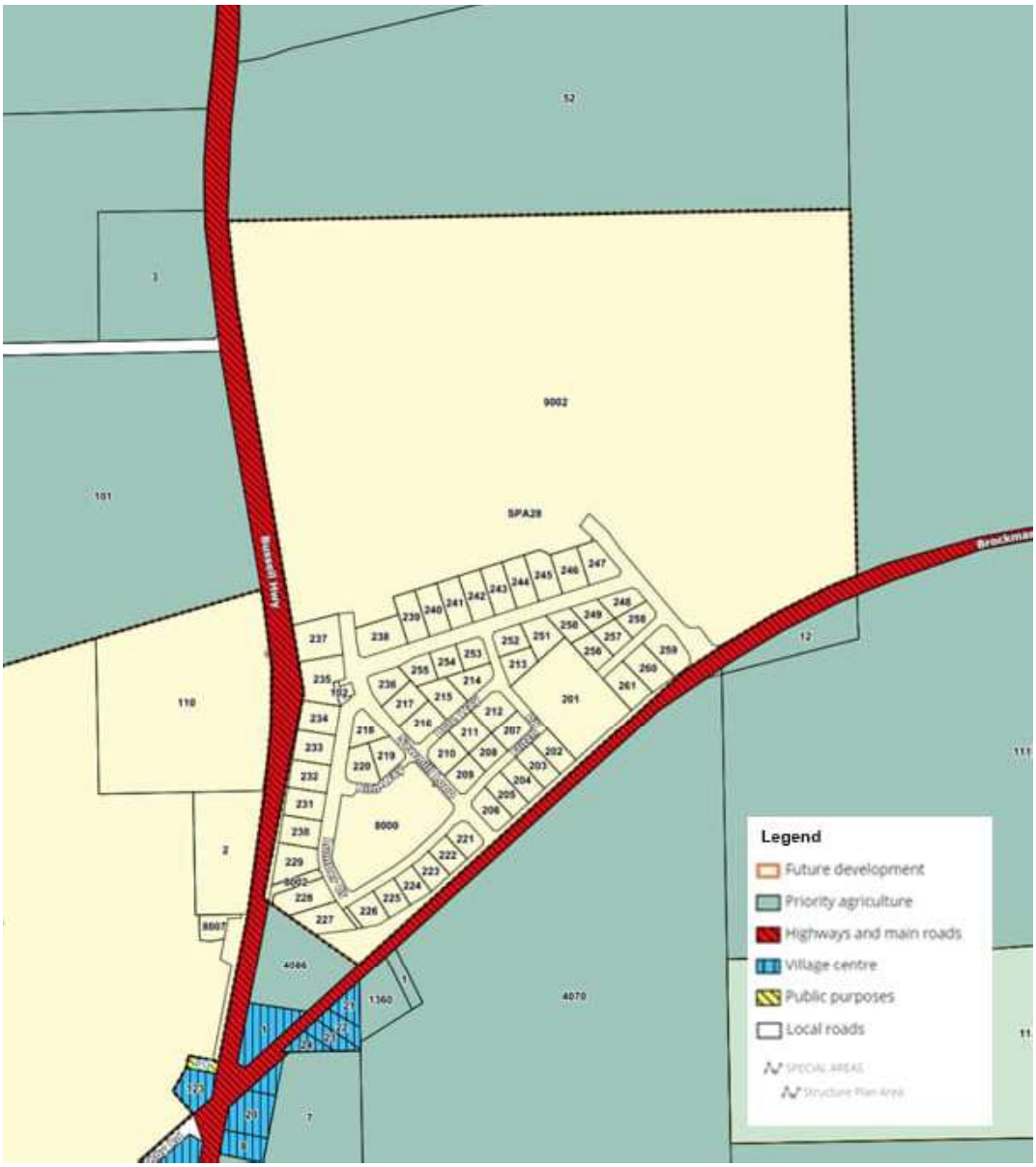
1.3 Planning Framework

1.3.1 Zoning and Reservations

1.3.1.1 Shire of Augusta-Margaret River Local Planning Scheme No.1

In 2014 the Shire of Augusta Margaret River Local Planning Scheme No. 1 was amended to rezone the entirety of the Site from 'Priority Agriculture' to 'Future Development' (Amendment No. 19) (Figure 2).

Figure 2: Zoning



As part of this Amendment, the Site was introduced into Schedule 15 – Structure Plan Areas of the Local Planning scheme as "SPA 28". The effect of including the Site in Schedule 15 was to ascribe the parameters, and facilitate the statutory adoption, of a structure plan enabling the subdivision and development of the land as described in the following table.

Shire of Augusta Margaret River, Local Planning Scheme No. 1. Schedule 15 Extract

Land Use Expectation	Matters to be Addressed in Structure Plan	Associated Provisions
Orderly and proper expansion of the Karridale Townsite to be generally in accordance with the Karridale Hamlet Settlement Strategy	The following issues are to be investigated and methods of resolution/implementation are to be addressed by the Structure Plan: • Provision of sustainable servicing options. • Staging of subdivision. • Preparation of a Local Water Management Plan. • Drainage based on water sensitive design principles. • Protection of remnant vegetation through future development and fire management protection should not compromise the environmental values of this vegetation. • Facilitation of efficient access to commercial development and the community node at Chapman Road. • Buffering to Bussell and Brockman Highways to mitigate visual impact on the function of these roads as travel corridors. • Investigation and preparation of a detailed development contribution Scheme in accordance with the Karridale Hamlet Settlement Strategy. • Preparation of design guidelines to address built form and integrated sustainability measures appropriate to the rural and historic context of Karridale. • Preparation of a comprehensive	1. Land use and development shall be generally in accordance with the approved Local Development Plan. 2. Notwithstanding the Zoning Table and land use definitions within Schedule 1 in the Local Planning Scheme No. 1 a Home Business is permitted to be carried out ancillary to an existing dwelling in a separate building. 3. Within the area identified as 'Rural Residential' on the Structure Plan, Home Based Trade is an 'A' use and is defined as follows: **Home Based Trade** means a business, service or profession carried out in a separate building or on land around a dwelling by an occupier of the dwelling which: i. is located on a property greater than 1.0ha;

	public open space strategy. • Preparation of a detailed fire management planning providing an acceptable mitigation of risk from the threat of wild fire without compromising the integrity of areas of remnant vegetation.	ii. does not employ more than 2 people not members of the occupiers household; iii. will not cause injury to or adversely affect the amenity of the neighbourhood; iv. does not occupy an area greater than 200 square metres; v. does not involve the retail sale, display or hire of goods of any nature; vi. in relation to vehicles and parking, does not result in traffic difficulties as a result of the inadequacy of parking or an increase in traffic in the neighbourhood; vii. does not involve the parking or storing of freezer/refrigerated type vehicles that require the cooling system to be operational; and viii. does not involve the paring of more than one truck for each employee/employer with a total of more than two trucks at any one time.

1.3.2 Planning Strategies and Statutes

1.3.2.1 South West Framework (October 2009)

The WAPC's South West Framework provides a strategic basis towards planning for the coordinated growth for the South-West region until 2029. The framework addresses the scale and distribution of future population growth and housing development in the context of key growth-related issues specific to the region. The Framework provides an overarching basis for local governments in the preparation of more detailed local planning strategies and local planning schemes. This document identifies Karridale

as a settlement with a low current growth rate and medium growth potential similar to Witchcliffe, Cowaramup and Gracetown.

The proposed development is consistent with the identified medium level growth potential for Karridale. As such, the proposed development seeks to provide around 180 large residential lots which is considered to be consistent with the intended manner of expansion, and preservation of the character of the Karridale Townsite. Section 3.4 provides further justification for the proposed Structure Plan lot yield in the context of the expansion of the Karridale Townsite and Karridale Hamlet Settlement Strategy (KHSS).

1.3.1.2 Leeuwin-Naturaliste Sub-regional Strategy (2019)

The Leeuwin-Naturaliste Sub-regional Strategy approved in May 2019 was prepared to ensure that growth and development in this region was well planned and complied with up to date objectives for environment and landscape protection, settlement patterns and the provision of diverse economic opportunities. The Strategy reviewed the settlement hierarchy set out in SPP6.1 with regard to hamlets and enclaves, and reclassified Karridale as a "Village with Enclaves".

The Leeuwin Naturaliste Ridge Statement of Planning Policy (SPP 6.1, refer Section 1.3.1.3 below) states that a Village with Enclaves should have local level commercial and community services with a permanent population of between 500 and 2,000 persons).

1.3.1.3 The Leeuwin-Naturaliste Ridge Statement of Planning Policy (SPP 6.1)

The Leeuwin-Naturaliste Ridge Statement of Planning Policy ("LNRSPP"), originally gazetted in 1998, has provided a broad framework for development of this region and has been implemented through a range of subsequent plans and policies. The SPP identified Karridale as a "Hamlet with Enclaves".

As part of the Policy's intent for the design of settlements, it identifies the following relevant elements which are required to be addressed through structure planning:

- Provision of a range of innovative settlement options to accommodate population growth and ensure a choice of accommodation types,
- Reinforcing and promoting efficient, clustered and minimal-impact forms of development and the use of buffers to avoid coalescence of any settlements,
- Integration with traditional urban character and energy efficiency including solar orientation,
- The use of water sensitive urban design and non-conventional servicing solutions.
- Presumption against clearing of remnant vegetation.
- The identification of Bussell Highway within the Landscape Classes Map (figure 3) as a 'Travel Route Corridor'.

As provided for by SPP 6.1, Karridale will serve as a rural service centre, with a focus for rural living and tourist facilities. Karridale will also be an inland settlement which will absorb 'other residential development', similar to Cowaramup, Witchcliffe and Kudardup. In considering the type of infrastructure provision for a Village such as Karridale, the Structure Plan provides for alternatives methods for water and sewerage provision as detailed in Section 3 of this report.

Figure 3 of SPP 6.1 identifies the Site as bordering a travel route corridor, being Bussell Highway. The

portion of the Site which adjoins the travel route corridor is not classified as being of significance in terms of the rural or natural landscape. As such, the Policy makes no special provisions for the screening and form of development in this locality.

The Policy prescribes that a hamlet should function as a rural service centre with a focus for rural living and tourist facilities. The policy defines a hamlet as a settlement with a permanent population of less than 500 people.

As described above, the 2019 Leeuwin-Naturaliste Sub-regional Strategy effectively reclassifies Karridale as a "Village with Enclaves". A Village is identified by the LNRSPP as the second highest tier of settlement within the policy area and having permanent populations of between 500 and 2,000 persons.

1.3.1.4 Shire of Augusta Margaret River Local Planning Strategy (2017 - Superseded)

The 2017 Local Planning Strategy (LPS) for the Shire of Augusta /Margaret River was originally endorsed by the WAPC in 2011 and subsequently reviewed and endorsed by the WAPC in 2017. It has since been superseded by the 2022 Local Planning Strategy.

The 2017 LPS identified Karridale as a 'hamlet' with a total capacity of 500 persons requiring development of a detailed townsite strategy to guide future development. The Site is contained within the Karridale Hamlet settlement area and was identified as a Development Investigation Area ("DIA - KA2").

The Strategy suggests that a strategic planning exercise to set out the form of expansion of Karridale was to be undertaken, which has been realised in the adoption of the Karridale Hamlet Settlement Strategy (KHSS) in 2011 by the Western Australian Planning Commission (WAPC).

1.3.1.5 Karridale Hamlet Settlement Strategy (2011)

The Karridale Hamlet Settlement Strategy (KHSS) was prepared by the Shire and endorsed by the WAPC in July 2011 to guide future development of Karridale in accordance with the LNRSPP and the LPS.

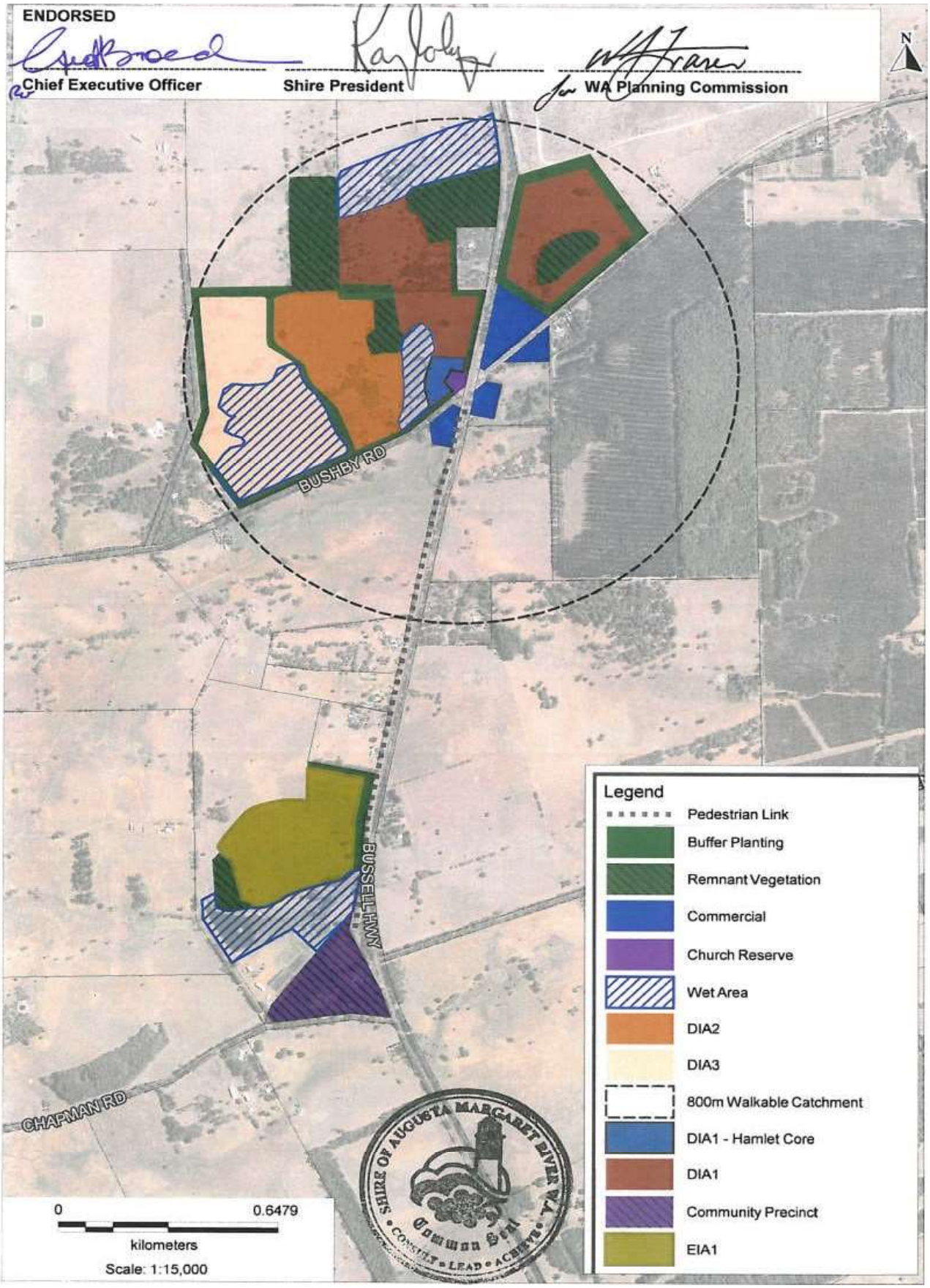
The KHSS identifies DIA 1 to the north of Brockman Highway and Bushby Road. DIA 1 is 19 hectares in total, comprising 10 hectares of land in close proximity to the junction of the Bussell Highway / Bushby Road intersection, a 1 hectare portion identified as 'Hamlet Core' adjacent to the crossroads and Church reserve, as well as the 8 hectare portion of land northeast of the junction of Brockman and Bussell Highway which forms a part of the Site (Figure 3). The western portion of DIA 1 is located within the Structure Plan area known as 'Karridale West', located on the western side of Bussell Highway. Also contained within the 'Karridale West' Structure Plan area are DIAs 2 and 3 in their entirety.

The KHSS has identified an 8 hectare portion of land within the Site which constitutes the eastern portion of DIA 1. The identification of DIA 1 within the Site signifies the suitability of the land and the intention that this site be developed as part of contributing to the expansion of the Karridale settlement.

The Strategy identified the Site as being within DIA1 (Development Investigation Area 1) and required the resolution of several matters at the rezoning and structure plan stages:

- The Site was expected to form the greatest density of development.
- Retention of native vegetation areas identified on the KHSS plan,
- The provision of adequate buffering along Brockman and Bussell Highways to mitigate visual impact.

Figure 3: Karridale Hamlet Settlement Strategy Map.



- Requirement for pedestrian linkages to commercial development and the community node at Chapman Road.
- Adjacent 'wet areas' to be excluded from development.

1.3.1.6 Lot 100 Brockman Highway Local Structure Plan (2014)

Following the gazettal of Amendment No. 19, a Structure Plan for Lot 100 was endorsed by the WAPC. The Structure Plan (Figure 4) and associated documentation comprehensively addressed all relevant matters pertaining to the Site's subdivision and development, including;

- Site conditions and constraints
- The statutory planning framework
- Visual Impact Management assessment
- Local Water Management Strategy
- Vegetation and Flora survey
- DIA Indigenous Heritage inquiry
- Acoustic Assessment
- Sustainability initiatives implementation framework
- Transport assessment; and
- Bushfire Management Plan

The 2014 Structure Plan facilitates the subdivision of the Site into a total of 73 residential lots (63 at R5 and 10 at R2.5), 10 rural residential lots, a public purposes lot (Western Power kiosk), a general agriculture lot and a public open space reserve.

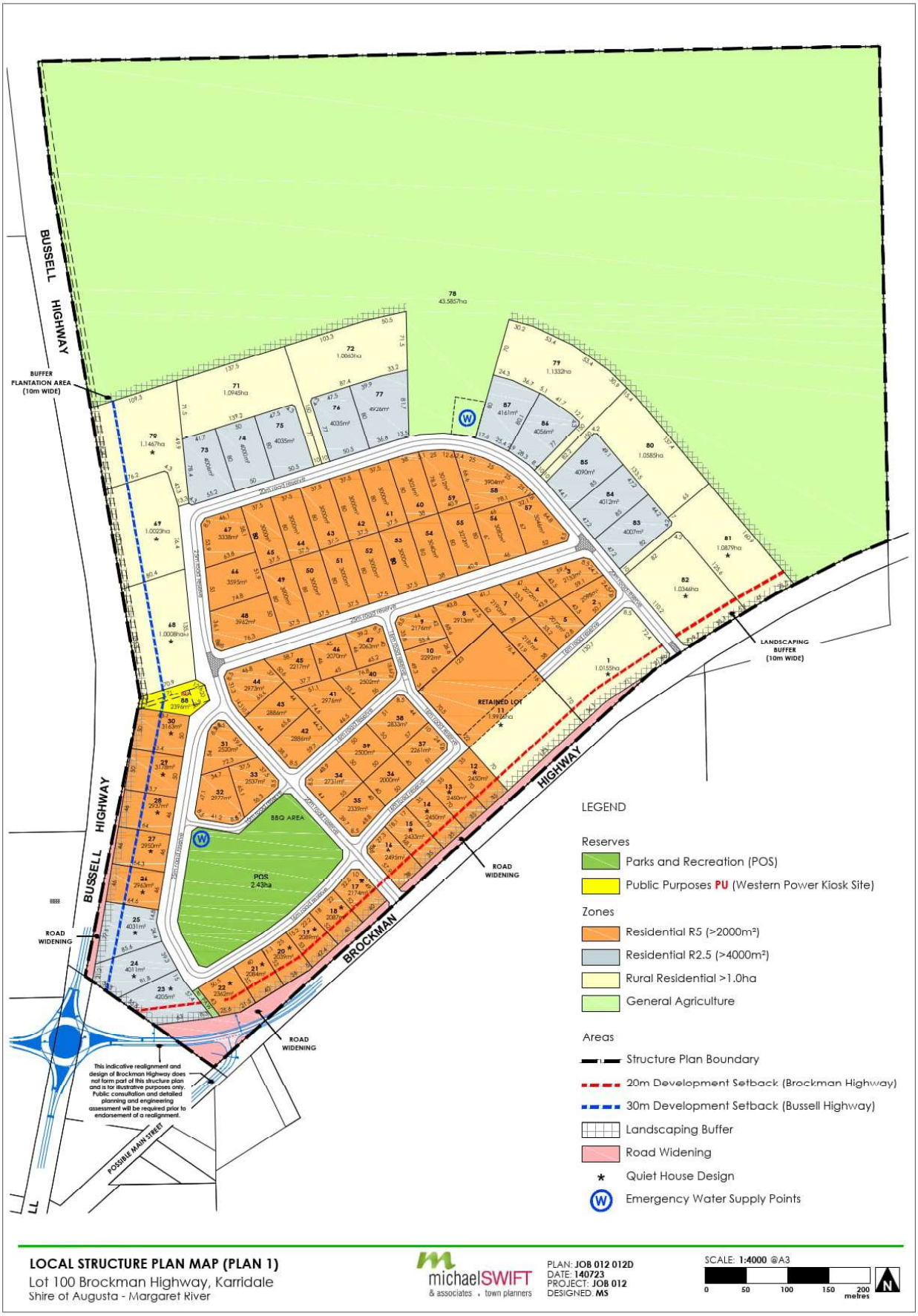
The 2014 Structure Plan has, for all intents and purposes, been implemented, with all the residential lots facilitated by this instrument either already created or under construction.

1.3.1.7 Western Australian Planning Commission Approval to Subdivide. Lot 201 Brockman Highway (Western Australian Planning Commission Ref. 161566).

On 12 January, 2022 the Western Australian Planning Commission issued its conditional approval to subdivide Lot 201 Brockman Highway into 8 lots of around 2,000m^2 in area each. This approval also facilitates the extension of Logging Road from Fitch Road to Sawmill Loop.

This approval is reflected in the Local Structure Plan.

Figure 4: 2014 Local Structure Plan



1.3.1.8 Western Australian Planning Commission Approval to Subdivide. Lot 9001 Bussell Highway (Western Australian Planning Commission Ref. 161814)

The Western Australian Planning Commission's approval to subdivide Ref. 161814 introduced a number of design elements which represent variations to the lot configurations north of Sawmill Loop envisaged by the 2014 Local Structure Plan.

This approval introduces smaller lots on the northern side of Sawmill Loop, eliminates the rural residential battleaxe lots and provides for future road connections to the K3 Planning Precinct (Figure 6).

1.3.1.9 Shire of Augusta-Margaret River Local Planning Strategy (2022)

Endorsed by the Western Australian Planning Commission on January 18, 2022 the current Shire of Augusta Margaret River Local Planning Strategy identifies Karridale as a Village and the Planning Precincts of Karridale as "K1", "K2" and "K3" (Figure 5).

K1 is that area to the west of Bussell Highway the subject of an existing structure plan ("Bushby Rise") and subdivision approval. The Strategy anticipates that the subdivision of Bushby Rise will yield in the order of 77 residential lots.

K2 represents that area of Hamelin Grove currently approved and being developed for residential development and "K3" is the area identified in the 2014 Structure Plan as an agricultural lot of approximately 23 hectares.K1 and K2 are identified in the Strategy as a Current Urban Growth Areas as described below;

Current Urban Growth Area		
Planning Precinct	Precinct Planning Requirements	
K1	**Proposed Land Use:** Residential **Current Zoning:** Future Development **Proposed Use:** Residential R2.5 – R5, Rural Residential, Parks and Recreation	**Development Timeframe:** Medium Term **Structure Planning Status/Required:** Structure Plan Endorsed **Estimated Lot Yield**: 77
	Planning matters to be addressed: Provisions of building envelopes which sit outside anticipated flood levels	
K2	**Proposed Land Use:** Residential **Current Zoning:** Future Development **Proposed Use:** Residential R2.5 – R5, Rural Residential	**Development Timeframe:** Short Term **Structure Planning Status/Required**: Structure Plan Endorsed **Estimated Lot Yield:** 50
	Planning matters to be addressed: Progressive subdivision as per approval.	

Planning Precinct K3 has been identified as Long Term Urban Growth Area, the proposed uses of which are residential to the densities of R5 to R2.5, rural residential and parks and recreation (POS). The anticipated lot yield of K3 is 83 lots, with the proviso that structure planning is required and that subdivision and development will only be supported following the substantial completion of K2 (which has already occurred) and more detailed investigations to the need for a departure from the Karridale Hamlet Settlement Strategy being undertaken, as described below;

Long Term Urban Growth Area		
Planning Precinct	Precinct Planning Requirements	
K3	**Proposed Land Use:** Residential **Current Zoning:** Future Development **Proposed Use:** Residential R2.5 – R5, Rural Residential, Parks and Recreation	**Development Timeframe:** to be investigated **Structure Planning Status/Required:** Structure Plan Required **Estimated Lot Yield:** 83
	Planning matters to be addressed: Subdivision/development will only be supported following the substantial completion of K2 and more detailed investigations into the need for a departure from the Karridale Hamlet Settlement Strategy.	

Figure 5: 2022 Local Planning Strategy – Karridale – Extract

The Strategy suggests that a small area in Karridale has progressed and that growth is anticipated to continue slowly over the planning period (20 years). However, the Hamelin Grove component of Karridale now represents some 96 developed or under construction residential lots, over half of which have been created over the last 3 years.

The last 27 lots that can be implemented under the current structure plan are currently being created and it is anticipated that the current supply of lots available from Hamelin Grove will be exhausted by mid 2024.

1.3.1.10 Rural Hamlet Design Handbook (2009)

The Rural Hamlet Design Handbook formulates design guidelines to inform the planning and development of future settlements, subdivision and buildings in Rural Hamlet Investigation Areas. As outlined in section 1.3.2.3, the subject site is located within DIA 1, and as such the guidelines prescribed within this handbook have been considered and applied where appropriate to the design of this Local Structure Plan to create a sustainable rural development while enhancing and protecting the rural character, amenity and ecological values.

The general design principle of the handbook to cluster smaller lots into areas of low environmental importance is generally adhered to by the Local Structure Plan, with larger rural residential lots only deployed out of necessity to limit any visual impacts associated with the adjoining travel corridors.

The self-sufficiency of the proposal, large lots and transitioning of land use to retain rural ambience in a hamlet atmosphere are key elements of the proposal that demonstrate consistency with the Handbook.

1.3.1.11 Planning in Bushfire Prone Areas (SPP 3.7)

The Local Structure Plan Area is identified as being within a Bushfire Prone Area under the Department of Fire and Emergency Services' online mapping.

State Planning Policy 3.7 (SPP 3.7) provides the foundation for land use planning to address bushfire risk management in Western Australia. It is to be used to inform and guide decision-makers, referral agencies and landowners/ proponents to help achieve acceptable bushfire protection outcomes.

SPP 3.7 applies to all higher order strategic planning documents, strategic planning proposals, subdivision and development applications located in designated bushfire prone areas. This policy also applies where an area is not yet designated as bushfire prone but is proposed to be developed in a way that introduces a bushfire hazard, as outlined in the Guidelines for Planning in Bushfire Prone Areas (WAPC 2015; the Guidelines).

The Policy Objectives of SPP 3.7 include;

- Avoid any increase in the threat of bushfire to people, property and infrastructure. The preservation of life and the management of bushfire impact are paramount.
- Reduce vulnerability to bushfire through the identification and consideration of bushfire risks in decision-making at all stages of the planning and development process.
- Ensure that higher order strategic planning documents, strategic planning proposals, subdivision and development applications take into account bushfire protection requirements and include specified bushfire protection measures.
- Achieve an appropriate balance between bushfire risk management measures and, biodiversity conservation values, environmental protection and biodiversity management and landscape amenity, with consideration of the potential impacts of climate change.

Clause 6.2 identifies those proposals to which the policy measures of SPP3.7 apply. These include Strategic planning proposals within designated bushfire prone areas relating to land that has or will have a Bushfire Hazard Level (BHL) above low and/or where a Bushfire Attack Level (BAL) rating above BAL-LOW apply.

Effectively, where applicable, SPP 3.7 evokes a requirement for planning proposals to meet the recommendations of the "Guidelines for Planning in Bushfire Prone Areas".

1.3.1.12 Guidelines for Planning in Bushfire Prone Areas Version 1.4 (Dec. 2021)

One of the primary purposes of the Guidelines for Planning in Bushfire Prone Areas (the Guidelines) is to provide specifications to be met for the preparation, assessment and implementation of Bushfire Attack Level assessments and Bushfire Management Plans.

The Guidelines specify requirements, inter alia, for access arrangements, water for firefighting purposes, maximum length of culs-de-sac and battleaxe driveways and building standards.

The design elements of Local Structure Plan have been informed by a Bushfire Management Plan (Appendix XX) which has been prepared under the requirements of both SPP 3.7 and the Guidelines.

1.3.1.13 Subdivision Approvals and Implementation

Since the adoption of the 2014 Local Structure Plan, the Western Australian Planning Commission has approved subdivision within the Structure Plan Area enabling the creation of around 100 residential lots and facilitating the ceding of land for road widening and public open space purposes.

Subdivision approval Western Australian Planning Commission ref 161814, issued by the Commission on 23 March 2022, facilitates the creation of the last 27 residential lots that can be created under the 2014 Local Structure Plan.

This approval however, enables the creation of lots of a different size and configuration to those envisaged by the 2014 Local Structure Plan north of Sawmill Loop, in part to reflect contemporary planning requirements, such as the elimination of battle-axe lots, and to facilitate the potential residential subdivision and development of the northern (K3) portion of the Local Structure Plan area by making allowances for future road connections and logical lot size transitions (Figure 6).

1.3.1.14 Local Development Plan

The Local Structure Plan area is subject to a Local Development Plan adopted by the Shire (Figure 7). The Local Development Plan sets out requirements for residential lot development and establishes a legislative framework to ensure that the amenity of the area is maintained to a high standard.

The subdivision and development of the K3 area in accordance with this Local Structure Plan will necessitate the modification of the Local Development Plan to include the new lots into this planning instrument.

It is not anticipated that the inclusion of lots to be created from the development of the K3 area into the Local Development Plan will necessitate any significant or materially structural modifications, or adversely affect the intent or effectiveness of the LDP.

Figure 6: Approved Subdivision Plan – Western Australian Planning Commission Ref 161814

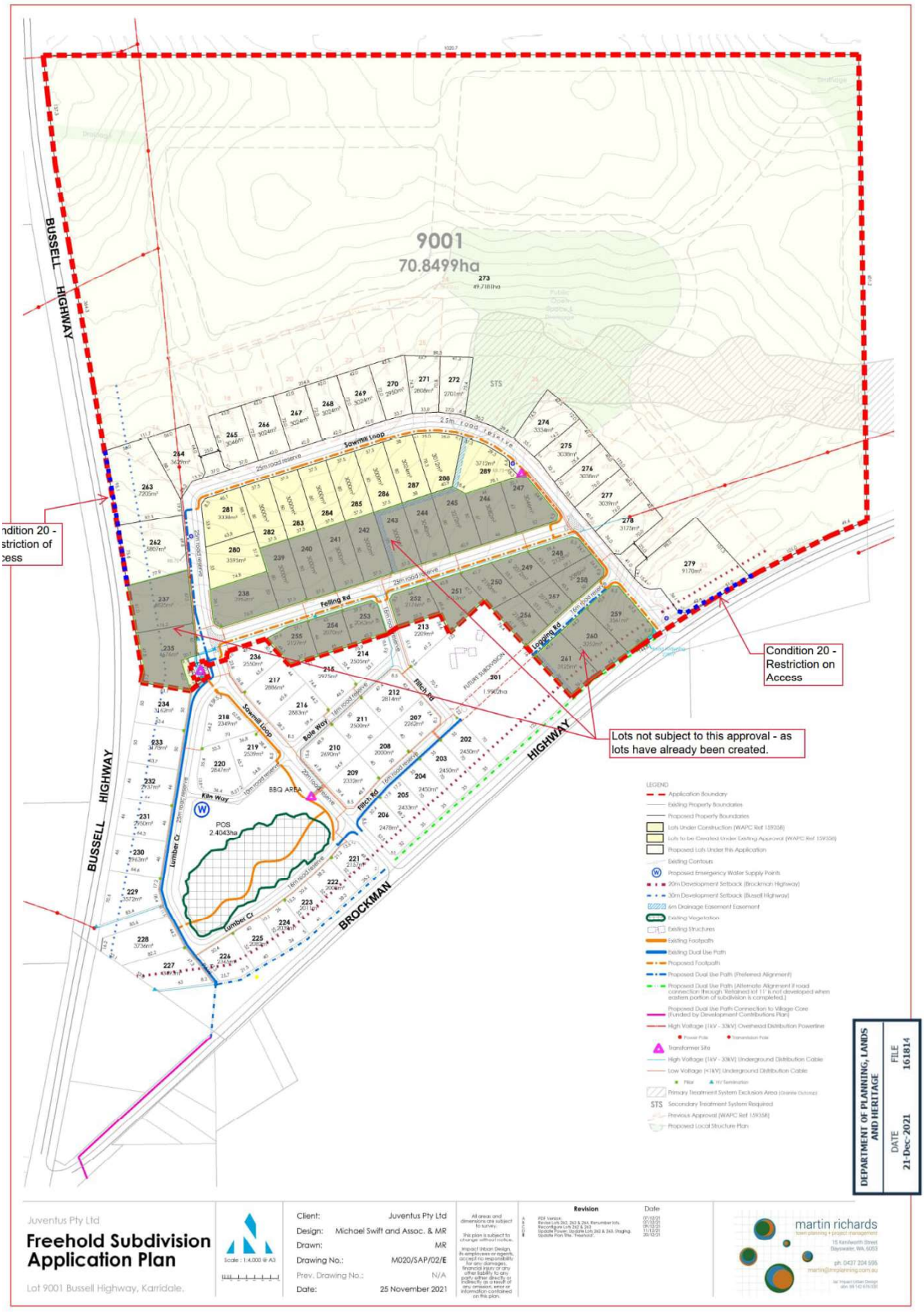
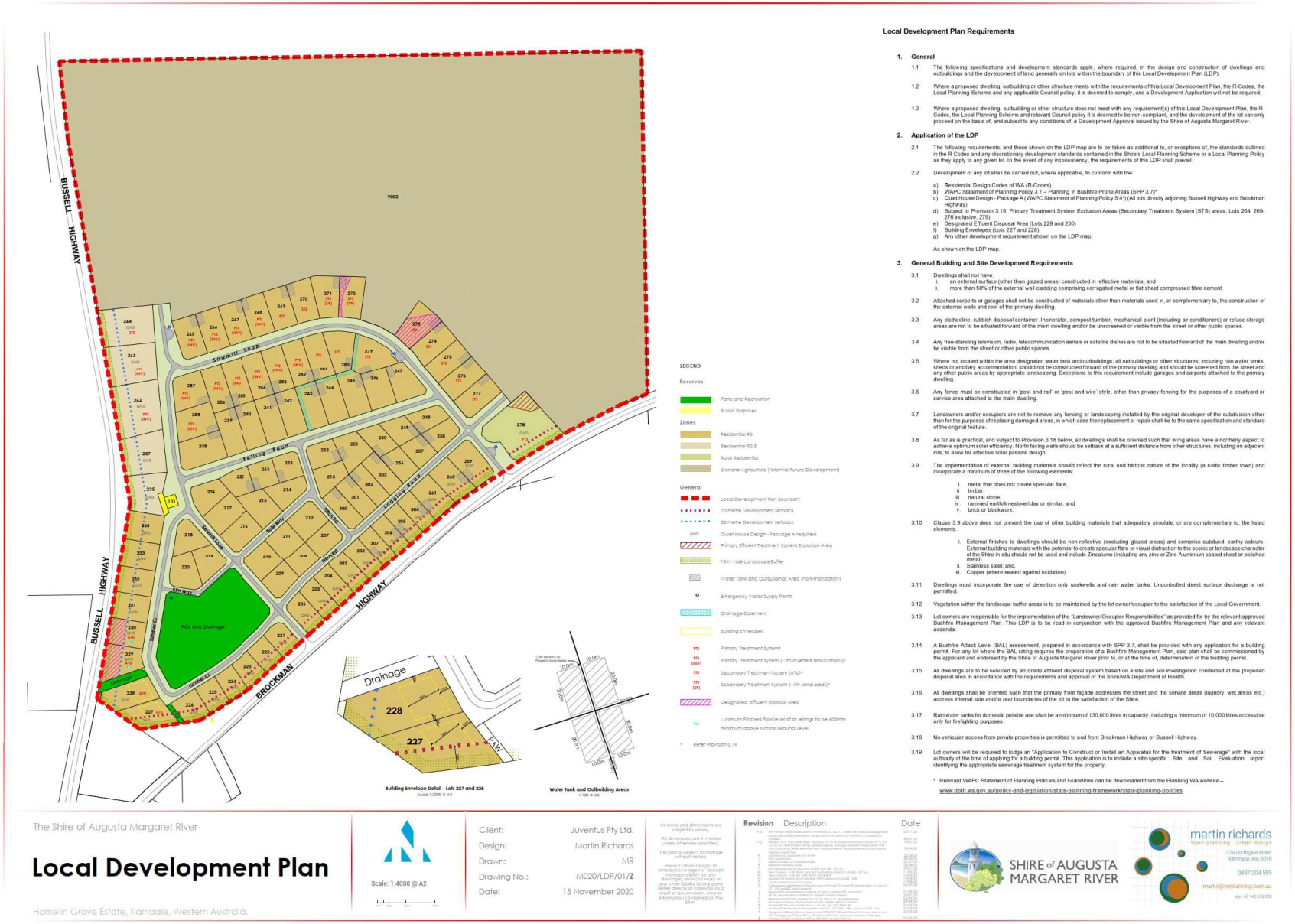


Figure 7: Local Development Plan



2 Site Conditions and Constraints

2.1 Biodiversity and Natural Area Assets

2.1.1 Vegetation

Bennett Environmental Consulting Pty Ltd has been commissioned to undertake a Level 2 survey of the vegetation values present within the Site. The findings of these investigations have been detailed in a flora report which is included as **Appendix D**.

Given the previous land uses of the Site which include clearing for the purposes of cattle crazing and commercial tree plantations, only a portion of land in the south-west of the site remains as remnant vegetation. The remnant portion of vegetation is identified as a tall forest of Eucalyptus marginata subsp. marginata and Corymbia calophylla over a low woodland of Agonis flexuosa var. flexuosa. The survey confirmed there are many dense and tall Jarrah and Marri trees with an understorey which has mainly been replaced with weed species. The vegetation condition for the remnant vegetation has been classified as 'Degraded' as per the Keighery (1994) Vegetation Condition Rating scale. Although the 'Degraded' condition of the remnant vegetation is reflective of previous disturbance, this vegetation is worthy of retention given the existence of tall Jarrah and Marri species. As such, this area of remnant vegetation has been preserved as a 2.5 hectare area of public open space, which has been reserved under the Scheme and ceded to the Crown and vested in the local authority.

The commercial plantation in the north of the Site has been harvested since the preparation and adoption of the 2014 Local Structure Plan. The K3 area is consequently entirely devoid of significant vegetation, and certainly native vegetation. During the Level 2 survey, undertaken whilst the plantation was in situ, however, no threatened or priority flora was recorded within the Site.

Measures to ensure the identification, protection and long term management of stands of remnant vegetation shall be addressed by way of a condition in the Structure Plan.

The potential for the smaller remnants and individual trees to be kept as is within the proposed large lots has also been retained as per the sustainability matrix.

2.1.2 Fauna

In addition to a survey of the Site's floristic values, a Level 1 fauna survey and targeted assessment of the Site's significance to threatened species was also undertaken as part of the preparation of the 2014 Local structure Plan. The fauna assessment revealed the presence of habitat potentially suitable for several threatened species listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999), namely three species of black cockatoo. This habitat is identified as the portion of remnant vegetation in the south of the Site retained and previously reserved and ceded as public open space. The detailed findings of the fauna investigations, along with recommendations aimed at mitigating and reducing potential impacts on fauna and fauna habitat are provided within **Appendix E**.

2.1.3 Environmentally Sensitive Areas

Findings from the Fauna and Flora investigations undertaken over the Site have indicated that there are no environmentally sensitive areas with the Structure Plan Area.

2.2 Landform and Soils

2.2.1 Soil Types and Topography

Records from the Geological Survey of Western Australia (2001) indicate that the geology of the Site is derived from the Cowaramup Complex (CoC), with loose deposits of rock which have been influenced by gravity at the base of a slope (colluvial) with undivided slopes and gravelly silty sands (refer to **Figure 2** of **Appendix C**).

The Site lies within the hyper humid southwest geographic region (Margaret River) with landforms related to the Cowaramup System (Cw1 and C1) (Mattiske and Havel, 2005). The landform of this system is characterised by low hills with gently to moderately inclined slopes and swampy drainage depressions.

The Site contains gentle slopes, with no part of the Site having a gradient of greater than 1:10.

As such there are no major topographical hindrances to subdivision or development within the Local Structure Plan area. The gentle sloping topography of the Site and associated soils characteristics are deemed to be suitable for the proposed development. Further information regarding soil permeability and phosphorous retention is provided in **Appendix D**.

2.2.2 Acid Sulphate soils

Analysis of the Department of Environment and Conservation (DEC) acid sulphate soil risk map identified an area within the Site as having a 'Moderate to Low Risk'. Additionally, a review of the Australian Soil Resource Information System (ASRIS) national maps of acid sulphate soil risks indicated the Site is within an area of 'Extremely Low Probability of Occurrence' of acid sulphate soils occurring generally at depths of more than 3 metres. The ASRIS information was supported by the acid sulphate soil risk mapping for the Lower South West (Landgate, 2012) which indicates that there is a 'moderate to low risk' of acid sulphate soils occurring within 3 metres of ground surface of soil type Cw1 (refer to **Figure 2** of **Appendix C**). The presence of soil type Cw1 within the Site is limited to relatively small portion of land in the east of the Site. The nature of development proposed involves negligible excavation and/or use of retaining walls. Also, lot sizes are sufficient for development to avoid the minor areas of mapped ASS risk. The Site is predominately classified as soil type C1 which does not have an associated ASS risk.

2.2.3: Land Capability

Desktop and on-site analysis of the Site's soil and landform characteristics has enabled the assessment of the Site's land capability as per the requirements of the guidelines for Land Capability Assessment (WAPC, 1989) for the proposed large lot residential land use. Such an assessment of the Site's land capability has taken into account the criteria contained in Table 5.

Table 5: Criteria Assessed in Determining Land Capability.

Ease of excavation.	Clayey soils are likely to be difficult to work under wet conditions.
Foundation stability.	High capability for all soils, subject to geotechnical investigations.
Phosphorus export risk.	Soil type Cw1 has a moderate risk of phosphorus export due to shallow soils.
Wind erosion hazard.	Low to moderate risk for C1 and no risk for Cw1.
Acid Sulfate Soils (ASS) within 3 metres of ground surface.	Moderate to low risk for Cw1 and no risk for C1.
Water pollution hazard.	Low or no risk with use of ATUs and appropriate irrigation areas.

The site conditions suggest that there are no waterlogging hazards, water erosion hazards, soil salinity risks or flood hazards. Generally, the Site is considered as capable of supporting residential development. This capability is enhanced because of the large lot sizes which are proposed (2,200m² to 2ha) and the ability to utilise ATUs where necessary.

2.3 Groundwater and Surface Water

A Local Water Management Strategy has been prepared for the subject site and is attached as **Appendix C.**

2.3.1 Surface Water and Wetlands

There is an ephemeral water course which occurs in the mid north-eastern portion of the Site (refer to **Figure 3** of **Appendix C**). A test pit dug in this area indicates that water is perching on granite and is being expressed at ground surface during wetter months when the rainfall rate exceeds the infiltration capacity of the soil profile. The water course is associated with landform Cw1 and does not extend to the valley floor. This area has been identified on the Local Structure Plan as "STS", excluding the use of primary effluent treatment systems within this area.

A dam has been constructed on the valley floor in the south west of the property and currently supplies water for cattle. This dam will be in- filled as part of the subdivision works for the Site.

There is a dampland (seasonally waterlogged basin) on Lot 4070 Brockman Highway to the south east of the Site (refer to Figure 3 of **Appendix C**). A site inspection undertaken by Aurora Environmental indicated that the Brockman Highway drainage system prevents direct drainage into the wetland from the Site.

There is also a paluslope wetland (seasonally inundated slope) on Lot 52 Bussell Highway to the north of the subject. The Geomorphic Wetland mapping indicates that this wetland extends onto the subject land. However, a site inspection confirmed that the wetland is confined to Lot 52.

There are no Environmental Protection Policy (EPP) wetlands within the Site. There are also no Public Drinking Water Source areas in the vicinity. Under the *Rights in Water Irrigation Act 1914,* the southern portion of the Site is within the proclaimed Cape to Cape South Surface Area and the north eastern portion is in the proclaimed Lower Blackwood River Surface Water Area. In proclaimed areas, a licence is required to use water from watercourses.

2.3.2 Hydrology and Groundwater

The hydrology of the subject land has been described by Mattiske and Havel (2005) as follows:

- Soil type C1: Mildly water shedding with good infiltration and storage capacity except in minor depressions where there is seasonal waterlogging; and
- Soil type Cw1: Water gaining, seasonally waterlogged with poor lateral and internal drainage.

The Site is within the *Rights in Water and Irrigation Act 1914* proclaimed Blackwood Groundwater Area and the eastern portion of the Cape to Cape South subarea. The groundwater associated with Management Area 12, located four kilometres to the west of the subject land, is managed to protect the values of cave systems and coastal vegetation. A licence is required to use groundwater in this area. The geology of the eastern part of the Cape to Cape South sub-area, comprises of fractured rock aquifers, where the rock body is solid and groundwater storage and movement can occur only along fractures in the rock,

which are usually relatively limited and in most instances, not well connected. Furthermore, groundwater conditions are highly variable, the yields are generally low and salinity may be up to 4000mg/L. As such, it is uncertain whether a sustainable groundwater resource may be utilised from the fractured rock aquifer due to its irregular nature and recharge.

Site investigations indicate that water is likely to perch on impermeable horizons such as granite, laterite and clay. The area associated with landform Cw1 has shallow soils and perched water is expressed at the ground surface in wetter months. The rest of the Site has sufficient depth to impermeable layers so that groundwater is generally not expressed at the ground surface.

The Site does not contain significant 'minor depressions' as adjacent properties do, so extended ponding of water is not likely to occur. Further information regarding groundwater levels is provided within **Appendix C.**

2.4 Bushfire Hazard

A Bushfire Management Plan is already in place for the Local Structure Plan Area.. A Bushfire Management Plan to reflect the interim and final land uses as proposed has been prepared and is attached as **Appendix J.** The plan will be implement prior to subdivision of the subject site.

2.5 Heritage

A review of the Department of Indigenous Affairs Aboriginal Heritage Inquiry System has revealed that there are no registered aboriginal heritage sites or other heritage places recorded within the Site. (**Appendix F)**.

2.6 Acoustic Assessment

An acoustic assessment was undertaken for the Structure Plan area and included within **Appendix G** of this report. As part of the study, the following was carried out:

- Monitoring of exiting noise received from vehicles travelling along both Bussell and Brockman Highways;
- Determination of noise levels for future traffic flows; and
- Assessment of the predicted noise levels for compliance with the appropriate criteria.

Based on the assessments undertaken noise received at the first row of residence along both the Bussell and Brockman Highways would comply with the Western Australian Planning Commission Planning Policy 5.4 'Noise Limits', but would exceed the 'Noise Target.' As such the requirements of Package A Quiet House Design will be required for these lots.

Covenants and Memorials on Titles will be placed on lots adjoining Bussell Highway and Brockman Highway to require that dwellings be constructed with Quiet House Design standards and to alert purchasers to the exposure to traffic noise.

Noise mitigation measures should be implemented by the developer, where appropriate, to minimise outdoor

noise levels. In this regard the Structure Plan proposes vegetated buffers and setbacks along the Bussell Highway and Brockman Highway frontages in addition to the recommendations of the acoustic assessment.

It should be noted that this assessment did not examine the impact of the expected lowering of traffic speeds in the area as a result of development, and therefore represents the worst case scenario.

2.7 Context and other Land Use Constraints

Existing above ground power lines traverse the Site east-west and north-south. These powerlines have been progressively relocated underground as part of subdivision works associated with the completed stages of the Hamelin Grove Estate.

The existing Western Power Kiosk has been retained on its own standalone lot (Lot 101). Appropriate screening will also be provided to ensure that there are no visual impacts..

An opportunities and constraints analysis was undertaken for the subject site as part of the Structure Plan design process (Figure 8).

Figure 8: Opportunities and Constraints Plan

3 Land Use and Subdivision Requirements

3.1 Land Use

The Local Structure Plan facilitates a total of around 170 large residential lots which vary from 2,000m² to 2 hectares in size. Of these 170 or so lots, 60 have been created and sold and a further 27 are under construction.

The balance 83 or so lots will be created from the subdivision of the area identified as K3 in the Shire's Local Planning Strategy, essentially being the "General Agriculture" lot of the 2014 Local Structure Plan.

The proposed residential development is consistent with SPP 6.1, the Leeuwin-Naturalist Sub-regional Strategy (which identifies Karridale as a "Village"), the Shire's Local Planning Strategy and the KHSS as it seeks to contribute to the planned expansion of the Karridale Settlement. As such, the intention for the future development of the Site is expressed in the identification of the "general Agriculture lot of the 2014 Local Structure Plan as a planned growth area (K3) in the Shire's Local Planning Strategy.

This Structure Plan report and accompanying documentation provides justification as to the suitability of the land for development, in terms the Site's landform characteristics, absence of limiting environmental constraints, demonstrated low risk of detrimental environmental impact and proximity to existing Townsite and facilities. Given this, the proposed development is considered to be a logical extension of the Karridale settlement and will provide a reasonable proportion of the eventual population of 500 to 2000 people associated with the intended Village settlement.

The Local Structure Plan map (Figure 9) is the authoritative document in relation to proposed land uses and conditions attached to subdivision and development. In the event of an inconsistency between the LSP map and any other map contained in the LSP documentation (which might occur due to the iterative process undertaken to formulate the proposal) the LSP map prevails to the extent of that inconsistency.

3.1.1 Visual Impact Assessment

A Visual Impact Management Assessment was undertaken to examine the visual landscape qualities of the subject site, in order to inform the 2014 Local Structure Plan. Attached in **Appendix B** is a copy of the Visual Impact Management Assessment.

Statutory Environment

The Shire of Augusta Margaret River Local Planning Strategy identifies and maps Visual Management Control areas and sets out applicable policies (Appendix 2 of the LPS). It identifies the Site as falling partially a "Travel Route Corridor (road)".

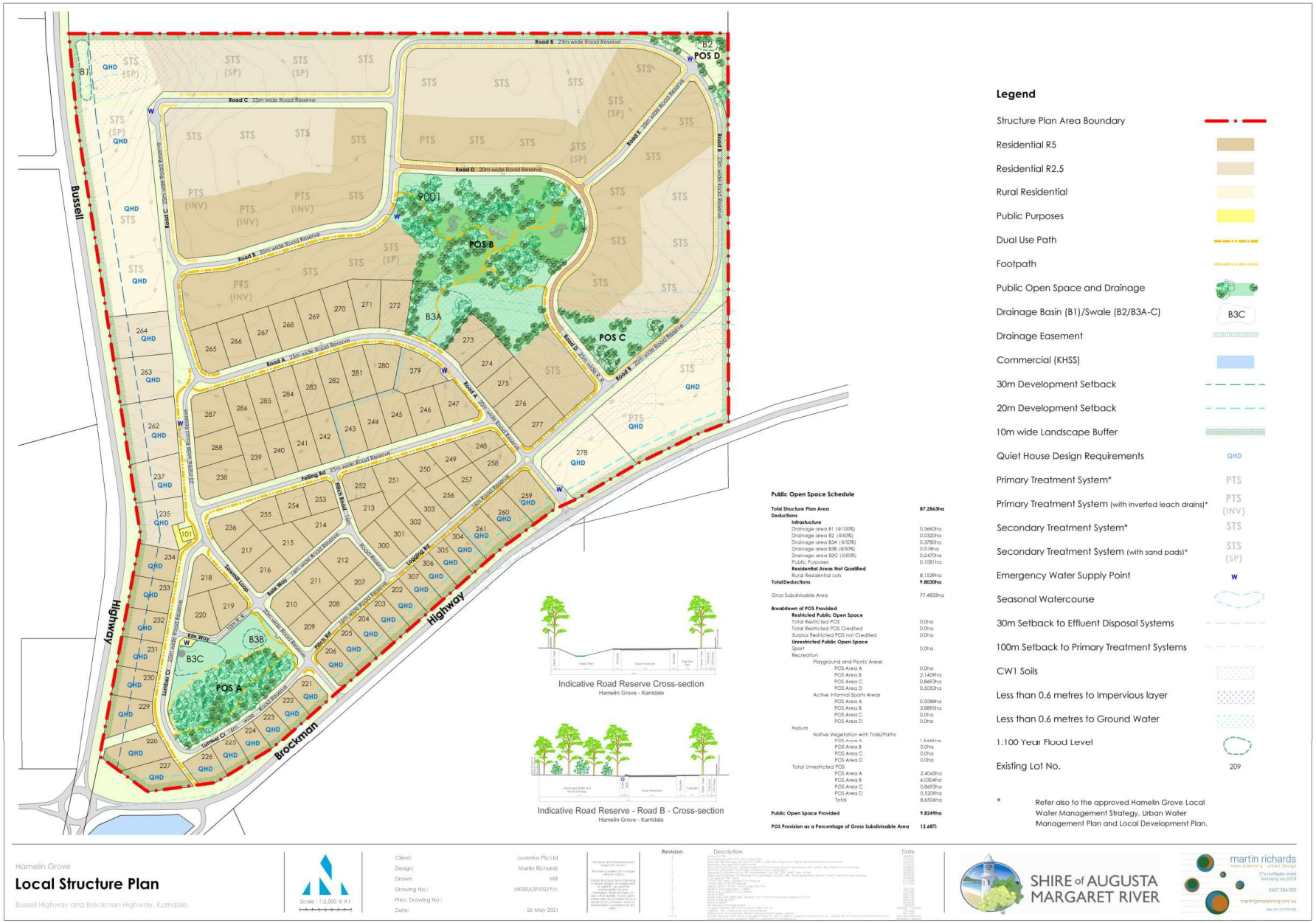
The Local Structure Plan area is not within areas identified by the Local Planning strategy as being visually sensitive or as having natural or rural landscape significance.

In terms of Policies, the Local Planning strategy requires that where corridors intersect with Landscape Qualities of Natural Significance, the existing natural aesthetic is to be maintained, and where corridors intersect with Landscape Qualities having Rural Significance, development or change of use should protect the rural character of the area.

The Travel Route Corridor as it relates to Bussell Highway and Brockman Highway adjacent the Local Structure

Plan area does not intersect with any Rural or Natural Landscape Quality of Significance as identified by the Local Planning Strategy, and accordingly the policy requirements of Appendix 2 of the LPS.

Figure 9: Local Structure Plan



The Local Structure Plan provides for visual impact mitigation to both highways in the form of substantial vegetation buffers of 10 metres in width within property boundaries, and within the road reserve along the eastern and northern boundaries of the Structure Plan area.

These buffers have been successfully implemented in the completed stages of the Hamelin Grove Estate and have proven to be effective in both screening residential development from the travelling public and providing an attractive backdrop to the estate itself.

Given the effectiveness of the existing buffers, the modified Local Structure Plan proposes to continue the implementation of the vegetated buffers to Bussell and Brockman Highways, as well as to the rural properties to the north.

Context

The Structure Plan Area is situated to the north of the Karridale townsite, which is a small rural centre comprising a general store/post office, farm supplies outlet and tavern, bottle shop and roadhouse. The townsite is approached via the Bussell and Brockman Highways and Bushby Road.

The Structure Plan area is not readily visible from any other notable point of public interest, particularly in the near or mid field.

The Structure Plan area is not elevated in the landscape, nor does it have any intrinsic visual interest.

Movement to and from Karridale is almost exclusively by vehicle.

Accordingly, any visual disturbance of concern would be experienced by motorists on the highways, particularly on the approaches from the north on Bussell Highway and from the east on Brockman Highway.

As of June 2024, the speed limits on Bussell Highway north of Brockman Highway are 70km/h for approximately 500 metres, whereafter the speed limit is 110km/h. The speed limits on Brockman Highway are 70km/h for approximately 1.2 kilometres east of Bussell Highway, and thereafter 110km/h.

The Bussell Highway road reserve adjacent the Structure Plan area is well vegetated, with the exception of a relatively small (around 40 metres) opening at the northern extremity of the Structure Plan area. The speed limit approaching and adjacent to this opening is 110km/h.

Approaching the Structure Plan area, vegetation within both the Bockman Highway and the McDonald Road road reserve screens views to the Structure Plan area. West of McDonald Road, the Structure Plan area is exposed across the pastural property adjoining the Structure Plan's eastern boundary to motorists westwards bound. The speed limit on the 800 metre stretch of Brockman Highway from which the K3 area of the Structure Plan area is exposed is predominantly 110km/h.

Both Highways experience relatively low traffic volumes. In the vicinity of the Bussell Highway/Brockman Highway intersection, Bussell Highway experiences 1802 vehicles per day ("vpd") and Brockman Highway 758vpd. Assuming north/south (Bussell Highway) and east/west (Brockman Highway) destinations can be distributed equally, 900 vehicles from the north on Bussell Highway and 380 vehicles from the east on Brockman Highway, per day, will be potentially impacted by any visual interruption resulting from the urban development of the Structure Plan area.

The K3 portion of the Structure Plan area was previously occupied by a Blue Gum plantation, which is not

endemic and, as a monoculture, has very little visual interest.

The permissible density of development is low. With a minimum lot size of 2,000 square metres, scaling up to 10,000 square metres and beyond, the ratio between development and open space/potential landscaping is very high, in landscaping's favour.

Analysis

Any potential visual impact of the urban development of the Structure Plan area will be by motorists, travelling at relatively high speeds, from the north via Bussell Highway and from the east via Brockman Highway.

With the exception of a relatively small window into the Structure Plan area from the northern approach of Bussell Highway, there is little scope for significant visual impact from this thoroughfare. Any view from Bussell Highway into the urban area will be filtered and fleeting.

The Structure Plan area's exposure from the east on Brockman Highway is more prolonged, and less filtered, albeit to far less travelers (900vpd (assumed) on Bussell Highway compared to 380vpd (assumed) on Brockman Highway).

Vehicular speeds where visual impacts are most likely to be of concern are relatively high. Any visual impacts to motorists are therefore likely to be fleeting.

As an element of Karridale's townsite, the urbanisation of the Structure Plan area can be an anticipated , albeit filtered, component of the landscape.

Mitigation

The vehicular approach to a settlement should provide a variety of sensory cues that the traveler is moving into a more intensively developed area to that of the rural countryside that precedes it. This will include reduced speed limits, signage, and increasing glimpses of urban development, encouraging more pedestrian friendly driver behavior until the town centre itself is reached.

The preceding analysis has demonstrated that any visual impact resulting from the urbanisation of the Structure Plan area need focus primarily on the eastern approach from Brockman Highway and the small, fleeting gap in existing vegetation adjacent to Bussell Highway.

However, a more robust approach is adopted by the Structure Plan, by which existing elements of visual impact mitigation are further complimented with additional measures. These include:

> <u>Remnant Bushland and Trees</u>

Retention of the few significant stands of remnant bushland provides visual and physical amenity, screening and habitat. The most significant stand of trees is retained within the existing public open space (POS A).

Scattered trees are a feature of the landscape of the Local Structure Plan area, but not within the K3 area, which has been previously cleared. Those existing trees that remain healthy should be retained wherever possible. With the caveat of ensuring that bushfire risk is minimised, future planting could emulate the character of scattered tree planting on open land, and domestic planting around houses

in the manner of traditional farm houses.

> Tree-lined Roads

The western boundary of Lot 100 with Bussell Highway is for the most part heavily tree lined, with a significant amount of the growth being within the road reserve. This has been, and will be augmented, by additional planting within the buffer areas, using similar species.

The Brockman Highway approach and eastern boundary is far more open, however rehabilitation of the buffer areas will minimise the impact of new development on the landscape.

Tree planting as part of subdivisional works within the internal roads will assist to bring this character into the Site, although the open pasture feel of the interior of the Site should not be compromised by excessive planting.

The Structure Plan for the K3 area advocates road reserve widths, typically 25 metres, capable of readily accommodating street trees on both sides of the carriageway.

> Views to Leeuwin Naturaliste Ridge

Long views to the Ridge from Brockman Highway along the eastern parts of the Site boundary and from some elevated parts of the Site are available as a result of the openness of the Site. Tree planting along the perimeter of the Site, and/or within the Site, will potentially filter or obscure this view, therefore care should be taken in to locate any dense tree planting or screening that may be proposed to preserve view corridors.

The landscape characteristics that have been identified in the Visual Impact Management Assessment can be augmented to provide a living environment with a sense of place that is compatible with the character of the surrounding area.

> Peripheral Planting – Private Lots and Road Reserves

The Structure Plan advocates the establishment, as part of subdivisional works, of 10 metre wide buffer areas along the entirety of periphery of the Structure Plan area. These areas are the subject of a Landscape Management Plan prepared and implemented by the subdivider and comprise of native species which compliment the existing vegetation within the Bussell and Brockman Highways' reserve and which possess excellent screening qualities.

Where private property abuts the external boundary of the Structure Plan area, the buffer planting is accommodated within the individual lots, the ongoing maintenance requirements undertaken by the lot owners and occupiers.

Where internal roads are aligned adjacent to the Structure Plan area boundaries, the buffer is to be incorporated into the road reserve with maintenance being undertaken by the local authority following establishment by the subdivider.

The maintenance of the buffer areas within private lots is enforced by the local authority through the Local Development Plan as adopted by the Shire of Augusta Margaret River.

As of June 2024, these buffer areas have been successfully implemented for Stages One and Two of the Hamelin Grove Estate and have proven very effective in screening the built urban environment from the Bussell and Brockman Highways.

> Transitional Lot Sizes

Further mitigating potential visual impact from the transport corridors, the Local Structure Plan advocates larger, rural residential lots (1 hectare +) within the K3 area, adjacent the highways, transitioning to smaller lots as the townsite approaches.

> Internal Planting – Public Open Space

The internal Public Open Space Areas will be the subject of landscaping initiatives implemented in accordance with approved Landscape Management Plans anticipated to be required as conditions of subdivision. The establishment of these initiatives will further mitigate any visual interruption not screened by the peripheral buffer areas, particularly on the approach from Brockman Highway.

> Internal Planting – Private Lots

The planting and maintenance of trees, shrubs and bushes as part of inevitable landscaping initiatives undertaken by private property owners and occupiers will further mitigate any visual impact resulting from the building of houses and outbuildings within the Structure Plan area.

3.2 Sustainability Initiatives

Appendix H provides the sustainability initiatives and implementation framework for the Site which presents a number of key sustainability elements such as water usage, energy consumption, biodiversity conservation and affordability. These sustainability initiatives for the Site have either informed the Local Structure Plan design or will be considered at the development stage. The framework designates responsibility for the implementation of the initiatives and provides advice as to how to achieve the measures.

3.3 Public Open Space

The Local Structure Plan makes provision for a 2.4043 hectare area of public open space located in the south western portion of the Site. The public open space area conserves 1.5 hectares of remnant vegetation and provides community amenities in the form of a landscaped barbeque area. The open space is strategically located in close proximity to the Karridale town centre and existing facilities, and is adjacent to the proposed Village Consolidation Precinct. As such, the public open space area together with the Village Consolidation Precinct will enhance the existing town centre and provide an attractive entrance to the proposed development from the primary access point off Brockman Highway. The location of the public open space also allows for convenient walkable access for residents with the majority of the proposed lots located within 400 metres of the open space, with no lot greater than 800 metres in distance.

As provided for in **Appendix H**, rehabilitation of the remnant vegetation within the public open space area will be undertaken which will incorporate the planting of native species where appropriate. The rehabilitation of the public open space area will be undertaken by the proponent with management of the area vested in the Shire of Augusta-Margaret River.

Public Open Space is to be provided in accordance with Table 6 – POS Schedule below. The Schedule has been prepared in accordance with Table 17 of (Draft) Liveable Neighbourhoods 2015. A total of 8.3237 hectares has been provided for, which equates to 10.75% of the gross subdivisible

Table 6: Public Open Space Schedule.

Calculation of Required POS Provision		
Total Site Area (ha)		**87.2863**
Deductions		
Infrastructure		
Drainage Area B1 -100%	0.366	
Drainage Area B2 - 50%	0.0245	
Drainage Area B3A - 50%	0.245	
Drainage Area B3B - 50%	0.0435	
Drainage Area B3C - 50%	0.162	
Western Power Kiosk - 100%	0.1081	
Rural Residential Area - 100%	8.1539	
Total Deductions	9.103	
Total Deductions		**9.103**
Gross Subdivisible Area (total area minus deductions)		78.1833
Required Public Open Space		**7.81833**
Breakdown of POS Provided		
Restricted Public Open Space		
Nil	0	
Total Restricted POS	0	
Total Restricted POS Credited to a maximum of 20%		0
Surplus Restricted POS Not Credited	0	
Unresticted Public Open Space: by function		
Sport	0	
Recreation		
POS A - Parkland*	0.2203	
POS A - Native vegetation and walk paths	1.5445	
POS B - Parkland and walk paths*	1.8959	
POS B - Active informal sports area	3.8895	
POS C - Parkland	0.8693	
POS D - Parkland*	0.4964	
Nature	0	
Total Unrestricted POS	8.9159	**8.9159**

Calculation of Required POS Provision		
Total Site Area (ha)		**87.2863**
Deductions		
Infrastructure		

Drainage Area B1 - 100%	0.366	
Drainage Area B2 - 50%	0.032	
Drainage Area B3A -50%	0.378	
Drainage Area B3B - 50%	0.518	
Drainage Area B3C - 50%	0.247	
Western Power Kiosk - 100%	0.1081	
Rural Residential Area - 100%	8.1539	
Total Deductions	9.803	
Total Deductions		**9.803**
Gross Subdivisible Area (total area minus deductions)		77.4833
Required Public Open Space		**7.74833**
Breakdown of POS Provided		
Restricted Public Open Space		
Nil	0	
Total Restricted POS	0	
Total Restricted POS Credited to a maximum of 20%		0
Surplus Restricted POS Not Credited	0	
Unrestricted Public Open Space: by function		
Sport	0	
Recreation		
POS A - Parkland	0.9282	
POS A - Native vegetation and walk paths	1.4761	
POS B - Parkland and walk paths	4.3715	
POS B - Active informal sports area	1.6589	
POS C - Parkland	0.8693	
POS D - Parkland	0.5209	
Nature		
Total Unrestricted POS	9.8249	**9.8249**
Total Unrestricted POS		9.8249
Total		**9.8249**
POS Provision as Percentage of Gross Subdivisible Area		**12.68002**

area (after deductions).

Of the POS provided for by the Local Structure Plan, 2.4 hectares has already been ceded to the Crown and vested in the Shire of Margaret River (POS A).

The expansion of the Karridale townsite into the K3 area identified by the Shire's Local Planning Strategy will facilitate the creation of a large (5.9 hectare) centrally located area of open space, to providing for a variety of

recreational opportunities, enhanced amenity and visual relief to not only the future residents of Hamelin Grove, but also to the existing community.

The configuration of the POS creates a highly effective yet passive link between the future stages of Hamelin Grove and the existing residential development. It is anticipated that the POS will be enhanced to incorporate

strategic planting of native vegetation, picnic and "kick-a-bout" grassed areas, playground equipment and interconnected pathways.

The location of the POS within the K3 precinct also coincides with a large area of the Primary Treatment Exclusion Area (STS) area as identified on the Local Structure Plan.

The implementation of the POS enhancement will be subject to a Shire approved Landscape Management Plan, required as a condition of subdivision.

3.4 Residential

The Structure Plan proposes a total lot yield of approximately 170 lots, of which around 85 will be created by the implementation of the Local Structure Plan as it relates to the K3 area. The proposed lot yield for the Local Structure Plan is consistent with the intentions of the Local Planning Strategy which anticipates the K3 area will yield around 83 residential lots.

Consistent with the expectations of the Shire's Local Planning Strategy, the Rural Hamlet Design Guidelines and the KHSS, proposed lot sizes generally increase and densities decrease towards the periphery of the Local Structure Plan area. To this effect, the northern portion of the Site contains areas identified by the Local Structure Plan at densities of R2.5 (4,000m^2 +), with the areas on the highway interfaces transitioning from nearest the town centre from an R5 density to rural residential (1+ hectares).

It is apparent that the contemporary planning instruments, namely the Western Australian Planning Commission's Leeuwin-Naturalist Sub-regional Framework and the Shire's Local Planning Strategy (2022) have moved away from population limits for townsites and settlements in the region.

Whilst the Leeuwin-Naturaliste Ridge Statement of Planning Policy retains suggested population limits for hamlets and villages, the sub-regional framework effectively reclassifies Karridale as a Village, for which the population target under the SPP is 500 to 2,000 persons.

Under the Shire's Local Planning Strategy, the total lot yield achievable at Karridale will be in the order of 210 lots. Assuming an optimistic 2.2 persons per dwelling, the Karridale village could ultimately be expected to accommodate 462 permanent residents, which is well within the 500 person limit envisaged by the KHSS.

3.4.1 Justification (K3 Expansion)

The Local Structure Plan advocates the area identified as a General Agriculture lot in the 2014 Local Structure Plan be subdivided and developed for residential and public open space purposes. As described above, this will facilitate the creation of around 83 additional residential and rural residential lots.

This initiative is entirely consistent with the recommendations of the Shire's recently adopted Local Planning Strategy which identifies the General Agriculture lot as a Long Term Urban Growth Area and as Planning Precinct K3. The Planning matters to be considered under this designation are addressed in Section 4 below.

The identification of the northern portion of the Local Structure Plan area as a General Agriculture lot in the 2014 Local Structure Plan was a response to the planning framework at the time, and in particular the requirements of the then Local Planning Strategy which identified Karridale as a Hamlet with a maximum population of 500 persons and the KHSS which only identified the southern portion of the Local structure Plan area as being within a Development Investigation Area.

At the time, the area to the west of Bussell Highway (Bushby Rise) was expected to account for a far greater proportion of the growth of Karridale, and accordingly, the growth potential for the land east of the highway was limited to around 80 lots, with a view to restricting the population of Karridale to a maximum of 500 persons.

Effectively, the balance of the Local Structure Plan area became a General Agriculture lot by default, rather than due to any practical planning reasoning beyond artificially limiting the permanent population of Karridale to accord with the planning framework of the time.

It is now apparent that the area west of Bussell Highway (K1) will yield significantly fewer lots that originally anticipated (around 30 less), and that even with the full development of K3 (and K4), the permanent population of Karridale is unlikely to exceed 500 persons (refer Section 4 and Table 7).

Accordingly, in terms of compliance with any objective to limit Karridale's permanent population to less than 500 persons, the restriction on the developable area of the Local Structure Plan area can reasonably be revisited.

Furthermore, existing and future local services and businesses will be far more sustainable with a substantial permanent population.

As detailed in the preceding sections of this report, there is no physical impediment to the subdivision and development of the K3 Planning Precinct; viz,

- The land is devoid of any vegetation of significance and has no matters of environmental significance,
- The land undulates gently and there are no topographical constraints to subdivision and development,
- The land has marginal agricultural capability and would not, given its size, soil characteristics and lack of water harvesting opportunities represent a productive agricultural property.
- The majority of the K3 area is suitable for Primary Treatment System effluent disposal, with only a small portion potentially requiring secondary treatment units.

Accordingly, the K3 planning precinct is physically unconstrained for subdivision and development. Those constraints, such as the Western Power overhead powerlines can be readily addressed as demonstrated by the existing subdivision and development of the southern and central portion of the Local Structure Plan area.

Given that the General Agriculture lot of the 2014 Local Structure Plan would be highly unlikely to be put to any productive agricultural use, its development for residential and open space purposes would not represent a net loss to agriculture productivity of the region. Further, its use solely for lifestyle purposes increases the potential for the land to fall to mismanagement, potentially raising safety and amenity concerns to the adjoining and nearby properties.

The development of the K3 planning precinct for residential and rural residential purposes represents the logical extension of the Hamelin Grove Estate and will build upon the significant investment already made in extending essential services, establishing open spaces, road systems, pedestrian networks and buffers. It will also facilitate the establishment of a large area of centrally located Public Open Space which will benefit both the

future and existing residents of Hamelin Grove, and Karridale more broadly.

Because the land is relatively unconstrained, it is not prohibitively expensive to subdivide and created lots can be offered to the market at affordable prices. Land affordability, and availability, is currently a critical social issue. The lots offered at Hamelin Grove have experienced strong demand and relatively rapid take-up. To maintain land affordability at Karridale, as elsewhere, a sufficient and timely supply must be maintained.

The current stage being constructed at Hamelin Grove represents the last lots that can be created under the auspices of the 2014 Local Structure Plan. This stage of subdivision also recognises the potential development of the K3 Planning Precinct and provides for carefully considered road connections and public open space connectivity.

3.5 Movement Networks

A Transport Assessment has been prepared for the Structure Plan area and is included within **Appendix I** of this report. A update addendum addressing the ramifications of the development of the K3 area for residential purposes also forms part of Appendix I.

The conclusions of the Transport Assessment(s) are as follows:

- Peak weekday hourly traffic volumes on Brockman Highway are currently in the range of 30 to 32 vehicles per hour (per direction), which is approximately equal to 1 car passing every 2 minutes.
- The proposed development would generate weekday peak hour volumes in the range of 15 to 60 vehicles per hour at the Sawmill Loop and Road A accesses.
- A weekday peak hour volume of 95 vehicles would be expected on Brockman Highway during the ultimate scenario (full buildout). This is significantly less than the capacity of Brockman Highway of 1,490 vehicles per hour.
- Negligible impact on the existing internal network is anticipated due to the low anticipated traffic generation of the proposed subdivision.
- No material impact on the surrounding road network is anticipated as a result of the low existing traffic volumes on Brockman Highway.

Therefore, based on the Transport Assessment, the proposed development will not impact on the surrounding transport networks given the low traffic volumes expected to be generated.

The proposed internal road network is considered responsive to the nature of subdivision and low density development. The road reserves are comparatively wide, enabling rural standard servicing arrangements (such as table drains), dual use and foot paths and street trees to be readily accommodated. The alignment of the roads ensures convenient access and viewscapes to points of interest, such as the existing and proposed POS, and are commensurate with the nature the of subdivision and low density and number of lots. The proposed network can be described as accommodating the guidelines relating to permeability by allowing as many movement choices and opportunities as possible.

The proposed road network for the K3 area has been configured to discourage extraneous local traffic generated by development of the northern portion of the Local Structure Plan area from using the southern road network to access Brockman Highway. The road interfaces between the existing internal road network and the proposed road system within K3 have been carefully configured such that traffic from the K3 area will typically use the northern most Sawmill Loop extension to access Brockman Highway.

The detailed civil engineering requirements for the road construction and geometric standards will be in accordance with the Local Government requirements at the time of the subdivision. The natural terrain indicates there will be no problems with sight distances.

Both vehicular access points to Brockman highway have been constructed to MRWA requirements as part of the implementation of the 2014 Local Structure Plan.

The implementation of the 2014 Local Structure Plan has resulted in an interconnected network of dual use and footpaths being established within the Hamelin Grove Estate and providing accessible links to the town centre. The proposed modifications to the 2014 Local Structure Plan expand upon the pedestrian and cyclist network established as part of the previous subdivision within the Local Structure Plan area.

3.6 Water Management

The subject site is not within the Water Corporation licence area and as such no provision of potable water and reticulated sewer system is available. Due to absence of reticulated servicing within the Structure Plan appropriate measures have been taken to ensure there is sufficient water capacity for fire fighting purposes,

Clause 5.22 of Local Planning Scheme (LPS) 1 states that dwellings without reticulated mains water supply are required to provide a rainwater tank with a minimum capacity of 120,000 litres prior to occupation, with an additional 15,000 litres for firefighting purposes. A minimum roof catchment area of 200m² is also required.

The water table is >0.5 metres below ground. Drainage and on-site effluent disposal are feasible and stormwater management systems will be designed to manage minor and major storm events. ATU's are recommended for onsite disposal of effluent and there are no risks of leaching into water bodies. The Application of WSUD principles will ensure that current best practice is used to enhance water use and treatment. Grey water re-use will be encouraged to meet sustainability principles of LPP and KHSS.

Existing native vegetation (1.7ha) has been retained in Public Open Space (POS A). Landscape and streetscaping plantings will focus on the use of low water use and/or local native species. Where practical, bioretention features will be incorporated in road reserves (refer to Figure 5 of Appendix D). This will help to improve water quality and also provide a water source for plantings. Irrigation of POS will not be required for this site.

3.6.1 Alterations to Existing Water and Nutrient Cycle

Due to the large lots sizes and the need to collect rainwater for potable use, it will be feasible for stormwater to be retained within each lot created. In terms of impervious surfaces, additional water runoff will be generated by the road system, which has been oriented to allow for channelling of water to treatment and detention points within the road reserve system and POS. Swales and basins will be appropriately sized and located to cater for rainfall events and to ensure that discharge from the development is maintained relative to pre-development rates. The principal sources of nutrients to groundwater and surface water within the proposed development are likely to be from domestic wastewater disposal, fertiliser application to lawns and gardens, and sediments in road runoff.

3.6.2 Water Quality

No water quality data is known to exist for the subject land. Early discussions with the Department of Water

(DoW) indicated that the Department considers that rural residential development with large lots, appropriate on-site effluent disposal, with the existing soil types and landform are likely to pose a low risk to the quality of groundwater and surface resources. The DoW did not require water quality monitoring for the LWMS for this Structure Plan, this indicating confidence in the land capability.

3.7 Infrastructure Coordination, Servicing and Staging

A Servicing Report has been prepared in support of the Local Structure Plan and is attached in **Appendix J**. The report concludes that the future subdivision of the subject site is capable of being serviced by the normal amenities expected in a rural development.

3.7.1 Power and Telecommunications

The Site is traversed by two high voltage aerial power lines. One line runs in a north-south direction approximately 100 metres east of Bussell Highway. The second high voltage lines runs in an east-west alignment from a large Western Power facility on the north-south line.

The Local Structure Plan design allows for the existing aerial lines to be placed below ground along their existing alignments. As such, the proposed lots will be serviced with a conventional Western Power underground power network.

It is acknowledged that Telstra network is operational within the general area. The connection of the proposed lots to the existing system will be subject to negotiation.

3.7.2 Sewerage

The attributes of the SP area, when compared to the minimum requirements, indicate that onsite effluent disposal can be managed. Most of the SP area can support primary treatment units. Areas associated with soil type CW1 will need to be tested during the building licence application stage to determine if site conditions require a primary or secondary treatment unit. Secondary treatment units require an agreement for quarterly servicing to ensure they are maintained in good working order.

3.7.3 Drainage

Due to the relatively low density of the residential areas, together with the fact that the roads will not be kerbed, a conventional sub-surface piped drainage system is not necessary for the proposed development.

The road system will incorporate table drains adjoining the sealed road surface, with culverts placed under road intersections to allow balance of flows during major storm events.

3.7.4 Proposed Staging of Subdivision and Development

The central and southern portions of the Local Structure Plan area have been completed or are under construction. Only the K3 precinct remains undeveloped.

Following appropriate approvals, the continuation of the Hamelin Grove Estate will occur in a logical manner,

extending from the planned road connection areas adjoining Sawmill Loop in a northerly direction.

As is standard practice, the large area of public open space (POS B) will form part of the first stage of the subdivision of the K3 precinct.

It is anticipated that the future stages will comprise in the order of 20 - 30 lots, and accordingly the K3 precinct will afford 3 to 5 years of supply to the local residential lot market.

3.8 Developer Contribution Arrangements

Developer contributions will be levied as a condition of subdivision commensurate with Schedule 10 – Community Infrastructure Development Contribution Plan for Development Contribution Areas of the Shire of Augusta Margaret River Local Planning Scheme No.1.

4 Statutory Compliance

It is apparent that the strategic and statutory planning framework applicable to the Site generally supports, if not contemplates, the expansion of the Hamelin Grove Estate into the northern portions of the Local Structure Plan area.

The Shire's recently adopted Local Planning Strategy identifies the land previously allocated as a General Agriculture lot in the 2014 Local Structure Plan as a 'Long Term Urban Growth Area' and includes it in the K3 Planning Precinct, with a projected yield of 83 residential and rural residential lots.

The Local Planning Strategy requires however that Structure Planning is required, which this document, the supporting technical analysis and associated structure plan achieves. The Strategy also requires that, prior to subdivision and development being supported in the K3 Planning Precinct, K2 should be substantially completed and more detailed investigations into the need for a departure from the Karridale Hamlet Settlement Strategy be undertaken.

K2 is, for all intents and purposes completed. The final 27 lots comprising K2 are currently under construction, with completion anticipated prior to the end of 2022.

It is also apparent that the proposed development of the K3 area is consistent with the broader principles of the Karridale Hamlet Settlement Strategy, departing only in terms of the area identified as being potentially suitable for residential development.

It is worthy to note that the residential component of the endorsed 2014 Local Structure Plan already extends well beyond the boundaries of the Development Investigation Area identified by the KHSS for the Site.

The KHSS adopts the LNRSPP's population 'limit' of 500 persons for hamlets and suggests that development be staged in an orderly fashion, generally progressing from the Karridale centre. The mechanism adopted by the KHSS is a series of 'triggers' requiring that development of outlying areas available for residential development should not proceed until a substantive proportion of the inner development areas have been completed.

Generally the logical expansion of the Karridale townsite envisaged by the KHSS has occurred via the implementation of the 2014 Local Structure Plan for Hamelin Grove, which has progressively been developed from the corner of Bussell Highway and Brockman Highway towards the north, to the extent that the area of DIA 1 occupying the Site could now be considered to be fully developed.

Given that the subdivision and development of DIA 1 is not subject to the triggers provided for by the KHSS, the implementation of the K3 Planning Precinct as identified by the Shire's Local Planning Strategy is the permanent population limit of 500 persons imposed by the KHSS.

The total lot yield within the Karridale townsite is estimated to be in the order of 265 lots, providing for an estimated population, based on the formular adopted by the Shire's Local Planning Strategy, of 422 persons.

In addition, the K4 Planning Precinct which is currently the subject of an application being considered by the Shire for rezoning and structure planning, could yield in the order of 39 lots, or an additional 62 permanent residents.

The total potential permanent residential population provided for by the current planning regime applicable to Karridale is therefore estimated to be 468 persons as per the following table.

Table 7. Potential Karridale Lot Yield and Population.

Potential Lot Yield and Population - Karridale		
Existing lots	**Lots**	**Permanent Population** (based on 2.2 persons per lot and 72.4% occupancy).
Karridale townsite	10	16
Hamelin Grove	45	72
Planning Precincts (Local Planning Strategy)		
K1	77	123
K2	50	80
K3	83	132
K4	39	62
Total	**294**	**468**

Potential Lot Yield and Population - Karridale		
Existing lots	**Lots**	**Permanent Population** (based on 2.2 persons per lot and 72.4% occupancy).
Karridale townsite	10	16
Hamelin Grove	45	72
Planning Precincts (Local Planning Strategy)		
K1	77	123
K2	50	80
K3	83	132
K4	39	62

It is therefore evident that even with the full development of the K3 and K4 Planning Precincts, Karridale would not exceed a permanent residential population of 500 persons. The objective of the KHSS to limit the population of Karridale to around 500 persons will accordingly be achieved, notwithstanding that the boundaries of DIA 1 will be exceeded.

In this respect, it is noted that the Planning Precincts identified in the Shire's Local Planning strategy do not necessarily respect the boundaries of the Development Investigation Areas identified by the KHSS.

As discussed in Section 3.4.1 above, the social and economic benefits of a maintaining a reliable and timely release of vacant lots and facilitating a population representing something approaching a critical mass for a townsite's services and businesses should not be underestimated. Apart from maintaining affordability in both the sales and rental markets, the creation of vacant lots stimulates the local construction industry, both in terms of subdivisional works and house construction, furnishing, landscaping supplies etc.

Given the above, it is evident that the development of the K3 Planning Precinct, as advocated by this Local

Structure Plan, complies with the intent and objectives of the KHSS and the overarching planning framework in general.

Potential Lot Yield and Population - Karridale	
Existing lots	**Lots**
Karridale townsite	10
Hamelin Grove	45
Planning Precincts (Local Planning Strategy)	
K1	77
K2	50
K3	83

5 Conclusion

The subject site has been identified for development in various WAPC and Shire documents, most particularly the Leeuwin Naturaliste Ridge Statement of Planning Policy, the Leeuwin-Naturaliste Sub-regional Framework, the Shire's Local Planning Strategy and the Karridale Hamlet Settlement Strategy.

In particular, the Local Structure Plan facilitates the implementation of the subdivision and development of the northern portion of the Site as envisaged by the Shire's recently adopted Local Planning Strategy.

All environmental, engineering and traffic studies confirm the Site is suitable for development. The subject site consists of broad acres of open pasture which is suitable for development and all significant stands of trees on the Site are protected as Public Open Space. The visual impact from Bussell and Brockman Highways will be managed through vegetated buffers and setbacks and tree planting along subdivisional roads will help to create a sense of place for the area.

The proposed road network is efficient, safe and permeable and traffic flows generated from the development will not impact on the surrounding road network.

The subject site is located in close proximity to the Crossroads Village Centre and residents will be within walking distance of these amenities. The Western Power Kiosk and existing transition lines have been retained and accommodated within the Structure Plan as requested by Western Power.

The subject site is capable of being serviced by the normal amenities expected in a rural development. Drainage and on-site effluent disposal are feasible and stormwater management systems will be designed to manage minor and major storm events. Most of the Site is suitable for Primary Treatment of effluent and there are no risks of leaching into water bodies. The Application of WSUD principles will ensure that current best practice is used to enhance water use and treatment. Grey water re-use will be encouraged to meet sustainability principles of LPP and KHSS.

The Local Structure Plan incorporates the general design principles from the WAPC's Liveable Neighbourhoods document and the Shire's Rural Hamlet Design Handbook. The plan provides for a variety of lot sizes, to satisfy the full range of market demands and to complement the environmental characteristics of the Site and locality. The structure plan provides the planning framework for future subdivision and development of the subject site which is consistent with the objectives of the Leeuwin Naturaliste Ridge Statement of Planning Policy and the Karridale Hamlet Settlement Strategy.

6 References

Landgate (2012) WA Atlas on line: www.landgate.wa.gov.au
Mattiske E.M. and Havel J.J. (2005) Derived from: Mattiske, E.M. and Havel, J.J. (1998) Vegetation

Complexes of the South-west Forest Region of Western Australia. Maps and report prepared as part of the Regional Forest Agreement, Western Australia for the Department of Conservation and Land Management and Environment Australia.

Local Structure Plan

APPENDIX A
CERTIFICATE OF TITLE

Cardno
Shaping the Future

WESTERN AUSTRALIA

REGISTER NUMBER	
100/DP51956	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
2	**25/9/2007**

RECORD OF CERTIFICATE OF TITLE

VOLUME **2643** FOLIO **171**

UNDER THE TRANSFER OF LAND ACT 1893

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 100 ON DEPOSITED PLAN 51956

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

JUVENTUS PTY LTD OF 601/199 REGENT STREET, REDFERN, NEW SOUTH WALES
(T K329615) REGISTERED 3 SEPTEMBER 2007

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. EASEMENT BURDEN CREATED UNDER SECTION 136C T.L.A. FOR RIGHT OF CARRIAGEWAY PURPOSES - SEE DEPOSITED PLAN 51956.
2. G524356 LEASE TO WA CHIP AND PULP CO PTY LTD OF CARE OF BUNNINGS TREEFARMS PTY. LTD., POST OFFICE BOX 444, MANJIMUP EXPIRES: SEE LEASE. REGISTERED 7.7.1997.
3. G561046 LEASE TO WA CHIP AND PULP CO PTY LTD OF CARE OF BUNNINGS TREEFARMS PTY. LTD., POST OFFICE BOX 444, MANJIMUP EXPIRES: SEE LEASE. AS TO PORTION ONLY. REGISTERED 20.8.1997.
4. *L589959 MORTGAGE TO NATIONAL AUSTRALIA BANK LTD REGISTERED 30.3.2011.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
Lot as described in the land description may be a lot or location.

----------END OF CERTIFICATE OF TITLE----------

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: DP51956 [SHEET 1].
PREVIOUS TITLE: 1915-69.
PROPERTY STREET ADDRESS: 83 BROCKMAN HWY, KARRIDALE.
LOCAL GOVERNMENT AREA: SHIRE OF AUGUSTA-MARGARET RIVER.

NOTE 1: L239467 SECTION 138D TLA APPLIES TO CAVEAT L047994
NOTE 2: DUPLICATE CERTIFICATE OF TITLE NOT ISSUED AS REQUESTED BY DEALING L589959

LANDGATE COPY OF ORIGINAL NOT TO SCALE Wed Nov 7 14:50:57 2012 JOB 40434399

Local Structure Plan

APPENDIX B
VISUAL IMPACT MANAGEMENT ASSESSMENT

Cardno
Shaping the Future

Visual Impact Management Assessment

Lot 100 Brockman Highway, Karridale

P12011

Prepared for
Juventus Pty Ltd

5 December 2012

michaelSWIFT
& associates , town planners

Cardno
Shaping the Future

Document Information

Prepared for	Juventus Pty Ltd
Project Name	Lot 100 Brockman Highway, Karridale
File Reference	Visual Impact Management Assessment.docx
Job Reference	P12011
Date	5 December 2012

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Document Control

Version	Date	Author	Author Initials	Reviewer	Reviewer Initials
1	5 December 2012	Denise Morgan	DM	Michael Swift	MS

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Executive Summary

This report represents an examination of the visual landscape qualities of Lot 100 Brockman Highway, Karridale, in order to inform the Local Structure Plan prepared for the site, which will provide the framework for future subdivision and development.

The Shire of Augusta Margaret River Local Planning Strategy identifies and maps Visual Management Zones and sets out applicable policies. It identifies the site as falling within 'Visual Management Zone C' and also within the Brockman Highway 'Travel Route Corridor' (refer to Figure 1-2).

Travel Route Corridors are associated with major roads used by the community and tourists. The view from major travel routes is the first and sometimes the only impression that a traveller has of the area, and hence the landscape qualities visible from these routes is very important.

Within Visual Management Area C, developments and changes of use may be visually dominant, but should "borrow from the naturally established form, line, colour and texture to be compatible with the existing landscape."

From a visual landscape perspective, the approach to a settlement should provide a variety of sensory cues that the traveller is moving into a more intensively developed area than the rural countryside that precedes it. This will include a reduced speed environment and increasing glimpses of development and a more pedestrian environment, until finally the town centre itself is reached.

Lot 100 is comprised of gently undulating land that slopes generally from north-east to south-west towards the junction of Bussell Highway, Brockman Highway and Bushby Road. A small valley is formed by a watercourse, with land rising either side. Generally speaking, the site is level with or slightly higher than the perimeter roads, gradually falling away towards the aforementioned valley. Figure 1-1 shows the topography of the site and the location of the watercourse.

This means that much of the future proposed development will be largely obscured from view from the highways by the topography of the site.

The land was cleared many years ago for grazing purposes and few of its natural attributes remain. The retention in the future subdivision of those natural features that do remain is one way of ensuring that the development will have its own sense of place.

The site contains a number of definable landscape elements:

1. Cleared with widely scattered trees over mixed grasses/weeds
2. Marri and Jarrah Woodland over regrowth Peppermint and mixed grasses/weeds
3. Peppermint regrowth with some emergent Marri over mixed grasses/weeds
4. Marri and Karri Open Woodland over mixed grasses/weeds
5. Karri Open Woodland over mixed grasses/weeds
6. Plantation
7. Planted non-endemic trees and shrubs
8. Man-made Dams

The visual assessment highlights a number of features that inform the structure plan in terms of site character and landscape features.

> Remnant Bushland and Trees

  Retention of the few significant stands of remnant bushland will provide visual and physical amenity, screening and habitat. The most significant stand of trees on Lot 100 is proposed to retained within the public open space.

Scattered trees are a feature of the landscape of the site. Those existing trees that remain healthy should be retained wherever possible. With the caveat of ensuring that bushfire risk is minimised, future planting could emulate the character of scattered tree planting on open land, and domestic planting around houses in the manner of traditional farm houses.

> Tree-lined Roads

The western boundary of Lot 100 with Bussell Highway is for the most part heavily tree lined, with a significant amount of the growth being within the road reserve. This could be augmented by additional planting within setbacks, using similar species.

The Brockman Highway boundary is far more open, however scattered tree planting within setbacks of the proposed R5 lots will help to minimise the impact of new development on the landscape.

Tree planting along subdivisional roads will help to bring this character into the site, although the open pasture feel of the interior of the site should not be compromised by excessive planting.

> Views to Leeuwin Naturaliste Ridge

Long views to the ridge from Brockman Highway along the eastern parts of the site boundary and from some elevated parts of the site are available as a result of the openness of the site. Heavy tree planting along the perimeter of the site or within the site could obscure this view, therefore care should be taken in to locate any dense tree planting or screening that may be proposed to preserve view corridors.

> Plantation

The blue gum plantation on the northern and eastern parts of the site is a commercial crop that will eventually be harvested. It is not a natural part of the landscape and does not reflect the pastoral heritage of the locality. Once harvested, the land will return to an open rural landscape. However it does provide an opportunity to return the landscape to something resembling that which the plantation replaced (open grassland with scattered trees) by selectively retaining some trees as individual specimens or small clusters.

The landscape characteristics that have been identified in this report can be augmented to provide a living environment with a sense of place that is compatible with the character of the surrounding area.

It would be a mistake to attempt to highly modify the landscape through introduction of dense screen planting on the perimeters of the site. Whilst supplementary tree planting is definitely desirable to counteract the impact of more intense built development, particularly adjacent to the main travel route corridors of Brockman Highway and Bussell Highway, the general impression should remain that of open country with scattered trees, dotted with small clusters of buildings surrounded by domestic planting.

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1 Introduction

This report represents an examination of the visual landscape qualities of Lot 100 Brockman Highway, Karridale, in order to inform the Local Structure Plan prepared for the site, which will provide the framework for future subdivision and development.

The Shire of Augusta Margaret River is renowned and valued for its stunning landscape qualities, comprised of both natural and agricultural rural landscapes. High landscape values provide attractions and improve the quality of life of people who live and work in the area, and for those visiting the Shire, as well as supporting the local tourism industry.

The Shire recognises that conservation and enhancement of the natural and scenic environment for its tourism potential is essential. Maintaining the overall rural and natural landscape and visual qualities of the Shire is therefore one of the stated aims of Local Planning Scheme No. 1. New development within the Shire is required to be planned in a holistic and integrated fashion, giving due consideration to the protection of landscape values and minimising potential visual impacts.

The contribution of Lot 100 Brockman Highway ("the site") to the Shire's landscape qualities is determined within the context of the Karridale Hamlet Strategy, which identifies the site within Development Investigation Area 1.

The site's location is illustrated in Figure 1-1.

1.1 Local Planning Strategy

The Shire of Augusta Margaret River Local Planning Strategy identifies and maps Visual Management Zones and sets out applicable policies. It identifies the site as falling within 'Visual Management Zone C' and also within the Brockman Highway 'Travel Route Corridor' (refer to Figure 1-2).

Travel Route Corridors are associated with major roads used by the community and tourists. The view from major travel routes is the first and sometimes the only impression that a traveller has of the area, and hence the landscape qualities visible from these routes is very important.

The Local Planning Strategy states that development within Travel Route Corridors will need to have regard for the following:

> encourage landowners to preserve all natural vegetation on their land, and where possible and consistent with reasonable use of the land for agricultural practice, to encourage the planting of further indigenous trees and shrubs;

> encourage the use of parkland clearing methods and the preservation of those sections of existing vegetation which are of the greatest significance for landscape protection, where clearing is required and approved by the Local Government for rural production or associated purposes;

> prohibit all advertisements except those essential for direction or identification; and

> prevent any proposal, which would adversely affect the amenity, rural character and landscape values of the area concerned. Where development must be exposed, the Shire will encourage the use of materials which will be complementary to, or enhance, the rural landscape.

Within Visual Management Area C, developments and changes of use may be visually dominant, but should "borrow from the naturally established form, line, colour and texture to be compatible with the existing landscape."

In contrast, land opposite the site on the western side of Bussell Highway is identified as falling within Visual Management Area 'A', where more stringent requirements apply to ensure that developments or changes in land use should not result in evident visual alteration to the landscape.

Figure 1-1 Location Plan and environmental features (derived from Aurora Environmental)

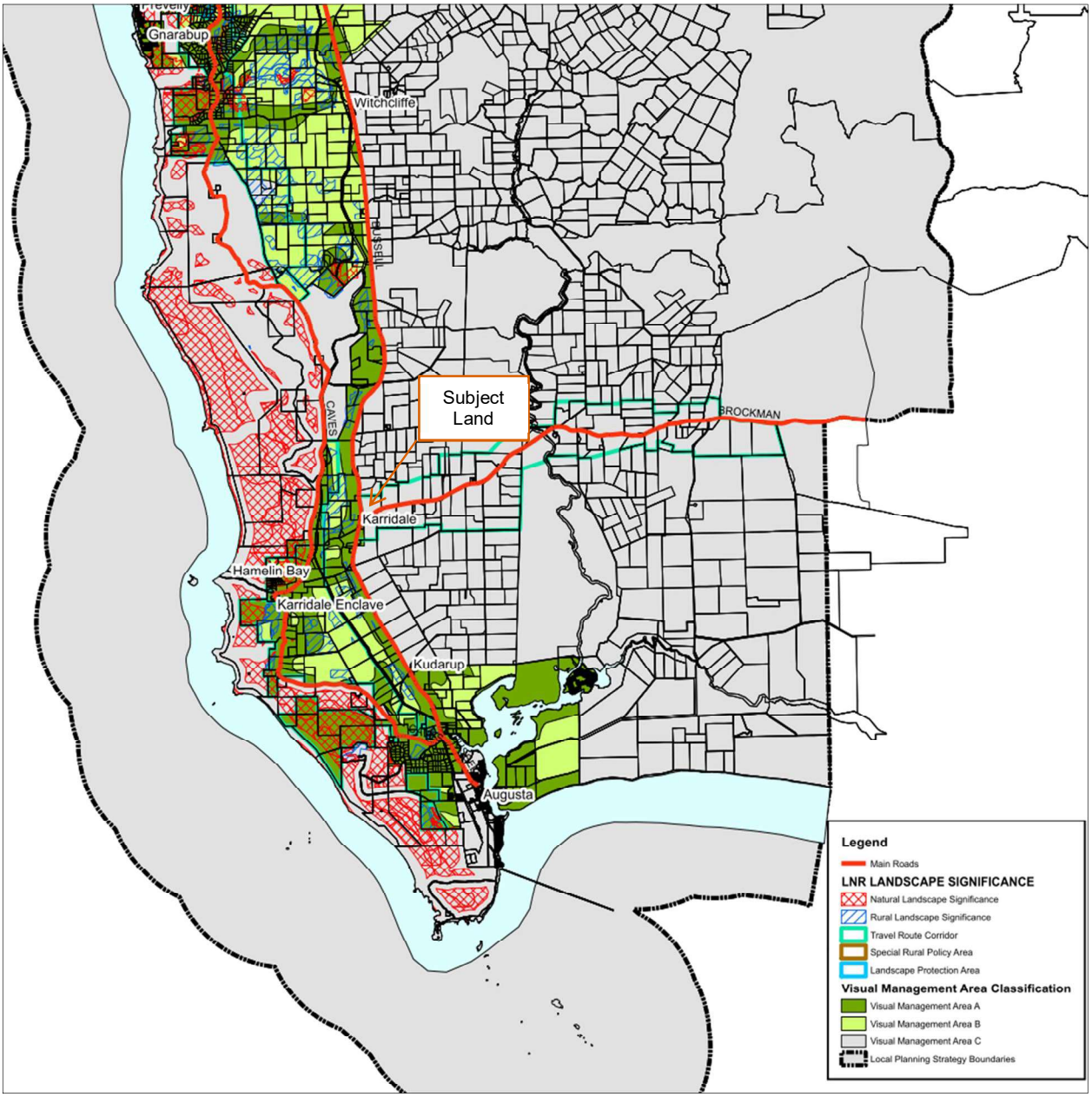

Figure 1-2 Extract, Shire of Augusta Margaret River Local Planning Strategy Figure 5 – Visual Management Areas – showing location of Lot 100 Brockman Highway

1.2 Karridale Hamlet Settlement Strategy

The requirements of the endorsed Karridale Hamlet Settlement Strategy are addressed by the Local Structure Plan for Lot 100, however with specific relevance to visual management, the strategy requires that:

> areas of remnant vegetation will need to be protected through future development and fire management protection should not compromise the environmental values of this vegetation; and

> buffering be provided to Bushby Road and Bussell/Brockman Highways to mitigate visual impact on the function of these roads as Travel Route Corridors.

It is noted that the Local Planning Strategy map does not include Bussell Highway as a Travel Route Corridor, however for the purposes of this assessment and in recognition of the Hamlet Settlement Strategy, it has been included as such.

1.3 Rural Hamlets Design Handbook

The Rural Hamlets Design Handbook is a comprehensive document that sets out the ideals for the creation of settlements within the Shire that respect landscape, agriculture, ecology and sustainable living. It is a guide only, and addresses matters such as the siting of development within the landscape based on opportunities and constraints mapping (referred to in the document as 'sieve mapping') and visual landscape assessment and impact management. The latter is the purpose of this document.

1.4 Intentions for Karridale

Consistent with the intentions set out in the Local Planning Strategy, Karridale is intended to develop as a 'hamlet' accommodating up to 500 people. Hamlets are predominantly residential in function, with development designed around a higher density activity centre (e.g. neighbourhood centre, school, civic use), each having its own distinct urban design and built form theme. They will be rural service centres and a focus for rural living and tourist facilities.

The junction of Bussell Highway and Brockman Highway will be the location of the 'activity centre' or Karridale town centre, and low intensity residential development will be located with decreasing density as the distance from the activity centre increases.

A local structure plan has already been approved for the land west of Bussell Highway ('Karridale West'), which also includes a combination of proposed residential densities, rural residential, public open space and conservation areas.

From a visual landscape perspective, the approach to a settlement should provide a variety of sensory cues that the traveller is moving into a more intensively developed area than the rural countryside that precedes it. This will include a reduced speed environment and increasing glimpses of development and a more pedestrian environment, until finally the town centre itself is reached.

Already the approach to Karridale requires reduced traffic speeds. Development of Karridale as proposed by the Karridale Hamlet Settlement Strategy will require the introduction of pedestrian crossings at key points, and a limited number of new road junctions with associated traffic devices will necessitate further reductions in speed. At lower speeds, both drivers and passengers are able to perceive more of their surroundings.

It would not be appropriate for the approach to the town centre to be heavily screened. Drivers must be forewarned that they are approaching potential hazards such as intersections and pedestrian crossings, and this cannot be left to signage alone. The experience should be of a gradual transition from an agricultural and rural landscape with large expanses of pasture, crops and/or forested land with a sparse scattering of buildings, to more closely developed and more visible buildings with domestic planting, and a town centre with closer, non-residential development and landscape.

2 Assessment

2.1 Landscape Characteristics

Lot 100 is comprised of gently undulating land that slopes generally from north-east to south-west towards the junction of Bussell Highway, Brockman Highway and Bushby Road. A small valley is formed by a watercourse, with land rising either side. Generally speaking, the site is level with or slightly higher than the perimeter roads, gradually falling away towards the aforementioned valley. This means that much of the future proposed development will be largely obscured from view from the highways by the topography of the site. Figure 1-1 shows the topography of the site and the location of the watercourse.

The land was cleared many years ago for grazing purposes and few of its natural attributes remain. The retention in the future subdivision of those natural features that do remain is one way of ensuring that the development will have its own sense of place.

The site contains a number of definable landscape elements, which relate to the fauna habitats identified by Greg Harewood[1]. His description of these elements is summarised as follows.

1. Cleared with widely scattered trees over mixed grasses/weeds

   Most of the southwest corner of the study area is represented by cleared paddocks and consists of a groundcover dominated by a mixture of introduced pasture grasses, clovers, weeds and some native sedges (refer to Figure 2-1).

   There are a small number of scattered individual and small groups of emergent trees. Scattered peppermints are also present around the existing farmhouse and shed. Some lower lying areas are inundated/waterlogged during the wetter months of year.

Figure 2-1 Central cleared section of the site, looking north-east (image source: G. Harewood)

[1] Harewood Greg, *Fauna Assessment of Lot 100 Brockman Highway Karridale v.2*, unpublished, October 2012

2. Marri and Jarrah Woodland over regrowth Peppermint and mixed grasses/weeds

   The large grove of trees in the south west section of the study area contains various densities of Marri and Jarrah with some areas of regrowth peppermint. Native groundcover is totally absent. Most of this area is to be retained as public open space (refer to Figure 2-2).

Figure 2-2 The proposed public open space area is comprised of Marri and Jarrah woodland over peppermint regrowth over mixed grasses (image source: G. Harewood)

3. Peppermint regrowth with some emergent Marri over mixed grasses/weeds

   South west of the proposed public open space (see figure 2-2) are discontinuous areas of regrowth peppermint (with some older trees) and emergent Marri. Native groundcover is totally absent (refer to Figure 2-3).

4. Marri and Karri Open Woodland over mixed grasses/weeds

   A small grove of mainly marri trees is present along the site's boundary with Brockman Highway (see Figure 2-4).

5. Karri Open Woodland over mixed grasses/weeds

   A small grove of ten trees is present in the north central section of the study area.

6. Plantation

   About 66 hectares of Lot 100 is used as a blue gum plantation and contains no remnant native vegetation.

7. Planted non-endemic trees and shrubs

   The farmhouse has some planted non-endemic trees and shrubs within its garden's lawns.

8. Manmade Dams

   Two manmade dams are present in the west and north-west sections of the study area. The study area contains no natural or manmade watercourses/drains.

Figure 2-3 Regrowth peppermint over mixed grasses and weeds in the south-west section of the site (image source: G. Harewood)

Figure 2-4 Marri and Karri grove over mixed grasses, adjacent Brockman Highway (image source: G. Harwood)

Figure 2-5 Blue gum plantation in the north of the site

2.2 Views into and across the site

Photographs were taken from the perimeter roads – Bussell Highway and Brockman Highway – to show both long views (as would be seen by drivers looking along the road) and looking into the site from the road. These photographs serve to illustrate the visual landscape qualities of these roads as Travel Corridors. The location and direction of photography is shown on Figure 2-6.

Of the two roads, Bussell Highway has the more vegetated verge adjacent to Lot 100. Much of the site is well screened by this roadside vegetation, with only glimpses to the open pasture land beyond. Land on the west side of Bussell Highway is generally lower than Lot 100, and has less roadside vegetation. Future development on the west side of Bussell Highway will be more visible than development on Lot 100.

Views from Brockman Highway across Lot 100 are less obscured by vegetation owing to the relative lack of roadside vegetation. From the higher vantage points to the east, long views across the site to the Leeuwin-Naturaliste Ridge are possible. Closer to Karridale the views are truncated by the site rising away from the road, and a dense copse of remnant vegetation (future public open space).

Opposite Lot 100 on the south side of Brockman Highway, the landscape is dominated by pine plantation.

The current blue gum plantation on Lot 100 forms a backdrop to views from several vantage points. However this backdrop is dynamic, as the trees are harvested periodically. This plantation and others in the locality replaced open farmland similar to that which remains. Although the plantations are presently a feature, they are by their nature transient (being crops) and hence should not be considered to be typical. When the plantations are harvested, the landscape will revert to being predominantly open, with perhaps some scattered trees remaining.

Following is a series of photographs taken from the road perimeters of the site, along with a brief commentary for each relating to the character of the view.

D Drivers view along road (not pointing camera into site)
O Distant views into site on appproach
S Site view (taken from side of road into site)

Figure 2-6 Location of Perimeter view photographs

Image 1

The northern approach to Lot 100, looking towards the site from Bussell Highway, north of the blue gum plantation.

The Bussell Highway approach to the site is characterised by roadside vegetation, including patches of peppermint regrowth and taller eucalypts. With the exception of the plantation itself, which is uncharacteristic of the wider locality, the landscape beyond the perimeter trees is generally of open farmland with scattered vegetation.

Image 2

View from Bussell Highway north of the site, looking towards the blue gum plantation.

Trees growing along the road allow glimpses to the pasture and plantation beyond. The plantation represents the northern boundary of Lot 100. The land in the foreground is not part of the site.

Image 3

The plantation is barely visible from Bussell Highway due to the screening vegetation already in place. Any development beyond this tree line will be largely screened.

Image 4

Blue gum plantation viewed through the roadside vegetation.

Image 5

Travelling south along Bussell Highway, the site (left) is not visible at all.

Image 6

Closer to Karridale, the view looking north-east into the site from an existing entry off Bussell Highway between road-side vegetation towards the future public open space (remnant native vegetation), is of a classic rural scene including open pasture, a dam and tanks.

Future development beyond the trees will not be visible from the highway.

R5 and R2.5 development will be set back 30 metres from the highway. Some supplementary tree planting in the setback will help to moderate the visual impact of new development, without fundamentally changing the character of the view.

Image 7

The junction of Bussell Highway (left) and Brockman Highway (right) with the former service station (not part of Lot 100). This is the future location of commercial development, as identified by the Karridale Hamlet Settlement Strategy.

Buildings in this location are and will continue to be visually prominent and development will be more intensive, as befits a 'village centre' environment.

Image 8

The view north from Brockman Highway towards the future public open space (the copse of trees). A row of lots along this boundary will benefit from supplementary tree planting in the highway setback to minimise the visual impact of future development that will occur in the foreground.

Future development beyond the public open space will not be visible from the highway.

Image 9

View north from Brockman Highway, just west of a small copse of trees. The site is generally very open in this part of the site.

The land rises gently at this point. Outbuildings associated with the existing farmhouse are just visible behind the trees.

The blue gum plantation in the north of the site forms a backdrop.

Future R5 development along this part of the highway will be partly obscured by the rising land within the highway setback, however supplementary tree planting in the setback will help to reduce the visual impact of additional buildings.

Image 10

Looking north-north-west from Bussell Highway, the future public open space can be seen on the left. Future R5 development will be partly obscured on the other side of the rise in the foreground.

Supplementary tree planting within the setback area will help to reduce the visual impact on the presently open farmland character.

Image 11

View along Brockman Highway looking west. The future public open space can be seen on the right, and effectively obscures the view of anything beyond it.

Image 12

Looking west from Brockman Highway across the open field to the existing farmhouse and outbuildings. The blue gum plantation forms the backdrop, with the Leeuwin Naturaliste Ridge in the far distance.

The far views of the ridge across open farmland are a feature of this particular location, and there should not be dense planting that would obscure this view. Building envelopes should be located on the larger lots to ensure buildings do not obscure this view.

The land in the foreground is proposed Rural Residential and should maintain an open feel, with some domestic planting around buildings in a traditional 'homestead' manner.

Future R5 development is unlikely to be visible from this location as it will be beyond the rise.

Image 13

View north from Brockman Highway across future Rural Residential and R2.5 land towards the blue gum plantation.

Supplementary tree planting will help reduce the visual impact of future buildings, although the open nature of the landscape should be preserved.

Image 14

Approaching the site (right) from the east, along Brockman Highway. The site rises steeply from the road, which dips into a small valley just past the pine plantation on the left (south) side of the road.

This will provide the first glimpses of the scattered development that will signal the entry into Karridale hamlet.

The copse of trees that will be a feature of the proposed public open space can be glimpsed in the distance, just above the dip in the road.

Image 15

The “Reduce Speed” signs signalling the entry into Karridale can be seen in the middle distance.

Image 16

The eastern boundary of the site, defined by the firebreak/perimeter road of the plantation. Looking north from Brockman Highway.

The plantation itself has changed the open grassland character that prevails in this general location.

In due course the planation will be harvested, and the landscape will revert to an open character. Consideration could be given to retaining some trees, to imitate the scattered trees and small clumps of trees that characterise the surrounding land.

Image 17

Approaching the site from the east along Brockman Highway.

There is very little screening vegetation along this stretch of road. Rather, the Brockman Highway approach to Karridale is characterised by open pasture.

3 Opportunities

The visual assessment highlights a number of features that inform the structure plan in terms of site character and landscape features.

Figure 3-1 summarises key site characteristics.

3.1 Remnant Bushland and Trees

Retention of the few significant stands of remnant bushland will provide visual and physical amenity, screening and habitat. The most significant stand of trees on Lot 100 is proposed to retained within the public open space.

Scattered trees are a feature of the landscape of the site. Those existing trees that remain healthy should be retained wherever possible. With the caveat of ensuring that bushfire risk is minimised, future planting could emulate the character of scattered tree planting on open land, and domestic planting around houses in the manner of traditional farm houses.

3.2 Tree-lined Roads

The western boundary of Lot 100 with Bussell Highway is for the most part heavily tree lined, with a significant amount of the growth being within the road reserve. This could be augmented by additional planting within setbacks, using similar species.

The Brockman Highway boundary is far more open, however scattered tree planting within setbacks of the proposed R5 lots will help to minimise the impact of new development on the landscape.

Tree planting along subdivisional roads will help to bring this character into the site, although the open pasture feel of the interior of the site should not be compromised by excessive planting.

3.3 Views to Leeuwin Naturaliste Ridge

Long views to the ridge from Brockman Highway along the eastern parts of the site boundary and from some elevated parts of the site are available as a result of the openness of the site. Heavy tree planting along the perimeter of the site or within the site could obscure this view, therefore care should be taken in to locate any dense tree planting or screening that may be proposed to preserve view corridors.

3.4 Plantation

The blue gum plantation on the northern and eastern parts of the site is a commercial crop that will eventually be harvested. It is not a natural part of the landscape and does not reflect the pastoral heritage of the locality. Once harvested, the land will return to an open rural landscape. However it does provide an opportunity to return the landscape to something resembling that which the plantation replaced (open grassland with scattered trees) by selectively retaining some trees as individual specimens or small clusters.

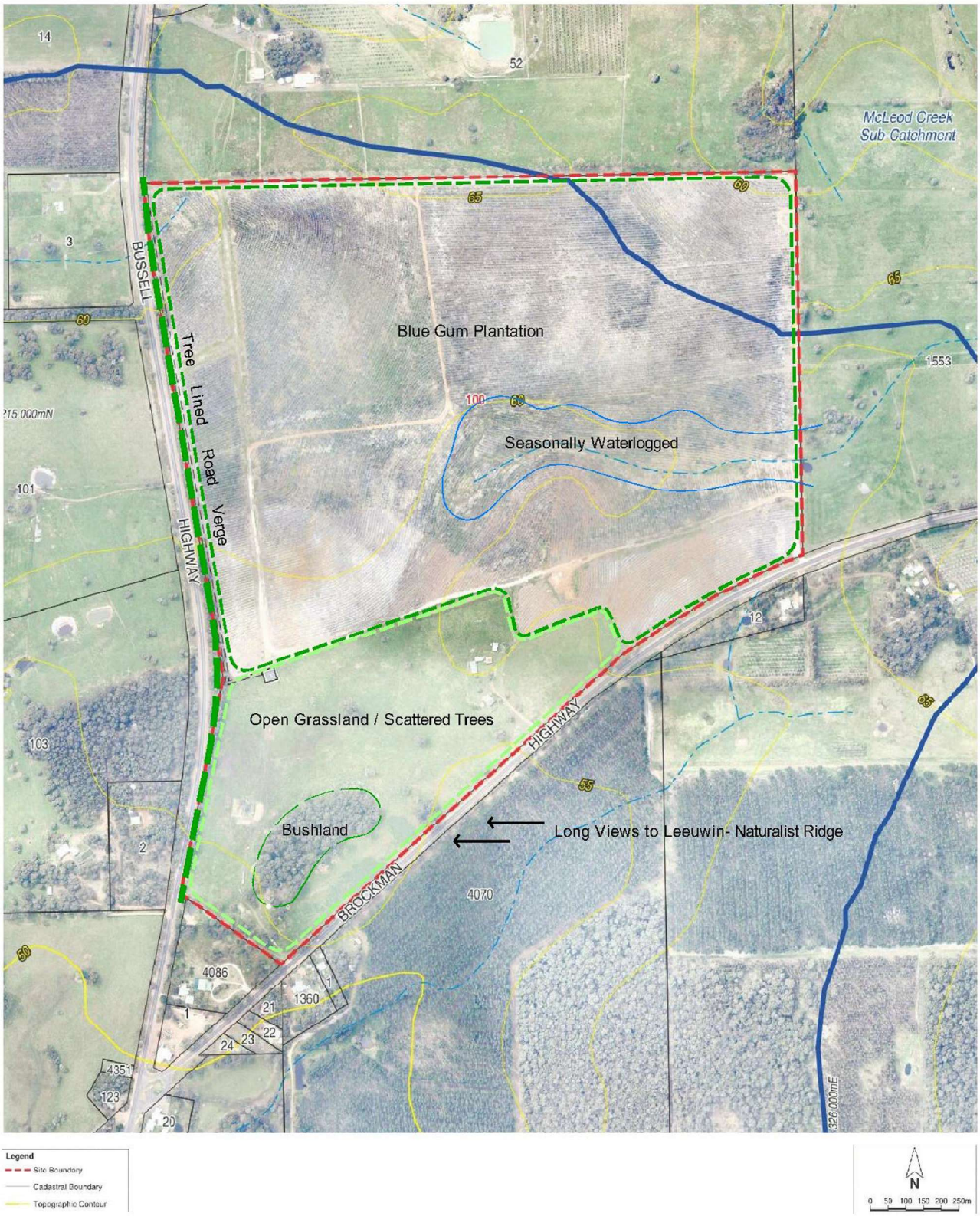

Figure 3-1 Key site characteristics

4 Conclusion

Lot 100 Brockman Highway is largely open grazing land with few intrinsic impediments to development.

The landscape characteristics that have been identified in this report can be augmented to provide a living environment with a sense of place, that is compatible with the character of the surrounding area.

It would be a mistake to attempt to highly modify the landscape through introduction of dense screen planting on the perimeters of the site. Whilst supplementary tree planting is definitely desirable to counteract the impact of more intense built development, particularly adjacent to the main travel route corridors of Brockman Highway and Bussell Highway, the general impression should remain that of open country with scattered trees, dotted with small clusters of buildings surrounded by domestic planting.

About Cardno

Cardno is an ASX200 professional infrastructure and environmental services company, with expertise in the development and improvement of physical and social infrastructure for communities around the world. Cardno's team includes leading professionals who plan, design, manage and deliver sustainable projects and community programs. Cardno is an international company, listed on the Australian Securities Exchange [ASX: CDD].

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Local Structure Plan

APPENDIX C
LOCAL WATER MANAGEMENT STRATEGY

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Local Water Management Strategy
Local Structure Plan - K3 Expansion, Hamelin Grove
Bussell Highway and Brockman Highway
Karridale – Shire of Augusta Margaret River, WA

Prepared For: Juventus Pty Ltd
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16 Kenilworth Street
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Document Number: AP2023/092

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Report Date: 12 June 2024

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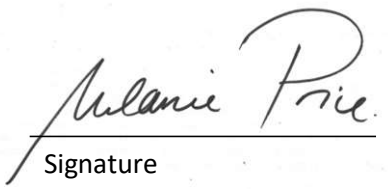
Author:	Melanie Price *Principal Environmental Scientist*		12 June 2024
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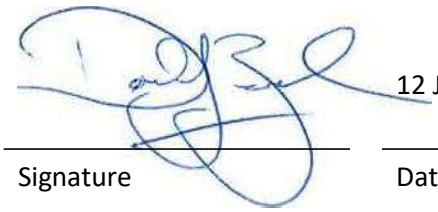
Reviewed by:	Paul Zuvela *Manager – Environmental Impact Assessment*		12 June 2024
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GLOSSARY

ARI and AEP

The Average Recurrence Interval (ARI) and the Annual Exceedance Probability (AEP) are both a measure of the rarity of a rainfall event.

What is ARI?

ARI is defined as: *"The average, or expected, value of the periods between exceedances of a given rainfall total accumulated over a given duration".* It is implicit in this definition that the periods between exceedances are generally random.

What is AEP?

AEP is defined as: *"The probability that a given rainfall total accumulated over a given duration will be exceeded in any one year."*

LIST OF ABBREVIATIONS AND GLOSSARY

AEP	Annual Exceedance Probability
AHD	Australian Height Datum
AMRS	August Margaret River Shire
ARI	Annual Recurrence Interval
ASS	Acid Sulfate Soils
ATU	Alternative Treatment Unit
BGL	Below Ground Level
DEC	Department of Environment and Conservation
DoH	Department of Health
DoW	Department of Water
DLRs	Design Loading Rates
DWER	Department of Water and Environmental Regulation
ETA	Evapo-transpiration/absorption
ETS	Evapo-transpiration/seepage
ha	Hectare
K_{SAT}	Permeability Coefficient
km	Kilometres
L	Litre
LLA	Land Application Area.

	The unencumbered area to which treated sewage from an on-site sewage system is distributed for further in-soil treatment and absorption or evaporation. This area is restricted to the distribution of treated sewage.
LPS	Local Planning Scheme
LSP	Local Structure Plan
LWMS	Local Water Management Strategy
m^2	Square metre
Mg/L	Milligrams per Litre
mm	Millimetre
PDWSA	Public Drinking Water Source Area The area from which water is captured to supply drinking water. It includes all underground water pollution control areas, catchment areas and water reserves constituted under the *Metropolitan Water Supply, Sewerage, and Drainage Act 1909* or the *Country Areas Water Supply Act 1947*.
POS	Public Open Space
PRI	Phosphorus Retention Index
PTS	Primary Treatment System A sewage treatment system which generally consists of watertight cylindrical tanks (septic tanks) followed by one or two sets of effluent soakage wells that have holes in their sides and no base (soakwells) or horizontal leach drains.
PVC	Polyvinyl Chloride
UWMP	Urban Water Management Plan
SSA	Sewage Sensitive Area (SSA) as defined in Government Sewerage Policy 2019
SPP	State Planning Policy
STS	Secondary Treatment System A sewage treatment system which produces treated sewage of secondary standard equal to or less than, i.e., 20 mg/L of Biochemical Oxygen Demand (BOD), 30 mg/L of Total suspended solids (TSS) and 10 cfu/100 mL of *Escherichia (E) coli* (for example, an aerobic treatment unit).
WELS	Water Efficiency Labelling Standards
WAPC	Western Australian Planning Commission
WHPZ	Wellhead Protection Zone A proclaimed area to protect the drinking water source from direct contamination in the immediate vicinity of production wells and reservoirs.
WSUD	Water Sensitive Urban Design

EXECUTIVE SUMMARY

This Local Water Management Strategy (LWMS) has been prepared for Juventus Pty Ltd and provides an update to previous water management strategies (Aurora Environmental, 2014 and 2019) due to proposed modifications to the Hamelin Grove Local Structure Plan for the K3 expansion at Lot 9001 Brockman Highway, Karridale. This version incorporates suggestions from submissions received during the Structure Plan advertising, including from the Department of Water and Environmental Regulation (DWER) and the Shire of Augusta Margaret River (SAMR).

The southern portion of the Structure Plan area has already been subdivided in accordance with the original Structure Plan to create residential lots. Changes in the most recent Local Structure Plan (LSP) reflect the layout of roads, development setbacks, landscape buffers, quiet house design requirements, emergency water supply points, public open space, nominated areas for on-site effluent disposal system types and key drainage infrastructure (Appendix A; Martin Richards Town Planning and Urban Design, 2021).

DVN Civil and Structural Project Engineers have analysed the pre-development conditions (Appendix B) and provided a Stormwater Management Plan to inform the design to be implemented via the LWMS for post development conditions (Appendix C). Calculations for pre and post development conditions are included in Appendix D.

A Site and Soil Evaluation/Geotechnical survey has been undertaken by Douglas Partners in spring 2022.

Design elements summarised in this LWMS are extended from the previously subdivided areas and include the following features:

- Pre development flows will be retained in the post development design;
- A reticulated potable water network is not available at the site. Rainwater tanks on individual lots with a minimum capacity of 135,000 L will be used as the potable water source;
- Due to proposed large lot sizes (0.2 ha to 1 ha) and collection of rainwater, storm water will be retained on individual lots for 16 mm events;
- Stormwater discharged from the LSP area will be at pre-development flows via swales and basins;
- Treatment of the first 16 mm of stormwater generated from the road system and conveyance of 5-year Annual Recurrence Interval (ARI) events will be achieved through the use of roadside swales. Treatments are subject to detailed design in an urban water management plan (UWMP);
- Swales and basins will also be incorporated into the Public Open Space (POS) to treat 16 mm events and attenuate events exceeding 1 year ARI (0.632 Annual Exceedance Probability (AEP));
- Management of 5-year ARI events to SAMRS requirements will be achieved using pipework and retention basins to attenuate stormwater flows;

- 1% AEP/ 100-year ARI flood events will be routed through the road network, attenuated in swales and retained in POS basins;
- Stormwater leaving the site will be treated in a suitably sized basin and swales prior to discharge. and
- The Structure Plan area will require a combination of primary (PTS) and secondary treatment systems (STS) for on-site effluent disposal (as shown in Figure 3). Areas requiring sand pads or inverted leach drains have also been identified. As the soil on the site is variable, there is the option for new landowners to carry out additional winter testing at the building license stage.

The Structure Plan layout indicates that the area can satisfactorily incorporate the objectives of Western Australian Planning Commission's (WAPC) Better Urban Water Management (2008) as summarised in Table 1.

TABLE 1: LOCAL WATER MANAGEMENT STRATEGY CHECKLIST

LOCAL WATER MANAGEMENT STRATEGY ITEM	DELIVERABLE	INCLUDED Y/N	NOTES
Executive Summary			
Executive Summary: Summary of the development design strategy, outlining how the design objectives are proposed to be met	Design elements and requirements for the best management practices and critical control points	Y	Executive Summary
Introduction			
Total water-cycle management - principles and objectives Planning background Previous studies		Y	Section 1
Proposed Development			
Local Planning Strategy, zoning, and land use Key landscape features Previous land use	Site context plan/ Structure Plan Conceptual subdivision plan	Y	Sections 2 and 3. Figures 1 – 3 Appendix A
Landscape - proposed public open space areas, water source, bore(s), irrigation areas (if applicable)	POS and water pathways identified	Y	Sections 4, 5, 6 and Appendix A
Design Criteria			
Agreed design objectives and source of objectives		Y	Section 5
Pre-Development Environment			
Existing information and more detailed assessment (monitoring). How do the site characteristics affect the design?	Ground and surface water monitoring undertaken, with outcomes	N	

LOCAL WATER MANAGEMENT STRATEGY ITEM	DELIVERABLE	INCLUDED Y/N	NOTES
	influencing design recommendations.		
Site conditions - existing topography/contours, aerial photo underlay, major physical features	Site conditions plan	Y	Sections 2 and 3; Figures 1 to 3
Geotechnical- topography, soils including acid sulfate soils and test pit locations	Soil types	Y	Sections 2 and 3; Figures 2 and 3; Appendix A
Environmental - areas of significant flora and fauna, wetlands and buffers, waterways and buffers, contaminated sites	Environmental plan plus supporting data where appropriate	Y	Section 2
Surface water - topography, 100-year floodways, and flood fringe areas (if applicable). Pre and post development flows	Surface-water plan	Y	Sections 2 and 5; Figure 3, Appendices A, C and D
Groundwater - topography, pre-development groundwater levels and water quality, test bore locations	Groundwater plan plus site investigations	Y	Sections 2, 3 and 5; Figures 2 and 3
Water Sustainability Initiatives			
Water efficiency measures - private and public open spaces including methods of enforcement		Y	Sections 5 and 6
Water supply (fit-for-purpose) strategy, agreed actions and implementation		Y	Section 5
Water Management		Y	Section 5
Stormwater Management Strategy			
Flood protection - peak flow rates, volumes and top water levels at control points, 1% AEP/ 100-year flow paths and detention storage areas	1% AEP/ 100-year-event-plan	Y	Section 5
Manage serviceability - storage and retention required for the critical 5-year ARI storm events. Minor roads should be passable in the 5-year ARI event	5-year-event plan	Y	Section 5; Appendices A and C

LOCAL WATER MANAGEMENT STRATEGY ITEM	DELIVERABLE	INCLUDED Y/N	NOTES
Protect ecology - treatment areas for the 16 mm events, areas for water quality treatment and types of agreed structural and non-structural best management practices and treatment trains (including indicative locations). Protection of waterways, remnant vegetation and ecological linkages	Treatment of 16 mm events	Y	Section 5; Appendices A and C
Groundwater Management Strategy			
Post-development groundwater levels, existing and likely final surface levels, outlet controls, and subsoil drain areas/exclusion zones	Groundwater/subsoil plan	Y	Section 5
Actions to address acid sulfate soils or contamination		Y	Sections 2.4
The next stage - Subdivision Conditions and Urban Water Management Plan			
Content and coverage of future urban water management plans to be completed at subdivision. Include areas where further investigations are required before detailed design		Y	LWMS provides strategic direction for detailed design at the subdivision stage.
Monitoring			
Recommended future monitoring plan including timing, frequency, locations, and parameters, together with arrangements for ongoing actions	No monitoring recommended.	Y	Section 9
Implementation			
Developer commitments		Y	Section 10
Roles, responsibility, funding for implementation		Y	Section 10
Review	No review required, unless there are substantial changes proposed to Structure Plan or at subdivision.	Y	Section 9

1 INTRODUCTION

1.1 BACKGROUND

Aurora Environmental has been commissioned to prepare an updated Local Water Management Strategy (LWMS) on behalf of Juventus Pty Ltd for the modified Structure Plan of Hamelin Grove, for the K3 expansion at Lot 9001 Brockman Highway, Karridale. The modified Structure Plan layout (Figures 1 and 2, Appendix A) incorporates additional residential lots in the northern portion of the Structure Plan area, ranging from 0.2 ha to approximately 1 ha.

The LSP has been advertised for public comment. This version includes updates in response to submissions, including from DWER and SAMR.

The Structure Plan area is 15 km north of Augusta and 26 km south of Margaret River in the Augusta Margaret River Shire (Figure 1).

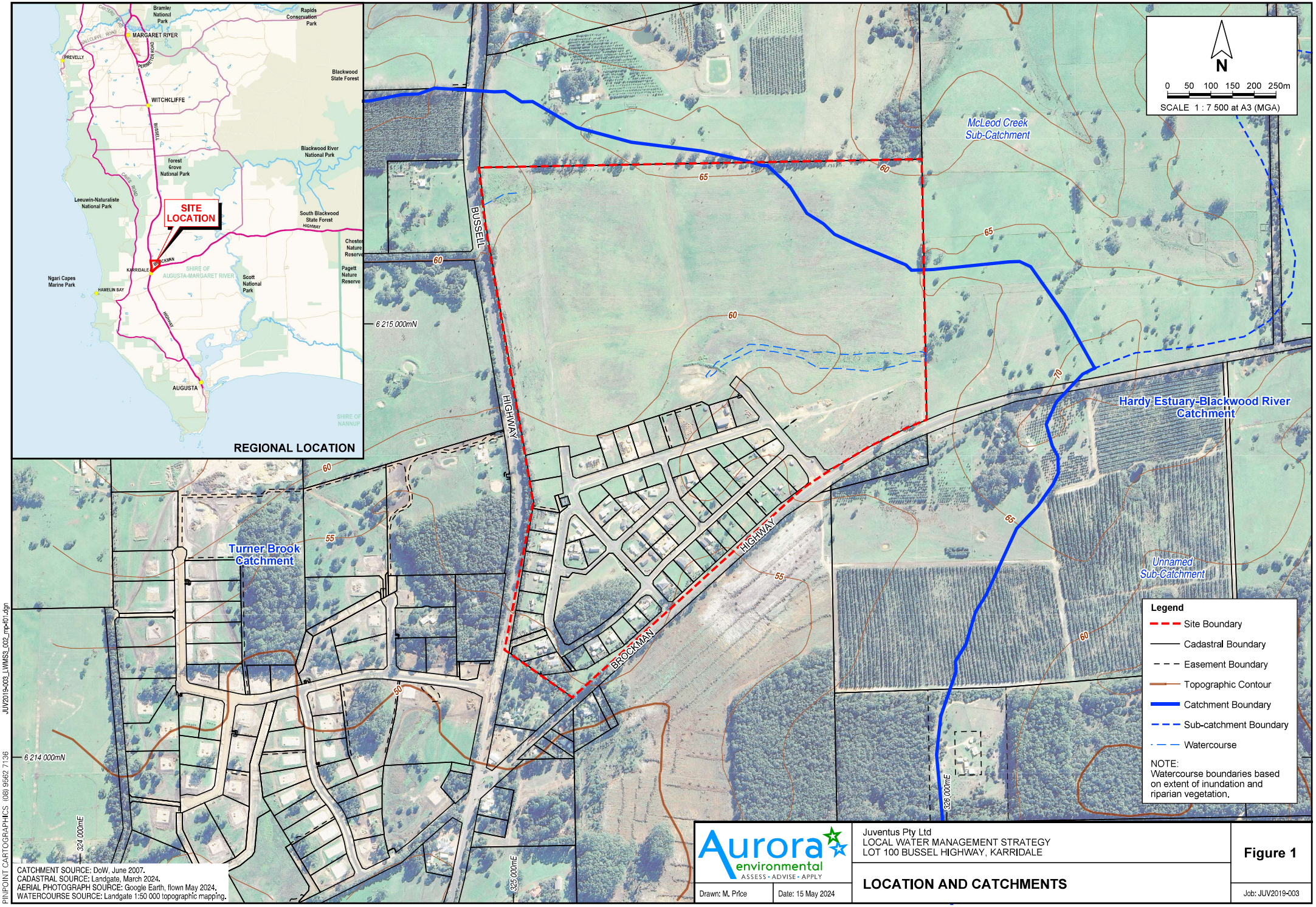
1.2 PURPOSE AND SCOPE

The Western Australian State Water Plan (Government of WA, 2007) identifies the need for planning for total water cycle management and Water Sensitive Urban Design (WSUD) to improve the management of storm water (particularly nutrients) and increase the efficiency of the use of water. Total water cycle management supported by WSUD is considered the most effective way to manage water resources in a development context.

This updated LWMS has been developed to support the modified structure plan by demonstrating how the structure plan design complies with the Better Urban Water Management Guidelines (WAPC, 2008a) and Decision Process for Stormwater Management (Department of Water and Environmental Regulation, DWER, 2017).

The purpose of this updated LWMS is to provide information about the site in relation to the modified Structure Plan layout. This includes consideration of previously collected baseline data for groundwater levels, strategies for efficient use of potable and non-potable water and a detailed examination of the proposed approach to effluent disposal and managing storm water at the site. To achieve this, the following scope has been undertaken:

- Documentation of pre-development hydrological information;
- Site and soil evaluation for the K3 urban expansion areas identified in the Shire's Local Planning Strategy;
- Identification of water management opportunities and constraints;
- Identification of potential alteration to the water balance as a result of development of the site;
- Development of strategies for the protection of water quality;
- Preliminary treatments for water quality and quantity for rainfall events;
- Recommendations regarding suitable on-site wastewater treatment; and



CATCHMENT SOURCE: DoW, June 2007.
CADASTRAL SOURCE: Landgate, March 2024.
AERIAL PHOTOGRAPH SOURCE: Google Earth, flown May 2024.
WATERCOURSE SOURCE: Landgate 1:50 000 topographic mapping.

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Juventus Pty Ltd
LOCAL WATER MANAGEMENT STRATEGY
LOT 100 BUSSEL HIGHWAY, KARRIDALE

Figure 1

LOCATION AND CATCHMENTS

Drawn: M. Price | Date: 15 May 2024 | Job: JUV2019-003

PINPOINT CARTOGRAPHICS (08) 9662 7136 JUV2019-003_LWMS2_002_mp-r01.dgn

- Summary of key responsibilities and timeline for implementation of each strategy.

1.3 LOCAL WATER MANAGEMENT STRATEGY OBJECTIVES

The objective of this LWMS is to provide the following information for the proposed development of the Structure Plan area:

- Identify the environmental outcomes to be achieved through the implementation of this LWMS;
- Demonstrate that best practice and WSUD principles are incorporated in the development; and
- Provide contingency plans if the performance criteria specified in the LWMS are not achieved.

1.4 WATER POLICY DOCUMENTS

This LWMS has used the following documents to define its design principles and objectives:

1.4.1 State Planning Policy 2.9 Water Resources

State Planning Policy (SPP) 2.9, *Water Resources* (WAPC, 2006) is made under Section 26 of the *Planning and Development Act 2005*. The objectives of SPP 2.9 are to:

- Protect, conserve, and enhance water resources that are identified as having significant economic, social, cultural and/or environmental values;
- Assist in ensuring the availability of suitable water resources to maintain essential requirements for human and all other biological life with attention to maintaining or improving the quality and quantity of water resources; and
- Promote and assist in the management and sustainable use of water resources.

The State government has developed a draft SPP 2.9 and Guidelines that will streamline and simplify the current water-related policy framework, consistent with the State Government's current planning reform agenda. Once gazetted, draft SPP 2.9 and Guidelines will supersede:

- State Planning Policy 2.1 Peel-Harvey Coastal Plain Catchment;
- State Planning Policy 2.2 Gnangara Groundwater Protection;
- State Planning Policy 2.3 Jandakot Groundwater Protection;
- State Planning Policy 2.7 Public Drinking Water Source Policy;
- State Planning Policy 2.9 Water Resources;
- Better Urban Water Management;
- State Planning Policy 2.10 Swan Canning River System;
- The policy measures that address flooding within State Planning Policy 3.4 Natural Hazards and Disasters; and
- Government Sewerage Policy.

The intent of draft SPP 2.9 and Guidelines is to deliver greater clarity around how water-related provisions are implemented. The draft SPP 2.9 and Guidelines incorporate improvements that will lead to better planning decision-making through consideration of appropriate management measures to achieve optimal water resource and development outcomes. However, at this time the draft has not been adopted.

1.4.2 Government Sewerage Policy

The Government Sewerage Policy (GSP) (DPLH, 2019) states the West Australian Government's position on the provision of sewerage services in the State through the planning and development of land. The GSP requires reticulated sewerage to be provided during the subdivision of land. The GSP acknowledges that reticulated sewerage cannot be provided in all development situations, and where this occurs adopts a position of best practice. The objectives of the GSP are:

- To generally require connection of new subdivision and development to reticulated sewerage;
- To protect public health and amenity;
- To protect the environment and the State's water and land resources;
- To promote the efficient use of infrastructure and land; and
- To minimise costs to the broader community.

1.4.3 Stormwater Management Manual for Western Australia

The DWER's current position on stormwater management in Western Australia is outlined in *Chapter 2: Understanding the Context of Stormwater Management Manual for Western Australia* (Department of Water, 2004-2007 as updated 2022) which details the management objectives, principles and a stormwater delivery approach for Western Australia.

The principal objectives for managing stormwater in Western Australia are:

- Water Quality: To maintain or improve the surface and groundwater quality in the development areas relative to pre-development conditions;
- Water Quantity: To maintain the total water cycle balance in the development area relative to the pre-development conditions;
- Water Conservation: To maximise the re-use of stormwater;
- Ecosystem Health: To retain natural drainage systems and protect ecosystem health;
- Economic Viability: To implement cost effective and easily maintained stormwater management systems that are economically viable over the long term;
- Public Health: To minimise risks, including risk of injury or loss of life, to the community;
- Protection of Property: To protect the built environment from flooding and waterlogging;
- Social Values: To ensure that social, aesthetic and cultural values are recognised and maintained when managing stormwater; and

- Development: To ensure the delivery of best practice stormwater management through planning and development of high-quality developed areas in accordance with sustainability and precautionary principles.

1.4.4 Decision Process for Stormwater Management

DWER (2017) has formulated a *Decision Process for Stormwater Management in Western Australia* which provides a framework for the planning and design of storm water management systems and assists in meeting the objectives outlined above. This process has been used in the formulation of this document and design criteria for events and treatments.

1.4.5 Shire of Augusta Margaret River – Policies and Local Planning Scheme

Local Planning Scheme

Clause 5.22 of Local Planning Scheme (LPS) 1 states that dwellings without reticulated mains water supply are required to provide a rainwater tank with a minimum capacity of 120,000 L with an additional 10,000 L for fire-fighting purposes. A minimum catchment (roof) area of 200 m^2 is also required.

1.4.6 Australian Standard 1547:2012

Australian Standard 1547:2012 (Standards Australia, 2012), considers permeability values calculated from field results and other factors including groundwater separation distances, to determine suitability and setbacks for on-site effluent disposal (as appropriate). This Standard is used when considering the application of the Draft Country Sewerage Policy (Department of Health (DoH), 2003) which sets out the wastewater disposal requirements for areas where reticulated sewer is not available.

1.4.7 Country Rainwater Collection

Rainwater collection provides potable water for many residences where reticulated drinking water supplies are not available. The DoH provides information regarding the safe collection and storage of rainwater for potable use (DoH, 2004 and 2011). To ensure that adequate volumes of water are available for residential consumption, consideration needs to be given to annual rainfall, collection area, tank size and the amount of water used by the household.

1.4.8 Grey Water Recycling

Grey water recycling is a useful strategy to enhance water reuse and is guided by a Code of Practice (DoH, 2010). The code outlines acceptable methods for recycling grey water to ensure that health and pollution risks are avoided. Grey water reuse systems need to be approved by local government prior to installation. Grey water systems are not generally recommended where secondary wastewater treatment systems are used for treatment of effluent as these units treat wastewater to a higher standard than grey water systems (*pers. comm.* Shire of Augusta Margaret River Health Department).

1.5 SITE VISITS AND DATA COLLECTION

The following data collection has been undertaken for the site and has been considered in the preparation of this document:

- Site and soil evaluation (Douglas Partners, 2022); and
- Depth to groundwater (Appendix E).

2 PRE-DEVELOPMENT ENVIRONMENT

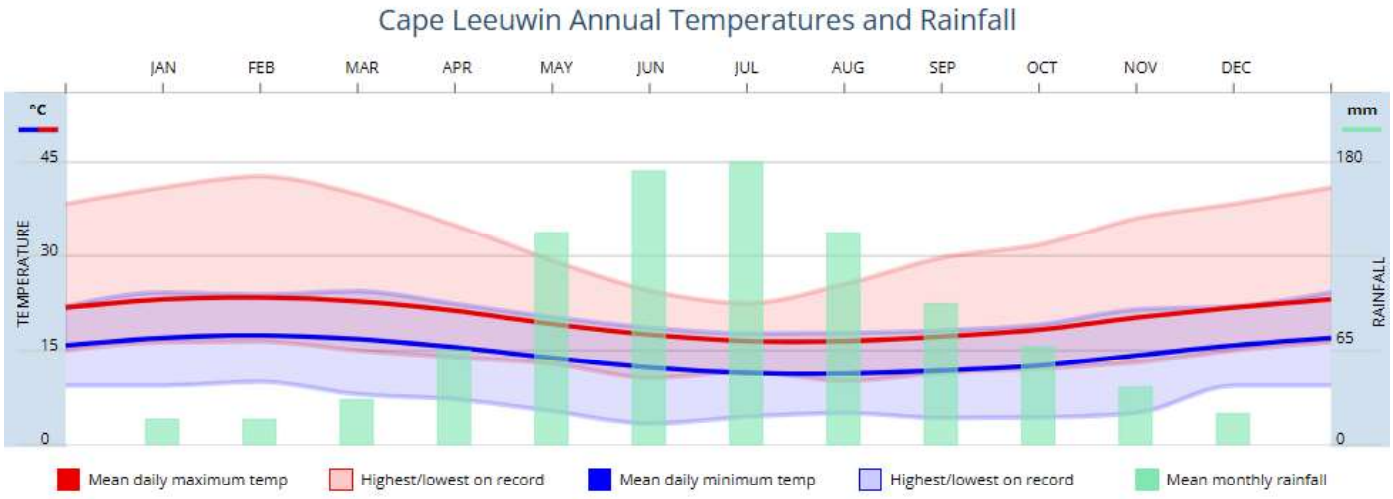
This section focuses on the attributes of the undeveloped portion of the Structure Plan area, in the context of the whole development area.

2.1 CLIMATE

Karridale, located near the west coast of southwestern Australia (WA), has a Mediterranean climate characterised by warm summers and cool, wet winters. The closest weather station to Karridale that has long term data is Cape Leeuwin (approximately 19.4 km from the Structure Plan area) The average monthly temperatures and rainfall are shown in Plate 1 (WeatherZone, 2024). Long term averages for Cape Leeuwin indicate that annual rainfall is in the vicinity of 978.3 mm per year, with the highest rainfall in July and lowest rainfall in February. Average summer temperatures peak at 23.4 °C in February, with winter maximums of 16.5 °C in July and August. Minimum temperatures are 17°C in Summer (January and February) and 11 °C in Winter (July to September).

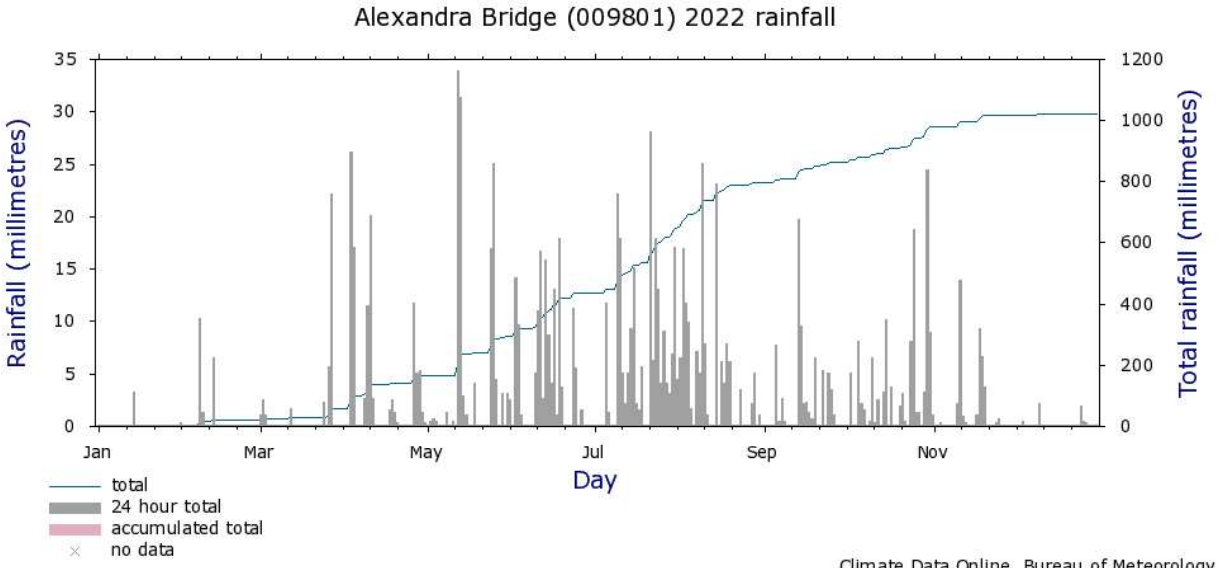
The 2022 rainfall recorded at Alexandra Bridge was 1022.5 mm (Plate 2; Bureau of Meteorology, 2023), which reflects a year of average rainfall. The 2023 rainfall was lower than 2023 with 914.9 mm of rain, reflecting a wetter than average June but a drier winter and spring.

PLATE 1: CLIMATE AVERAGES

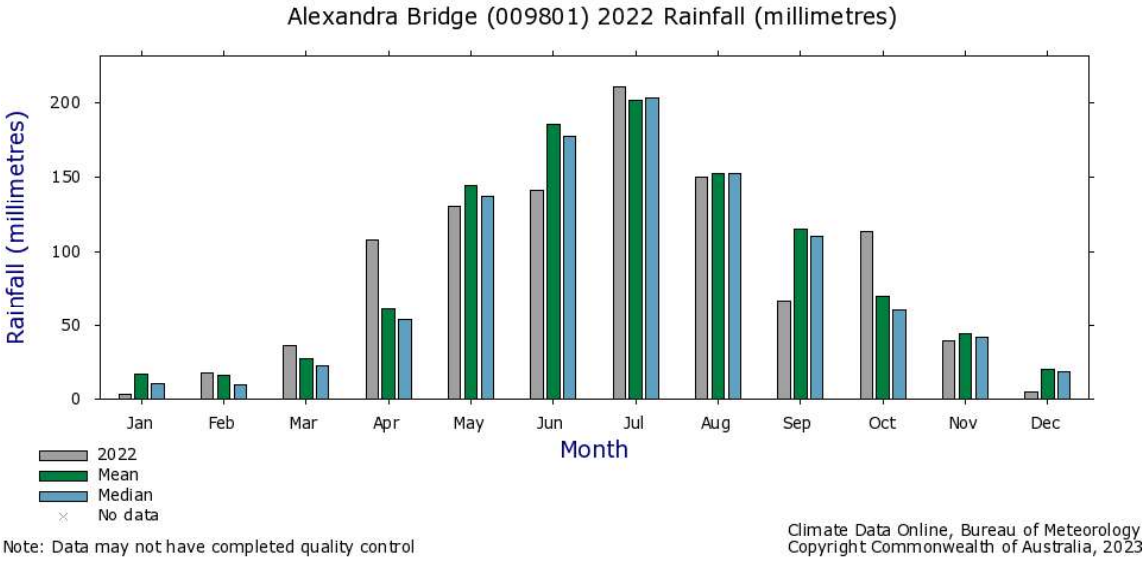


Source: Weatherzone, 2024

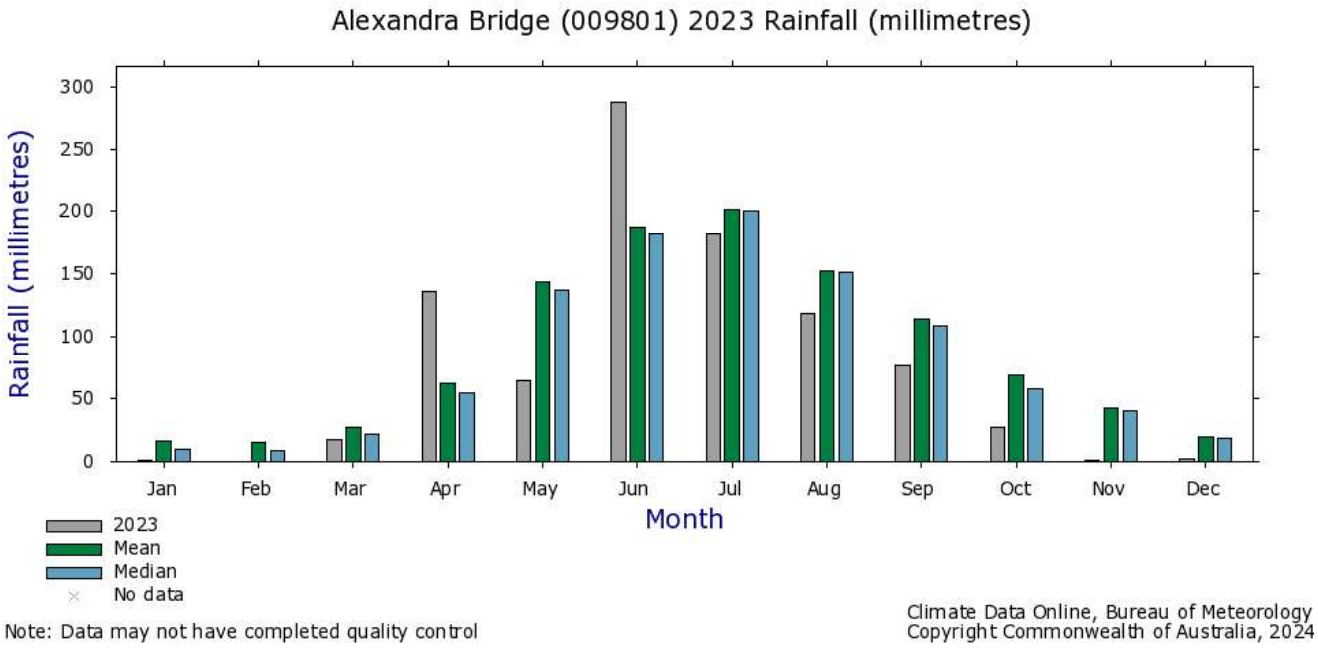
PLATE 2: RAINFALL 2022 AND 2023



Source: BOM, 2024
http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_display_type=dataDGraph&p_stn_num=009801&p_nccObsCode=136&p_month=13&p_startYear=2022



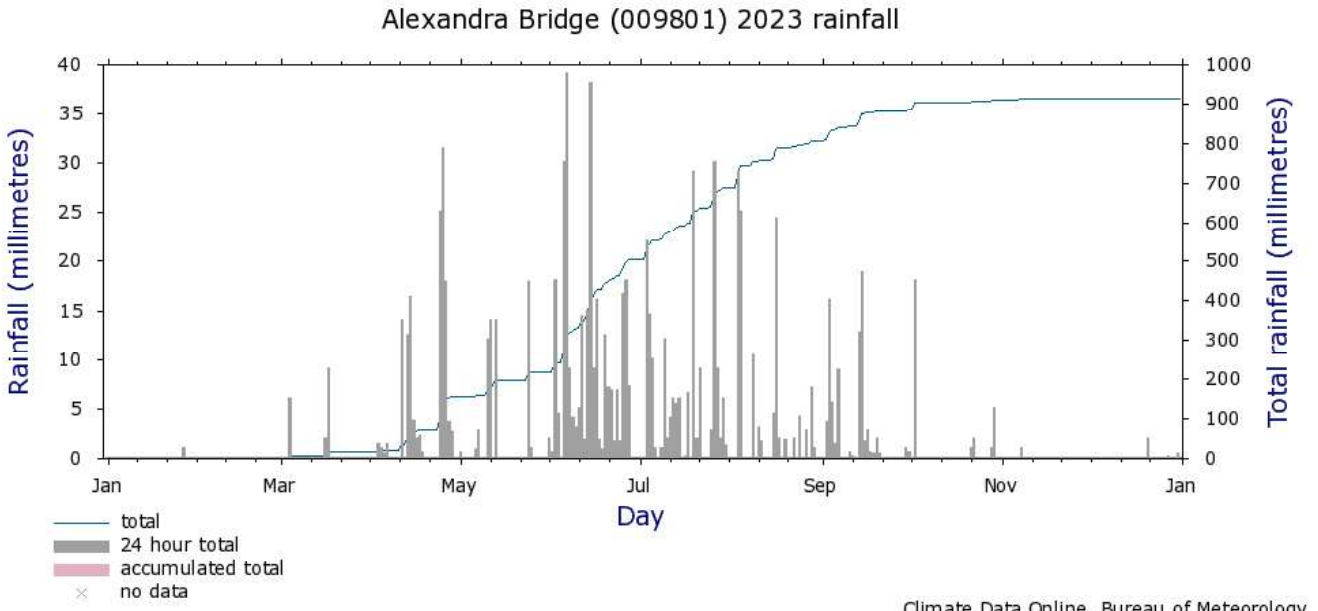
Source: BOM, 2024
http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_display_type=dataSGraph&p_stn_num=009801&p_nccObsCode=136&p_month=13&p_startYear=2022



Note: Data may not have completed quality control

Climate Data Online, Bureau of Meteorology
Copyright Commonwealth of Australia, 2024

Source: BOM, 2024
http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_display_type=dataSGraph&p_stn_num=009801&p_nccObsCode=136&p_month=13&p_startYear=2023



Note: Data may not have completed quality control.

Climate Data Online, Bureau of Meteorology
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Source:
http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_display_type=dataDGraph&p_stn_num=009801&p_nccObsCode=136&p_month=13&p_startYear=2023

2.2 TOPOGRAPHY

Available topographic contours (Figure 2) indicate that the highest points in the Structure Plan area are on the northern and eastern boundaries, at approximately 65 mAHD. The land slopes gently down to the southwest from these points with a shallow valley oriented from the mid-eastern portion of the site to a wide valley floor in the south west portion. The lowest point is on the southwest boundary at around 55 mAHD).

2.3 GEOMORPHOLOGY, GEOLOGY AND SOILS

Records from the Geological Survey of Western Australia (2001) 1:50,000 Regolith Landform Series indicate that the geology of the Structure Plan area is derived from the Cowaramup Complex (CoC) with loose deposits of rock which have been influenced by gravity at the base of a slope (colluvial) with undivided slopes and gravelly silty sands (Figure 2).

The Structure Plan area lies within the hyper humid southwest geographic region (Margaret River) with landforms related to the Cowaramup System (Cw1 and C1) (Mattiske and Havel, 2005). The landform of this system is characterised by low hills with gently to moderately inclined slopes and swampy drainage depressions. Slopes in this landform can be steep to precipitous along deeply incised waterways. However, the Structure Plan area contains relatively gentle slopes. No part of the Structure Plan area has a gradient of greater than 1:10.

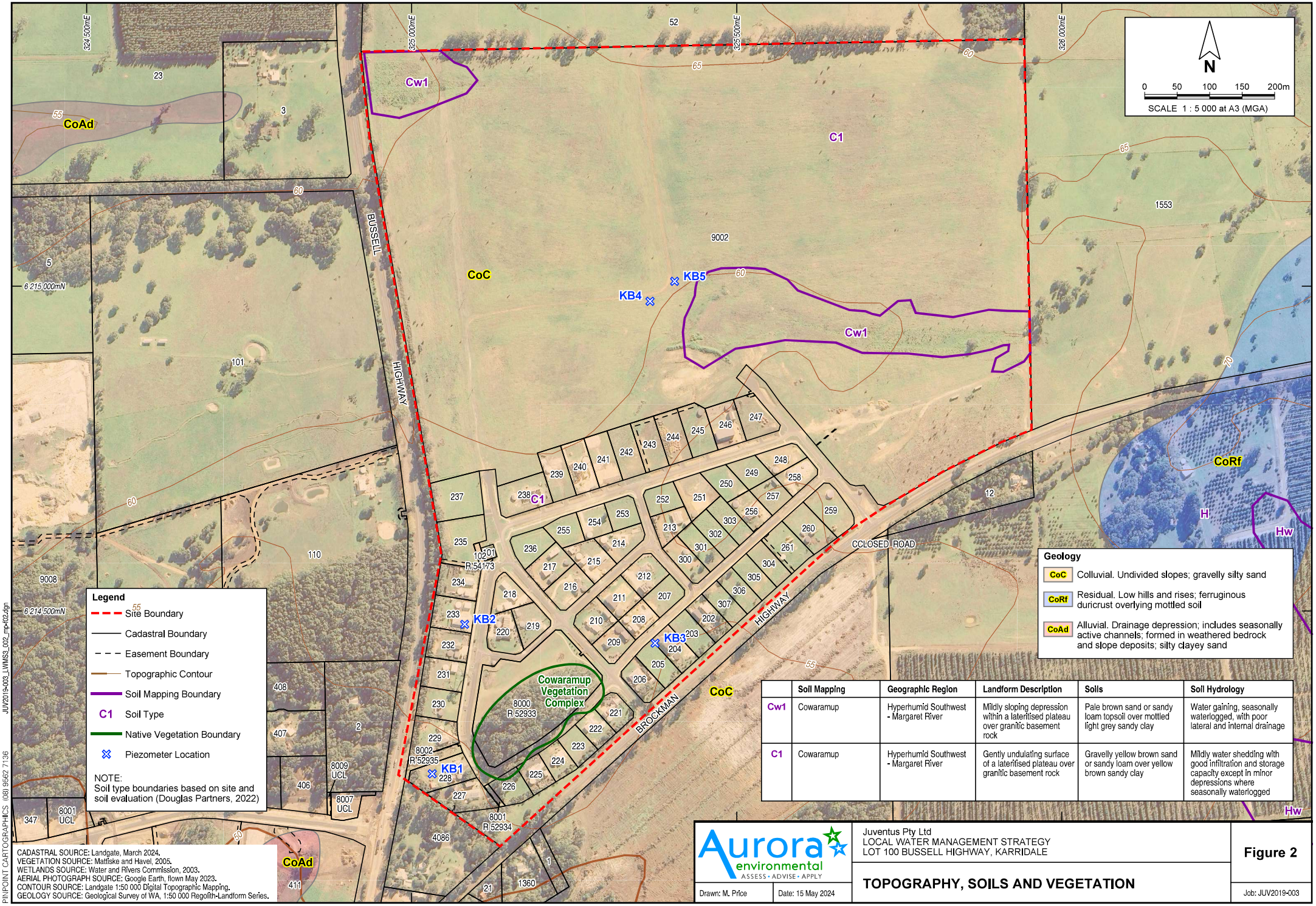
The Cowaramup System is characterised by residual materials (e.g. gravel) and colluvial deposits which overlie weathered rocks of the Leeuwin Complex. Hillcrests are commonly capped by ferruginous gravel or duricrust and leached quartz sand. Exposures of gneiss are common. Waterlogging may occur during winter in areas of low slope angle or depressions. Erosion may occur in sloping, cleared areas during heavy rain. The system may be overlain by sands of the Quindalup and Spearwood Systems. The distribution of these landforms is shown in Figure 2 and units C1 and Cw1 are described as follows (Mattiske and Havel, 2005):

C1: Gently undulating surfaces of a lateritised plateau over granitic basement rock comprising gravelly yellow brown sand or sandy loam over yellow brown sandy clay; and

Cw1: Mildly sloping depressions with a lateritised plateau over granitic basement rock comprising pale brown sands or sandy loam topsoil over mottled light grey sandy clay.

A geotechnical investigation (Douglas Partners, 2022) determined that soil profiles across the site comprise:

- **Sandy Topsoil** (Silty SAND SM, SAND SP-SM and Silty Sandy GRAVEL GM) **–** approximately varying between 100 mm and 200 mm in thickness, fine to medium grained, fine to coarse sized, grey-brown, with various amounts of fines, trace roots, from surface at all test locations, except test locations 44, 51, 65 and 66 where no topsoil was encountered; and
- **Unit 1: Possibly Alluvium** (Silty SAND SM and SAND SP-SM) – fine to medium grained, grey-orange-brown, with various amounts of fines, trace gravel, encountered beneath the topsoil at the test locations within the low-lying areas of the site (test locations 1, 2, 19, 30 to 34, 38, 39, 43, 48 and 62) to depths of between 0.4 m and more than 2 m (test target depth). An organic Silty SAND SM



	Soil Mapping	Geographic Region	Landform Description	Soils	Soil Hydrology
Cw1	Cowaramup	Hyperhumid Southwest - Margaret River	Mildly sloping depression within a lateritised plateau over granitic basement rock	Pale brown sand or sandy loam topsoil over mottled light grey sandy clay	Water gaining, seasonally waterlogged, with poor lateral and internal drainage
C1	Cowaramup	Hyperhumid Southwest - Margaret River	Gently undulating surface of a lateritised plateau over granitic basement rock	Gravelly yellow brown sand or sandy loam over yellow brown sandy clay	Mildly water shedding with good infiltration and storage capacity except in minor depressions where seasonally waterlogged

CADASTRAL SOURCE: Landgate, March 2024.
VEGETATION SOURCE: Mattiske and Havel, 2005.
WETLANDS SOURCE: Water and Rivers Commission, 2003.
AERIAL PHOTOGRAPH SOURCE: Google Earth, flown May 2023.
CONTOUR SOURCE: Landgate 1:50 000 Digital Topographic Mapping.
GEOLOGY SOURCE: Geological Survey of WA, 1:50 000 Regolith-Landform Series.

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LOCAL WATER MANAGEMENT STRATEGY
LOT 100 BUSSELL HIGHWAY, KARRIDALE

TOPOGRAPHY, SOILS AND VEGETATION

Figure 2

Drawn: M. Price | Date: 15 May 2024 | Job: JUV2019-003

PINPOINT CARTOGRAPHICS (08) 9662 7136 JUV2019-003_LWMS2_002_mp-f02.dgn

layer approximately 0.55 m thick was also recorded below the topsoil to a depth of 0.7 m below existing ground level, at test location 12, in the north eastern part of the site. The alluvial soils were generally 'very loose' to 'loose' to depths of between 0.3 m and 1.5 m, becoming medium dense with depth, except at test locations 1, 2 and 19 (north-western corner of the site) where no loose soils were recorded.

- **Unit 2A: Granular Colluvium** (mostly Silty SAND SM, but also SAND SP-SC, Silty Sandy GRAVEL GM and GRAVEL GP-GM) – fine to coarse grained, fine to coarse sized, grey-orange-brown, with various amounts of fines, encountered beneath the topsoil and Unit 1 soils at most test locations to depths of between 0.4 m and more than 2 m (target depth). No Unit 2A soils were encountered at locations 1, 2, 19, 30 to 34, 39 to 43, 48 to 50, 65 and 66. The granular colluvial soils were generally loose to depths of between 0.3 m and 1.2 m, becoming medium dense with depth at test locations 7, 8, 16, 21 to 24, 26, 28, 35 to 38, 45, 46, 54, 56, 58 and 60. Exceptions were test locations 35 and 44, where increased thicknesses (1.4 m and 1.65 m) of loose soils were recorded and test locations 9, 13, 17, 18, 20, 27, 29, 47, 51 to 53, 57, 59, 62 and 64 where no loose soils were recorded. Moderately to well cemented Silty SAND SM layers varying between 0.3 m and more than 1.3 m in thickness were recorded within the Unit 2A soils at several locations (test locations 6, 8, 9, 12, 3, 17, 24, 26 to 28, 36 to 38, 45, 53 and 54).
- **Unit 2B: Cohesive Colluvium** (generally Clayey SAND SC, but also Sandy CLAY CL-CH, CLAY CI-CH, Clayey Sandy GRAVEL GC and Clayey GRAVEL GC) – low to high plasticity, fine to medium gained, fine to coarse sized, various colours, trace cobbles, encountered beneath the soils of Units 1 and 2A or from surface at most test locations, except test locations 8, 12, 21, 24, 27, 28, 30, 32 to 34, 36 to 38, 42, 45, 47, 53 to 55 and 60 where no cohesive colluvial soils were recorded within testing depths of between 1.3 m (refusal on cemented soils) and 2 m (target depth). Unit 2B is interpreted to be mostly of colluvial origin, with some residual soils. The cohesive soils of Unit 2B were generally medium dense or denser and stiff or stiffer, except at test locations 9, 11, 15, 25, 42, 44 and 49 where loose soils were recorded to depths of between 0.7 m and more than 2.1 m.
- **Unit 3: Bedrock (granitic and ferruginous weathered rock)**: moderately weathered, medium to high strength, granite, and laterite excavated as GRAVEL GP-GM, fine to coarse sized, with sand and silt, encountered below Units 2A and 2B soils at test locations 50, 51 and 55 (southern part of the site) from depths of between 0.5 m and 1.9 m below existing ground levels.

The soil profiles described in Douglas Partners (2022) generally support the Cw1 and C1 descriptions. The extent of the Cw1 soil type is shown in Figure 2 based on has been inferred based on soil mapping (Mattiske and Havel, 2005), the site and soil evaluation (Douglas Partners, 2022) and examination of aerial photography.

2.4 ACID SULFATE SOILS

Acid sulfate soils (ASS) are wetland soils and unconsolidated sediments that contain iron sulfides which, when exposed to atmospheric oxygen in the presence of water, form sulfuric acid. ASS commonly occur in low-lying coastal lands such as Holocene marine muds and sands. When disturbed, these soils may produce sulfuric acid which can mobilise iron, arsenic, aluminium, manganese and

other heavy metals. The release of these reaction products can be detrimental to biota, human health and built infrastructure.

DWER (Department of Environment and Conservation, 2015a and 2015b) and the WAPC (2008b) have released guidance notes on ASS, covering the requirement for assessing sites and the management of sites where ASS is identified. ASS investigations are commonly required as part of the conditions of subdivision or as a requirement for a dewatering licence application.

ASS risk mapping for the Lower Southwest (Landgate, 2023) indicates that there is a 'moderate to low risk' of ASS occurring within 3 m of ground surface of soil type Cw1 (Figure 2). Soil type C1 does not have an associated ASS risk.

If excavation of Cw1 soils to depths greater than 1.5 m below ground level and greater than 100 m^3 is proposed, the activity would require testing for ASS and depending on the results, the preparation of an ASS Management Plan.

2.5 VEGETATION

The Structure Plan area has been cleared of native vegetation for agricultural purposes. Vegetation mapping by Mattiske and Havel (2005) for the Southwest Forest Region indicates that the vegetation previously found on the site was most likely distributed as shown in Figure 2, comprising the following two vegetation types:

C1: Open to Tall Open Forest of *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* with *Banksia grandis* and *Persoonia longifolia*. Shrubs and herbs are characterised by *Leucopogon verticillatus, Leucopogon capitellatus, Pteridium esculentum, Bossiaea linophylla, Bossiaea ornata, Hovea elliptica and Lasiopetalum floribundum*; and

Cw1: Woodland of *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* on slopes, with some *Agonis flexuosa*. Shrubs and herbs are characterised by *Pericalymma ellipticum*, *Astartea fascicularis, Taxandria linearifolia* ms, *Mesomelaena tetragona* and *Lepidosperma effusum.*

The northern portion of the Lot was planted with blue gums (*Eucalyptus globulus*). However, the plantation has now been removed (approximately 2020). Although blue gums may have altered the hydrology during growth, the groundwater system would have reached equilibrium one or two years after harvesting.

2.6 CATCHMENTS AND SUB-CATCHMENTS

The northeastern portion of the Structure Plan area is in the McLeod Creek sub-catchment of the Blackwood River (Figure 1). Water from this system ultimately discharges into the Hardy Inlet. The balance of the property is in the Turner Brook sub-catchment which discharges to the coast at Deepdene.

2.7 SURFACE WATER

Under the *Rights in Water Irrigation Act 1914* (RIWI Act), the southern portion of the property is within the proclaimed Cape to Cape South Surface Area and the northeastern portion is in the proclaimed

Lower Blackwood River Surface Water Area. In proclaimed areas, a licence is required to use water from watercourses, or alter beds and banks associated with a watercourse.

There are two areas in the SP associated with soil type Cw1 (Figure 2 and Figure 3) which have shallow soils over clay and granite. The geotechnical investigation undertaken in 2022 (Douglas Partners, 2022) indicates that water is perching on granite and clay and is being expressed at ground surface during wetter months when the rainfall rate exceeds the infiltration capacity of the soil profile. These areas do not support native vegetation (Plate 3).

These features have been deemed to be watercourses for the purpose of the RIWI Act with water flowing from east to west. In the central portion of the SP area, the surface water dissipates into the soil at the western edge of the Cw1 soil area. Disturbance of these features will need to be addressed via a Beds and Banks permit to allow for construction of roads, swales, POS and other features.

PLATE 3: PHOTOGRAPHS OF PERCHED WATER ON Cw1 SOILS

Source: Photographs taken in winter 2022

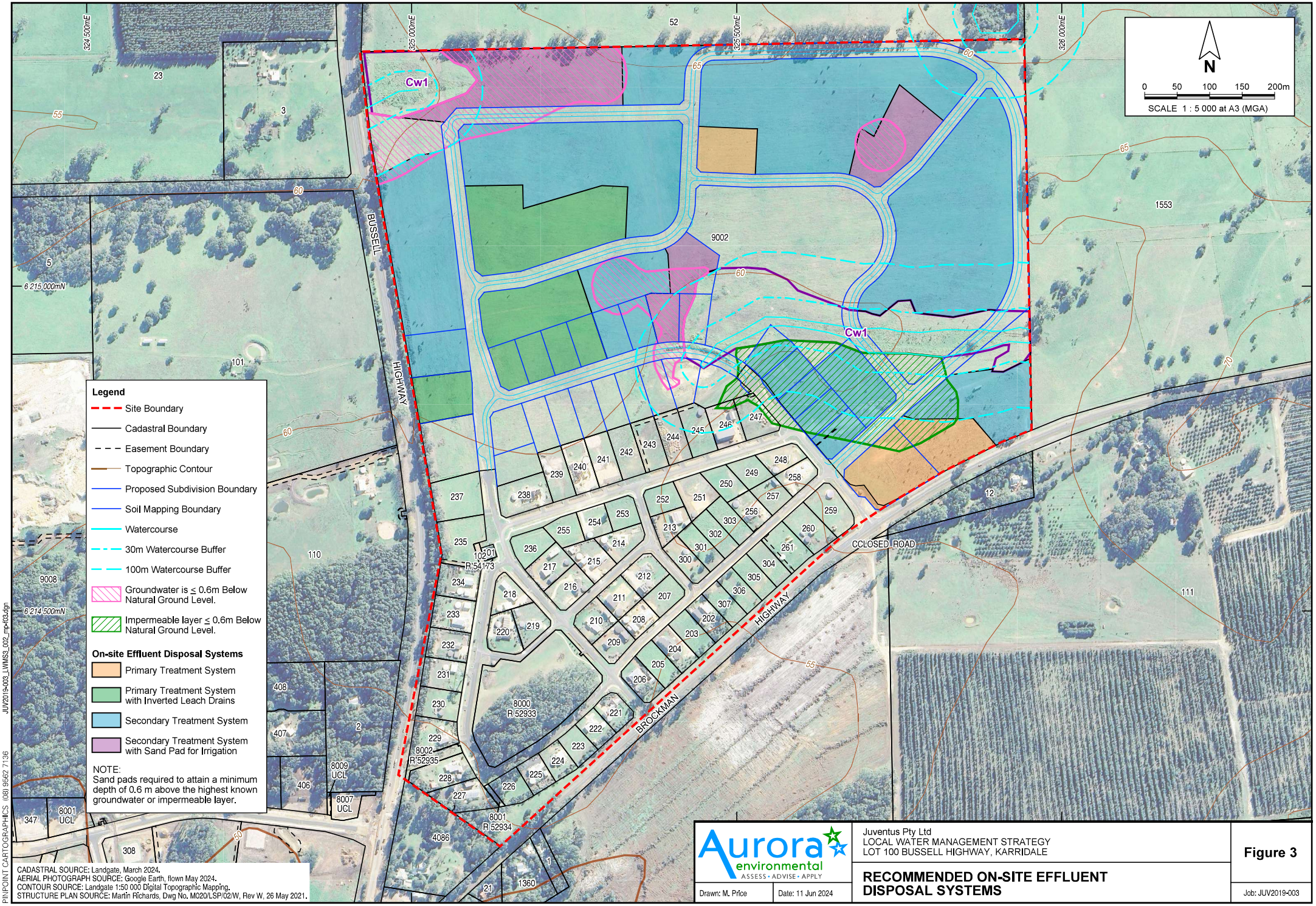
2.8 WETLANDS

There is a dampland (seasonally waterlogged basin) on Lot 4070 Brockman Highway to the southeast of the Structure Plan area (Figure 3; Geomorphic Wetlands – Augusta to Walpole; DEC, 2003). A site inspection indicated that the Brockman Highway drainage system prevents direct drainage into the wetland from the Structure Plan area.

There is also a paluslope wetland (seasonally inundated slope) on Lot 52 Bussell Highway to the north of the Structure Plan area (Figure 3). The Geomorphic Wetland mapping indicates that this wetland extends onto the Structure Plan area. However, a site inspection indicated that the wetland is confined to Lot 52.

There are no Environmental Protection Southwest Agriculture Zone Wetlands Policy 1998 wetlands on the Structure Plan area.

There are no Public Drinking Water Source Areas in the vicinity.



CADASTRAL SOURCE: Landgate, March 2024.
AERIAL PHOTOGRAPH SOURCE: Google Earth, flown May 2024.
CONTOUR SOURCE: Landgate 1:50 000 Digital Topographic Mapping.
STRUCTURE PLAN SOURCE: Martin Richards, Dwg No. M020/LSP/02/W, Rev W, 26 May 2021.

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Drawn: M. Price | Date: 11 Jun 2024

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LOCAL WATER MANAGEMENT STRATEGY
LOT 100 BUSSELL HIGHWAY, KARRIDALE

RECOMMENDED ON-SITE EFFLUENT DISPOSAL SYSTEMS

Figure 3

Job: JUV2019-003

PINPOINT CARTOGRAPHICS (08) 9662 7136 JUV2019-003_LWMS2_002_mp-f03.dgn

2.9 GROUNDWATER

The Structure Plan area is within the RIWI Act proclaimed Blackwood Groundwater Area and the eastern portion of the Cape to Cape South subarea. The groundwater associated with Management Area 12 (four kilometres to the west of the Structure Plan area) is managed to protect the values of cave systems and coastal vegetation. A licence is required to abstract and use groundwater in this area.

The geology of the eastern part of the Cape to Cape South subarea, including the Structure Plan area, comprises fractured rocks of the Leeuwin Complex, which are granitic with an overlying weathered profile. They are overlain by shallow surficial deposits. In fractured rock aquifers, the rock body is solid and groundwater storage and movement can occur only along fractures in the rock, which are usually relatively limited, and in most instances, not well connected. There is considerable uncertainty associated with the development of a sustainable groundwater resource from the fractured rock aquifer due to its irregular nature and recharge. Groundwater conditions are highly variable, the yields are generally low and salinity may be up to 4,000 mg/L.

The hydrology of the Structure Plan area has been described by Mattiske and Havel (2005) as follows:

C1: Mildly water shedding with good infiltration and storage capacity except in minor depressions where there is seasonal waterlogging. 0r

Cw1: Water gaining, seasonally waterlogged with poor lateral and internal drainage.

Site geotechnical investigations (Douglas Partners, 2022) were undertaken on 24 and 27 October 2022 during a wet spring period (refer to Section 2.1). The results indicate that there are two main areas where water perches in wet conditions. These soils comprise Cw1 where water is likely to perch on impermeable horizons such as granite, laterite and clay. The Cw1 areas is depicted in Figure 2 and Figure 3, which shows areas where groundwater during Spring 2022 was less than 0.6 m from the ground surface and where an impermeable layer(s) was less than 0.6 m below ground surface (Figure 3, Appendix D).

Groundwater depths of more than 2 m BGL were also detected (Appendix E). A groundwater contour diagram is included in Appendix F.

There has been some discussion about the impact of the blue gum plantation on groundwater. However, as the plantation was removed around 2020, the investigation by Douglas Partners in Spring of 2022 would have sampled the area after readjustment to a post blue gum water regime.

2.10 WATER QUALITY

No water quality data has been collected for the Structure Plan area as the residential development will have relatively large lots, incorporate appropriate on-site effluent disposal with soil type C1 likely to pose a low risk to the quality of groundwater and surface resources.

2.11 LAND CAPABILITY

Identification of soils, landform types and on-site investigations for the Structure Plan area have been undertaken so land capability of the K3 expansion area can be assessed as per the requirements for site and soil evaluations (DoH, 2021[1]).

The desktop assessment and on-site testing indicate that the following points need to be considered for large lot residential development:

- Potential perching of water on impermeable layers in wet conditions.
- Ease of excavation – Clayey soils are likely to be difficult to work under wet conditions.
- Foundation stability – High capability for all soils, subject to geotechnical investigations;
- Phosphorus export risk – Soil type Cw1 has a moderate risk of phosphorus export due to shallow soils;
- Wind erosion hazard – Low to moderate risk for C1 and no risk for Cw1;
- ASS within 3 m of ground surface – Moderate to low risk for Cw1 and no risk for C1; and
- Water pollution hazard – Low or no risk with use of approved on-site effluent disposal systems.

The site conditions suggest that there are waterlogging hazards associated with Cw1 soils. However with adequate treatments (e.g. location of lots, use of sand pads and drainage treatments) this risk can be minimised. Water erosion and flood hazards can be managed through implementation of drainage treatments which intercept and slow storm water flow. Soil salinity is a low risk .

In broad terms, the K3 expansion area is capable of supporting residential development. This capability is enhanced because of the large lot sizes which are proposed (0.2 ha – 1 ha) and the ability to utilise systems for on-site effluent disposal.

[1] https://www.health.wa.gov.au/~/media/Files/Corporate/general-documents/water/Wastewater/Site-Soil-Evaluation.pdf

3 ON SITE EFFLUENT DISPOSAL

3.1 FACTORS FOR ON-SITE EFFLUENT DISPOSAL

The Hamelin Grove and Karridale areas are not proposed for connection to a reticulated sewerage scheme. The ability for the Structure Plan area to incorporate on-site effluent disposal has previously been assessed according to the *Draft Country Sewerage Policy*, released by DoH in 2002 and amended 2003 (Aurora Environmental, 2014) as incorporated in the Hamelin Grove Structure Plan at that time.

In 2019 the Western Australian Government adopted the *Government Sewerage Policy* (GSP) (Government of Western Australia, 2019).

The GSP outlines requirements at various states of the planning system for effluent disposal in Schedule 1. The Structure Plan area is able to comply with the criteria in the GSP, indicating that on-site effluent disposal can be supported in the Structure Plan area.

However, Cw1 soils are generally not suitable for irrigation of treated waste water. Allowances have been made to locate primary treatment systems (PTS) in areas where separation to groundwater and soil types are suitable. Secondary treatment systems (STS) irrigation areas will be located where appropriate (e.g. in areas between 30 to 100 m from areas prone to inundation and areas where there is an impermeable layer or groundwater table less than 1.5 m below ground level).

Table 2 evaluates environmental compliance with the requirements of GSP - Schedule 1. Recommended systems in the LSP area are shown in Figure 3.

TABLE 2: REQUIREMENTS OF GOVERNMENT SEWERAGE POLICY

FACTOR	REQUIREMENT	STATUS/ COMMENT
A 1. Subregional/district and Local Planning Strategies		
No Local Planning Strategies for sub-regional or district plans apply to the Structure Plan area.		
Public Drinking Water Source Area (PDWSA), Priority 1, 2 or 3 area	The Structure Plan area is not within a PDWSA. The nearest PDWSA is on Fisher Road, 11 km to the south east.	The Structure Plan area is not within, or close to a PDWSA.
Sensitive receiving environments as outlined (in Section 7) of the GSP below:		
• Sewerage Sensitive Area	Approximately 1.7 km to an estuary catchment on the Swan and Scott Coastal Plains. (DPLH-062) Lower Blackwood River (sewerage sensitive area) is 3.1 km to the east of the Structure Plan area (noting that only a small part of the north-eastern portion of the land is in the same catchment).	The Structure Plan area is not within a sewerage sensitive area.
• Wetlands	There is a wetland on the northeast corner of the site. This wetland has 5.31 ha of its catchment within the Structure Plan area. Water perches on areas with shallow impermeable layers and soils. However these areas do not contain	The Structure Plan ensures that all created lots are more than 30 m from the wetland boundary. The Structure Plan area does not contain wetlands (including

FACTOR	REQUIREMENT	STATUS/ COMMENT
	features such as native vegetation and have been pasture or part of a blue gum plantation for many years. These areas will be managed in the context of drainage and water movement. Some of these areas will be within POS. Wetlands adjacent to the Structure Plan area are shown in Figure 3. These wetlands do not receive water from the Structure Plan area.	immediately downstream of the Structure Plan area).
• Marine reserves	The Ngari Capes Marine Park occurs 5.5 km to the west of the Structure Plan area. However, there are no water courses that directly link the subject land with the ocean.	The Structure Plan area is unlikely to impact on the marine reserve.
• Karst systems	There are no karst systems associated with the Structure Plan area.	This factor is not relevant to the Structure Plan.
Sewerage servicing options for future growth areas, including nearest reticulated sewerage	Water Corporation has confirmed that it is not viable to extend reticulated sewer from Augusta to the Structure Plan area.	On-site effluent disposal is required.
Major infrastructure requirements	Major infrastructure is not required as individual on-site effluent disposal systems (and grey water systems) are adequate for the size and density of the proposed development.	Lot sizes have been proposed to cater for on-site effluent disposal.
Opportunities for recycled and alternative water supplies and fit-for-purpose use and management	Individual wastewater treatment systems on site will allow for some reuse of treated wastewater (e.g. for irrigation).	Several alternatives are likely to be suitable for the Structure Plan area, including PTS and STS, and grey water systems, where appropriate. Sand pads and inverted leach drains may be required in some areas.
2 (b) REZONING AND STRUCTURE PLANNING		
Landform and soils	Geotechnical investigations for the Structure Plan area were undertaken by Douglas Partners in November 2022. An element of these investigations was to characterise the ground conditions in relation to the suitability for onsite effluent disposal. These geotechnical investigations indicated that soil types, permeability, depth to groundwater, and or a hardpan/bedrock and phosphorus retention is adequate for on-site effluent disposal. In some areas, sand pads may be required for irrigation of treated wastewater where groundwater perches over an impermeable layer and or separation to maximum ground water is less than 0.6 m below ground surface.	Installation of STS and subsurface irrigation of treated effluent. Sand pads required in areas where depth to groundwater or an impermeable layer is less than 0.6 mBGL.

Source: Based on GSP (2019)

Table 3 provides information regarding minimum site requirements and setbacks for onsite effluent disposal as outlined in Section 4 and Schedule 2 of the GSP. The Structure Plan area generally meets the requirements of the GSP and recommendations of specific effluent treatment systems and irrigation areas are made to ensure that the objectives of the GSP can be met.

TABLE 3: MINIMUM REQUIREMENTS FOR ON-SITE EFFLUENT DISPOSAL

REQUIREMENT		STATUS
Location/ Land Use		
Sewerage sensitive Area		The Structure Plan area is not within a sewerage sensitive area.
Public Drinking Water Source Area (PDWSA)		The Structure Plan area is not within, or close to a PDWSA.
Separation from Water Resources: On-site Effluent Disposal – Primary Treatment		
Resource	**Distance Requirement**	**Comment**
Wellhead protection zone (WHPZ) or on Crown land within a reservoir protection zone	Not to be located within zone	The Structure Plan area is not within 100 m of a WHPZ or reservoir.
High water mark of a reservoir used for a public drinking water supply	100 m	The Structure Plan area is not within 100 m of a reservoir.
Bore used for public drinking water supply	100 m	No bores used for the purposes of a public drinking water supply are within 100 m of the Structure Plan area.
Private bore used for household / drinking water purposes	30 m	The Structure Plan area is not within 30 m of private bore. (Water Information Reporting: http://wir.water.wa.gov.au/Pages/Water-Information-Reporting.aspx)
Waterway or significant wetland and not within a waterway foreshore area or wetland buffer	100 m for primary treatment. Setback can be reduced to 30 m for secondary treatment where other criteria are met.	The Structure Plan contains areas with water perched on granite and clay during the wetter months (Cw1, Figure 2, Appendix E). However, these areas do not support native vegetation and will be managed as part of the drainage system. PTS will be at least 100 m from areas defined a watercourse with STS incorporated between 30 and 100 m from watercourse boundaries. All water generated in the Structure Plan area will be treated in a 'train' system prior to discharge (detail to be provided in Urban Water Management Plan (UWMP) prior to subdivision). There is a paluslope wetland 15 m north of the northeast corner of the Structure Plan area (Figure 2). STS irrigation areas will be more than 30 m from the wetland.
Drainage system that discharges directly into a	100 m	There will be no drainage systems that will directly discharge into a waterway, significant wetland or selected

waterway or significant wetland without treatment		inlet estuary. All water generated in the subdivision will be treated via a treatment train prior to discharge (detailed design to be developed via UWMP prior to subdivision).
Area subject to inundation and / or flooding in a 10 % AEP rainfall event	Subject to flooding in a 10 % AEP rainfall event	Douglas Partners (2022) observed inundation of Cw1 soils in the northwestern and central portion of the Structure Plan area during their geotechnical investigations in Spring of 2022. These soil types will be subject to a combination of interception of surface water and fill as required.
Groundwater – Vertical separation (discharge point of onsite effluent disposal systems)		
Public drinking water source area (PDWSA)	2 m	Does not apply to this Structure Plan area.
Sewage sensitive area (SSA)	1.5 m	Does not apply to this Structure Plan area.
Separation to groundwater outside PDWSA and SSA: • 0.6 m loams and heavy soils; • 1 m for gravels; • 0.6 m for sands – secondary treatment with nutrient removal; or • 1.5 m for sands – primary treatment		Relevant to this Structure Plan area. Depth to groundwater ranged from presence at ground level to greater than 2 mBGL. To achieve the separation of groundwater from the point of effluent disposal, lots will require a range of system types as shown in Figure 3. Testing of individual lots by future landowners is an option to determine if alternative systems may be suitable (building licence stage).

Soil classification is part of the consideration for sizing of land application/ irrigation areas for on-site effluent disposal. Table 4 shows Soil Classification 5 – Light clays – requires 300 m^2 for STS.

TABLE 4: LAND APPLICATION AREAS FOR SINGLE HOUSES

SOIL CATEGORY	SOIL TEXTURE	LAND APPLICATION AREA (m^2)	
		PRIMARY TREATMENT	SECONDARY TREATMENT
1	Gravels and sands	339	180
2	Sandy loams	339	180
3	Loams	429	225
4	Clay loams	620	257
5	Light clays	1,156	300
6	Medium to heavy clays	Special design	450

3.2 SOIL PERMEABILITY

Soil permeability is a measure of the rate at which water flows through a soil profile and is important in land capability investigations as it provides an indication of whether stormwater will infiltrate readily into the soil, or if it will potentially cause ponding and/or surface runoff.

As a part of geotechnical investigations, infiltration tests undertaken in October 2022 (Douglas Partners, 2022; as shown in Table 5), the soils tested were classified according to AS 1547-2012. Douglas Partners (2022) advised that given the soil variability across the site, a Soil Category 5 should be applied to the area, unless a higher permeability is indicated by field infiltration at the specific location of a proposed effluent disposal system.

K_{SAT} values were calculated from the field permeability results. Calculated K_{SAT} values ranged from 0 m/day to 3.4 m/day. Six test locations had a very low permeability, two test locations a low permeability and two test locations as being practically impermeable. Table 5 details measured permeability of test locations.

TABLE 5: CALCULATED K_{SAT} VALUES AND DRAINAGE CLASSIFICATION

Test Location	Depth (m)	Measured Permeability		In situ Conditions of Tested Material
		(m/s)	(m/day)	
7	1.0	2.9 x 10-7[1]	0.03 [1]	Unit 2A: SAND SP-SC, with clay, loose
10	1.0	2.1 x 10-7[1]	0.02 [1]	Unit 2B: Clayey SAND SC, medium dense
14	1.0	3.3 x 10-7[1]	0.03 [1]	
23	1.0	2.5 x 10-7[1]	0.02 [1]	
36	0.5	4.0 x 10-5[1]	3.4 [1]	Unit 1: Silty SAND SM, medium dense
42	1.0	1.7 x 10-6[1]	0.10 [1]	Unit 2B: Clayey SAND SC, medium dense
56	1.0	3.0 x 10-7[1]	0.03 [1]	
59	0.9	0 [1] [3]	0 [1], [3]	Unit 2B: Sandy CLAY CI-CH, hard
61	1.0	0 [1] [3]	0 [1], [3]	Unit 2B: CLAY CH, stiff
64	1.0	7.0 x 10-7 [2]	0.06 [2]	Unit 2B: Sandy CLAY CH, stiff to very stiff

[1] Constant Head Method, [2] Falling head method, [3] No infiltration recorded over a 10 minute testing period. Douglas Partners (2022). *Soil Category as per AS 1547:2012.

Douglas Partners (2022) have advised, based on their field observations and permeability tests, that soils across the site are considered to be Category 5: a light clay which is imperfectly drained (Standards Australia, 2012).

The recommended Design Loading Rates (DLRs) for disposal of wastewater to land are based on the calculated K_{SAT} values and interpreted soil category as presented in AS1547:2012 (Standards Australia, 2012). These rates are given for conventional absorption trenches and beds, evapo-transpiration: absorption (ETA)/seepage (ETS), mounds and irrigation. The DLRs for soils categories found on the Structure Plan area are summarised in Table 6.

The soil categories present on site, as determined through site testing, provide a number of options for types of onsite disposal of effluent. That is, trenches, beds, ETA, ETS, mounds, pads and irrigation are appropriate means for wastewater disposal.

TABLE 6: RECOMMENDED DESIGN LOADING RATES

Soil Characteristics				Disposal Method			
Soil Category	Structure	Soil Texture	Indicative Permeability (K_{sat} metres/ day)	Trenches and Beds	Evapo Transpiration / Absorption/ Seepage	Mounds	Irrigation
5	Strongly Structured		0.12- 0.5	12 mm /day	8 mm /day	8	
	Moderately structured	Clay loams	0.06 – 0.12	10 mm /day	5 mm /day See Notes 1 & 2)	5 (see Note 4	3 See Note 3
	Weakly structured or massive		<0.6	8 mm /day			

* Source: AS 1547:2012. Notes:

1. To enable use of such soils for on-site wastewater land application, special design requirements and distribution techniques or soil modification procedures will be necessary. For any system designed for these soils, the effluent absorption rate shall be based upon soil permeability testing. Specialist soils advice and special design techniques will be required for clay dominated soils having dispersive (sodic) or shrink/swell behaviour. Such soils shall be treated as Category 6 soils. In most situations, the design will need to rely on more processes than just absorption by the soil.
2. If K_{sat} < 0.06 m/d, a full water balance for the land application can be used to calculate trench/bed size
3. For Category 3 to 5 soils (loams to light clays), the drip irrigation system needs to be installed in an adequate depth of topsoil (in the order of 150 - 250 mm of in situ or imported good quality topsoil) to slow the soakage and assist with nutrient reduction.

3.3 PHOSPHORUS RETENTION

The treatment capacity of the soil, as well as its hydraulic capacity determines the effluent loading rate (Standards Australia, 2012). To determine the treatment capacity of the soil, the Phosphorus Retention Index (PRI) for soils present at the site was analysed from four samples collected on 7 November 2022 as a part of Douglas Partners geotechnical investigations.

PRI provides a measure of the phosphorus-holding capacity of a soil, which is important as it provides an indication of whether phosphorus discharged in effluent will be bound to soils and held in the soil profile or leached directly to the environment. High PRI scores indicate a high phosphorus retention capability.

Soils with PRI ratings higher than 10 have a reduced risk of leaching nutrients through the soil profile and into groundwater (Department of Water 2006). The *Code of Practice for the Design, Manufacture, Installation and Operation of Aerobic Treatment Units* (DoH, 2001) specifies surface irrigation disposal areas need to contain soils with PRI values greater than 20. If soil PRI is less than 20, use of amended soils are recommended for irrigation. The soil of test location 7 has a poor ability to absorb phosphorus and is reflective of pale grey sands. However, the other sites analysed had a high ability to adsorb phosphorus (Table 7) due to the presence of orange gravelly sands and clayey sands.

TABLE 7: PRI TESTS RESULTS

TEST LOCATION	DEPTH	PRI
7	1.0 m	3.4

10	1.0 m	330
56	1.0 m	1300
61	1.8 m	890

Source: Douglas Partners, 2022

3.4 DETERMINING TYPES OF SYSTEMS

Catering for on-site effluent disposal requires consideration of a number of factors including soil type, permeability, distance to groundwater, slopes and PRI values. Given the variable soil conditions at the site and soil evaluation (Douglas Partners, 2022), depth to groundwater and/or impermeable layers areas for different systems have been delineated for different systems.

The following systems will be required:

- Primary treatment systems (where there is a minimum 1.5 m depth to maximum groundwater);
- Primary treatment with inverted leach drains (where there is depth to maximum groundwater of greater than 0.6 m but less than 1.5 m;
- STS where there is a depth to groundwater of greater than 0.6 m; and
- STS with sand pads (where there is a depth to groundwater of less than 0.6m).

In some areas, STS with sand pads for irrigation of treated waste water will be required due to inadequate separation to maximum winter ground water levels, or where there is an impermeable layer within 0.6 m of the ground surface. These areas are indicated in Figure 2 and Figure 3 and comprise Cw1 soils, areas with a maximum groundwater of less than 0.6 m BGL (shown in orange) and areas with an impermeable layer less than 0.6 m from ground level (shown in blue).

Figure 3 shows recommendations for on-site effluent disposal systems in the LSP area. However, as the soils across the site are variable and the SSE/geotechnical investigations (Douglas Partners, 2022) tested at 100 m intervals, at the building licence stage, there are several options for more detailed assessment of types of treatment systems to be used. If additional soil profile testing is undertaken for maximum winter groundwater, depth to impermeable layers (September – October) and PRI landowners may be able to identify locations on individual lots which contain:

1. A suitable area where there is 1.5 m separation to maximum winter groundwater and an impermeable layer (clay or granite). If the 1.5 m separation can be achieved, a PTS is likely to be suitable. The area must be at least 100 m from water courses.
2. A suitable area with maximum groundwater deeper than 0.6 m BGL. Where additional testing indicates that the minimum 0.6 m separation can be achieved, on site effluent disposal can be achieved by installation of STS without a sand pad.
3. Irrigation areas with grey sands may have a reduced ability to sorb phosphorus and may require soil amendment or a nutrient removing STS.

STS systems are more expensive to install compared to PTS, although pricing appears to be closer to PTS than in the past. However, use of an STS means that there is a lower risk of discharge of nutrients

and pathogens. Some STS have the ability to remove nutrients such as phosphorus and nitrogen which may be required in areas with grey sands which may have a lower ability to sorb phosphorus.

STS must have regular service requirements (usually quarterly) and maintenance must be through an authorised person or contractor. The irrigation area forms an integral part of the approved wastewater system and should:

- Be marked with warning signs;
- Include minimum setbacks from buildings, boundaries and areas used by humans;
- Be maintained so that irrigation lines are accessible for maintenance; and
- Be planted with nutrient tolerant plants to avoid puddles or run off of effluent.

Irrigation areas must be 30m from wells, bores, dams or water course that are associated with animal or human contact.

Secondary treatment land application areas, excluding setbacks should be a minimum of 300 m^2 and require at least 300 mm of permeable soils above an underlying limiting layer (such as massive laterite, granite or clay). The Structure Plan area does not contain any slopes approaching 1:10 which would require the surface irrigation area to be increased or the irrigation area to be benched or bunded to ensure adequate infiltration of wastewater. The exact specifications for onsite effluent disposal will ultimately depend on the size of the household (determined by number of bedrooms) and Lot conditions. The AMRS will require verification of the system type at the building licence stage, when the new owners are proposing the location and type of effluent treatment system for each lot.

4 PROPOSED DEVELOPMENT

4.1 KEY ELEMENTS OF THE K3 EXPANSION STRUCTURE PLAN

The southern portion of the original Structure Plan area has been subdivided as Stages 1 to 3 (Appendix A) with water management in line with the adopted LWMS (Aurora Environmental, 2014). The proposed modifications to the Structure Plan for the K3 Expansion area outlines the creation of residential lots ranging from 0.2 to 1 ha. POS areas will also be created (to a total of 9.0721 ha for the entire Structure Plan area).

Karridale is not serviced with reticulated potable water or sewer, so new residents will be required to install rainwater tanks and on-site effluent disposal units.

Douglas Partners SSE (2022) has characterised the Cw1 soil with areas which have perched water in winter incorporated into POS. The Cw1 boundaries are shown in Figure 2. In addition, at the subdivision stage, lot sizing and orientation will allow for suitable areas for disposal of treated waste water. Analysis for on-site effluent disposal (Section 3) has taken the physical attributes of the Cw1 soils into account and designated suitable treatment systems (Figure 3) based on the GSP (2019).

4.2 HYDROLOGICAL OPPORTUNITIES AND CONSTRAINTS

Opportunities associated with the proposed development include:

- Soil permeability is 'low' to 'medium to low', but adequate for domestic wastewater disposal;
- Proposed lot sizes are relatively large;
- There is low to no risk of ASS for soil type C1;
- Potable water will be collected on-site;
- The site is suitable for infrastructure such as stormwater gardens, tree pits, swales, side entry pits and detention basins; and
- Soils have very high capacity to attenuate nutrients such as phosphorus without amendment.

Environmental constraints that need to be managed include:

- Perched water associated with Cw1 soils that have a shallow topsoil overlying an impermeable layer;
- Areas of perched water have been identified as water courses under the *Rights in Water and Irrigation Act 1914* (Figure 1); and
- On-site domestic wastewater disposal will be required with use of STS (and sand pads for irrigation, depending on presence of perched water and impermeable layers of clay or granite).

5 WATER MANAGEMENT

5.1 WATER MANAGEMENT PRINCIPLES AND OBJECTIVES

The principles and objectives for water management for the K3 Expansion area includes the following:

- Minimise impact on existing natural features and ecological processes;
- Minimise impact on natural hydrological behaviour of catchments;
- Protect water quality of surface and ground waters;
- Collect, treat, store and/or reuse stormwater (while ensuring natural processes are maintained);
- Increase social amenity in residential areas through multi-purpose green space, landscaping and integrating water into the landscape to enhance visual, social, cultural and ecological values; and
- Add value while minimising development costs – minimise the drainage infrastructure cost of the development.

5.2 PREDICTED ALTERATIONS TO EXISTING WATER AND NUTRIENT CYCLE

Due to the large lot sizes and the need to collect rainwater for potable use, it will be feasible for stormwater to be retained within each lot created for the most frequent storm events. In terms of impervious surfaces, additional water runoff will be generated from the road system, which has been oriented to allow for channelling of water to swales in the road reserve system and then treatment and infiltration points within POS. Swales and basins will be appropriately sized and located to cater for rainfall events and to ensure that discharge from the development is maintained relative to pre-development rates.

The principal sources of nutrients to groundwater and surface water within the proposed development are likely to be from domestic wastewater disposal, fertiliser application to lawns and gardens and sediments in road runoff.

The Structure Plan design has been developed to manage changes to the water and nutrient cycle by treating stormwater from frequent rainfall events, attenuating stormwater runoff from impermeable surfaces to pre-development flows and using appropriate wastewater treatment systems on site.

Areas of perched water have been identified as water courses under the *RIWI Act* (Figure 1 and Figure 3). These areas will be disturbed during road construction and other subdivision works (swales, POS, basin, services). Disturbance of these areas will be addressed via a beds and banks permit under Section 17 of the RIWI Act, submitted to DWER. The permit application will address extent and management of disturbed areas. This will occur at the subdivision stage.

5.3 DESIGN CRITERIA

The objective for development is to use water efficiently, while treating and retaining water close to its source. Stormwater systems will be designed to manage minor and major storm events. Management objectives and system performance outcomes related to rainfall design events are:

Manage Water Quality

- Manage — retain and/or detain and treat (if required) — stormwater runoff from constructed impervious surfaces generated by the first 16 mm of rainfall at-source as much as practical.

Maintain form and hydrology of sensitive receiving environments

- Maintain pre-development peak flow rates and total volume runoff from the outlets of the development area for the critical 1 exceedance per year event.

Provide serviceability, amenity and road safety

- Design stormwater management systems to provide serviceability, amenity and road safety during minor rainfall events. This is generally for greater than 16 mm events and up to 5-year ARI events for residential areas.

Major rainfall events — flood protection

- Maintain the 1% AEP / 100-year ARI pre-development flood regime (flood level, peak flow rates and storage volumes);
- Identify flow paths during subdivision design;
- Contain flows within 'major system conveyance' - roads, verges, public open space, living streams, waterways and wetlands;
- Protect people and buildings – confirm design flood levels; and
- Reduce risk of flooding and manage flow rates.

The following sections detail how development at the site will be undertaken to meet these objectives and design criteria.

5.4 GENERAL WATER MANAGEMENT

Water management post-development will aim to:

- Maintain or enhance water quality with respect to pre-development conditions by:
    - Minimising water borne sediments leaving the development;
    - Minimising export of nutrients to surface or groundwater;
    - Maintaining post-development flows relative to pre-development rates; and
    - Applying point source water management treatments; and
    - Encouraging prospective landowners not to use excessive fertilisers on the site.
- Encourage water conservation by:
    - Ensuring adequately sized rainwater tanks are installed;
    - Promoting infiltration, where practicable; and
    - Reducing irrigation requirements.

- Management of the water regime through:
    - Preventing water damage in proposed development areas;
    - Preventing erosion; and
    - Ensuring pollutants do not enter downstream waterways/drains.
- Specific treatments in lots, road reserves and POS are yet to be finalised, but may include:
    - Piped drainage in easement on nominated lots (associated with POS B and Basin 3A);
    - Shallow swales in 16 m road reserves (to cater for 16 mm and 5-year ARI events);
    - Deeper swales in 22 – 25 m wide road reserves (to cater for 16 mm and 5-year ARI events); and
    - Hardening or rock pitching where water flow is concentrated to reduce risk of erosion.

An urban water management plan (UWMP) will be prepared at the subdivision stages and will be guided by this LWMS. Design structures appropriate to the landform, soil type and structure plan design will be detailed in the UWMP with implementation of the most practical, simple and maintenance free systems.

5.5 PRE-DEVELOPMENT SURFACE DRAINAGE

The K3 Expansion area is divided into five catchments as indicated in Appendix B (DVN Engineers, 2022). The most significant of which (Catchment 3) comprises approximately 66.0 ha and falls southward from a ridge of high ground located inside the northern boundary. This ridge also creates two smaller northern catchments (Catchments 1 and 2) falling to the north-west and north-east corners of the site respectively. An external catchment (Catchment 4) comprising an area of approximately 10.3 ha lies to the east and forms an eastern extension of Catchment 3. A fifth catchment (Catchment 5) located immediately adjacent to Bussell Highway (south) and Brockman Highway is contiguous with and drains directly toward these roads.

The existing Hamelin Grove development is situated within Catchments 3 and 5 and includes a drainage basin (Basin 3C) within public open space at the southern end of the development. This basin has been sized and configured to accommodate stormwater runoff from the development (approximately 50% of catchment 3 in its developed form and 50% of catchment 3 in its undeveloped form) and discharges into existing stormwater infrastructure at Bussell Highway. Additional basins within this catchment are required to detain and filter stormwater runoff resulting from the expansion area.

Those parts of the development which are contiguous with and fall toward the highway reserve (Catchment 5) will continue to be drained by existing table drains inside these reserves. This catchment does not include any new road pavements, and as such, runoff characteristics will remain largely unaffected by the expansion.

Catchment 1 currently discharges via an existing culvert beneath Bussell Highway where it contributes to the natural water courses west of Bussell Highway. Drainage to the Bussell Highway is not operating as it was originally constructed (DVN Engineers) with water ponding in the northwestern corner of the

Structure Plan area. It is intended that the drainage be reinstated as part of the proposed development and the existing catchment storage rationalised into a formal stormwater reserve.

Landform in the vicinity of Catchment 2 results in stormwater run-off crossing the boundary into a small gully within the adjacent farmland. This outlet is to be augmented with formal stormwater retention.

Calculations for pre-development discharge are included in Appendix D.

5.6 STORMWATER MANAGEMENT STRATEGY

The stormwater management strategy is shown in Appendix C and summarised as follows:

EXISTING INFRASTRUCTURE

Drainage facilities immediately downstream of the Structure Plan area include constructed culverts beneath the Bussell Highway and Brockman Highway pavements, 'depressions' within downstream farmland, leading to more defined streams (within private farmland) prior to entering Turner Brook which discharges to the Indian Ocean at Deepdene.

Stormwater management treatments are predicated upon the intention that Basin 3C in the southern portion of the Structure Plan area will remain in its current form, with additional basins installed upstream to regulate flows and ensure that discharge to the downstream outlet infrastructure is not exceeded (Appendix C). In doing so, no adjustment to the outlet will be required and discharge flows will remain below pre-development levels.

Northern expansion of the proposed development will impact on catchments 1 and 2 which are located at the north-west and north-east corners of the Structure Plan area, respectively. Stormwater run-off from catchment 1 currently exits the site via a culvert beneath the Bussell Highway, while catchment 2 discharges via a small water course into adjacent farmland. The stormwater strategy makes provision for compensating basins to be installed upstream of these outlet points to maintain outlet flow rates at or below pre-development levels (Appendix C).

DRAINAGE CATCHMENTS

Catchments 1 and 2 are relatively small and well-defined. The stormwater strategy provides for water quality improvement and regulation of outflow rates at or below pre-existing levels to be provided by small basins within these catchments.

An increase in impermeable surfaces in catchment 3 will require the construction of roadside swales and Basin 3A in POS B to capture and retain water, with controlled release into the southern portion of the Structure Plan area. Basin 3A will regulate and delay stormwater flows coming from the expansion area. Additional stormwater flow from Bole Way and Flitch Road will be attenuated prior to entry into Basin 3C by reinstatement of a small basin on the eastern edge of the southern POS A, which formed part of the 2015 stormwater management plan, but was subsequently reduced in scale.

Post development drainage rates are shown in Appendix D.

DRAINAGE OF PUBLIC LAND

The road system will be designed to meet rural road standards, including uncurbed roads and table drains. Narrower road reserves located at the upper end of drainage catchments may be drained with 300 mm deep swales which will be discharged via a pipe system upstream of each lot crossover. Drainage of the road reserves will mimic the existing gradual migration of stormwater through the catchment by retention in the roadside swales and retention basins prior to exiting the site via the existing drainage infrastructure. Treatment of the various storm events are detailed below and quantified in Appendix C:

1:1 YEAR STORM EVENT

Runoff from the 16 mm storm events will mostly be contained within table drain swales and tree pits (subject to detailed design and acceptance by the local authority) incorporated into the roadside drainage system. Where possible, road pavements adjacent to POS will be elevated to allow runoff to move via sheet flow into the area.

1:5 YEAR STORM EVENT (20% AEY)

Runoff from more significant storm events (e.g. 1: 5-year events) will simulate the current system of slow migration toward the existing drainage infrastructure. The increased run-off resulting from additional impervious surfaces and reduced concentration times associated with the more efficient table drains will be compensated by sizing the retention basins to attenuate water flow (Appendix C).

1:100 YEAR STORM EVENTS (1% AEP)

Major event runoff (1:100 year or 1% AEP) within the Structure Plan area will cross property boundaries, accumulating in the low areas in the vicinity of the retention basins. Flood water will overflow to downstream water courses across strategically located drainage infrastructure and road reserves. The drainage reserves will be depressed to create the overland flow path required.

DRAINAGE OF PRIVATE LAND

The elevation and slope of the local terrain does not allow standing water from a major flood event to accumulate to any significant depth. It is recommended that planning guidelines require that all dwellings be elevated on a sand pad a minimum of 0.6 m above the adjacent ground level, allowing floodwaters to bypass the residence as it flows to lower ground.

Isolated areas at the northwestern corner of the site and in vicinity of the proposed POS within the proposed K3 expansion are currently inundated during the winter months. Inundation will be prevented through drainage works (including subsurface drainage) and use of fill material. The details of this will be addressed during the detailed design of the subdivision civil works.

The control of sediment and prevention of transportation through the new drainage system will be managed via the drainage structures and swales integrated into the drainage network. All structures will be readily accessible and may require periodic cleaning during the early stages of development.

SURFACE WATER - CW1 SOILS

Perched water associated with Cw1 soils will continue to travel across the landscape via POS B to POS C from the property to the east. Treatment and attenuation of the water during wetter months will occur in POS B and Basin 3A. Water will then enter the subdivision drainage system.

6 WATER CONSERVATION AND EFFICIENCY

Efficient use of the water resources will ensure a continuous supply for households that rely on capturing their own potable water, even during periods of low rainfall. Domestic water use can be divided into in-house (e.g. showers) and ex-house (e.g. gardens). The objectives of water supply management for the Structure Plan area are:

- To minimise the use of potable water where potable water use is not essential; and
- To meet the Western Australian State Water Plan (Government of Western Australia, 2007) target of reducing unrestricted annual water consumption to 100 kL/person/year (274 L/day), including an aspirational target to achieve not more than 40 – 60 kL/person/year of scheme water use.
- Strategies to achieve this include:
- Installation of water tanks for potable water supply and firefighting;
- Fit-for-purpose use of existing water sources, including use of treated wastewater;
- Improved water use efficiency; and
- Water recycling.

The Water Corporation completed a domestic water use study (2010b) which provides data for water use for households in Perth (Table 8) and identified potential water savings that could be made through improved efficiencies, including:

- A shower head that is rated 3 star (Water Efficient Labelling Standards; WELS) or above reduces shower water consumption by 25 %;
- Fixing a running toilet can save around 9,000 L a year; and
- Replacing a standard flush toilet with a dual flush system can save 90 L per day.

TABLE 8: DOMESTIC WATER USE ESTIMATES

USE KL PER PERSON PER YEAR (2008/09)	KL PER PERSON PER YEAR (2008/09)	L PER PERSON PER DAY	% OF OVERALL USE
Indoor use			
Shower and bath	27	74	25
Toilet	10	27	9
Washing machine	8	22	7
Taps	6	16	6
Evaporative air conditioner	4	11	4
Dishwasher	1	3	1

Indoor use – total	**56**	**153**	**52**
USE KL PER PERSON PER YEAR (2008/09)	**KL PER PERSON PER YEAR (2008/09)**	**L PER PERSON PER DAY**	**% OF OVERALL USE**
Outdoor use			
Hand watering	3	8	3
Pool and spa	2	5	2
Irrigation	41	112	39
Outdoor use – total	**46**	**126**	**44**
Private plumbing leaks	4	11	**4**
Total Outdoor Water Use	**96**	**263**	
Total Household Water Use	**106**	**290**	

Source: Water Corporation, 2010b.

Water use reduction can be achieved at the household level by utilising water-efficient fixtures and fittings such as WaterWise taps, showerheads, appliances and landscaping using plants with lower water requirements.

Incorporation of water-efficient taps, showerheads and toilet systems is required by the *Building Code of Australia* (Australian Building Code Board) for new houses. All tap fittings (other than bath outlets and garden taps) must be a minimum of 4-star WELS rated, all showerheads must be a minimum of 3-star WELS rated, and all toilet systems must be a minimum of 4-star WELS rated dual-flush. This would be enforced by the AMRS through the building license process.

It is recommended that the installation of 135,000 L rainwater tanks (minimum) be enforced by the AMRS through addition of provisions under the LPS for the Structure Plan area and implemented via the building approval process. Water tanks with a capacity of 135,000 L should provide adequate water for an average family, including an emergency supply of 10,000 L for firefighting.

Potential water savings may also be achieved by reducing ex-house irrigation water requirements where treated wastewater from secondary treatment units is used for irrigation.

6.1 VEGETATION, STREETSCAPING AND PUBLIC OPEN SPACE MANAGEMENT

The Structure Plan for the K3 Expansion includes 7.4 ha of POS in the northwestern portion of the Structure Plan area, in addition to the existing 1.7 ha of POS in the south western area.

Landscape and streetscaping plantings will use plants with low water requirements and/or local native species.

Irrigation of POS will not be required for this site, other than for initial establishment of landscaping (most likely provided during summer from tankered water).

Dedicated areas for treatment of 16 mm events (basins) will be planted with nutrient treating plant species such as *Carex appressa, Ficinia nodosa, Juncus sp.* and *Melaleuca sp*.

7 SUBDIVISION WORKS, MAINTENANCE AND ON-GOING MANAGEMENT

Maintenance strategies to maintain or improve water quality and on-going management will be undertaken during the subdivision construction phase and for two years after practical completion of major service infrastructure (roads, services, drainage system), including:

- Erosion, sediment and drainage controls during subdivision construction;
- Street sweeping of hotspots where sediment and debris concentrate (monthly during construction phase, quarterly post construction);
- Removal of sediment build-up and litter layer in grassed swales and basin inlet zones (if required); and
- Mowing of turfed areas and disposal of clippings to an appropriate green waste disposal facility.

Ongoing access to basins will be required for periodic maintenance, including removal of sediments. This is unlikely to be required more than every five years if treatments within the catchments are adequately maintained.

Construction works at the subdivision stage will be undertaken to minimise unnecessary disturbance to the landscape. The following recommendations will be incorporated into earthmoving contracts:

DEWATERING

Excavations for subdivision works are not likely to be more than 1.0 mBGL. The works are to be constructed during the summer and autumn months when the excavations can be completed without the need for dewatering.

DUST AND SEDIMENT CONTROL

The subdivision works will occur over the summer and autumn months and should therefore be undertaken in accordance with *Guideline For The Development And Implementation Of A Dust Management Program* (Department of Environment Regulation, 2011). The contractor will be responsible for provision of water for construction purposes, noting that both surface and ground water supplies in the immediate locality fall within proclaimed areas under the *Rights In Water And Irrigation Act 1914.*

The construction contract will require the developer's contractor to return to the site during and at the completion of the 12-month defects liability period to make good any areas of erosion or scour that may occur during the first winter after completion. Depending on evidence of erosion or sediment, the contractor will be required to clear sediment from drainage swales and return structures to design standard, as required. After the first winter it is likely that grasses and other vegetation will stabilise disturbed areas and provide ongoing protection for the embankments and swales.

PLANNING AT THE SUBDIVISION STAGE

An urban water management plan (UWMP) will be prepared prior to subdivision, based on the requirements outlined in this LWMS. The UWMP will be a simple document outlining:

- Detailed design of infrastructure; and
- Calculations that show that treatments can cater for the design criteria.

The UWMP will be subject to approval by AMRS.

8 EDUCATION AND COMMUNITY ENGAGEMENT

Sustainable water management outcomes can be significantly enhanced through raising awareness of future residents of the Structure Plan area. Information will be provided to prospective residents (e.g. via sales marketing and real estate agents), encouraging the purchasers to be water efficient, plant low water use gardens and minimise the use of fertilisers.

Existing information brochures and material will be used where appropriate including WaterWise brochures (Appendix E).

9 MONITORING AND REVIEW

As this Structure Plan represents a low risk in terms of sensitive receiving environments, a monitoring program is not considered necessary.

Review of this LWMS is only required if there is a substantial change to the Structure Plan.

10 IMPLEMENTATION

The developer will be responsible for the implementation of the management actions presented in this LWMS, as well as the on-going management and maintenance to the satisfaction of AMRS for a minimum of two years following the practical completion of site works and construction of major services (roads, drainage system and lots).

Following this period, AMRS will be responsible for the management and the on-going implementation water management actions as they relate to the road and drainage network and the POS area(s). Table 9 outlines the management actions that have been identified as key components of this LWMS within the Structure Plan area.

TABLE 9: MANAGEMENT ACTIONS, TIMING AND RESPONSIBILITY

ISSUE	ACTION	TIMING	RESPONSIBILITY
Water Conservation and Efficiency	Ensure water efficiency in new residences through requirement of water efficient fixtures and fittings (including taps and showerheads).	Building licence	AMRS
	Select plant species that have a low requirement for water.	Post-construction	Initially developer, then AMRS
	Ensure installation of rainwater tanks (minimum capacity of 135,000 L with outlet for emergency firefighting)	Building licence	AMRS
Planning and Management	Apply for a Beds and Banks permit under the Rights in Water and Irrigation Act 1914 for Cw1 soils/ inundated areas/ water courses (Figure 1, Figure 3)	Subdivision	Developer (application to DWER).
	Implement contingency actions if the performance of the stormwater management system is not meeting objectives set in this report.	Post-construction	Developer (in consultation with the AMRS)
Water Quality and Quantity	Finalise detailed design and construct water management features (including swales, basins etc.).	Subdivision stage/ Endorsement of subdivision plan	Developer
	Implement the water management system outlined in this plan to ensure all stormwater generated in 16 mm events is retained within the Structure Plan area using swales, basins and similar structures. Locate these features strategically to minimise the extent of underground piping and maximise treatment of water close to its source. All lots are expected to retain/dispose of stormwater onsite for 16 mm events.	Subdivision stage	Developer

ISSUE	ACTION	TIMING	RESPONSIBILITY
On-site Effluent Disposal	Ensure installation of approved on-site effluent treatment systems in accordance with Section 3 (Figure 3). As soils across the site are variable, at the building licence stage, there are several options for additional assessment of types of treatment systems to be used, including additional groundwater and impermeable layer testing (September – October) to determine if a location: 1. Contains a suitable area where there is 1.5 m separation to maximum winter groundwater and an impermeable layer (clay or granite). If the 1.5 m separation can be achieved, a PTS will be suitable. The area must be at least 100 m from watercourses. 2. Contains an area with maximum groundwater deeper than 0.6 m BGL where installation of STS without a sand pad will be suitable. 3. Contains grey sands with a low ability to sorb phosphorus where nutrient removing STS may be required.	Building licence	AMRS
On-site Effluent Disposal	Where there is a risk of groundwater more shallow than 0.6 m BGL, the developer will provide a sand pad for irrigation of treated waste water to be used with an STS as shown in Figure 3.	Pre subdivision	Developer
Maintenance	Sweep streets to reduce particulate build-up on road surface and gutters.	Monthly during construction and quarterly post construction	Developer and then AMRS
	Remove sediment build-up, litter layer and debris in the bottom of grassed swales and other infrastructure.	During construction and on-going	Developer and then AMRS
	Mow turfed areas in POS monthly (or as required) and dispose of clippings appropriately.	Monthly/on-going	Developer and then AMRS
Education	Provide information brochures to prospective residents regarding reducing use of fertilisers, planting water wise gardens, minimising pollutant runoff into waterways, using STS and reducing water use in households.	Sale of Lots	Developer

11 REFERENCES

Aurora Environmental (2014) Local Water Management Strategy – Lot 100 Bussell Highway, Karridale – Shire of Augusta Margaret River. Prepared for Juventus Pty Ltd. AA2012/016 V3.

Aurora Environmental (2019) Update to Local Water Management Strategy Lots 9001 and 201 Brockman Highway Karridale – Shire of Augusta Margaret River WA, Prepared for Juventus Pty Ltd. AA2019/015

Bureau of Meteorology (2023) www.bom.gov.au.

Department of Environment Regulation (2011) A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities.

Department of Environment Regulation (2015a) Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes. Acid Sulfate Soil Guideline Series.

Department of Environment Regulation (2015b) Treatment and Management of Soils and Water in Acid Sulfate Soil Landscapes. Acid Sulfate Soil Guideline Series. Department of Environment and Conservation (DEC), Perth, WA.

Department of Environmental Protection and Water and Rivers Commission (2001) Environmental Guidelines for the Establishment and Maintenance of Turf and Grassed Areas.

DoH, Department of Health (2001) Code of Practice for the Design, Manufacture, Installation and Operation of Aerobic Treatment Units. Perth, Western Australia.

DoH, Department of Health (2003) Draft Country Sewerage Policy. Perth, Western Australia.

DoH, Department of Health (2004) Guidance on Use of Rainwater Tanks.

DoH, Department of Health (2010) Code of Practice – Grey Water Recycling.

DoH, Department of Health (2011) Country Rainwater Collection.

Department of Water (2004-2007) Stormwater Management Manual for Western Australia. Perth, Western Australia.

Department of Water (2006) Water Quality Protection Note 22: Irrigation with Nutrient Rich Wastewater. Perth, Western Australia.

Department of Water (2010) South West Regional Water Plan.

Douglas Partners (2022) Proposed Residential Subdivision Lot 9001 Brockman Highway Karridale, WA prepared for Juventus Pty Ltd Atf The Prevelly Development Trust

DPLH, Department of Planning, Lands and Heritage (2019) Government Sewerage Policy

DWER, Department of Water and Environmental Regulation (2017) Decision process for stormwater management in WA.

Geological Survey of Western Australia (2001) Karridale –Tooker Western Australia 1: 50,000 Regolith – Landform Resource Series. Sheet 1929 – IV and Part of 1829 – I.

Government of Western Australia (2007) State Water Plan 2007.

Landgate (2023) Locate. https://maps.slip.wa.gov.au/landgate/locate/

Mattiske E.M. and Havel J.J. (2005) Derived from: Mattiske, E.M. and Havel, J.J. (1998) Vegetation Complexes of the South-west Forest Region of Western Australia. Maps and report prepared as part

of the Regional Forest Agreement, Western Australia for the Department of Conservation and Land Management and Environment Australia.

Shire of Augusta Margaret River (2011) Karridale Settlement Strategy.

Standards Australia (2012) On-site Domestic- Wastewater Management. AS/NZS 1547:2012.

WAPC, Western Australian Planning Commission (2006). Statement of Planning Policy 2.9 Water Resources. Western Australian Planning Commission (WAPC), Perth, WA.

WAPC, Western Australian Planning Commission (2008a) Better Urban Water Management. Prepared in partnership with Department of Planning and Infrastructure, Department of Water, Australian Government Department of the Environment, Water, Heritage and the Arts and Western Australian Local Government Association. Perth, Western Australia.

WAPC, Western Australian Planning Commission (2008b) Planning Bulletin 64/2009. Acid Sulfate Soils. Perth, Western Australia.

Weatherzone (2023) Climate Average for Witchcliffe. http://www.weatherzone.com.au/climate/station.jsp?lt=site&lc=9746

APPENDIX A

Structure Plan – K3 Expansion

Indicative Road Reserve Cross-section
Hamelin Grove - Karridale

Indicative Road Reserve - Road B - Cross-section
Hamelin Grove - Karridale

Legend

- Structure Plan Area Boundary
- Residential R5
- Residential R2.5
- Rural Residential
- Public Purposes
- Dual Use Path
- Footpath
- Public Open Space and Drainage
- Drainage Basin (B1, B2/3A-C)
- Drainage Easement
- Commercial (KHSS)
- 30m Development Setback
- 20m Development Setback
- 10m wide Landscape Buffer
- 20m wide Landscape Buffer
- Quiet House Design Requirements — QHD
- Primary Treatment System* — PTS
- Primary Treatment System (with inverted leach drains)* — PTS (INV)
- Secondary Treatment System* — STS
- Secondary Treatment System (with sand pads)* — STS (SP)
- Emergency Water Supply Point — W
- Seasonal Watercourse
- 30m Setback to Effluent Disposal Systems
- 100m Setback to Primary Treatment Systems
- CW1 Soils
- Less than 0.6 metres to Impervious layer
- Less than 0.6 metres to Ground Water
- 1:100 Year Flood Level
- Existing Lot No. — 209

Public Open Space Schedule

Total Structure Plan Area	**87.2863ha**
Deductions	
Infrastructure	
Drainage area B1 (@100%)	0.3560ha
Drainage area B2 (@50%)	0.3020ha
Drainage area B3A (@50%)	0.3780ha
Drainage area B3B (@50%)	0.5180ha
Drainage area B3C (@50%)	0.2470ha
Public Purposes	0.108 ha
Residential Areas Not Qualified	
Rural Residential Lots	8.1339ha
Total Deductions	**9.3038ha**
Gross Subdivisable Area	77.4833ha
Breakdown of POS Provided	
Restricted Public Open Space	
Total Restricted POS	0.0ha
Total Restricted POS Credited	0.0ha
Surplus Restricted POS not Credited	0.0ha
Unrestricted Public Open Space	
Sport	0.0ha
Recreation	
Playground and Picnic Areas	
POS Area A	0.0ha
POS Area B	2.1609ha
POS Area C	0.8593ha
POS Area D	0.5030ha
Active Informal Sports Areas	
POS Area A	0.5088ha
POS Area B	3.3895ha
POS Area C	0.0ha
POS Area D	0.0ha
Nature	
Native Vegetation with Trails/Paths	
POS Area A	1.3445ha
POS Area B	0.0ha
POS Area C	0.0ha
POS Area D	0.0ha
Total Unrestricted POS	
POS Area A	2.4043ha
POS Area B	6.3804ha
POS Area C	0.8593ha
POS Area D	0.5209ha
Total	8.6506ha
Public Open Space Provided	**9.3249ha**
POS Provision as a Percentage of Gross Subdivisable Area	**12.68%**

* Refer also to the approved Hamelin Grove Local Water Management Strategy, Urban Water Management Plan and Local Development Plan.

Hamelin Grove

Local Structure Plan

Bussell Highway and Brockman Highway, Karridale.

Scale : 1:2,500 @ A1

Client:	Juventus Pty Ltd
Design:	Martin Richards
Drawn:	MR
Drawing No.:	M020/LSP/02/Y/e
Prev. Drawing No.:	
Date:	26 May 2021

All areas and dimensions are subject to survey. Proposal is subject to change without notice. Martin Richards Town Planning + Urban Design, its employees and consultants accept no responsibility for any damages, losses or liability arising from reliance by any person or user of any report, plan, concept or any variation, errors or information contained in this plan.

Revision	Description	Date

SHIRE of AUGUSTA MARGARET RIVER

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town planning + urban design
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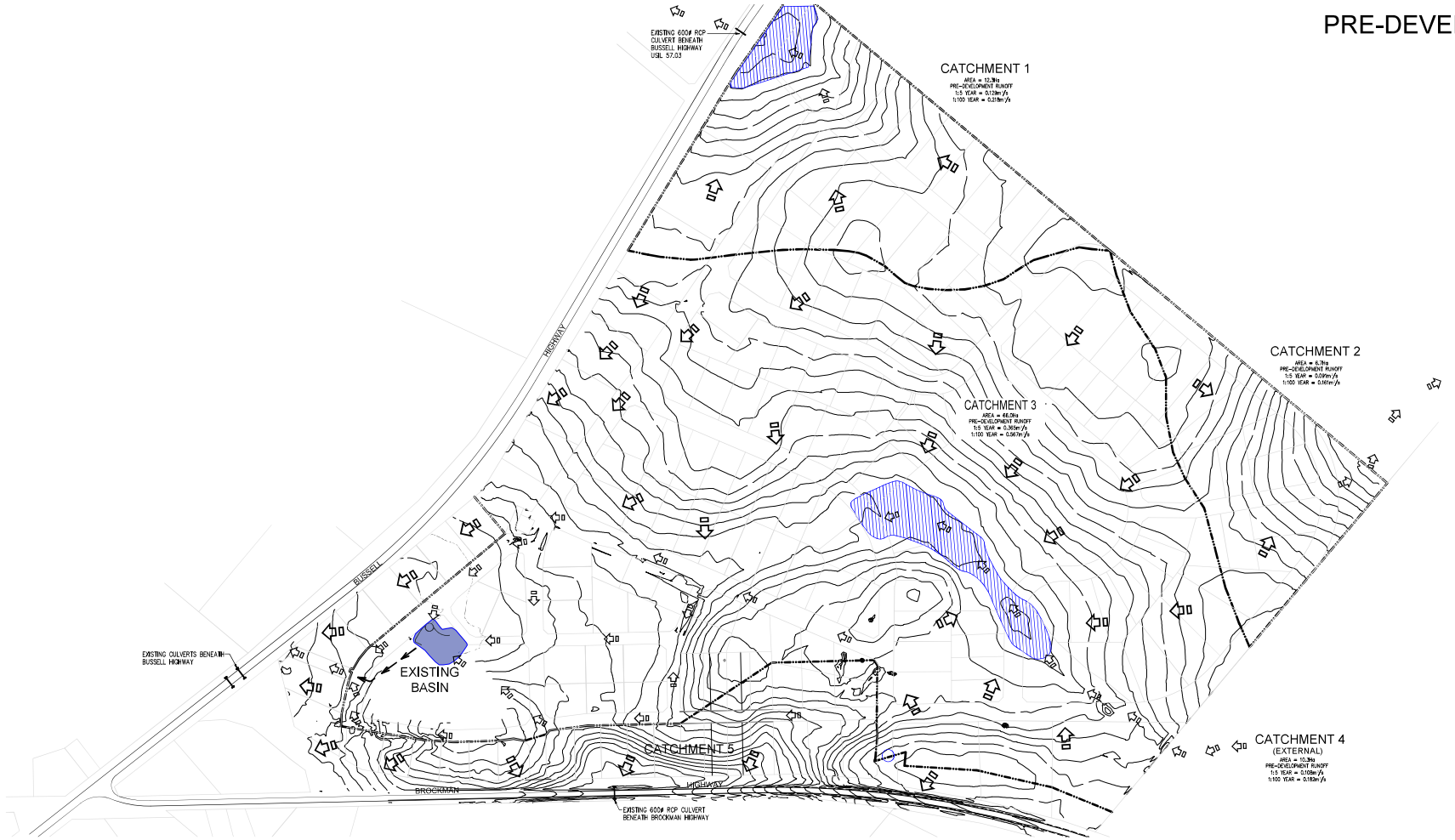
APPENDIX B

Pre and Post-Development Conditions

PRE-DEVELOPMENT PLAN



PLANNING BACKGROUND

THE AFFECTED LAND, KNOWN LOCALLY AS THE HAMELIN GROVE SUBDIVISION, WAS SUBJECT TO AMENDMENT IN 2015 CHANGING THE LAND USE FROM AGRICULTURE TO AGRICULTURE / RURAL RESIDENTIAL. PART OF THE PROPERTY WAS SUBSEQUENTLY SUBDIVIDED UNDER WAPC SUBDIVISION APPROVAL 150727 AND FURTHER UNDER APPROVAL 159358. REVISION OF THE LOCAL PLANNING STRATEGY FOR THE TOWN OF KARRIDALE IS NOW BEING CONSIDERED BY THE SHIRE OF AUGUSTA MARGARET RIVER, PART OF WHICH INCLUDES NORTHERN EXPANSION OF THE HAMELIN GROVE DEVELOPMENT IN AN AREA REFERRED TO AS R3 IN THE PRELIMINARY LPS AMENDMENT DOCUMENTS. A LOCAL WATER MANAGEMENT STRATEGY IS BEING PREPARED BY AURORA ENVIRONMENTAL CONSULTANTS IN SUPPORT OF THE PROPOSED PLANNING AMENDMENT AND IT IS INTENDED THAT THIS STORMWATER MANAGEMENT PLAN FORM PART OF THAT STRATEGY.

DESIGN CRITERIA

A STORMWATER MANAGEMENT PLAN WAS PREPARED IN 2015 COVERING THE EARLIER STAGES OF THE HAMELIN GROVE SUBDIVISION PROVIDING A FRAMEWORK AIMED AT ACHIEVING THE WATER QUALITY OBJECTIVES OUTLINED IN STATE PLANNING POLICY 2.9 "WATER RESOURCES" AND ASSOCIATED GUIDELINES "BETTER URBAN WATER MANAGEMENT". THE SAME CRITERIA IS TO BE APPLIED TO THE EXPANDED SUBDIVISION PROPOSAL AND THIS STORMWATER MANAGEMENT PLAN IS UPDATED TO REFLECT THIS.

THE SUBJECT LAND IS LOCATED WITHIN THE CATCHMENT OF TURNER BROOK WHICH IS A PROCLAIMED WATERWAY UNDER THE RIGHTS IN WATER AND IRRIGATION ACT 1914. ALTHOUGH LOCATED PREDOMINANTLY WITHIN PRIVATE PROPERTY, THIS WATERWAY FALLS GENERALLY UNDER THE CONTROL OF THE DEPARTMENT OF WATER. AMONGST OTHER THINGS, AN OUTCOME OF THE URBAN WATER MANAGEMENT PLAN SHALL BE NO INCREASE IN STORMWATER FLOW RATES EXISTING THE SITE BETWEEN PRE-DEVELOPMENT AND POST-DEVELOPMENT STATES AND STRUCTURAL MEASURES INCLUDED IN THE PROPOSED DEVELOPMENT SHALL PROVIDE AN IMPROVEMENT IN WATER QUALITY DISCHARGED TO DOWNSTREAM WATERCOURSES.

THE SHIRE OF AUGUSTA MARGARET RIVER REQUIRES THAT THE DRAINAGE SYSTEM SAFELY AND EFFECTIVELY DIRECT STORMWATER TO DOWNSTREAM DRAINAGE INFRASTRUCTURE AND PROTECT PROPERTY FROM FLOOD RELATED DAMAGE. PIPED SYSTEMS ARE TO BE SELF FLUSHING AND OPEN DRAINS / BASINS NOT UNDULY DIFFICULT TO MAINTAIN.

PREVIOUS STUDIES

A LOCAL STRUCTURE PLAN WAS PREPARED BY MICHAEL SWIFT AND ASSOCIATES TOWN PLANNERS IN RESPECT TO THE PROPOSED REZONING OF THE SUBJECT LAND. AMONGST OTHER SUPPORTING DOCUMENTS, THAT STRUCTURE PLAN INCLUDED A LOCAL WATER MANAGEMENT STRATEGY PREPARED BY AURORA ENVIRONMENTAL CONSULTANTS. THE STRATEGY DETAILED THE MECHANISM FOR STORMWATER MANAGEMENT, THE SITES CAPACITY FOR ON-SITE EFFLUENT DISPOSAL AND SOURCES OF POTABLE WATER SUPPLY.

PRE DEVELOPMENT ENVIRONMENT

SITE DESCRIPTION
THE NATURAL LANDFORM WITHIN THE SUBJECT SITE COMPRISES UNDULATING LAND WITH THE PREDOMINANT STORMWATER CATCHMENT FALLING GRADUALLY (AVERAGING 1:25) FROM 49m AHD IN THE NORTH TO 37m AHD IN THE SOUTH. SOIL TYPES COMPRISE A CLAYEY LOAM SURFACE STRATA OF LOW TO MODERATE ABSORPTIVE CAPACITY OVERLYING CLAY AND A GRANITE SUBSTRATUM AT DEPTH. THE MOST RECENT LAND USE OVER THE AREA PROPOSED FOR SUBDIVISION EXPANSION HAS BEEN PLANTATION TIMBER, ALTHOUGH THIS HAS RECENTLY BEEN HARVESTED AND THE LAND IS NOW REGENERATING NATURALLY.

SURFACE DRAINAGE
THE SITE HAS GOOD SURFACE DRAINAGE WITH ONLY ISOLATED AREAS IN THE SOUTHERN AND NORTH WESTERN CORNERS OF THE PROPERTY SHOWING A DEGREE OF INUNDATION DURING THE WINTER MONTHS. THE STUDY AREA IS DIVIDED INTO 5 NOTABLE CATCHMENTS AS INDICATED ON THE PLAN ABOVE, THE MOST SIGNIFICANT OF WHICH (CATCHMENTS 3) COMPRISES APPROXIMATELY 66.0Ha AND FALLS SOUTHWARD FROM A RIDGE OF HIGH GROUND LOCATED INSIDE THE NORTHERN BOUNDARY. THIS RIDGE ALSO CREATES 2 SMALLER NORTHERN CATCHMENTS (CATCHMENTS 1 & 2) FALLING TO THE NORTH-WEST AND NORTH-EAST CORNERS OF THE SITE RESPECTIVELY. AN EXTERNAL CATCHMENT (CATCHMENT 4) COMPRISING AN AREA OF APPROXIMATELY 10.3Ha LIES TO THE EAST AND IN FACT FORMS AN EASTERN EXTENSION OF CATCHMENT 3. A FIFTH CATCHMENT LOCATED IMMEDIATELY ADJACENT BUSSELL HIGHWAY (SOUTH) AND BROCKMAN HIGHWAY IS CONTIGUOUS WITH, AND DRAINS DIRECTLY TOWARD, THESE RESERVES.

THE EXISTING HAMELIN GROVE DEVELOPMENT IS SITUATED WITHIN CATCHMENTS 3 & 5 AND INCLUDES A DRAINAGE BASIN WITHIN PUBLIC OPEN SPACE AT THE SOUTHERN END OF THE DEVELOPMENT. THIS BASIN HAS BEEN SIZED AND CONFIGURED TO ACCOMMODATE STORMWATER RUN-OFF FROM THE DEVELOPMENT OF APPROXIMATELY 50% OF CATCHMENT 3 AND DISCHARGES TO EXISTING STORMWATER INFRASTRUCTURE AT BUSSELL HIGHWAY. ADDITIONAL BASINS WITHIN THIS CATCHMENT ARE REQUIRED TO DETAIN AND FILTER STORMWATER RUNOFF RESULTING FROM THE EXTENDED DEVELOPMENT.

THOSE PARTS OF THE DEVELOPMENT WHICH ARE CONTIGUOUS WITH AND FALL TOWARD THE HIGHWAY RESERVES (CATCHMENT 5) CONTINUE TO BE DRAINED BY EXISTING TABLE DRAINS INSIDE THESE RESERVES. THIS CATCHMENT DOES NOT INCLUDE ANY NEW ROAD PAVEMENTS, AND AS SUCH, RUNOFF CHARACTERISTICS WILL REMAIN LARGELY UNEFFECTED BY THE PROPOSAL.

CATCHMENT 1 CURRENTLY OUTLETS VIA AN EXISTING CULVERT BENEATH BUSSELL HIGHWAY WHERE IT CONTRIBUTES TO THE NATURAL WATER COURSES WEST OF BUSSELL HIGHWAY. LINKAGE TO THE BUSSELL HIGHWAY CULVERT IS INTERUPTED BY AN EARTHEN BUND WHICH RESULTS IN LOCALISED PONDING IN THE NORTH WESTERN CORNER OF THE PROJECT SITE. IT IS INTENDED THAT THIS LINKAGE BE REINSTATED AS PART OF THE PROPOSED DEVELOPMENT AND THE EXISTING CATCHMENT STORAGE RATIONALIZED INTO A FORMAL STORMWATER BASIN.

THE LANDFORM IN CATCHMENT 2 RESULTS IN STORMWATER RUN-OFF CROSSING THE BOUNDARY INTO A SMALL GULLY WITHIN THE ADJACENT FARMLAND. THIS OUTLET IS TO BE AUGMENTED WITH FORMAL STORMWATER RETENTION AT THE LOCATION INDICATED.

GROUND WATER
PREVIOUS STUDIES UNDERTAKEN BY AURORA ENVIRONMANTAL CONSULTANTS AND DOUGLAS PARTNERS HAVE DETERMINED THE MAXIMUM GROUND WATER LEVEL GENERALLY TO BE NO HIGHER THAN 0.5m BENEATH THE EXISTING GROUND SURFACE. NOTED EXCEPTION BEING WITHIN PROPOSED POS "E" AND AN ISOLATED AREA IN THE NORTH WESTERN CORNER OF THE PROPERTY WHERE THE GROUND SURFACE BECOMES SODDEN DURING THE WINTER MONTHS.

ACID SULFATE SOILS
INVESTIGATION UNDERTAKEN BY DOUGLAS PARTNERS CONCLUDE THAT THE MAJORITY OF THE SITE CONTAINS NO KNOWN RISK OF ACID SULFATE SOILS AND ONLY ISOLATED AREAS WITH MODERATE TO LOW RISK OF ACID SULFATE SOILS WITHIN 3m OF THE SOIL SURFACE. CONSTRUCTION CONTRACTS ARE TO INCLUDE PROVISION FOR ASSESSMENT IN ACCORDANCE WITH W.A.P.C. "ACID SULFATE SOILS – SELF ASSESSMENT FORM" AND D.E.C. DOCUMENT "IDENTIFICATION AND INVESTIGATION OF ACID SULFATE SOILS AND ACIDIC LANDSCAPES" PRIOR TO CONSTRUCTION COMMENCING.

PROPOSED DEVELOPMENT

THE PROPOSED DEVELOPMENT INCLUDES EXPANSION OF THE EXISTING HAMELIN GROVE SUBDIVISION NORTHWOOD INTO LAND PREVIOUSLY OCCUPIED BY PLANTATION TIMBER. CONSTRUCTION OF HOUSING WITHIN THE DEVELOPMENT AREA HAS LITTLE IMPACT ON STORMWATER RUN-OFF AS ROOF WATER IS COLLECTED FOR POTABLE CONSUMPTION AND SUBSEQUENTLY RETURNED TO GROUNDWATER THROUGH APPROVED EFFLUENT DISPOSAL MECHANISMS. CONSTRUCTION OF ROAD PAVEMENTS AND ASSOCIATED DRAINAGE INFRASTRUCTURE WITHIN THE DEVELOPMENT SITE INCREASES RUN-OFF RATES AND THE SPEED AT WHICH SURFACE RUN-OFF REACHES THE DOWNSTREAM WATERCOURSES. ACCORDINGLY, THE QUANTITY AND RATE OF STORMWATER RUNOFF IS TO BE MANAGED BY A SERIES OF SWALES, BASINS AND OTHER DETENTION FACILITIES PRIOR TO DISCHARGE TO DOWNSTREAM WATER COURSES AS DETAILED IN THE FOLLOWING SECTION.

STORMWATER MANAGEMENT STRATEGY

THE STORMWATER MANAGEMENT STRATEGY IS QUANTIFIED AT SHEET 2, AND SUMMARISED AS FOLLOWS:

EXISTING INFRASTRUCTURE
DRAINAGE FACILITIES IMMEDIATELY DOWNSTREAM OF THE SUBJECT SITE INCLUDES CONSTRUCTED CULVERTS BENEATH THE BUSSELL HIGHWAY AND BROCKMAN HIGHWAY PAVEMENTS, GENERAL "DEPRESSIONS" WITHIN DOWNSTREAM FARMLAND, LEADING TO MORE FORMALLY DEFINED GULLIES (ALSO PREDOMINANTLY WITHIN PRIVATE FARMLAND) PRIOR TO ENTERING TURNER BROOK WHICH OUTLETS TO THE INDIAN OCEAN AT DEEPSENE. TURNER BROOKE IS A PROCLAIMED WATERWAY WITHIN JURISDICTION OF THE DEPARTMENT OF WATER.

A DRAINAGE COMPENSATING BASIN HAS BEEN CONSTRUCTED WITHIN PUBLIC OPEN SPACE OF THE EXISTING HAMELIN GROVE DEVELOPMENT. THIS BASIN HAS BEEN SIZED AND CONFIGURED TO LIMIT RUN-OFF RATES TO PRE-DEVELOPMENT LEVELS WHEN THE CATCHMENT IS DEVELOPED IN ACCORDANCE WITH THE CURRENT DEVELOPMENT APPROVAL. BY RATIONALIZING RUNOFF WITHIN THE CATCHMENT KNOWN, THE BASIN IS SUITABLE TO ACCOMMODATE THE PROPOSED UPSTREAM EXPANSION.

THE STORMWATER STRATEGY IS PREDICATED UPON THE INTENTION THAT THE EXISTING STORMWATER BASIN SHOULD REMAIN IN ITS CURRENT FORM. MINOR UPGRADING OF AN EXISTING SECOND BASIN WITHIN THE POS AND PROVISION OF A THIRD BASIN WITHIN THE EXPANSION AREA IS DESIGNED TO REGULATE FLOWS TO SUCH A LEVEL THAT THE CAPACITY OF THE EXISTING OUTLET INFRASTRUCTURE IS NOT EXCEEDED. IN DOING SO, NO ADJUSTMENT TO THE OUTLET IS REQUIRED AND DISCHARGE FLOWS REMAIN BELOW PRE-DEVELOPMENT LEVELS.

NORTHERN EXPANSION OF THE PROPOSED DEVELOPMENT WILL IMPACT UPON 2 MINOR CATCHMENTS LOCATED AT THE NORTH-WEST AND NORTH-EAST CORNERS OF THE SUBJECT LAND, BEING CATCHMENTS 1 & 2 RESPECTIVELY. STORMWATER RUN-OFF FROM CATCHMENT 1 CURRENTLY EXITS THE SITE VIA A CULVERT BENEATH THE BUSSELL HIGHWAY PAVEMENT, WHILST CATCHMENT 2 OUTLETS VIA A SMALL GULLY INTO ADJACENT FARMLAND. THE STRATEGY MAKES PROVISION FOR COMPENSATING BASINS TO BE INSTALLED UPSTREAM OF THESE OUTLET POINTS IN ORDER TO MAINTAIN OUTLET FLOW RATES AT OR BELOW PRE-DEVELOPMENT LEVELS.

DRAINAGE CATCHMENTS
CATCHMENTS 1 & 2 ARE RELATIVELY SMALL AND WELL-DEFINED. THE STRATEGY PROVIDES FOR WATER QUALITY IMPROVEMENT AND REGULATION OF OUTFLOW RATES AT OR BELOW PRE-EXISTING LEVELS TO BE PROVIDED BY SMALL BASINS WITHIN THESE CATCHMENTS.

AN INCREASE IN STORMWATER RUN-OFF WITHIN CATCHMENT 3 RESULTING FROM THE PROPOSED EXPANSION WILL REQUIRE ADJUSTMENT TO THE MANNER IN WHICH STORMWATER ENTERS THE EXISTING DRAINAGE BASIN (BASIN 3C) AND OUTLET STRUCTURES. AS BASIN 3C HAS BEEN DESIGNED ONLY TO SUPPORT THE EXTENT OF DEVELOPMENT CURRENTLY APPROVED, RUN-OFF FROM THE EXPANSION AREA REQUIRES SETTLEMENT AND COMPENSATION PRIOR TO OVERFLOW INTO THIS BASIN. SUCH REGULATION OF FLOWS FROM THE EXPANSION AREA WILL OCCUR IN PROPOSED BASIN 3A, HOWEVER ADDITIONAL FLOW WILL INVARIABLY ENTER THE EXISTING BASIN FROM THIS SOURCE. IN ORDER TO COUNTER THE ADDITIONAL FLOW, FURTHER RETENTION WITHIN THE EXISTING SUBURBANDAL TYPICALLY THE AREAS OF SEDGE WAY AND FITCH ROAD IS PROPOSED BY AUGMENTATION OF AN EXISTING SILLING POND LOCATED AT THE EASTERN END OF THE POS NEAR THE INTERSECTION OF MUN WAY AND SAWMILL LOOP.

DRAINAGE OF PUBLIC LAND
THE PROPOSED SUBDIVISION LAYOUT IS INDICATED IN THE POST DEVELOPMENT PLAN AT SHEET 2. THE ROAD SYSTEM IS TO GENERALLY COMPRISE CONVENTIONAL RURAL ROAD STANDARD, INCLUDING UN-KERBED ROADS AND TABLE DRAINS. NARROWER ROAD RESERVES LOCATED AT THE UPPER END OF DRAINAGE CATCHMENTS MAY BE DRAINED WITH 300mm DEEP SWALES WHICH ARE EMPTIED VIA A PIPE DRAINAGE SYSTEM UPSTREAM OF EACH LOT CROSSOVER. DRAINAGE OF THE ROAD RESERVES IS INTENDED TO MIMIC THE EXISTING GRADUAL MIGRATION OF STORMWATER THROUGH THE CATCHMENT BY RETENTION IN ROADSIDE SWALES AND DETENTION / RECHARGE BASINS PRIOR TO EXITING THE SITE VIA NATURAL DRAINAGE LINES. DRAINAGE INFRASTRUCTURE THAT REFLECTS THE EXISTING CATCHMENT TREATMENT OF THE VARIOUS STORM EVENTS ARE DETAILED BELOW AND QUANTIFIED AT SHEET 2:

1:1 YEAR STORM EVENT
RUNOFF FROM THE CRITICAL 1:1 YEAR STORM EVENT SHALL WHERE POSSIBLE BE CONTAINED WITHIN TABLE DRAIN SWALES AND TREE PITS (SUBJECT TO DETAILED DESIGN AND ACCEPTANCE BY THE LOCAL AUTHORITY) INCORPORATED INTO THE ROAD SIDE DRAINAGE SYSTEM. WHERE POSSIBLE ROAD PAVEMENTS ADJACENT PUBLIC OPEN SPACE SHALL BE SUPER ELEVATED TO DEFLECT RUN-OFF DIRECTLY INTO THESE AREAS.

1:5 YEAR STORM EVENT
RUNOFF FROM MORE SIGNIFICANT STORM EVENTS SHALL SIMULATE THE CURRENT SYSTEM OF SLOW MIGRATION TOWARD THE EXISTING DRAINAGE INFRASTRUCTURE. THE INCREASED RUN-OFF RESULTING FROM ADDITIONAL IMPERVIOUS PAVEMENTS AND REDUCED CONCENTRATION TIMES ASSOCIATED WITH MORE EFFICIENT TABLE DRAINS SHALL BE COMPENSATED BY DETENTION/RECHARGE BASINS PRIOR TO DISCHARGE INTO EXISTING DOWNSTREAM WATERCOURSES. DETAILS OF THE DETENTION BASIN REQUIRED TO ACHIEVE THIS DEGREE OF COMPENSATION IS DESCRIBED SHEET 2.

1:100 YEAR STORM EVENT
THE RURAL NATURE OF OF THIS DEVELOPMENT PROHIBITS THE GLOBAL FILLING OF THE PROPOSED LOTS AND RESULTS IN RUNOFF FROM MAJOR STORM EVENTS FOLLOWING THE PRE-EXISTING GROUND CONTOURS AND ROAD NETWORKS. MAJOR EVENT RUNOFF WITHIN THE SUBDIVISION IS EXPECTED TO INVARIABLE PROPERTY BOUNDARIES, ACCUMULATING IN THE LOW AREAS IN THE VICINITY OF THE DETENTION BASINS AND OVERFLOW TO DOWN STREAM WATER COURSES ACROSS STRATEGICALLY LOCATED DRAINAGE RESERVES. THE DRAINAGE RESERVES SHALL BE DEPRESSED TO CREATE THE OVERLAND FLOW PATH REQUIRED.

DRAINAGE OF PRIVATE LAND
THE ELEVATION AND SLOPE OF THE LOCAL BERMAN DOES NOT ALLOW STANDING WATER FROM A MAJOR FLOOD EVENT TO ACCUMULATE TO ANY SIGNIFICANT DEPTH. IT IS RECOMMENDED THAT PLANNING GUIDELINES REQUIRE THAT ALL RESIDENTIAL DEVELOPMENT TO BE ELEVATED ON A SAND PAD A MINIMUM OF 500mm ABOVE THE ADJACENT GROUND LEVEL, ALLOWING FLOODWATERS TO BYPASS THE RESIDENCE AS THEY TRAVERSE THE SITE TO LOWER GROUND.

ISOLATED AREAS AT THE NORTH WESTERN CORNER OF THE SITE AND IN VICINITY OF THE PROPOSED POS WITHIN THE PROPOSED K3 EXPANSION WHICH ARE KNOWN TO BECOME INUNDATED DURING THE WINTER MONTHS SHALL BE ADDRESSED DURING THE DETAILED DESIGN OF THE SUBDIVISION CIVIL WORKS. EXPANSION OF THE DRAINAGE NETWORK, INCLUDING SUBSOIL DRAINAGE AS NECESSARY AND/OR LOT FILLING SHALL BE ESTABLISHED SO AS TO PROTECT PROPOSED BUILDING AREAS FROM FUTURE INNUNDATION.

THE CONTROL OF SEDIMENTS AND PREVENTION OF IT ENTERING DOWNSTREAM WATER COURSES THROUGH THE NEW DRAINAGE SYSTEM SHALL BE MANAGED VIA THE DRAINAGE STRUCTURES AND SWALES INTEGRATED INTO THE DRAINAGE NETWORK. ALL ARE READILY ACCESSABLE AND MAY REQUIRE PERIODIC CLEANING DURING THE EARLY STAGES OF DEVELOPMENT.

MANAGING THE SUBDIVISION WORKS

CONSTRUCTION WORKS AT THE DEVELOPMENT SITE SHOULD BE UNDERTAKEN IN SUCH A MANNER AS TO MINIMIZE UN-NECESSARY DISTURBANCES. THE FOLLOWING RECOMMENDATIONS ARE TO BE DIRECTED TO THE CONTRACTOR FOR IMPLEMENTATION:

DEWATERING
EXCAVATION NECESSARY FOR COMPLETION OF THE WORKS DO NOT EXTEND MORE THAN 1.0m BENEATH THE EXISTING GROUND SURFACE LEVEL. THE WORKS ARE TO BE CONSTRUCTED DURING THE SUMMER AND AUTUMN MONTHS WHEN THE EXCAVATIONS CAN BE COMPLETED WITHOUT THE NEED FOR DE-WATERING.

ACID SULFATE SOILS
THE CONSTRUCTION WORKS CONTRACT IS TO BE WRITTEN IN SUCH A MANNER TO REQUIRE THE CONTRACTOR TO ENGAGE AN APPROVED CONSULTANT TO INVESTIGATE THE SITE PRIOR TO CONSTRUCTION COMMENCING AND MANAGE ANY WORKS THAT MAY REQUIRE THE DISTURBANCE OF ACID SULFATE SOILS.

DUST AND SEDIMENT CONTROL
THE WORKS ARE TO BE CONSTRUCTED OVER THE SUMMER / AUTUMN MONTHS AND SHOULD THEREFORE BE UNDERTAKEN IN ACCORDANCE WITH D.E.R. DOCUMENT "A GUIDELINE FOR THE DEVELOPMENT AND IMPLEMENTATION OF A DUST MANAGEMENT PROGRAM" 2008. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVISION OF HIS OWN WATER SUPPLY FOR CONSTRUCTION PURPOSES, NOTING THAT BOTH SURFACE AND GROUND WATER SUPPLIES IN THE IMMEDIATE LOCALITY FALL WITHIN PROCLAIMED AREAS UNDER THE RIGHTS IN WATER AND IRRIGATION ACT.

CONTROL OF SEDIMENTS IS NOT LIKELY TO BECOME A PROBLEM UNTIL AFTER THE WORKS ARE COMPLETE AND THE CONTRACTOR HAS LEFT THE SITE. THE CONSTRUCTION CONTRACT IS TO BE WRITTEN IN SUCH A MANNER TO REQUIRE THE CONTRACTOR TO RETURN TO THE SITE DURING AND AT THE COMPLETION OF THE 12 MONTH DEFECTS LIABILITY PERIOD TO MAKE GOOD ANY EROSION OR SCOUR THAT OCCURS DURING THE FIRST WINTER AFTER COMPLETION AND CLEAR SEDIMENT FROM DRAINAGE SWALES AS REQUIRED. MONITORING AND PERIODIC MAINTENANCE DURING THE FIRST WINTER GENERALLY ESTABLISHES GRASSES AND VEGETATION SUITABLE FOR ONGOING PROTECTION OF THE EMBANKMENTS AND SWALES.

LEGEND :

- PRE DEVELOPMENT CATCHMENT BOUNDARY
- PRE DEVELOPMENT OVERLAND FLOW PATHS
- PIPED BASIN OUTLET
- AREA OF HIGH WINTER WATER TABLE
- EXISTING DRAINAGE BASIN

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PROJECT No	MCI01-A-14
SHEET	1 OF 2
REVISION	F
LOCAL AUTHORITY	AUGUSTA MARGARET RIVER
SCALE	1 : 3000 (@ A1)
DATUM	AHD

REVISION DATE	No	REVISION DESCRIPTION	DESIGN	DRAWN	CHECKED	APPROVED
7 DECEMBER 2014	0	PRELIMINARY – NOT FOR CONSTRUCTION	DVN	DVN	DVN	
20 JANUARY 2015	A	ISSUED FOR APPROVAL	DVN	DVN	DVN	
18 DECEMBER 2020	B	REVISED FOR WAPC 159358	DVN	DVN	DVN	
16 SEPTEMBER 2021	C	REVISED FOR K3 EXPANSION	DVN	DVN	DVN	
21 DECEMBER 2022	D	AMENDED K3 EXPANSION	DVN	DVN	DVN	
20 JANUARY 2023	E	CADASTRAL PLAN AMENDED	DVN	DVN	DVN	
1 MARCH 2023	F	CADASTRAL PLAN AMENDED	DVN	DVN	DVN	

PROJECT
LOT 9001 BROCKMAN HIGHWAY KARRIDALE

DRAWING TITLE
STORMWATER MANAGEMENT STRATEGY

APPENDIX C

Stormwater Management Plan

6 January 2023

DIRK VAN NOORT
CIVIL & STRUCTURAL PROJECT ENGINEER

Aurora Environmental
Unit 7 57-59 Lockyer Avenue
ALBANY WA 6330

Attention M Price

Dear Melanie

LOT 9001 BROCKMAN HIGHWAY KARRIDALE – K3 EXPANSION

Further to our discussion surrounding the Local Water Management Strategy that you are preparing in support of the above proposal, I am pleased to provide the attach Stormwater Management Plan to assist in this endeavour.

Primarily, the Plan represents an expansion of previous SWMP prepared in relation to the earlier stages of the Hamelin Grove Development and includes an assessment of the stormwater runoff regime that existed prior to the development commencing in 2015. Acknowledging the propensity for proposed road pavements and more efficient drainage networks to increase the rate at which stormwater runoff exits the site, the SWMP provides details of mechanisms required to mitigate these flow rates to levels at or below the pre-development environment.

I am aware that there has been reported increases in water levels in the natural water courses west of Bussell Highway during recent winters. On the basis of assessments undertaken in preparation of the SWMP, this has not resulted from the current Hamelin Grove development, which has been implemented with numerous structural measures, restricting the drainage outflow to levels below that which existed prior to the subdivision development.

Significant clearing of plantation timbers has occurred within catchment south of Brockman Highway over recent years, having the potential to markedly increase stormwater runoff to downstream water courses. It appears that measures to mitigate this increased flow may not have been implemented, with the likely result of a net increase in stormwater runoff emanating from this source.

Further, it should be noted that rainfall recorded during the winter of 2021 was substantially higher than the average for the Karridale area and that some increase in inundation of low areas was to be expected.

Structural measures detailed in the Stormwater Management Plan and to be incorporated into the subdivision's drainage network will cause retention of stormwater flows on site and release at a controlled, lesser rate so as to maintain a flow regime similar to that which existed prior to any subdivision development at the site. Accordingly, the proposed K3 expansion of the Hamelin Grove Development will therefore not exacerbate any reported drainage issues within the downstream water courses.

Stormwater issues that have manifested during the earlier stages of development inside Hamelin Grove include:

1. *Retention of stormwater north of the Stage 2 Development*. Staged earthwork construction created a depression upstream of lot filling installed as part of the stage 2 works. Water retention was mitigated by connection of the area into the subdivision drainage network. Completion of the lot filling required for development of stage 3 will eliminate this depression with stormwater runoff directed into the future drainage network.
2. *Ponding within lots adjacent Bussell Highway*. Stormwater flowing overland entered two properties in low lying areas adjacent Bussell Highway, creating a degree of ponding during the winter months. Initial works were installed to limit these flows by directing them into the drainage network. Such flows will be further intercepted and redirected by construction of additional roads and table drains associated with the proposed K3 expansion. As stated however in the Stormwater Management Plans prepared to date, all residential construction within the subdivision should be built upon a 500mm sand pad in order to protect against such overland flows.

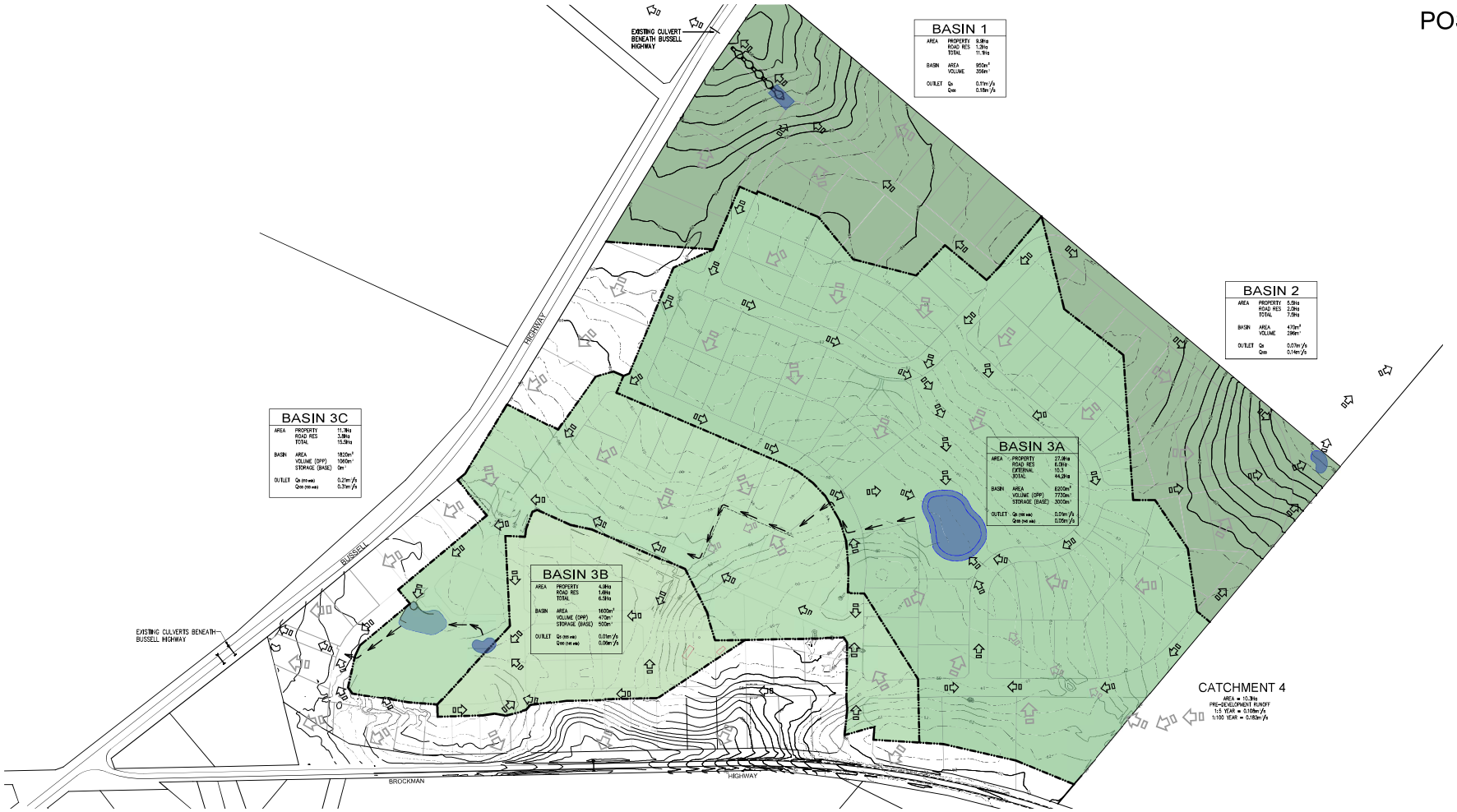
The above issues have generally been addressed by temporary measures, and will be more fully reconciled by works to be undertaken during future stages of development. Low areas and areas of known inundation have been identified within the proposed expansion area and will be subject to detailed design, including diversion drains, lot filling and subsoil drainage as required to protect properties on and adjacent these sites.

I trust that the attached Plan will provide the support required to address Stormwater Management issues covered in your Local Water Management Strategy. Please do not hesitate to contact me however should you have any queries or require further information.

Yours sincerely,

Dirk van Noort BE(hons)UWA
Senior Civil Engineer

POST-DEVELOPMENT PLAN



DESIGN GUIDELINES

THE PRIMARY REQUIREMENTS OF THE STORMWATER MANAGEMENT IS TO IMPROVE WATER QUALITY AND LIMIT PEAK POST DEVELOPMENT DISCHARGE FLOWS TO THE EXTENT THAT THEY DO NOT EXCEED THE PREDEVELOPMENT FLOWS FOR SIMILAR STORM EVENTS.

SUMMARY OF OUTFLOW RATES:

CATCHMENT	EVENT	PRE-DEVELOPMENT	POST-DEVELOPMENT
ONE	1:5 YEAR	0.129m³/s	0.110m³/s
	1:100 YEAR	0.218m³/s	0.180m³/s
TWO	1:5 YEAR	0.091m³/s	0.070m³/s
	1:100 YEAR	0.161m³/s	0.014m³/s
THREE	1:5 YEAR	0.365m³/s	0.180m³/s
	1:100 YEAR	0.567m³/s	0.280m³/s

HYDRAULIC DETAILS FOR THE BASINS PROPOSED IN THE POST DEVELOPMENT STATE INCLUDE:

	BASIN 1	BASIN 2	BASIN 3A	BASIN 3B	BASIN 3C
ROAD RES (C = 0.8)	1.2Ha	2.0Ha	6.0Ha	1.6Ha	3.8Ha
PROPERTIES (C = 0.15)	9.9Ha	5.5Ha	27.9Ha	4.9Ha	11.7Ha
EXTERNAL (C = 0.15)	0.0Ha	0.0Ha	10.3Ha	0.0Ha	0.0Ha
CATCHMENT (NET C.A	2.4Ha	1.0Ha	10.5Ha	6.5Ha	15.5Ha
SWALE STORAGE	70m³	133m³	264m³	112m³	133m³
SWALE AREA	470m²	890m²	1760m²	750m²	890m²
CRITICAL DURATION	30min	20min	145min	145min	145min
PEAK RUNOFF (5/100)	0.25/0.42	0.14/0.24	0.43/0.70	0.08/0.13	0.17/0.28
PEAK U/S INFLOW (5/100)	–	–	–	–	0.03/0.11
BASIN AREA	950m²	470m²	6200m²	1600m²	1820m²
DEAD STORAGE	–	–	3000m³	500m³	–
OPPERATING VOL	356m³	296m³	7730m³	470m³	1060m³
OUTLET PIPE SIZE	150mm	150mm	300mm	300mm	450mm
PEAK DISCHARGE (5/100)	0.11/0.18	0.07/0.14	0.01/0.05	0.01/0.06	0.18/0.28

1:1 YEAR STORM EVENTS

RUNOFF FROM MINOR STORM EVENTS, ESTABLISHED ON THE BASIS OF A 1 HOUR 1 IN 1 YEAR ARI EVENT (OR 16mm) IS TO BE CONTAINED IN SWALES CONSTRUCTED IN CONJUNCTION WITH THE ROAD SIDE TABLE DRAINS.

STORAGE IS ESTABLISHED BY INSTALLING 300mm HIGH BUNDS ACROSS THE TABLE DRAIN TO PROVIDE AN AVERAGE STORAGE DEPTH OF 150mm WITHIN THE DRAINS.

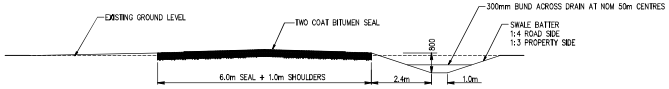
1:5 YEAR STORM EVENTS

THE SUBJECT SITE PRESENTLY DRAINS TO TURNER BROOK WEST OF BUSSELL HIGHWAY. THIS WATERCOURSE SERVICES THE AGRICULTURAL ACTIVITIES OF THE AREA AND FALLS UNDER THE CONTROL OF THE DEPARTMENT OF WATER. IN ORDER TO MITIGATE POTENTIAL FLOODING OF THE DOWNSTREAM CATCHMENT THE PEAK FLOW RATE EXITING THE DEVELOPMENT MUST NOT EXCEED THAT WHICH CURRENTLY OCCURS FROM THE PRE EXISTING ENVIRONMENT.

1:100 YEAR STORM EVENTS

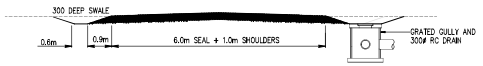
THE PROJECT SITE IS LOCATED UPON WELL ELEVATED LAND WITH A NATURAL GRADIENT OF APPROXIMATELY 1.0% FALLING FROM NORTH TO SOUTH. A SMALL PORTION OF AGRICULTURAL LAND (APPROXIMATELY 10.3Ha) DRAINS ACROSS THE EASTERN BOUNDARY FROM HIGHER LAND. AS SUCH THE PROPERTY IS NOT THREATENED BY SIGNIFICANT STORMWATER RUN-OFF EMANATING FROM HIGHER IN THE CATCHMENT

WITHIN THE CATCHMENT, SURFACE RUN-OFF FROM A MAJOR STORM EVENT CANNOT REACH ANY SIGNIFICANT DEPTH AS IT SHEETS UNIFORMLY OVER THE GROUND SURFACE. CONCENTRATION OF FLOOD WATER DURING SUCH AN EVENT OCCURS WITHIN TABLE DRAINS CONSTRUCTED IN ROAD RESERVES WHERE IT IS CONVEYED TO DOWNSTREAM RECEIVING WATERS. IT IS RECOMMENDED THAT PLANNING GUIDELINES FOR THE AREA REQUIRE RESIDENTIAL FLOOR LEVELS TO BE SET 500mm ABOVE THE SURROUNDING GROUND LEVELS TO PROVIDE PROTECTION FROM FLOODING FROM THIS SOURCE.



TYPICAL PAVEMENT AND TABLE DRAIN SECTION

SCALE 1:100



TYPICAL PAVEMENT AND SWALE DRAIN SECTION

LEGEND :

- POST DEVELOPMENT FLOW PATHS
- POST DEVELOPMENT CATCHMENT BOUNDARY
- CONCRETE STORMWATER PIPE
- PROPOSED ROAD AND TABLE DRAIN
- CROSSOVER TO BE CONSTRUCTED WITH SUBDIVISION WORKS

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PROJECT No	MCI01-A-14
SHEET	2 OF 2
REVISION	C
LOCAL AUTHORITY	AUGUSTA MARGARET RIVER
SCALE	1 : 2000 (@ A1)
DATUM	AHD

REVISION DATE	No	REVISION DESCRIPTION	DESIGN	DRAWN	CHECKED	APPROVED
7 DECEMBER 2014	0	PRELIMINARY – NOT FOR CONSTRUCTION	DVN	DVN	DVN	
20 JANUARY 2015	A	ISSUED FOR APPROVAL	DVN	DVN	DVN	
18 DECEMBER 2020	B	REVISED FOR WAPC 159358	DVN	DVN	DVN	
16 SEPTEMBER 2021	C	REVISED FOR K3 EXPANSION	DVN	DVN	DVN	

PROJECT

LOT 9001 BROCKMAN HIGHWAY KARRIDALE

DRAWING TITLE

STORMWATER MANAGEMENT STRATEGY

APPENDIX D

Calculations – Pre and Post Development Flows

A Summary of an assessment of water management calculation by Urbanise includes:

1. The Runoff Coefficient used in the UWMP is 0.15 for undeveloped / lots and 0.8 for road reserves. Runoff Coefficient's vary based on type of soil, use and vegetation across the catchment. 0.15 is seen as mid-range between Farmland use with soil combination of sand & clays with topography in the order of 2 to 7% slopes. In our opinion 0.15 to 0.18 runoff co-efficient is within the expected range for pre-development flow assessment, therefore 0.15 is considered slightly conservative

   The UWMP post development Runoff Coefficient has used 0.15 for lots and 0.8 for road reserves which as a combined Runoff Coefficient calculated in a range of 0.22 to 0.34. Urbanise has reviewed the Runoff Coefficient to take into consideration the increase due to development of lots and roads. Due to the large lots, the Runoff Coefficient is calculated at 0.25 based on an average house area of 350m2. Similar with the roads, due to the large road reserves, the Runoff Coefficient is calculated to be in the order of 0.6. The resulting Runoff Coefficient is slightly higher on average by 0.04 across the site. In our opinion the overall Runoff Coefficient is within tolerances.

   We note that as there are no Water Corporation mains within the development, it is expected that the Runoff Coefficient would be less due to water collection expected from the property owners.

2. Detention basin Calculations – A detention capacity has been reviewed between UWMP values and our calculation using the UWMP co-efficient parameters.
   a. Basin 1 – Slightly below detention, during detail design this will be shaped to increase capacity
   b. Basin 2 – Below detention storage required, during detail design this will be shaped to increase capacity
   c. Basin 3A – meets detention storage required.
   d. Basin 3B – meets 20% AEP detention and doesn't meet 1% AEP, however combined with Basin 3C detention capacity is meet.
   e. Basin 3C – meets detention storage required.

   Note storage within drainage swales have not been considered.

   Urbanise has also assessed detention capacity based on adjusted impervious factors and pre-development flows with the following summary:-
   a. Basin 1, 2 & 3A are less than the values nominated within the UWMP, however at detail design the basins detention will be sized to accommodate the require storage.
   b. Basin 3B & 3C, are less than the values nominated within the UWMP, however we do not have survey of actual basin size constructed, as part of future designs, a investigation of existing basin size will be conducted to assess capacity and works required if any.

In conclusion, taking into consideration of the land use, the runoff coefficient used within the UWMP are considered fair and reasonable design parameters, and with post-development discharge flows slightly less than pre-development flows, the system implemented meets design principles for stormwater management across the site.

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Director

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Stormwater Drainage Summary

Date: 11/06/2024
Project : Hamelin Grove - Future Stages - Karridale
Project No: URB0722
File Ref# 0722-Cal-DR-001
Revision: A

	UWMP (Adopted)											
	Area (ha)			Runoff Coefficient				Adopted Pre-Development Flow		Urbanise Calculated Detention Storage		UWMP
Description	Property / land	Road Reserve	Total	Property / land	Road Reserve	Total Impervious	Resulting Impervious	m3/s	m3/s	m3	m3	Volume m3	
				0.15	0.8	Area	Factor	*20% AEP*	*1% AEP*	*20% AEP*	*1% AEP*		
Basin 1	9.5	1.1	10.6	1.425	0.88	2.305	0.22	0.080	0.120	355	696	680	Slightly less, Detail to review and increase capacity
Basin 2	5.5	2.2	7.7	0.825	1.76	2.585	0.34	0.090	0.140	398	766	210	Detail to review and increase capacity
Basin 3A	34.7	4.4	39.1	5.205	3.52	8.725	0.22	0.080	0.090	2568	5311	5345	meets detention capacity
Basin 3B	5.9	2.1	8	0.885	1.68	2.565	0.32	0.080	0.130	417	784	500	
Basin 3C	15.2	5.4	20.6	2.28	4.32	6.6	0.32	0.230	0.300	1015	2111	2390	Combined 3B & 3C meet detention capacity

	Urbanise Cross Reference											
	Area (ha)			Runoff Coefficient				Urbanise Calculated Pre-Development Flow		Urbanise Calculated Detention Storage		
Description	Property / land	Road Reserve	Total	Property / land	Road Reserve	Total Impervious	Resulting Impervious	m3/s	m3/s	m3	m3	Comments
				0.25	0.6	Area	Factor	*20% AEP*	*1% AEP*	*20% AEP*	*1% AEP*	
Basin 1	9.5	1.1	10.6	2.375	0.66	3.035	0.29	0.137	0.261	411	710	Pre-Development Flow UWMP adopted less
Basin 2	5.5	2.2	7.7	1.375	1.32	2.695	0.35	0.093	0.166	416	748	Pre-Development Flow UWMP adopted less
Basin 3A	34.7	4.4	39.1	8.675	2.64	11.315	0.29	0.120	0.160	3104	6089	Pre-Development Flow UWMP adopted less
Basin 3B	5.9	2.1	8	1.475	1.26	2.735	0.34	0.110	0.197	395	709	Pre-Development Flow UWMP adopted less
Basin 3C	15.2	5.4	20.6	3.8	3.24	7.04	0.34	0.415	0.575	1236	2645	Bussell Hwy Discharge Pre-Development Flow UWMP adopted less

	Impervious Factor Calculatons			
	Lot			
Description	Area	Impervious Factor	Impervious Area	
Avg. House Area	350	1.000	350	Note Tank Storage not considered
House Surround	2650	0.150	398	
Total Avg. Lot Area	3000	0.249	748	

	Impervious Factor Calculatons			
	Road Reserve			
Description	Area	Impervious Factor	Impervious Area	
Road & Footpath	394	1.000	394	Average Std 37.5m frontage, road width 25m
Driveways	96	1.000	96	Average 6m wide, 8m long both sides of road
Verge	448	0.150	67	Average Std 37.5m frontage, road width 25m, less road and driveways
Total Avg. Road Area	938	0.594	557	

Pre-Development / Post Development Flow Assessment

Date: 11/06/2024
Project : Hamelin Grove - Future Stages - Karridale
Project No: URB0722
File Ref# 0722-Cal-DR-002
Revision: A

Pre-Development

Description	Cat Area m2	Total Area m2	F_q	Area Ha	Tc (min) 20%AEP	Tc (Min) 1%AEP	Pre-Development UWMP C 0.15	Pre-Development DVN 20%AEP Q m3/s	Pre-Development Adopted 1%AEP Q m3/s	Pre-Development UWMP C 0.15	Pre-Development DVN 20%AEP m3/s	Pre-Development Adopted 1%AEP m3/s	Comments
Basin 1	106,000	106,000	0.00278	10.600	54.0	49.0	0.15	0.129	0.080	0.15	0.218	0.120	
Basin 2	77,000	77,000	0.00278	7.700	57.0	56.0	0.15	0.091	0.090	0.15	0.161	0.140	
Basin 3A	391,000	391,000	0.00278	39.100	435.0	640.0	0.15		0.080	0.15		0.090	
Basin 3B	80,000	80,000	0.00278	8.000	100.0	105.0	0.15		0.080	0.15		0.130	20% AEP - 3A, 3B & 3C Combined Flow slightly more
Basin 3C	206,000	206,000	0.00278	20.600	150.0	215.0	0.15	0.365	0.230	0.15	0.567	0.300	1% AEP - 3A, 3B & 3C Combined Flow slightly less

Pre-Development

Description	Cat Area m2	Total Area m2	F_q	Area Ha	Tc (min) 20%AEP	Tc (Min) 1%AEP	Pre-Development Urbanise Cross Reference C 0.15	20% I	Q m3/s	C 0.15	1% I	Q m3/s	Comments
Basin 1	106,000	106,000	0.00278	10.600	54.0	49.0	0.15	30.9	0.137	0.15	59.0	0.261	UWMP adopted less
Basin 2	77,000	77,000	0.00278	7.700	57.0	56.0	0.15	29.0	0.093	0.15	51.8	0.166	UWMP adopted less
Basin 3A	391,000	391,000	0.00278	39.100	435.0	640.0	0.15	7.3	0.120	0.15	9.8	0.160	UWMP adopted less
Basin 3B	80,000	80,000	0.00278	8.000	45.0	45.0	0.15	32.9	0.110	0.15	59.0	0.197	UWMP adopted less
Basin 3C	677,000	677,000	0.00278	67.700	150.0	215.0	0.15	14.7	0.415	0.15	20.4	0.575	Bussell Hwy Discharge UWMP adopted less

Based on Farmland with consideration contains combination of sand & clay pockets 2-7% surface grades

Type of ground surface	Coefficient of surface runoff, F_{ps}
Road:	
Pavement	0.70–0.90
Permeable pavement	0.30–0.40
Gravel road	0.30–0.70
Shoulder or top of slope:	
Fine soil	0.40–0.65
Coarse soil	0.10–0.30
Hard rock	0.70–0.85
Soft rock	0.50–0.75
Grass plot of sand:	
Slope 0–2%	0.05–0.10
Slope 2–7%	0.10–0.15
Slope 7%	0.15–0.20
Grass plot of clay:	
Slope 0–2%	0.13–0.17
Slope 2–7%	0.18–0.22
Slope 7%	0.25–0.35
Roof	1.00
Unused bare land	0.20–0.40
Athletic field	0.40–0.80
Park with vegetation	0.10–0.25
Mountain with a gentle slope	0.30
Mountain with a steep slope	0.50
A paddy field or water	0.70–0.80
Farmland	0.10–0.30

DRAINAGE FLOW CALCULATION

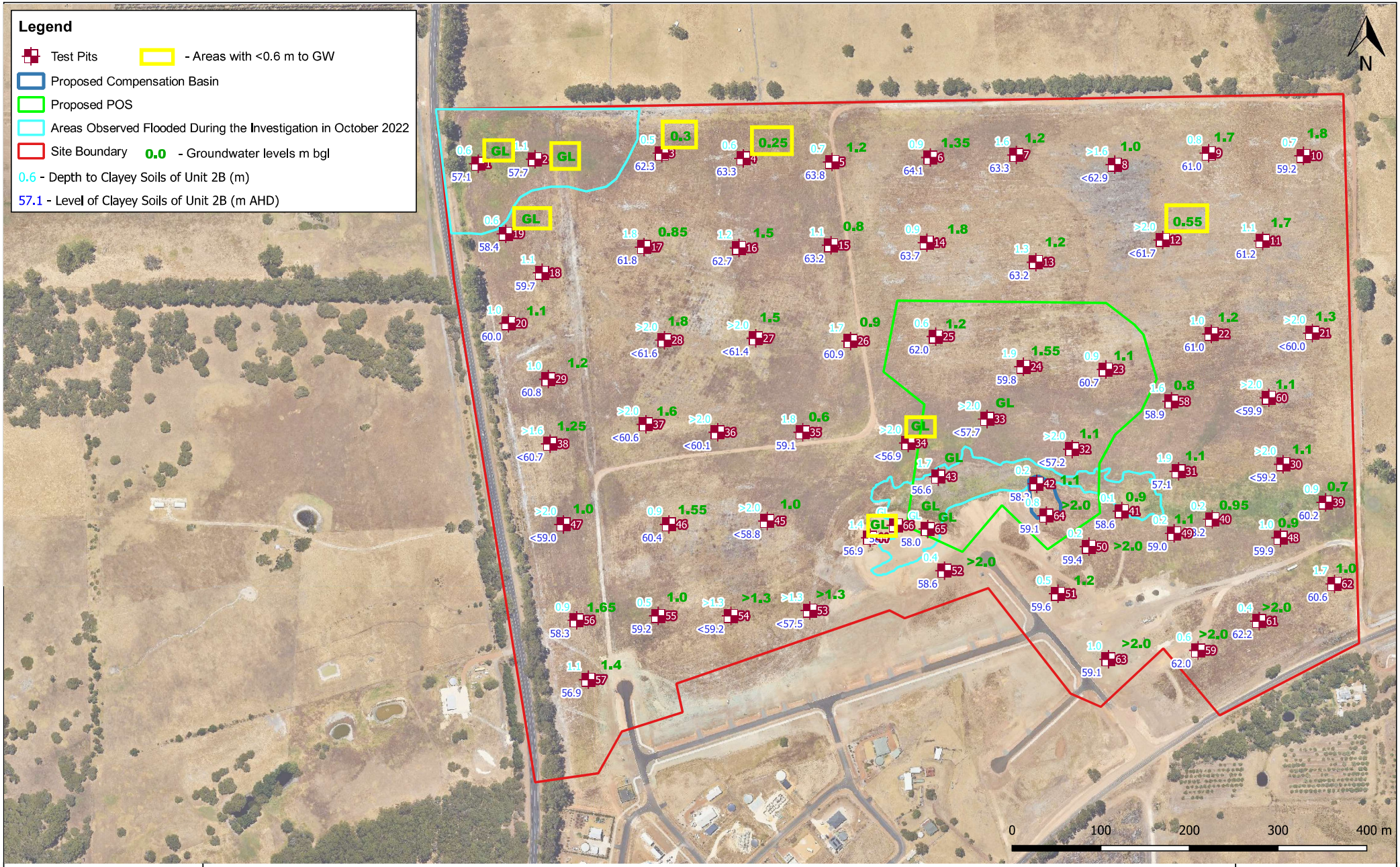
Date: 11/06/2024
Project : Hamelin Grove - Future Stages - Karridale
Project No: URB0722
File Ref# 0722-Cal-DR-003
Revision: A

Pre-Development Flows

Description	Cat Area m2	Total Area m2	F_q	Area Ha	US LEVEL	DS LEVEL	Change Height (m)	L (km)	$A^{0.1}$	S m/km	$S^{0.2}$	F_{tc}	Tc (min)	Tc (hrs)	Adopted (Tc hrs)			
															20%		1%	
															min	hrs	min	hrs
Basin 1	106,000	106,000	0.00278	10.600	65.00	58.00	7.00	0.500	1.266	14.000	1.695	92.7	21.6	0.36	54.00	0.90	49.00	0.82
Basin 2	77,000	77,000	0.00278	7.700	65.00	58.00	7.00	0.500	1.226	14.000	1.695	92.7	22.3	0.37	57.00	0.95	56.00	0.93
Basin 3A	391,000	391,000	0.00278	39.100	65.00	58.00	7.00	0.950	1.443	7.368	1.491	92.7	40.9	0.68	435.00	7.25	640.00	10.67
Basin 3B	80,000	80,000	0.00278	8.000	58.50	55.50	3.00	0.480	1.231	6.250	1.443	92.7	25.1	0.42	100.00	1.67	105.00	1.75
Basin 3C	206,000	677,000	0.00278	67.700	65.00	54.00	11.00	1.250	1.524	8.800	1.545	92.7	49.2	0.82	150.00	2.50	215.00	3.58

APPENDIX E

Depth to Groundwater



Douglas Partners
Geotechnics | Environment | Groundwater

Depth to the Surface of Clayey Soils of Unit 2
Proposed Residential Subdivision
Lot 9001 Brockman Highway, Karridale, WA

CLIENT: Juventus Pty Ltd Atf The Prevelly Development Trust

PROJECT:	218332.00
Drawing No:	3
REV:	0
DATE:	28/11/2022

APPENDIX F

Education Material

Information Materials and Brochures

Waterwise information is available from Water Corporation at

Waterwise
Climate change means we all have a role to play to protect and adapt the way we use water.

Find everything you need to save water in your home or business. Check your watering days, compare how waterwise you are within your neighborhood, and get tips for simple ways you can save water.
https://www.watercorporation.com.au/Waterwise

Waterwise Products
Find waterwise products endorsed by Water Corporation including pool blankets and mulch to help you save water in your home and garden.
https://www.watercorporation.com.au/Waterwise/Waterwise-products?radio=pool-and-spa-18

Waterwise Specialists
Search to find waterwise specialist across WA that have been endorsed by Water Corporation.

They can help you with garden landscaping, irrigation and household plumbing maintenance and installation to ensure you are using water efficiently around your home.
https://www.watercorporation.com.au/Waterwise/Waterwise-specialists?radio=gardenIrrigators

Waterwise Offers
Looking for more ways you can save water in your home and garden? Every year, we provide waterwise offers on products and services to help you to be more water efficient.

Current offers and check your eligibility can be viewed through.
https://www.watercorporation.com.au/Waterwise/Waterwise-offers

Waterwise Plants for WA:

Plants suited to our climate need less water, are low maintenance and will look great in your garden. Use our directory to find waterwise plants that will grow best where you live.
Waterwise Plants Perth & WA | Water Saving & Drought Tolerant Plants (watercorporation.com.au)

Rain Gardens
Raingardens are self-watering, low-maintenance gardens designed to protect our rivers and creeks, by capturing stormwater that runs off hard surfaces when it rains.

Use Melbourne Water resources to build your own raingarden and view examples in Melbourne.
https://www.melbournewater.com.au/water-and-environment/saving-water/raingardens

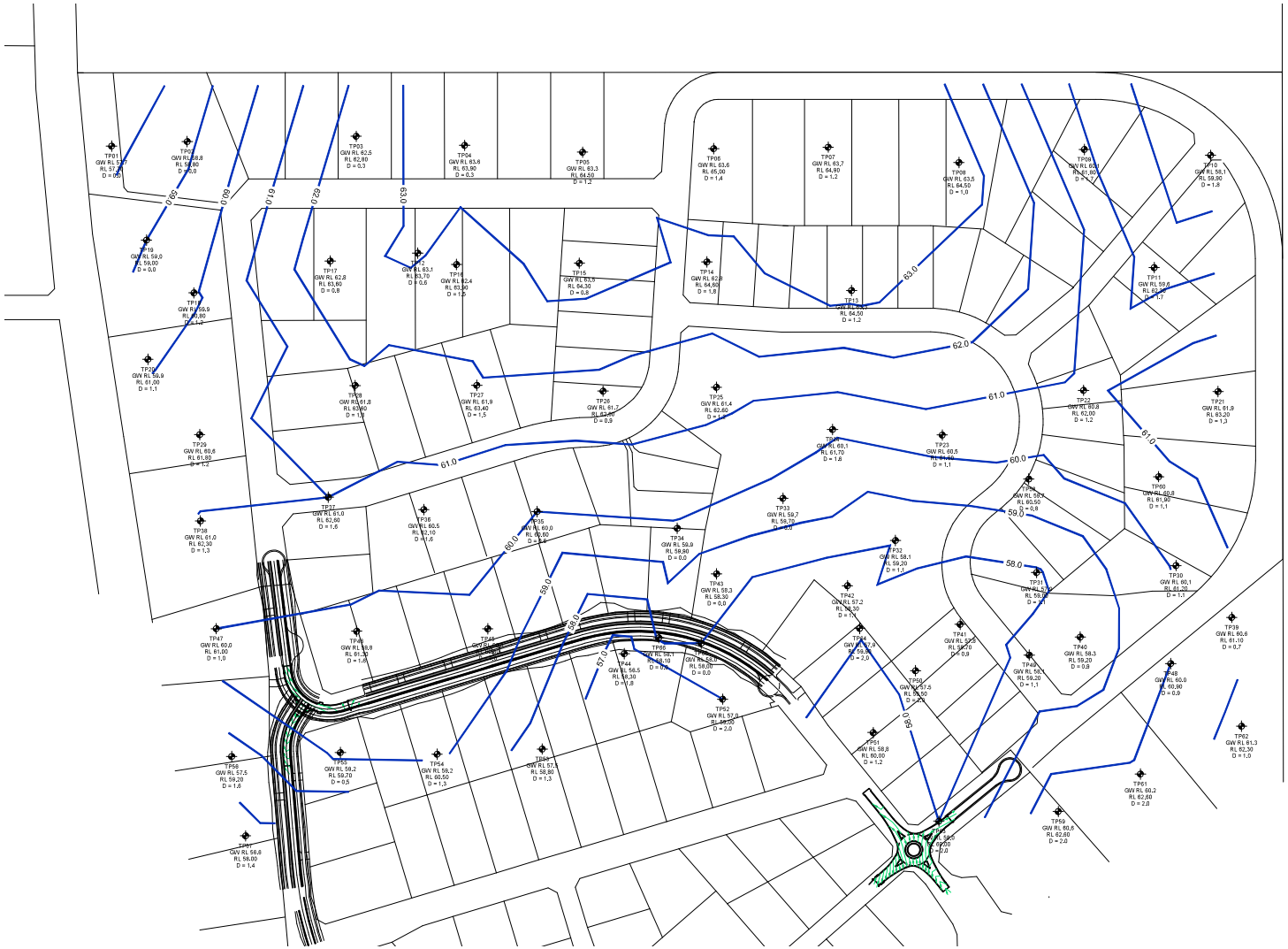
Information Materials and Brochures

Water wise information is available from Water Corporation at www.watercorporation.com.au

Try: https://www.watercorporation.com.au/save-water

APPENDIX G

Groundwater Contours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TP61 GW RL 60.2 RL 62.60 D = 2.0
TP62 GW RL 61.3 RL 62.30 D = 1.0
58.0
59.0
60.0
61.0
62.0
63.0

Local Structure Plan

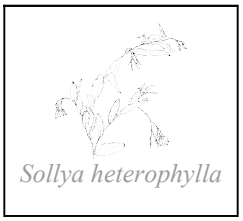
APPENDIX D
VEGETATION AND FLORA SURVEY

Cardno
Shaping the Future

FLORA AND VEGETATION
OF
LOT 101 BROCKMAN HIGHWAY
KARRIDALE

Prepared for:
Michael Swift and Associates Town Planners
21 Endeavour Circle,
Wannanup, WA 6210

Prepared by:
Bennett Environmental Consulting Pty Ltd



PO Box 341
KALAMUNDA 6926

September 2012

STATEMENT OF LIMITATIONS

Scope of Services

This report ("the report") has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Eleanor Bennett ("the Author"). In some circumstances a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services.

Reliance on Data

In preparing the report, the Author has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise stated in the report, the Author has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. The Author will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to the Author.

Environmental Conclusions

In accordance with the scope of services, the Author has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

The conclusions are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of preparing the report. Also it should be recognised that site conditions, can change with time.

Within the limitations imposed by the scope of services, the field assessment and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

Report for Benefit of Client

The report has been prepared for the benefit of the Client and no other party. The Author assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of the Author or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

Other Limitations

The Author will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report. The scope of services did not include any assessment of the title to or ownership of the properties, buildings and structures referred to in the report nor the application or interpretation of laws in the jurisdiction in which those properties, buildings and structures are located.

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SUMMARY

Bennett Environmental Consulting Pty Ltd was contracted to undertake a vegetation and flora survey of Lot 101 Brockman Highway. The site was just north of the Karridale townsite and extended west to the Bussell Highway.

There was only a small area of remnant vegetation retained on the site as it had been developed for tree plantations and utilized to graze cattle. The vegetation of the remnant was:

- Tall Forest of *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* over Low Woodland A of *Agonis flexuosa* var. *flexuosa* in sandy loam.

It included many dense, tall Jarrah and Marri trees which are worthy of retention but the understory was mainly replaced with weeds. There were occasional shrubs of *Hibbertia cuneiformis*.

No threatened or priority flora were recorded during the survey.

1. INTRODUCTION

1.1 Background

Bennett Environmental Consulting Pty Ltd was commissioned to undertake a vegetation survey of the remnant vegetation Lot 101 Brockman Highway. Most of the site is developed for farming, and tree plantations as seen in Diagram 1.

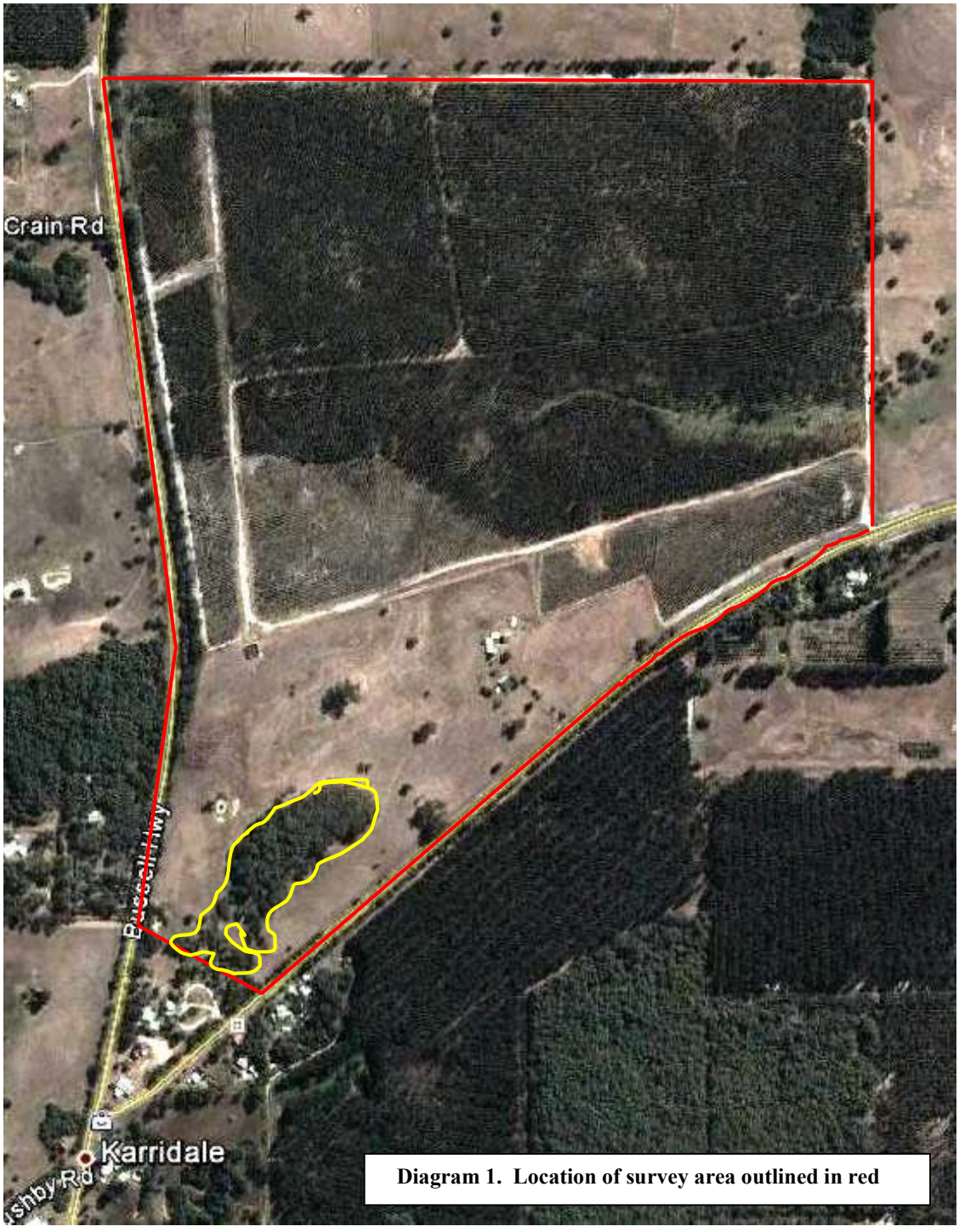

Diagram 1. Location of survey area outlined in red

There was a small area of remnant vegetation in the southern area of the site which is outlined in yellow in Diagram 1. This wax the only area surveyed.

1.2 Scope of Works

The requirements for this project were to:

i. Undertake a Level 2 survey (Environmental Protection Authority, 2004) of the remnant vegetation;
ii. Record the vegetation units and associated species in the remnant bushland; and
iii. Search for and record all significant species at the site.

2. REGIONAL METHODOLOGY

2.1 Vegetation

The Interim Biogeographical Regionalisation for Australia (IBRA) (Thackway and Cresswell, 1995) recognises 85 bioregions. The IBRA is used as the common unit to compare biological and biophysical attributes. Bioregions represent a landscape based approach to classifying the land surface and each region is defined by a set of major environmental influences, which shape the occurrence of flora and fauna and their interaction with the physical environment. The study area is in the Jarrah Forest (South) (JF2- Southern Jarrah Forest Region).

The Southern Jarrah Forest Region is described as Duricrusted plateau of Yilgarn Craton characterised by Jarrah-Marri forest on laterite gravels and, in the eastern part, by Wandoo - Marri woodlands on clayey soils. Fluvial and alluvial deposits support *Agonis* shrublands. In areas of Mesozoic sediments, Jarrah forests occur in a mosaic with a variety of species-rich shrublands (Hearne et al., 2002).

The Regional Forest Agreement (RFA) (Mattiske and Havel, 1998) mapped the vegetation complexes of the forest areas of Western Australia. This included the Jarrah Forest and therefore also the proposed development area. The RFA vegetation complex of the site is Cowaramup (C1) described as Open to Tall Open Woodland of *Eucalyptus marginata* subsp. *marginata*, *Corymbia calophylla* and *Banksia grandis* on lateritic uplands in the hyper-humid zone.

3. METHODS

The area was surveyed using the methods set out in the EPA Guidance No 51 (2004). Only the vegetation remnant was surveyed.

Temporary 10m x 10m quadrats were set up using a compass and oriented due N,S,E,W. Quadrats were placed to record the variation, mainly in the understorey species. All species, including weeds were recorded. The vegetation, flora, Threatened and Priority Flora and weed surveys were conducted concurrently. For each quadrat, the following were recorded in the field:

- GPS reading (WGS84, equivalent to Geocentric Datum of Australia 1994 (GDA94)) at NW corner.
- Digital photograph taken at the NW corner.
- Soil type.
- Presence, size and type of any outcropping rocks.
- Topography – eg. ridge, upper slope, middle slope, lower slope, drainage line, minor creek, major creek, wetland.
- Aspect where this is applicable.
- Vegetation condition using the scale of Keighery (1994).
- Presence of any Threatened or Priority Flora or other significant flora.
- Additional information including dieback, age since fire, predators, erosion, weeds, grazing, tracks etc.

- All species were listed together with their percentage cover within the quadrat and average height.

The area outside of each quadrat was also surveyed to record additional (opportunistic) species for that vegetation unit. All species unknown in the field were collected, pressed and identified later using appropriate keys and by comparison with collections housed at the Western Australian Herbarium.

4. RESULTS

The survey was undertaken on 14th September 2012. As can be seen from Diagram 1 there was only one area of remnant vegetation present at the site. Only the weed taxa included in the quadrats were recorded, as often there were many additional weeds outside of the quadrat. The pasture species of the surrounding farming land were not surveyed.

4.1 Vegetation Units

The vegetation units recorded from the remnants were described using the vegetation classification of Muir (1977) as described in Table 1.

Table 1. Vegetation Classification (from Muir 1977)

LIFE FORM / HEIGHT CLASS	Canopy Cover			
	DENSE 70 % - 100%	MID DENSE 30% - 70%	SPARSE 10% - 30%	VERY SPARSE 2% - 10%
Trees > 30m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
Trees 15 – 30m	Dense Forest	Forest	Woodland	Open Woodland
Trees 5 – 15m	Dense Low Forest A	Low Forest A	Low Woodland A	Open Low Woodland A
Trees < 5m	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B
Mallee tree form	Dense Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
Mallee shrub form	Dense Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
Shrubs > 2m	Dense Thicket	Thicket	Scrub	Open Scrub
Shrubs 1.5 – 2m	Dense Heath A	Heath A	Low Scrub A	Open Low Scrub A
Shrubs 1 - 1.5m	Dense Heath B	Heath B	Low Scrub B	Open Low Scrub B
Shrubs 0.5 – 1m	Dense Low Heath C	Low Heath C	Dwarf Scrub C	Open Dwarf Scrub C
Shrubs 0 - 0.5m	Dense Low Heath D	Low Heath D	Dwarf Scrub D	Open Dwarf Scrub D
Mat plants	Dense Mat Plants	Mat Plants	Open Mat Plants	Very Open Mat Plants
Hummock grass	Dense Hummock Grass	Mid-Dense Hummock Grass	Hummock Grass	Open Hummock Grass
Bunch grass > 0.5m	Dense Tall Grass	Tall Grass	Open Tall Grass	Very Open Tall Grass
Bunch grass < 0.5m	Dense Low Grass	Low Grass	Open Low Grass	Very Open Low Grass
Herbaceous spp.	Dense Herbs	Herbs	Open Herbs	Very Open Herbs
Sedges > 0.5m	Dense Tall Sedges	Tall Sedges	Open Tall Sedges	Very Open Tall Sedges
Sedges < 0.5m	Dense Low Sedges	Low Sedges	Open Low Sedges	Very Open Low Sedges
Ferns	Dense Ferns	Ferns	Open Ferns	Very Open Ferns
Mosses, liverworts	Dense Mosses	Mosses	Open Mosses	Very Open Mosses

The vegetation at the site varied according to the amount of clearing that had occurred. Three quadrats were recorded but the vegetation was the same.

Tall Forest of *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* over Low Woodland A of *Agonis flexuosa* var. *flexuosa* in sandy loam.

Quadrat 1 recorded a higher cover of *Corymbia calophylla* and no *Agonis flexuosa* var. *flexuosa* than quadrat 1. Quadrat 2 recorded not as high a cover of *Corymbia calophylla* an quadrat 1, but a higher cover of *Eucalyptus marginata* subsp. *marginata* and low trees of *Agonis flexuosa var. flexuosa.* Quadrat 3 consisted of a dense cover of *Agonis flexuosa* var. *flexuosa* and only scattered trees of *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla*.

4.2 Vegetation Condition

Bushland has been historically subject to ongoing degradation and is especially susceptible to disturbances arising as a result of indirect impacts from surrounding developments and human activity. Degradation is caused by a wide range of factors, including isolation, edge effects, weed invasion, plant diseases, changes in fire frequency, landscape fragmentation and increased predation on native fauna by feral animals resulting in a decrease in species richness and general modification of ecological function. These issues can affect the biodiversity rating and ecological viability of areas of remnant vegetation and should be assessed in line with conservation values.

Vegetation condition was rated according to the vegetation condition scale used in Keighery (1994). The vegetation condition recorded for each of the quadrats is included in Appendix B and mapped in Appendix C.

Table 2. Explanation of Vegetation Condition Rating (Keighery, 1994)

Rating	Description	Explanation
1	Pristine	Pristine or nearly so, no obvious signs of disturbance.
2	Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
3	Very Good	Vegetation structure altered, obvious signs of disturbance.
4	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it.
5	Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management.
6	Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species.

Using the vegetation condition rating explained in Table 2 the remnant bushland was rated as degraded. The understory had been nearly completely replaced with pasture species but the tree canopy was excellent. Cattle still graze this area.

4.3 Significant Flora

No significant flora was recorded from the site**.**

5. DISCUSSION

There was only a small area of remnant vegetation retained on the block as it had been developed for tree plantations and utilized to graze cattle. The vegetation of the remnant was:

- Tall Forest of *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* over Low Woodland A of *Agonis flexuosa* var. *flexuosa* in sandy loam.

It included many dense, tall Jarrah and Marri trees which are worthy of retention but the understory was mainly replaced with weeds. There were occasional shrubs of *Hibbertia cuneiformis.*

No threatened or priority flora were recorded during the survey.

6. REFERENCES

Department of Environment and Conservation (2012a). *Threatened and Priority List for Western Australia.* Published list by the Department of Conservation and Land Mangement, Western Australia

Department of Environment and Conservation (2012b). *List of Threatened Ecological Communities on the Department of Conservation and Land Management's Threatened Ecological Communities (TEC) Database endorsed by the Minister for the Environment*. http://www.naturebase.net/plants_animals/watscu/pdf/tec/endorsed_tec_list_jan04.pdf

Environmental Protection Authority (2004). *Guidance for the Assessment of Environmental Factors, Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia. No. 51.* EPA, Perth

Hearn, R., Williams, K., Comer, S. and Beecham, B. (2002). *Jarrah Forest 2 (JF2 – Southern Jarrah Forest subregion)* In *A Biodiversity Audit of Western Australia's 53 Biogeographical subregions*. Department of Environment and Conservation

Keighery, B.J. (1994). *Bushland Plant Survey: a Guide to Plant Community Surveys for the Community.* Wildflower Society of Western Australia (Inc.) Nedlands, Western Australia

Mattiske, E.M. and Havel, J.J. (1998). *Regional Forest Agreement Vegetation Complexes Busselton - Augusta Western Australia*. Department of Conservation and Land Management

Muir, B.G. (1977). *Biological Survey of the Western Australian Wheatbelt. Part II: Vegetation and habitat of Bendering Reserve*. Records of the Western Australian Museum, Supplement No. 3

Thackway, R. and Cresswell I. D. (1995). *An Interim Biogeographical Regionalisation for Australia: a Framework for Setting Priorities in the National Reserves System Cooperative Program.* Australian Nature Conservation Agency, Canberra, ACT

Western Australian Herbarium (2012a). *Florabase*. Department of Environment and Conservation. http://www.calm.wa.gov.au/science/florabase.html

Western Australian Herbarium (2012b). *Max*. Department of Environment and Conservation

APPENDIX A

Quadrat Data

LEGEND

ABBREVIATION	DESCRIPTION
sp.	Species, used where the plant is vegetative
subsp.	Subspecies
var.	Variety
*	Weed

QUADRAT 1

Location: At the northern end of the remnant bushland
Datum (WGS84): 325184E; 6214401N
Soil: Loam with few outcropping laterite boulders
Topography: Upper slope
Vegetation Description: Tall Forest of *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla*
Vegetation Condition: 5
Litter: Logs 5%; Leaves 15%
Notes: Trees very tall. Area grazed. Large number of tree deaths. Black cockatoos surveying a couple of hollows for a nesting site.

QUADRAT 1

SPECIES	HEIGHT (CM)	% COVER
**Anthoxanthum odoratum*	50	40
**Cirsium vulgare*	20	<1
Corymbia calophylla	3000	45
**Cynodon dactylon*	25	10
**Ehrharta longiflora*	70	<1
Eucalyptus marginata subsp. *marginata*	3000	5
**Euphorbia peplus*	15	<1
**Geranium molle*	30	15
**Hypochaeris glabra*	10	<1
**Pennisetum clandestinum*	25	10
**Stellaria media*	30	15

QUADRAT 2

Location: Southwest of quadrat 1
Datum (WGS84): 325139E; 6214315N
Soil: Brown sandy loam with few laterite boulders
Topography: Middle slope
Vegetation Description: Tall Forest of *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* over Low Woodland B of *Agonis flexuosa* var. *flexuosa*
Vegetation Condition: 5
Litter: Logs 2%; Leaves 30%
Notes: Tree cover is excellent. *Agonis* are regrowth

QUADRAT 2

SPECIES	HEIGHT (CM)	% COVER
Agonis flexuosa var. *flexuosa*	300	15
**Anthoxanthum odoratum*	70	50
**Briza maxima*	30	15
Corymbia calophylla	2500	25
**Ehrharta longiflora*	60	30
Eucalyptus marginata subsp. *marginata*	2600	15
**Euphorbia peplus*	20	<1
**Geranium molle*	25	1
Hibbertia cuneiformis	120	<1
**Hypochaeris glabra*	5	<1
**Lysmachia arvensis*	20	<1
**Oxalis corniculata*	40	15
**Pennisetum clandestinum*	25	5
**Solanum nigrum*	60	<1
**Stellaria media*	30	2
**Trifolium* sp.	20	2
**Zantedeschia aethiopicum*	30	<1

QUADRAT 3

Location: Southern corner of site
Datum (WGS84): 325120E; 6214215N
Soil: Sandy loam with gravel on surface
Topography: Lower slope
Vegetation Description: Low Forest B of *Agonis flexuosa* var. *flexuosa*
Vegetation Condition: 5
Litter: Leaves: 30%
Notes: Cattle graze area. Many trees have been removed

QUADRAT 3

SPECIES	HEIGHT (CM)	% COVER
Agonis flexuosa var. *flexuosa*	400	40
**Anthoxanthum odoratum*	50	25
**Ehrharta calycina*	70	<1
**Ehrharta longiflora*	70	10
**Geranium molle*	25	3
**Hypochaeris glabra*	2	5
**Lotus subbiflorus*	15	5
**Pennisetum clandestinum*	30	10
**Petrorhagia dubia*	25	<1
**Poa annua*	30	<1
**Romulea rosea*	60	10
**Rumex* sp.	40	2
**Sonchus oleraceus*	30	<1
**Stellaria media*	30	5
**Trifolium* sp.	20	<1

APPENDIX B

Approximate location of quadrats

Diagram 2. Approximate location of quadrats

Local Structure Plan

APPENDIX E
FAUNA ASSESSMENT

Cardno
Shaping the Future

Fauna Assessment

of

Lot 100

Brockman Highway

Karridale

NOVEMBER 2012

Version 3

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DISCLAIMER

This fauna assessment report ("the report") has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Greg Harewood ("the Author"). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints. In accordance with the scope of services, the Author has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

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EXECUTIVE SUMMARY

Introduction

This report details the results of a fauna assessment of Lot 100, Brockman Highway, Karridale (the study area). The site is located about 14 km north of Augusta in south west Western Australia has an area of approximately 88 ha and is mainly cleared (Figures 1 and 2).

The proponents are proposing to subdivide the exist lot into smaller residential lots of various sizes. Planning for the proposal is still progressing however key characteristics of the project are:

- The majority of currently proposed lots range in size from about 2,000 to 5,000 sqm with a small number falling between about 1 ha and 1.5 ha and one lot around the existing farm house and sheds being about 2.0 ha in size. Most of the northern section of the lot is not to be subdivided;
- Total lot yield is currently estimated at about 73, subject to detailed design and approval; and
- The main area of remnant vegetation is to be protected within a 2.5 ha area of public open space (POS).

The fauna survey forms part of a series of investigations which will be used to assess environmental opportunities and constraints that will be used for future planning and subsequent development at the site.

Scope of Works

The scope of works was to conduct a Level 1 fauna survey as defined by the Environmental Protection Authority (EPA 2004). Because some listed threatened species (e.g. western ringtail possums and several species of black cockatoo) are known to occur in the general area, the scope of the survey work was expanded to include targeted assessment of the site's significance to these species.

To comply with the scope of works the assessment has included a desktop study and a daytime site reconnaissance survey. The site reconnaissance survey was carried out by Greg Harewood (B.Sc. Zoology) on the 24 July, 2012.

Potential Conservation Significant Fauna Species

A list of potential conservation significant fauna species considered likely to occur in the general vicinity of the study area was compiled from information obtained during the desktop study and is presented in Table 1.

Fauna Habitats

Broadly defined fauna habitats present within the study area are described below.

1. Cleared with widely scattered trees over mixed grasses/weeds: Most of the southwest corner of the study area is represented by cleared paddocks and consists of a groundcover dominated by a mixture of introduced pasture grasses, clovers, weeds and some native sedges. There are a small number of scattered individual and small groups of emergent trees. The small number of scattered trees (i.e. not in the larger groves) are marri (*Corymbia calophylla*) or peppermint *(Agonis flexuosa)*. Scattered peppermints are also present around the existing farmhouse and shed. Some lower lying areas are inundated/waterlogged during the wetter months of year (Plate 1).

2. Marri (*C. calophylla*) and Jarrah (*E. marginata*) Woodland over regrowth Peppermint (*Agonis flexuosa*) and mixed grasses/weeds: The large grove of trees in the south west section of the study area contains various densities of marri and jarrah with some areas of regrowth peppermint. Native groundcover is totally absent (Plate 2). Most of this area is to be retained as POS.

3. Peppermint (*A. flexuosa*) regrowth with some emergent Marri (*C. calophylla*) over mixed grasses/weeds: South west of the POS area are discontinuous areas of regrowth peppermint (with some older trees) and emergent marri. Native groundcover is totally absent (Plate 3).

4. Marri (*C. calophylla*) and Karri (*E. diversicolor*) Open Woodland over mixed grasses/weeds: A small grove of mainly marri trees is present along the sites boundary with Brockman Highway (Plate 4).

5. Karri (*E. diversicolor*) Open Woodland over mixed grasses/weeds: A small grove of 10 trees is present in the north central section of the study area.

6. Plantation: About 66 ha of Lot 100 is utilised as a blue gum plantation and contains no remnant native vegetation of any type (See Figure 2).

7. Planted non-endemic trees and shrubs: The farmhouse has some planted non-endemic trees and shrubs within its gardens lawns

8. Manmade Dams: Two manmade dam is present in the west and north west sections of the study area (Plate 4). The study area contains no natural or manmade watercourses/drains.

Excluding the trees within the POS (which was not surveyed as it is being retained) two trees within the site were observed to contain hollows of various sizes. The site is largely cleared and has been open to livestock grazing or used as plantation for many

years. As a consequence native vegetation (where present) can be classified as "parkland cleared" with groundcover in most areas being dominated by introduced grasses and weeds. The historical and ongoing disturbances have reduced the sites overall fauna biodiversity by impacting on habitat quality and species diversity. Most of the fauna species using the site now are likely to be generalist species able to utilise disturbed habitats and are therefore still widespread and common.

Opportunistic Fauna Observations

Opportunistic fauna observations are listed in Appendix C. A total of 13 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the study area. Three introduced species were also observed.

Evidence of the forest red-tailed black cockatoo foraging on vegetation with the proposed POS was found (chewed marri fruits). No evidence of any other conservation significant species using the site was found during the field survey.

No western grey kangaroos were observed during the field survey though some possibly graze paddock areas at times. They do not however appear to be utilising the study area to a degree that would require a site specific management plan.

Western Ringtail Possum Assessment

No evidence (dreys, scats or individuals) of western ringtail possums using vegetation within the study area was observed despite a targeted search. Most of the vegetation (marri, jarrah or karri woodland) within the study area appears unsuitable for WRPs to use on a permanent basis. This conclusion is primarily based on a distinct lack of midstorey vegetation, a structural component favoured by the species in woodlands (G. Harewood pers. obs.). The proposed POS contains some regrowth peppermint but no evidence of the species utilising this resource was found.

The areas of regrowth peppermint (total area <0.2ha) in the southwest corner of the study area and to a much lesser extent the few (~13) widely scattered peppermints in paddocks and around the farmhouse represent potential WRP habitat which may be used by the species at times, given their known presence in the wider area, but as indicated the species did not appear to be utilising vegetation within the project area during the survey period.

Black Cockatoo Habitat Assessment

The tree assessment identified 29 specimens within the study area (excluding those within the proposed POS area) that fit DSEWPaC's criteria for black cockatoo breeding habitat (i.e. suitable tree species with a diameter at breast height (DBH) of >50cms) (Figure 3). Two of these trees were observed to contain hollows of some type though none appeared to be large enough for black cockatoos to use for nesting purposes.

Seventeen of the trees were marri (*C. calophylla*), 11 karri (*E. diversicolor*) and two were jarrah (*E. marginata*). Additional details on each observed "habitat tree" can be found in Appendix D.

Foraging evidence left by black cockatoos was observed during the study area in the form of chewed marri fruits at one location within the proposed POS. This evidence was attributed to the forest red-tailed black cockatoo.

Potential foraging habitat onsite is represented by the groves and scattered marri and jarrah trees present in various densities across the area. It is difficult to provide an exact estimate of the area of foraging habitat present as much of the vegetation is fragmented and not all is comprised of suitable plant species but the area within the proposed POS total about 1.7 ha. The area of potential foraging habitat outside of this area and that may require clearing is difficult to estimate as it is comprised of scattered individual trees and small groves of trees but is unlikely to total no more than about 0.3 ha. While peppermint (insect larvae) and karri (fruits) are foraged upon by black cockatoos occasionally they both make up only an extremely small proportion of their total diet and therefore these cannot be regarded as quality black cockatoo foraging habitat of any significance and therefore do not contribute to this estimated total.

No existing roosting trees (trees used at night by black cockatoos to rest) were observed during the survey period

Potential Impacts

The most likely potential impacts on fauna of any development within the study site itself are:

- Loss of vegetation/fauna habitat that may be used for foraging, breeding, roosting, or dispersal; and
- Death or injury of fauna during clearing and construction.

Most of the native vegetation with the study area is to be retained as POS and there is also some potential for the smaller remnants and individuals trees to be kept as is within the proposed large lots. It is therefore considered highly unlikely that impacts on the overall status of any fauna species, including those of conservation significance will be substantial. All of the fauna species currently using the site can be expected to continue to utilise the area to a similar degree as they do now and their status in the area will not change as a consequences of the proposal proceeding.

Possible impacts of development on all species of conservation significance considered likely to occur in the general vicinity of the study area are summarised in the table below.

Likelihood of Occurrence and Possible Impacts – Fauna Species of Conservation Significance (continues on following pages)

Species	Conservation Status (see Appendix A for codes)			Habitat Present	Likelihood of Occurrence	Maximum Possible Impact
	EPBC Act	WC Act	DEC Priority			
Cape Leeuwin Freshwater Snail *Austroassiminea letha*	-	S1	-	No	Unlikely	No impact. Habitat unsuitable.
Balston's Pygmy Perch *Nannatherina balstoni*	Vulnerable	S1	-	No	Unlikely	No impact. Habitat unsuitable.
White-bellied Frog *Geocrinia alba*	Endangered	S1	-	No	Unlikely	No impact. Habitat unsuitable.
Southern Carpet Python *Morelia spilota imbricata*	-	S4	P4	No	Unlikely	No impact. Habitat unsuitable.
Short-nosed Snake *Elapognathus minor*	-	-	P2	No	Unlikely	No impact. Habitat unsuitable.
Great Egret *Ardea alba*	Migratory	S3	-	Yes, degraded paddocks	Possible	No significant impact likely. Loss of manmade foraging habitat.
Cattle Egret *Ardea ibis*	Migratory	S3	-	Yes, degraded paddocks	Possible	No significant impact likely. Loss of manmade foraging habitat.
Migratory shorebirds various species	Migratory	S3		No	Unlikely	No impact. Habitat unsuitable.
Australasian Bittern *Botaurus poiciloptilus*	Endangered	S1	-	No	Unlikely	No impact. Habitat unsuitable.
White-bellied Sea-Eagle *Haliaeetus leucogaster*	Migratory	S3	-	No	Unlikely	No impact. Habitat unsuitable.
Peregrine Falcon *Falco peregrinus*	-	S4	-	Yes	Possible	No significant impact likely. Modification of some foraging habitat.
Carnaby`s Black Cockatoo *Calyptorhynchus latirostris*	Endangered	S1	-	Yes	Possible	Loss of a small area of habitat. Most to be retained.
Baudin`s Black Cockatoo *Calyptorhynchus baudinii*	Vulnerable	S1	-	Yes	Possible	Loss of a small area of habitat. Most to be retained
Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*	Vulnerable	S1	-	Yes	Possible	Loss of a small area of habitat. Most to be retained
Ground Parrot *Pezoporus wallicus flaviventris*	Endangered	S1	-	No	Unlikely	No impact. Habitat unsuitable. Locally extinct.
Barking Owl (SW population) *Ninox connivens connivens*	-	-	P2	No	Unlikely	No impact. Habitat unsuitable.

Species	Conservation Status (see Appendix A for codes)			Habitat Present	Likelihood of Occurrence	Maximum Possible Impact
	EPBC Act	WC Act	DEC Priority			
Masked Owl (SW population) *Tyto n. novaehollandiae*	-	-	P3	Yes	Possible	No significant impact likely. Modification of some foraging habitat. Most to be retained
Noisy Scrub-bird *Atrichornis clamosus*	Vulnerable	S1	-	No	Unlikely	No impact. Habitat unsuitable. Locally extinct.
Fork-tailed Swift *Apus pacificus*	Migratory	S3	-	Yes	Flyover only	No impact.
Rainbow Bee-eater *Merops ornatus*	Migratory	S3	-	Yes	Possible	Loss/modification of a small area of potential foraging habitat.
Western Shrike Tit Falcunculus frontatus leucogaster	-	-	P4	No	Unlikely	No impact. Habitat unsuitable.
Chuditch *Dasyurus geoffroii*	Vulnerable	S1	-	No	Unlikely	No impact. Habitat unsuitable.
Southern Brush-tailed Phascogale *Phascogale tapoatafa ssp*	-	S1	-	No/Marginal	Unlikely but Possible	No significant impact likely. Habitat marginal. Most to be retained.
Southern Brown Bandicoot *Isoodon obesulus fusciventer*	-	-	P5	No	Unlikely	No impact. Habitat unsuitable.
Western Ringtail Possum *Pseudocheirus occidentalis*	Vulnerable	S1	-	Yes/Very Marginal	Possible	Loss of a small area of marginal habitat. Most to be retained.
Western Brush Wallaby *Macropus irma*			P4	No	Unlikely	No impact. Habitat unsuitable.
Gilberts Potoroo *Potorous gilbertii*	Critically Endangered	S1	-	No	Unlikely	No impact. Habitat unsuitable. Locally extinct.
Quokka *Setonix brachyurus*	Vulnerable	S1	-	No	Unlikely	No impact. No suitable habitat.
Woylie *Bettongia penicillata ogilbyi*	Endangered	S1	-	No	Unlikely	No impact. No suitable habitat.
Western False Pipistrelle *Falsistrellus mackenziei*	-	-	P4	Yes/Marginal	Possible	Loss/modification of a small area of potential habitat. Most to be retained
Water Rat *Hydromys chrysogaster*	-	-	P4	No	Unlikely	No impact. No suitable habitat.

Potential Constraints on Development

Constraints on development within the study area will largely be centred on the presence of habitat used or potentially used by threatened fauna species in particular those listed under the *EPBC Act*, namely the three species of black cockatoo. This fact has been already taken into consideration during planning and the planned retention of

the larger vegetation remnant as POS has minimised significant vegetation loss as much as reasonable and practical and as a consequence impacts on fauna species are anticipated to be very minimal.

EPBC Act

Using current DSEWPaC significant impact/referral guidelines, it is the Authors opinion that the proposed development is unlikely to constitute a "significant impact" on any *EPBC Act* threatened fauna species despite triggering some referral guidelines with respect to black cockatoos.

Recommendations

A series of recommendations aimed at mitigating and minimising potential impacts on fauna and fauna habitat in general are provided in Section 10. These should be taken into consideration during ongoing planning and onsite development where considered reasonable and practicable.

1. INTRODUCTION

This report details the results of a fauna assessment of Lot 100, Brockman Highway, Karridale (the study area). The site is located about 14 km north of Augusta in south west Western Australia and is centred at approximately 34.192252 °S and 115.105613 °E. The study site has an area of approximately 88 ha and is mainly cleared (Figures 1 and 2).

The fauna survey forms part of a series of investigations which will be used to assess environmental opportunities and constraints that will be used for future planning and subsequent development at the site. Information obtained as part of this fauna assessment report will also be used in conjunction with other environmental investigations to allow regulatory authorities to assess the potential impact of the proposal. The information will enable the formulation of management plans (if required) aimed at minimising potential environmental impacts if the proposal is granted final approval and proceeds.

2. DEVELOPMENT PROPOSAL

The proponents are proposing to subdivide the exist lot into smaller residential lots of various sizes. Planning for the proposal is still progressing however key characteristics of the project are:

- The majority of currently proposed lots range in size from about 2,000 to 5,000 sqm with a small number falling between about 1 ha and 1.5 ha and one lot around the existing farm house and sheds being about 2.0 ha in size. Most of the northern section of the lot is not to be subdivided;
- Total lot yield is currently estimated at about 73, subject to detailed design and approval; and
- The main area of remnant vegetation is to be protected within a 2.5 ha area of public open space (POS).

3. SCOPE OF WORKS

The scope of works is to conduct a level 1 fauna survey as defined by the EPA (EPA 2004). Because the general area is known to be utilised by black cockatoos and western ringtails possums (WRP) the scope of the survey work has been expanded to include an initial assessment of the sites significance to these species. The fauna assessment has therefore included:

1. Level 1 Fauna Survey (to EPA standard);

2. Targeted survey for evidence of western ringtail possums (WRP - dreys scats and individuals);

3. Targeted assessment of black cockatoo habitat (foraging, nesting and roosting habitat); and

4. Report summarising results with recommendations for fauna management. The potential requirement to refer the project to DSEWPaC will be discussed.

Note: For the purposes of this report the term black cockatoo is in reference to Baudin's black cockatoo *Calyptorhynchus baudinii*, Carnaby's black cockatoo *Calyptorhynchus latirostris* and the Forest red-tailed black cockatoo *Calyptorhynchus banksii naso*.

4. METHODS

4.1 POTENTIAL CONSERVATION SIGNIFICANT FAUNA - DESKTOP STUDY

4.1.1 Database Searches

Searches of the following databases were undertaken to aid in the compilation of a list of conservation significant fauna species (including invertebrates) potentially occurring within the study area:

- DEC's NatureMap Database Search (combined data from DEC, Western Australian Museum and Birds Australia) (DEC 2012): and

- Protected matters search tool (Department of Sustainability, Environment, Water, Population and Communities - DSEWPaC 2012b).

It should be noted that these lists are based on observations from a broader area than the study site and therefore may include species that would only ever occur as vagrants in the actual study area due to a lack of suitable habitat or the presence of

only marginal habitat. The databases also often included very old records and in some cases the species in question have become locally or regionally extinct.

Information from these sources should therefore be taken as indicative only and local knowledge and information needs also to be taken into consideration when determining what actual species may be present within the specific area being investigated.

4.1.2 Fauna of Conservation Significance

The conservation significance of fauna species has been defined using data from the following sources:

- *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*). Administered by the Australian Government Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC);
- *Wildlife Conservation Act 1950 (WC Act).* Administered by the Western Australian Department of Environment and Conservation (DEC);
- Red List produced by the Species Survival Commission (SSC) of the World Conservation Union (also known as the IUCN Red List - the acronym derived from its former name of the International Union for Conservation of Nature and Natural Resources). The Red List has no legislative power in Australia but is used as a framework for State and Commonwealth categories and criteria; and the
- DEC Priority Fauna list. A non-legislative list maintained by the DEC for management purposes.

The *EPBC Act* also requires the compilation of a list of migratory species that are recognised under international treaties including the:

- Japan Australia Migratory Bird Agreement 1981 (JAMBA);
- China Australia Migratory Bird Agreement 1998 (CAMBA);
- Republic of Korea-Australia Migratory Bird Agreement 2007 (ROKAMBA); and
- Bonn Convention 1979 (The Convention on the Conservation of Migratory Species of Wild Animals).

(Note - Species listed under JAMBA are also protected under Schedule 3 of the *WC Act*.)

All migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as matters of national environmental significance under the *EPBC Act*.

The conservation status of all vertebrate fauna species listed as occurring or possibly occurring in the vicinity of the Project area has been assessed using the most recent lists published in accordance with the above-mentioned instruments and is indicated as such in the fauna listings of this report. A full listing of conservation codes are provided in Appendix A.

4.1.3 Taxonomy and Nomenclature

Taxonomy and nomenclature for fauna species used in this report is generally taken from the DEC's WA Fauna Census Database which is assumed to follow Aplin and Smith (2001) for amphibians and reptiles, How *et al.* (2001) for mammals and Johnstone (2001) for birds.

Common names are taken from the Western Australia Museum (WAM) recognised primary common name listings when specified, though where common names are not provided they have been acquired from other publications. Sources include Van Dyck & Strahan (2008), Bush *et al.* (2007), Wilson and Swan (2010), Bush *et al*. (2002), Tyler *et al*. (2000), Christidis and Boles (2008) and Glauret (1961). Not all common names are generally accepted.

4.2 SITE SURVEYS

Field survey work was carried out by Greg Harewood (B.Sc. Zoology) on the 24 July, 2012.

4.2.1 Fauna Habitat Assessment

Vegetation units observed during the site reconnaissance survey have been used to define broad fauna habitat types across the site.

The main aim of the habitat assessment was to determine if it was likely that any species of conservation significance would be utilising the areas that maybe impacted on as a consequence of development at the site. The habitat information obtained was also used to aid in finalising the overall potential fauna list.

As part of the desktop literature review, available information on the habitat requirements of the species of conservation significance listed as possibly occurring in the area was researched. During the field survey the habitats within the study area were assessed and specific elements identified, if present, to determine the likelihood of listed threatened species utilising the area and its significance to them.

4.2.2 Opportunistic Fauna Observations

Opportunistic observations of fauna species was made during a series of transects across the site while searching microhabitats such as logs, rocks, leaf litter (if present) and observations of bird species with binoculars.

4.2.3 Western Ringtail Possum Assessment

To determine if western ringtail possums were utilising the study area the following was carried out:

- Daytime survey of the site searching for dreys, obvious tree hollows, scats and individual WRPs; and
- Determination of the amount and quality of WRP habitat within the study area.

4.2.4 Black Cockatoo Habitat Assessment

The black cockatoo habitat assessment included a:

- Habitat tree survey: This involved the identification of all suitable trees species within the study area that have a Diameter at Breast Height (DBH) of over 50cm (irrespective of the presence/absence of suitable hollows – DSEWPaC criteria). The location of each tree identified was recorded with a GPS and details on tree species, number and size of hollows (if any) noted. Trees with hollows were marked with "H" using spray paint. Trees within the proposed POS were not assessed as they will not be subject to possible clearing.

  Target tree species included marri, jarrah and karri or any other suitable *Corymbia/Eucalyptus* species of a suitable size that may be present. Peppermints, banksia, sheoak and melaleuca tree species (for example) were not assessed as they typically do not develop hollows that are used by black cockatoos.

  For the purposes of this study a potential cockatoo nest hollow was defined as:

  > *Generally any tree which is alive or dead that contains one or more visible hollows (cavities within the trunk or branches) suitable for occupation by any of the three black cockatoo species for the purpose of nesting/breeding. Hollows that had an entrance greater than about 12cm in diameter and would allow the entry of a cockatoo (white tailed or red-*

tailed) into a suitably orientated and sized branch/trunk, were recorded as a "potential nest hollow".

Identified hollows (if any) were examined using binoculars for evidence of actual use by black cockatoos (e.g. chewing around hollow entrance, scarring and scratch marks on trunks and branches). Trees with possible nest hollows were also scratched and raked with a large stick/pole to flush any sitting birds from hollows and calls of chicks were also listened for.

- Black cockatoo foraging assessment: The location and nature of black cockatoo foraging evidence (e.g. chewed fruits around base of trees) observed during the field survey was recorded.

- Roosting habitat survey: Direct and indirect evidence of black cockatoos roosting within trees on site was noted if observed (e.g. branch clippings, droppings or moulted feathers).

5. SURVEY CONSTRAINTS

No seasonal sampling has been carried out as part of this fauna assessment. The conclusions presented are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of preparing the report. It should also be recognised that site conditions can change with time.

Some fauna species are reported as potentially occurring within the study area based on there being suitable habitat (quality and extent) within the study area or immediately adjacent. With respect to opportunistic observations, the possibility exists that certain species may not have been detected during field investigations due to:

1. seasonal inactivity during the field survey;

2. species present within micro habitats not surveyed;

3. cryptic species able to avoid detection; and

4. transient wide-ranging species not present during the survey period.

Lack of observational data on some species should therefore not necessarily be taken as an indication that a species is absent from the site.

In recognition of survey limitations, a precautionary approach has been adopted for this assessment. Any conservation significant fauna species that would possibly occur within the study area (or immediately adjacent), as identified through ecological databases, publications, discussions with local experts/residents and the habitat knowledge of the Author, has been assumed to potentially occur in the study area.

During the black cockatoo habitat survey trees with hollows were recorded. It should be noted that identifying hollows suitable for fauna species from ground level has limitations. Generally the full characteristics of any hollow seen are not fully evident (e.g. internal dimensions). It is also difficult to locate all hollows within all trees as some are not observable from ground level.

The location of habitat trees was recorded using a handheld GPS. The accuracy of the GPS cannot be guaranteed above a level of about 5 to 10 metres, though it should be noted that in some circumstance the accuracy can be worse or better than this.

6. RESULTS

6.1 POTENTIAL CONSERVATION SIGNIFICANT FAUNA - DESKTOP STUDY

A list of potential conservation significant fauna species considered likely to occur in the general vicinity of the study area was compiled from information obtained during the desktop study and is presented in Table 1 below. The raw database search results from NatureMap (DEC 2012) and the Protected Matters Search Tool (DSEWPaC 2012b) are contained within Appendix B.

Table 1: Conservation Significant Fauna Potentially Present in the Roelands Area (continued on following page)

Species	Conservation Status (see Appendix A for codes)		
	EPBC Act	WC Act	DEC Priority
Cape Leeuwin Freshwater Snail *Austroassiminea letha*	-	S1	-
Balston's Pygmy Perch *Nannatherina balstoni*	Vulnerable	S1	-
White-bellied Frog *Geocrinia alba*	Endangered	S1	-
Southern Carpet Python *Morelia spilota imbricata*	-	S4	P4

Species	Conservation Status (see Appendix A for codes)		
	EPBC Act	WC Act	DEC Priority
Short-nosed Snake *Elapognathus minor*	-	-	P2
Malleefowl *Leipoa ocellata*	Vulnerable	S1	-
Great Egret *Ardea alba*	Migratory	S3	-
Cattle Egret *Ardea ibis*	Migratory	S3	-
Migratory shorebirds various species	Migratory	S3	-
Australasian Bittern *Botaurus poiciloptilus*	Endangered	S1	-
White-bellied Sea-Eagle *Haliaeetus leucogaster*	Migratory	S3	-
Peregrine Falcon *Falco peregrinus*	-	S4	-
Carnaby`s Black Cockatoo *Calyptorhynchus latirostris*	Endangered	S1	-
Baudin`s Black Cockatoo *Calyptorhynchus baudinii*	Vulnerable	S1	-
Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*	Vulnerable	S1	-
Ground Parrot *Pezoporus wallicus flaviventris*	Endangered	S1	-
Barking Owl (SW population) *Ninox connivens connivens*	-	-	P2
Masked Owl (SW population) *Tyto n. novaehollandiae*	-	-	P3
Noisy Scrub-bird *Atrichornis clamosus*	Vulnerable	S1	-
Fork-tailed Swift *Apus pacificus*	Migratory	S3	-
Rainbow Bee-eater *Merops ornatus*	Migratory	S3	-
Western Shrike Tit Falcunculus frontatus leucogaster	-	-	P4
Chuditch *Dasyurus geoffroii*	Vulnerable	S1	-
Southern Brush-tailed Phascogale *Phascogale tapoatafa ssp*	-	S1	-
Southern Brown Bandicoot *Isoodon obesulus fusciventer*	-	-	P5
Western Ringtail Possum *Pseudocheirus occidentalis*	Vulnerable	S1	-
Western Brush Wallaby *Macropus irma*	-	-	P4
Quokka *Setonix brachyurus*	Vulnerable	S1	-

Species	Conservation Status (see Appendix A for codes)		
	EPBC Act	WC Act	DEC Priority
Gilberts Potoroo *Potorous gilbertii*	Critically Endangered	S1	-
Woylie *Bettongia penicillata ogilbyi*	Endangered	S1	-
Western False Pipistrelle *Falsistrellus mackenziei*	-	-	P4
Water Rat *Hydromys chrysogaster*	-	-	P4

6.2 SITE SURVEYS

6.2.1 Fauna Habitat Assessment

Broadly defined fauna habitats present within the study area are described below.

1. Cleared with widely scattered trees over mixed grasses/weeds: Most of the southwest corner of the study area is represented by cleared paddocks and consists of a groundcover dominated by a mixture of introduced pasture grasses, clovers, weeds and some native sedges. There are a small number of scattered individual and small groups of emergent trees. The small number of scattered trees (i.e. not in the larger groves) are marri (*Corymbia calophylla*) or peppermint *(Agonis flexuosa)*. Scattered peppermints are also present around the existing farmhouse and shed. Some lower lying areas are inundated/waterlogged during the wetter months of year (Plate 1).

2. Marri (*C. calophylla*) and Jarrah (*E. marginata*) Woodland over regrowth Peppermint (*Agonis flexuosa*) and mixed grasses/weeds: The large grove of trees in the south west section of the study area contains various densities of marri and jarrah with some areas of regrowth peppermint. Native groundcover is totally absent (Plate 2). Most of this area is to be retained as POS.

3. Peppermint (*A. flexuosa*) regrowth with some emergent Marri (*C. calophylla*) over mixed grasses/weeds: South west of the POS area are discontinuous areas of regrowth peppermint (with some older trees) and emergent marri. Native groundcover is totally absent (Plate 3).

4. Marri (*C. calophylla*) and Karri (*E. diversicolor*) Open Woodland over mixed grasses/weeds: A small grove of mainly marri trees is present along the sites boundary with Brockman Highway (Plate 4).

5. Karri (*E. diversicolor*) Open Woodland over mixed grasses/weeds: A small grove of 10 trees is present in the north central section of the study area.

6. Plantation: About 66 ha of Lot 100 is utilised as a blue gum plantation and contains no remnant native vegetation of any type (See Figure 2).

7. Planted non-endemic trees and shrubs: The farmhouse has some planted non-endemic trees and shrubs within its gardens lawns

8. Manmade Dams: Two manmade dam is present in the west and north west sections of the study area (Plate 4). The study area contains no natural or manmade watercourses/drains.

Excluding the trees within the POS (which was not surveyed as it is being retained) two trees within the site were observed to contain hollows of various sizes. The site is largely cleared and has been open to livestock grazing or used as plantation for many years. As a consequence native vegetation (where present) can be classified as "parkland cleared" with groundcover in most areas being dominated by introduced grasses and weeds. The historical and ongoing disturbances have reduced the sites overall fauna biodiversity by impacting on habitat quality and species diversity. Most of the fauna species using the site now are likely to be generalist species able to utilise disturbed habitats and are therefore still widespread and common.

6.2.2 Opportunistic Fauna Observations

Opportunistic fauna observations are listed in Appendix C. A total of 13 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the study area. Three introduced species were also observed.

Evidence of the forest red-tailed black cockatoo foraging on vegetation with the proposed POS was found (chewed marri fruits). No evidence of any other conservation significant species using the site was found during the field survey.

No western grey kangaroos were observed during the field survey though some possibly graze paddock areas at times. They do not however appear to be utilising the study area to a degree that would require a site specific management plan.

6.2.3 Western Ringtail Possum Assessment

No evidence (dreys, scats or individuals) of western ringtail possums using vegetation within the study area was observed despite a targeted search. Most of the vegetation (marri, jarrah or karri woodland) within the study area appears unsuitable for WRPs to use on a permanent basis. This conclusion is primarily

based on a distinct lack of midstorey vegetation, a structural component favoured by the species in woodlands (G. Harewood pers. obs.). The proposed POS contains some regrowth peppermint but no evidence of the species utilising this resource was found.

The areas of regrowth peppermint (total area <0.2ha) in the southwest corner of the study area and to a much lesser extent the few (~13) widely scattered peppermints in paddocks and around the farmhouse represent potential WRP habitat which may be used by the species at times, given their known presence in the wider area, but as indicated the species did not appear to be utilising vegetation within the project area during the survey period.

6.2.4 Black Cockatoo Habitat Assessment

The tree assessment identified 29 specimens within the study area (excluding those within the proposed POS area) that fit DSEWPaC's criteria for black cockatoo breeding habitat (i.e. suitable tree species with a diameter at breast height (DBH) of >50cms) (Figure 3). Two of these trees were observed to contain hollows of some type though none appeared to be large enough for black cockatoos to use for nesting purposes.

Seventeen of the trees were marri (*C. calophylla*), 11 karri (*E. diversicolor*) and two were jarrah (*E. marginata*). Additional details on each observed "habitat tree" can be found in Appendix D.

Foraging evidence left by black cockatoos was observed during the study area in the form of chewed marri fruits at one location within the proposed POS. This evidence was attributed to the forest red-tailed black cockatoo.

Potential foraging habitat onsite is represented by the groves and scattered marri and jarrah trees present in various densities across the area. It is difficult to provide an exact estimate of the area of foraging habitat present as much of the vegetation is fragmented and not all is comprised of suitable plant species but the area within the proposed POS total about 1.7 ha. The area of potential foraging habitat outside of this area and that may require clearing is difficult to estimate as it is comprised of scattered individual trees and small groves of trees but is unlikely to total no more than about 0.3 ha. While peppermint (insect larvae) and karri (fruits) are foraged upon by black cockatoos occasionally they both make up only an extremely small proportion of their total diet and therefore these cannot be regarded as quality black cockatoo foraging habitat of any significance and therefore do not contribute to this estimated total.

No existing roosting trees (trees used at night by black cockatoos to rest) were observed during the survey period.

7. FAUNA VALUES

7.1 CONSERVATION SIGNIFICANCE OF THE STUDY AREA

The conservation significance of the study area has been determined by applying site specific criteria such as:

- Fauna species and/or habitat present that is poorly represented in the general study area;
- Fauna habitat within the general study area supporting species of conservation or other significance;
- Fauna habitat in better condition than other similar locations in general study area.

The potential habitat value of the larger grove of vegetation has been recognised by developers and it is being retained as POS. The balance of the site has a small amount of value in supporting species of conservation significance such as the black cockatoo species in an otherwise relatively cleared landscape however the limited area of vegetation present, its fragmented and degraded nature compromise its value and therefore these mainly paddock areas cannot be considered to be of local or regional conservation significance.

7.2 VALUE OF THE STUDY AREA AS AN ECOLOGICAL LINKAGE/WILDLIFE CORRIDOR

Vegetation within the site has little or no value as an ecological linkage or wildlife corridor due to the fragmented nature of vegetation in the wider area. The retention of the main block of vegetation as POS will however see any existing value the site may have as a stepping stone for wildlife movement retained.

8. POTENTIAL IMPACTS AND DEVELOPMENT CONSTRAINTS

8.1 POTENTIAL IMPACTS OF DEVELOPMENT

The most likely potential impacts on fauna of any development within the study site itself are:

- Loss of vegetation/fauna habitat that may be used for foraging, breeding, roosting, or dispersal; and

- Death or injury of fauna during clearing and construction.

Most of the native vegetation with the study area is to be retained as POS and there is also some potential for the smaller remnants and individuals trees to be kept as is within the proposed large lots. It is therefore considered highly unlikely that impacts on the overall status of any fauna species, including those of conservation significance will be substantial. All of the fauna species currently using the site can be expected to continue to utilise the area to a similar degree as they do now and their status in the area will not change as a consequences of the proposal proceeding.

Possible impacts of development on all species of conservation significance considered likely to occur in the general vicinity of the study area are summarised in Table 2 below.

Table 2: Likelihood of Occurrence and Possible Impacts – Fauna Species of Conservation Significance (continues on following pages)

Species	Conservation Status (see Appendix A for codes)			Habitat Present	Likelihood of Occurrence	Maximum Possible Impact
	EPBC Act	WC Act	DEC Priority			
Cape Leeuwin Freshwater Snail *Austroassiminea letha*	-	S1	-	No	Unlikely	No impact. Habitat unsuitable.
Balston's Pygmy Perch *Nannatherina balstoni*	Vulnerable	S1	-	No	Unlikely	No impact. Habitat unsuitable.
White-bellied Frog *Geocrinia alba*	Endangered	S1	-	No	Unlikely	No impact. Habitat unsuitable.
Southern Carpet Python *Morelia spilota imbricata*	-	S4	P4	No	Unlikely	No impact. Habitat unsuitable.
Short-nosed Snake *Elapognathus minor*	-	-	P2	No	Unlikely	No impact. Habitat unsuitable.
Great Egret *Ardea alba*	Migratory	S3	-	Yes, degraded paddocks	Possible	No significant impact likely. Loss of manmade foraging habitat.
Cattle Egret *Ardea ibis*	Migratory	S3	-	Yes, degraded paddocks	Possible	No significant impact likely. Loss of manmade foraging habitat.
Migratory shorebirds various species	Migratory	S3		No	Unlikely	No impact. Habitat unsuitable.
Australasian Bittern *Botaurus poiciloptilus*	Endangered	S1	-	No	Unlikely	No impact. Habitat unsuitable.
White-bellied Sea-Eagle *Haliaeetus leucogaster*	Migratory	S3	-	No	Unlikely	No impact. Habitat unsuitable.

Species	Conservation Status (see Appendix A for codes)			Habitat Present	Likelihood of Occurrence	Maximum Possible Impact
	EPBC Act	WC Act	DEC Priority			
Peregrine Falcon *Falco peregrinus*	-	S4	-	Yes	Possible	No significant impact likely. Modification of some foraging habitat.
Carnaby`s Black Cockatoo *Calyptorhynchus latirostris*	Endangered	S1	-	Yes	Possible	Loss of a small area of habitat. Most to be retained.
Baudin`s Black Cockatoo *Calyptorhynchus baudinii*	Vulnerable	S1	-	Yes	Possible	Loss of a small area of habitat. Most to be retained
Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*	Vulnerable	S1	-	Yes	Possible	Loss of a small area of habitat. Most to be retained
Ground Parrot *Pezoporus wallicus flaviventris*	Endangered	S1	-	No	Unlikely	No impact. Habitat unsuitable. Locally extinct.
Barking Owl (SW population) *Ninox connivens connivens*	-	-	P2	No	Unlikely	No impact. Habitat unsuitable.
Masked Owl (SW population) *Tyto n. novaehollandiae*	-	-	P3	Yes	Possible	No significant impact likely. Modification of some foraging habitat. Most to be retained
Noisy Scrub-bird *Atrichornis clamosus*	Vulnerable	S1	-	No	Unlikely	No impact. Habitat unsuitable. Locally extinct.
Fork-tailed Swift *Apus pacificus*	Migratory	S3	-	Yes	Flyover only	No impact.
Rainbow Bee-eater *Merops ornatus*	Migratory	S3	-	Yes	Possible	Loss/modification of a small area of potential foraging habitat.
Western Shrike Tit Falcunculus frontatus leucogaster	-	-	P4	No	Unlikely	No impact.
Chuditch *Dasyurus geoffroii*	Vulnerable	S1	-	No	Unlikely	No impact. Habitat unsuitable.
Southern Brush-tailed Phascogale *Phascogale tapoatafa ssp*	-	S1	-	No/Marginal	Unlikely but Possible	No significant impact likely. Habitat marginal. Most to be retained.
Southern Brown Bandicoot *Isoodon obesulus fusciventer*	-	-	P5	No	Unlikely	No impact. Habitat unsuitable.
Western Ringtail Possum *Pseudocheirus occidentalis*	Vulnerable	S1	-	Yes/Very Marginal	Possible	Loss of a small area of marginal habitat. Most to be retained.
Western Brush Wallaby *Macropus irma*			P4	No	Unlikely	No impact. Habitat unsuitable.

Species	Conservation Status (see Appendix A for codes)			Habitat Present	Likelihood of Occurrence	Maximum Possible Impact
	EPBC Act	WC Act	DEC Priority			
Gilberts Potoroo *Potorous gilbertii*	Critically Endangered	S1	-	No	Unlikely	No impact. Habitat unsuitable. Locally extinct.
Quokka *Setonix brachyurus*	Vulnerable	S1	-	No	Unlikely	No impact. No suitable habitat.
Woylie *Bettongia penicillata ogilbyi*	Endangered	S1	-	No	Unlikely	No impact. No suitable habitat.
Western False Pipistrelle *Falsistrellus mackenziei*	-	-	P4	Yes/Marginal	Possible	Loss/modification of a small area of potential habitat. Most to be retained
Water Rat *Hydromys chrysogaster*	-	-	P4	No	Unlikely	No impact. No suitable habitat.

8.2 POTENTIAL CONSTRAINTS ON DEVELOPMENT

Constraints on development within the study area will largely be centred on the presence of habitat used or potentially used by threatened fauna species in particular those listed under the *EPBC Act*, namely the three species of black cockatoo. This fact has been already taken into consideration during planning and the planned retention of the larger vegetation remnant as POS has minimised significant vegetation loss as much as reasonable and practical and as a consequence impacts on fauna species are anticipated to be very minimal.

9. COMMONWEALTH ENVIRONMENT PROTECTION & BIODIVERSITY CONSERVATION ACT 1999

A number of fauna species known to or potentially present within the study area are listed under the federal *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*. The objective of the *EPBC Act* is to provide for the protection of the environment, especially those aspects that are of national significance, promote ecologically sustainable development, the conservation of biodiversity and a cooperative approach to the protection and management of the environment.

EPBC Act listed threatened fauna species identified as possibly utilising at times the study area were:

- *Pseudocheirus occidentalis* Western Ringtail Possum - Vulnerable
- *Calyptorhynchus latirostris* Carnaby's Black Cockatoo – Endangered

- *Calyptorhynchus baudinii* Baudin's Black Cockatoo – Vulnerable
- *Calyptorhynchus banksii naso* Forest Red-tailed Black Cockatoo – *Vulnerable*

EPBC Act listed migratory fauna species identified as possibly using the study area were:

- *Ardea alba* Great Egret – Migratory
- *Ardea ibis* Cattle Egret – Migratory
- *Apus pacificus* Fork-tailed Swift – Migratory
- *Merops ornatus* Rainbow Bee-eater – Migratory

The following *EPBC Act* listed threatened/migratory fauna species (or their habitat) were determined during the fauna assessment not to be present in the study area despite appearing in database searches. Their exclusion from the potential species list is primarily justified by an obvious lack of suitable habitat or known local extinction. It is also very unlikely that vegetation at the site represents habitat critical for the recovery of the respective threatened species in the area. These species will not be discussed further:

- *Nannatherina balstoni* Balston's Pygmy Perch – Vulnerable
- *Geocrinia alba* White-bellied Frog – Endangered
- *Leipoa ocellata* Malleefowl – Vulnerable
- *Botaurus poiciloptilus* Australasian Bittern – Endangered
- *Haliaeetus leucogaster* White-bellied Sea-Eagle – Migratory
- Various migratory waders – Migratory
- *Pezoporus wallicus flaviventris* Ground Parrot – Endangered
- *Atrichornis clamosus* Noisy Scrub Bird - Vulnerable
- *Dasyurus geoffroii* Chuditch – Vulnerable
- *Potorous gilbertii Gilberts Potoroo* – Critically Endangered

- *Setonix brachyurus* Quokka – Vulnerable

- *Bettongia penicillata ogilbyi* Woylie - Endangered

If an action (i.e. the possible clearing of sections the site) is deemed to have a potential "significant impact" on listed species a referral to the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) is required to ensure compliance with the *EPBC Act*. Currently, for the species in question, "significant impact" is defined within two documents, these being:

- Department of the Environment and Heritage (2006), EPBC Act - Principal Significant Impact Guidelines 1.1, Matters of National Environmental Significance. *EPBC Act* Policy Statement.

DSEWPaC have recently released a document detailing referral guidelines for the three threatened black cockatoo species, this being

- Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2012a). EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered) Calyptorhynchus latirostris, Baudin's cockatoo (vulnerable) Calyptorhynchus baudinii, Forest red-tailed black cockatoo (vulnerable) Calyptorhynchus banksii naso.

The DSEWPaC document titled "Significant Impact Guidelines for the vulnerable western ringtail possum (Pseudocheirus occidentalis) in the southern Swan Coastal Plain, Western Australia (DEWHA 2009) summarises what scale of actions would be considered likely to have a significant impact on WRPs in a defined section of the southern Swan Coastal Plain. The study site in question is outside of this policy area and therefore the guidelines contained within this document are not relevant in this instance and the "Principal Significant Impact Guidelines 1.1" (DEH 2006) must be referred to for guidance on the likelihood of significant impact and the need for referral with respect to western ringtail possums.

An assessment of significant impact on federally listed threatened fauna species and the possible need to refer the project to DSEWPaC using criteria within the abovementioned documents are provided below.

9.1 WESTERN RINGTAIL POSSUMS

The DSEWPaC document titled "Principal Significant Impact Guidelines 1.1, Matters of National Environmental Significance (DEH 2006) summarises what scale of actions would be considered likely to have a significant impact on listed vulnerable fauna species including the western ringtail possum.

The significant impact criteria for vulnerable species are defined in the Significant Impact Guidelines (DEH 2006) as:

> An action is likely to have a significant impact on a vulnerable species (e.g. western ringtail possum) if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of an important population of a species;
- reduce the area of occupancy of an important population;
- fragment an existing important population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of an important population;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;
- introduce disease that may cause the species to decline; or
- interfere substantially with the recovery of the species.

'Habitat critical to the survival of a species or ecological community' has been defined by DSEWPaC as areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal;
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- to maintain genetic diversity and long term evolutionary development;

- for the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the Minister under the *EPBC Act.*

An 'important population' has been defined by DSEWPaC as a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal;
- populations that are necessary for maintaining genetic diversity; and
- populations that are near the limit of the species range.

The study area only contains some relatively marginal habitat for western ringtail possums (WRPs). A targeted search for evidence of the species failed to find any indication of current use of this vegetation by WRPs. It is considered unlikely, based on these observations that the site contains or is utilised by an "important population" of western ringtail possums.

Given the small area of marginal habitat present and the apparent current absence of the species from the site it is considered extremely unlikely that any of the above mentioned criteria with respect to significant impact on WRPs will be compromised by the proposal proceeding. No referral of the project to DSEWPaC (with respect to western ringtail possums) is therefore considered necessary.

9.2 BLACK COCKATOOS

The recently released DSEWPaC document titled "*EPBC Act* referral guidelines for three threatened black cockatoo species" (DSEWPaC 2012a) summarises what scale of actions would be considered likely to have a significant impact on the three black cockatoo species.

The following points provide general guidance on what, in DSEWPaC's view, may be at high and low risk of requiring a referral to ensure compliance with the *EPBC Act* as well as providing some guidance on uncertainty.

<u>Actions that have a high risk of significant impacts</u>

- Clearing of any known nesting tree.

- Clearing or degradation of any part of a vegetation community known to contain breeding habitat.
- Clearing of more than 1 ha of quality foraging habitat.
- Clearing or degradation (including pruning the top canopy) of a known night roosting site.
- Creating a gap of greater than 4 km between patches of black cockatoo habitat (breeding, foraging or roosting).

Actions that have and uncertain risk of significant impacts

- Degradation (such as through altered hydrology or fire regimes) of more than 1 ha of foraging habitat. Significance will depend on the level and extent of degradation and the quality of the habitat.
- Clearing or disturbance in areas surrounding black cockatoo habitat that has the potential to degrade habitat through introduction of invasive species, edge effects, hydrological changes, increased human visitation or fire.
- Actions that do not directly affect the listed species but that have the potential for indirect impacts such as increasing competitors for nest hollows.
- Actions with the potential to introduce known plant diseases such as Phytophthora spp. to an area where the pathogen was not previously known.

Actions that have a low risk of significant impacts

- Actions that do not affect black cockatoo habitat or individuals.
- Actions whose impacts occur outside the modelled distribution of the three black cockatoos

The only criteria that may be seen being as compromised by the project proceeding relates to the "Clearing or degradation of any part of a vegetation community known to contain breeding habitat" which may occur as some trees with a DBH of over 50cm (DSEWPaC's (2012a) definition of breeding habitat) will require removal. However, no evidence of actual breeding onsite was observed and based on the low number of previous documented breeding episodes in the wider area, the probability of black cockatoos utilising the site itself for breeding can be considered to be very low. Based on these observations it is considered unlikely that development of the site would disrupt the breeding cycle of any black cockatoo populations. It is therefore highly debateable that this risk is actually high in this instance given that the number of trees that have the potential to require clearing is relatively small,

none have any existing hollows suitable for cockatoos and given that the probability that any one of these trees would ever develop a hollow that would then be used for breeding is extremely low.

In the Authors opinion, the results of the above assessment suggest that development at the site is unlikely to have any substantial risk of significant impact on black cockatoos given the limited amount of clearing required. No referral of the project to DSEWPaC (with respect to black cockatoos) is therefore considered necessary.

9.3 LISTED MIGRATORY SPECIES

The DSEWPaC document titled "Principal Significant Impact Guidelines 1.1, Matters of National Environmental Significance (DEH 2006) summarises what scale of actions would be considered likely to have a significant impact on listed migratory species.

Within this document an action has, will have, or is likely to have a significant impact on migratory species if it does, will, or is likely to:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species; or
- result in invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species; or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

An area of important habitat is:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species;
- habitat that is of critical importance to the species at particular life-cycle stages;
- habitat utilised by a migratory species which is at the limit of the species range; or
- habitat within an area where the species is declining.

To have a significant impact on a migratory species as defined under the DSEWPaC's Significant Impact Guidelines (DEH 2006), any proposed development would need to trigger at least one of the abovementioned significant impact criteria thresholds.

It is considered extremely unlikely that any of these thresholds relating to migratory species will be compromised by development at the site at any scale. The habitat within the study area likely to be used by migratory species does not represent "important habitat" and the number of individuals utilising the study area would not, under any circumstances, represent an ecologically significant proportion of the population of any of the species in question. No referral of the project to DSEWPaC (with respect to migratory fauna species) is therefore considered necessary.

10. RECOMMENDATIONS

The following recommendations are provided for guidance during ongoing development planning and aim to reduce the impact on fauna and fauna habitat as much as reasonable and practicable. It is recommended that:

- Implementation of the currently proposed development guide plan should aim to avoid the need to clear as much of the existing vegetation as possible.
- Any proposed landscaping/plantings on site should utilise local seed stock that includes cockatoo food plants, specifically *Eucalyptus*, *Corymbia, Banksia, Hakea*, and *Allocasuarina*. The final selection of suitable species should be carried out after liaison with appropriate experts or local land care groups to ascertain which species are most suitable for the area.
- During site works areas requiring clearing should be clearly marked and access to other areas restricted to prevent accidental clearing of areas to be retained.
- No dead, standing or fallen timber should be removed unnecessarily. Logs (hollow or not) and other debris resulting from land clearing should be used to enhance fauna habitat in untouched and rehabilitated areas if possible.
- During clearing operations a suitably experienced "fauna spotter" should be employed to inspect logs and hollow trees (where possible) before clearing to reduce likelihood of injury to fauna. If feasible any fauna encountered should be relocated to retained suitable habitat.

- A Construction and Operations Fire Management Plan should be prepared to reduce the risk of unplanned fires and provide contingency measures to minimise any associated impacts. The plan should include a contingency and response plan in the event of any bushfires that commence as a result of the works on site.

- A Dieback Management Plan should be prepared to reduce the risk of plant diseases being introduced/spread during site works.

- Native fauna injured during clearing or normal site operations should be taken to a designated veterinary clinic or a DEC nominated wildlife carer.

- Any trenching required for services should be kept open for only as long as necessary and suitable escape ramps (45°) and bridging provided if the site is to be left unattended for extended periods (>1day). Significant sized trenches should be inspected for fauna immediately prior to filling.

11. CONCLUSION

The fauna assessment within the study area was undertaken for the purposes of delineating and characterising the fauna habitats and faunal assemblages present and to identify potential impacts of the proposed road works. Targeted searches for western ringtail possums and black cockatoo individuals and their habitat were also carried out.

A list of potential conservation significant fauna species considered likely to occur in the general vicinity of the study area was compiled from information obtained during the desktop study. Most conservation significant species known from the region are unlikely to be impacted on by the proposal due to the fact that the study area does not contain their preferred habitat and therefore they are unlikely to be present. In most cases where some habitat is present likely impacts are anticipated to be low given the small area of clearing required and its generally marginal quality. The retention of most of the vegetation within POS will see the most significant fauna values of the site retained for the long term.

Using current DSEWPaC significant impact/referral guidelines, it is the Authors opinion that the proposed development is unlikely to constitute a “significant impact” on any *EPBC Act* threatened fauna species despite triggering some referral guidelines with respect to black cockatoos.

A series of recommendations aimed at mitigating and minimising potential impacts on fauna and fauna habitat in general are provided in Section 10. These should be implemented as part of existing or proposed management plans where considered reasonable and practicable.

12. BIBLIOGRAPHY

(not necessarily cited)

Allen, G.R., Midgley, S.H., Allen, M. (2003). Freshwater Fishes of Australia. Western Australian Museum, Perth, Western Australia.

Aplin, K.P. and Smith, L.A. (2001). Checklist of the frogs and reptiles of Western Australia, Records of the Western Australian Museum Supplement No. 63, 51-74.

Barrett, G., Silcocks, A., Barry, S., Cunningham, R. and Poulter, R. (2003). The New Atlas of Australian Birds. Royal Australasian Ornithologists Union, Victoria.

Burbidge A.A, & de Tores P. (1997). Western Ringtail Possum Interim Recovery Plan 1997-1999. Department of Conservation and Land Management, Perth Western Australia.

Burbidge, A. (1997-98). Endangered: Western Ringtail Possum. LANDSCOPE 13(2): 49.

Bush, B., Maryan, B., Browne-Cooper, R. & Robinson, D. (2010). Reptiles and Frogs of the Perth Region. UWA Press, Nedlands.

Bush, B., Maryan, B., Browne-Cooper, R. & Robinson, D. (2007). Reptiles and Frogs in the Bush: Southwestern Australia. UWA Press, Nedlands.

Cale, B. (2003). Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan 2002-2012. CALM, Wanneroo.

CALM (2005). Fauna Note No. 05/2005 Carnaby's Cockatoo, Written by Tamra Chapman, Belinda Cale and Marion Massam. CALM, Wanneroo.

Centre for Ecosystem Management (CEM) (2009) Black Cockatoo Study of the ECU South West Campus in Bunbury (August-September 2009) Marieke Weerheim & William Stock CEM Report No. 2009-13. Unpublished report for ECU.

Christidis, I. and Boles, W.E. (1994). The Taxonomy and Species of Birds of Australia and its Territories. RAOU, Monograph 2.

Christidis, L. and Boles, W.E. (2008) Systematics and Taxonomy of Australian Birds. CSIRO Publishing, Melbourne.

Churchill, S. (2008). Australian Bats. Second Edition, Allen & Unwin

Cogger, H.G., (2000). Reptiles and Amphibians of Australia. Reed, Sydney.

Christensen, P., Annels, A., Liddelow, G. and Skinner,P. (1985). Vertebrate Fauna in The Southern Forests of Western Australia, A Survey. Forest Dept. of Western Australia, Bull. No. 94. Perth.

de Tores, P. (2008). Western Ringtail Possum *Pseudocheirus occidentalis* pp 253-255 in Van Dyck, S. & Strahan R. (eds). (2008). The Mammals of Australia. Queensland Museum / Reed Books.

de Tores, P., Rosier, S. & Paine, G. (1998). Conserving the Western Ringtail Possum. LANDSCOPE 13(4): 28.

de Tores, P., Hayward, M. W. & Rosier, S.M. (2004). The western ringtail possum *Pseudocheirus occidentalis* and the quokka, *Setonix brachyurus*, case studies: Western Shield review- February 2003. Conservation Science W. Aust 5 (2): 235-257.

de Tores, P., Rosier, S. Jackson, J., Clarke, J & Aravidis, L. (2008). Working to Conserve the Western Ringtail Possum. LANDSCOPE 25(4): 55-60.

Dell, J. (2000). A draft summary assessment of the fauna values of the Kemerton Bushland. Unpublished report for the Conservation Branch, Policy Division, Department of Environmental Protection.

Dell, J., & Hyder-Griffiths, B. (2002). A Description of the Fauna Values of the Muddy Lakes Area of the South Bunbury to Capel Coastal Corridor. Department of Environmental Protection, Perth.

Department of Conservation and Land Management (1994). Chuditch Recovery Plan 1992-2001, by Peter Orell and Keith Morris for the Chuditch Recovery Team.

Department of Environment and Conservation (2001). Karrak-watch: A summary of information about the Forest red-tailed black cockatoo, http://science.calm.wa.gov.au/articles/2001-10-04/.

Department of Environment and Conservation (2007). Forest Black Cockatoo (Baudin's Cockatoo - *Calyptorhynchus baudinii*) and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) Recovery Plan. DEC.

Department of Environment and Conservation (2012). NatureMap Database search. "By Circle" 115°06' 12" E, 34°11' 47" S – (plus 10km buffer). 10th August 2012.

Department of the Environment and Heritage (2006), EPBC Act - Principal Significant Impact Guidelines 1.1, Matters of National Environmental Significance. *EPBC Act* Policy Statement.

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2008). Background Paper to the EPBC Act Policy Statement 3.10 – Nationally Threatened Species and Ecological Communities. "Significant Impact Guidelines for the vulnerable western ringtail possum (*Pseudocheirus occidentalis*) in the southern Swan Coastal Plain, Western Australia".

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2009). Environment Protection and Biodiversity Conservation Act 1999 (*EPBC Act*) Policy Statement 3.10 "Significant Impact Guidelines for the vulnerable western ringtail possum (*Pseudocheirus occidentalis*) in the southern Swan Coastal Plain, Western Australia".

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2012a). EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered) *Calyptorhynchus latirostris*, Baudin's cockatoo (vulnerable) *Calyptorhynchus baudinii*, Forest red-tailed black cockatoo (vulnerable) *Calyptorhynchus banksii naso*.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC); (2012b). EPBC Act Protected Matters Report: Point Search -34.19648 115.10331 (5km Buffer) Available from: http://www.environment.gov.au. Accessed 10/08/12 @ 14:30:08.

Environmental Protection Authority (EPA) (2002). Terrestrial Biological Surveys As An Element of Biodiversity Protection. Position Statement No. 3. EPA, Perth.

Environmental Protection Authority (EPA), (2003a). Level of Assessment for Proposals Affecting Natural Areas Within the System 6 Region and Swan Coastal Plain Portion of the *System* 1 Region. Guidance Statement 10.

Environmental Protection Authority (EPA) (2003b). Greater Bunbury Region Scheme – EPA Bulletin 1108. EPA, Perth.

Environmental Protection Authority (EPA) (2004). Guidance for the Assessment of Environmental Factors - Terrestrial fauna surveys for environmental impact assessment in Western Australia. Guidance Statement No 56 EPA, Perth.

Environmental Protection Authority (EPA) and Department of Environment and Conservation (DEC) (2010), Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessments (eds B.M. Hyder, J. Dell and M.A. Cowan), Perth Western Australia.

Glauret, L. (1961). A Handbook of the Lizards of Western Australia. Handbook 6, Western Australian Naturalists Club, Perth.

Government of Western Australia (1998). Perth Bushplan

Government of Western Australia (2000a). Bush Forever Volume 1. Policies, Principles and Processes. Department of Environmental Protection Perth, Western Australia.

Government of Western Australia (2000b). Bush Forever Volume 2. Directory of Bush Forever Sites. Department of Environmental Protection Perth, Western Australia.

How, R., Cooper, N.K. and Bannister, J.L. (2001). Checklist of the mammals of Western Australia, Records of the Western Australian Museum Supplement No. 63, 91-98.

How, R.A., Dell, J., and Humphreys, W. F. (1987). The ground vertebrate fauna of coastal areas between Busselton and Albany, Western Australia. Records of the Western Australian Museum 13(4):553-574.

Johnstone, R.E. (2001). Checklist of the birds of Western Australia, Records of the Western Australian Museum Supplement No. 63, 75-90.

Johnstone, R.E. and Storr, G.M. (1998). Handbook of Western Australian Birds: Volume 1 – Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth Western Australia.

Johnstone, R. E. and Storr, G.M. (2004). Handbook of Western Australian Birds: Volume 2 – Passerines (Blue-winged Pitta to Goldfinch). Western Australian Museum, Perth Western Australia.

Johnstone, R.E. & C (2004). Review of Baudin's Cockatoo and Forest Red-Tailed Black Cockatoo in South Western Australia with Special Reference to Collie Area – In Bluewater's Power Station PER May 2004 – Appendix C.

Johnstone, R. E. & Kirkby, T. (2011). Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Baudin's Cockatoo (*Calyptorhynchus baudinii*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) on the Swan Coastal Plain (Lancelin–Dunsborough), Western Australia. Studies on distribution, status, breeding, food, movements and historical changes. Report for the Department of Planning, Western Australia.

Keighery, B. J. (1994). Bushland Plant Survey: a Guide to Plant Community Surveys for the Community. Wildflower Society of Western Australia (Inc.) Nedlands, Western Australia.

Kirkby, T. (2009) Results of Black Cockatoo Survey at Lot 2 Dawesville. Unpublished report for WA Limestone.

Maxwell S., Burbidge A.A & Morris K. (1996). The 1996 Action Plan for Australian Marsupials and Monotremes. Wildlife Australia, Canberra.

Molloy, S., Wood, J., Hall, S., Wallrodt, S., and Whisson, G., (2009) South West Regional Ecological Linkages Technical Report, Western Australian Local Government Association and Department of Environment and Conservation Perth.

Morcombe, M. (2004). Field Guide to Australian Birds. Steve Parish Publishing, Archerfiled, Queensland.

Menkhorst, P. and Knight, F. (2011). A Field Guide to the Mammals of Australia. Oxford University Press, Melbourne.

Nevill, S (ed) (2005). Guide to the Wildlife of the Perth Region. Simon Nevill Publications, Perth.

Nowicki, A. (2007) Analysis of Capture Data: a case study using Program MARK for analysis of brushtail possum trapping data and its relevance to conservation management of the western ringtail possum. Thesis for Honours degree, Murdoch University.

Saunders, D. (1980) Food and Movements of the Short-billed Form of the White-tailed Black Cockatoo. Aust. Wildl. Res. 7(1980) pp. 257-269.

Shah, B. (2006) Conservation of Carnaby's Black Cockatoo on the Swan Coastal Plain, Western Australia. Birds Australia, Perth.

Simpson, K. and Day, N. (2010). Field Guide to the Birds of Australia. Penguin Books, Ringwood.

Sorena M. and T. Soderquist (1995). Western Quoll *Dasyurus geoffroyi*. pp 62-64 in Strahan R. (ed). (1995). The Mammals of Australia. Australian Museum / Reed Books.

Soderquist T. (1995). Brush-tailed Phascogale *Phascogale tapoatafa*. pp 104-106 in Strahan R. (ed). (1995). The Mammals of Australia. Australian Museum / Reed Books.

Storr, G.M., Smith, L.A. and Johnstone R.E. (1983). Lizards of Western Australia II: Dragons and Monitors. WA Museum, Perth.

Storr, G.M., Smith, L.A. and Johnstone R.E. (1990). Lizards of Western Australia III: Geckos and Pygopods. WA Museum, Perth.

Storr, G.M., Smith, L.A. and Johnstone R.E. (1999). Lizards of Western Australia I: Skinks. Revised Edition, WA Museum, Perth.

Storr, G.M., Smith, L.A. and Johnstone R.E. (2002). Snakes of Western Australia. Revised Edition, WA Museum, Perth.

Tyler M.J. & Doughty P. (2009). Field Guide to Frogs of Western Australia, Fourth Edition, WA Museum, Perth.

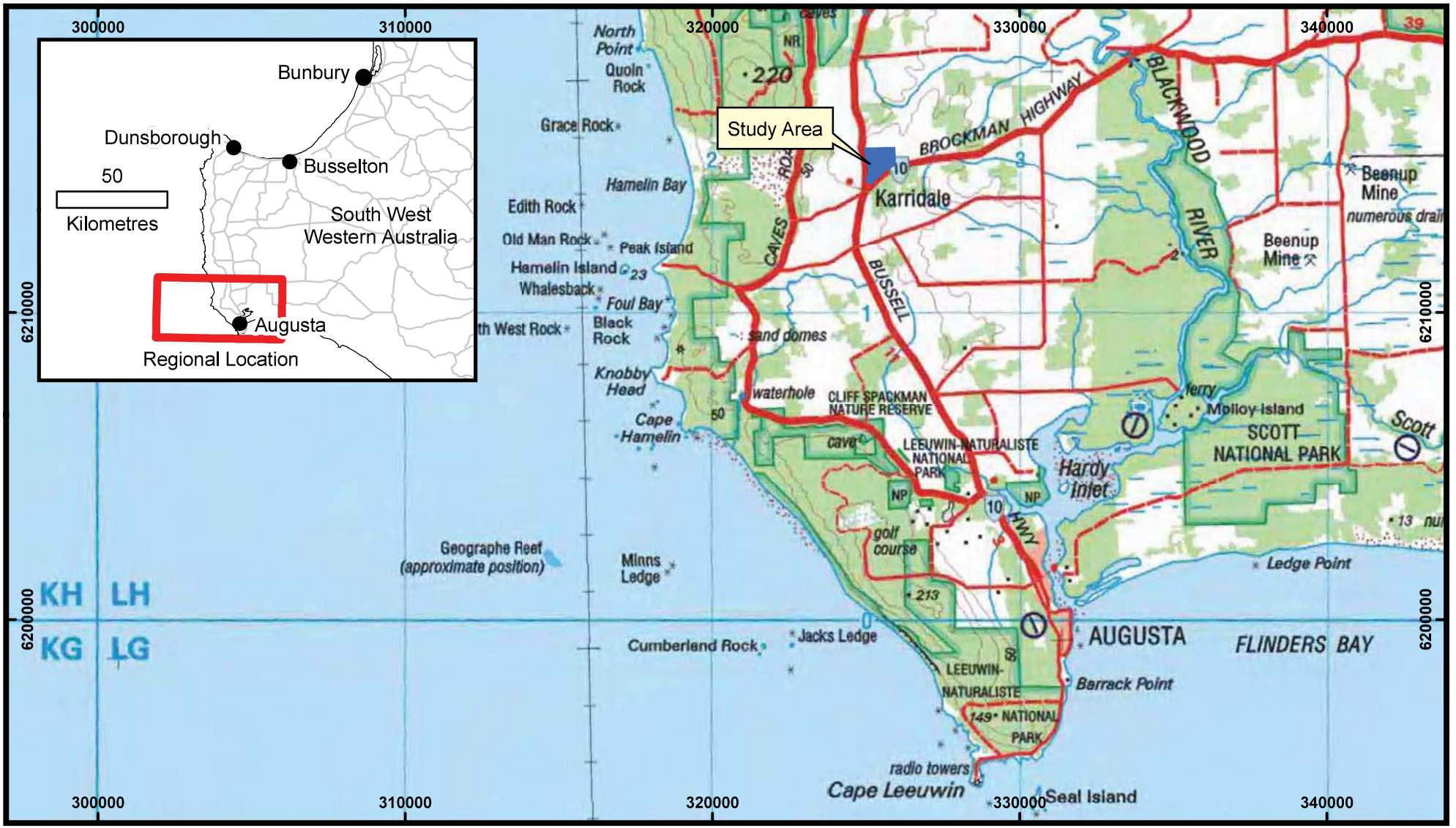
Tyler M.J., Smith L.A. and Johnstone R.E. (2000). Frogs of Western Australia, Revised Edition, WA Museum, Perth.

Thackway, R. and Cresswell, I.D. (1995). An Interim Biogeographic Regionalisation for Australia. Australian Nature Conservation Agency, Canberra.

Van Dyck, S. & Strahan, R. Eds (2008) The Mammals of Australia. Third edition Queensland Museum.

Wilson, S. and Swan, G. (2010) A Complete Guide to Reptiles of Australia. Reed, New Holland, Sydney.

FIGURES



Legend

Study Area

0 2 4 6 8 10

Kilometres

MGA Zone 50

Fauna Assessment

DRAWN:G Harewood

DATE : Aug 2012

SCALE: 1:180,000

LOT 100
BROCKMAN HIGHWAY
KARRIDALE

Study Area and Surrounds

Figure: 1

Legend

- Study Area
- POS Boundary (Approx.)

0 100 200 300 400 500

Metres

Fauna Assessment

LOT 100
BROCKMAN HIGHWAY
KARRIDALE

Study Area Air Photo

DRAWN:G Harewood
DATE : Oct 2012
SCALE: 1:8,250
MGA Zone 50

Figure: 2

Legend

- Study Area
- POS Boundary (Approx.)
- Tree >50cm DBH, no hollows seen
- Tree >50cm DBH, one or more hollows seen (none suitable for black cockatoos)

N

0 40 80 120 160 200

Metres

Note: Trees to be retained in POS were not assessed

Fauna Assessment

LOT 100
BROCKMAN HIGHWAY
KARRIDALE

Habitat Trees (>50cm DBH)

DRAWN:G Harewood
DATE : Oct 2012
SCALE: 1:3,750
MGA Zone 50

Figure: 3

PLATES

Plate 1: Central cleared section of the study area looking north east

Plate 2: Marri and jarrah woodland over peppermint regrowth over mixed grasses and weeds in the proposed POS area

Plate 3: Regrowth peppermint over mixed grasses and weeds in south west section of study area adjoin the POS to left

Plate 4: Grove of marri and karri over mixed grasses bordering Brockman Highway

APPENDIX A

CONSERVATION CATEGORIES

EPBC Act (1999) Threatened Fauna Categories

Category	Code	Description
Extinct	E	There is no reasonable doubt that the last member of the species has died.
*Extinct in the wild	EW	A species (a) is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
*Critically endangered	CE	A species is facing an extremely high risk of extinction in the wild in the immediate future.
*Endangered	EN	A species: (a) is not critically endangered; and (b) is facing a very high risk of extinction in the wild in the near future.
*Vulnerable	VU	A species (a) is not critically endangered or endangered; and (b) is facing a high risk of extinction in the wild in the medium-term future.
Conservation dependent	CD	A species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered
*Migratory	Migratory	(a) all migratory species that are: (i) native species; and (ii) from time to time included in the appendices to the Bonn Convention; and (b) all migratory species from time to time included in annexes established under JAMBA, CAMBA and ROKAMBA; and (c) all native species from time to time identified in a list established under, or an instrument made under, an international agreement approved by the Minister.
Marine	Ma	Species in the list established under s248 of the EPBC Act

Note: Only species in those categories marked with an asterix are matters of national environmental significance under the *EPBC Act*.

Western Australian Wildlife Conservation Act (1950) Threatened Fauna Categories

Category	Code	Description
Schedule 1	S1	Fauna which is rare or likely to become extinct Threatened fauna (Schedule 1) are further ranked by the DEC according to their level of threat using IUCN Red List criteria: **CR: Critically Endangered** - considered to be facing an extremely high risk of extinction in the wild. **EN: Endangered** - considered to be facing a very high risk of extinction in the wild. **VU: Vulnerable** - considered to be facing a high risk of extinction in the wild.
Schedule 2	S2	Fauna which is presumed extinct
Schedule 3	S3	Birds which are subject to an agreement between the governments of Australia and Japan (JAMBA) relating to the protection of migratory birds and birds in danger of extinction
Schedule 4	S4	Fauna that is otherwise in need of special protection

Western Australian DEC Priority Fauna Categories

Category	Code	Description
Priority 1	P1	Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes..
Priority 2	P2	Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
Priority 3	P3	Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
Priority 4	P4	(a) **Rare**. Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. (b) **Near Threatened**. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
Priority 5	P5	Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxa becoming threatened within five years.

IUCN Red List Threatened Species Categories

Category	Code	Description
Extinct	EX	Taxa for which there is no reasonable doubt that the last individual has died.
Extinct in the Wild	EW	Taxa which is known only to survive in cultivation, in captivity or and as a naturalised population well outside its past range and it has not been recorded in known or expected habitat despite exhaustive survey over a time frame appropriate to its life cycle and form.
Critically Endangered	CR	Taxa facing an extremely high risk of extinction in the wild.
Endangered	EN	Taxa facing a very high risk of extinction in the wild.
Vulnerable	VU	Taxa facing a high risk of extinction in the wild.
Near Threatened	NT	Taxa which has been evaluated but does not qualify for CR, EN or VU now but is close to qualifying or likely to qualify in the near future.
Least Concern	LC	Taxa which has been evaluated but does not qualify for CR, EN, VU, or NT but is likely to qualify for NT in the near future.
Data Deficient	DD	Taxa for which there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status.

A full list of categories and their meanings are available at:

http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria

APPENDIX B

DEC & *EPBC ACT* DATABASE SEARCH RESULTS

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Greg Harewood on 10/08/2012

Kingdom Animalia
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115°06' 11" E,34°11' 47" S
Buffer 5km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	24260	*Acanthiza apicalis (Broad-tailed Thornbill)*			
2.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
3.	24262	*Acanthiza inornata (Western Thornbill)*			
4.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
5.	25011	*Acritoscincus trilineatum*			
6.	24312	*Anas gracilis (Grey Teal)*			
7.	24316	*Anas superciliosa (Pacific Black Duck)*			
8.	24561	*Anthochaera carunculata (Red Wattlebird)*			
9.	24285	*Aquila audax (Wedge-tailed Eagle)*			
10.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
11.	24162	*Bettongia penicillata subsp. ogilbyi (Woylie, Brush-tailed Bettong)*		T	
12.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
13.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo (short-billed black-cockatoo))*		T	
14.	24321	*Chenonetta jubata (Australian Wood Duck)*			
15.	24396	*Climacteris rufa (Rufous Treecreeper)*			
16.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
17.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
18.	25592	*Corvus coronoides (Australian Raven)*			
19.	25595	*Cracticus tibicen (Australian Magpie)*			
20.	25596	*Cracticus torquatus (Grey Butcherbird)*			
21.	25049	*Ctenotus labillardieri*			
22.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*			
23.	24092	*Dasyurus geoffroii (Chuditch, Western Quoll)*		T	
24.	30907	*Diomedea chlororhynchos subsp. carteri (Indian Yellow-nosed Albatross)*		T	
25.	30836	*Diomedea exulans subsp. exulans (Tristan Albatross)*		T	
26.	24470	*Dromaius novaehollandiae (Emu)*			
27.	24652	*Eopsaltria georgiana (White-breasted Robin)*			
28.	24567	*Epthianura albifrons (White-fronted Chat)*			
29.	25621	*Falco berigora (Brown Falcon)*			
30.	25622	*Falco cenchroides (Australian Kestrel)*			
31.	25677	*Falcunculus frontatus (Crested Shrike-tit)*			
32.	24616	*Falcunculus frontatus subsp. leucogaster (Western Shrike-tit, Crested Shrike-tit)*		P4	
33.	25403	*Geocrinia alba (White-bellied Frog)*		T	
34.	25530	*Gerygone fusca (Western Gerygone)*			
35.	24735	*Glossopsitta porphyrocephala (Purple-crowned Lorikeet)*			
36.	24443	*Grallina cyanoleuca (Magpie-lark)*			
37.	25118	*Hemiergis peronii subsp. tridactyla*			
38.	24491	*Hirundo neoxena (Welcome Swallow)*			
39.	25133	*Lerista elegans*			
40.	25661	*Lichmera indistincta (Brown Honeyeater)*			
41.	25415	*Limnodynastes dorsalis (Western Banjo Frog)*			
42.	25378	*Litoria adelaidensis (Slender Tree Frog)*			
43.	24133	*Macropus irma (Western Brush Wallaby)*		P4	
44.	25650	*Malurus elegans (Red-winged Fairy-wren)*			
45.	25654	*Malurus splendens (Splendid Fairy-wren)*			
46.	25191	*Morethia lineoocellata*			
47.	24223	*Mus musculus (House Mouse)*			
48.	34033	*Nannatherina balstoni (Balston's Pygmy Perch)*		T	
49.	24738	*Neophema elegans (Elegant Parrot)*			
50.	24739	*Neophema petrophila (Rock Parrot)*			
51.	25748	*Ninox novaeseelandiae (Boobook Owl)*			
52.	24407	*Ocyphaps lophotes (Crested Pigeon)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
53.	25679	*Pachycephala pectoralis (Golden Whistler)*			
54.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
55.	24692	*Pachyptila belcheri (Slender-billed Prion)*			
56.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
57.	25682	*Pardalotus striatus (Striated Pardalote)*			
58.	24409	*Phaps chalcoptera (Common Bronzewing)*			
59.	24099	*Phascogale tapoatafa subsp. tapoatafa (Southern Brush-tailed Phascogale, Wambenger)*		T	
60.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
61.	25720	*Platycercus icterotis (Western Rosella)*			
62.	24747	*Platycercus spurius (Red-capped Parrot)*			
63.	24843	*Plegadis falcinellus (Glossy Ibis)*		IA	
64.	24679	*Podargus strigoides subsp. brachypterus*			
65.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
66.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
67.	24145	*Setonix brachyurus (Quokka)*		T	
68.	24645	*Stagonopleura oculata (Red-eared Firetail)*			
69.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*			
70.	25705	*Tachybaptus novaehollandiae (Australasian Grebe)*			
71.	24331	*Tadorna tadornoides (Australian Shelduck)*			
72.	24167	*Tarsipes rostratus (Honey Possum)*			
73.	24844	*Threskiornis molucca (Australian White Ibis)*			
74.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
75.	24206	*Vespadelus regulus (Southern Forest Bat)*			
76.	25765	*Zosterops lateralis (Grey-breasted White-eye)*			

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.

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.

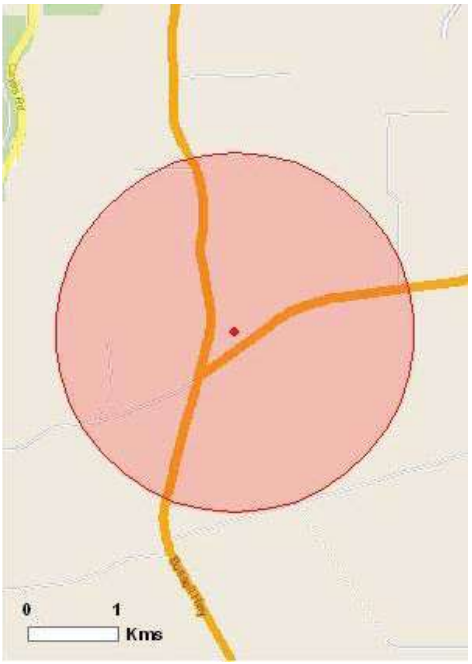
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

Report created: 10/08/12 14:30:33

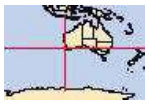
Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 2.0Km



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 - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	None
Threatened Species:	18
Migratory Species:	8

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 environment anywhere.

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 and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html

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 environment anywhere.

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. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.

Commonwealth Lands:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	5
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

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

Place on the RNE:	None
State and Territory Reserves:	None
Regional Forest Agreements:	1
Invasive Species:	9
Nationally Important Wetlands:	None

Details

Matters of National Environmental Significance

Threatened Species		[Resource Information]
Name	Status	Type of Presence
BIRDS		
Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Calyptorhynchus banksii naso		
Forest Red-tailed Black-Cockatoo [67034]	Vulnerable	Species or species habitat may occur within area
Calyptorhynchus baudinii		
Baudin's Black-Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Breeding known to occur within area
Calyptorhynchus latirostris		
Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat likely to occur within area
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
FROGS		
Geocrinia alba		
White-bellied Frog, Creek Frog [26181]	Endangered	Species or species habitat likely to occur within area
MAMMALS		
Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Pseudocheirus occidentalis		
Western Ringtail Possum [25911]	Vulnerable	Species or species habitat likely to occur within area
PLANTS		
Banksia nivea subsp. uliginosa		
Swamp Honeypot [82766]	Endangered	Species or species habitat may occur within area
Banksia squarrosa subsp. argillacea		
Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat may occur within area
Caladenia hoffmanii		
Hoffman's Spider-orchid [56719]	Endangered	Species or species habitat may occur within area
Caladenia winfieldii		
Majestic Spider-orchid [64504]	Endangered	Species or species habitat may occur within area
Centrolepis caespitosa		
[6393]	Endangered	Species or species habitat likely to occur within area
Drosera fimbriata		
Manypeaks Sundew [18749]	Vulnerable	Species or species habitat may occur within area
Gastrolobium papilio		
Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area
Lambertia echinata subsp. occidentalis		
Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within area
Reedia spathacea		
Reedia [2995]	Critically Endangered	Species or species habitat may occur within area
Sphenotoma drummondii		
[21160]	Endangered	Species or species habitat may occur within area

Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area

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.

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area

Extra Information

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
South West WA RFA	Western Australia

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit,

Name	Status	Type of Presence
Mammals		
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area

Coordinates

-34.19648 115.10331

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other

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.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

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:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA 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, Atherton and Canberra

-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-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

FAUNA OBSERVED IN STUDY AREA

Fauna observed in the study area

Lot 100 Brockman Highway, Karridale

Compiled by Greg Harewood - July 2012

Class **Family** *Species*	Common Name	Conservation Status
Amphibians		
Myobatrachidae Ground or Burrowing Frogs		
Crinia glauerti	Glauert`s Froglet	LC
Geocrinia leai	Lea`s Frog	LC
Birds		
Cacatuidae Cockatoos, Corellas		
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	S1 VU Be VU
Psittacidae Parrots		
Platycercus spurius	Red-capped Parrot	LC
Platycercus zonarius	Australian Ringneck Parrot	LC
Halcyonidae Tree Kingfishers		
Dacelo novaeguineae	Laughing Kookaburra	Introduced
Meliphagidae Honeyeaters, Chats		
Anthochaera carunculata	Red Wattlebird	LC
Phylidonyris novaehollandiae	New Holland Honeyeater	Bp LC
Pachycephalidae Crested Shrike-tit, Crested Bellbird, Shrike Thrushes, Whistlers		
Pachycephala pectoralis	Golden Whistler	Bh LC
Dicruridae Monarchs, Magpie Lark, Flycatchers, Fantails, Drongo		
Rhipidura fuliginosa	Grey Fantail	LC
Campephagidae Cuckoo-shrikes, Trillers		
Coracina novaehollandiae	Black-faced Cuckoo-shrike	LC

WC Act Status - S1 to S4, EPBC Act Status - EX = Extinct, EN = Endangered, VU = Vulnerable, Mg = Migratory, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions = LC, LR, NT, DD ect - see http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria

Class **Family** *Species*	Common Name	Conservation Status
Artamidae Woodswallows, Butcherbirds, Currawongs		
Cracticus tibicen	Australian Magpie	LC
Cracticus torquatus	Grey Butcherbird	LC
Corvidae Ravens, Crows		
Corvus coronoides	Australian Raven	LC

Mammals

Bovidae Horned Ruminants		
Bos taurus	European Cattle	Introduced
Leporidae Rabbits, Hares		
Oryctolagus cuniculus	Rabbit	Introduced

WC Act Status - S1 to S4, EPBC Act Status - EX = Extinct, EN = Endangered, VU = Vulnerable, Mg = Migratory, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions = LC, LR, NT, DD ect - see http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria

APPENDIX D

HABITAT TREE DETAILS

Habitat Trees
Datum - GDA 94

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	Number of Hollows	Hollow Type 1	Hollow Size 1 (cm)	Hollow Type 2	Hollow Size 2 (cm)	Hollow Type 3	Hollow Size 3 (cm)	Hollow Type 4	Hollow Size 4 (cm)	Hollow Type 5	Hollow Size 5 (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt001	50H	325104	6214177	Marri	15-20	0											No Signs	No Signs	No	
wpt002	50H	325133	6214185	Marri	20+	0											No Signs	No Signs	No	
wpt003	50H	325103	6214176	Marri	15-20	0											No Signs	No Signs	No	
wpt004	50H	325097	6214187	Jarrah	15-20	0											No Signs	No Signs	No	
wpt005	50H	325075	6214391	Marri	20+	5+	Knot Hole	5-12	Knot Hole	5-12	Branch	5-12	Branch	5-12	Branch	5-12	No Signs	No Signs	No	
wpt006	50H	325182	6214551	Marri	15-20	0											No Signs	No Signs	No	
wpt007	50H	325235	6214539	Karri	15-20	0											No Signs	No Signs	No	
wpt008	50H	325235	6214540	Karri	15-20	0											No Signs	No Signs	No	
wpt009	50H	325239	6214539	Karri	15-20	0											No Signs	No Signs	No	
wpt010	50H	325240	6214539	Karri	15-20	0											No Signs	No Signs	No	
wpt011	50H	325242	6214539	Karri	15-20	0											No Signs	No Signs	No	
wpt012	50H	325245	6214538	Karri	15-20	0											No Signs	No Signs	No	
wpt013	50H	325250	6214535	Karri	15-20	0											No Signs	No Signs	No	
wpt014	50H	325250	6214541	Karri	15-20	0											No Signs	No Signs	No	
wpt015	50H	325245	6214543	Karri	15-20	0											No Signs	No Signs	No	
wpt016	50H	325241	6214541	Karri	15-20	0											No Signs	No Signs	No	
wpt017	50H	325355	6214494	Marri	15-20	0											No Signs	No Signs	No	
wpt018	50H	325356	6214388	Marri	20+	0											No Signs	No Signs	No	
wpt019	50H	325359	6214380	Marri	20+	0											No Signs	No Signs	No	
wpt020	50H	325369	6214387	Marri	20+	0											No Signs	No Signs	No	
wpt021	50H	325368	6214371	Marri	15-20	2	Spout Branch	5-12	Spout Branch	5-12							No Signs	No Signs	No	
wpt022	50H	325353	6214377	Marri	20+	0											No Signs	No Signs	No	
wpt023	50H	325364	6214360	Marri	20+	0											No Signs	No Signs	No	
wpt024	50H	325363	6214353	Marri	20+	0											No Signs	No Signs	No	
wpt025	50H	325372	6214359	Marri	20+	0											No Signs	No Signs	No	
wpt026	50H	325376	6214361	Marri	20+	0											No Signs	No Signs	No	
wpt027	50H	325373	6214375	Karri	20+	0											No Signs	No Signs	No	
wpt028	50H	325284	6214373	Marri	20+	0											No Signs	No Signs	No	
wpt029	50H	325266	6214357	Marri	20+	0											No Signs	No Signs	No	

Local Structure Plan

APPENDIX F
DIA INDIGENOUS HERITAGE INQUIRY

Cardno
Shaping the Future

Aboriginal Heritage Inquiry System

Aboriginal Sites Database

Search Criteria

0 sites in a search box. The box is formed by these diagonally opposed corner points:

MGA Zone 50	
Northing	Easting
6213887	324895
6215350	326140

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Disclaimer

Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist. Consultation with Aboriginal communities is on-going to identify additional sites. The AHA protects all Aboriginal sites in Western Australia whether or not they are registered.

Copyright

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Legend

Restriction

N	No restriction
M	Male access only
F	Female access

Access

C	Closed
O	Open
V	Vulnerable

Coordinate Accuracy

Accuracy is shown as a code in brackets following the site coordinates.

[Reliable]	The spatial information recorded in the site file is deemed to be reliable, due to methods of capture.
[Unreliable]	The spatial information recorded in the site file is deemed to be unreliable due to errors of spatial data capture and/or quality of spatial information reported.

Status

L - Lodged		ACMC Decision Made
Information lodged, awaiting assessment	→	R - Registered Site I - Insufficient information S - Stored Data

Spatial Accuracy

Index coordinates are indicative locations and may not necessarily represent the centre of sites, especially for sites with an access code “closed” or “vulnerable”. Map coordinates (Lat/Long) and (Easting/Northing) are based on the GDA 94 datum. The Easting / Northing map grid can be across one or more zones. The zone is indicated for each Easting on the map, i.e. '5000000:Z50' means Easting=5000000, Zone=50.

Sites Shown on Maps

Site boundaries may not appear on maps at low zoom levels

List of Registered Aboriginal Sites with Map

No results

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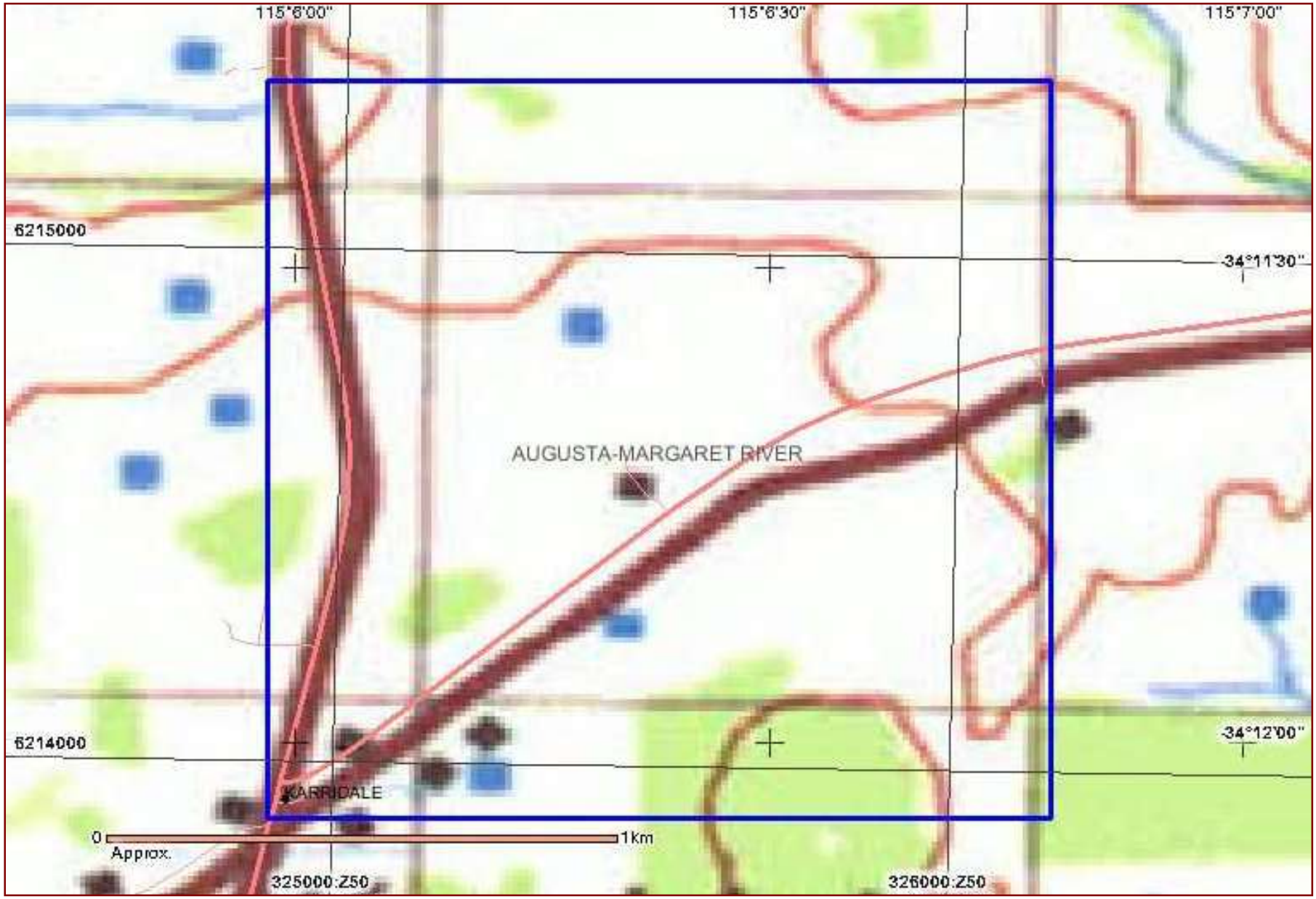
Aboriginal Heritage Inquiry System

Aboriginal Sites Database



Legend

Selected Heritage Sites

Registered Sites

Town

Map Area

Search Area

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List of Other Heritage Places with Map

No results

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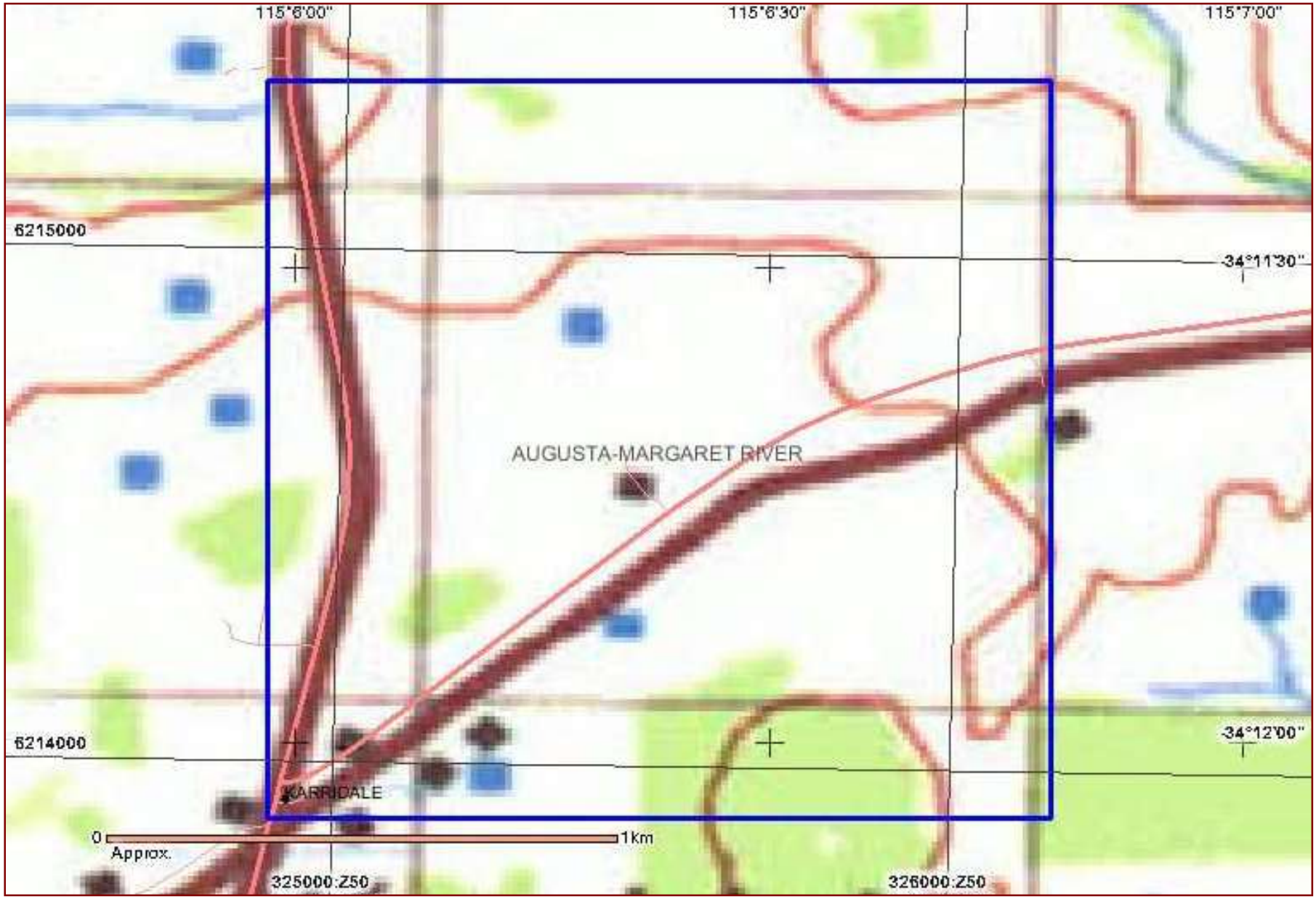
Aboriginal Heritage Inquiry System

Aboriginal Sites Database



Legend

Selected Heritage Sites

Other Heritage Places

Town

Map Area

Search Area

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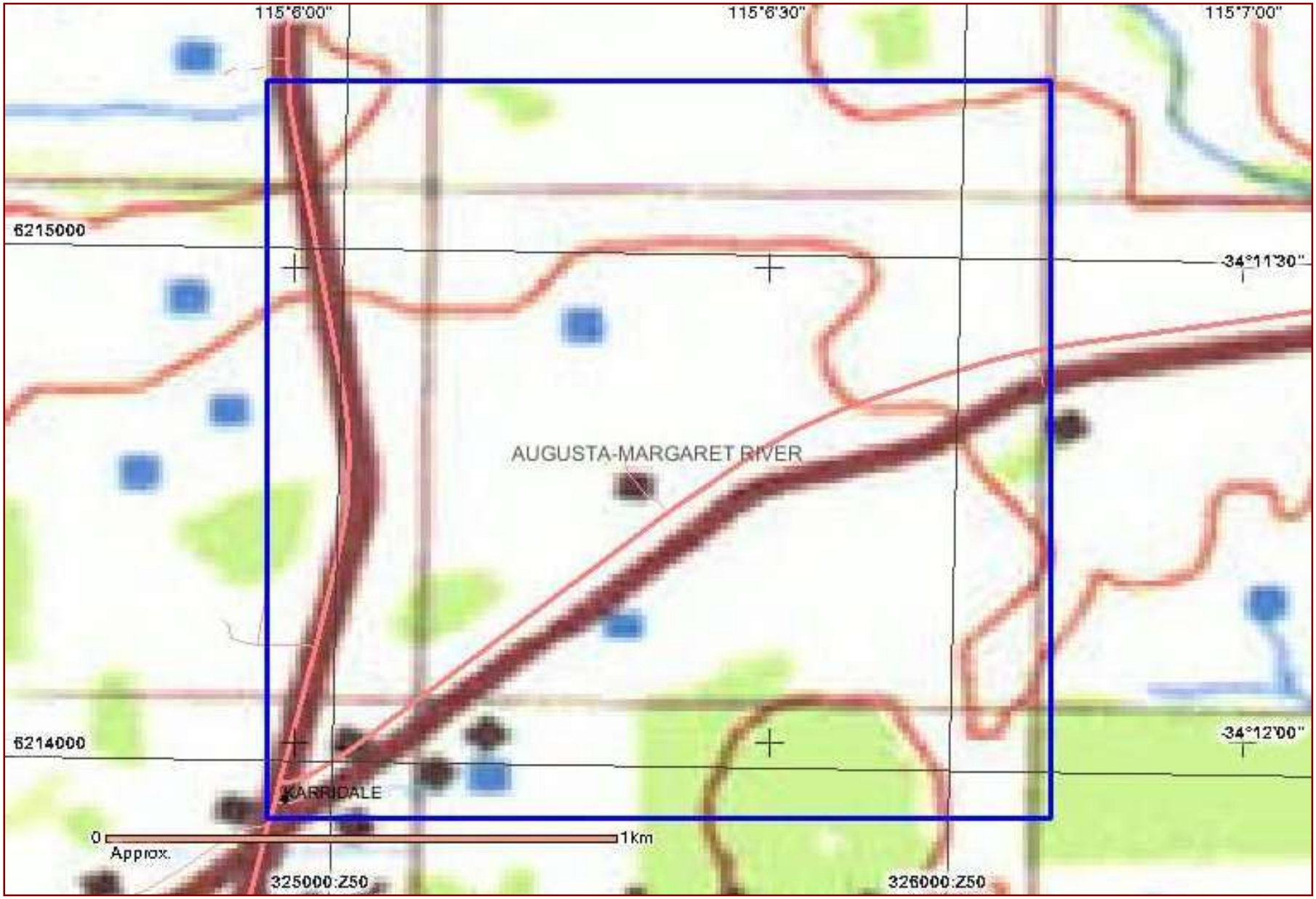
Map Showing Registered Aboriginal Sites and Other Heritage Places

© Government of Western Australia

Aboriginal Heritage Inquiry System

Aboriginal Sites Database



Legend

Selected Heritage Sites

- Registered Sites
- Other Heritage Places
- Town
- Map Area
- Search Area

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Local Structure Plan

APPENDIX G
ACOUSTIC ASSESSMENT

Cardno
Shaping the Future

HERRING STORER ACOUSTICS

Our ref: 31767-1-20384

20 October 2023

MR Planning
21A Northgate Street
KARRINYUP, WA, 6018

Attention: Martin Richards
Address: martin@mrplanning.com.au

Dear Martin,

LOT 9001 BROCKMAN HIGHWAY, KARRIDALE
TRAFFIC VOLUME CLARIFICATION

It is understood that a query was raised in regards to the acoustic assessment conducted for the above development. Reference for the acoustic assessment is 28412-1-20384 conducted in September 2021.

The query raised was from Main Roads WA (MRWA) and related to the traffic volumes assumed for the future Bussell and Brockman Highway.

Further information was sought from the MRWA ROM department for the future traffic volumes, with the information attached.

As per the attached, MRWA have referred us to the traffic counts on the current MRWA website with a recommended annual increase of 1.0% for future traffic volumes.

The acoustic study carried out for the development used traffic counts from the MRWA web site and allows for an increase of 2.5% per annum for future traffic.

Therefore, the study undertaken for the future traffic noise impact would be considered conservative, as the acoustic assessment has increased the traffic volumes for future flows over and above the MRWA modelling, hence would require no change.

Yours faithfully,
for **HERRING STORER ACOUSTICS**

Paul Daly

Att.

Rochdale Holdings Pty Ltd A.B.N. 85 009 049 067 trading as:
HERRING STORER ACOUSTICS
P.O. Box 219, Como, W.A. 6952
(08) 9367 6200
hsa@hsacoustics.com.au

Paul Daly (Herring Storer Acoustics)

From: Gage Daly <gage@hsacoustics.com.au>
Sent: Friday, 30 September 2022 9:18 AM
To: Paul Daly (Herring Storer Acoustics)
Subject: FW: #42391 - Noise Assessment for Brockman Hwy and Bussell Hwy, Karridale
Attachments: Surface Detail.M027.71.02.73.18.B.2022-09-27.14-40.423483884.PDF; Surface Detail.H043.122.94.128.23.B.2022-09-27.14-39.423481850.PDF

From: NG Thomas (TMA)
Sent: Thursday, 29 September 2022 4:45 PM
To: Gage Daly
Cc: SOET Wesley (PM-PTM/A) ; YU Clare (On Leave)
Subject: #42391 - Noise Assessment for Brockman Hwy and Bussell Hwy, Karridale

Hi Gage,

Our State Wide Model suggests that the projected compound growth rate is in the order of **1.0%** per annum. Please applied the observed counts from https://trafficmap.mainroads.wa.gov.au/map

Please note that due to the strategic level of network coding, the detail localised development may not be considered in the State Wide model as part of the business-as-usual land use trend case.

Road surface information attached.

Let me know if you have any other questions.

Thank you.

Kind regards,
Thomas Ng
Transport Modelling Analyst
Planning and Technical Services
p: +61 8 93236366
w: www.mainroads.wa.gov.au

mainroads WESTERN AUSTRALIA
We're working for Western Australia.

METRO TRAFFIC REGIONAL TRAFFIC

From: Gage Daly <gage@hsacoustics.com.au>
Sent: Monday, 19 September 2022 11:54 AM
To: NG Thomas (TMA) <Thomas.Ng@mainroads.wa.gov.au>
Cc: Paul Daly (Herring Storer Acoustics) <pldaly@hsacoustics.com.au>
Subject: FW: Brockman and Bussell Hwy Karridale

CAUTION: This email originated from outside of Main Roads. Do not click links or open attachments unless you recognise the sender and know the content is safe.

LOT 100 BROCKMAN HIGHWAY, KARRIDALE
LOCAL STRUCTURE PLAN

BUSSELL AND BROCKMAN HIGHWAY TRAFFIC (SPP 5.4)
NOISE MANAGEMENT PLAN

SEPTEMBER 2021

OUR REFERENCE: 28412-2-20384

Rochdale Holdings Pty Ltd A.B.N. 85 009 049 067 trading as:
HERRING STORER ACOUSTICS
P.O. Box 219, Como, W.A. 6952
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hsa@hsacoustics.com.au

DOCUMENT CONTROL PAGE

ACOUSTIC ASSESSMENT
LOT 100 BROCKMAN HIGHWAY, KARRIDALE

Job No: 20384

Document Reference: 28412-1-20384

FOR

JUVENTUS ATF PREVELLY DEVELOPMENT

DOCUMENT INFORMATION			
Author:	Paul Daly	**Checked By:**	Tim Reynolds
Date of Issue :	24 September 2021		

REVISION HISTORY

Revision	Description	Date	Author	Checked

DOCUMENT DISTRIBUTION

Copy No.	Version No.	Destination	Hard Copy	Electronic Copy
1	1	MR Planning Martin Richards martin@mrplanning.com.au	✓	

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APPENDICIES

A	Subdivision Plan
B	$L_{Aeq\ (16hr)}$ Noise Contours
C	Traffic Flow
D	Noise Monitoring Results
E	Deemed To Satisfy Quiet House Design Requirements

1. INTRODUCTION

Herring Storer Acoustics was commissioned by Martin Richards Planning on behalf of Juventus ATF Prevelly Development to undertake an acoustical assessment of noise received within the proposed Local Structure Plan (LSP) at Lot 100 Brockman, Karridale.

An acoustic assessment conducted under a prior version of the State Planning Policy 5.4 was conducted for this development, reference 15528-2-12173. The purpose of this current acoustic assessment is to update the information to the latest edition of the policy, and to reassess for the latest LSP. Updated road traffic measurements conducted in 2020 have also been included for Bussell Highway.

As part of the study, the following was carried out:

- Measure the existing noise levels received at the proposed development associated with the current vehicle flows on Bussell Highway.
- Determine by noise modelling the noise levels that would be received at residences within the development from vehicles travelling on the future Bussell Highway and Brockman Highway.
- Assess the predicted noise levels received at residence for compliance with the requirements of the WAPC State Planning Policy 5.4 *"Road and Rail Noise"* (SPP 5.4).
- If exceedances are predicted, comment on possible noise amelioration options for compliance with the appropriate criteria.

For information, the proposed development plan is attached in Appendix A.

2. SUMMARY

Under the WAPC State Planning Policy 5.4, for this development, the appropriate "Noise Targets" to be achieved under SPP 5.4, external to a residence are:

External

Day	Maximum of 55 dB(A) L_{Aeq}
Night	Maximum of 50 dB(A) L_{Aeq}

The policy states that the "outdoor targets are to be met at all outdoor areas as far as reasonable and practical to do so using the various noise mitigation measures outlined in the guidelines". The Policy also states, under Section 6 – Policy Measures that "a reasonable degree of acoustic amenity for living areas on each residential lot". The policy recognises that "it may not be practicable to meet the outdoor noise targets".

The Policy states the following acceptable internal noise levels:

Internal

Living and Work Areas	$L_{Aeq(Day)}$ of 40 dB(A)
Bedrooms	$L_{Aeq(Night)}$ of 35 dB(A)

For this development, compliance with the requirements of SPP 5.4, are based on the day period for Lots located adjacent to Bussell Highway and Brockman Highway.

The results of the acoustic assessment indicate that noise received at residential Lots located adjacent to both Highways would exceed with the "Noise Targets" as outlined in SPP 5.4.

Due to the size of the lots, and that buildings can only occur in areas below the 56 dB(A) noise level contour, no noise amelioration in the form of Quiet House Design is required. However, as the lots receive noise levels in excess of 55 dB(A), notification on titles of noise associated with Bussell and Brockman Highway would be required.

Therefore, to comply with the Policy, the following options have been provided:

- Notification on titles for the Lots affected by noise greater than 55 dB(A).
- Building envelopes (setbacks) to be in areas below the 56 dB(A) noise contour.

It is noted that the LSP contains the QHD contours as notations.

3. CRITERIA

The Western Australian Planning Commission (WAPC) released on 6th September 2019 State Planning Policy 5.4 *"Road and Rail Noise".* The requirements of State Planning Policy 5.4 are outlined below.

POLICY APPLICATION (Section 4)

When and where it applies (Section 4.1)

SPP 5.4 applies to the preparation and assessment of planning instruments, including region and local planning schemes; planning strategies, structure plans; subdivision and development proposals in Western Australia, where there is proposed:

*a) noise-sensitive land-use within the policy's trigger distance of a transport corridor as specified in **Table 1**;*

*b) New or major upgrades of roads as specified in **Table 1** and maps **(Schedule 1,2 and 3);** or*

*c) New railways or major upgrades of railways as specified in maps (**Schedule 1, 2 and 3);** or any other works that increase capacity for rail vehicle storage or movement and will result in an increased level of noise.*

Policy trigger distances (Section 4.1.2)

***Table 1** identifies the State's transport corridors and the trigger distances to which the policy applies.*

*The designation of land within the trigger distances outlined in **Table 1** should not be interpreted to imply that land is affected by noise and/or that areas outside the trigger distances are un-affected by noise.*

*Where any part of the lot is within the specified trigger distance, an assessment against the policy is required to determine the likely level of transport noise and management/ mitigation required. An initial screening assessment (**guidelines: Table 2: noise exposure forecast**) will determine if the lot is affected and to what extent."*

TABLE 1: TRANSPORT CORRIDOR CLASSIFICATION AND TRIGGER DISTANCES

Transport corridor classification	***Trigger distance***	***Distance measured from***
Roads		
Strategic freight and major traffic routes *Roads as defined by Perth and Peel Planning Frameworks and/or roads with either 500 or more Class 7 to 12 Austroads vehicles per day, and/or 50,000 per day traffic volume*	*300 metres*	*Road carriageway edge*
Other significant freight/traffic routes *These are generally any State administered road and/or local government road identified as being a future State administered road (red road) and other roads that meet the criteria of either >=23,000 daily traffic count (averaged equivalent to 25,000 vehicles passenger car units under region schemes)*	*200 metres*	*Road carriageway edge*
Passenger railways		
	100 metres	*Centreline of the closest track*
Freight railways		
	200 metres	*Centreline of the closest track*

Proponents are advised to consult with the decision making authority as site specific conditions (significant differences in ground levels, extreme noise levels) may influence the noise mitigation measures required, that may extend beyond the trigger distance.

POLICY MEASURES (Section 6)

The policy applies a performance-based approach to the management and mitigation of transport noise. The policy measures and resultant noise mitigation will be influenced by the function of the transport corridor and the type and intensity of the land-use proposed. Where there is risk of future land-use conflict in close proximity to strategic freight routes, a precautionary approach should be applied. Planning should also consider other broader planning policies. This is to ensure a balanced approach takes into consideration reasonable and practical considerations.

Noise Targets (Section 6.1)

***Table 2** sets out noise targets that are to be achieved by proposals under which the policy applies. Where exceeded, an assessment is required to determine the likely level of transport noise and management/mitigation required.*

In the application of the noise targets the objective is to achieve:

- *indoor noise levels as specified in **Table 2** in noise sensitive areas (for example, bedrooms and living rooms of houses, and school classrooms); and*

- *a reasonable degree of acoustic amenity for outdoor living areas on each residential lot. For non-residential noise-sensitive developments, for example schools and child care centres the design of outdoor areas should take into consideration the noise target.*

It is recognised that in some instances, it may not be reasonable and/or practicable to meet the outdoor noise targets. Where transport noise is above the noise targets, measures are expected to be implemented that balance reasonable and practicable considerations with the need to achieve acceptable noise protection outcomes.

TABLE 2: NOISE TARGETS

Proposals	***New/Upgrade***	***Noise Targets***		
		Outdoor		***Indoor***
		Day (L_{Aeq}(Day) dB) (6 am-10 pm)	***Night (L_{Aeq}(Night)dB) (10 pm-6 am)***	***(L_{Aeq} dB)***
Noise-sensitive land-use and/or development	*New noise sensitive land use and/or development within the trigger distance of an existing/proposed transport corridor*	*55*	*50*	*L_{Aeq} (Day) 40(Living and work areas)* *L_{Aeq} (Night) 35 (bedrooms)*
Roads	*New*	*55*	*50*	*N/A*
	Upgrade	*60*	*55*	*N/A*
Railways	*New*	*55*	*50*	*N/A*
	Upgrade	*60*	*55*	*N/A*

Notes:

- *The noise target is to be measured at one metre from the most exposed, habitable façade of the proposed building, which has the greatest exposure to the noise-source. A habitable room has the same meaning as defined in State Planning Policy 3.1 Residential Design Codes.*
- *For all noise-sensitive land-use and/or development, indoor noise targets for other room usages may be reasonably drawn from Table 1 of Australian Standard/New Zealand Standard AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors (as amended) for each relevant time period.*
- *The 5dB difference in the criteria between new and upgrade infrastructure proposals acknowledges the challenges in achieving noise level reduction where existing infrastructure is surrounded by existing noise-sensitive development.*
- *Outdoor targets are to be met at all outdoor areas as far as is reasonable and practical to do so using the various noise mitigation measures outlined in the guidelines. For example, it is likely unreasonable for a transport infrastructure provider to achieve the outdoor targets at more than 1 or 2 floors of an adjacent development with direct line of sight to the traffic.*

<u>Noise Exposure Forecast (Section 6.2)</u>

*When it is determined that SPP 5.4 applies to a planning proposal as outlined in Section 4, proponents and/or decision makers are required to undertake a preliminary assessment using **Table 2**: noise exposure forecast in the guidelines. This will provide an estimate of the potential noise impacts on noise-sensitive land-use and/ or development within the trigger distance of a specified transport corridor. The outcomes of the initial assessment will determine whether:*

- *no further measures is required;*
- *noise-sensitive land-use and/or development is acceptable subject to deemed-to- comply mitigation measures; or*
- *noise-sensitive land-use and/or development is not recommended. Any noise-sensitive land-use and/ or development is subject to mitigation measures outlined in a noise management plan."*

4. NOISE MONITORING

Noise monitoring was undertaken as part of the study with the results used to calibrate the noise model.

In summary, the monitoring for Bussell Highway was undertaken over 13-day period commencing Wednesday 4th November 2020. Monitoring was conducted at Lot 102 Moodjar Court, Karridale. The monitor was placed 14m from the nearest running edge of Bussell Highway.

The results of this monitoring are summarised in Table 4.1.

TABLE 4.1 : SUMMARY OF MEASURED ROAD TRAFFIC NOISE LEVELS (dB(A)) BUSSELL HWY

Date	South Western Highway Monitor		
	$L_{A10(18hour)}$	$L_{Aeq,day}$ (6am to 10pm)	$L_{Aeq,night}$ (10pm to 6am)
AVERAGE	63.3	62.7	51.7

For noise related to Brockman Highway, we have referred to the previous assessment conducted, with this data being valid as there has been little change to the road system in this area since the monitoring was conducted.

TABLE 4.2 : SUMMARY OF MEASURED ROAD TRAFFIC NOISE LEVELS (dB(A)) BROCKMAN HWY

Date	South Western Highway Monitor		
	$L_{A10(18hour)}$	$L_{Aeq,day}$ (6am to 10pm)	$L_{Aeq,night}$ (10pm to 6am)
AVERAGE	50.0	59.0	42.2

We note that with the difference between the $L_{Aeq,8hr}$ and the $L_{Aeq,16hr}$ being greater than 5 dB(A), (Bussell Highway) achieving compliance with the day period criteria will also achieve compliance with the night period criteria. Therefore, noise modelling was only undertaken for the day period.

For information, the results of the monitoring are shown graphically in Appendix D with Figure 1 showing the location map, and Figure 2 showing the monitor in situ and the Bussell Highway road surface.

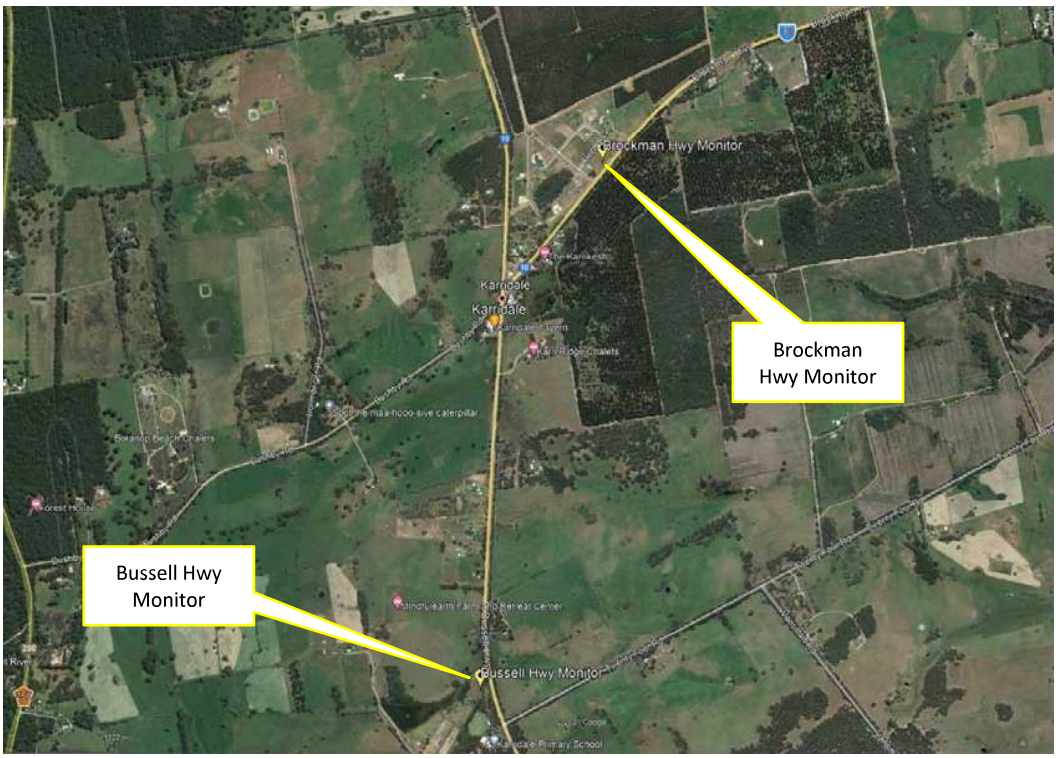


FIGURE 1 - NOISE MONITOR LOCATION PLAN

FIGURE 2 - NOISE MONITOR INSITU AND ROAD SURFACE

5. MODELLING

The future road traffic volumes were based on information provided on the MRWA traffic web site for current traffic flows. For the future proposed traffic volumes, an increase of 2.5% per annum was used.

Predictive noise modelling has allowed for 2,500 vpd in the future (2041) which is around a 2.5 % annual increase. This equates to a 2 dB(A) increase in noise levels for the future road traffic volumes. It is noted this would be slightly conservative as Brockman Highway has been assumed to have the same traffic flows as Bussell Highway, however with a higher percentage of heavy vehicles.

Other information relevant to the calculations are shown below in Table 5.1.

TABLE 5.1 - NOISE MODELLING INPUT DATA

Parameter	Current (2020/21)	Future (2041)
Traffic flows Bussell Highway	1,781	2,500
Heavy Vehicles (%)	13.8%	13.8%
Traffic Speed km/hr	90	90
Traffic flows Brockman Highway	677	2,500
Heavy Vehicles (%)	19.5%	19.5%
Traffic Speed km/hr	90	90
Road Surface	Chip Seal	Chip seal
Façade Correction	+2.5	+2.5

Other input data for the model included:

- Traffic data from MRWA (https://mrapps.mainroads.wa.gov.au/TrafficMap/)
- Noise source heights for the three road source strings (Passenger Vehicles, Heavy Vehicles Engine and Heavy Vehicle Exhausts) are +0.5, +1.5 and +3.6m, with a noise correction of -0.8 and -8.0 applied to the heavy vehicles engine and exhaust noise sources.
- Topographical data, with the ground level within the development based on natural ground levels as surveys conducted.
- A +2.5 dB adjustment to allow for façade reflection.
- Development receiver heights at 1.4m above ground level.
- CoRTN algorithms as per SPP 5.4.

To determine the noise that would be received within the development from the surrounding road network, acoustic modelling was carried out using the computer program 'SoundPlan'.

The following scenario was modelled:

1. Future traffic volumes, without any noise amelioration.

Based on the above, the noise contours plot for day period for the above modelling scenario is attached in Appendix B.

6. DISCUSSION / RECOMMENDATION

Under the WAPC State Planning Policy 5.4, for this development, the appropriate "Noise Targets" to be achieved under SPP 5.4, external to a residence are:

External

Day	Maximum of 55 dB(A) L_{Aeq}
Night	Maximum of 50 dB(A) L_{Aeq}

The policy states that the "outdoor targets are to be met at all outdoor areas as far as reasonable and practical to do so using the various noise mitigation measures outlined in the guidelines". The Policy also states, under Section 6 – Policy Measures that "a reasonable degree of acoustic amenity for living areas on each residential lot". The policy recognises that "it may not be practicable to meet the outdoor noise targets".

The Policy states the following acceptable internal noise levels:

Internal

Living and Work Areas	$L_{Aeq(Day)}$ of 40 dB(A)
Bedrooms	$L_{Aeq(Night)}$ of 35 dB(A)

For this development, compliance with the requirements of SPP 5.4, are based on the day period for Lots located adjacent to Bussell Highway and Brockman Highway.

The results of the acoustic assessment indicate that noise received at residential Lots located adjacent to both Highways would exceed with the "Noise Targets" as outlined in SPP 5.4.

Due to the size of the lots, and that buildings can only occur in areas below the 56 dB(A) noise level contour, no noise amelioration in the form of Quiet House Design is required. However, as the lots receive noise levels in excess of 55 dB(A), notification on titles of noise associated with Bussell and Brockman Highway would be required.

Therefore, to comply with the Policy, the following options have been provided:

- Notification on titles for the Lots affected by noise greater than 55 dB(A).
- Building envelopes (setbacks) to be in areas below the 56 dB(A) noise contour.

It is noted that the LSP contains the QHD contours as notations.

APPENDIX A

DEVELOPMENT SURVEY

Indicative Road Reserve Cross-section
Hamelin Grove - Karridale

Indicative Road Reserve - Road B - Cross-section
Hamelin Grove - Karridale

Legend

- Structure Plan Area Boundary
- Residential R5
- Residential R2.5
- Rural Residential
- Public Purposes
- Commercial (KHSS)
- 30m Development Setback
- 20m Development Setback
- 10m wide Landscape Buffer
- Quiet House Design Requirements (QHD)
- Emergency Water Supply Point (W)
- Primary Treatment System Exclusion Area (Secondary Treatment Systems Required) (STS)
- POS and Drainage
- Drainage Easement
- Existing Lot No. (209)
- Dual Use Path
- Footpath

Public Open Space Schedule

Total Structure Plan Area	**87.2863ha**
Deductions	
Infrastructure	
Drainage area A (DA)	0.2320ha
Drainage area B (DB)	0.1900ha
Drainage area C (DC)	0.2600ha
Drainage area D (DD)	0.5750ha
Public Purposes	0.1081ha
Residential Areas Not Qualified	
Rural Residential Lots	10.3090ha
Total Deductions	**11.7641ha**
Gross Subdivisable Area	75.5222ha
Breakdown of POS Provided	
Restricted Public Open Space	
Total Restricted POS	0.0ha
Total Restricted POS Credited	0.0ha
Surplus Restricted POS not Credited	0.0ha
Unrestricted Public Open Space	
Sport	0.0ha
Recreation	
Playground and Picnic Areas	
POS Area A	0.0ha
POS Area B	1.7680ha
Active Informal Sports Areas	
POS Area A	0.8598ha
POS Area B	3.8995ha
Nature	
Native Vegetation with Trails/Paths	
POS Area A	1.5445ha
POS Area B	0.0ha
Total Unrestricted POS	
POS Area A	2.4043ha
POS Area B	5.6645ha
Total	8.0688ha
Public Open Space Provided	**8.0688ha**
POS Provision as a Percentage of Gross Subdivisable Area	**10.68%**

Hamelin Grove

Local Structure Plan

Bussell Highway and Brockman Highway, Karridale

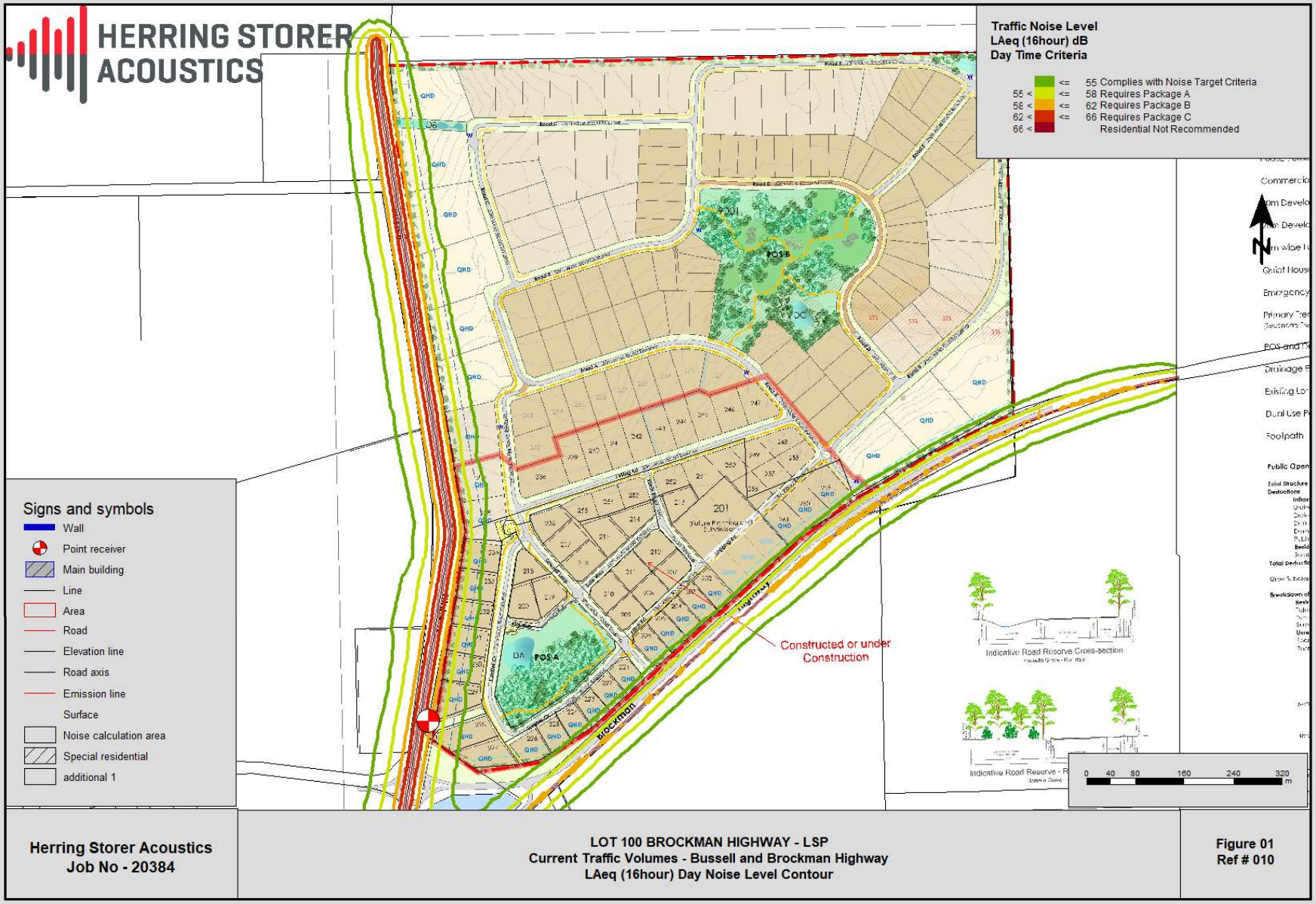
Revision | Description | Date

SHIRE of AUGUSTA MARGARET RIVER

martin richards

APPENDIX B

$L_{Aeq(16hr)}$ DAY
NOISE CONTOURS FOR BUSSELL AND BROCKMAN HIGHWAY

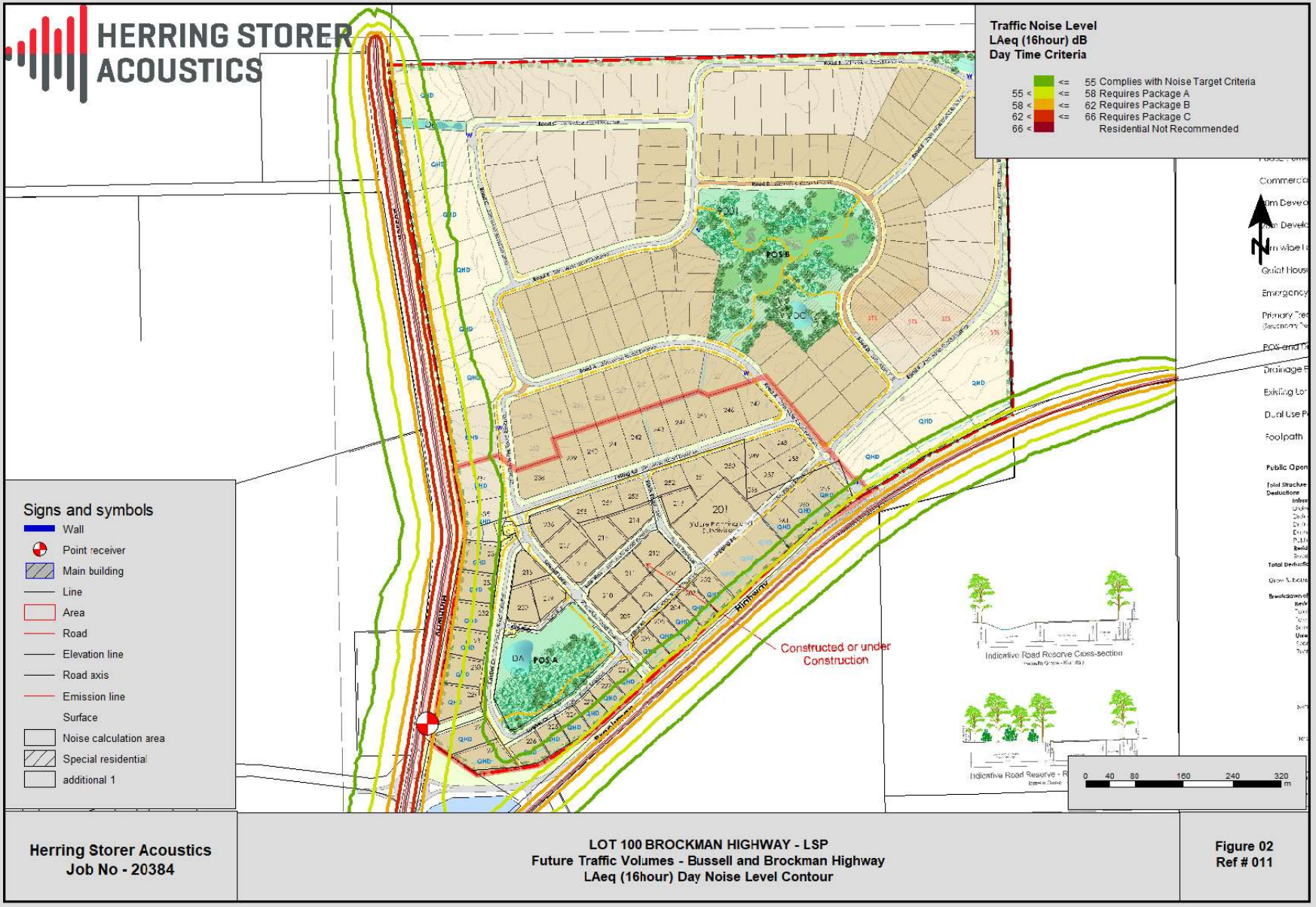


Herring Storer Acoustics
Job No - 20384

LOT 100 BROCKMAN HIGHWAY - LSP
Current Traffic Volumes - Bussell and Brockman Highway
LAeq (16hour) Day Noise Level Contour

Figure 01
Ref # 010

HERRING STORER ACOUSTICS



Herring Storer Acoustics
Job No - 20384

LOT 100 BROCKMAN HIGHWAY - LSP
Future Traffic Volumes - Bussell and Brockman Highway
LAeq (16hour) Day Noise Level Contour

Figure 02
Ref # 011

APPENDIX C

TRAFFIC FLOW VOLUMES

mainroads WESTERN AUSTRALIA

SITE 15523

Hourly Volume

Bussell Hwy (H043)

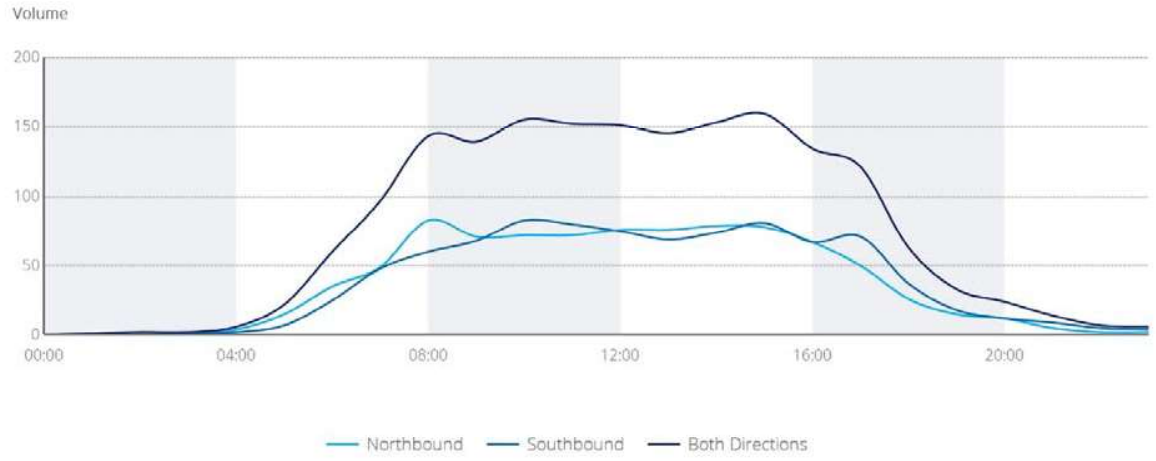
South of Chapman Rd (SLK 129.00)

2019/20
Monday to Friday

	All Vehicles			Heavy Vehicles			
	NB	SB	Both	NB	SB	Both	%
00:00	0	0	0	0	0	0	0.0
01:00	1	0	1	1	0	1	100.0
02:00	0	2	2	0	1	1	50.0
03:00	1	1	2	1	1	2	100.0
04:00	4	2	6	1	1	2	33.3
05:00	15	7	22	2	1	3	13.6
06:00	35	25	60	5	7	12	20.0
07:00	49	48	97	7	14	21	21.6
08:00	83	60	143	11	13	24	16.8
09:00	71	68	139	10	14	24	17.3
10:00	72	83	155	9	16	25	16.1
11:00	72	80	152	13	18	31	20.4
12:00	76	75	151	12	13	25	16.6
13:00	76	69	145	11	13	24	16.6
14:00	79	74	153	13	15	28	18.3
15:00	78	81	159	15	12	27	17.0
16:00	67	67	134	11	9	20	14.9
17:00	50	71	121	6	10	16	13.2
18:00	26	37	63	2	6	8	12.7
19:00	15	18	33	1	2	3	9.1
20:00	12	12	24	0	2	2	8.3
21:00	5	9	14	1	1	2	14.3
22:00	2	5	7	0	0	0	0.0
23:00	2	4	6	0	1	1	16.7
TOTAL	891	898	1789	132	170	302	16.9

Peak Statistics

AM	TIME	08:00	10:00	11:45	11:45	10:30	11:00
	VOL	83	83	157	15	18	31
PM	TIME	14:45	15:00	14:45	15:15	14:00	15:15
	VOL	86	81	166	16	15	29



mainroads WESTERN AUSTRALIA

SITE 53308

Hourly Volume

Brockman Hwy (M027)

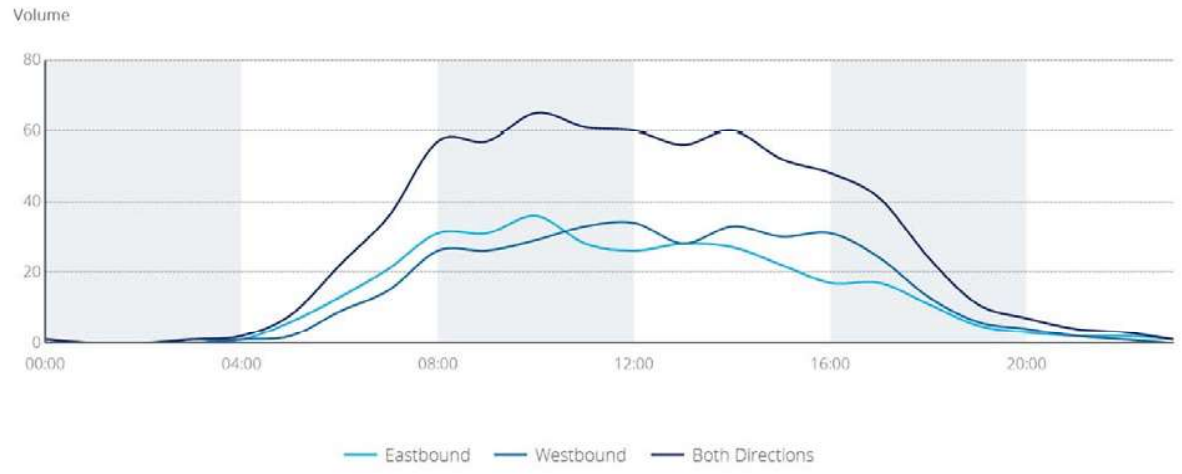
West of Clive Rd (SLK 67.31)

2020/21
Monday to Friday

	All Vehicles			Heavy Vehicles			
	EB	WB	Both	EB	WB	Both	%
00:00	1	0	1	0	0	0	0.0
01:00	0	0	0	0	0	0	0.0
02:00	0	0	0	0	0	0	0.0
03:00	1	0	1	0	0	0	0.0
04:00	1	1	2	1	1	2	100.0
05:00	6	2	8	0	0	0	0.0
06:00	13	9	22	2	4	6	27.3
07:00	21	15	36	5	4	9	25.0
08:00	31	26	57	8	7	15	26.3
09:00	31	26	57	5	8	13	22.8
10:00	36	29	65	7	8	15	23.1
11:00	28	33	61	6	11	17	27.9
12:00	26	34	60	4	10	14	23.3
13:00	28	28	56	6	7	13	23.2
14:00	27	33	60	5	8	13	21.7
15:00	22	30	52	3	8	11	21.2
16:00	17	31	48	3	6	9	18.8
17:00	17	24	41	2	5	7	17.1
18:00	11	13	24	3	3	6	25.0
19:00	5	6	11	1	1	2	18.2
20:00	3	4	7	0	0	0	0.0
21:00	2	2	4	0	0	0	0.0
22:00	2	1	3	0	0	0	0.0
23:00	1	0	1	0	0	0	0.0
TOTAL	330	347	677	61	91	152	22.5

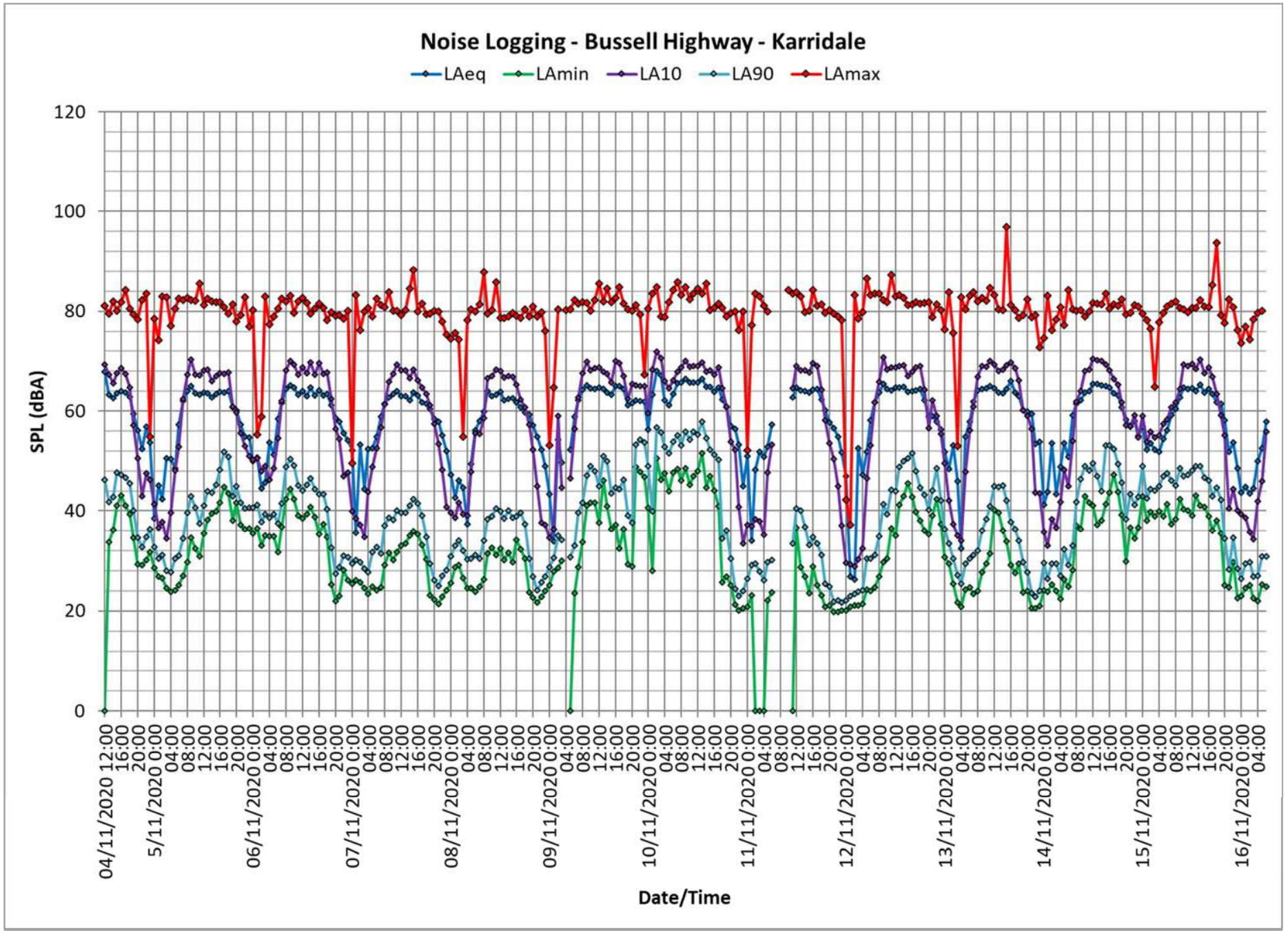
Peak Statistics

AM	TIME	09:30	11:00	09:30	07:45	11:30	10:45
	VOL	37	33	68	9	12	18
PM	TIME	13:45	12:15	12:30	13:15	12:15	12:15
	VOL	29	36	62	6	12	17



APPENDIX D

MONITIORING DATA


Noise Logging - Bussell Highway - Karridale
LAeq
LAmin
LA10
LA90
LAmax
SPL (dBA)
120
100
80
60
40
20
0
04/11/2020 12:00
16:00
20:00
5/11/2020 0:00
04:00
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04:00
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16/11/2020 0:00
04:00
Date/Time

Rochdale Holdings Pty Ltd A.B.N. 85 009 049 067 trading as:
HERRING STORER ACOUSTICS
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PROPOSED RESIDENTIAL DEVELOPMENT

Lot 100 BROCKMAN HIGHWAY, KARRIDALE

NOISE ASSESSMENT

DECEMBER 2012

OUR REFERENCE: 15528-2-12173

DOCUMENT CONTROL PAGE

NOISE ASSESSMENT
KARRIDALE

Job No: 12173

Document Reference: 15528-2-12173

FOR

JUVENTUS ATF PREVELLY DEVELOPMENT

DOCUMENT INFORMATION			
Author:	Tim Reynolds	**Checked By:**	Paul Daly
Date of Issue :	04 December 2012		

REVISION HISTORY

Revision	Description	Date	Author	Checked
1	Correction to Lot Number	05/12/12	TR	PLD

DOCUMENT DISTRIBUTION

Copy No.	Version No.	Destination	Hard Copy	Electronic Copy
1	1	Michael Swift & Associates		✓
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APPENDICES

A Development Plans

B Noise Monitoring Results

C Noise Contour Plot For Day Period

D Package A “Quiet House” Design Requirements

1. INTRODUCTION

Michael Swift and Associates on behalf of Juventus AFT Prevelly Developments commissioned Herring Storer Acoustics to carry out a road traffic noise assessment for the proposed development located at the Lot 100 Brockman Highway, Karridale.

The purpose of this assessment was to assess noise received within the development from vehicles travelling along both the Bussell and Brockman Highways and if exceedance with the stated criteria were determined, establish the required attenuation measures to control noise intrusion to acceptable levels. The traffic noise assessment has been carried out in accordance with the WAPC State Planning Policy 5.4 *"Road and Rail Transportation Noise and Freight Consideration in Land Use Planning"*.

As part of the study, the following was carried out:

- Monitor existing noise received from vehicles travelling along both Bussell and Brockman Highways.
- For future traffic flows, determine noise that would be received at residences within the development from vehicles travelling on both Bussell and Brockman Highways.
- Assess the predicted noise levels for compliance with the appropriate criteria.
- If exceedances are predicted, comment on possible noise amelioration options for compliance with the appropriate criteria.

For information, the development plan is attached in Appendix A.

2. SUMMARY

Under the Western Australian Planning Commission (WAPC) Planning Policy 5.4 *"Road and Rail Transport Noise and Freight Considerations in Land Use Planning"* (SPP5.4), we believe that the appropriate criteria for assessment for this development are as listed below for "Noise Limits".

EXTERNAL

$L_{Aeq(Day)}$ of 60 dB(A); and
$L_{Aeq(Night)}$ of 55 dB(A).

INTERNAL

$L_{Aeq(Day)}$ of 40 dB(A) in living and work areas; and
$L_{Aeq(Night)}$ of 35 dB(A) in bedrooms.

Noise received at an outdoor area should also be reduced as far as practicable, with an aim of achieving an L_{Aeq} of 50 dB(A) during the night period.

Noise received at the first row of residence along both the Bussell and Brockman Highways would, as shown by the noise contour plot attached as Figure C1 in Appendix C, comply with the Policies "Noise Limits", but would exceed the "Noise Target". Therefore, Package A "Quiet House" Design and notifications on titles are required.

For information, Package A "Quiet House" requirements are attached in Appendix D.

3. ACOUSTIC CRITERIA

3.1 WAPC PLANNING POLICY

The Western Australian Planning Commission (WAPC) released on 22 September 2009 State Planning Policy 5.4 *"Road and Rail Transport Noise and Freight Considerations In Land Use Planning"*. Section 5.3 – Noise Criteria, which outlines the acoustic criteria, states:

"5.3 - NOISE CRITERIA

Table 1 sets out the outdoor noise criteria that apply to proposals for new noise-sensitive development or new major roads and railways assessed under this policy.

These criteria do not apply to –

- *proposals for redevelopment of existing major roads or railways, which are dealt with by a separate approach as described in section 5.4.1; and*
- *proposals for new freight handling facilities, for which a separate approach is described in section 5.4.2.*

The outdoor noise criteria set out in Table 1 apply to the emission of road and rail transport noise as received at a noise-sensitive land use. These noise levels apply at the following locations—

- *for new road or rail infrastructure proposals, at 1 m from the most exposed, habitable façade of the building receiving the noise, at ground floor level only; and*
- *for new noise-sensitive development proposals, at 1 m from the most exposed, habitable façade of the proposed building, at each floor level, and within at least one outdoor living area on each residential lot.*

Further information is provided in the guidelines.

Table 1 - Outdoor Noise Criteria

Time of day	***Noise Target***	***Noise Limit***
Day (6 am–10 pm)	$L_{Aeq(Day)}$ *= 55 dB(A)*	$L_{Aeq(Day)}$ *= 60 dB(A)*
Night (10 pm–6 am)	$L_{Aeq(Night)}$ *= 50 dB(A)*	$L_{Aeq(Night)}$ *= 55 dB(A)*

The 5 dB difference between the outdoor noise target and the outdoor noise limit, as prescribed in Table 1, represents an acceptable margin for compliance. In most situations in which either the noise-sensitive land use or the major road or railway already exists, it should be practicable to achieve outdoor noise levels within this acceptable margin. In relation to greenfield sites, however, there is an expectation that the design of the proposal will be consistent with the target ultimately being achieved.

Because the range of noise amelioration measures available for implementation is dependent upon the type of proposal being considered, the application of the noise criteria will vary slightly for each different type. Policy interpretation of the criteria for each type of proposal is outlined in sections 5.3.1 and 5.3.2.

The noise criteria were developed after consideration of road and rail transport noise criteria in Australia and overseas, and after a series of case studies to

assess whether the levels were practicable. The noise criteria take into account the considerable body of research into the effects of noise on humans, particularly community annoyance, sleep disturbance, long-term effects on cardiovascular health, effects on children's learning performance, and impacts on vulnerable groups such as children and the elderly. Reference is made to the World Health Organization (WHO) recommendations for noise policies in their publications on community noise and the Night Noise Guidelines for Europe. See the policy guidelines for suggested further reading.

5.3.1 Interpretation and application for noise-sensitive development proposals

In the application of these outdoor noise criteria to new noise-sensitive developments, the objective of this policy is to achieve –

- *acceptable indoor noise levels in noise-sensitive areas (for example, bedrooms and living rooms of houses, and school classrooms); and*
- *a reasonable degree of acoustic amenity in at least one outdoor living area on each residential lot[1].*

If a noise-sensitive development takes place in an area where outdoor noise levels will meet the noise target, no further measures are required under this policy.

In areas where the noise target is likely to be exceeded, but noise levels are likely to be within the 5dB margin, mitigation measures should be implemented by the developer with a view to achieving the target levels in a least one outdoor living area on each residential lot[1]. Where indoor spaces are planned to be facing any outdoor area in the margin, noise mitigation measures should be implemented to achieve acceptable indoor noise levels in those spaces. In this case, compliance with this policy can be achieved for residential buildings through implementation of the deemed-to-comply measures detailed in the guidelines.

In areas where the outdoor noise limit is likely to be exceeded (i.e. above $L_{Aeq(Day)}$ of 60 dB(A) or $L_{Aeq(Night)}$ of 55 dB(A)), a detailed noise assessment in accordance with the guidelines should be undertaken by the developer. Customised noise mitigation measures should be implemented with a view to achieving the noise target in at least one outdoor living or recreation area on each noise-sensitive lot or, if this is not practicable, within the margin. Where indoor spaces will face outdoor areas that are above the noise limit, mitigation measures should be implemented to achieve acceptable indoor noise levels in those spaces, as specified in the following paragraphs.

For residential buildings, acceptable indoor noise levels are $L_{Aeq(Day)}$ of 40 dB(A) in living and work areas and $L_{Aeq(Night)}$ of 35 dB(A) in bedrooms[2]. For all other noise-sensitive buildings, acceptable indoor noise levels under this policy comprise noise levels that meet the recommended design sound levels in Table 1 of Australian Standard AS 2107:2000 Acoustics—Recommended design sound levels and reverberation times for building interiors.

1 For non residential noise-sensitive developments, (e.g. schools and child care centres) consideration should be given to providing a suitable outdoor area that achieves the noise target, where this is appropriate to the type of use.
2 For residential buildings, indoor noise levels are not set for utility spaces such as bathrooms. This policy encourages effective "quiet house" design, which positions these non-sensitive spaces to shield the more sensitive spaces from transport noise (see guidelines for further information).

These requirements also apply in the case of new noise-sensitive developments in the vicinity of a major transport corridor where there is no existing railway or major road (bearing in mind the policy's 15-20 year planning horizon). In these instances, the developer should engage in dialogue with the relevant infrastructure provider to develop a noise management plan to ascertain individual responsibilities, cost sharing arrangements and construction time frame.

If the policy objectives for noise-sensitive developments are not achievable, best practicable measures should be implemented, having regard to section 5.8 and the guidelines."

The Policy, under Section 5.7, also provides information regarding "Notifications on Titles".

3.2 APPROPRIATE CRITERIA

Based on the above, the following criteria are proposed for this development:

External

Day	Maximum of 60 dB(A) L_{Aeq}
Night	Maximum of 55 dB(A) L_{Aeq}
Outdoor Living Areas*	Maximum of 50 dB(A) $L_{Aeq\ (night\ period)}$

Internal

Sleeping Areas	35 dB(A) $L_{Aeq(night)}$
Living Areas	40 dB(A) $L_{Aeq(day)}$

*This is a suggested noise level; noise is to be reduced as far as practicably possible.

4. MEASUREMENTS AND OBSERVATIONS

To determine the existing acoustic environment at the proposed development, noise data loggers were deployed adjacent to both Bussell and Brockman Highways on Friday 9th November 2012. The automatic noise data logger records sound pressure levels in accordance with Australian Standard 2702-1984: *Acoustics - Method For Measurement of Road Traffic Noise.* The logger used records statistical noise level data, of which the L_{A1}, L_{A10}, L_{Aeq} and L_{A90} levels are reported. These are defined below:

L_{A1} The noise level exceeded for 1% of the time (in this instance, the noise level exceeded for 36 seconds in each 1-hour period).

L_{A10} The noise level exceeded for 10% of the time (in this instance, the noise level exceeded for 6 minutes in each 1-hour period).

L_{Aeq} The energy equivalent noise level for the 1-hour period. A single number value that expresses the time-varying sound level for the 1-hour period as though it were a constant sound level with the same total sound energy as the time-varying level.

L_{A90} The noise level exceeded for 90% of the time (in this instance, the noise level exceeded for 54 minutes in each 1-hour period).

The loggers were located as shown on the site plan attached in Appendix A. The loggers were calibrated before and after the measurement period and have been subject to a laboratory calibration within the last 24 months.

The results of the noise logging are summarised in Tables 4.1 and 4.2. The results are also shown graphically on Figures B1 and B2, attached in Appendix B.

TABLE 4.1 - SUMMARY OF MEASURED NOISE LEVELS (BUSSELL HWY)

Parameter	Measured Level dB(A)*	Difference between $L_{10(18hour)}$ and $L_{Aeq(parameter)}$ dB(A)
$L_{A10\ (18\ hour)}$	57.3	N/A
$L_{Aeq,\ day\ (6am\ to\ 10pm)}$	63.3	= $L_{A10\ (18\ hour)}$ + 6.0
$L_{Aeq,\ night\ (10pm\ to\ 6am)}$	51.9	= $L_{A10(18\ hour)}$ - 5.4

* It is normal practice to quote decibels to the nearest whole number. Fractions are retained here to minimise any cumulative rounding error.

TABLE 4.2 - SUMMARY OF MEASURED NOISE LEVELS (BROCKMAN HWY)

Parameter	Measured Level dB(A)*	Difference between $L_{10(18hour)}$ and $L_{Aeq(parameter)}$ dB(A)
$L_{A10\ (18\ hour)}$	50.0	N/A
$L_{Aeq,\ day\ (6am\ to\ 10pm)}$	59.0	= $L_{A10\ (18\ hour)}$ + 9.0
$L_{Aeq,\ night\ (10pm\ to\ 6am)}$	42.2	= $L_{A10(18\ hour)}$ - 7.8

* It is normal practice to quote decibels to the nearest whole number. Fractions are retained here to minimise any cumulative rounding error.

5. METHODOLOGY

Modelling of noise received within the subdivision from Bussell and Brockman Highways was carried out using SoundPlan, using the Calculation of Road Traffic Noise (CoRTN) algorithms. The input data for the model included:

- Increased traffic volume, assuming 2% growth over 20 years.
- Other traffic data as listed in Table 4.1.
- A +2.5 dB adjustment to allow for façade reflection.

The traffic data currently available on the Main Roads web site are as listed in Table 5.1. Table 5.1 also lists the percentage heavy vehicles and the calculated future traffic flows (15 years from now).

TABLE 5.1 - SUMMARY OF TRAFFIC DATA

Parameter	Bussell Highway	Brockman Highway
Current Traffic Flow (vpd)	1800	580
Future Traffic Flow (vpd)	2670	860
Percentage Heavy Vehicles (%)	10.5	11.8

For the noise modeling for future traffic it has been assumed that the percentage of future heavy vehicles remains the same as for the current traffic flows. In this case, we believe that this is a conservative approach, as we believe that the percentage of heavy vehicles would fall over time.

6. CALIBRATION OF TRAFFIC NOISE LEVELS

Based on the existing traffic volumes detailed in Section 5 and the current road alignment, the existing traffic noise levels have been calculated to verify the prediction model and calibrated to correlate with the monitored noise levels. Calculations are free field as the noise logger was located away from any building façades. The SoundPlan computer model was calibrated with the monitored data as listed in Table 4.1.

7. PREDICTED FUTURE NOISE LEVELS

We note that for both Bussell and Brockman Highways, as the difference between the $L_{Aeq,16hr}$ and the $L_{Aeq,8hr}$ being greater than 5 dB(A), achieving compliance with the day period criteria will also result in achieving compliance with the night period criteria. Therefore, noise modelling was carried out for the day period only and the results are shown on Figure C1 in Appendix C.

8. ASSESSMENT

In accordance with the WAPC Planning Policy 5.4, an assessment of the noise that would be received within the development located at Lot 100 Brockman Highway, Karridale, from vehicles travelling on both Bussell and Brockman Highways has been undertaken.

In accordance with the Policy, the following would be the acoustic criteria applicable to this project:

External

Day	Maximum of 60 dB(A) L_{Aeq}
Night	Maximum of 55 dB(A) L_{Aeq}
Outdoor Living Areas (Night)	Maximum of 50 dB(A) L_{Aeq}

Internal

Sleeping Areas	35 dB(A) $L_{Aeq(night)}$
Living Areas	40 dB(A) $L_{Aeq(day)}$

Noise received at the first row of residence along both the Bussell and Brockman Highways would, as shown by the noise contour plot attached as Figure C1 in Appendix C, comply with the Policies "Noise Limits", but would exceed the "Noise Target". Given the location of the development, we believe that the use of “Quiet House” design would be the preferred noise amelioration option and the construction of a noise barrier is not recommended. Therefore, "Quiet House" Design and notifications on titles are required. For the first row of residence along both Bussell and Brockman Highways, "Quiet House" design by way of Package A, as outlined in the Implementation Guidelines, for both the ground floor and first storeys, would be required.

Under SPP 5.4, notification on titles are also required for the first row of residence along both Bussell and Brockman Highways.

An example of a suitable notice, as provided within the Guidelines is:

> *This lot is situated in the vicinity of either or both Bussell and Brockman Highways and is currently affected, and / or may in the future be affected by transport noise.*

Notes:

1 Alternative constructions to those listed for “Quiet House” Package A are acceptable, provided they are assessed and a report submitted by a suitably qualified acoustic consultant. For Information, Package A requirements are attached in Appendix D.

APPENDIX A

DEVELOPMENT PLAN

Structure Plan Conditions

General

1. This structure plan provides a framework for future subdivision and development of the subject land.

2. This Structure Plan is to be read in conjunction with Schedule 15 of the Shire of Augusta-Margaret River Local Planning Scheme No. 1.

3. Key environmental management issues shall be addressed as follows:
   - Landscaping and vegetation protection within the Public Open Space and highway buffer areas shall be addressed in a Landscape Management Plan prepared as a condition of subdivision to the satisfaction of Council;
   - Measures to ensure the identification, protection and long term management of stands of remnant vegetation shall be addressed by way of a condition in the Structure Plan;
   - Measures to ensure appropriate management of weeds and the spread of dieback shall be addresses in the Landscape Management Plan prepared as a condition of subdivision to the satisfaction of Council;
   - Protection of water quality to be addressed by way of implementation of the Local Water Management Strategy that has been prepared to accompany this Structure Plan at the detailed engineering design stage.

4. A detailed Developer Contributions Plan shall be prepared and implemented in accordance with the Karridale Hamlet Settlement Strategy. The subdivider is to contribute proportionately with other subdividers within Karridale Hamlet in accordance with that Plan for the provision of local amenities and facilities required as a consequence of the new development.

Subdivision

5. As a condition of subdivision a Landscape Management Plan is to be prepared to the satisfaction of the Shire to address the landscape treatment of proposed buffers, creekline rehabilitation areas and open space. Any such plan is to include the use of local endemic species that occur within the relevant vegetation complexes and soil types across the Structure Plan and demonstrate ssufficient planting to meet the buffering requirements identified on the Structure Plan.

6. As a condition of subdivision the Fire Management Plan prepared to accompany this Structure Plan is to be implemented to the satisfaction of Council and all development shall comply with this plan including, in nominated areas, the construction of dwellings in accordance with AS3959.

7. As a condition of subdivision, the subdivider shall place a Section 70A (Transfer of Land Act 1893) notification on the Certificate(s) of Title advising landowners of their obligations under the approved Fire Management Plan .

8. As a condition of subdivision, Design Guidelines to apply to all lots comprising less than 5000m² shall be prepared to the satisfaction of Council and all subsequent development shall in accordance with the approved Design Guidelines.

9. As a condition of subdivision the subdivider shall place a Section 70A (Transfer of Land Act 1893) notification on the Certificate(s) of Title advising prospective purchasers of the existence of Design Guidelines and the need to comply.

10. As a condition of subdivision covenants and Memorials on Titles will be placed on lots adjoining Bussell Highway and Brockman Highway to require that dwellings be constructed to Quiet House Design standards and to alert purchasers to the exposure to traffic noise.

Development

11. Clearing of any land within the Structure Plan area is prohibited expect where it is necessary to:
    a) Develop within applicable building envelopes;
    b) Gain vehicle access to the lots;
    c) Comply with the Bush Fire Act 1954 and the endorsed Fire Management Plan;
    d) Remove trees that are dead, diseased or dangerous;
    e) Construct dwellings and outbuildings to provide sufficient protection for those buildings at risk from bushfire;
    f) Harvest the tree plantation in the north east of the Structure Plan area preliminary to subdivision; and
    g) Implement endorsed drainage and open space development within reserves.

12. Onsite water supply provision within the Structure Plan area shall be by rain water catchment tanks in accordance with clause 5.22 of Local Planning Scheme No. 1.

13. Notwithstanding any other provision of Local Planning Scheme No.1, the disposal of liquid and solid waste shall be carried out with the Structure Plan area by the installation of sewerage disposal systems to the satisfaction of the Local Government subject to:
    a) Aerobic treatment units and effluent disposal systems or alternative effluent and disposal systems, capable of minimizing phosphorous movement from each lot shall be installed to provide treatment and disposal of effluent waste water.
    b) A minimum separation of 50m is to be retained between effluent waste water disposal sites and perennial water courses.
    c) Grey water disposal and waste water reuse systems are to be installed to the satisfaction of the local government and the Department of Health.

14. Notwithstanding the Zoning Table and land use definitions within Schedule 1 in the Local Planning Scheme No. 1 the following variations apply to the Structure Plan area:
    a) Home Business is permitted to be carried out ancillary to an existing dwelling in a separate building.
    b) Within the Village Consolidation Precinct the following additional 'A' uses are permissible as separate buildings ancillary to an existing dwelling within the R10 Residential zone:
       - Art and Craft Centre
       - Consulting Rooms
    c) Within the Rural Residential Precinct, Home-based Trade is permitted as an 'A' use in accordance with the following definition:

Home Based Trade means a business, service or profession carried out in a dwelling or separate building or on land around a dwelling by an occupier of the dwelling which:
   i. is located on a property greater than 1.0ha;
   ii. Does not employ more than 2 people not members of the occupiers household;
   iii. Will not cause injury to or adversely affect the amenity of the neighbourhood;
   iv. Does not occupy an area greater than 200 square metres;
   v. Does not involve the retail sale, display or hire of goods of any nature;
   vi. In relation to vehicles and parking, does not result in traffic difficulties as a result of the inadequacy of parking or an increase in traffic in the neighbourhood;
   vii. Does not involve the use of an essential service of greater capacity than normally required in the zone;
   viii. Does not involve the parking or storing of freezer/refrigerated type vehicles that require the cooling system to be operational;
   ix. Does not involve the paring of more than one truck for each employee/employer with a total of more than two trucks at any one time.

ADOPTED BY RESOLUTION OF THE SHIRE OF AUGUSTA - MARGARET RIVER
PRESIDENT OF SHIRE OF AUGUSTA - MARGARET RIVER _____ DATE_____
CEO OF SHIRE OF AUGUSTA - MARGARET RIVER _____ DATE_____

STRUCTURE PLAN

Lot 101 Brockman Highway, Karridale
Shire of Augusta - Margaret River

0m 100m 200m
Scale 1:4000 @ A2

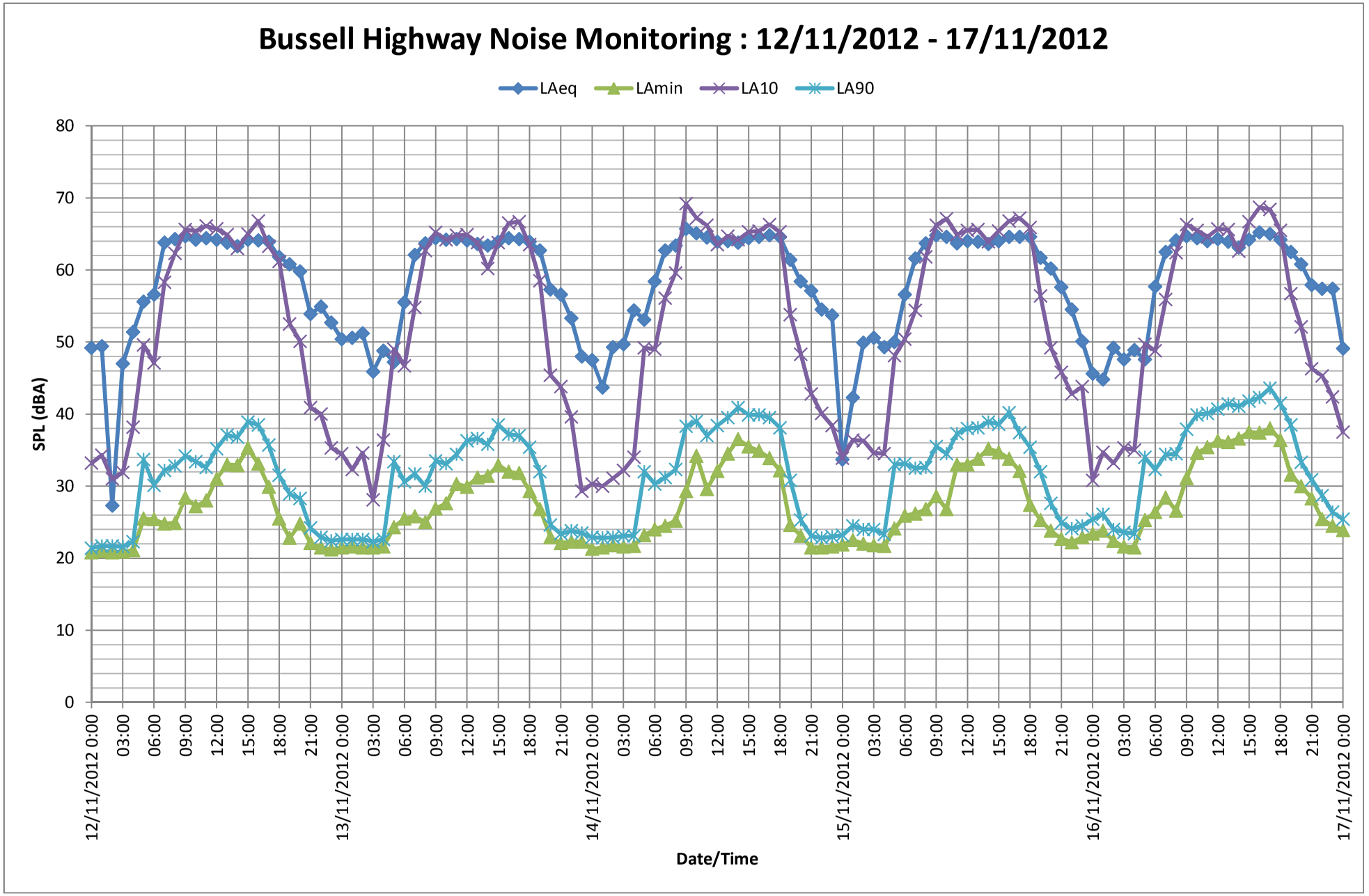
michaelSWIFT & associates + town planners

JOB 012 009B Date - (04.12.12)

This plan is subject to detail design and survey. For illustrative purposes only.

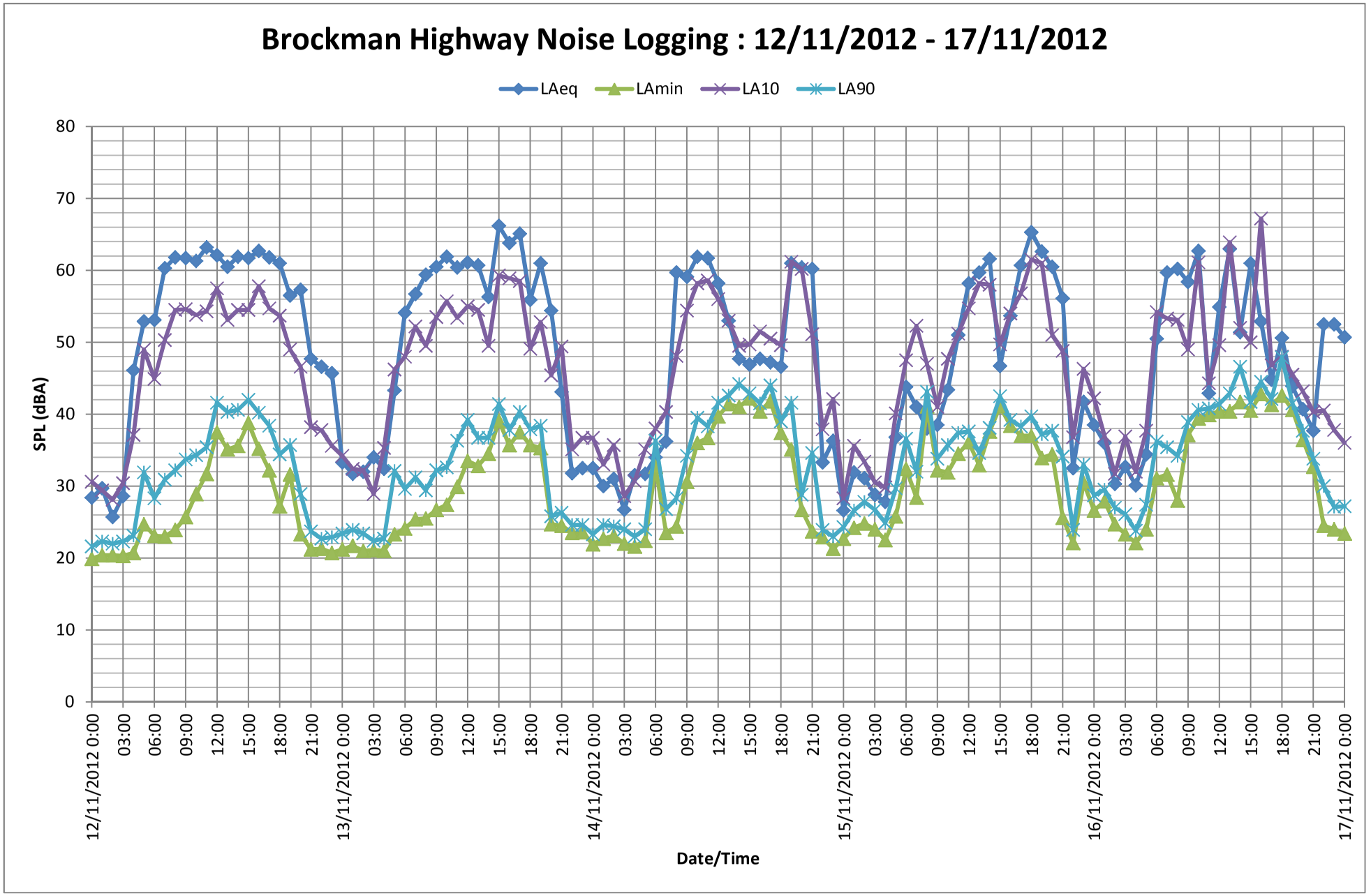
APPENDIX B

NOISE MONITORING RESULTS



Herring Storer Acoustics
Job No : 12173

Figure B1
Appendix B

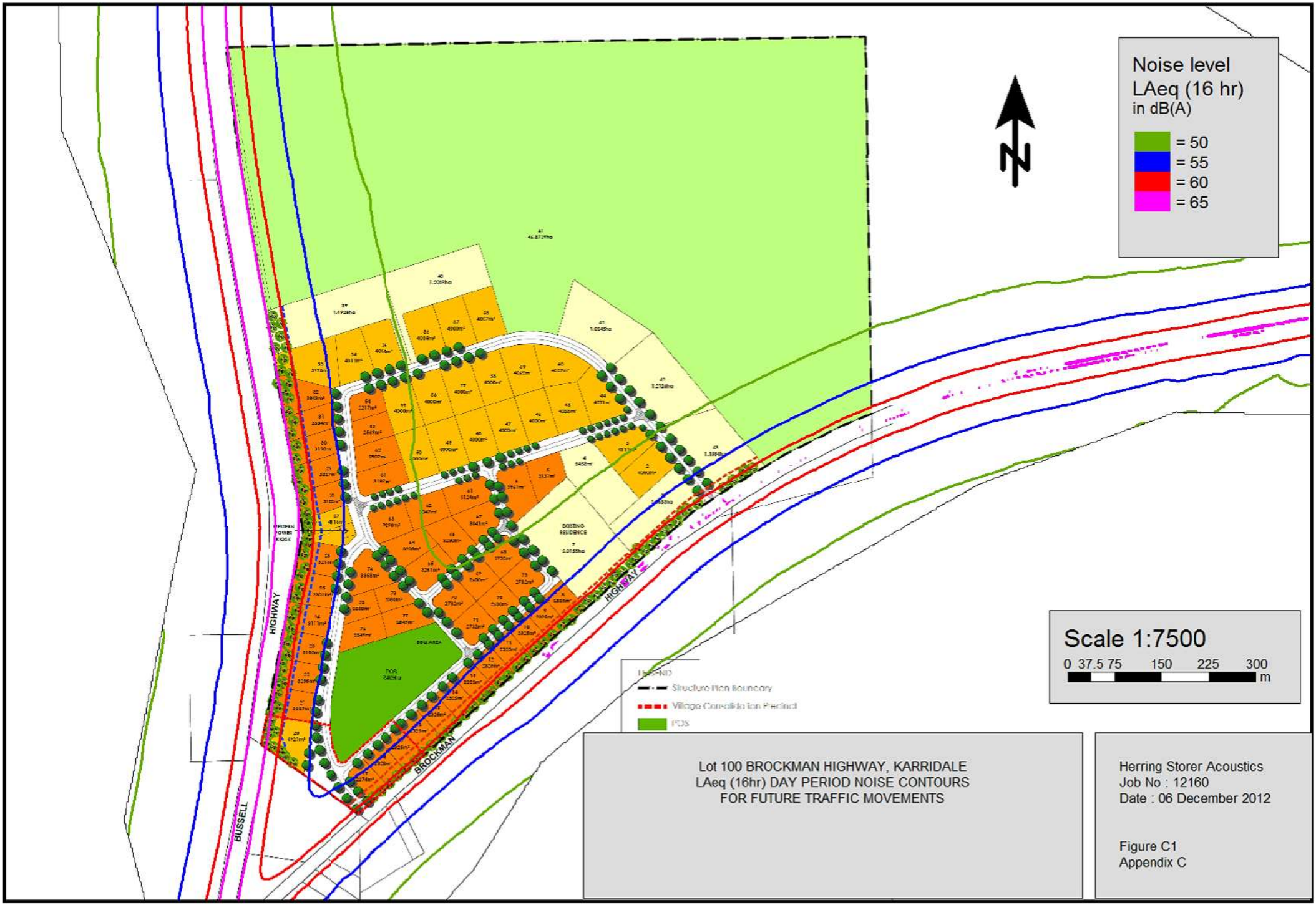


Herring Storer Acoustics
Job No : 12173

Figure B2
Appendix B

APPENDIX C

NOISE CONTOUR PLOT
FOR DAY PERIOD


Noise level
LAeq (16 hr)
in dB(A)
= 50
= 55
= 60
= 65
N
Scale 1:7500
0 37.5 75 150 225 300
m
HIGHWAY
BUSSELL
BROCKMAN
HIGHWAY
EXISTING RESIDENCE
BBQ AREA
POS
Structure Plan Boundary
Village Consolidation Precinct
POS
Lot 100 BROCKMAN HIGHWAY, KARRIDALE
LAeq (16hr) DAY PERIOD NOISE CONTOURS
FOR FUTURE TRAFFIC MOVEMENTS
Herring Storer Acoustics
Job No : 12160
Date : 06 December 2012
Figure C1
Appendix C

APPENDIX D

PACKAGE A “QUIET HOUSE”
DESIGN REQUIREMENTS

4.4.2 Other design considerations

Care needs to be taken with the integration of the foregoing measures with other design requirements to ensure that safety, functionality and energy efficiency are not compromised in the pursuit of noise reduction. For example, designs with climate requirements may suggest a need for the location of living areas and/or orientation of openings that are not conducive to noise amelioration. In such circumstances, additional measures may be necessary to provide a satisfactory level of noise reduction, or it may be necessary to accept some compromise in relation to either or both of the conflicting design requirements.

In cases in which new living and sleeping areas are to be located in close proximity to a railway or major road, consideration also needs to be given to reducing the maximum passby noise levels, in addition to the "average" L_{Aeq} noise levels, to acceptable levels. This may be done in consultation with the Department of Environment and Conservation.

4.5 Noise insulation – "deemed to comply" packages for residential development

The following "deemed-to-comply" packages outline noise insulation measures designed to ensure that the indoor noise standards in the policy are achieved for residential developments in areas where outdoor noise levels will exceed the "target" noise levels by up to 8dB(A). These packages have been designed for developments adjacent to major roads and passenger railways, where noise levels are likely to be higher during the day than at night. In the case of freight rail, where noise levels are likely to be fairly constant over the 24-hour period, these packages can be adapted. See section 4.8 of the guidelines for guidance on developments adjacent to freight railways.

The deemed-to-comply specifications are intended to simplify compliance with the noise criteria, and the relevant package should be required as a condition of development. However, this should not remove the option to pursue alternative measures or designs. Departures from the deemed-to-comply specifications need to be accompanied by acoustic certification from a competent person, to the effect that the development will achieve the requirements of the policy.

Superior construction standards, such as those specified in the deemed-to-comply packages, are now becoming more prevalent in residential buildings; and they do not significantly increase the cost of building. A similar standard of construction has been recommended by the Western Australian Planning Commission for new housing in areas forecast to be seriously affected by aircraft noise.[4] That recommendation followed a comprehensive assessment of the efficacy and costs of noise attenuation measures, taking into account the recent changes in industry building standards as well as changes to the *Building Code of Australia*.

Where transport noise levels are more than 8dB above the noise "target", i.e. 3dB above the noise "limit", or where noise-sensitive development other than residential is proposed, a detailed assessment should be prepared by a competent person. The report should specify the level of noise reduction required and the noise insulation measures needed to comply with the policy. The approval may require that the construction drawings be checked for compliance with the detailed assessment, and that follow-up verification be carried out to certify compliance.

[4] Statement of Planning Policy No 5.1, *Land Use Planning in the Vicinity of Perth Airport* and the accompanying report on *Aircraft Noise Insulation for Residential Development in the Vicinity of Perth Airport,* February 2004.

4.5.1 Package A: noise levels within the "margin"

The following noise insulation package (Table 8) is designed to meet the indoor noise standards for residential developments in areas adjacent to major roads or passenger railways where noise levels exceed the noise "target" but are within the "limit".

Table 8

Area type	Orientation	Package A measures
Indoors		
Bedrooms	Facing road/rail corridor	• 6 mm laminated glazing • Casement or awning windows • No external doors • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning (see 4.5.3)
	Side-on to corridor	• 6 mm laminated glazing • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Living and work areas[5]	Facing corridor	• 6 mm laminated glazing • Casement or awning windows • 35 mm (minimum) solid core external doors with acoustic seals[6] • Sliding doors must be fitted with acoustic seals • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning
	Side-on to corridor	• 6 mm glazing • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Other indoor areas	Any	No requirements
Outdoors		

[5] These deemed-to-comply guidelines adopt the definitions of indoor spaces used in AS 2107-2000. A comparable description for bedrooms, living and work areas is that defined by the Building Guide of Australia as a "habitable room". The Building Guide of Australia may be referenced if greater clarity is needed. A living or work area can be taken to mean any "habitable room" other than a bedroom. Note that there are no noise insulation requirements for utility areas such as bathrooms. The Building Guide of Australia describes these utility spaces as "non-habitable rooms".

[6] Glazing panels are acceptable in external doors facing the transport corridor. However these must meet the minimum glazing requirements.

Outdoor living area[7]	Facing corridor	• Minimum 2.0 m high solid fence (e.g. Hardifence, pinelap, or Colorbond) • Picket fences are not acceptable
	Side-on to corridor	
	Away from corridor	No requirements

4.5.2 Package B: noise within 3dB above the "limit"

The following noise insulation package (Table 9) is designed to meet the indoor noise standards for residential developments in areas adjacent to major roads or passenger railways where transport noise levels exceed the noise "limit" but by no more than 3dB (See Table 1 in policy).

Table 9

Area type	Orientation	Package B measures
Indoors		
Bedrooms	Facing road/rail corridor	• 10 mm laminated glazing • Casement or awning windows • No external doors • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning (see 4.5.3)
	Side-on to corridor	• 6 mm laminated glazing • Casement or awning windows • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Living and work areas[8]	Facing corridor	• 10 mm laminated glazing • Casement or awning windows • 40 mm (minimum) solid core external doors with acoustic seals[9] • Sliding doors must be fitted with acoustic seals • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning

[7] The Policy requires that at least one outdoor living area be reasonably protected from transport noise. The protected area should meet the minimum space requirements for outdoor living areas, as defined in the Residential Design Codes of Western Australia.

[8] These deemed-to-comply guidelines adopt the definitions of indoor spaces used in AS 2107-2000. A comparable description for bedrooms, living and work areas is that defined by the Building Guide of Australia as a "habitable room". The Building Guide of Australia may be referenced if greater clarity is needed. A living or work area can be taken to mean any "habitable room" other than a bedroom. Note that there are no noise insulation requirements for utility areas such as bathrooms. The Building Guide of Australia describes these utility spaces as "non-habitable rooms".

[9] Glazing panels are acceptable in external doors facing the transport corridor. However these must meet the minimum glazing requirements.

	Side-on to corridor	• 6 mm laminated glazing • Casement or awning windows • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Other indoor areas	Any	No requirements
Outdoors		
Outdoor living area[10]	Facing corridor	• Minimum 2.4 m solid fence (e.g. brick, limestone or Hardifence) • Colorbond and picket fences are not acceptable
	Side-on to corridor	
	Away from corridor	No requirements

4.5.3 Mechanical ventilation/airconditioning

Where outdoor noise levels are above the "target", both packages A and B require mechanical ventilation or airconditioning to ensure that windows can remain closed in order to achieve the indoor noise standards.

In implementing packages A and B, the following need to be observed:

- Evaporative airconditioning systems will meet the requirements for packages A and B provided attenuated air vents are provided in the ceiling space. Without such vents, these systems require windows to remain open.
- Refrigerative airconditioning systems need to be designed to achieve fresh air ventilation requirements.
- Air inlets need to be positioned facing away from the corridor where practicable.
- Ductwork needs to be provided with adequate silencing, particularly in higher noise areas, to prevent noise intrusion.

4.6 Reasonable and practicable considerations

The policy requires consideration and implementation of all "reasonable" and "practicable" noise mitigation measures to achieve the noise target and acceptable indoor noise levels. Where it can be demonstrated that it is neither practicable nor reasonable to reduce noise levels to the noise target, then higher noise levels may be acceptable, but longer term noise management strategies may need to be considered.

"Practicable" considerations for the purposes of the policy normally relate to the engineering aspects of the noise mitigation measures under evaluation. These may include:

- limitations of the different mitigation measures to reduce transport noise;
- safety issues (such as impact on crash zones or restrictions on road vision);

[10] The Policy requires that at least one outdoor living area be reasonably protected from transport noise. The protected area should meet the minimum space requirements for outdoor living areas, as defined in the Residential Design Codes of Western Australia.

- topography and site constraints (such as space limitations);
- drainage requirements;
- access requirements (for driveways, pedestrian access etc);
- maintenance requirements; and
- suitability of the building for acoustic treatments.

For example, if there is insufficient space between a road and a residence then it would not practicable to build an earth bund as a noise mitigation measure, given the technical requirements for the bund to be built at a certain slope.

See also the definition of "practicable" in the *Environmental Protection Act 1986*[11].

"Reasonableness" considerations, for the purposes of the policy, would be based on understanding and balancing a range of factors, and then agreeing on the best overall outcome, taking a triple bottom line approach to the assessment of these factors.

A judgment about whether a noise mitigation measure is reasonable might include a consideration of:

- the noise reduction benefit provided;
- the number of people protected;
- the cost of mitigation;
- existing and future noise levels, including changes in noise levels;
- community views and impacts;
- aesthetic and visual impacts;
- compatibility with other planning policies;
- differences between metropolitan and regional situations; and
- the benefits arising from the proposed development.

The purpose of considering "reasonableness" concerns is to achieve the best balanced outcome with respect to noise abatement. Assessment should involve careful and thorough consideration of a wide range of factors, not just one criterion. The assessment should identify the social, economic and environmental aspects of the benefits, and the disbenefits of implementing the noise mitigation measure. In some cases it may be helpful to quantify performance against each factor, thereby enabling a more objective decision to be made.

An assessment of reasonableness should also clearly demonstrate that efforts have been made to resolve conflicts, without compromising on the need to protect noise amenity. For example, if residents are concerned about the height of a transport noise barrier, have reasonable efforts been made to design, relocate or vegetate the barrier to address these concerns?

It is preferable that reasonableness arguments be presented in triple bottom line terms. For instance, rather than arguing that a transport noise barrier should not be built because residents want their views to be retained, "reasonableness" considerations would cause an investigation into the cost of building a transparent barrier, which would enable residents' views to be retained and their noise

[11] "Practicable" is defined in the *Environmental Protection Act 1986* to mean "reasonably practicable having regard to, among other things, local conditions and circumstances (including costs) and to the current state of technical knowledge".

amenity to be protected. In another case, the benefits of differing noise mitigation options could be compared by calculating the cost per unit of noise reduction provided by the barrier ($/dB), or the cost per residence ($/residence), or a combination of these ($/dB/residence).

Effective community consultation is critical in noise mitigation planning, and should be considered a vital element in any reasonableness assessment where it is proposed that residual noise impacts will remain even after the application of appropriate noise mitigation measures. This principle applies to developers, who should consult with local government, existing residents and road/rail authorities, and to new transport infrastructure providers, with a responsibility to engage with impacted residents and the local government. Stakeholders should be able to participate in the selection of the most appropriate noise mitigation option in an open, equitable and effective way.

Any case outlining reasonable and practicable considerations must be justifiable and so should be well documented. A submission outlining the reasonable and practicable considerations should help to facilitate a determination on the matter and should assist in communicating that decision to the community in a transparent way.

Example of rural highway project:

A new highway is being constructed to link two large regional centres. A detailed assessment indicates that noise levels will exceed the noise ”limit” at distances of up to 100 m from the road, and that noise amelioration measures will be needed at existing residences.

Where the road passes alongside a built-up area on the outskirts of one of the centres, the infrastructure provider decides to use an open graded asphalt road surface instead of chip seal, as a practicable measure to achieve an initial noise reduction. A noise barrier is identified as a further practicable measure. To achieve the noise “limit” will require a barrier of height 1.5 m, while achieving the “target” will require a barrier height of 4.5 m. A “reasonable” barrier height of 3 m is negotiated through consultation with the stakeholders. This barrier is predicted to achieve a noise level $L_{Aeq\ (Day)}$ of 57dB(A), which is accepted as being within the “margin”, while preserving some views.

As the road passes out from the built-up areas into semi-rural areas, the economics of the quieter road surface and noise barrier are less attractive, and the infrastructure provider considers alternatives. In this area there are about 10 houses per kilometre. Based on a cost of about $0.5m per kilometre for a limestone blockwork wall, the cost per house for the barrier option is $50 000 per house. By comparison, the cost of noise insulation of the individual houses is $15 000 per house, for upgrading of the window glazing and some doors; providing ducted evaporative airconditioning; and erecting some local outdoor privacy walls around the entertaining areas. Following consultation, the residents accept the offer of noise insulation.

The infrastructure provider documents the various noise amelioration measures for the built-up area and the semi-rural area in the noise management plan for the project.

4.7 Noise management plan

Having received a detailed noise assessment report and considered reasonable and practicable mitigation measures, the developer or infrastructure provider would normally prepare a comprehensive noise management plan to outline their commitments in relation to noise mitigation and management.

Local Structure Plan

APPENDIX H
SUSTAINABILITY INITIATIVES IMPLEMENTATION FRAMEWORK

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Sustainability Initiatives and Implementations Framework						
Sustainability Pillar	Sustainability Element	Objective	Details	Responsible body for implementation	Responsible body for long-term management	Outcomes/ implementation
Environment	Water use	Water self sufficiency	Use rainwater tanks for all water uses within the house	Landowner/Council	Landowner	Rainwater tanks required by local planning scheme and mandated in building approvals
				Developer/Landowner	Landowner/Council	Developer will provide information on grey water reuse and will consider mandating their use by covenant subject to affordability considerations at time of subdivison. Systems have to be compliant with Department of Health regulations
			Treated wastewater used for subsurface irrigation of non-food plants within designated disposal area	Landowner	Landowner/Council	Key areas of each lot identified as designated effluent disposal areas. Council monitors system maintenance
			Streetscape and POS partly watered by stormwater runoff	Developer	Council	Bioretention gardens fed by stormwater infiltrates into the soil profile for use by deep rooted plants
		Improved water use efficiency	Low water use plants (i.e native and endemic species) and lawns through waterwise landscaping rebate	Developer and Landowner	Landowner	Developer to partly provide and to encourage lot owners to establish waterwise gardens
			Focus on water use plants (i.e native and endemic species) used for landscaping areas	Developer	Council	Landscaping utilises low water use and native species with efficient irrigation methods
			Landscaping areas to be planted after first winter rains where possible to aid in establishment and decrease need for supplementary watering	Developer	N/A	Incorporated into landscaping program
			Use of mulch in all landscaping areas to retain moisture and provide nutrients to aid plant growth	Developer	Council	Incorporated into landscaping program
			Water efficient fittings and appliances mandated within private lots	Developer/Landowner	Landowner	Developer imposes covenants to require five star water efficient fixtures to be installed in all

						dwellings as per building standards
		Management of water quality	Application of water sensitive urban design throughout subdivision	Developer	Council	Undertaken as part of future water management planning (through LWMS) and site construction
			Minimal fertiliser and low water soluble fertiliser applied to landscaping areas and private gardens	Developer and Landowner	Council and Landowner	Plants with local fertilizer requirements utilised and supported with nutrient wise gardening information and landscaping nutrient management criteria
			Use soil amendments throughout landscaping areas to reduce nutrient seepage to groundwater	Developer	N/A	Soil amendments incorporated as part of site works where required
			Controls on land uses to minimise nutrient loading within private lots	Developer and Council	Landowner	Achieved through provisions for permissible land uses and guidance provided to landowners
			Erosion control during site development	Developer	N/A	Control sediment runoff during subdivision construction utilising such techniques as sediment curtains, sediment traps, hydromulch.
			Erosion control during house construction	Council and Builder	N/A	Encourage use of builders who are green star accredited. Provide builders and landowners with information that states that they must control sediment runoff.
			All wastewater treatment systems to incorporate nutrient stripping/absorbing methods	Landowner/ Council	Landowner	Controlled through building approvals
	Energy	Reduce usage of energy from non-renewable sources	Mandate installation of grid connected photovoltaics on each residence to meet part of dwelling demand	Developer/Landowner	Landowner	Developer imposes requirement for specified minimum solar energy harvesting by covenant. Landowners are provided information on the types and function of photovoltaic cells and their benefits, and required

						to install and maintain systems.
			Encourage installation of gas boosted solar hot/heat pump water heating	Developer/ Landowner/ Council	Landowner	Developer to provide information regarding benefits of solar hot water systems and stipulated through building approvals
		Reduced use of energy	Solar passive/ energy efficient housing to be encouraged through building guidelines and 6 star minimum requirements	Developer/ Landowner/ Builder	-	Houses to meet relevant Australian Building guidelines. Houses to meet local Design Guidelines including solar orientation
			Lots are large enough to accommodate houses which align their axis to provide for effective solar orientation	Developer/ Landowner/ WAPC/ Council	Council	Subdivision layout and Local Area Plans set the framework for maximising the preferred solar orientation. Council to analyse suitability of building design for solar orientation.
			Energy efficient lighting to be used within public realm i.e. street verge	Developer	Council	Lighting to minimise energy costs and light pollution
	Biodiversity	Enhancement of local biodiversity values	Maximise the use of native plant species in private gardens by providing awareness raising material and incentives	Developer / Landowner	Landowner	Achieved through Local Area Plan / landscaping guidelines
			Use native species where ever possible in landscaping areas and streetscapes to assist with fauna habitat and movement	Developer	Council	Outlined within Local Area Plan / landscaping guidelines
			Rehabilitation with POS area and revegetation within selected areas	Developer	Council	Outlined within Local Area Plan / landscaping guidelines
			Protect and enhance existing vegetation through incorporation into POS areas and strategic placement of building envelopes	Developer	Council	Outlined within Local Area Plan / landscaping guidelines and building approvals
			Revegetation of a green buffer / corridor along Brockman and Bussell Highway to enhance screening of development and habitat linkages	Developer	Landowner/Council	Planted as part of subdivisional works and managed through Local Area Plan / landscaping guidelines
	Landform	Retain significant/ natural local landforms	Retain on site landforms through structure plan design. Encourage stumped house design and similar	Developer	Council	Minimal earthworks to be undertaken and layout designed to respond to local landforms.

			techniques to reduce retaining walls.			Design guidelines.
	Waste	Clean building sites	Contain waste on site in approved manner until disposed of correctly	Builder/Council	N/A	Builders to maintain clean building sites to prevent sediment and rubbish movement. Council to enforce
			Contain all site construction waste as part of development in approved manner and recycle or reuse material where ever possible	Developer/Council	N/A	Subdivision works include dust and sediment control mechanisms. Enforced by Council
			Demolish and remove existing buildings and recycle/reuse material where ever possible.	Developer	N/A	Undertaken as part of subdivisional works
Social	Visual/ Landscape amenity	Incorporation of native species	Landscaped areas and gardens reflect the ecological integrity of the site and surrounding area	Developer	Council	Developer to maximise the retention of existing vegetation in POS areas. Native and endemic species to be used in landscaping areas. Landowners encouraged to plant native and endemic species.
	Local community development	Community garden/ market site	Community garden incorporated into landscaping/ POS areas to cater for productive plantings	Developer	Council/ Community	Implemented as part of subdivisional work with the potential for the community to take some responsibility for the site.
	Travel	Roads are safe and attractive	Road reserves are both safe and visually attractive to encourage walking and cycling while minimising potential for accidents.	Developer	Council	Road verges planted with appropriate species. Road design and edge treatments meet safety standards.
		Dual use paths provided	Provide paths suitable for cycling and walking with structure plan area which link to existing or future path network	Developer	Council	Developer to provide roads, dual use paths that allow people to move through the structure plan area and to local services and amenities with minimal car use. Council/ other developers to provide links to other areas off site.
		Public Transport	Living areas are close to available public transport routes/services	Developer/WAPC/Council	N/A	Project location in proximity to Bussell Hwy and local public transport stops/nodes at Karridale crossroads.

	Noise	Reduce noise pollution	Provide appropriate buffer planting along Bussell Highway and Brockman Highway	Developer	Landowner/Council	Developer to implement planted buffer as part of subdivisional works. Landowners to maintain established buffers within lots.
	Housing diversity	Range of lifestyle options	Provide a variety of lot sizes and formats to cater for a range of landuses and lifestyles.	Developer/WAPC	N/A	Developer to provide a variety of lot sizes and guidelines through a LSP, to be approved by WAPC.
			A range of built form to be encouraged to provide a range of living options and visual diversity, with building guidelines also developed.	Builder/ Landowner/ Council	Landowners	Design Guidelines formulated by developer and endorsed by Council. Council to encourage through Building Approvals.
Economic	Local employment	Local employment	Provide local employment opportunities through encouragement of home based businesses and suitable lot styles.	Developer/ Home occupier/ Council	Home occupier/ Council	House plans that allow for the flexibility to work efficiently from home to be encouraged and accepted by Council. Along with flexible zoning provisions to create opportunity.
		General employment options	Site located close to surrounding employment opportunities with good connectivity	Developer	Council	Subject land is close to Augusta, Margaret River, agriculture sector and other employment nodes..
	Affordability	House and land affordability	Provide a range of dwelling options to assist with the affordability of accommodation	Developer/WAPC/Council		Developer to provide a range of lot sizes and Design Guidelines within affordability considerations. Council/WAPC to not burden development with conditions which unnecessarily add to price of land and/or counter the affordability objective.

Local Structure Plan

APPENDIX I
TRANSPORT ASSESSMENT

Cardno
Shaping the Future

Transport Impact Assessment - TIA

Hamelin Grove Local Structure Plan

CW1200517

Prepared for
Juventus Pty Ltd

18 November 2022

Cardno

now

Stantec

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Our report is based on information made available by the client. The validity and comprehensiveness of supplied information has not been independently verified and, for the purposes of this report, it is assumed that the information provided to Cardno is both complete and accurate. Whilst, to the best of our knowledge, the information contained in this report is accurate at the date of issue, changes may occur to the site conditions, the site context or the applicable planning framework. This report should not be used after any such changes without consulting the provider of the report or a suitably qualified person.

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1 Introduction

1.1 Background

Cardno now Stantec have been commissioned by Juventus Pty Ltd "the Client" to prepare a Transport Impact Assessment (TIA) for the updated 'Hamelin Grove' Local Structure Plan located northeast of Brockman Highway / Bussell Highway intersection, Karridale within the Shire of Augusta Margaret River.

This report has been prepared in accordance with the *Western Australian Planning Commission (WAPC) Transport Impact Assessment Guidelines for Developments: Volume 2: Planning Schemes, Structure Plans and Activity Centre Zones (2016)*.

1.2 Site Location

The development is located at lot 100 Brockman Highway, Karridale. It is bounded by Brockman Highway to the south, Bussell Highway to the west, and Priority Agriculture land to the north and east. Karridale is located approximately 300km south of Perth, approximately 30km south of Margaret River and approximately 15km north of Augusta. The location of the development is illustrated in **Figure 1-1**.

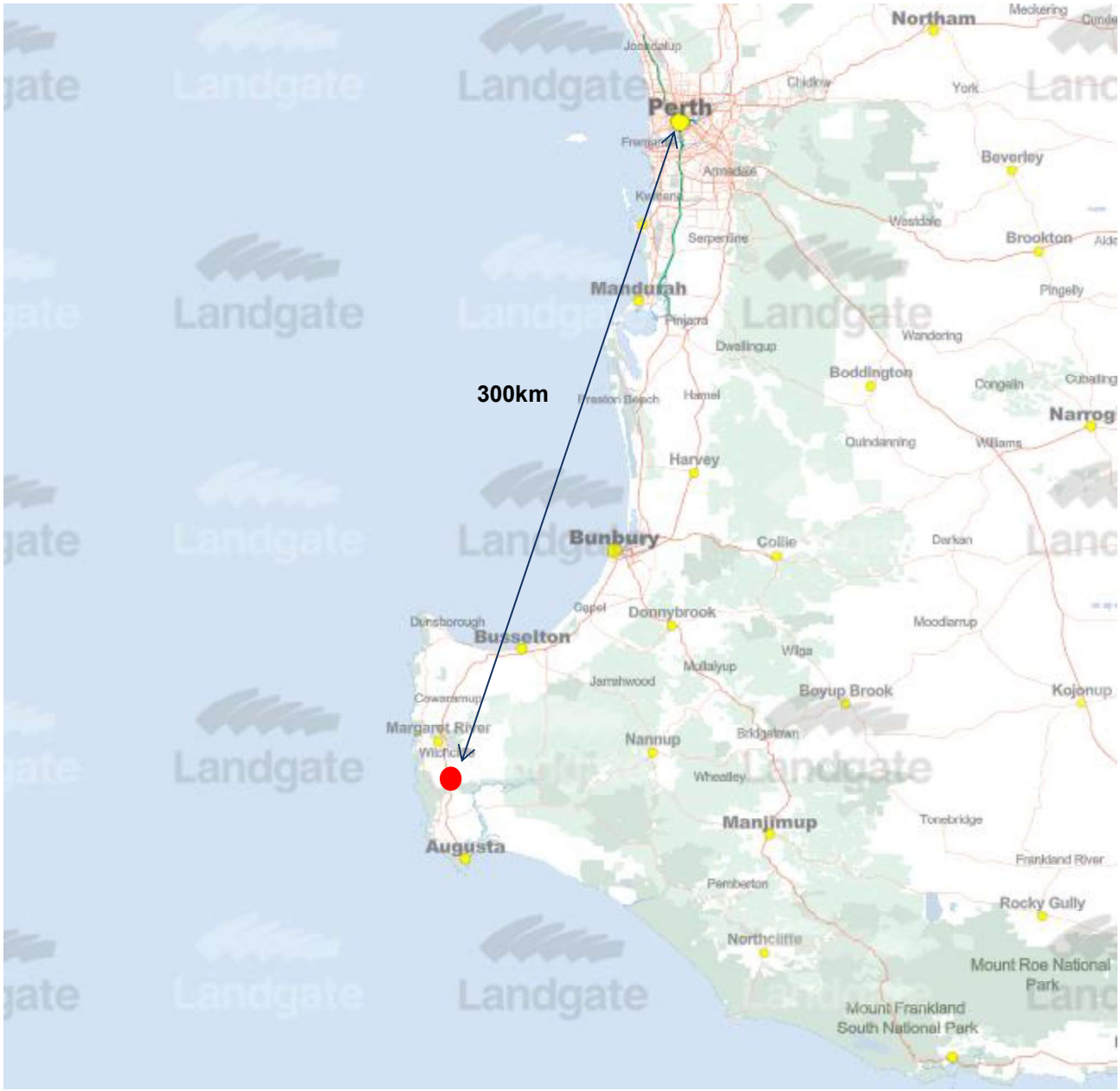
Figure 1-1 Study Area

Source: MetroMap 2022

2 Proposed Structure Plan

The proposed Local Structure Plan is located in Karridale, approximately 300km south of Perth CDB, refer to **Figure 2-1**. The LSP includes and area of 75,5ha of subdivision for residential lots and 8,98ha of public open spaces. Figure 2-1

Figure 2-1 Regional Context



Source: Landgate map viewer 2022

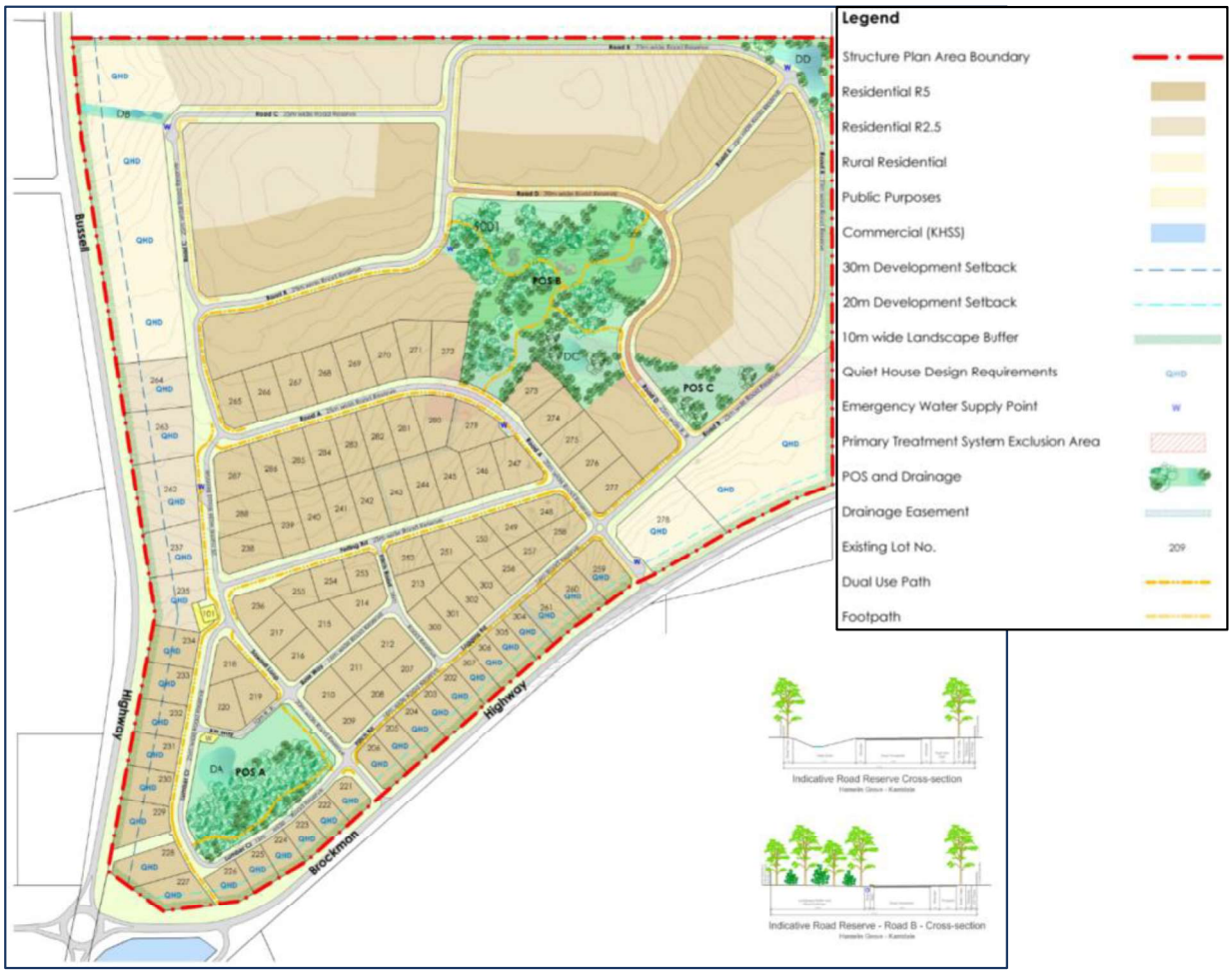
2.2 Proposed Land Use

The proposed structure plan layout is shown below in **Figure 2-2**. It includes:

- 89 Residential lots zoned R5, min area of 2000m2 per lot; and
- 6 Residential lots zoned R2.5 min area of 4000m2 per lot.

When fully developed, the structure plan is projected to include 164 dwellings. Larger version of the site plan has been provided in **Appendix A.**

Figure 2-2 Regional Context



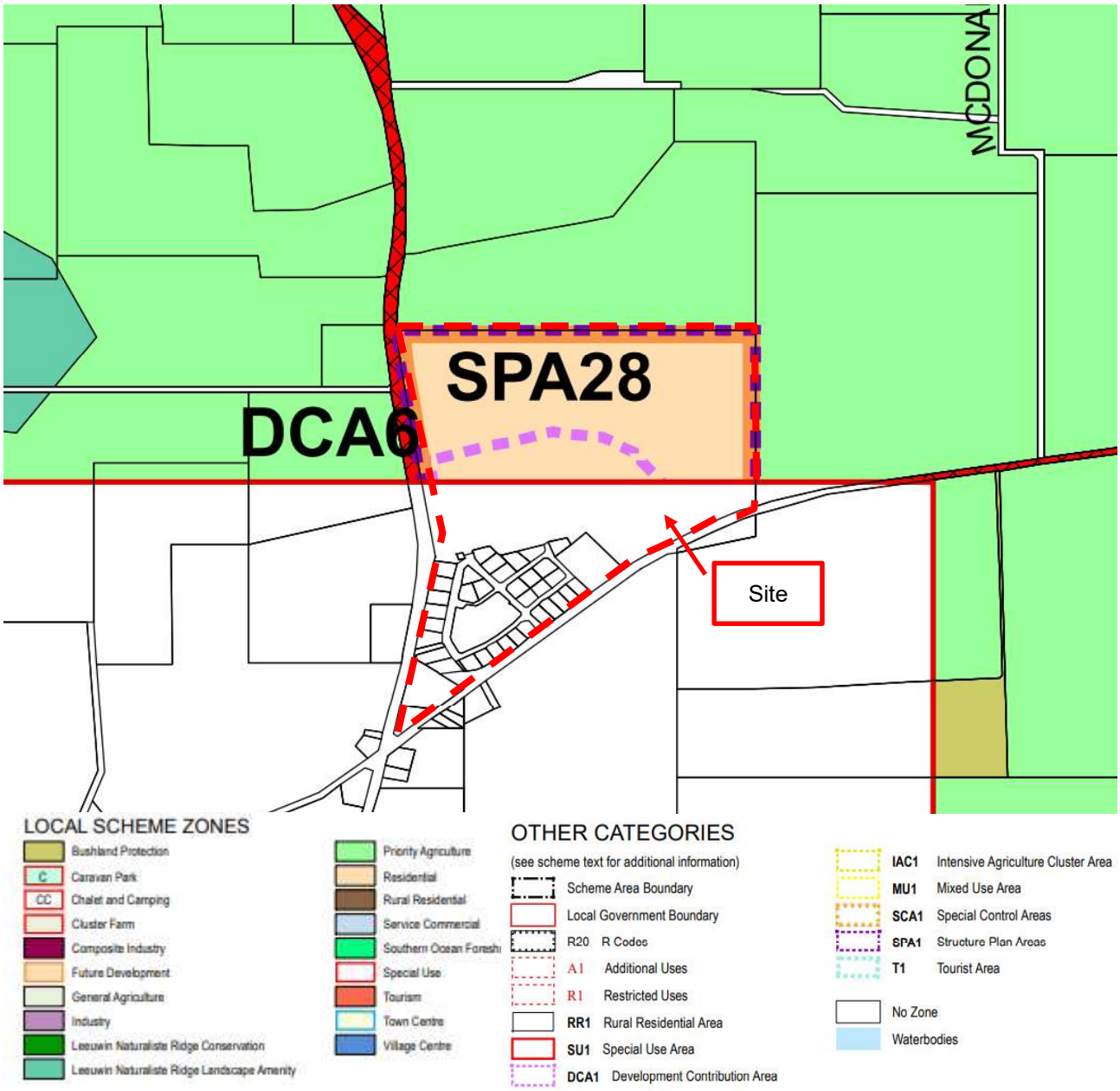
Source: Martin Richards town planning. Urban design 21/10/2022

3 Existing Situation

3.1 Surrounding Land Uses

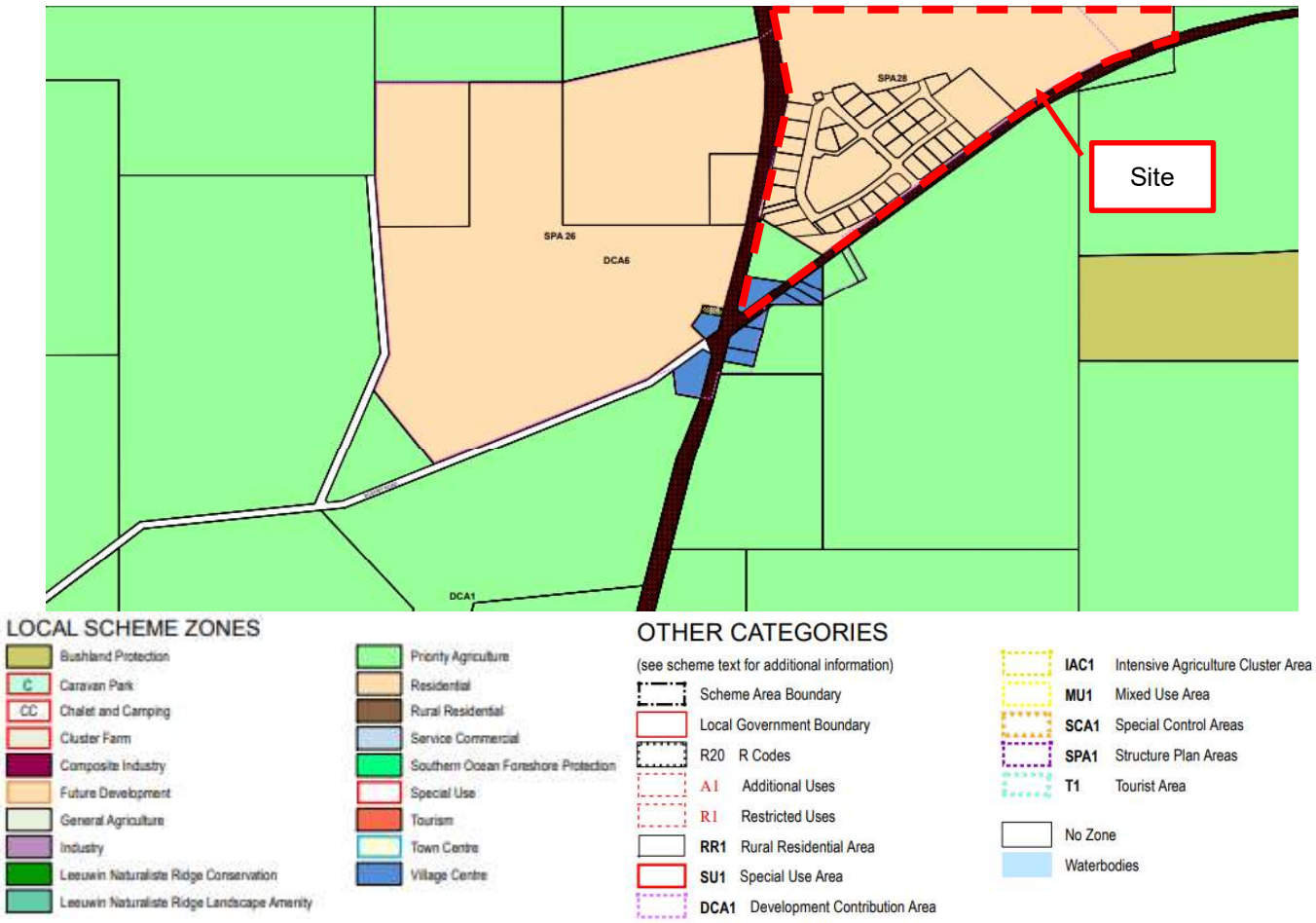
Pursuant to the provision of the Shire of Augusta-Margaret River Local Planning Scheme no.1, the Site is zoned 'Village Centre ', 'priority Agricultural' and 'Residential' as shown in **Figure 3-1** and **Figure 3-2**. The Site is surrounded by priority Agricultural land to the north, west and south, and Residential to the east.

Figure 3-1 Existing zoning 1/2



Source: Shire of Augusta – Margaret River planning information. Map 3 – Augusta Margaret River Locality Central West

Figure 3-2 Existing zoning 2/2



Source: Shire of Augusta – Margaret River planning information. Map 20 – Karridale townsite

3.2 Existing Road Network

Road classifications are defined in the main Road Functional Hierarchy as follows:

> **Primary Distributors (light blue)**: Form the regional and inter-regional grid of Main Roads WA traffic routes and carry large volumes of fast-moving traffic. Some are strategic freight routes, and all are National or State Roads WA.

> **Regional Distributors (red)**: Roads that are not Primary Distributors but link significant destinations and are designed for efficient movement of people and goods within and beyond regional areas. They are managed by Local Government.

> **District Distributor A (green)**: These carry traffic between industrial, commercial, and residential areas and connect to Primary Distributors. These are likely to be truck routes and provide only limited access to adjoining properties. They are managed by Local Government.

> **District Distributor B (dark blue)**: Perform a similar function to District Distributor A but with reduced capacity due to flow restrictions from access to and roadside parking alongside the adjoining property. These are often older roads with traffic demand in excess of what was originally intended. District Distributor A and B roads run between land-use cells and not through them, forming a grid that would ideally be around 1.5 kilometres apart. They are managed by Local Government.

> **Local Distributors (orange)**: Carry traffic within a cell and link District Distributors at the boundary to access roads. The route of the Local Distributor discourages through traffic so that the cell formed by the grid of District Distributors only carries traffic belonging to or serving the area. These roads should accommodate buses but discourage trucks. They are managed by Local Government.

> **Access Roads (grey)**: Provide access to abutting properties with amenity, safety and aesthetic aspects having priority over the vehicle movement function. These roads are bicycle and pedestrian friendly. They are managed by Local Government.

The site is bound by Bussell Highway, and Brockman Highway and in close proximity to Bushby Road as shown in **Figure 3-3**. The characteristics of these roads are further described in **Table 3-1**.

Figure 3-3 Existing road network

Source: MRWA Road information mapping system

Table 3-1 Road network classification

Road name	Road hierarchy	jurisdiction	No. of lanes	No. of footpaths	Width (m)	Posted speed (km/h)
Bussell Highway	Primary distributor	Main Roads WA	2	0	Approx.8.5m including sealed shoulders	Transition between 90-110km/k 90 km/k in the proximities of the intersection
Brockman Highway	Primary distributor	Main Roads WA	2	0	Approx.7.0m	Transition between 80-100 km/k. 80 km/k in the proximities to the intersection
Bushby Road	Regional distributor	Local Government	2	0	Approx.6.2m	90km/h

3.3 Existing Intersections

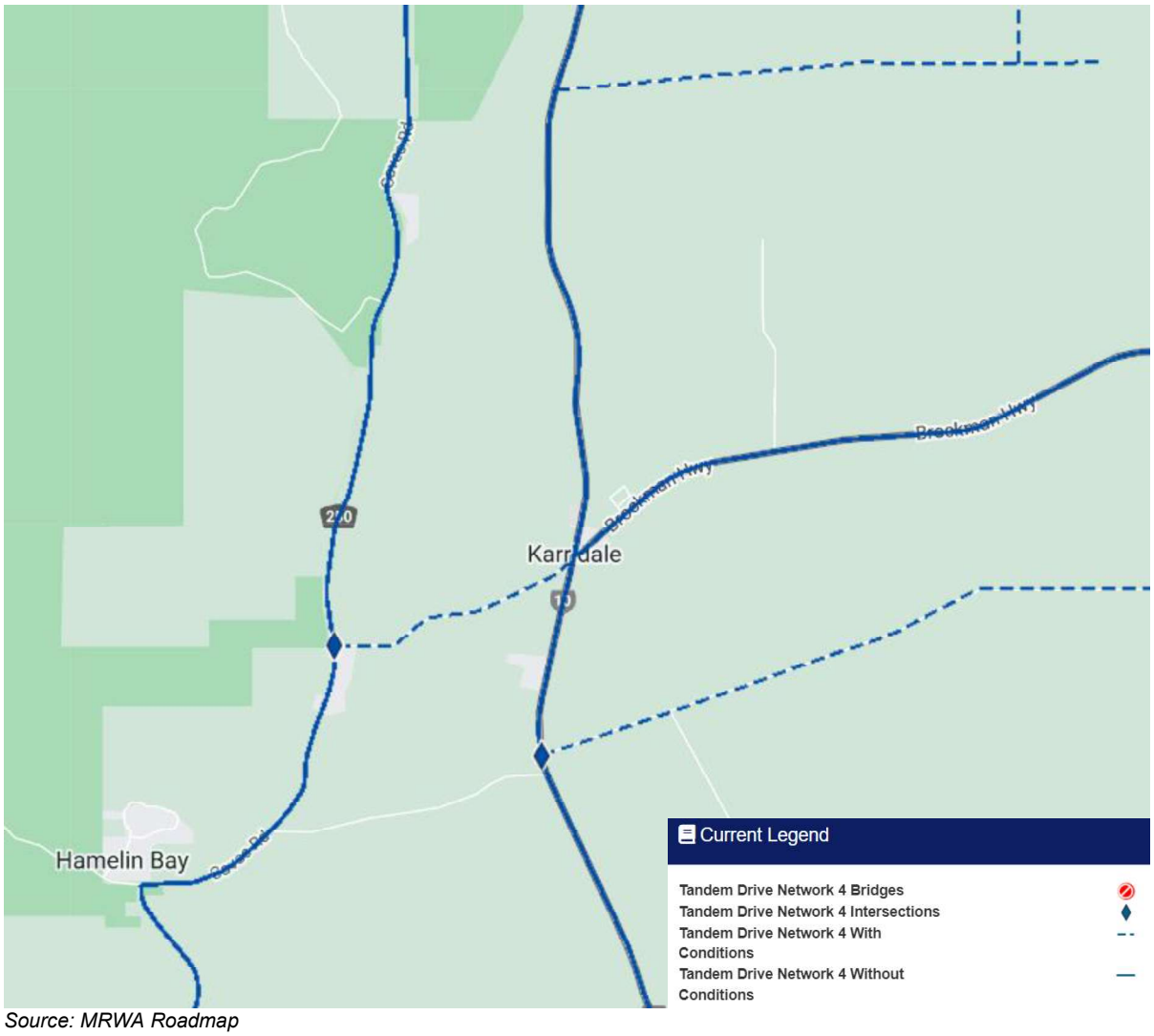
The intersections that surround the site are discussed below:

- **Bussell Highway / Brockman Highway**: located on the southwest corner of the site; it is a three-way Give way-controlled intersection with single approach and departure lanes.
- **Bussell Highway / Bushby Road**: located approximately 90m south of the site, is a three-way Give way-controlled intersection with single approach and departure lanes.
- **Brockman Highway / Sawmill loop**: located approximately 580m from Bussell Highway / Brockman Highway intersection, is a three-way Give way-controlled intersection with single approach and departure lanes.

3.4 Existing Restricted Access Vehicles (RAV) Network

The existing RAV network is shown below in **Figure 3-4.** Brockman Highway and Bussell Highway are included in the RAV 4 network.

Figure 3-4 Existing RAV network

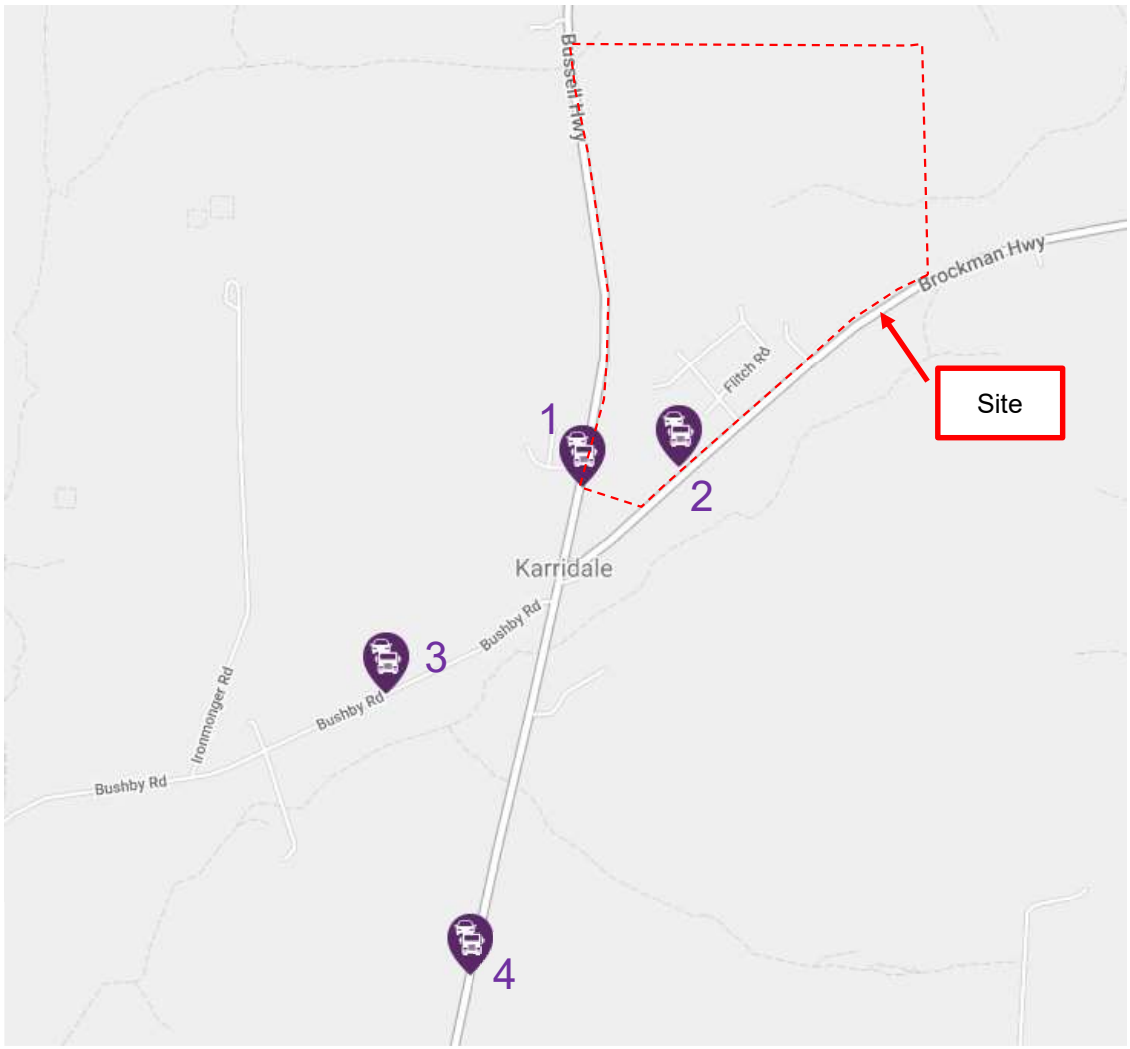


Source: MRWA Roadmap

3.5 Existing Traffic Volume

The most recent traffic volumes for the roads in the vicinity of the site were obtained from the Main Road Traffic map through four counting stations as shown below, and email correspondence from Main Roads included in **Appendix B**.

Figure 3-5 Traffic counting stations



Source: MRWA Traffic map

Table 3-2 Traffic count stations

Location	Survey date	Average daily traffic. Monday to Sunday	Percentage of heavy vehicles
1. Bussell Hwy North of Brockman Hwy	2020/2021	1,909	12.4%
2. Brockman Hwy East of Bussell Hwy	2020/2021	824	15.7%
3. Bushby Rd West of Bussell Hwy	2020/2021	287	11.1%
4. Bussell Hwy North of Twenty-Four Rd	2020/2021	1,962	11.1%

3.6 Existing Public Transport Facilities

The public transport provisions available in Karridale area include the following routes:
> SW1 - Perth to Augusta (Transwa), 1 service each direction per day and 2 services five days a week
> Perth to Augusta via Margaret River (South West Coach Lines), 1 service each direction weekdays.

3.7 Existing Pedestrian / cycle network

There is currently no pedestrian/cycle path facility in the immediate area surrounding the development site.

3.8 Crash Data

Cardno now Stantec has reviewed the crash data of the study area for the recent 5-year period (2017 - 2021) obtained from the MRWA Crash report. **Figure 3-6** summarises the crashes reported in the proximities of the Study Area.

Figure 3-6 Crash map

Three accidents were registered in the area, all resulted in PDO major and include: one hit animal, one collision while leaving parking, and one thru-right crash that occurred at the intersection

3.9 Access Arrangement

The proposed development incorporates two give-way controlled access connecting with Brockman Highway as shown below.

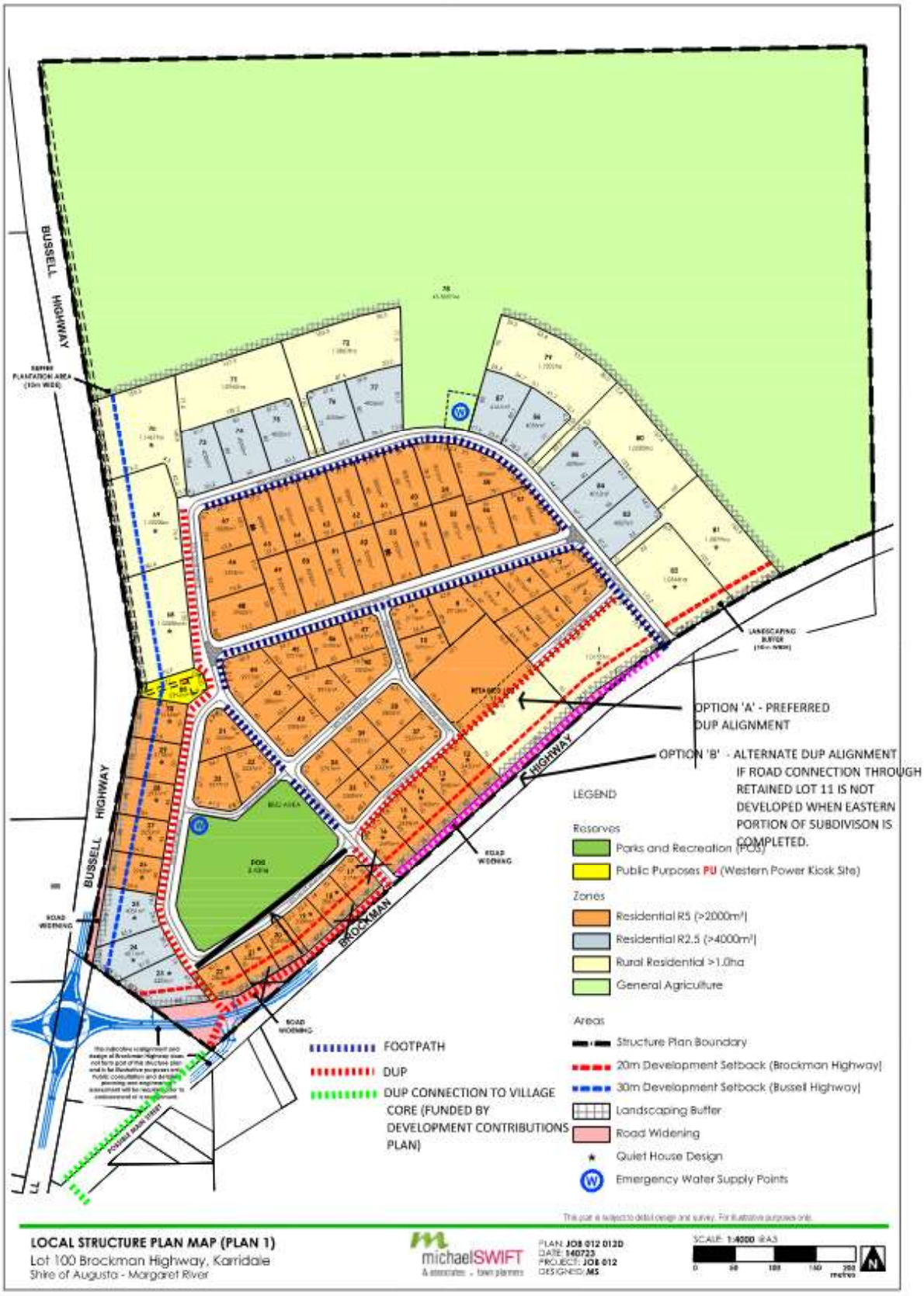
Figure 3-7 Access arrangements

Source: martin Richards town planning. Urban design 21/10/2022

3.10 Internal Road Network, Pedestrian, and cycle network

Cardno now Stantec contacted The Shire of Augusta and Margaret River and was provided with a draft for the potential footpaths around the site.

Figure 3-8 Potential footpaths draft



Source: Shire of Augusta Margaret River

Details for the LSP's internal road network, cross-section, pedestrian and cycle network will be provided at detailed design stage where detailed site plans would be available. Local area traffic management plan should be also considered within subdivision stages for the site.

The internal road network and provided road reserve widths need to be sufficient to allow for drainage, footpaths, underground services and street trees; and the road reserve shall be in accordance with Liveable Neighbourhoods requirements including at least one shared path along the road. Note that the final alignment of footpaths will be determined based on the location of drainage basins and low points along the area to minimize the risk of floodings.

Indicative crossover layouts for the internal access roads and the neighbourhood connectors (existing western access and proposed eastern access) are illustrated below in **Figure 3-9** and **Figure 3-10**.

Figure 3-9 Indicative crossover layout for Access roads

Figure 3-10 Indicative crossover layout for Neighbourhood connector

3.11 Development trip generation

Trip generation and trip distribution for the development has been estimated in accordance with WAPC Vol.2 for residential use.

Table 3-3 Trip generation

Land use	Source	Trip Generation Rates	
		AM peak hour	PM peak hour
Residential	Table 1 WAPC Vol.2	0.8 trips per dwelling unit	0.8 trips per dwelling unit

Entry and exit distributions are expected as follow

Table 3-4 Trip distribution

Land use	AM peak hour		PM peak hour	
	IN	OUT	IN	OUT
210 / Single family detached housing	20%	60%	50%	30%

4 Changes to Surrounding Transport Network

4.1 Road network

From liaison with Main Roads WA, Cardno now Stantec has been advised of a potential re-alignment of Brockman Highway connecting to Bussell Highway, West Karridale and an access road to Karridale West through a roundabout. This is a long-term network planning objective which will be funded by Main Roads WA.

A desktop sight distance review of the area was conducted to identify potential issues for the roundabout installation. The intended location of the roundabout is located in a straight road section along Bussell Highway; it is considered a safe location with sufficient sightlines along the North-south corridor. Although it is not clear if the Bussell Highway / Brockman / Highway intersection will remain, the safe intersection sight distance SISD between the roundabout and the intersection needs to fulfill the requirements of SISD as per Austroads Guide to Road Design Part 4A: unsignalised and signalised intersections.

The sight distances from the east and west approach will need to be evaluated once the preliminary designs are released.

At the time of this document, information regarding the roundabout, including preliminary designs were not available.

4.2 Changes to pedestrian / cycle network

From liaison with the Shire of Augusta Margaret River, it is noted that there is currently no information available regarding future changes to pedestrian and cycle networks in the proximities of the area.

4.3 Public transport

From liaison with Shire of Augusta Margaret River, it is noted that there is currently no information available regarding future planning of public transport for Karridale.

5 Integration with Surrounding Area

5.1 Surrounding major attractors/generators

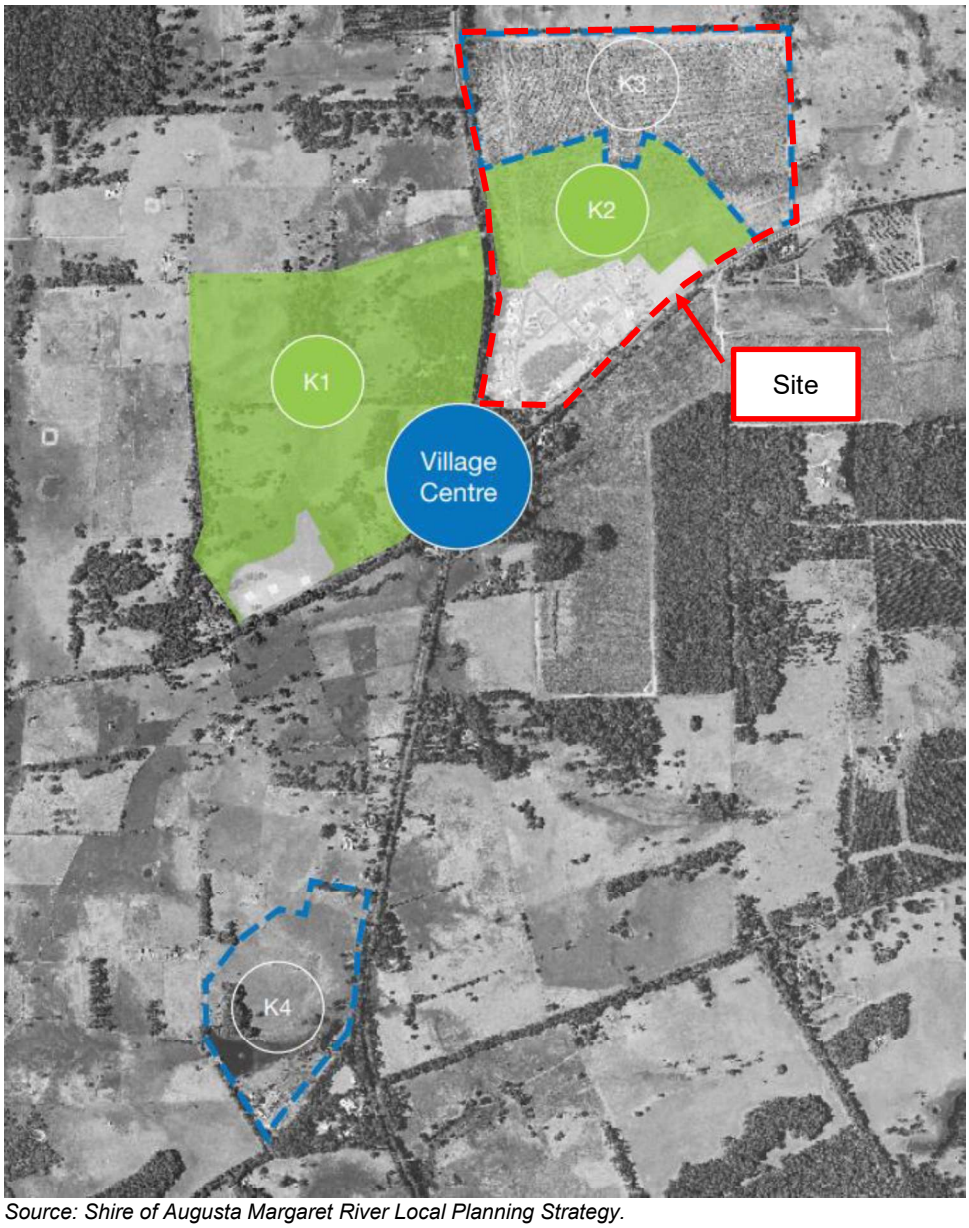
The major attractors/generators surrounding the development are Karridale Village centre, Karridale primary school, Augusta at approximately 15km to the south, Margaret River at approximately 30km to the north on the Bussell Highway, and Hamelin Bay at approximately 8.5km to the west. The existing public transport

services are considered to be poor and it is expected that most residents or visitors will travel by private vehicle.

5.2 5.2 Proposed changes to surrounding land uses

As per the Augusta Margaret River Planning Strategy, there are areas identified for future growth, including Karridale West K1 and K4 as shown below.

Figure 5-1 Areas for future growth



Source: Shire of Augusta Margaret River Local Planning Strategy.

6 Analysis of Transport Networks

6.1 Transport assessment

Future traffic conditions have been analysed for year 2038 which is the approximate 15-year horizon after development completion, assuming completion in 2023. The assessment herein quantifies the effect that additional development traffic has on the surrounding road network, specifically the intersections below.

> Bussell Highway / Brockman Highway – current alignment

> Brockman Highway / Hamelin Grove Western Access

> Brockman Highway / Hamelin Grove Eastern Access

> Bussell Highway / West Karridale / Hamelin Grove proposed roundabout

6.2 Growth Rates

As advised by Main Roads WA, a linear growth rate of 1.5% was applied to through movements along Bussell Highway while an annual growth rate of 1% was applied for Brockman Highway and Bushby Road.

6.3 Assessment scenarios

The assessment undertaken in this study considers the following year scenarios both AM and PM peak periods:

> **Scenario 1 –** 2022 Background Condition (based on provided traffic data and existing 23 dwellings)

> **Scenario 2 –** 2023 With Development (Background plus development 95 dwellings)

> **Scenario 3 –** 2038 Full Development + 15yrs existing road alignment

> **Scenario 4 –** 2038 Full Development + 15yrs Bussell Highway / Brockman Hwy / Karridale West access roundabout

As advised via email by Main Roads, turning percentages of 30% and 70% were applied to traffic travelling from Bushy Road and Brockman Highway to Augusta and Margaret River respectively; turning percentages from Bussell Hwy to Brockman Highway and Bushy Road were extracted from previous traffic counts conducted by Cardno in 2012.

Scenario 1 has been developed utilising the existing Main Roads WA traffic count information 2020/2021 multiplied by the mentioned growth factors and the traffic generation by the existing 23 dwellings.

Scenario 2 has been developed utilising the existing Main Roads WA traffic count information 2020/2021 multiplied by the mentioned growth factors and the traffic generation by the proposed 95 dwellings.

Scenario 3 has been developed utilising the existing Main Roads WA traffic count information 2020/2021 multiplied by the mentioned growth factors and the traffic generation by the full development of Hamelin Grove and adjacent developments.

Scenario 4 has been developed utilising the existing Main Roads WA traffic count information 2020/2021 multiplied by the mentioned growth factors and the traffic generation by Karridale West and adjacent developments. Traffic distribution includes through traffic along Bussell Hwy, Brockman Highway and Hamelin Grove.

6.4 Site performance

Analysis of the traffic impacts of the proposed development has been carried out for the 4 scenarios mentioned above.

The analysis was performed using the SIDRA analysis program. This program calculates the performance of intersections based on input parameters, including geometry and traffic volumes. As an output SIDRA

provides values for the Degree of Saturation (DOS), queue lengths, delays, level of service, and 95th Percentile Queue. These parameters 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 theoretical intersection capacity is exceeded for an un-signalized intersection where DOS > 0.80;
- 95% Queue: is the statistical estimate of the queue length up to or below which 95% of all observed queues would be expected;
- Average Delay: is the average of all travel time delays for vehicles through the intersection. An unsignalized intersection can be considered to be operating at capacity where the average delay exceeds 40 seconds for any movement; and
- Level of Service (LOS): is the qualitative measure describing operational conditions within a traffic stream and the perception by motorists and/or passengers. The different levels of service can generally be described as shown in **Table 6-1**.

Table 6-1 Level of Service (LOS) Performance Criteria

LOS	Description	Signalised Intersection	Unsignalized Intersection
A	Free-flow operations (best condition)	≤10 sec	≤10 sec
B	Reasonable free-flow operations	10-20 sec	10-15 sec
C	At or near free-flow operations	20-35 sec	15-25 sec
D	Decreasing free-flow levels	35-55 sec	25-35 sec
E	Operations at capacity	55-80 sec	35-50 sec
F	A breakdown in vehicular flow (worst condition)	≥80 sec	≥50 sec

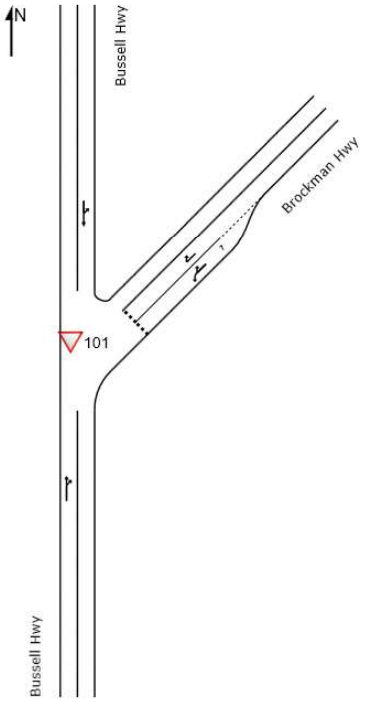
A LOS exceeding these values indicates that the road section is exceeding its practical capacity. Above these values, users of the intersection are likely to experience unsatisfactory queueing and delays during the peak hour periods.

6.5 Traffic Analysis

6.5.1 Scenario 1

Bussell Highway / Brockman Highway intersection has been analysed for the existing conditions. Background traffic plus traffic generated by the existing 23 dwellings.

Figure 6-1 Network layout



The analysis results for the AM and PM peak periods are presented in **Table 6-2**. The results show that the site is performing satisfactorily under the current traffic conditions. The average delays are 4.8sec and 95% back of queue of 2m

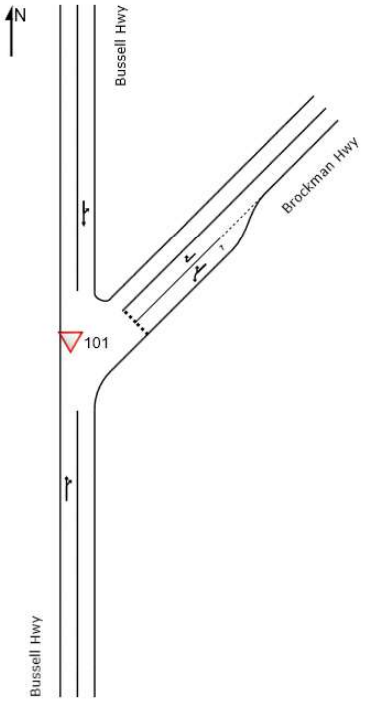
Table 6-2 Scenario 1 Results (2022)

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (sec)	LOS	95% back of Queue (m)	DOS	Delay (sec)	LOS	95% back of Queue (m)
South: Bussell Hwy	T	0.065	0.2	LOS A	1.9	0.077	0.2	LOS A	2.1
	R	0.065	6.7	LOS A	1.9	0.077	6.7	LOS A	2.1
NorthEast: Brockman Hwy	L	0.031	7.3	LOS A	1.1	0.022	7.3	LOS A	0.8
	R	0.072	8.8	LOS A	2.0	0.053	8.9	LOS A	1.4
North: Bussell Hwy	L	0.073	8.3	LOS A	0.0	0.080	8.3	LOS A	0.0
	T	0.073	0.0	LOS A	0.0	0.080	0.0	LOS A	0.0
All Vehicles		0.073	4.8	NA	2.0	0.080	4.0	NA	2.1

6.5.2 Scenario 2

Bussell Highway / Brockman Highway intersection has been analysed for the Background traffic plus traffic generated by the proposed 95 dwellings.

Figure 6-2 Network layout



The analysis results for the AM and PM peak periods are presented in **Table 6-3**. Similar to the results of scenario 2, site will keep performing satisfactorily under the proposed development of 95 dwellings. The average delays are 5.3sec and 95% back of queue of 3m

Table 6-3 Scenario 2 Results (2023)

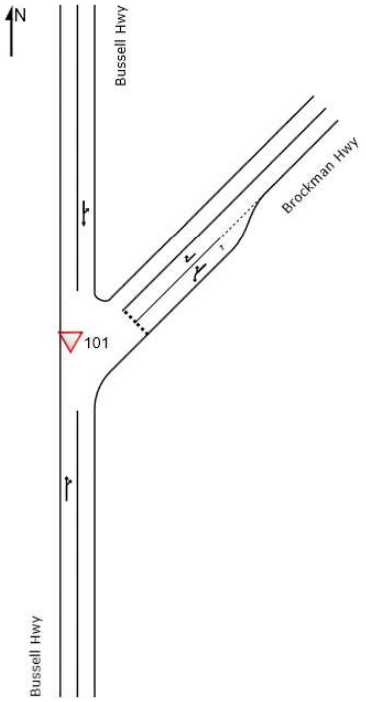
Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (sec)	LOS	95% back of Queue (m)	DOS	Delay (sec)	LOS	95% back of Queue (m)
South: Bussell Hwy	T	0.069	0.3	LOS A	2.1	0.086	0.4	LOS A	2.6
	R	0.069	6.7	LOS A	2.1	0.086	6.8	LOS A	2.6
NorthEast: Brockman Hwy	L	0.045	7.3	LOS A	1.6	0.030	7.4	LOS A	1.0
	R	0.104	8.9	LOS A	2.9	0.071	9.2	LOS A	1.9
North: Bussell Hwy	L	0.081	8.3	LOS A	0.0	0.100	8.3	LOS A	0.0
	T	0.081	0.0	LOS A	0.0	0.100	0.0	LOS A	0.0
All Vehicles		0.104	5.3	NA	2.9	0.100	4.6	NA	2.6

6.5.3 Scenario 3

Bussell Highway / Brockman Highway intersection has been analysed for the Background traffic plus adjacent developments including:

- Hamelin Grove – full development .164 dwellings;
- Karridale West K1 – 76 dwellings proposed;
- K4 – 40 dwellings proposed;
- Kudardup – 150 dwellings proposed;
- Hamlin bay – 36 dwellings proposed; and
- Augusta – 350 extra dwellings projected for 15+ future scenario.

Figure 6-3 Network layout



The analysis results for the AM and PM peak periods are presented in **Table 6-4**. It is expected for the site to perform satisfactorily with the projected developments in the proximities of the area. The projected average delays are 3.5sec and 95% back of queue of 5m

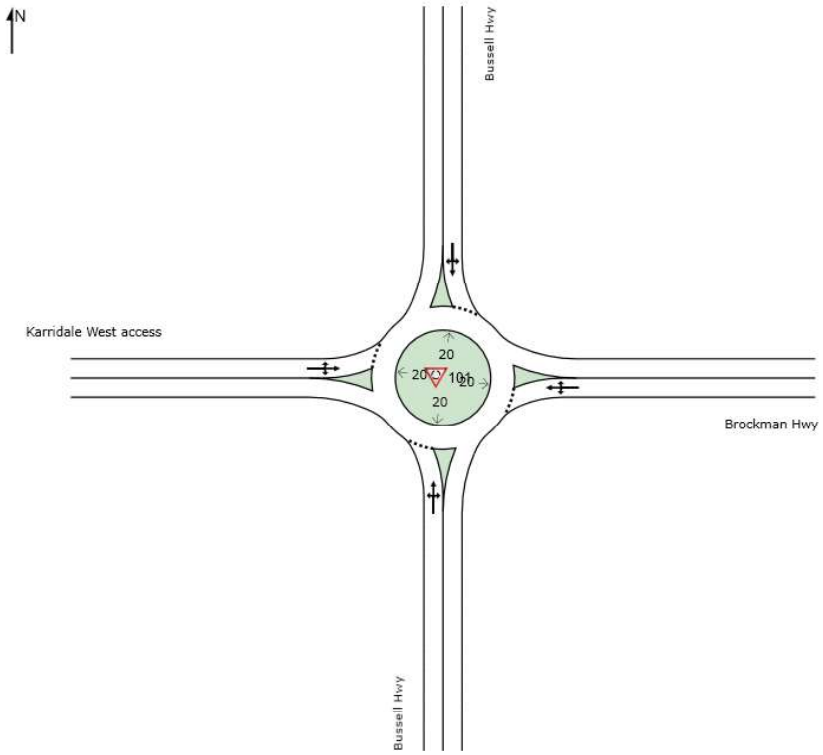
Table 6-4 Scenario 3 Results (2038 -existing road alignment)

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (sec)	LOS	95% back of Queue (m)	DOS	Delay (sec)	LOS	95% back of Queue (m)
South: Bussell Hwy	T	0.228	0.3	LOS A	3.9	0.185	0.8	LOS A	4.8
	R	0.228	7.5	LOS A	3.9	0.185	8.5	LOS A	4.8
NorthEast: Brockman Hwy	L	0.069	7.8	LOS A	2.2	0.055	8.7	LOS A	1.7
	R	0.174	12.5	LOS B	4.8	0.125	13.3	LOS B	3.4
North: Bussell Hwy	L	0.151	8.3	LOS A	0.0	0.252	8.3	LOS A	0.0
	T	0.151	0.0	LOS A	0.0	0.252	0.1	LOS A	0.0
All Vehicles		0.228	3.5	NA	4.8	0.252	3.1	NA	4.8

6.5.4 Scenario 4

Scenario 4 has been analysed for the future year 2038, full development of adjacent projects and the proposed roundabout that will connect Bussell Highway, Brockman Highway, and Hamelin Grove.

Figure 6-4 Network layout



The analysis results for the AM and PM peak periods are presented in **Table 6-5**. It is expected for the roundabout to perform satisfactorily with the projected developments in the proximities of the area. The projected average delays are 8.2sec and 95% back of queue of 17.3m

Table 6-5 Scenario 4 Results (2038 proposed roundabout)

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (sec)	LOS	95% back of Queue (m)	DOS	Delay (sec)	LOS	95% back of Queue (m)
South: Bussell Hwy	L	0.315	6.6	LOS A	15.8	0.236	6.4	LOS A	11.0
	T	0.315	7.2	LOS A	15.8	0.236	7.0	LOS A	11.0
	R	0.315	11.8	LOS B	15.8	0.236	11.6	LOS B	11.0
East: Brockman Hwy	L	0.156	7.4	LOS A	7.0	0.109	8.1	LOS A	4.6
	T	0.156	8.0	LOS A	7.0	0.109	8.7	LOS A	4.6
	R	0.156	12.6	LOS B	7.0	0.109	13.3	LOS B	4.6
North: Bussell Hwy	L	0.198	6.2	LOS A	8.9	0.333	6.3	LOS A	17.3
	T	0.198	6.8	LOS A	8.9	0.333	6.9	LOS A	17.3
	R	0.198	11.4	LOS B	8.9	0.333	11.5	LOS B	17.3
West: Karridale West access	L	0.067	6.4	LOS A	3.0	0.027	4.8	LOS A	1.0
	T	0.067	6.3	LOS A	3.0	0.027	4.7	LOS A	1.0
	R	0.067	10.9	LOS B	3.0	0.027	9.3	LOS A	1.0
All Vehicles		0.315	8.2	NA	15.8	0.333	7.9	NA	17.3

6.6 Turn Warrant Assessment

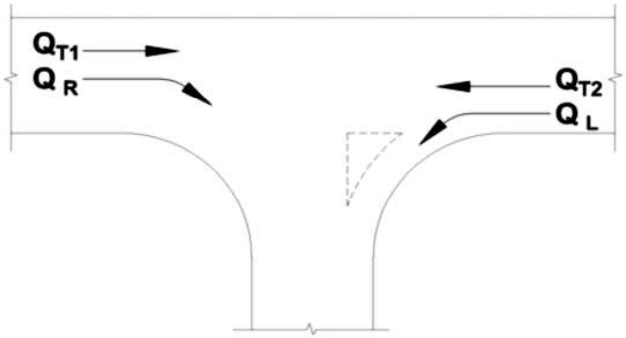
A Turn Warrant Assessment was conducted for the Brockman Highway / Bussell Highway intersection as per Austroads *Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings (2020).* The assessment provides a warrant for the preferred minimum turn treatments on major roads (i.e., the road that has traffic priority over another at an intersection).

The preferred turn treatments are determined by the following parameters:

- **QL or QR**: development peak hour entry turning movement volume.
- **QM**: traffic volume on the major road, see **Figure 6-5** for the calculation of QM for a two-way two-lane road; and
- **design speed –** 100km/h design speed is adopted with the acknowledgement that Bussell Highway has a 90km/h posted speed limit in the proximities of the intersection.
- **Traffic volume –** Existing traffic volumes (2020/2021) sourced from Main Roads WA Traffic map and the turning percentages were based on Main Roads WA split assumption of 70% traffic travelling north and 30% travelling south.

The above parameters are then plotted into **Figure 6-6** to determine the preferred turn treatment.

Figure 6-5 Calculation of QM

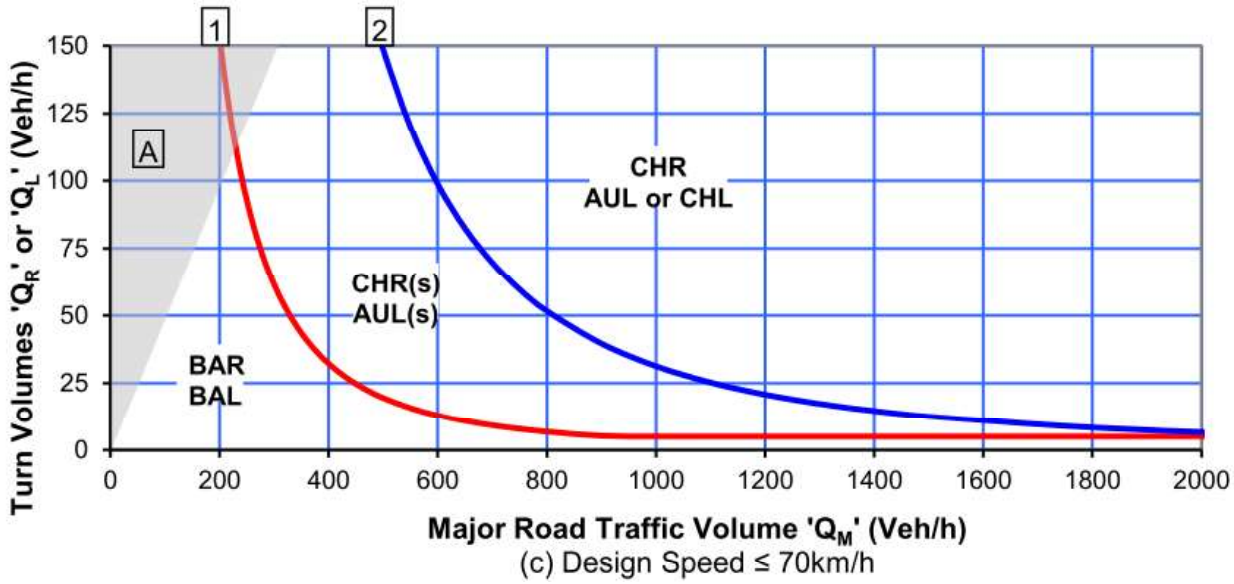


Road type	Turn type	Splitter island	Q_M (veh/h)
Two-lane two-way	Right	No	= $Q_{T1} + Q_{T2} + Q_L$
		Yes	= $Q_{T1} + Q_{T2}$
	Left	Yes or no	= Q_{T2}
Four-lane two-way	Right	No	= 50% x $Q_{T1} + Q_{T2} + Q_L$
		Yes	= 50% x $Q_{T1} + Q_{T2}$
	Left	Yes or no	= 50% x Q_{T2}
Six-lane two-way	Right	No	= 33% x $Q_{T1} + Q_{T2} + Q_L$
		Yes	= 33% x $Q_{T1} + Q_{T2}$
	Left	Yes or no	= 33% x Q_{T2}

Source: TMR (2016a).

As per Austroads *Guide to Traffic Management Part 6,* it is important to note that these warrants focus on safety performance outcomes and not operational performance. Additionally, it is developed for intersections on new roads. It is not intended for direct application to accesses and driveways.

Figure 6-6 Warrants for Turn Treatments on Major Road at Unsignalised Intersection



6.6.2 Traffic Generation

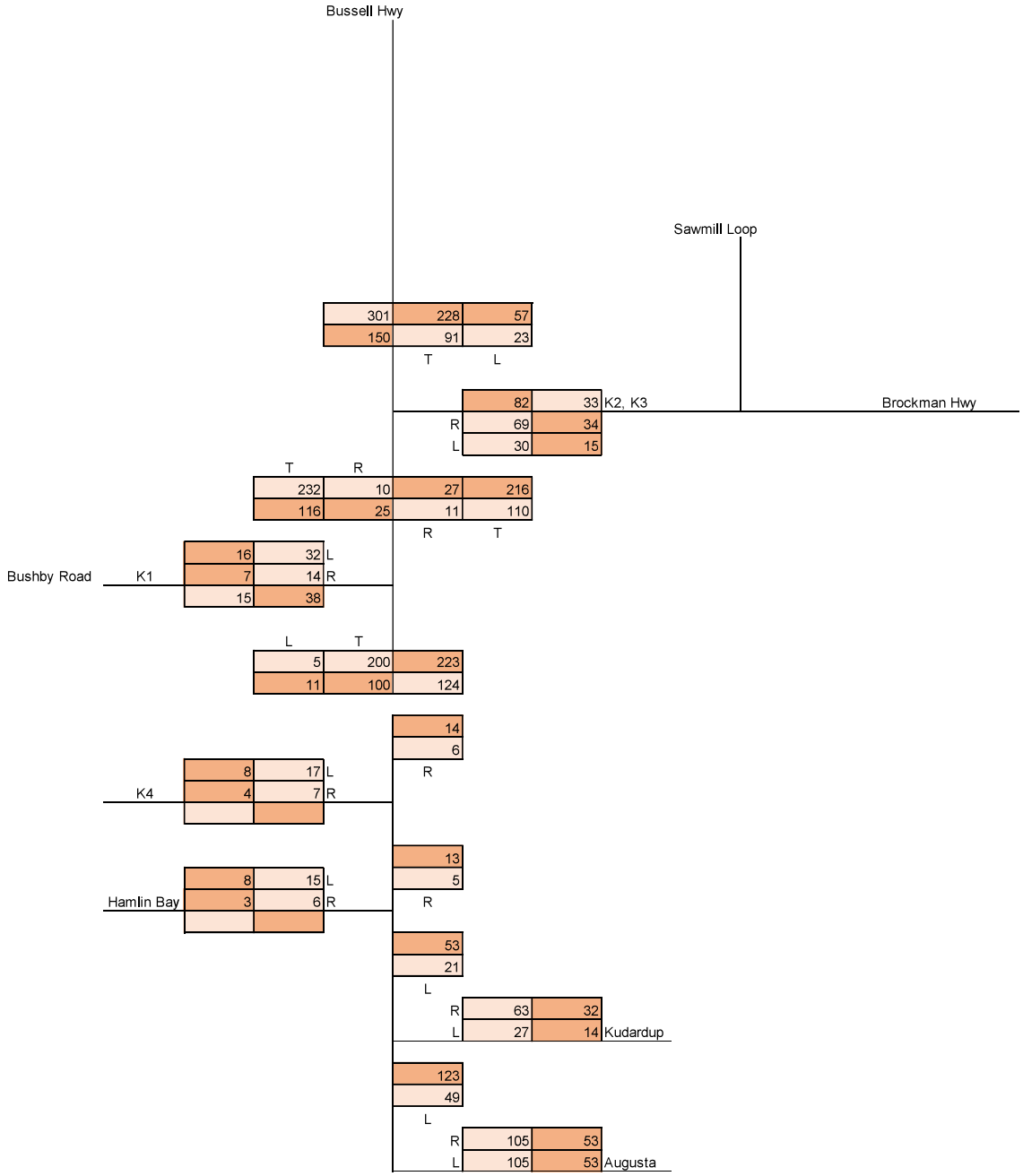
Trip generation estimates has been based on background traffic counts provided by Main Roads WA and projections of adjacent developments.

Traffic generation distribution to estimate QL and QR have been based on the typical land use trip rates as per WAPC Vol.2 and the split distribution proposed by Main Roads WA (70%travelling north towards Margaret River, 30% travelling south towards Augusta)

Traffic volume calculation includes:

- Background traffic from Main Roads counting stations;
- Hamelin Grove – K2, K3 full development (164 lots proposed);
- Karridale West- K1 (76 lots proposed);
- Future urban growth – K4 (40 lots proposed);
- Kudardup (150 lots proposed);
- Lot 21 Caves Road Hamlin Bay (36 lots proposed); and
- Augusta (350 permits/dwellings to be developed over the assessment year period).

Figure 6-7 Traffic generation from site and adjacent developments



6.7 Intersection Warrants

6.7.1 Assessment Results

Table 6-6 to **Table 6-8**shows the turn warrant assessments for AM peak and PM peaks for the background traffic 2022, opening year 2023 and future scenario 2038. Based on the assessment abovementioned for both peak hours, the higher order treatment will be selected. Hence the required turn treatments are:

- Right turn treatment: CHR
- Left turn treatment: AUL(S) or CHL

The analysis of the transport network includes:

- Background traffic: traffic volumes provided by Main Roads WA Traffic map 2021 (4 counting stations in the proximities of the study area) with annual traffic growths of 1.5% for Bussell Hwy through movements and 1% for Brockman Hwy and Bushby Road as suggested by Main Roads;
- Adjacent developments (K1, K4, Kudardup, Hamlin Bay, Augusta); and
- Hamelin Grove

The analysis has been conducted for the following scenarios:

- Scenario 1. Background traffic 2022
- Scenario 2. Opening year 2023 (95 dwellings)
- Scenario 3. Final scenario 2038 (Hamelin Grove fully developed – 164 dwellings)

The results of the Turning warrant assessment are shown below:

Table 6-6 Assessment results for Bussell Highway / Brockman Highway intersection – Scenario 1. Background traffic 2022

Bussell Hwy / Brockman Hwy intersection- Background traffic 2022 AM and PM Peak Turn Warrant Assessment						
Assessment		**QM**	**QR**	**QL**	**Right Turn Treatment**	**Left Turn Treatment**
AM	Right Turn Assessment	167	37	-	AUR	-
	Left Turn Assessment	67	-	35		BAL
PM	Right Turn Assessment	169	28	-	BAR	-
	Left Turn Assessment	82	-	8		BAL

Table 6-7 Assessment results for Bussell Highway / Brockman Highway intersection – Scenario 2. Opening year 2023

Bussell Hwy / Brockman Hwy intersection- Opening year 2023 AM and PM Peak Turn Warrant Assessment						
Assessment		**QM**	**QR**	**QL**	**Right Turn Treatment**	**Left Turn Treatment**
AM	Right Turn Assessment	183	43	-	AUR	-
	Left Turn Assessment	68	-	49		BAL
PM	Right Turn Assessment	204	42	-	AUR	-
	Left Turn Assessment	83	-	41		BAL

Table 6-8 Assessment results for Bussell Highway / Brockman Highway intersection – Scenario 3. Final year 2038

Bussell Hwy / Brockman Hwy intersection- Final year 2038 AM and PM Peak Turn Warrant Assessment						
Assessment		**QM**	**QR**	**QL**	**Right Turn Treatment**	**Left Turn Treatment**
AM	Right Turn Assessment	554	55	-	CHR	-
	Left Turn Assessment	175	-	175		AUL (S)
PM	Right Turn Assessment	611	59	-	CHR	-
	Left Turn Assessment	330	-	67		AUL or CHL

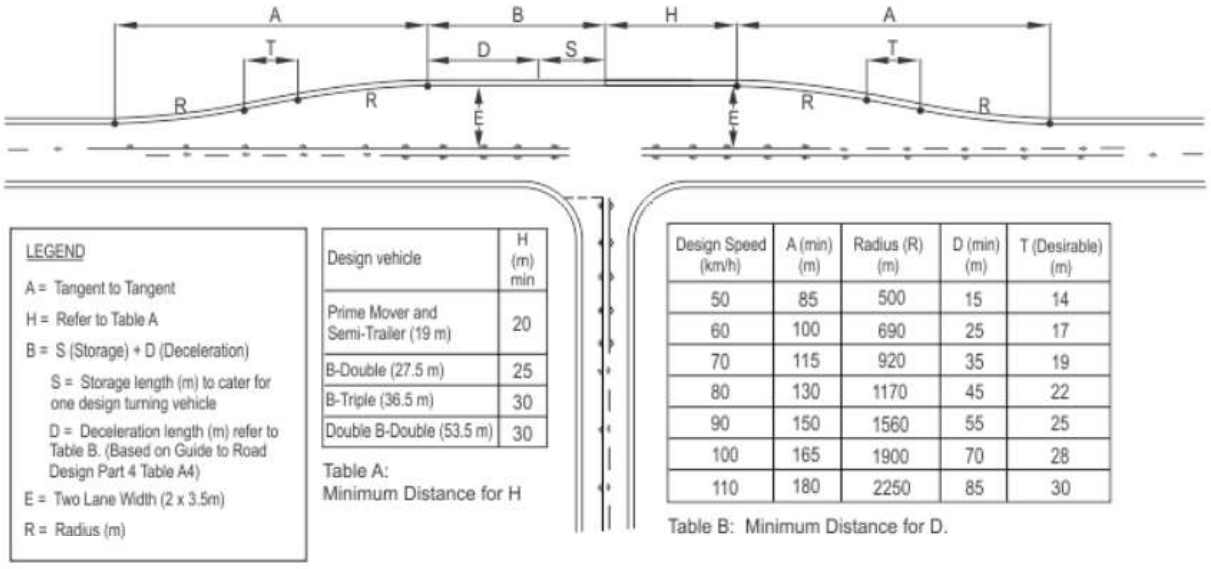
For the final year, the results suggest channelised right turn and auxiliary lane or channelised left turn for the Bussell Hwy / Brockman Hwy intersection. Note this analysis has been conducted for the existing T intersection alignment.

6.7.2 Turn Treatment Types

6.7.2.1 AUR Treatment

AUR treatment is an auxiliary lane turn treatment that involves the creation of an additional lane to allow through traffic to bypass turning vehicles. It is a relatively low cost and low maintenance treatment solution to reduce the risk of rear-end crashes.

Figure 6-8 Typical Main Roads Type AUR treatment

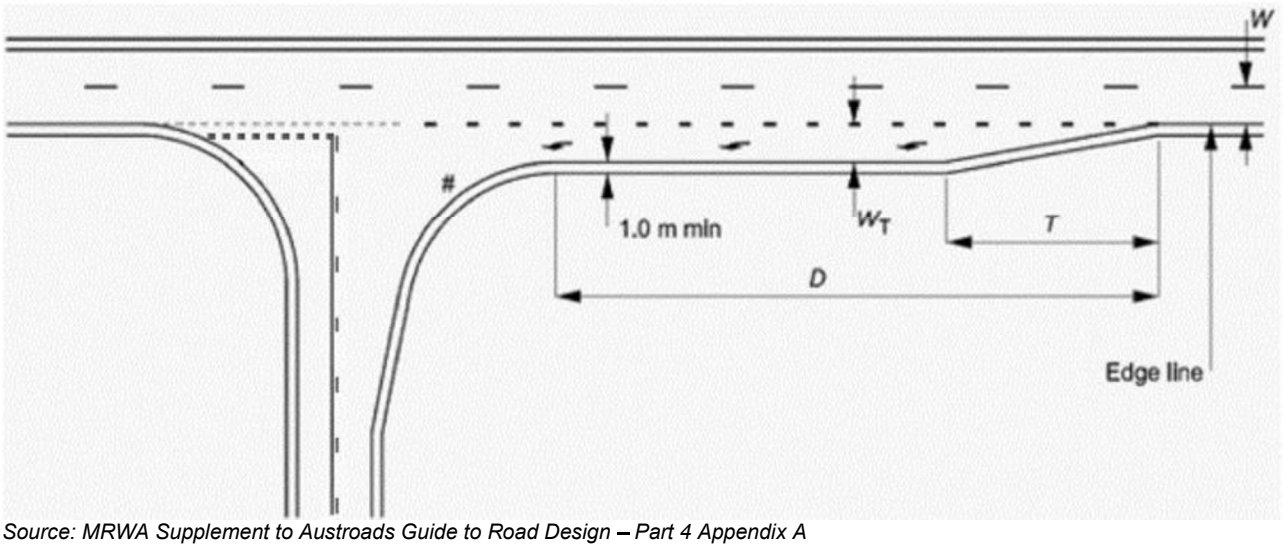


Source: MRWA Supplement to Austroads Guide to Road Design – Part 4 Appendix A

6.7.2.2 AUL(S) Treatment

AUL(S) treatment is a Rural auxiliary left-turn treatment – short turn lane on the major road. that involves the creation of an additional short lane on the major road to allow through traffic to bypass turning vehicles. The AUL(S) layout should not be used where there is reduced visibility to the turn treatment. Left-turning drivers on the major road need to perceive the location of the deceleration lane and the side road in time to make the necessary speed reduction in the through lane prior to diverging. **Figure 6-9** illustrates a typical layout for AUL(S) treatment.

Figure 6-9 Typical Main Roads Type AUL(S) treatment

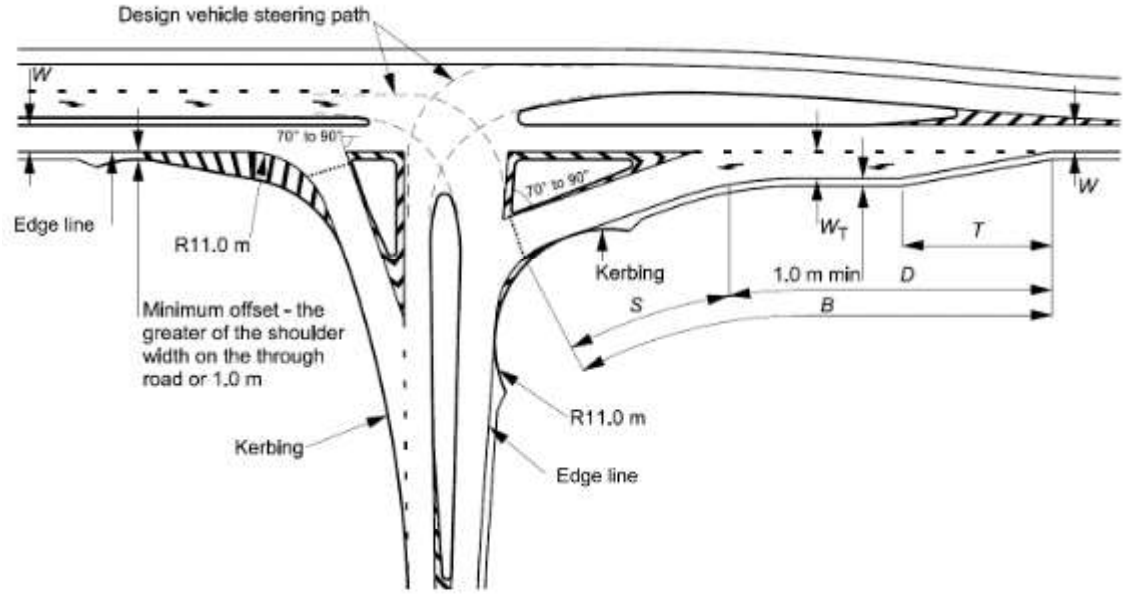


Source: MRWA Supplement to Austroads Guide to Road Design – Part 4 Appendix A

6.7.2.3 CHL Treatment

CHL treatment is a Rural channelised left-turn treatment is designed for use in high-speed environments. **Figure 6-10** illustrates a typical layout for CHL treatment.

Figure 6-10 Typical Main Roads Type CHL treatment



Notes:

Approaches to left-turn slip lanes can create hazardous situations between cyclists and left-turning motor vehicles. One treatment to reduce the number of potential conflicts at left-turn slip lanes is given in AGRD Part 4 (Austroads 2017).

Figure 6.4 details minimum offsets to islands.

Desirable minimum area of rural islands ≥ 50 m².

The dimensions of the treatment are defined as:

- W = *Nominal through lane width (m) (including widening for curves). For a new intersection on an existing road, the width is to be in accordance with the current link strategy.*
- W_T = *Nominal width of turn lane (m), including widening for curves based on the design turning vehicle. Desirable minimum = W, absolute minimum = 3.0 m.*
- B = *Total length of auxiliary lane including taper, diverge/deceleration and storage (m).*
- D = *Diverge/deceleration length including taper. Adjust for grade using the 'correction to grade' factor (Section 5).*
- T = *Physical taper length (m) and is given by Equation 5 being:* $T = \frac{0.33VW_T}{3.6}$.
- S = *Storage length (m) should be the greater of:*
  1. *the length of one design turning vehicle or*
  2. *(calculated car spaces –1) x 8 m (Guide to Traffic Management Part 3: Traffic Studies and Analysis (Austroads 2013e)), or use computer program e.g. aaSIDRA.*

Source: MRWA Supplement to Austroads Guide to Road Design – Part 4 Appendix A

6.7.2.4 CHR Treatment

Rural channelised turn treatment CHR separates through movements from turning vehicles. Auxiliary lanes are often used in conjunction with channelisation. Travel path directions need to be clear for drivers in order to avoid potential confusion. **Figure 6-11** below illustrates the principles of the CHR treatment.

Figure 6-11 Rural CHR treatment

Source: Austroads Guide to Road Design Part 4A

The turn treatment warrant assessment for the 2022 background traffic shows that auxiliary lane turn treatments are currently warranted at the intersection of Bussell Highway and Brockman Highway. The traffic generated by the proposed Hamelin Grove LSP is currently not contributing to this outcome. Due to the warrants already being met by the existing intersection traffic, any cost associated with the upgrading of the intersection for the inclusion of turn treatments should be shared proportionally between Main Roads WA and the development.

7 Summary

This assessment has been prepared in accordance with the *WAPC Transport Assessment Guidelines for Developments: Volume 2 – Planning Schemes, Structure Plans and Activity Centre Plans* (2016).

The following conclusions have been made in regard to the proposed LSP:

- The LSP currently includes 89 residential lots R5 and 6 residential lots R2.5. When fully developed, it will include a total of 164 dwellings.
- The LSP proposes 2 access roads to the site. The western and eastern access are located along Brockman Highway.
- Analysis of the key intersections has been undertaken with the following conclusions:
  - Existing road alignment (Bussell Highway / Brockman Highway intersection) will be able to cater for the LSP traffic and the estimated background traffic growth.
  - Proposed roundabout (Brockman Highway / Hamelin Grove / Karridale West) will be able to cater for the LSP traffic and the estimated background traffic growth.

The Turn treatment warrant assessment conducted along Bussell Highway / Brockman Highway intersection shows that auxiliary turn treatments are currently warranted at the intersection based on the existing background traffic volumes.

APPENDIX

A

SITE PLAN

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APPENDIX

B

CORRESPONDENCE

Cardno

now

Stantec

From: NAUDE Daniel (RCPM) <Daniel.Naude@mainroads.wa.gov.au>
Date: Thu, 13 Oct 2022 at 18:08
Subject: Traffic data: Review of Traffic Impact Assessment - Karridale East Structure Plan Amendment
To: Dr Kevin McIsaac <kevin.mcisaac@gmail.com>
Cc: DAVIES Paul (Con) <paul.davies@mainroads.wa.gov.au>

Hi Kevin,

I refer to our recent discussion regarding the requirement for the updated TIA for the current Structure Plan Amendment under consideration and the drainage in the location.

As discussed, the developer for 'Karridale West' did a traffic survey/count for the Bussell Highway access in 2021, however, our 'traffic data section' has updated the system recently with new data for Bussell Highway just north of the Brockman Highway junction, referencing 1909 VPD, which is lower than the volumes used for the Karridale West development. However, the figure of 1909 VPD can be used for analysis purposes with an annual traffic growth rate of 1.5% applied for the 'base case scenario' for traffic analysis purposes. The new traffic data depicts traffic volumes of 1909 VPD with a 50%/50% North – South split.

As also discussed, Main Roads has previously undertaken an analysis of potential future urban growth of the planned surrounding and southern settlement areas, having regard to the Shire's Local Planning Strategy, discussions with Shire planning and building services staff and recent building permit 'stats' for Augusta provided by the Shire.

The purpose of the analysis was to estimate the additional traffic that could reasonably be contributed by the urban 'growth areas' to the existing traffic 'base case' scenario in order to arrive at an estimation of future traffic volumes for Bussell Highway for a 15 year forecast period to inform a turn warrant assessment for the new intersection/access for Karridale West. It is considered that a similar approach could be followed for your Estate in Karridale East whereby the estimated traffic generation for Karridale West and the settlement areas referred to below are added to the updated traffic analysis to inform the required turn warrant assessment for the Bussell Highway / Brockman Highway junction.

I note that there is current traffic volume data (664 VPD - 2021/2022) available just to the east of the Karridale East Location which should also be utilised in the analysis as back ground traffic. Limited traffic data is available for Brockman Highway and traffic volumes seems to be fairly consistent at the moment, however, Main Roads consider that traffic will marginally increase over time, as discussed, and a 1% growth rate on Brockman Highway should be applied for traffic analysis purposes.

In relation to relation to 'Karridale West', I have attached the endorsed local structure plan which depicts 77 lots being created, including a 'mixed business use' site. One of the sites (to the north of the planned intersection) have since been converted to a local reserve with a water tank for fire suppression purposes, which reduces the lot yield from 77 to 76 lots for traffic analysis purposes.

The DPLH has previously agreed for the mixed-use site to be considered as a 'standard' rural-residential lot for traffic analysis purposes, given the uncertainty of the site being development in the short to medium term and the perceived difficulty to predict the possible range of commercial uses and/or the site's development potential. This aspect was not supported by Main Roads as the original TIA prepared by the developer did actually assume a range of likely commercial uses and development potential of the site with associated trip generation figures, however, Main Roads will agree to the commercial lot being assessed as a standard residential lot for consistency purposes.

The previously estimated urban growth analysis for the relevant settlement areas are outlined below. As discussed, the Shire's Local Planning Strategy states that it is estimated that 70% to 75% of employment is located in the Margaret River townsite and surrounding locality and the Shire acknowledges that Augusta is a very low employment generator and only has a primary school. Accordingly, Main Roads was previously prepared to accept a traffic split of 70% N / 30% S for the Karridale West development and this split can be used for Karridale East to determine distribution split and calculate turning volumes at the Bussell Highway / Brockman Highway junction for consistency purposes.

The warrant calculation for the left turn treatment is of critical interest to Main Roads - specifically the PM period, given the 70% North traffic split for development traffic. Further extrapolation from the information below is required to undertake both AM and PM warrant calculations, as necessary. The trip generation calculation below is for the peak hour traffic period.

Karridale

The Shire's Draft Local Planning Strategy provides for a number of growth scenarios for the settlement area, however, the Shire has previously confirmed that the WAPC's list of modifications to the Draft Strategy requires all 'staging provisions' in the Draft Strategy to be removed. This will have the effect that any of the planning precincts identified in the Strategy can be progressed at any stage.

Main Roads notes in relation to Karridale 'West' / K1 that the structure plan proposes 76 lots:

'Future Urban Growth Traffic' to be calculated and data utilised as follows –

AM: 76 Lots x 0.6 (to determine peak traffic out from development – refer WAPC TIA Guidelines) = 45.6 trips x 70 N / 30 S split

= 32 trips NB [70%]

= 14 trips SB to be added to Bussell HWY as return traffic to Karridale West and for AM RT warrant analysis at Bussell Hwy / Brockman Hwy [30%]

PM: 76 Lots x 0.3 (to determine peak traffic out from development) = 22.8 trips x 70 N / 30 Split

= 16 trips returning into Karridale West at new access and not relevant to any warrant calculation. [70%]

= 7 trips S to be added to Bussell HWY traffic for LT warrants calculation at Bussell Hwy / Brockman Hwy junction [30%]

Main Roads notes in relation to Karridale 'East' (Area 'K2' in the Shire's LPS) that an overall lot yield of 164 lots are proposed:

'Future Urban Growth Traffic' to be calculated and data utilised as follows –

AM: 164 Lots x 0.6 (to determine peak traffic out from development) = 98.4 trips x 70 N / 30 S split

= 69 trips NB [70%]

= 30 trips SB to be added to Bussell HWY as return traffic to Karridale West and for AM RT warrant analysis at Bussell Hwy / Brockman Hwy [30%]

PM: 164 Lots x 0.5 (to determine peak returning to development) = 82 trips x 70 N / 30 Split

= 58 returning trips SB to be added to Bussell HWY traffic for LT warrant calculation at Bussell Hwy / Brockman Hwy junction [70%]

= 25 trips NB to be added to Bussell HWY traffic for RT warrant calculation at Bussell Hwy / Brockman Hwy junction [30%]

Discussion with the planning consultants (Halsall & Associates) for Planning Precinct 'K4' (enclave development in Shire's LPS) advise that the Shire has recently supported an 'in-principle request' to initiate a Scheme Amendment and Structure plan for an approximate 40 lots in precinct K4 and will be lodging formal documentation in due course with the Shire. It is reasonable to consider that at least all of these lots will be created in the life time of the Local Planning Strategy and Assessment Year for this traffic analysis.

'Future Urban Growth Traffic' to be calculated and data utilised as follows –

AM: 40 Lots x 0.6 (to determine peak traffic out from development) = 24 trips x 70 N / 30 S split

= 17 trips NB for RT warrant calculation at Bussell Hwy / Brockman Hwy junction [70%]

= 7 trips SB towards Augusta and not relevant to warrant analysis at Bussell Hwy / Brockman Hwy [30%]

PM: 40 Lots x 0.5 (to determine peak returning to development) = 20 trips x 70 N / 30 Split

= 14 trips SB returning traffic to be added to Bussell HWY traffic for LT warrant calculation at Bussell Hwy / Brockman Hwy junction [70%]

= 6 trips SB towards Augusta and not relevant to warrant analysis at Bussell Hwy / Brockman Hwy [30%]

Kudardup

A total number of 150 lots have been issued subdivisional approval in the last two years.

'Future Urban Growth Traffic' to be calculated and data utilised as follows –

AM: 150 Lots x 0.6 (to determine peak traffic out from development) = 90 trips x 70 N / 30 S split

= 63 trips NB for RT warrant calculation at Bussell Hwy / Brockman Hwy junction [70%]

= 27 trips SB towards Augusta and not relevant to warrant analysis at Bussell Hwy / Brockman Hwy [30%]

PM: 150 Lots x 0.5 (to determine peak returning to development) = 75 trips x 70 N / 30 Split

= 53 trips SB returning traffic to be added to Bussell HWY traffic for LT warrant calculation at Bussell Hwy / Brockman Hwy junction [70%]

= 23 trips SB towards Augusta and not relevant to warrant analysis at Bussell Hwy / Brockman Hwy [30%]

Hamlin Bay

Lot 21 Caves Road Hamlin Bay – WAPC has approved 36 Lots on 25/05/2021

'Future Urban Growth Traffic' to be calculated and data utilised as follows –

AM: 36 Lots x 0.6 (to determine peak traffic out from development) = 90 trips x 70 N / 30 S split

= 63 trips NB for RT warrant calculation at Bussell Hwy / Brockman Hwy junction [70%]

= 27 trips SB towards Augusta and not relevant to warrant analysis at Bussell Hwy / Brockman Hwy [30%]

PM: 36 Lots x 0.5 (to determine peak returning to development) = 21.6 trips x 70 N / 30 Split

= 15 trips SB returning traffic to be added to Bussell HWY traffic for LT warrant calculation at Bussell Hwy / Brockman Hwy junction [70%]

= 6 trips SB towards Augusta and not relevant to warrant analysis at Bussell Hwy / Brockman Hwy [30%]

Augusta

Discussions on Monday 13th September 2021 with an officer from the planning department at the Shire has suggested that Augusta is not experiencing any significant development in general. Further information received on Tuesday the 14th September from the Shire's Building Coordinator confirmed that the Shire had processed a 118 building permits for Augusta in the period from 14/09/2019 to 14/09/2021 which equates to between 50 and 60 permits per year. The number of permits is considered significant in the context of current traffic investigations and should be accounted for in the analysis.

It is acknowledged that this level of growth is probably unlikely to be sustained for the period of analysis and Main Roads is prepared to accept a 60% reduction in permits (20 permits per year) from 2022 onwards to balance the growth scenario.

'Approximately 160 building permits have been approved in the referenced two year period – given likely construction time frames Main Roads is prepared to accept that 50 permits be allocated to future growth analysis plus 20 permits per year. Main Roads was prepared to accept a 50 / 50 split for future traffic with 50% of traffic going north due to low employment generators and to account for holiday homes in this location.

50 Building permits + 20 building permits per annum for 15 years = 350 permits/dwellings to be developed over the Assessment Year period for the TIA with x 50 N / 50 S] split

'Future Urban Growth Traffic' to be calculated and data utilised as follows –

AM: 350 Lots x 0.6 (to determine peak traffic out from development) = 210 trips x 50 N / 50 S split

= 105 trips NB for RT warrant calculation at Bussell Hwy / Brockman Hwy junction [70%]

= 105 trips circulating within Augusta and not relevant to warrant analysis at Bussell Hwy / Brockman Hwy [30%]

PM: 350 Lots x 0.5 (to determine peak returning to development) = 175 trips x 50 N / 50 Split

= 88 trips SB returning traffic to be added to Bussell HWY traffic for LT warrant calculation at Bussell Hwy / Brockman Hwy junction [50%]

= 88 circulating trip within Augusta and not relevant to warrant analysis at Bussell Hwy / Brockman Hwy [50%]

Acoustics Assessment –

In relation to the traffic volumes required for the acoustic assessment, the following volumes are to be used for 'daily' Bussell Hwy traffic volumes for modelling purposes –

- Apply and grow the existing estimated daily traffic count of 2,384 VPD at 1.5% for 15 years = 2,980 VPD
- Add Karridale West traffic - 76 Lots x 8 trips per dwelling = 608 trips x 70 N / 30 S split = 426 trips VPD N to be added to Bussell HWY traffic which will return back past the development frontage on Bussell Hwy.
- Add Karridale East traffic - 164 Lots x 8 trips per dwelling = 1312 trips x 70 N / 30 S split = 918 VPD trips past the development frontage on Bussell Hwy + Existing Brockman Hwy, calculated as follows:

  Add westbound traffic east of development area - Approx. 350 VPD westbound x 70 N / 30 S split = 245 VPD trips past the development frontage on Bussell Hwy

- Kudardup - 150 Lots x 8 trips per dwelling = 1200 trips x 70 N / 30 S split = 840 VPD trips N to be added to Bussell HWY traffic
- Hamlin Bay - 36 Lots x 8 trips per dwelling = 288 trips x 70 N / 30 S split = 201 VPD trips N to be added to Bussell HWY traffic
- Augusta – estimated 350 future Lots x 8 trips per dwelling = 2800 trips x 50 N / 50 S split = 1400 VPD trips N to be added to Bussell HWY traffic

Total = 7010 VPD on Bussell Hwy past the structure plan development frontage.

Please do not hesitate to contact me should you require any further assistance in the matter.

Regards,

Daniel Naude

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Karridale Hamlet Concept Residential Development

Transport Assessment (FINAL)

Prepared for Juventus Pty Ltd
October 2012

Cardno
Shaping the Future

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1 (DRAFT)	August 2012	Elaine Chan	EC	Ray Cook	RJC
2 (FINAL)	October 2012	Elaine Chan	EC	Ray Cook	RJC

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Executive Summary

This Transport Assessment outlines the transport aspects of the Karridale Hamlet Concept residential development focussing on traffic operations, access, circulation and car parking. Discussion regarding pedestrian, cycle and public transport considerations are also provided.

The Karridale Hamlet Concept residential development proposes 77 single residential units, public open space, and six chalets within the vineyard area, in addition to an existing residential unit, which will help cater for the future tourist accommodation demand within the Shire of Augusta Margaret River region. It is noted that the "Karridale West" residential development located on the north-west corner of Bussell Highway/Bushby Road intersection, is currently being proposed but has not yet been approved by the Shire of Augusta Margaret River.

The analysis indicates that the Bussell Highway/Brockman Highway intersection, as well as the two development access locations, will operate well within capacity limits with the Karridale Hamlet Concept residential development scenario and also with the proposed "Karridale West "development scenario, beyond a ten year horizon. Therefore no upgrade works are required.

Pedestrian footpaths and cycle facilities in the area are noted as being limited and but is considered to be acceptable due to the low traffic environment of the surrounding road network.

This assessment has been prepared in accordance with the WAPC *Transport Assessment Guidelines for Developments: Volume 4 – Individual Developments (2006)* for lodgement with the development application with the Shire of Augusta Margaret River.

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Appendices

Appendix A **WAPC Transport Assessment Checklist for Development**

Appendix B **Karridale Hamlet Concept Residential Development Plan**

Appendix C **Shire of Augusta Margaret River Maps**

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Appendix D Bus Routes

Appendix E Crash Data & Road Use Movement (RUM) Codes (MRWA)

Appendix F SIDRA Outputs

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1 Introduction

1.1 Background

Juventus Pty Ltd commissioned Cardno to prepare a *Transport Assessment* for the proposed Karridale Hamlet Concept residential development located at Lot 100 Brockman Highway, Karridale. The development is bounded by Brockman Highway to the east and south, and Bussell Highway to the west. Karridale is located approximately 300km south of Perth, approximately 30km south of Margaret River and approximately 15km north of Augusta.

This report has been prepared in accordance with the Western Australian Planning Commission (WAPC) *Transport Assessment Guidelines for Developments: Volume 4 – Individual Developments (2006)* and the checklists is included at **Appendix A**. Specifically, this report aims to outline the transport aspects of the proposed development, with a focus on accessibility, traffic operation, circulation and car parking.

The proposed development location is illustrated on **Figure 1**.

Figure 1 Karridale Hamlet Concept Residential Development Locality

2 Proposed Development

2.1 Karridale Hamlet Concept residential development

The proposed development comprises of 77 single residential units, public open space, and six chalets within the vineyard area. It is noted that the six chalets and vineyard area are conceptual uses. It is understood that this development is expected to supply tourism accommodation to service the expected demand within the Shire of Augusta Margaret River region.

2.2 Development proposed land uses

The Karridale Hamlet Concept residential development plan, included at **Appendix B**, comprises the following elements:

> Residential
  - 71 single dwelling units of land size under 0.5 hectors
  - Six single dwelling units of land size above 0.5 hectors
  - Six chalets

2.3 Access arrangement

The proposed development incorporates two access locations connecting with Brockman Highway, as illustrated at **Appendix B**. These access locations will service the ingress and egress movements of the development.

2.4 Development trip generation

Trip generation for the development has been estimated generally in accordance with *The Institute of Transportation Engineers (ITE): Trip Generation 7th Edition.*

For the purpose of determining potential trip generation rates, the proposed development has been classified as per the following ITE classifications:

Table 1 Karridale Hamlet Concept Residential Development ITE Classification

Land Use	ITE Classification	ITE Classification Code
Single Unit Accommodations	Single-Family Detached Housing	210
Chalets	Recreational Homes	260

**Note that the closet description of activities from ITE classification have been used for the proposed land uses.*

Table 2 summarises the RTA trip generation rates for each peak and daily time period.

Table 2 ITE Trip Generation Rates

ITE Land Use	ITE Land Use Code	Trip Generation Rates	
		AM Peak Hour	PM Peak Hour
Single Unit Accommodations	210	0.77 trips per dwelling unit	1.02 trips per dwelling unit
Recreational Homes	260	0.30 trips per dwelling unit	0.31 trips per dwelling unit

NOTE. It is noted that full occupancy is used as assumption.

Additionally, entry and exit distribution for the development is expected be as follows.

Table 3 ITE Directionality Rates

ITE Land Use	AM Peak Hour		PM Peak Hour	
	IN	OUT	IN	OUT
Single Unit Accommodations	26%	74%	64%	36%
Recreational Homes	49%	51%	44%	56%

Table 4 summarises the expected trip generation for the proposed development by applying the above trip rates and entry/exit distributions.

Table 4 Karridale Hamlet Concept Residential Development Trip Generation

Land Use	Development Yields	AM Peak Hour		PM Peak Hour	
		IN	OUT	IN	OUT
Single Unit Accommodations	77 dwelling units	16 trips	44 trips	51 trips	29 trips
Recreational Homes	6 dwelling units	1 trip	1 trip	1 trip	1 trip
Total		**17 trips**	**45 trips**	**52 trips**	**30 trips**

As estimated above the proposed development is expected to generate **62 trips during AM peak hour** and **82 trips during PM peak hour**.

It is expected that vehicle demand for the proposed development will consist predominantly of private vehicles, and also refuse collection and delivery vehicles.

2.5 Development traffic distribution

Based on the location of local key attractions and generators, the following trip distribution has been adopted for traffic travelling from the development towards:

- Brockman Highway East 20%;
- Brockman Highway West 80%.

Figure 2 illustrates the distributed development traffic volumes for AM and PM peak hours.

Figure 2 Karridale Hamlet Concept Residential Development Trip Generation (AM & PM Peak Hours)

2.6 Vehicle parking provision

The statutory parking requirement for the proposed development, as calculated in **Table 5** is in accordance with the Shire of Augusta Margaret River *Local Planning Scheme No.1*.

Table 5 Karridale Hamlet Concept Residential Development Parking Requirement

Land Use	Development Yield	Shire of Augusta Margaret River Parking Rate	Statutory Parking Requirement
Residential	77 dwellings	As per R-Codes: 2 spaces per dwelling	154 spaces
Chalet/Far-stay Accommodation	6 chalets	1 space per chalet plus 1 visitor parking space for every 4 chalets	8 spaces
TOTAL			**162 spaces**

As indicated above, the proposed development requires 162 parking spaces. It is expected that the requirement of the parking spaces will be provided by the future land owners of the individual lots.

It is also noted that the public open space and vineyard area are for internal use only, therefore no additional parking provision for these facilities are required.

2.7 End of trip facilities

It is expected that bicycle parking and end of trip facilities such as shower provision will be available at each residential unit.

2.8 Internal road layout

Development plans included at **Appendix B** show access arrangement for the development as well as provisions for service activities. It is intended for all vehicles to enter and exit in a forward gear.

It is noted that that the proposed internal roadways will accommodate two way circulation of traffic with the road reserve in the range of 16m to 25m.

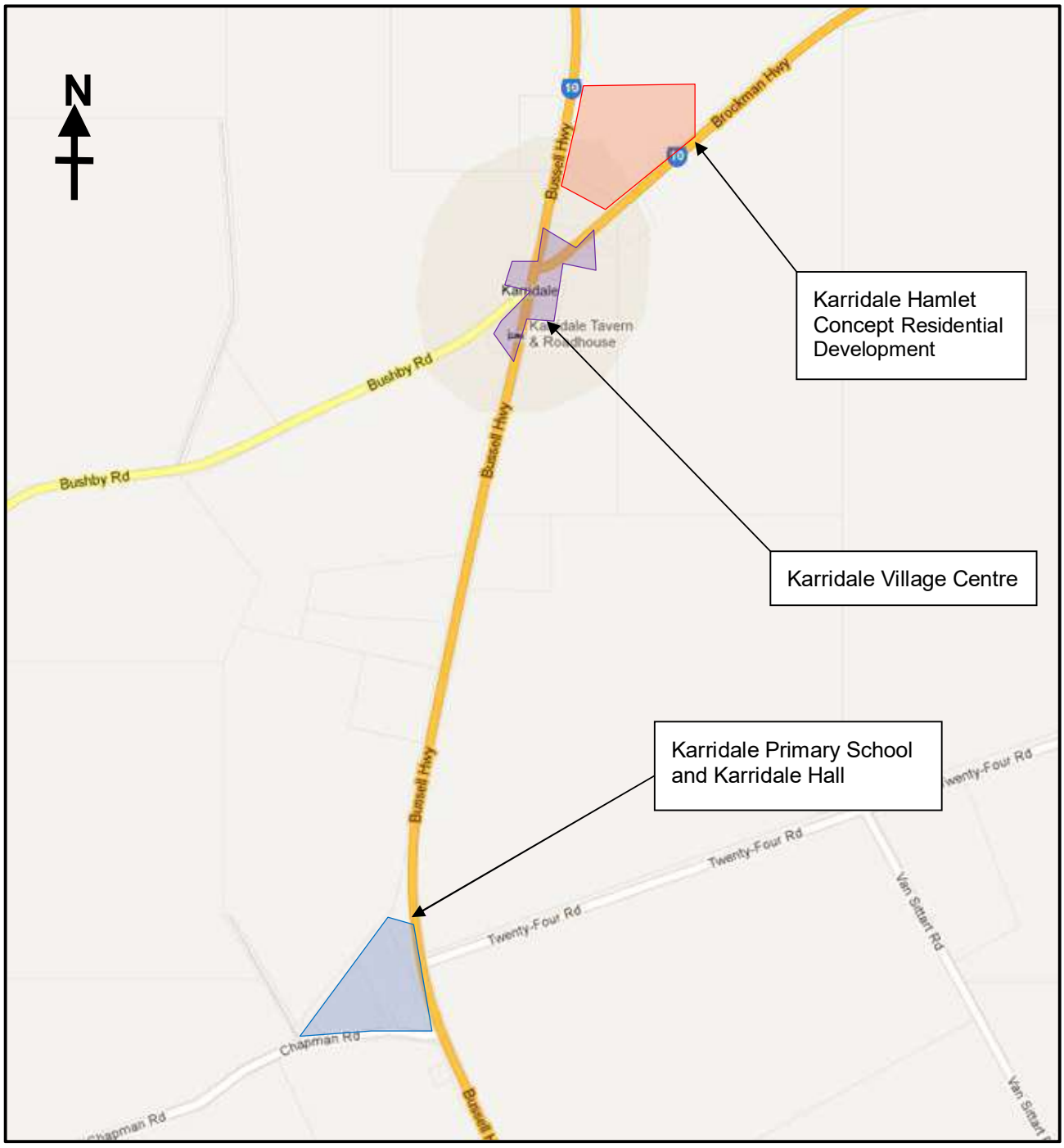
3 Existing Situation

3.1 General

The site is located within the "Priority Agriculture" area as described by the Shire of Augusta Margaret River *Local Planning Scheme No.1* and is located in "Development Investigation Area 1" as described by the Shire *Karridale Hamlet Settlement Strategy (KHSS)*, included at **Appendix C**.

As indicated on **Figure 3**, the surrounding area consists of commercial and village centre uses to the south including a petrol station, a roadhouse and tavern and a general store with post office. The rest of the surrounding area is primarily an agriculture area. It is noted that the Karridale Primary School and Karridale Hall is located 2km south on Bussell Highway.

Figure 3 Existing Surrounding Land Use



3.2 Existing development

Currently the location of the proposed development consists of a vineyard and one house with one vehicle access located at Brockman Highway.

Existing development trip generation

Table 6 summarises the ITE trip generation rates for each peak and daily time period.

Table 6 ITE Trip Generation Rates

ITE Land Use	ITE Land Use Code	Trip Generation Rates	
		AM Peak Hour	PM Peak Hour
Single Unit Accommodations	210	0.77 trips per dwelling unit	1.02 trips per dwelling unit

NOTE. It is noted that full occupancy is used as assumption.

The entry and exit distribution for the development is expected be as follows.

Table 7 ITE Directionality Rates

ITE Land Use	AM Peak Hour		PM Peak Hour	
	IN	OUT	IN	OUT
Single Unit Accommodations	26%	74%	64%	36%

Table 8 summarises the expected trip generation for the existing development by applying the above trip rates and entry/exit distributions.

Table 8 Existing Development Trip Generation

Land Use	Development Yields	AM Peak Hour		PM Peak Hour	
		IN	OUT	IN	OUT
Single Unit Accommodations	1 dwelling unit	1 trip	1 trip	1 trip	1 trip
Total		**1 trip**	**1 trip**	**1 trip**	**1 trip**

3.3 Existing road network

The following discusses the characteristics of the surrounding road network:

> **Brockman Highway** is a state road and classified as a *Primary Distributor* according to MRWA *Main Roads Functional Road Hierarchy (MRFH)* with a posted speed of 110 km/h and seal width of approximately 8.6m.
> **Bussell Highway** is a state road and classified as a *Primary Distributor* according to MRWA *Main Roads Functional Road Hierarchy (MRFH)* with a posted speed of 90km/h and seal width of approximately 7.6m.
> **Bushby Road** is classified as a *Regional Distributor* according to MRWA *Main Roads Functional Road Hierarchy (MRFH)* with a posted speed of 50km/h in built up areas or 110km/h outside built up areas. The road has a seal width of approximately 6.2m.

3.4 Existing intersections

The following discusses the intersections that surround the development:

> **Brockman Highway/Bussell Highway intersection**, located approximately 1km to the left of the development, is a three-way Give Way controlled intersection comprising single approach and departure lanes.
> **Bussell Highway/Bushy Road intersection**, located approximately 90m south of the Brockman Highway/Bussell Highway intersection, is a three-way Give Way controlled intersection comprising single approach and departure lanes.

3.5 Existing traffic volumes

The existing traffic volumes have been taken from the following sources:

> Main Roads Western Australia (MRWA) *South West Traffic Digest 2003/04 – 2008/09*
> Traffic volumes from *Karridale West Local Structure Plan*
> Site observations and counts.

Onsite traffic surveys have been undertaken during the AM peak hour on 31 August 2012 and PM peak hour on 27 August 2012 to identify the traffic distributions for Bussell Highway, Brockman Highway and Bushby Road, as follows:

> For traffic travelling from Bussell Highway North towards:
  - Bussell Highway South 66% (AM), 91% (PM), of which 3% (AM) and 9% (PM) turn on to Bushby Road;
  - Brockman Highway 34% (AM), 9% (PM).
> For traffic travelling from Bussell Highway South towards:
  - Bussell Highway North 64% (AM), 74% (PM);
  - Brockman Highway 36% (AM), 26% (PM), of which 2% (AM) and 0% (PM) turn on to Bushby Road.
> For traffic travelling from Brockman Highway towards:
  - Bussell Highway North 55% (AM), 36% (PM);
  - Bussell Highway South 45% (AM), 64% (PM), of which 0% on both peak periods turn on to Bushby Road.
> For traffic travelling from Bushby Road towards:
  - Bussell Highway North 50% (AM), 83% (PM), of which 0% on both peak periods turn on to Brockman Highway;
  - Bussell Highway South 50% (AM), 17% (PM).

As indicated above, the majority of the traffic travels towards the north and the south via Bussell Highway during the peak hour periods. Very little traffic is observed to use Bushby Road and therefore this intersection is not assessed in this report.

Figure 4 illustrates the existing 2012 traffic volumes for AM and PM peak hours.

Figure 4 2012 Background Traffic Volumes (AM & PM Peak Hours)

3.6 Existing intersection operation

Analysis of the existing traffic volumes operation has been carried out for the following external intersection:

> Bussell Highway/Brockman Highway

The results of the SIDRA analysis in **Table 9** quantifies the existing intersection operations for both the AM peak period 9am-10am and PM peak period 3pm-4pm.

Table 9 Bussell Highway/Brockman Highway Intersection Performance – 2012 Existing

Intersection Approach		2012 Existing AM Peak				2012 Existing PM Peak			
		DOS	Delay	LOS	95% Queue	DOS	Delay	LOS	95% Queue
Bussell Highway - S	T	0.062	0.4	A	2.4	0.064	0.4	A	2.6
	R	0.062	13.0	B	2.4	0.064	13.0	B	2.6
Brockman Highway - E	L	0.039	15.2	C	1.1	0.037	15.0	C	1.0
	R	0.039	15.0	B	1.1	0.037	14.8	B	1.0
Bussell Highway - N	L	0.050	13.1	B	0.0	0.050	13.1	B	0.0
	T	0.050	0.0	A	0.0	0.050	0.0	A	0.0

From above it is noted that the Bussell Highway/Brockman Highway intersection is currently operating within acceptable capacity limits.

3.7 Existing pedestrian/cycle networks

There is currently no pedestrian/cycle path facility in the immediate area surrounding the development site.

3.8 Existing public transport services

The public transport provisions available in Karridale area include the following routes:

> SW1 - Perth to Augusta (Transwa), 1 service each direction per day
> Perth to Augusta via Margaret River (South West Coach Lines), 1 service each direction per day
> Augusta to Bunbury Route 24 (School Bus), 1 service each for the morning and afternoon
> A local school bus collects and delivers children to and from the Karridale primary school

The general store on Bussell Highway in Karridale also acts as the bus stop. Timetables of the above routes are included at **Appendix D**.

3.9 Crash assessment

Assessment of the crash data for the five year period between 2007 and 2011 has been performed for Brockman Highway. It is noted that there was no recorded crash within the five year period. The closest recorded crash was located approximately 700m east of the existing development access and the crash involved in hitting an animal.

The detailed output is included at **Appendix E** .

4 Changes to Surrounding Transport Networks

4.1 Road network

From liaison with Shire of Augusta Margaret River, it is noted that there is currently no information available regarding future planning on the surrounding road network for Karridale.

4.2 Changes to pedestrian/cycle networks

It is noted that the KHSS document proposes a dual use path between the Karridale Village Centre and the primary school, as shown on the plan included at **Appendix C**.

At the time of this document, information regarding the timeframe for installation of the dual use path from Shire of Augusta Margaret River was not available.

4.3 Public transport

From liaison with Shire of Augusta Margaret River, it is noted that there is currently no information available regarding future planning of public transport for Karridale.

5 Integration with Surrounding Area

5.1 Surrounding major attractors/generators

The major attractors/generators surrounding the development are the Karridale Village Centre, Karridale primary school, Augusta at approximately 15km to the south, Margaret River at approximately 30km to the north on the Bussell Highway, and Hamelin Bay at approximately 8.5km to the west. The existing public transport services are considered to be poor and it is expected that most resident or tourist will travel by private vehicle.

5.2 Proposed changes to surrounding land uses

The “Karridale West” residential development is currently being proposed but has not yet been approved by the Shire of Augusta Margaret River. This development is located on the north-west corner of the Bussell Highway and Bushby Road intersection, and comprises of approximately 107 residential lots. The estimated traffic generation is 1520vpd of which 50% of the traffic is expected to access Bussell Highway and the other 50% are expected to access Bushby Road.

The impact from “Karridale West” additional traffic is expected to be minimal due to the low traffic demand on Bussell Highway.

6 Analysis of Transport Networks

6.1 Transport assessment

Future traffic conditions have been analysed for year 2023 which is the approximate 10 year horizon after development completion. The assessment herein quantifies the effect that additional development traffic has on the surrounding road network, specifically the intersections below.

> Bussell Highway/Brockman Highway
> Brockman Highway/Development Access (west)
> Brockman Highway/Development Access (east)

Growth Rates

Due to insufficient historic traffic data available from the Shire and MRWA, and considering the expected growth in the area, a linear growth rate of 2% (applied to background traffic volumes in this assessment) is deemed appropriate for the road network and future plans.

6.2 Assessment scenarios

The assessment undertaken in this study considers the following year scenarios both AM peak period 9am-10am and PM peak period 3pm-4pm:

> Scenario 1 – 2023 Background Condition (without development)
> Scenario 2 – 2023 With Development (Background plus development)
> Scenario 3 – 2023 With Development & Proposed "Karridale West" Development

Scenario 1 has been developed utilising the existing traffic count information multiplied by an adopted 2% growth rate to forecast volumes for the 2023 design year. The following outlines the calculation for the future base case condition:

Scenario 1 - 2023 Background Condition = Existing traffic volumes x 2%

For Scenario 2, this traffic demand case has been developed through the addition of Scenario 1 and the development.

Scenario 2 – 2013 With Development = *Scenario 1 + Karridale Hamlet Concept residential development*

For Scenario 3, this traffic demand case has been developed through the addition of Scenario 2 and the proposed "Karridale West" development.

Scenario 3 – 2013 With Development = *Scenario 2 + "Karridale West" Residential development*

Figures 5 to **7** illustrate the traffic volumes for AM and PM peak hours expected for the three scenarios above.

Figure 5 Scenario 1 - 2023 Background Condition Traffic Volumes (AM & PM Peak Hours)

Figure 6 Scenario 2 - 2023 With Development Traffic Volumes (AM & PM Peak Hours)

Figure 7 Scenario 3 - 2023 With Development & Karridale West Development Traffic Volumes (AM & PM Peak Hours)

6.3 Road network assessment

Analysis of the traffic impacts of the proposed development has been carried out for the following external intersection:

> Bussell Highway/Brockman Highway
> Brockman Highway/Development Access (west)
> Brockman Highway/Development Access (east)

The three identified intersections have been analysed for each scenario using the SIDRA v5.1 analysis program. This program calculates the performance of intersections based on input parameters, including geometry and traffic volumes. As an output SIDRA v5.1 provides values for the Degree of Saturation (DOS), queue lengths and delays. The generally accepted upper limits for the DOS (where it is considered that the operation of the intersection is constrained) are:

> 0.80 for unsignalised intersections
> 0.85 for roundabouts
> 0.95 for signalised intersections

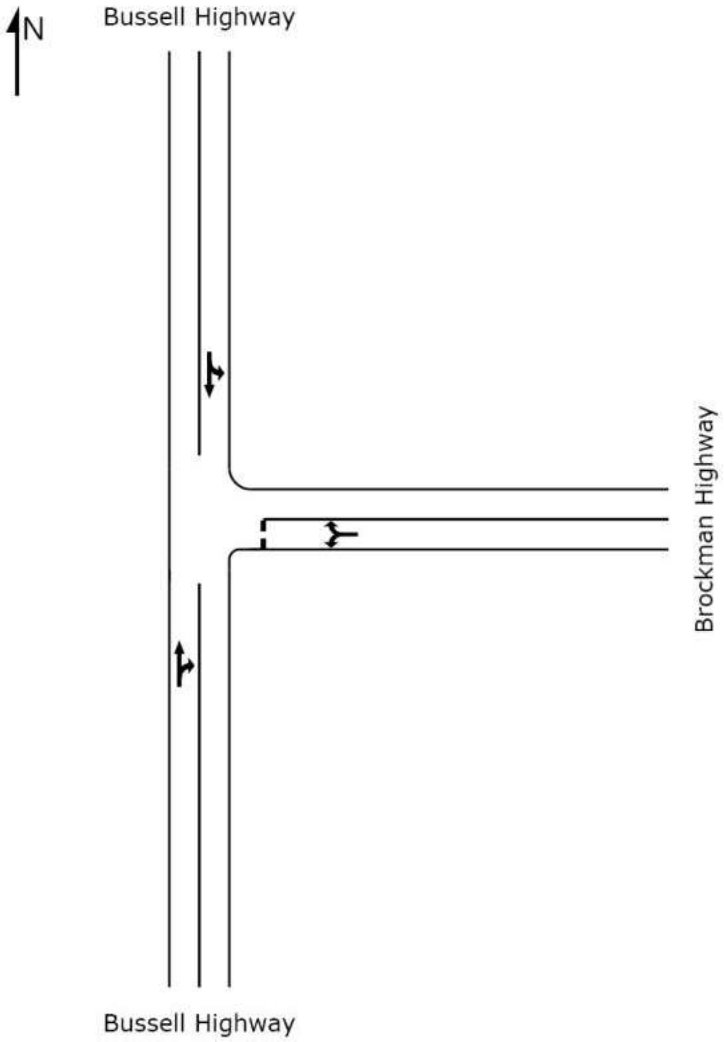
A DOS exceeding these values indicates that the intersection is exceeding its practical capacity. Above these values, users of the intersection are likely to experience unsatisfactory queuing and delays during the peak hour periods.

All SIDRA outputs referenced herein are included at **Appendix F**.

Bussell Highway/Brockman Highway intersection assessment

The assessment below analyses the Bussell Highway/Brockman Highway intersection for the three scenarios according to the existing three-way Give Way controlled configuration. **Figure 8** is a SIDRA layout representation of the intersection at this location.

Figure 8 Bussell Highway/Brockman Highway Intersection Layout



The results of the SIDRA analysis for this intersection is summarised below.

Table 10 Bussell Highway/Brockman Highway Intersection Performance – 2023 Scenario 1

Intersection Approach		2023 Scenario 1 AM Peak				2023 Scenario 1 PM Peak			
		DOS	Delay	LOS	95% Queue	DOS	Delay	LOS	95% Queue
Bussell Highway - S	T	0.077	0.5	A	3.0	0.080	0.5	A	3.3
	R	0.077	13.1	B	3.0	0.080	13.1	B	3.3
Brockman Highway - E	L	0.051	15.5	C	1.5	0.046	15.3	C	1.3
	R	0.051	15.3	C	1.5	0.046	15.1	C	1.3
Bussell Highway - N	L	0.062	13.1	B	0.0	0.060	13.1	B	0.0
	T	0.062	0.0	A	0.0	0.060	0.0	A	0.0

From above it is noted that the intersection will operate within acceptable capacity limits beyond a ten year horizon. No upgrade works are required to cater for the Scenario 1.

Table 11 Bussell Highway/Brockman Highway Intersection Performance – 2023 Scenario 2

Intersection Approach		2023 Scenario 2 AM Peak				2023 Scenario 2 PM Peak			
		DOS	Delay	LOS	95% Queue	DOS	Delay	LOS	95% Queue
Bussell Highway - S	T	0.082	0.5	A	3.2	0.101	0.6	A	4.1
	R	0.082	13.2	B	3.2	0.101	13.2	B	4.1
Brockman Highway - E	L	0.100	15.7	C	3.0	0.080	15.6	C	2.3
	R	0.100	15.5	C	3.0	0.080	15.4	C	2.3
Bussell Highway - N	L	0.066	13.1	B	0.0	0.069	13.1	B	0.0
	T	0.066	0.0	A	0.0	0.069	0.0	A	0.0

From above it is noted that the intersection will operate within acceptable capacity limits beyond a ten year horizon. No upgrade works are required to cater for the Scenario 2.

Table 12 Bussell Highway/Brockman Highway Intersection Performance – 2023 Scenario 3

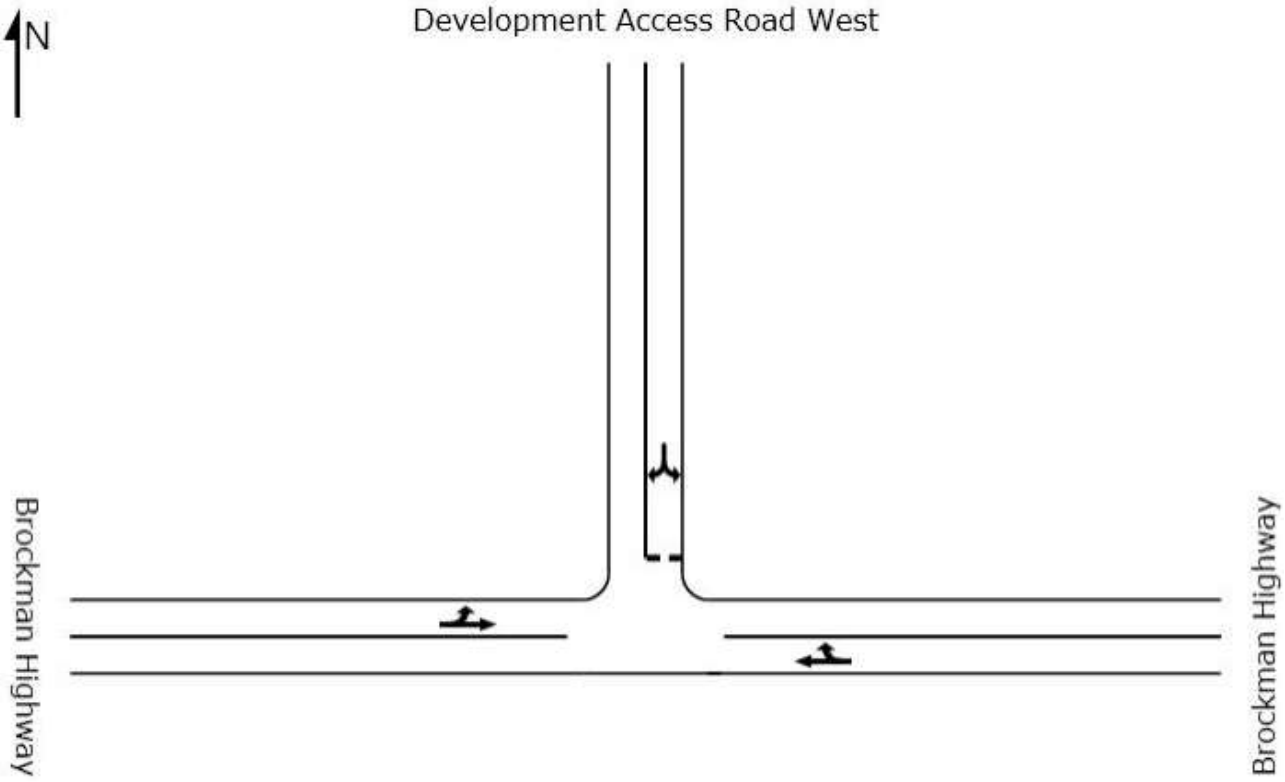
Intersection Approach		2023 Scenario 3 AM Peak				2023 Scenario 3 PM Peak			
		DOS	Delay	LOS	95% Queue	DOS	Delay	LOS	95% Queue
Bussell Highway - S	T	0.124	0.6	A	5.3	0.145	0.7	A	6.2
	R	0.124	13.3	B	5.3	0.145	13.3	B	6.2
Brockman Highway - E	L	0.113	16.6	C	3.3	0.090	16.3	C	2.6
	R	0.113	16.4	C	3.3	0.090	16.1	C	2.6
Bussell Highway - N	L	0.072	13.1	B	0.0	0.076	13.1	B	0.0
	T	0.072	0.0	A	0.0	0.076	0.0	A	0.0

From above it is noted that the intersection will operate within acceptable capacity limits beyond a ten year horizon. No upgrade works are required to cater for the Scenario 3.

Brockman Highway/Development Access (west) intersection assessment

The assessment below analyses the Bussell Highway/Brockman Highway intersection for the three scenarios according to the proposed three-way Give Way controlled configuration. **Figure 9** is a SIDRA layout representation of the intersection at this location.

Figure 9 Brockman Highway/Development Access (west) Intersection Layout



The results of the SIDRA analysis for this intersection is summarised below.

Table 13 Brockman Highway/Development Access (west) Intersection Performance – 2023 Scenario 1

Intersection Approach		2023 Scenario 1 AM Peak				2023 Scenario 1 PM Peak			
		DOS	Delay	LOS	95% Queue	DOS	Delay	LOS	95% Queue
Brockman Highway - E	T	0.021	0.2	A	0.8	0.021	0.2	A	0.8
	R	0.021	15.5	C	0.8	0.021	15.5	C	0.8
Access Street - N	L	0.002	7.4	A	0.1	0.002	7.4	A	0.1
	R	0.002	7.3	A	0.1	0.002	7.3	A	0.1
Brockman Highway - W	L	0.024	15.3	C	0.0	0.024	15.3	C	0.0
	T	0.024	0.0	A	0.0	0.024	0.0	A	0.0

From above it is noted that the western development access will operate within acceptable capacity limits beyond a ten year horizon. No upgrade works are required to cater for the Scenario 1.

Table 14 Brockman Highway/Development Access (west) Intersection Performance – 2023 Scenario 2

Intersection Approach		2023 Scenario 2 AM Peak				2023 Scenario 2 PM Peak			
		DOS	Delay	LOS	95% Queue	DOS	Delay	LOS	95% Queue
Brockman Highway - E	T	0.032	0.4	A	1.3	0.031	0.3	A	1.2
	R	0.032	15.7	C	1.3	0.031	15.7	C	1.2
Access Street - N	L	0.030	8.2	A	0.8	0.020	8.0	A	0.5
	R	0.030	8.1	A	0.8	0.020	7.9	A	0.5
Brockman Highway - W	L	0.051	15.3	C	0.0	0.047	15.3	C	0.0
	T	0.051	0.0	A	0.0	0.047	0.0	A	0.0

From above it is noted that the western development access will operate within acceptable capacity limits for the 2023 Scenario 2 traffic demand. No upgrade works are required to cater for the Scenario 2.

Table 15 Brockman Highway/Development Access (west) Intersection Performance – 2023 Scenario 3

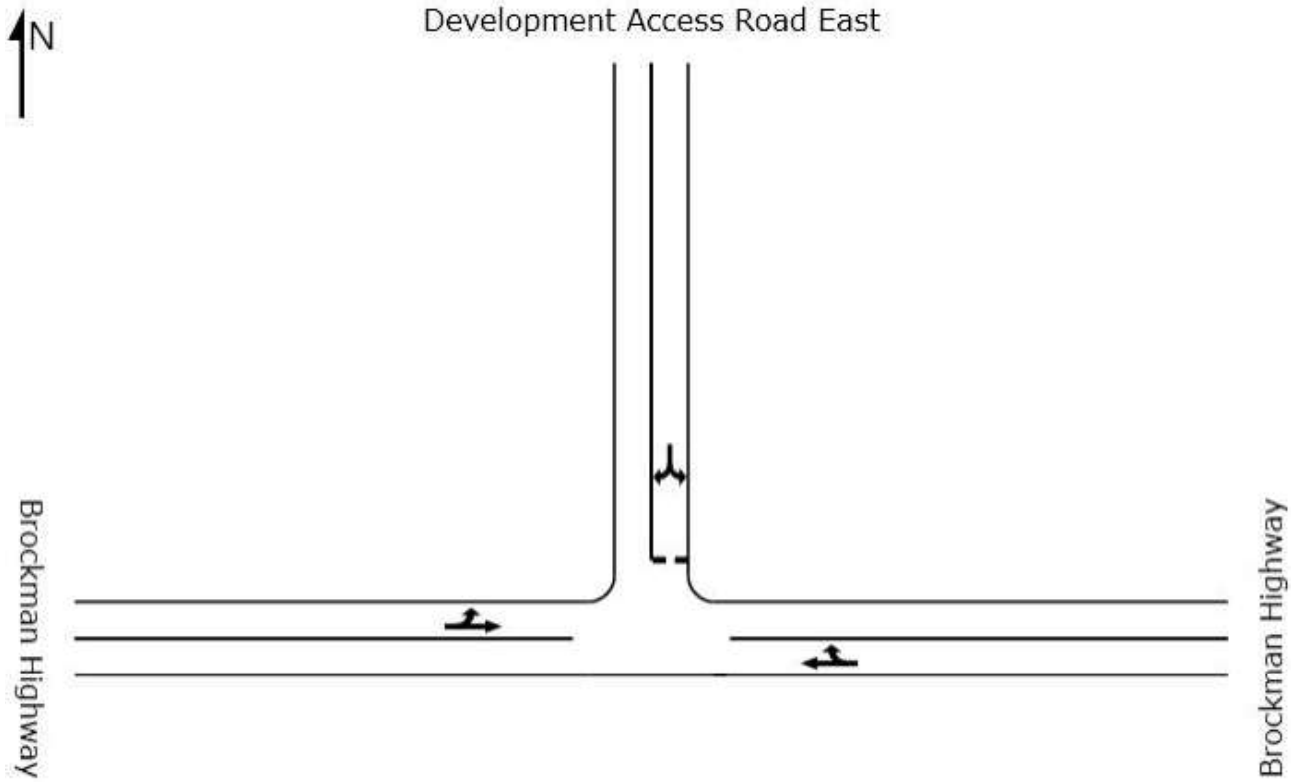
Intersection Approach		2023 Scenario 3 AM Peak				2023 Scenario 3 PM Peak			
		DOS	Delay	LOS	95% Queue	DOS	Delay	LOS	95% Queue
Brockman Highway - E	T	0.033	0.4	A	1.4	0.031	0.4	A	1.3
	R	0.033	15.8	C	1.4	0.031	15.7	C	1.3
Access Street - N	L	0.031	8.4	A	0.8	0.021	8.1	A	0.5
	R	0.031	8.3	A	0.8	0.021	8.0	A	0.5
Brockman Highway - W	L	0.060	15.3	C	0.0	0.056	15.3	C	0.0
	T	0.060	0.0	A	0.0	0.056	0.0	A	0.0

From above it is noted that the western development access will operate within acceptable capacity limits for the 2023 Scenario 3 traffic demand. It is noted that no road infrastructure works are required at this location.

Brockman Highway/Development Access (east) intersection assessment

The assessment below analyses the Bussell Highway/Brockman Highway intersection for the three scenarios according to the proposed three-way Give Way controlled configuration. **Figure 10** is a SIDRA layout representation of the intersection at this location.

Figure 10 Brockman Highway/Development Access (east) Intersection Layout



The results of the SIDRA analysis for this intersection is summarised below.

Table 16 Brockman Highway/Development Access (east) Intersection Performance – 2023 Scenario 1

Intersection Approach		2023 Scenario 1 AM Peak				2023 Scenario 1 PM Peak			
		DOS	Delay	LOS	95% Queue	DOS	Delay	LOS	95% Queue
Brockman Highway - E	T	0.020	0.3	A	0.8	0.020	0.2	A	0.8
	R	0.020	15.6	C	0.8	0.020	15.5	C	0.8
Access Street - N	L	0.002	7.6	A	0.1	0.002	7.4	A	0.1
	R	0.002	7.5	A	0.1	0.002	7.3	A	0.1
Brockman Highway - W	L	0.044	15.3	C	0.0	0.024	15.3	C	0.0
	T	0.044	0.0	A	0.0	0.024	0.0	A	0.0

From above it is noted that the eastern development access will operate within acceptable capacity limits beyond a ten year horizon. No upgrade works are required to cater for the Scenario 1.

Table 17 Brockman Highway/Development Access (east) Intersection Performance – 2023 Scenario 2

Intersection Approach		2023 Scenario 2 AM Peak				2023 Scenario 2 PM Peak			
		DOS	Delay	LOS	95% Queue	DOS	Delay	LOS	95% Queue
Brockman Highway - E	T	0.022	0.3	A	0.9	0.026	0.2	A	1.0
	R	0.022	15.7	C	0.9	0.026	15.6	C	1.0
Access Street - N	L	0.029	7.9	A	0.8	0.018	7.7	A	0.5
	R	0.029	7.8	A	0.8	0.018	7.6	A	0.5
Brockman Highway - W	L	0.049	15.3	C	0.0	0.036	15.3	C	0.0
	T	0.049	0.0	A	0.0	0.036	0.0	A	0.0

From above it is noted that the eastern development access will operate within acceptable capacity limits for the 2023 Scenario 2 traffic demand. No upgrade works are required to cater for the Scenario 2.

Table 18 Brockman Highway/Development Access (east) Intersection Performance – 2023 Scenario 3

Intersection Approach		2023 Scenario 3 AM Peak				2023 Scenario 3 PM Peak			
		DOS	Delay	LOS	95% Queue	DOS	Delay	LOS	95% Queue
Brockman Highway - E	T	0.023	0.4	A	0.9	0.026	0.3	A	1.0
	R	0.023	15.8	C	0.9	0.026	15.7	C	1.0
Access Street - N	L	0.030	8.1	A	0.8	0.019	7.9	A	0.5
	R	0.030	8.0	A	0.8	0.019	7.8	A	0.5
Brockman Highway - W	L	0.058	15.3	C	0.0	0.045	15.3	C	0.0
	T	0.058	0.0	A	0.0	0.045	0.0	A	0.0

From above it is noted that the eastern development access will operate within acceptable capacity limits for the 2023 Scenario 3 traffic demand. It is noted that no road infrastructure works are required at this location.

6.4 Road safety

The proposed development will result in an increase in pedestrian crossing on Bussell Highway and Brockman Highway towards the Karridale Village Centre. Due to the low traffic demand on these two highways, it is considered to be acceptable.

The access locations on Brockman Highway are proposed to be located approximately 350m and 1km away from the Bussell Highway/Brockman Highway intersection. It is considered the two access locations have adequate sight distance for vehicles to safely manoeuvre in/out of the development.

7 Summary

This Transport Assessment outlines the transport aspects of the Karridale Hamlet Concept residential development focussing on traffic operations, access, circulation and car parking. Discussion regarding pedestrian, cycle and public transport considerations are also provided.

This assessment has been prepared in accordance with the WAPC *Transport Assessment Guidelines for Developments: Volume 4 – Individual Developments (2006)* for lodgement with the development application for Shire of Augusta Margaret River.

The following conclusions have been made in regards to the proposed Karridale Hamlet Concept residential development:

> The proposed development of 77 single residential units and six chalets will help cater for the future tourist accommodation demand within the Shire of Augusta Margaret River region.
> The development generated traffic volumes are expected to be approximately 62 vehicles during AM peak hour and 82 vehicles during PM peak hour.
> Parking supply for the proposed development is expected to be provided by the future land owners of the individual lot.
> All vehicles are able to enter and exit the development in a forward gear. The internal road network also caters for light vehicle as well as refuse collection and delivery vehicles.
> The existing traffic volumes comprise of the existing development and existing traffic volumes taken from MRWA and *Karridale West Local Structure Plan*. It is noted that a 2% linear growth rate was applied to the traffic volumes to obtain a ten year horizon demand.
> The development proposes two access locations, of which both will operate well within capacity limits with the development scenario and with the proposed “Karridale West “development scenario beyond a ten year horizon.
> The Bussell Highway/Brockman Highway will operate well within capacity limits with the development scenario and with the proposed “Karridale West “development scenario beyond a ten year horizon.
> No vehicle crashes were recorded within the immediate area of the development during the five year period of 2007 to 2011.
> Pedestrian footpaths and cycle facilities in the area are noted as being limited and but is considered to be acceptable due to the low traffic environment of the surrounding road network.

APPENDIX

A

WAPC Transport Assessment Checklist for Development

Cardno
Shaping the Future

Item	Status	Comments/Proposals
Summary	Included	
Introduction/Background		
name of applicant and consultant	Included	Discussed in Section 1.1
development location and context	Included	Discussed in Section 1.1
brief description of development proposal	Included	Discussed in Section 2.1
key issues	Included	Discussed in Section 1.1
Background information	Included	Discussed in Section 1.1
Development proposal		
regional context	Included	Discussed in Section 3.1
proposed land uses	Included	Discussed in Section 2.1
table of land uses and quantities	Included	Discussed in Section 2.2
access arrangements	Included	Discussed in Section 2.3
parking provision	Included	Discussed in Section 2.6
end of trip facilities	Included	Discussed in Section 2.7
any specific issues	N/A	
Existing situation		
existing site uses (if any)	Included	Discussed in Section 3.2
existing parking and demand (if appropriate)	Included	Discussed in Section 3.2
existing access arrangements	Included	Discussed in Section 3.2
existing site traffic	Included	Discussed in Section 3.2
surrounding land uses	Included	Discussed in Section 3.1
surrounding road network	Included	Discussed in Section 3.3
traffic management on frontage roads	Included	Discussed in Section 3.3
traffic flows on surrounding roads (usually AM and PM peak hours)	Included	Discussed in Section 3.5
traffic flows at major intersections (usually AM and PM peak hours)	Included	Discussed in Section 3.5
operation of surrounding intersections	Included	Discussed in Section 3.6
existing pedestrian / cycle networks	Included	Discussed in Section 3.7
existing public transport services	Included	Discussed in Section 3.8
crash data	Included	Discussed in Section 3.9
Changes to surrounding transport networks		
road network	Included	Discussed in Section 4.1
intersection layouts and controls	Included	Discussed in Section 4.1
pedestrian/cycle networks and crossing facilities	Included	Discussed in Section 4.2
public transport services	Included	Discussed in Section 4.3

Integration with surrounding area		
surrounding major attractors/generators	Included	Discussed in Section 5.1
proposed changes to land uses within 1200 metres	Included	Discussed in Section 5.2
travel desire lines from development to these attractors/generators	Included	Discussed in Section 5.1
adequacy of existing transport networks	Included	Discussed in Section 5.1
deficiencies in existing transport networks	N/A	
remedial measures to address deficiencies	N/A	
Analysis of transport networks		
assessment years	Included	Discussed in Section 6.1
time periods	Included	Discussed in Section 6.2
development generated traffic	Included	Discussed in Section 2.4
distribution of generated traffic	Included	Discussed in Section 2.5
parking supply & demand	Included	Discussed in Section 2.6
committed developments and transport proposals	Included	Discussed in Section 5.2/6.3
base and "with development" traffic flows	Included	Discussed in Section 6.2
analysis of development accesses	Included	Discussed in Section 2.3
impact on surrounding roads	Included	Discussed in Section 6.3
impact on intersections	Included	Discussed in Section 6.3
impact on neighbouring areas	Included	Discussed in Section 6.3
traffic noise and vibration	N/A	
road safety	Included	Discussed in Section 6.4
public transport access	Included	Discussed in Section 3.8/5.1
pedestrian access / amenity	Included	Discussed in Section 3.7
cycle access / amenity	Included	Discussed in Section 3.7
analysis of pedestrian / cycle networks	Included	Discussed in Section 3.7
safe walk/cycle to school (for residential and school site developments only)	N/A	
traffic management plan (where appropriate)	N/A	
Conclusions	Included	Discussed in Section 7

Proponent's name	**Company**	**Signature**	**Date**
Transport assessor's name	**Company**	**Signature**	**Date**

APPENDIX

B

Karridale Hamlet Concept Residential Development Plans

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Development Schematic for McDonald's Farm at Karridale
Lot 101 Brockman Highway, Karridale
Shire of Augusta Margaret River

0m 100m 200m
Scale 1:3000 @ A2 (approx. 1:4000 @ A3)

michaelSWIFT & associates · town planners
JOB 012.04D Date - (07.01.12)
This plan is subject to detail design and survey. For illustrative purposes only.

APPENDIX

C

Shire of Augusta
Margaret River Plans

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LEGEND

LOCAL SCHEME RESERVES

- HIGHWAYS AND MAIN ROADS
- LOCAL ROADS
- NATIONAL PARKS AND NATURE RESERVES
- PARKS AND RECREATION
- PUBLIC PURPOSES
- PUBLIC PURPOSES
  DENOTED AS FOLLOWS:

A	AERODROME
ATC	AUSTRALIAN TELECOMMUNICATION COMMISSION
C	CEMETERY
CP	COMMUNITY PURPOSES
FF	FORESHORE FACILITIES
G	GRAVEL
GR	GOVERNMENT REQUIREMENTS
H	HOSPITAL
HS	HALL SITE
P	POLICE
PU	PUBLIC UTILITIES

- PUBLIC PURPOSES
  DENOTED AS FOLLOWS:

S	SCHOOL
SP	SHIRE PURPOSES

- STATE FOREST
- WATERWAYS

ZONES

- RESIDENTIAL
- C — CARAVAN PARK
- CC — CHALET AND CAMPING
- FUTURE DEVELOPMENT
- SERVICE COMMERCIAL
- TOURISM
- TOWN CENTRE
- VILLAGE CENTRE
- SPECIAL USE
- COMPOSITE INDUSTRY
- INDUSTRY
- CLUSTER FARM
- GENERAL AGRICULTURE
- LEEUWIN NATURALISTE RIDGE CONSERVATION
- LEEUWIN NATURALISTE RIDGE LANDSCAPE AMENIT
- PRIORITY AGRICULTURE
- RURAL RESIDENTIAL
- SOUTHERN OCEAN FORESHORE PROTECTION

OTHER

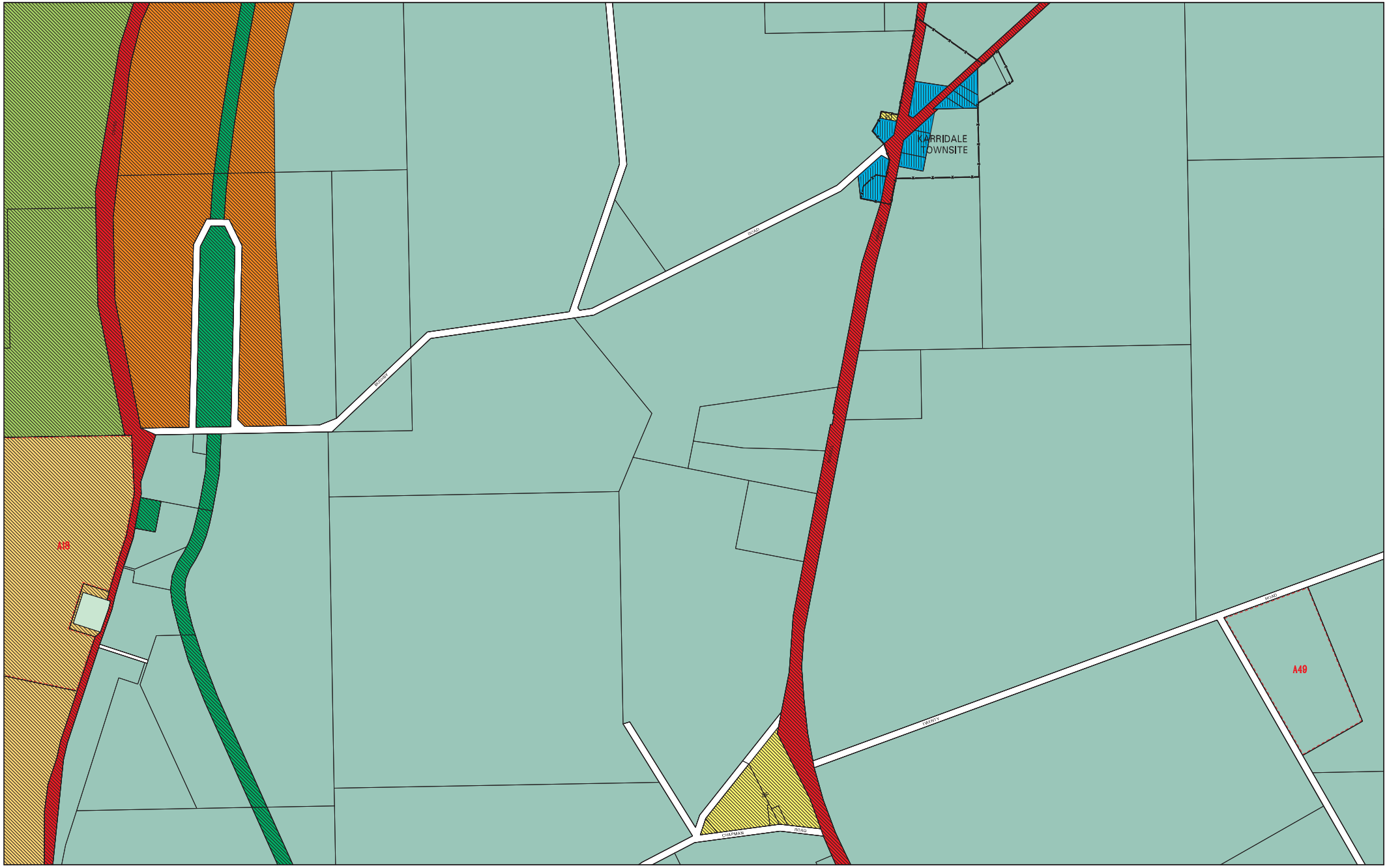
- R20 — R CODES
- A1 — ADDITIONAL USES
- R1 — RESTRICTED USES
- SCHEME BOUNDARY
- LOCAL GOVERNMENT BOUNDARY
- TOWNSITE -- LAND ACT
- SU8 — SPECIAL USE AREA (SEE SCHEME TEXT)
- RR7 — RURAL RESIDENTIAL AREA (SEE SCHEME TEXT)
- T13 — TOURIST AREA (SEE SCHEME TEXT)
- SCA1 — SPECIAL CONTROL AREAS (SEE SCHEME TEXT)
- SPA10 — STRUCTURE PLAN AREAS (SEE SCHEME TEXT)
- DCA1 — DEVELOPMENT CONTROL AREAS (SEE SCHEME TEXT)

VERSION No 1

AUGUSTA-MARGARET RIVER

LOCAL PLANNING SCHEME NO. 1

(DISTRICT SCHEME)



Produced by Mapping and GeoSpatial Data Branch, Department of Planning.

Whilst all care has been taken to accurately portray the current Scheme provisions, no responsibility shall be taken for any omissions or errors in this documentation.

Consultation with the respective Local Government should be made to view a legal version of the Scheme. Please advise the Department of Planning of any omissions or errors in the document.

Base Information Supplied by the Western Australian Land Information Authority. GL248-2007-2

SHIRE OF AUGUSTA-MARGARET RIVER

LOCAL PLANNING SCHEME NO 1

(DISTRICT SCHEME)

SCALE 1:10000

0 250 m

MAP OVERVIEW

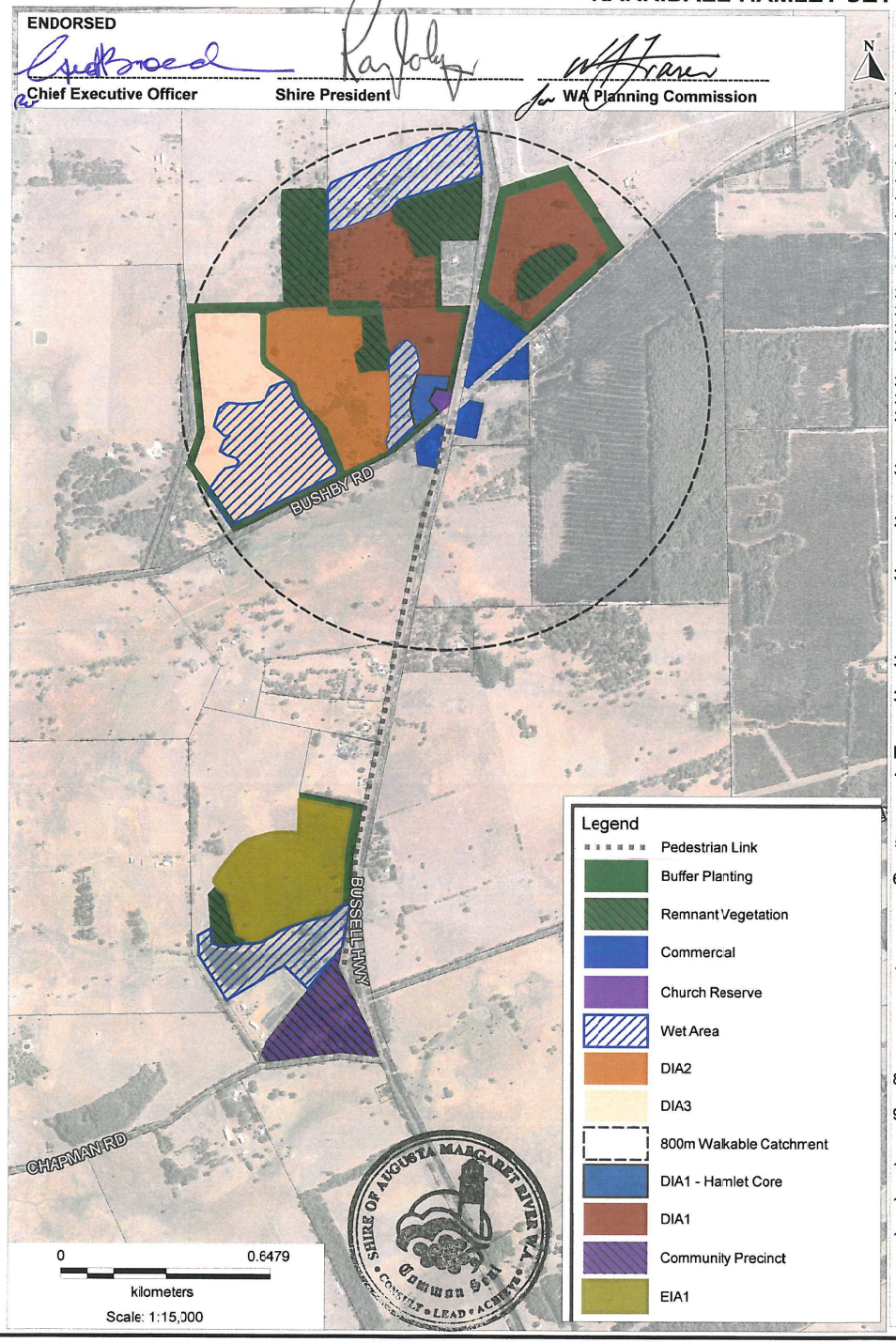
Authorised: Victor Chew
Plot date: 15 Feb 2012
G.Gazette: 24-September-2010

LOCAL PLANNING SCHEME MAP No. 20 of 25

KARRIDALE HAMLET SETTLEMENT STRATEGY- MAY 2011

ENDORSED

Chief Executive Officer Shire President for WA Planning Commission



GENERAL PRECURSORS TO DEVELOPMENT

1. A local water management strategy shall be prepared, to the satisfaction of the Shire and DoW prior to support for any Scheme amendment. This Local Water Management Strategy shall be completed in accordance with the "Better Urban Water Management Framework", and this plan shall address and provide detailed information on, but not be limited to, the following:

1.1 The hydrological system in the sub-district, including the Turner Brook System, and the nature and extent of surface and groundwater;
1.2 Identification and mapping of flood risk 1 in 5, 1 in 10 and 1 in 100 year events both north and south of Bushby Road and measures to control peak flow rates in natural systems;
1.3 Sustainable Water Supply including collection and use of rain water and connection to a reticulated potable and recycled water scheme;
1.4 Strategy for collection, treatment, reuse and disposal of wastewater;
1.5 Control of run off and nutrients into Turner Brook and groundwater;
1.6 Stormwater reuse, treatment and infiltration at source;
1.7 Water requirements to sustain and enhance wetlands / water dependent ecosystems;
1.8 Inclusion of water in urban design and landscape elements to enhance the amenity of urban areas.

2. The total lot yield shall not exceed 250 lots within the area identified for development on this strategy plan. Development will be staged in accordance with the text of this Strategy.
3. The rezoning of any land for development under this strategy shall include:
3.1 The preparation of a detailed structure plan consistent with the provisions of Local Planning Scheme No. 1;
3.2 Investigation and the preparation of detailed development contribution requirements that include provision for:
3.2.1 Forward funding or construction of a dual use path to connect commercial facilities and residential land use in the north of the strategy plan with the school and community facilities at the junction of Bussell Highway and Chapman Road;
3.2.2 Upgrading and improvement to the Karridale Hall facilities;
3.2.3 Facilitation of pedestrian movements across Bussell Highway at the location of commercial activities;
3.2.4 Connection of the Crossroads to the Rails to Trails reserve.
The development contribution requirements shall be subject to consultation concurrent with any modification to the zoning of land to implement the strategy.
3.3 An assessment of the flora and fauna values of areas of remnant vegetation. This assessment shall also detail long term management strategies for the preservation and enhancement of areas of remnant vegetation identified on the strategy plan, with these strategies given effect through the Scheme Amendment, Structure Plan and Subdivision processes.
3.4 A requirement for design guidelines to be prepared and implemented at the subdivision and development stages and enforced as either a component of the required structure planning or as a subsidiary Detailed Area Plan. These guidelines will address appropriate built form and integrated sustainability measures appropriate to the rural and historic context of Karridale.
3.5 A comprehensive Public Open Space strategy addressing the distribution, management and tenure of open space to meet the recreational needs of the community and where necessary, provide for mitigation of the visual impact of development.
3.6 Consideration of provisions for land use that encourage working from home.
3.7 Detailed Fire Management Planning, providing for acceptable mitigation of risk from the threat of fire without compromising the integrity of areas of remnant vegetation.
3.8 Within DIAs1 & 2, examination in detail of the traffic, capacity and safety of Bushby Road and propose any relevant upgrades to the satisfaction of the Shire and Main Roads WA. Conservation of existing mature trees along Bushby Road will be given due regard.
3.9 Future development shall avoid seasonally waterlogged areas, as identified by the district water management strategy and included on this strategy plan as the 'wet areas' known at the time of compiling this strategy. Additionally, future development shall choose locations where minimal fill to avoid high water tables is required. This shall be detailed in structure planning for each development area.

DEVELOPMENT AREAS (See Text of Strategy for Specific Requirements)

4. Development Investigation Area 1 - Land within DIA1 will form the greatest density of development. Wet areas will be avoided, remnant vegetation protected and development buffered by appropriate mitigation through landscape planting. The development of the Hamlet Core should be subject to an investigation of suitable live/work opportunities to be facilitated by provisions introduced through a future amendment to LPS1.
5. Development Investigation Area 2 - Land within DIA2 will form a transition in lot size/density between DIA1 and DIA3. Development of DIA2 is subject to preservation of remnant vegetation, avoidance of wet areas, and buffering from DIAs1, 3 and Bushby Road.
6. Development Investigation Area 3 - Land within DIA3 will be developed in the form of rural residential development incorporating measures to ensure the physical separation of development from the adjacent DIA2, including the establishment of buffer planting as identified on the Strategy Plan, buffer planting to establish the northern and western boundaries of development, and to provide a physical separation from potential agricultural uses on adjoining land. Investigation will be undertaken of management and tenure of the adjacent 'wet area' with consideration of measures to incorporate this land within rural residential lots but exclude significant physical infrastructure such as roads and buildings.
7. Enclave Investigation Area 1 - The Development of EIA1 is subject to substantial progress of DIAs1 and 2, as identified in the staging requirements of the Strategy Text. Development is subject to protection of remnant vegetation, buffer planting and consideration of the adjacent 'wet area' including the dam in terms of appropriate tenure for long term management and incorporation into the future development concept. Development of the site is to be consistent with the principles of the Shire's Hamlet Design Guidelines, with not more than 20 lots provided, generally in the area identified. A further 5 rural smallholdings of between 1 and 5 ha may be established about the periphery.
8. All remnant vegetation is to be retained and measures examined through the Scheme Amendment and Structure Plan process to ensure appropriate long term tenure and management of these features. Remnant vegetation should not be impact on by fire management regimes.
9. Commercial areas will be utilised to enhance the function of Karridale as a rural service centre, and provide convenience retail, tourism facilities and opportunities for cottage industry. Development should enhance the streetscape and be consistent with the character and context of Karridale.
10. The community precinct will remain the focal point for community based activities, and development contributions will assist and enhance the existing community facilities.
11. Future tenure, management and land use on the church reserve will be investigated by the Council with a view to incorporating this land within the development of Karridale, subject to the retention of significant vegetation on this land.
12. Buffer planting is required to serve the purpose of mitigating the visual impact of development, preventing coalescence between development areas, and mitigating land use conflict between residential and agricultural land use.

SHIRE of AUGUSTA MARGARET RIVER

APPENDIX

D

Bus Routes

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Shaping the Future

CONTRACT #	19703	SERVICE NAME	Augusta to Bunbury Bus 24
Transport Service ID	19575		

	GARAGING DETAILS	COMMENTS
Approved		AM Primary Service
Actual	10 BUNBURY ST, BUSSELTON	Effective From Term 3, 2012

TIME	STOPID	PICK UP/SET DOWN	NARRATIVE
4:30	35871	Depot	10 BUNBURY ST, BUSSELTON
			Depart Depot along Bunbury St, left Barlee St, right Strelly St, right Busselton Bypa, left Bussell Hwy, right Allnut Tce, left Ellis St, left Blackwood Av to bus stop across from newsagency
6:12	31145	Terminus	72 BLACKWOOD AV, AUGUSTA
			Continue along Blackwood Av, which becomes Bussell Hwy
6:23	31152	2	KARRIDALE PS, KARRIDALE
			Continue along Bussell Hwy, left Wallcliffe Rd, right Farrelly St, right Tunbridge St, right Charles West Av
6:46	30989	3	17 CHARLES WEST AV, MARGARET RIVER
			Continue along Charles West Av, left Fearn Av, left Bussell Hwy to Cowaramup store
7:07	30990	4	BUSSELL HWY (COWARAMUP STORE), COWARAMUP
			Continue along Bussell Hwy
7:14	31349	5	CNR BUSSELL HWY & METRICUP RD , METRICUP
			Continue along Bussell Hwy to Vasse store
7:30	22108	6	BUSSELL HWY (VASSE GENERAL STORE), VASSE
			Continue along Bussell Hwy, through roundabout to continue along Bussell Hwy
7:33	34017	7	CNR BUSSELL HWY & RAY AV , BROADWATER
			Continue along Bussell Hwy
7:34	34018	8	CNR BUSSELL HWY & HARVEST RD , BROADWATER
			Continue along Bussell Hwy
7:40	31352	9	CNR BUSSELL HWY & DOLPHIN RD , BROADWATER
			Continue along Bussell Hwy, which becomes Albert St
7:45	33451	10	39 ALBERT ST, BUSSELTON
			Continue along Albert St, right Stanley Pl, right Peel Tce, left Causeway Rd, left Bussell Hwy, left Tuart Dr
8:04	34030	11	CNR TUART DR & LUDLOW-HITHERGREEN RD , LUDLOW
			Continue along Tuart Dr, left Bussell Hwy, right Capel Dr
8:15	31027	12	CAPEL DR (CAPEL PARK / INFO BAY), CAPEL
			Continue along Capel Dr, right Bussell Hwy, right Hasties Rd, left Hawkins Dr, left Jenour Ct to School
8:30	4142	School	BUNBURY CATHEDRAL GRAMMAR SCHOOL
			Depart School, turn around, return along Jenour Ct, right Hawkins Dr, right Hasties Rd, right Bussell Hwy, right Robertson Dr to School
8:41	24309	School	SOUTH WEST COLLEGE OF TAFE
			Depart School, left Robertson Dr, left Bussell Hwy, through to Busselton Bypa, right Strelly St, left Barlee St, right Bunbury St to Depot.
	35871	Depot	10 BUNBURY ST, BUSSELTON

CONTRACT #	19703	SERVICE NAME	Augusta to Bunbury Bus 24
Transport Service ID	19575		

	GARAGING DETAILS	COMMENTS
Approved		PM Primary Service
Actual	10 BUNBURY ST, BUSSELTON	Effective from Term 3, 2012

TIME	STOPID	PICK UP/SET DOWN	NARRATIVE
14:40	**35871**	**Depot**	**10 BUNBURY ST, BUSSELTON**
			Depart Depot Bunbury St, left Barlee St, right Strelly St, left Busselton Bypa, into Bussell Hwy, right Hasties Rd, left Hawkins Dr, left Jenour Ct to School
15:18	**4142**	**School**	**BUNBURY CATHEDRAL GRAMMAR SCHOOL**
			Depart School, turn around, return along Jenour Ct, right Hawkins Dr, right Hasties Rd, left Bussell Hwy, left Capel Dr
15:43	**31027**	**1**	**CAPEL DR (CAPEL PARK / INFO BAY), CAPEL**
			Continue along Capel Dr, left Bussell Hwy, right Tuart Dr
15:58	**34030**	**2**	**CNR TUART DR & LUDLOW-HITHERGREEN RD , LUDLOW**
			Continue along Tuart Dr, right Layman Rd
16:03	**31370**	**3**	**CNR LAYMAN RD & KEEL RTT , GEOGRAPHE**
			Continue along Layman Rd, right Navigation Wy, left Marine Tce
16:07	**34027**	**4**	**CNR MARINE TCE & CASUARINA DR , GEOGRAPHE**
			Continue along Marine Tce
16:10	**34025**	**5**	**CNR MARINE TCE & ARMITAGE DR , GEOGRAPHE**
			Continue along Marine Tce
16:20	**35872**	**6**	**10 MARINE TCE, BUSSELTON**
			Continue along Marine Tce, left West St, left Albert St. **(TAFE students on Bus 29 travelling to Margaret River/Augusta will transfer onto Bus 24 at Albert St)**
16:24	**33451**	**7**	**39 ALBERT ST, BUSSELTON (Bus departs Albert St at 16:30)**
			Turn around at roundabout, return along Albert St, which becomes Bussell Hwy
16:34	**31352**	**8**	**CNR BUSSELL HWY & DOLPHIN RD , BROADWATER**
			Continue along Bussell Hwy
16:35	**34019**	**9**	**CNR BUSSELL HWY & ALAN ST , BROADWATER**
			Continue along Bussell Hwy
16:39	**34018**	**10**	**CNR BUSSELL HWY & HARVEST RD , BROADWATER**
			Continue along Bussell Hwy to Vasse General store
16:44	**22108**	**13**	**BUSSELL HWY (VASSE GENERAL STORE), VASSE**
			Continue along Bussell Hwy
17:00	**31349**	**14**	**CNR BUSSELL HWY & METRICUP RD , METRICUP**
			Continue along Bussell Hwy
17:06	**30996**	**15**	**COWARAMUP TENNIS CLUB, COWARAMUP**
			Continue along Bussell Hwy, right Tunbridge St, left Charles West Av
17:16	**30989**	**16**	**17 CHARLES WEST AV, MARGARET RIVER**
			Continue along Charles West Av, left Fearn Av, right Bussell Hwy
17:26	**31152**	**17**	**KARRIDALE PS, KARRIDALE**

			Continue along Bussell Hwy, which becomes Blackwood Av
17:46	**31145**	**Terminus**	**72 BLACKWOOD AV, AUGUSTA**
			Turn around, return Blackwood Av, which becomes Bussell Hwy, right Busselton Bypa, left Strelly St, left Barlee St, right Bunbury St to Depot.
	35871	**Depot**	**10 BUNBURY ST, BUSSELTON**

SOUTH WEST COACH LINES

Book online at southwestcoachlines.com.au

BUSSELTON (08) 9753 7700 BUNBURY (08) 9722 7800 PERTH (08) 9261 7600

AUGUSTA via MARGARET RIVER to PERTH	MON-SUN D100	MON - SUN A610	MON-FRI P420	SAT & SUN A400
Augusta Terminus		am 6.10		pm 4.00
Kudardup		6.15		4.05
Karridale		6.20		4.10
Witchcliffe		6.35		4.25
Margaret River (Charles West Avenue)		am 6.45		pm 4.35
Prevelly Park			pm 4.20	
Margaret River			4.38	
Margaret River (Charles West Avenue)		am 6.55	pm 4.50	pm 4.40
Cowaramup		7.04	4.58	4.48
Metricup		7.10	5.03	4.53
Carbunup		7.22	5.13	5.03
Vasse		7.27	5.17	5.07
Abbey		7.30	5.20	5.10
Monaghan's Corner (Bus Bay)	am 1.15			
Broadwater		7.31	5.21	5.11
Busselton West		7.33	5.23	5.13
Busselton Terminus (39 Albert Street)	am 1.25	am 7.38	pm 5.28	pm 5.18

		MON-SUN B740	MON-SUN B100	MON - FRI B545	SAT - SUN B530
Busselton Terminus (39 Albert Street)	am 1.25	am 7.40	pm 1.00	pm 5.45	pm 5.30
Bayside Store (Marine & Armitage)	1.35	7.41	1.01	5.46	5.31
Wonnerup		7.50	1.10	5.55	5.40
Capel	1.55	8.06	1.26	6.11	5.56
Stratham		8.14	1.34	6.19	6.04
Gelorup		8.20	1.40	6.25	6.10
Condellos	2.10				
Bunbury Health Campus		8.24	1.44	6.29	6.14
Bunbury Central Bus Station		pm 8.35	pm 1.55	pm 6.40	pm 6.25
Bunbury Central Bus Station		pm 8.45	pm 2.00	pm 6.45	pm 6.30
Bunbury Forum	2.25				
Eaton Fair	2.30				
Australind	2.40	9.00	2.15	7.00	6.45
Binningup Beach Turn Off		9.10	2.25	7.10	6.55
Lake Clifton			2.45		
Miami			3.10		
Pinjarra Road Interchange	3.30	9.50		7.50	7.35
Mandurah Train Station			3.30		
Cockburn Central		10.25	4.15	8.35	8.20
Perth Esplanade Busport		am 10.45		pm 8.50	pm 8.35
Burswood Entertainment Complex		am 10.55			
Perth Domestic Terminal	am 4.30	am 11.20	pm 4.55	pm 9.15	pm 9.00
Skippers Aviation	am 4.40			pm 9.25	pm 9.10
Perth International Terminal	am 4.55	am 11.40	pm 5.05	pm 9.35	pm 9.20
Perth Esplanade Busport	am 5.00		pm 5.45		

Operates School Year ONLY ■ **Denotes P.M. connection** ♦

Does NOT operate on Public Holidays ● **Operates School Holidays ONLY** ☂

PASSENGERS ARE REQUIRED AT PICK UP LOCATIONS 15 MINUTES BEFORE STATED DEPARTURE TIME.

EFFECTIVE 07.08.2012. TIMETABLES ARE SUBJECT TO CHANGE WITHOUT PRIOR NOTICE.

SOUTH WEST COACH LINES

Book online at southwestcoachlines.com.au

BUSSELTON (08) 9753 7700 BUNBURY (08) 9722 7800 PERTH (08) 9261 7600

PERTH to AUGUSTA via MARGARET RIVER	MON-FRI 0730BY	SAT - SUN SCH & PUB HOL 0730BY	MON - FRI 1245BY	SAT - SUN SCH & PUB HOL 1245BY	MON - SUN 1845BY	MON - SUN 2200BY
Perth International Terminal			pm **12.45**	pm **12.45**		
Perth Domestic Terminal			pm **12.55**	pm **12.55**		
Perth Esplanade Busport	am **7.30**	am **7.30**	pm **1.30**	pm **1.30**	pm **6.45**	
Burswood Entertainment Complex					pm **7.00**	
Skippers Aviation						
Perth Domestic Terminal	am **7.55**	am **7.50**			pm **7.15**	pm **10.00**
Perth International Terminal						pm **10.10**
Cockburn Central	8.30	8.30	1.55	1.55	7.50	10.45
Mandurah Train Tration			2.45	2.45		
Pinjarra Road Interchange	9.15	9.15			8.30	11.20
Miami			3.05	3.05		
Lake Clifton			3.30	3.30		
Binningup Bch T/Off	9.45	9.45	3.50	3.50	9.10	12.00
Australind	9.55	9.55	4.00	4.00	9.20	12.10
Bunbury Central Bus Station	am **10.10**	am **10.10**	pm **4.15**	pm **4.15**	pm **9.35**	am **12.25**
Bunbury Central Bus Station	am **10.15**	am **10.15**	pm **4.20**	pm **4.20**	pm **9.40**	am **12.30**
Bunbury Health Campus	10.31	10.31	4.36	4.36	9.31	12.41
Gelorup	10.35	10.35	4.40	4.40	9.35	12.45
Stratham	10.41	10.41	4.46	4.46	9.41	12.51
Capel	10.49	10.49	4.54	4.54	9.49	12.59
Wonnerup	11.05	11.05	5.10	5.10	9.55	
Bayside Store (Marine & Armitage)	11.11	11.11	5.16	5.16	10.01	
Busselton Terminus (39 Albert Street)	am **11.15**	am **11.15**	pm **5.20**	pm **5.20**	pm **10.05**	am **1.20**
Busselton Terminus (39 Albert Street)		am **11.20**	pm **5.30**	pm **5.20**		
Busselton West		11.25	5.35	5.25		
Broadwater		11.27	5.37	5.27		
Abbey		11.28	5.38	5.28		
Vasse		11.31	5.41	5.31		
Carbunup		11.35	5.45	5.35		
Metricup		11.45	5.55	5.45		
Cowaramup		11.50	6.00	5.50		
Margaret River (Charles West Avenue)		am **11.58**	pm **6.08**	pm **5.58**		
Margaret River (Charles West Avenue)		am **12.00**	pm **6.10**	pm **6.00**		
Witchcliffe		12.10	6.20	6.10		
Karridale		12.25	6.35	6.25		
Kudardup		12.30	6.40	6.30		
Augusta Terminus		pm **12.35**	pm **6.45**	pm **6.35**		

Operates School Year ONLY ■ **Denotes P.M. connection** ♦

Does NOT operate on Public Holidays ● **Operates School Holidays ONLY** ℙ

PASSENGERS ARE REQUIRED AT PICK UP LOCATIONS 15 MINUTES BEFORE STATED DEPARTURE TIME.

EFFECTIVE 07.08.2012. TIMETABLES ARE SUBJECT TO CHANGE WITHOUT PRIOR NOTICE.

Bookings

Reservations are essential on all services and may be made up to three months in advance by telephoning 1300 662 205 (Australia wide, local call cost) from 8.30am - 5.00pm Monday to Friday, 8.30am - 4.30pm Saturday and 10.00am - 4.00pm Sunday (WST), at Transwa booking centres, accredited ticketing agents (times vary) or online at www.transwa.wa.gov.au. TTY callers may call the National Relay Service on 13 36 77 then quote 1300 662 205.

Fares and Concession

Valid concession card details must be provided at time of booking for a passenger to be entitled to a concessional fare. Passengers must present their valid concession card when collecting their ticket, boarding services and if requested. Proof of identity may also be required. Full time students (Western Australian residents) aged 16 years and older are entitled to a concession on presentation of their Transperth SmartRider Student card, available from schools, colleges and universities.

Children

Children aged 5-15 years travel at half fare. Children under 5 years can travel free but if a seat is required a child's fare will apply. Children under 10 years must be accompanied by a guardian aged 16 years or over. Proof of age will be required. Special arrangements apply for children aged 10-15 years (inclusive) who are not accompanied by an adult. Please enquire for further information.

Luggage

Passengers are limited to one item of stowed luggage (up to 20kgs) and one item of hand luggage (up to 7kgs). Luggage must be of a manageable size and clearly labelled with the passenger's name and destination. Luggage is carried at the owner's risk and if liability is accepted for lost and damaged items this will be limited to a maximum of $200. The carriage of certain items, including bicycles and surfboards on some services are prohibited or restricted, and fees may apply so please enquire when booking

Unaccompanied luggage cannot be accepted and lockers are not available at Transwa stations.

Wheelchair Passengers

Transwa trains and road coaches are specially fitted to accommodate people in wheelchairs. Bookings are essential and any requirements should be explained to ensure availability. Some restrictions apply for motorised gophers/scooters.

Payment

Visa and MasterCard are accepted for telephone, internet and booking centre bookings. Transwa booking centres also accept EFTPOS for payment. Please check with accredited ticketing agents for payment options.

Cancellation

Refunds will only be made when tickets are cancelled prior to the scheduled departure of the booked service and are only available from Transwa booking centres upon presentation of the valid ticket. A cancellation fee of 10% of the ticket value (minimum $2) will apply.

Refreshments

The consumption of personal alcohol is prohibited on all Transwa services. Alcoholic drinks may be consumed on the Australind and Prospector trains only if purchased onboard. Snack foods and soft drinks are available for purchase on Australind and Prospector trains. Stops are made on road coach routes for the purchase of refreshments. There are no refreshments available for sale on the AvonLink or MerredinLink services.

Feedback

Feedback is welcome and may be made in writing to:
General Manager
Transwa
PO Box 8125
Perth Business Centre WA 6849
Alternatively telephone the PTA Information and Feedback Line by dialling 13 62 13
or email info@transwa.wa.gov.au.

To view Transwa's full Terms and Conditions, go to:
www.transwa.wa.gov.au/Bookings/BookingConditions

Smoking is strictly prohibited on all services.

Public Transport Authority

Transwa

Transwa

Timetable

Perth (East Perth Terminal)
to Augusta
via Bunbury
to Pemberton
via Bunbury and Augusta

SW1

Bookings and information
1300 662 205
www.transwa.wa.gov.au

Effective from 11 May 2012
Subject to change without notice

Perth to Augusta via Bunbury **- to Pemberton** via Augusta/Bunbury

SW1

From Perth		271S	271 321/253	277	279
		Sun	Mon to Thu	Sun to Fri	Fri
		PM	PM	AM	PM
East Perth Terminal ♿	Dep	12.15	12.15	9.00	4.30
Cockburn Central (Stand No 7)	Dep	12.40	12.45	9.30	5.15
Mandurah Bus Station	Dep	1.25	1.30	10.15	6.00
Falcon (Cobblers Tavern)	Dep	1.38	1.43	10.28	6.13
Settlers Roadhouse ☺	Arr	-	-	-	6.45
	Dep	-	-	-	7.15
Australind (Mulgara St) ●	Dep	2.30	2.35	11.20	7.35
Bunbury Passenger Terminal ♿ ☺	Arr	2.40	2.45	11.30	7.45
	Dep	2.45	3.15	12.05	7.50
Capel (Information bay) ●	Dep	3.09	3.39	12.29	8.08
Busselton (Visitor Centre)	Dep	3.28	3.58	12.48	8.27
Siesta Park Roadhouse ☺	Arr	3.45	-	-	-
	Dep	4.15	-	-	-
Dunsborough (Visitor Centre)	Dep	4.26	4.26	1.16	8.55
Yallingup (Hall)	Dep	4.35	4.35	1.25	9.04
Margaret River (Charles West Rd)	Dep	5.15	5.15	2.05	9.44
Karridale (bus shelter)	Dep	5.35	5.35	2.25	10.04
Augusta (opp newsagency)	Dep	5.45	5.45	2.35	10.15
		Sun	Tue & Thu		
Nannup (Visitor Centre)	Dep	6.52	6.52		
Pemberton (Visitor Centre)	Arr	7.50	7.50		

From Pemberton		276	278 254/322	280S	280
		Mon Wed Fri	Tue Thu Sat	Sun	Mon to Fri
		AM	AM	PM	PM
Pemberton (Visitor Centre)	Dep	6.00			
Nannup (Visitor Centre)	Dep	6.58			
Augusta (opp newsagency)	Arr	8.00			
	Dep	8.10	8.10	**3.05**	**3.05**
Karridale (bus shelter)	Dep	8.22	8.22	**3.15**	**3.15**
Margaret River (Charles West Rd)	Dep	8.45	8.45	**3.35**	**3.35**
Yallingup (Hall)	Dep	9.25	9.25	**4.15**	**4.15**
Dunsborough (Visitor Centre)	Dep	9.34	9.34	**4.24**	**4.24**
Siesta Park Roadhouse ☺	Arr	-	-	**4.35**	-
	Dep	-	-	**4.55**	-
Busselton (Visitor Centre)	Dep	10.05	10.05	**5.12**	**4.52**
Capel (Information bay) ●	Dep	10.24	10.24	**5.31**	**5.11**
Bunbury Passenger Terminal ♿ ☺	Arr	10.50	10.50	**5.55**	**5.35**
	Dep	11.20	11.20	**6.00**	**6.00**
Australind (BP Roadhouse)	Dep	11.30	11.30	**6.10**	**6.10**
Falcon (Ampol Roadhouse)	Dep	**12.22**	**12.22**	**7.02**	**7.02**
Mandurah Bus Station	Dep	**12.37**	**12.37**	**7.17**	**7.17**
Cockburn Central (Stand No 7)	Dep	**1.22**	**1.22**	**8.02**	**8.02**
East Perth Terminal ♿	Arr	**2.00**	**2.00**	**8.30**	**8.30**

☺ Comfort stop (km) Kilometres from townsite ♿ Wheelchair accessible toilet facilities available

● Coach will only divert to Capel/Australind if advance bookings are made.

Amendments apply on most public holidays and during school holidays. Coaches will only stop at other authorised stopping points if pre-booked. Transwa recommends passengers be ready to board 15 minutes prior to departure.

2930-300-018 Rev 1.20: Effective 11/05/2012

APPENDIX

E

Crash Data & Road Use Movement (RUM) Codes (MRWA)

Cardno
Shaping the Future

ROAD USE MOVEMENT (RUM) CODES

	0	1	2	3	4	5	6	7	8	9
	PEDESTRIAN on foot, in toy/pram	INTERSECTION vehicles from adjacent approaches	VEHICLES FROM OPPOSING DIRECTIONS	VEHICLES FROM ONE DIRECTION	MANOEUVRING	OVERTAKING	ON PATH	OFF STRAIGHT, ON STRAIGHT	OFF PATH, ON CURVE	PASSENGERS AND MISCELLANEOUS
1	NEAR SIDE 1	THRU-THRU 11	SIDE SWIPE HEAD ON 21	Vehicles in same lanes: REAR END 31		HEAD ON 51	PARKED 61	OFF CARRIAGEWAY TO LEFT 71	OFF CARRIAGEWAY RIGHT BEND 81	FELL IN/FROM VEHICLE 91
2	EMERGING 2	RIGHT-THRU 12	THRU-RIGHT 22	LEFT REAR 32	LEAVING PARKING 42	OUT OF CONTROL 52	DOUBLE PARKED 62	LEFT OFF CARRIAGEWAY INTO OBJECT/VEHICLE 72	OFF RIGHT BEND INTO OBJECT/VEHICLE 82	LOAD STRUCK VEHICLE 92
3	FAR SIDE 3	LEFT-THRU 13	RIGHT LEFT 23	RIGHT REAR 33	PARKING 43	PULLING OUT 53	ACCIDENT OR BROKEN DOWN 63	OFF CARRIAGEWAY TO RIGHT 73	OFF CARRIAGEWAY LEFT BEND 83	STRUCK TRAIN 93
4	PLAYING, WORKING LYING, STANDING ON CARRIAGEWAY 4	THRU-RIGHT 14	RIGHT RIGHT 24	U TURN 34	PARKING VEHICLES ONLY 44	CUTTING IN 54	CAR DOOR 64	RIGHT OFF CARRIAGEWAY INTO OBJECT/VEHICLE 74	OFF LEFT BEND INTO OBJECT/VEHICLE 84	STRUCK RAILWAY XING FURNITURE 94
5	WALKING WITH TRAFFIC 5	RIGHT-RIGHT 15	THRU LEFT 25	Vehicles in parallel lanes: LANE SIDE SWIPE 35	REVERSING 45	PULLING OUT REAR END 55	PERMANENT OBSTRUCTION 65	OUT OF CONTROL ON CARRIAGEWAY 75	OUT OF CONTROL ON CARRIAGEWAY 85	ANIMAL OFF CARRIAGEWAY 95
6	FACING TRAFFIC 6	LEFT-RIGHT 16	LEFT LEFT 26	LANE CHANGE RIGHT 36	REVERSING INTO FIXED OBJECT 46	O.T.-RT 56	TEMPORARY ROADWORKS 66	LEFT TURN 76		PARKED CAR RAN AWAY 96
7	DRIVEWAY 7	THRU-LEFT 17	U TURN 27	LANE CHANGE LEFT 37	LEAVING DRIVEWAY 47		TEMPORARY OBJECT ON CARRIAGEWAY 67	RIGHT TURN 77		VEHICLE MOVEMENTS NOT KNOWN 97
8	ON FOOTWAY 8	RIGHT-LEFT 18		RIGHT TURN S/S 38	LOADING BAY 48					
9	STRUCK WHILE BOARDING OR ALIGHTING 9	LEFT-LEFT 19		LEFT TURN S/S 39	FROM FOOTWAY 49		ON CARRIAGEWAY 69			
	OTHER 98	OTHER 10	OTHER 20	OTHER 30	OTHER 40	OTHER 50	OTHER 60 (MISSILE/ FLYING OBJECT)	OTHER 70	OTHER 80	OTHER 90

ANDREASSEN 1994

CAD 95317046
20/3/95

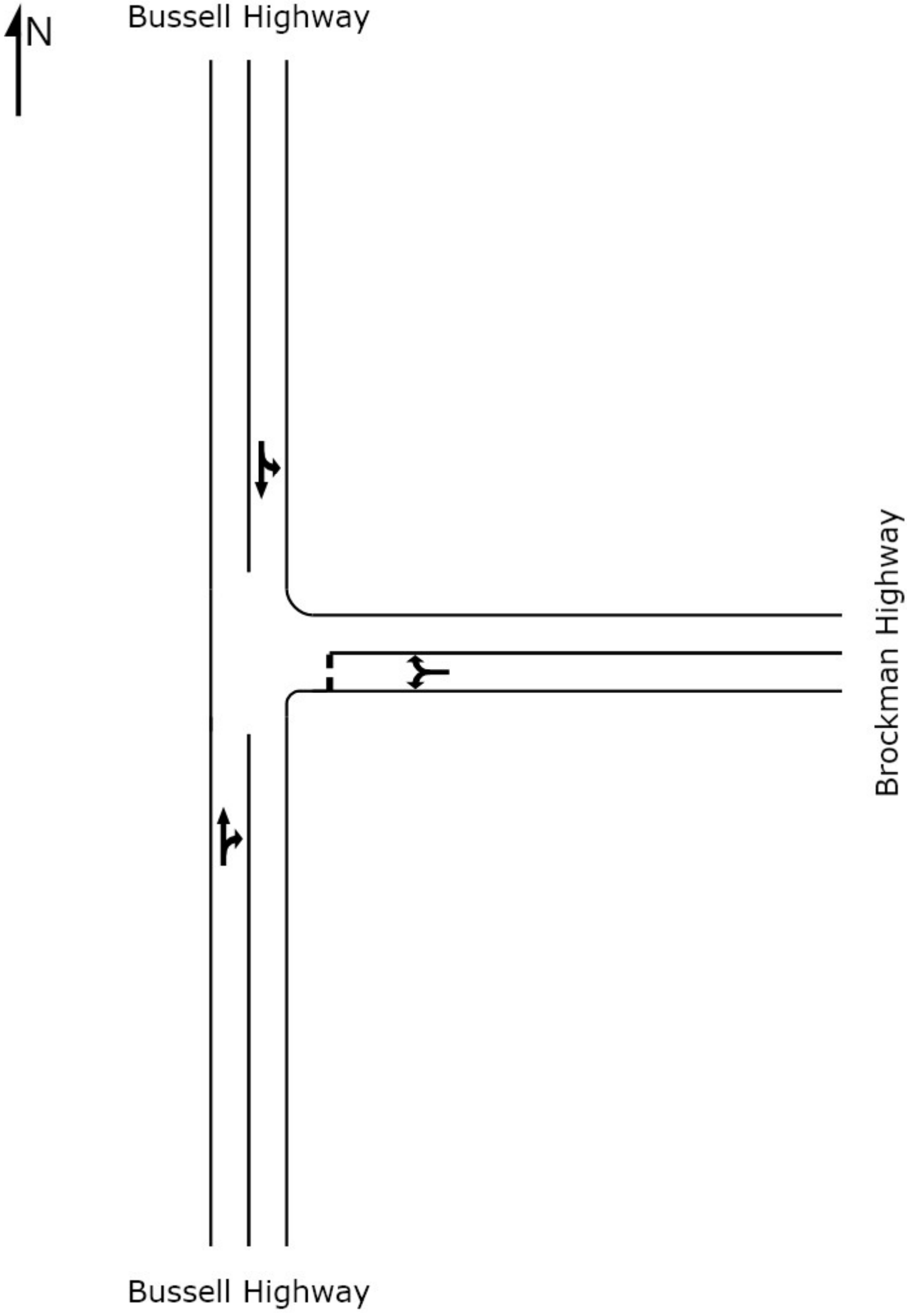
ROUTE_NE	NM_SLK	NM_TRUE	ACC_ATYP	ACC_DATE	ACC_DAY	ACC_TIME	ACC_SEVERITY	ACC_LIGHTING	ACC_ROAD	ACC_SPEED	ACC_TRAFFIC_CONTROL	ACC_ROAD	EVT_MR_NATU	EVT_EVEN1	EVT_ROAD_USER_MOVEMENT_CODE	UNIT	UNIT_EVT_FROM_DIRN	EVT_TO_DIRN	EVT_VEH_MOVT	UNT_FIRST	UNT_SECO	UNT_THIR	TARGET_UNIT_	IMPACT_POINT_CODE
M027	71.47	71.47	Midblock	18/03/2011	Friday	2030	PDO Minor	Dark - Street Lights Not Provided	Dry	110	No Sign Or Control	Straight	Hit Animal	On Cway	69:On Path: Hit Animal	Colliding	Car W	E	Straight Ahead: Not Out Of Control	Kangaroo				

APPENDIX

F

SIDRA Outputs

Cardno
Shaping the Future


N
Bussell Highway
Brockman Highway
Bussell Highway

MOVEMENT SUMMARY

Site: 12 BG AM - Bussell Hwy/ Brockman Hwy

CEP02144 Karridale Residential Development
2012 AM Background Traffic Volumes
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Bussell Highway											
2	T	65	9.0	0.062	0.4	LOS A	0.3	2.4	0.21	0.00	79.4
3	R	34	9.0	0.062	13.0	LOS B	0.3	2.4	0.21	0.95	70.2
Approach		99	9.0	0.062	4.7	NA	0.3	2.4	0.21	0.33	75.7
East: Brockman Highway											
4	L	14	12.0	0.039	15.2	LOS C	0.1	1.1	0.25	0.67	66.8
6	R	16	12.0	0.039	15.0	LOS B	0.1	1.1	0.25	0.75	67.4
Approach		30	12.0	0.039	15.1	LOS C	0.1	1.1	0.25	0.71	67.1
North: Bussell Highway											
7	L	31	11.0	0.050	13.1	LOS B	0.0	0.0	0.00	1.05	69.3
8	T	59	11.0	0.050	0.0	LOS A	0.0	0.0	0.00	0.00	90.0
Approach		90	11.0	0.050	4.5	NA	0.0	0.0	0.00	0.36	81.0
All Vehicles		219	10.2	0.062	6.1	NA	0.3	2.4	0.13	0.39	76.5

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: 12 BG PM - Bussell Hwy/ Brockman Hwy

CEP02144 Karridale Residential Development
2012 PM Background Traffic Volumes
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Bussell Highway											
2	T	79	9.0	0.064	0.4	LOS A	0.3	2.6	0.22	0.00	79.6
3	R	27	9.0	0.064	13.0	LOS B	0.3	2.6	0.22	1.01	70.4
Approach		106	9.0	0.064	3.6	NA	0.3	2.6	0.22	0.26	76.8
East: Brockman Highway											
4	L	19	12.0	0.037	15.0	LOS C	0.1	1.0	0.24	0.68	67.0
6	R	11	12.0	0.037	14.8	LOS B	0.1	1.0	0.24	0.76	67.7
Approach		30	12.0	0.037	15.0	LOS B	0.1	1.0	0.24	0.71	67.3
North: Bussell Highway											
7	L	8	11.0	0.050	13.1	LOS B	0.0	0.0	0.00	1.26	69.3
8	T	82	11.0	0.050	0.0	LOS A	0.0	0.0	0.00	0.00	90.0
Approach		90	11.0	0.050	1.2	NA	0.0	0.0	0.00	0.11	87.4
All Vehicles		226	10.2	0.064	4.1	NA	0.3	2.6	0.13	0.26	79.2

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: 23 BG AM - Bussell Hwy/ Brockman Hwy

CEP02144 Karridale Residential Development
2023 AM Background Traffic Volumes
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Bussell Highway											
2	T	80	9.0	0.077	0.5	LOS A	0.4	3.0	0.24	0.00	78.2
3	R	41	9.0	0.077	13.1	LOS B	0.4	3.0	0.24	0.95	70.2
Approach		121	9.0	0.077	4.8	NA	0.4	3.0	0.24	0.32	75.1
East: Brockman Highway											
4	L	17	12.0	0.051	15.5	LOS C	0.2	1.5	0.29	0.67	66.1
6	R	20	12.0	0.051	15.3	LOS C	0.2	1.5	0.29	0.77	66.8
Approach		37	12.0	0.051	15.4	LOS C	0.2	1.5	0.29	0.72	66.5
North: Bussell Highway											
7	L	38	11.0	0.062	13.1	LOS B	0.0	0.0	0.00	1.05	69.3
8	T	72	11.0	0.062	0.0	LOS A	0.0	0.0	0.00	0.00	90.0
Approach		110	11.0	0.062	4.5	NA	0.0	0.0	0.00	0.36	81.0
All Vehicles		268	10.2	0.077	6.1	NA	0.4	3.0	0.15	0.39	76.1

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: 23 BG PM - Bussell Hwy/ Brockman Hwy

CEP02144 Karridale Residential Development
2023 PM Background Traffic Volumes
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Bussell Highway											
2	T	96	9.0	0.080	0.5	LOS A	0.4	3.3	0.25	0.00	78.4
3	R	34	9.0	0.080	13.1	LOS B	0.4	3.3	0.25	0.99	70.5
Approach		130	9.0	0.080	3.8	NA	0.4	3.3	0.25	0.26	76.0
East: Brockman Highway											
4	L	23	12.0	0.046	15.3	LOS C	0.2	1.3	0.28	0.68	66.5
6	R	13	12.0	0.046	15.1	LOS C	0.2	1.3	0.28	0.78	67.2
Approach		36	12.0	0.046	15.3	LOS C	0.2	1.3	0.28	0.71	66.7
North: Bussell Highway											
7	L	9	11.0	0.060	13.1	LOS B	0.0	0.0	0.00	1.27	69.3
8	T	100	11.0	0.060	0.0	LOS A	0.0	0.0	0.00	0.00	90.0
Approach		109	11.0	0.060	1.1	NA	0.0	0.0	0.00	0.10	87.6
All Vehicles		275	10.2	0.080	4.2	NA	0.4	3.3	0.15	0.26	78.7

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: 23 BG+Dev AM - Bussell Hwy/Brockman Hwy

CEP02144 Karridale Residential Development
2023 AM Background+Development Traffic Volumes
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Bussell Highway											
2	T	80	9.0	0.082	0.5	LOS A	0.4	3.2	0.25	0.00	77.7
3	R	47	9.0	0.082	13.2	LOS B	0.4	3.2	0.25	0.93	70.2
Approach		127	9.0	0.082	5.2	NA	0.4	3.2	0.25	0.34	74.5
East: Brockman Highway											
4	L	33	12.0	0.100	15.7	LOS C	0.4	3.0	0.30	0.68	65.8
6	R	39	12.0	0.100	15.5	LOS C	0.4	3.0	0.30	0.78	66.5
Approach		72	12.0	0.100	15.6	LOS C	0.4	3.0	0.30	0.73	66.2
North: Bussell Highway											
7	L	45	11.0	0.066	13.1	LOS B	0.0	0.0	0.00	1.02	69.3
8	T	72	11.0	0.066	0.0	LOS A	0.0	0.0	0.00	0.00	90.0
Approach		117	11.0	0.066	5.0	NA	0.0	0.0	0.00	0.39	80.1
All Vehicles		316	10.4	0.100	7.5	NA	0.4	3.2	0.17	0.45	74.4

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: 23 BG+Dev PM - Bussell Hwy/Brockman Hwy

CEP02144 Karridale Residential Development
2023 PM Background+Development Traffic Volumes
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Bussell Highway											
2	T	96	9.0	0.101	0.6	LOS A	0.5	4.1	0.26	0.00	77.0
3	R	60	9.0	0.101	13.2	LOS B	0.5	4.1	0.26	0.92	70.1
Approach		156	9.0	0.101	5.5	NA	0.5	4.1	0.26	0.35	74.0
East: Brockman Highway											
4	L	38	12.0	0.080	15.6	LOS C	0.3	2.3	0.30	0.69	66.0
6	R	22	12.0	0.080	15.4	LOS C	0.3	2.3	0.30	0.80	66.6
Approach		60	12.0	0.080	15.6	LOS C	0.3	2.3	0.30	0.73	66.2
North: Bussell Highway											
7	L	24	11.0	0.069	13.1	LOS B	0.0	0.0	0.00	1.16	69.3
8	T	100	11.0	0.069	0.0	LOS A	0.0	0.0	0.00	0.00	90.0
Approach		124	11.0	0.069	2.5	NA	0.0	0.0	0.00	0.22	84.6
All Vehicles		340	10.3	0.101	6.2	NA	0.5	4.1	0.17	0.37	76.0

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: 23 BG+Dev+KarridaleW Dev
AM - Bussell Hwy/Brockman Hwy

CEP02144 Karridale Residential Development
2023 AM Background+Development+Karridale West Development Traffic Volumes
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Bussell Highway											
2	T	134	9.0	0.124	0.6	LOS A	0.7	5.3	0.28	0.00	76.8
3	R	62	9.0	0.124	13.3	LOS B	0.7	5.3	0.28	0.95	70.4
Approach		196	9.0	0.124	4.6	NA	0.7	5.3	0.28	0.30	74.4
East: Brockman Highway											
4	L	33	12.0	0.113	16.6	LOS C	0.4	3.3	0.34	0.68	64.4
6	R	40	12.0	0.113	16.4	LOS C	0.4	3.3	0.34	0.82	65.1
Approach		73	12.0	0.113	16.4	LOS C	0.4	3.3	0.34	0.75	64.8
North: Bussell Highway											
7	L	46	11.0	0.072	13.1	LOS B	0.0	0.0	0.00	1.04	69.3
8	T	83	11.0	0.072	0.0	LOS A	0.0	0.0	0.00	0.00	90.0
Approach		129	11.0	0.072	4.7	NA	0.0	0.0	0.00	0.37	80.7
All Vehicles		398	10.2	0.124	6.8	NA	0.7	5.3	0.20	0.41	74.4

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: 23 BG+Dev+KarridaleW Dev PM - Bussell Hwy/Brockman Hwy - Copy

CEP02144 Karridale Residential Development
2023 PM Background+Development+Karridale West Development Traffic Volumes
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Bussell Highway											
2	T	151	9.0	0.145	0.7	LOS A	0.8	6.2	0.29	0.00	76.1
3	R	75	9.0	0.145	13.3	LOS B	0.8	6.2	0.29	0.94	70.3
Approach		226	9.0	0.145	4.9	NA	0.8	6.2	0.29	0.31	73.9
East: Brockman Highway											
4	L	38	12.0	0.090	16.3	LOS C	0.3	2.6	0.33	0.69	64.9
6	R	23	12.0	0.090	16.1	LOS C	0.3	2.6	0.33	0.83	65.5
Approach		61	12.0	0.090	16.2	LOS C	0.3	2.6	0.33	0.74	65.1
North: Bussell Highway											
7	L	26	11.0	0.076	13.1	LOS B	0.0	0.0	0.00	1.16	69.3
8	T	111	11.0	0.076	0.0	LOS A	0.0	0.0	0.00	0.00	90.0
Approach		137	11.0	0.076	2.5	NA	0.0	0.0	0.00	0.22	84.7
All Vehicles		424	10.1	0.145	5.7	NA	0.8	6.2	0.20	0.34	75.6

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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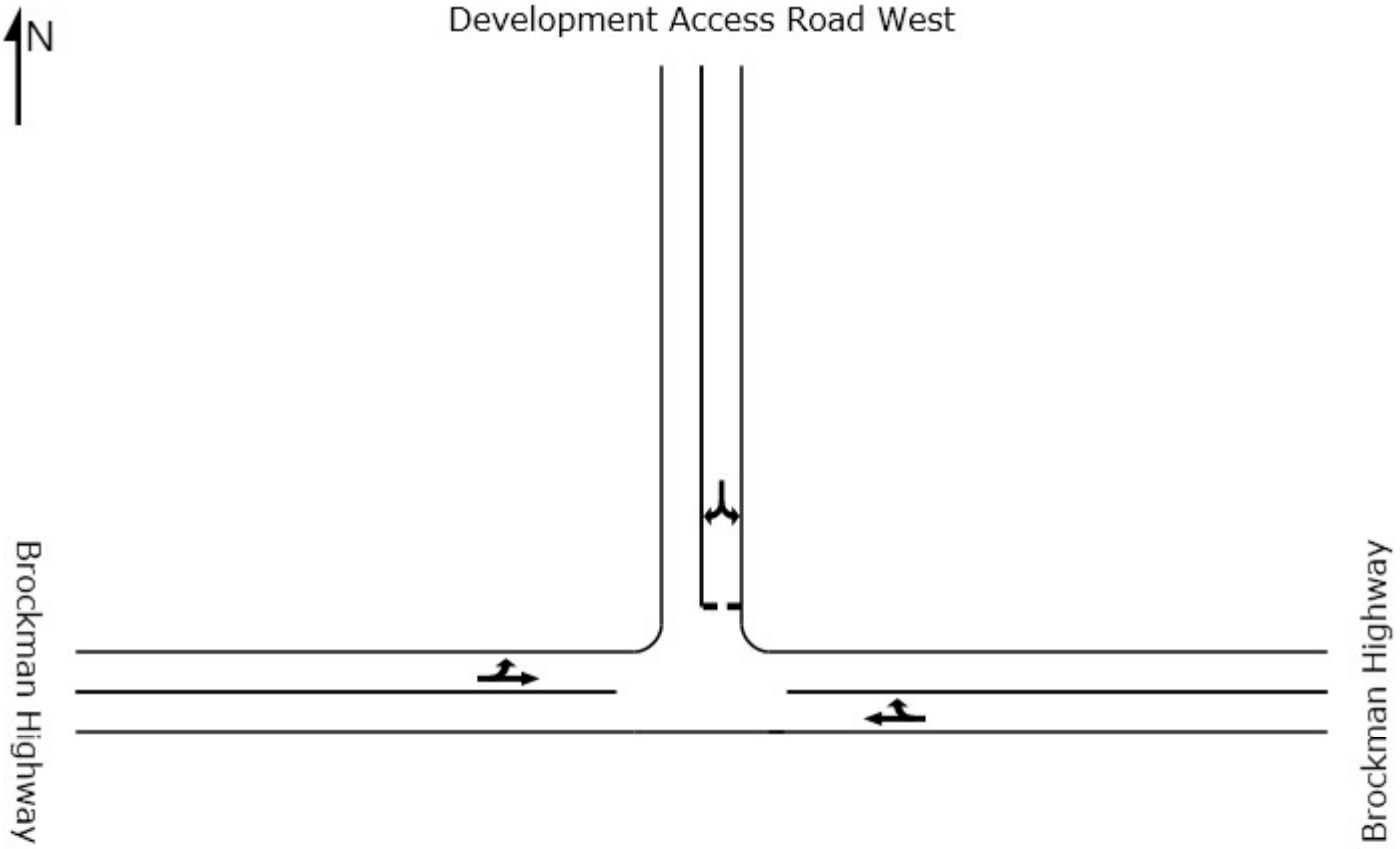
N
Development Access Road West
Brockman Highway
Brockman Highway

MOVEMENT SUMMARY

Site: 23 BG AM - Brockman Hwy/ Dev Access Rd W

CEP02144 Karridale Residential Development
2023 AM Background Traffic Volumes
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Brockman Highway											
5	T	36	12.0	0.021	0.2	LOS A	0.1	0.8	0.14	0.00	100.7
6	R	1	0.0	0.021	15.5	LOS C	0.1	0.8	0.14	1.14	67.3
Approach		37	11.7	0.021	0.6	NA	0.1	0.8	0.14	0.03	99.8
North: Development Access Road West											
7	L	1	0.0	0.002	7.4	LOS A	0.0	0.1	0.16	0.56	52.2
9	R	1	0.0	0.002	7.3	LOS A	0.0	0.1	0.16	0.62	52.5
Approach		2	0.0	0.002	7.3	LOS A	0.0	0.1	0.16	0.59	52.4
West: Brockman Highway											
10	L	1	0.0	0.024	15.3	LOS C	0.0	0.0	0.00	1.21	66.4
11	T	43	12.0	0.024	0.0	LOS A	0.0	0.0	0.00	0.00	110.0
Approach		44	11.7	0.024	0.3	NA	0.0	0.0	0.00	0.03	108.9
All Vehicles		83	11.4	0.024	0.6	NA	0.1	0.8	0.07	0.04	102.1

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: 23 BG PM - Brockman Hwy/ Dev Access Rd W

CEP02144 Karridale Residential Development
2023 PM Background Traffic Volumes
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Brockman Highway											
5	T	36	12.0	0.021	0.2	LOS A	0.1	0.8	0.14	0.00	100.7
6	R	1	0.0	0.021	15.5	LOS C	0.1	0.8	0.14	1.14	67.3
Approach		37	11.7	0.021	0.6	NA	0.1	0.8	0.14	0.03	99.8
North: Development Access Road West											
7	L	1	0.0	0.002	7.4	LOS A	0.0	0.1	0.16	0.56	52.2
9	R	1	0.0	0.002	7.3	LOS A	0.0	0.1	0.16	0.62	52.5
Approach		2	0.0	0.002	7.3	LOS A	0.0	0.1	0.16	0.59	52.4
West: Brockman Highway											
10	L	1	0.0	0.024	15.3	LOS C	0.0	0.0	0.00	1.21	66.4
11	T	43	12.0	0.024	0.0	LOS A	0.0	0.0	0.00	0.00	110.0
Approach		44	11.7	0.024	0.3	NA	0.0	0.0	0.00	0.03	108.9
All Vehicles		83	11.4	0.024	0.6	NA	0.1	0.8	0.07	0.04	102.1

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
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MOVEMENT SUMMARY

Site: 23 BG+Dev AM - Brockman Hwy/Dev Access Rd W

CEP02144 Karridale Residential Development
2023 AM Background+Development Traffic Volumes
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Brockman Highway											
5	T	55	12.0	0.032	0.4	LOS A	0.2	1.3	0.22	0.00	96.1
6	R	2	0.0	0.032	15.7	LOS C	0.2	1.3	0.22	1.09	67.9
Approach		57	11.6	0.032	0.9	NA	0.2	1.3	0.22	0.04	95.1
North: Development Access Road West											
7	L	4	0.0	0.030	8.2	LOS A	0.1	0.8	0.29	0.55	51.7
9	R	19	0.0	0.030	8.1	LOS A	0.1	0.8	0.29	0.63	51.9
Approach		23	0.0	0.030	8.1	LOS A	0.1	0.8	0.29	0.62	51.9
West: Brockman Highway											
10	L	7	0.0	0.051	15.3	LOS C	0.0	0.0	0.00	1.21	66.4
11	T	86	12.0	0.051	0.0	LOS A	0.0	0.0	0.00	0.00	110.0
Approach		93	11.1	0.051	1.2	NA	0.0	0.0	0.00	0.09	106.4
All Vehicles		173	9.8	0.051	2.0	NA	0.2	1.3	0.11	0.14	90.2

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: 23 BG+Dev PM - Brockman Hwy/Dev Access Rd W

CEP02144 Karridale Residential Development
2023 PM Background+Development Traffic Volumes
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Brockman Highway											
5	T	49	12.0	0.031	0.3	LOS A	0.2	1.2	0.20	0.00	96.6
6	R	5	0.0	0.031	15.7	LOS C	0.2	1.2	0.20	1.10	67.8
Approach		54	10.9	0.031	1.7	NA	0.2	1.2	0.20	0.10	94.0
North: Development Access Road West											
7	L	3	0.0	0.020	8.0	LOS A	0.1	0.5	0.26	0.55	51.8
9	R	13	0.0	0.020	7.9	LOS A	0.1	0.5	0.26	0.62	52.1
Approach		16	0.0	0.020	7.9	LOS A	0.1	0.5	0.26	0.61	52.0
West: Brockman Highway											
10	L	21	0.0	0.047	15.3	LOS C	0.0	0.0	0.00	1.20	66.4
11	T	64	12.0	0.047	0.0	LOS A	0.0	0.0	0.00	0.00	110.0
Approach		85	9.0	0.047	3.8	NA	0.0	0.0	0.00	0.30	98.3
All Vehicles		155	8.7	0.047	3.5	NA	0.2	1.2	0.10	0.26	88.4

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
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MOVEMENT SUMMARY

Site: 23 BG+Dev+KarridaleW Dev AM - Brockman Hwy/Dev Access Rd W

CEP02144 Karridale Residential Development
2023 AM Background+Development+Karridale West Development Traffic Volumes
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Brockman Highway											
5	T	56	12.0	0.033	0.4	LOS A	0.2	1.4	0.24	0.00	94.9
6	R	2	0.0	0.033	15.8	LOS C	0.2	1.4	0.24	1.08	68.1
Approach		58	11.6	0.033	1.0	NA	0.2	1.4	0.24	0.04	94.0
North: Development Access Road West											
7	L	4	0.0	0.031	8.4	LOS A	0.1	0.8	0.31	0.56	51.5
9	R	19	0.0	0.031	8.3	LOS A	0.1	0.8	0.31	0.64	51.7
Approach		23	0.0	0.031	8.3	LOS A	0.1	0.8	0.31	0.62	51.7
West: Brockman Highway											
10	L	7	0.0	0.060	15.3	LOS C	0.0	0.0	0.00	1.21	66.4
11	T	102	12.0	0.060	0.0	LOS A	0.0	0.0	0.00	0.00	110.0
Approach		109	11.2	0.060	1.0	NA	0.0	0.0	0.00	0.08	106.9
All Vehicles		190	10.0	0.060	1.9	NA	0.2	1.4	0.11	0.13	91.2

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
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MOVEMENT SUMMARY

Site: 23 BG+Dev+KarridaleW Dev PM - Brockman Hwy/Dev Access Rd W

CEP02144 Karridale Residential Development
2023 PM Background+Development+Karridale West Development Traffic Volumes
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Brockman Highway											
5	T	50	12.0	0.031	0.4	LOS A	0.2	1.3	0.22	0.00	95.3
6	R	5	0.0	0.031	15.7	LOS C	0.2	1.3	0.22	1.09	68.0
Approach		55	10.9	0.031	1.8	NA	0.2	1.3	0.22	0.10	93.0
North: Development Access Road West											
7	L	3	0.0	0.021	8.1	LOS A	0.1	0.5	0.29	0.55	51.7
9	R	13	0.0	0.021	8.0	LOS A	0.1	0.5	0.29	0.63	51.9
Approach		16	0.0	0.021	8.1	LOS A	0.1	0.5	0.29	0.61	51.9
West: Brockman Highway											
10	L	21	0.0	0.056	15.3	LOS C	0.0	0.0	0.00	1.20	66.4
11	T	80	12.0	0.056	0.0	LOS A	0.0	0.0	0.00	0.00	110.0
Approach		101	9.5	0.056	3.2	NA	0.0	0.0	0.00	0.25	100.1
All Vehicles		172	9.1	0.056	3.2	NA	0.2	1.3	0.10	0.24	89.8

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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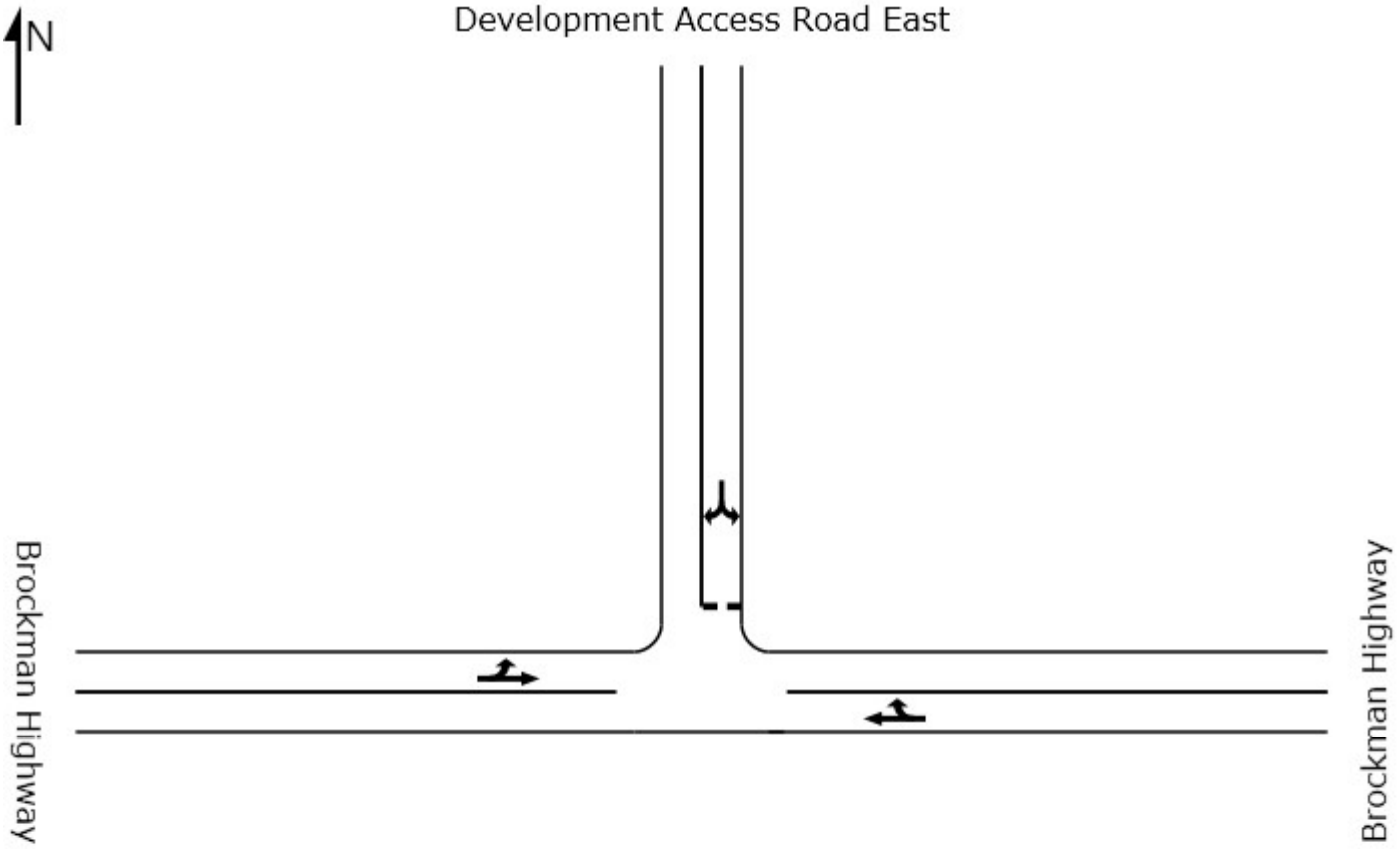
N
Development Access Road East
Brockman Highway
Brockman Highway

MOVEMENT SUMMARY

Site: 23 BG AM - Brockman Hwy/ Dev Access Rd E

CEP02144 Karridale Residential Development
2023 AM Background Traffic Volumes
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Brockman Highway											
5	T	35	12.0	0.020	0.3	LOS A	0.1	0.8	0.20	0.00	97.3
6	R	1	0.0	0.020	15.6	LOS C	0.1	0.8	0.20	1.10	67.8
Approach		36	11.7	0.020	0.7	NA	0.1	0.8	0.20	0.03	96.5
North: Development Access Road East											
7	L	1	0.0	0.002	7.6	LOS A	0.0	0.1	0.22	0.55	52.0
9	R	1	0.0	0.002	7.5	LOS A	0.0	0.1	0.22	0.61	52.3
Approach		2	0.0	0.002	7.6	LOS A	0.0	0.1	0.22	0.58	52.2
West: Brockman Highway											
10	L	1	0.0	0.044	15.3	LOS C	0.0	0.0	0.00	1.21	66.4
11	T	78	12.0	0.044	0.0	LOS A	0.0	0.0	0.00	0.00	110.0
Approach		79	11.8	0.044	0.2	NA	0.0	0.0	0.00	0.02	109.4
All Vehicles		117	11.6	0.044	0.5	NA	0.1	0.8	0.06	0.03	103.2

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: 23 BG PM - Brockman Hwy/ Dev Access Rd E

CEP02144 Karridale Residential Development
2023 PM Background Traffic Volumes
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Brockman Highway											
5	T	35	12.0	0.020	0.2	LOS A	0.1	0.8	0.14	0.00	100.8
6	R	1	0.0	0.020	15.5	LOS C	0.1	0.8	0.14	1.14	67.3
Approach		36	11.7	0.020	0.6	NA	0.1	0.8	0.14	0.03	99.9
North: Development Access Road East											
7	L	1	0.0	0.002	7.4	LOS A	0.0	0.1	0.16	0.56	52.2
9	R	1	0.0	0.002	7.3	LOS A	0.0	0.1	0.16	0.62	52.5
Approach		2	0.0	0.002	7.3	LOS A	0.0	0.1	0.16	0.59	52.4
West: Brockman Highway											
10	L	1	0.0	0.024	15.3	LOS C	0.0	0.0	0.00	1.21	66.4
11	T	42	12.0	0.024	0.0	LOS A	0.0	0.0	0.00	0.00	110.0
Approach		43	11.7	0.024	0.4	NA	0.0	0.0	0.00	0.03	108.9
All Vehicles		81	11.4	0.024	0.6	NA	0.1	0.8	0.06	0.04	102.1

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: 23 BG+Dev AM - Brockman Hwy/Dev Access Rd E

CEP02144 Karridale Residential Development
2023 AM Background+Development Traffic Volumes
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Brockman Highway											
5	T	37	12.0	0.022	0.3	LOS A	0.1	0.9	0.21	0.00	96.4
6	R	2	0.0	0.022	15.7	LOS C	0.1	0.9	0.21	1.09	67.9
Approach		39	11.4	0.022	1.1	NA	0.1	0.9	0.21	0.06	95.0
North: Development Access Road East											
7	L	5	0.0	0.029	7.9	LOS A	0.1	0.8	0.27	0.56	51.8
9	R	18	0.0	0.029	7.8	LOS A	0.1	0.8	0.27	0.63	52.1
Approach		23	0.0	0.029	7.9	LOS A	0.1	0.8	0.27	0.61	52.0
West: Brockman Highway											
10	L	7	0.0	0.049	15.3	LOS C	0.0	0.0	0.00	1.21	66.4
11	T	82	12.0	0.049	0.0	LOS A	0.0	0.0	0.00	0.00	110.0
Approach		89	11.1	0.049	1.2	NA	0.0	0.0	0.00	0.09	106.2
All Vehicles		151	9.5	0.049	2.2	NA	0.1	0.9	0.09	0.16	89.2

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: 23 BG+Dev PM - Brockman Hwy/Dev Access Rd E

CEP02144 Karridale Residential Development
2023 PM Background+Development Traffic Volumes
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Brockman Highway											
5	T	40	12.0	0.026	0.2	LOS A	0.1	1.0	0.17	0.00	98.3
6	R	5	0.0	0.026	15.6	LOS C	0.1	1.0	0.17	1.12	67.6
Approach		45	10.7	0.026	1.9	NA	0.1	1.0	0.17	0.12	94.9
North: Development Access Road East											
7	L	3	0.0	0.018	7.7	LOS A	0.1	0.5	0.22	0.55	52.0
9	R	12	0.0	0.018	7.6	LOS A	0.1	0.5	0.22	0.62	52.3
Approach		15	0.0	0.018	7.6	LOS A	0.1	0.5	0.22	0.60	52.2
West: Brockman Highway											
10	L	21	0.0	0.036	15.3	LOS C	0.0	0.0	0.00	1.20	66.4
11	T	45	12.0	0.036	0.0	LOS A	0.0	0.0	0.00	0.00	110.0
Approach		66	8.2	0.036	4.9	NA	0.0	0.0	0.00	0.38	95.1
All Vehicles		126	8.1	0.036	4.1	NA	0.1	1.0	0.09	0.32	86.1

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: 23 BG+Dev+KarridaleW Dev AM - Brockman Hwy/Dev Access Rd E

CEP02144 Karridale Residential Development
2023 AM Background+Development+Karridale West Development Traffic Volumes
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Brockman Highway											
5	T	38	12.0	0.023	0.4	LOS A	0.1	0.9	0.23	0.00	95.2
6	R	2	0.0	0.023	15.8	LOS C	0.1	0.9	0.23	1.08	68.0
Approach		40	11.4	0.023	1.2	NA	0.1	0.9	0.23	0.05	93.9
North: Development Access Road East											
7	L	5	0.0	0.030	8.1	LOS A	0.1	0.8	0.29	0.56	51.7
9	R	18	0.0	0.030	8.0	LOS A	0.1	0.8	0.29	0.63	52.0
Approach		23	0.0	0.030	8.0	LOS A	0.1	0.8	0.29	0.62	51.9
West: Brockman Highway											
10	L	7	0.0	0.058	15.3	LOS C	0.0	0.0	0.00	1.21	66.4
11	T	98	12.0	0.058	0.0	LOS A	0.0	0.0	0.00	0.00	110.0
Approach		105	11.2	0.058	1.0	NA	0.0	0.0	0.00	0.08	106.8
All Vehicles		168	9.7	0.058	2.0	NA	0.1	0.9	0.09	0.15	90.6

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: 23 BG+Dev+KarridaleW Dev PM - Brockman Hwy/Dev Access Rd E

CEP02144 Karridale Residential Development
2023 PM Background+Development+Karridale West Development Traffic Volumes
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Brockman Highway											
5	T	41	12.0	0.026	0.3	LOS A	0.1	1.0	0.19	0.00	96.8
6	R	5	0.0	0.026	15.7	LOS C	0.1	1.0	0.19	1.10	67.8
Approach		46	10.7	0.026	2.0	NA	0.1	1.0	0.19	0.12	93.8
North: Development Access Road East											
7	L	3	0.0	0.019	7.9	LOS A	0.1	0.5	0.25	0.55	51.9
9	R	12	0.0	0.019	7.8	LOS A	0.1	0.5	0.25	0.62	52.2
Approach		15	0.0	0.019	7.8	LOS A	0.1	0.5	0.25	0.60	52.1
West: Brockman Highway											
10	L	21	0.0	0.045	15.3	LOS C	0.0	0.0	0.00	1.20	66.4
11	T	61	12.0	0.045	0.0	LOS A	0.0	0.0	0.00	0.00	110.0
Approach		82	8.9	0.045	3.9	NA	0.0	0.0	0.00	0.31	97.9
All Vehicles		143	8.6	0.045	3.7	NA	0.1	1.0	0.09	0.28	88.1

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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Local Structure Plan

APPENDIX J
FIRE MANAGMENT PLAN

Cardno
Shaping the Future

Bushfire Management Plan Coversheet

This Coversheet and accompanying Bushfire Management Plan has been prepared and issued by a person accredited by Fire Protection Association Australia under the Bushfire Planning and Design (BPAD) Accreditation Scheme.

Bushfire Management Plan and Site Details					
Site address / Plan reference:	Lot 9001 Brockman Highway				
Suburb:	Karridale	State:	WA	Postcode:	6288
Local government area:	Shire Augusta Margaret Rover				
Description of the planning proposal:	Structure Plan				
BMP / Reference number:	20865	Version:	F	Date of issue:	04/03/2025
Client / Business name:	Hamelin Grove C/- Martin Richards Town Planning & Project Management				

Reason for referral to DFES[1]	Yes	No
Has the BAL been calculated by a method other than Method 1 as outlined in AS3959? (Tick *No* if AS3959 Method 1 has been used to calculate the BAL)		✓
Have any of the bushfire protection criteria elements been addressed through the use of an outcomes-based approach?		✓
Strategic planning proposal (including rezoning applications)		✓
Local planning scheme amendment containing supplementary provisions, additional to the deemed provisions for bushfire risk management		✓
Where a bushfire local planning policy, or variation to the acceptable solutions or the APZ is proposed		✓
Where there is a conflict of opinion between the decision maker and proponent		✓
Expert technical advice on bushfire behaviour, emergency management, or other occasions where bushfire technical advice is required to support planning decision-making		✓
Expert technical advice on bushfire matters referred to State Administrative Tribunal (SAT) or Development Assessment Panel (DAP)		✓
Comments on future buildings' compliance with FES Commissioner's operational requirement guidelines		✓
Decision maker discretionary referral, (e.g. renewable energy, hazardous materials, vulnerable land use)		✓

If the development is a special development type as listed above, explain why the proposal is considered to be one of the above listed classifications (E.g. considered vulnerable land-use as the development is for accommodation of the elderly, etc.)?

Note: The decision maker (e.g. local government or the WAPC) should only refer the proposal to DFES for comment if one (or more) of the above answers are ticked "Yes".

BPAD Accredited Practitioner Details and Declaration

Name	Accreditation Level	Accreditation No.	Accreditation Expiry
Gary McMahon	Level 3	35078	Nov 2025
Company		**Contact No.**	
Ecosystem Solutions Pty Ltd		08 9759 1960	

I declare that the information provided within this bushfire management plan is to the best of my knowledge true and correct.

Signature of Practitioner Date 04/03/2025

[1] For more information please refer to DFES Referral to DFES Checklist

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Bushfire Management Plan

Lot 9001 Brockman Highway, Karridale

4 March 2025

Prepared for:

Hamelin Grove

C/- Martin Richards Town Planning & Project Management

Limitations Statement

This report has been prepared in accordance with the Agreement between Ecosystem Solutions Pty Ltd and Hamelin Grove ("**Client**"). It has been solely prepared for Bushfire Management Plan for a Structure Plan for Lot 9001 Brockman Highway, Karridale ("**Site**").

Information

In undertaking this work the authors have made every effort to ensure the accuracy of the information used. Unless otherwise stated in the report, Ecosystem Solutions Pty Ltd has not independently verified such information and cannot guarantee its accuracy or completeness.

Conclusions

Within the limitations imposed by the scope of work, preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable bushfire consultants under similar circumstances. No other warranty, expressed or implied, is made.

Reliance

This report is solely for the use of the Client and any reliance on this report by third parties will be at such party's sole risk. This report must only be presented in full and may not be used to support any other purpose than those set out in the report and the Agreement, except where prior written approval with comments are provided by Ecosystem Solutions Pty Ltd. All intellectual property rights in documents created by Ecosystem Solutions Pty Ltd remain the property of Ecosystem Solutions Pty Ltd.

Other parties should not rely on the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters. Ecosystem Solutions Pty Ltd accepts no Liability, or responsibility whatsoever for or in respect of any use or reliance upon this report and its supporting material subsequently used by others. Please note that the contents of this report may not be directly applicable towards another organisation's needs and may not contain sufficient information for purposes of other parties or for other uses.

Ecosystem Solutions Pty Ltd will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of this report.

Other limitations

The measures contained in this report cannot guarantee that a structure or building will not be damaged or would survive a bushfire event on every occasion. This is due to the degree of vegetation management,

the unpredictable nature of fire behaviour (knowledge in this field continues to develop) and the unpredictable nature of extreme weather conditions.

The growth, planting or removal of vegetation, poor maintenance of any fire prevention/mitigation measures, addition of structures not included in this report, or other activity can and will change the bushfire threat to all properties detailed in this report. The implementation of fire precautions will depend on the actions of the landowner or occupiers of the land, over which Ecosystem Solutions Pty Ltd has no control. Should changes be made to the Site, a new Bushfire Management Plan is required.

Ecosystem Solutions Pty Ltd accepts no Liability, including Liability for any Loss in connection with:

- a Claim, damage, or injury to property, or persons caused by fire;
- further growth, planting, or removal of vegetation on the Site;
- poor maintenance of any fire protection measures;
- additional structures not included in this assessment; or
- any other activity that may change the bushfire threat level.

The Client and owner of the Site each acknowledge that they have been made aware of the exclusions above and that such exclusion of Liability is reasonable in all the circumstances.

This report is valid for a period of two years only from the date of its issue. All BAL ratings identified in this report are indicative and are required to be verified at the time of construction of individual buildings to ensure appropriate setbacks identified in the Site/building have been achieved.

STATEMENT OF CONFORMITY – PLANNING AND DEVELOPMENT ACT 2005

Gary McMahon
B.Sc. M. Env Mgmt. PG Dip Bushfire Protection. C.EnvP, BPAD Level 3 (35078)

The signatory declares that this Bushfire Management Plan meets the requirements of State Planning Policy 3.7 and the Planning for Bushfire Guidelines (2024) .

DISCLAIMER

**All capitalised terms used in the Limitations Statement above that are not defined are defined in the Agreement between Ecosystem Solutions Pty Ltd and the Client.*

*** The limitations above are subject to any relevant rights or remedies that the Client may be entitled to under legislation, including Schedule 2 of the Competition and Consumer Act 2010 (Cth).*

Document Control

Client - Hamelin Grove

C/- Martin Richards Town Planning & Project Management

Site - Lot 9001 Brockman Highway, Karridale

Version	Revision	Purpose	Author	Reviewer	Submitted	
					Form	Date
Report	Rev A	Initial Report	DC (BPAD 48409 – Level 1)	KL (BPAD 38253 – Level 2)	Electronic (email)	14/05/2020
Report	Rev B	MR Comments	DC (BPAD 48409 – Level 1)	KL (BPAD 38253 – Level 2)	Electronic (email)	18/05/2020
Report	Rev C	Wording regarding water tanks	KL (BPAD 38253 – Level 2)	DC (BPAD 48409 – Level 1)	Electronic (email)	22/12/2020
Report	Rev D	Update Lot layout	KL (BPAD 38253 – Level 2)	DC (BPAD 48409 – Level 1)	Electronic (email)	20/01/2021
Report	Rev E	Update Site Plan	DC (BPAD 48409 – Level 1)	KL (BPAD 38253 – Level 2)	Electronic (email)	13/09/2021
Report	Rev F	Update Structure Plan	DC (BPAD 48409 – Level 2)	GM (BPAD 48409 – Level 3)	Electronic (email)	4/3/2024

Filename: Y:\PROJECTS\20865 Hamelin Grove, Karridale BMP\Reports\Hamelin Grove Lot 9001 Brockman Hwy, Karridale BMP rev f.docx

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1 Introduction

This Bushfire Management Plan (BMP) has been prepared for Hamelin Grove, Lot 9001 Brockman Highway, Karridale by Ecosystem Solutions Pty Ltd, Dani Cuthbert (Dip. TM., Dip BM., BPAD 48409 – Level 1) and Kelly Lamp (B.Sc. Hons. Nat Rs Mgmt, BPAD 38253 – Level 2).

The Site is currently zoned for Future Development under the Shire of Augusta Margaret River local Planning Scheme 1. The proposal is to subdivide the lot, with the Structure Plan provided in Figure 2 which includes a mixture of Rural Residential, Residential 5 and Residential 2.5 lots and areas of Public Utility and Public Open Space.

The Site is located within the Shire of Augusta-Margaret River. Karridale town centre is directly to the west, with Augusta located approximately 12 km to the south of the Site. The area is within a bushfire prone area, as declared by *State Planning Policy 3.7: Planning in Bushfire Prone Areas* (Figure 1).

The majority of the Site is currently cleared of native vegetation. The Site and surrounding landscape is predominantly flat with a very gentle slope in some areas, with maximum slope category of >0 to 5 degrees.

The purpose of this BMP is to detail the fire management methods and requirements that will be implemented within the Site as part of the subdivision of the Site. The aim of the BMP is to reduce the threat to residents and fire fighters in the event of a fire within or near the Site.

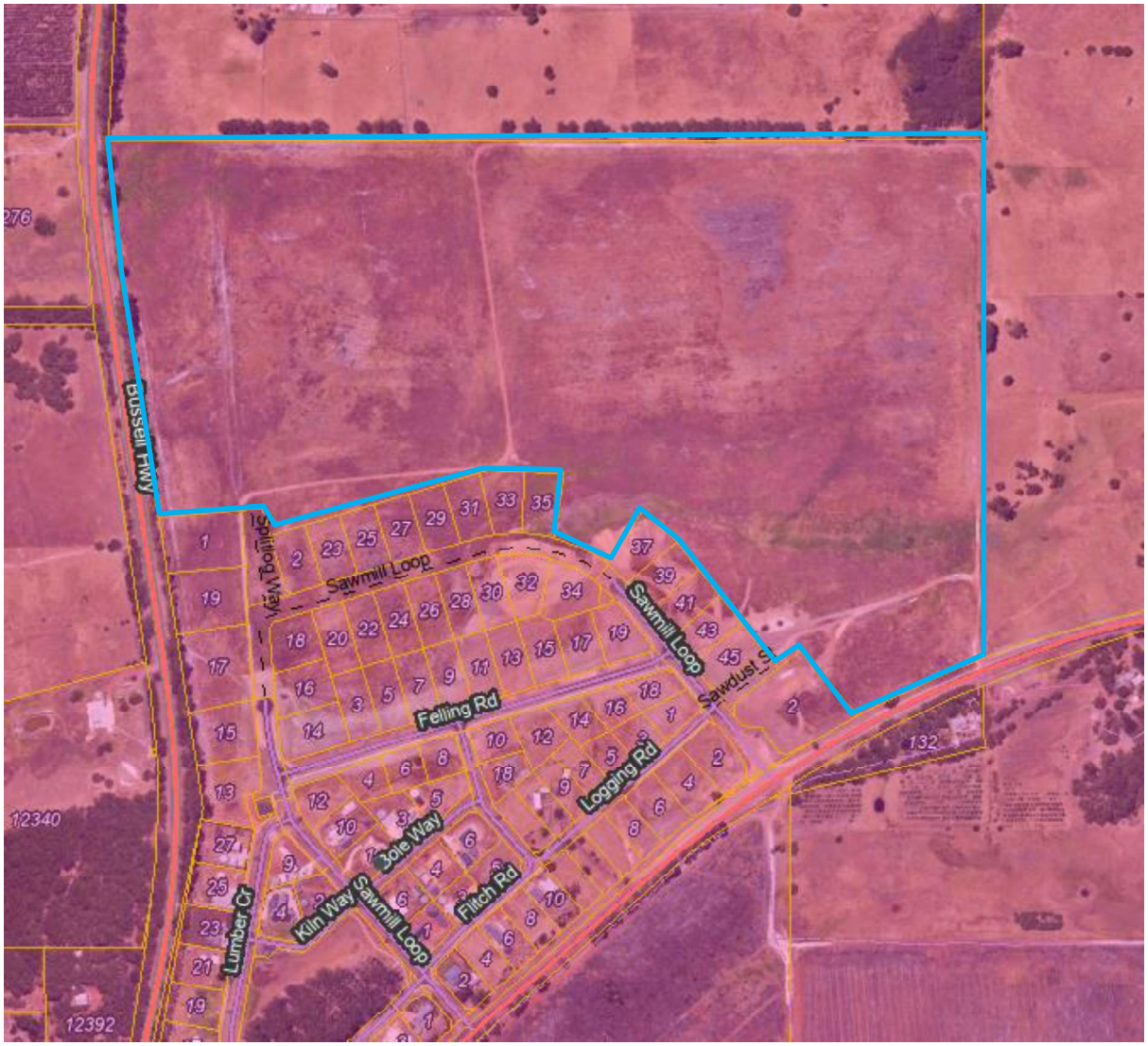


Figure 1 Extract Map of Bushfire Prone Areas for Lot 9001 Brockman Highway, Karridale, within the blue polygon, accessed 3rd February 2025

Figure 2 Structure Plan for Lot 9001 Brockman Highway, Karridale

2 Environmental Considerations

2.1 Native Vegetation – Modification and Clearing

Lot 9001 Brockman Highway, Karridale was previously a plantation, which has been removed. Since the time of the removal of the plantation there has been some recruitment of Tasmainian Blue Gums and reeds over introduced grasses throughout the Site. This BMP requires all proposed lots to be established and maintained to Asset Protection Zone (APZ) standards by the developer until individual lots are sold, where it becomes to the responsibility of the individual lot owner.

This bushfire assessment assumes that relevant government approvals for any vegetation modification will be achieved prior to the commencement of any clearing.

The Site and the surrounding 150m buffer have been assessed for environmental values using a simple desktop review (Table 1). The Protected Matters Search Tool and public state databases, searched 3rd February 2025, identifies conservation significant flora, fauna, and vegetation with a number of threatened flora and fauna species or species habitat that may occur in the area.

Table 1 Significant environmental values identified within the Site

Environmental Value	Yes or No	If Yes - describe
Conservation Covenants	No	Nil
Bushfire Forever Sites	No	Nil
Conservation Category Wetlands and Buffer	No	Nil
Threatened Ecological Communities (TECs)	Yes	Empodisma peatlands of south western Australia may occur within the area.
Threatened Flora	Yes	A number of Threatened flora species or species habitat may occur within the area.
Threatened Fauna	Yes	A number of threatened fauna species or species habitat are known to occur in the area including: • Western Ringtail Possum (*Pseudocheirus occidentalis* - Critically Endangered); and • Black Cockatoo species (*Calyptorhynchus banksii naso* - Vulnerable, *Zanda baudinii* - Endangered & *Zanda latirostris* - Endangered).
Environmentally Sensitive Area	No	Nil

2.2 Revegetation / Landscape Management Plans

Any revegetation within the Public Open Space and drainage reserves will be subject to an approved landscape management plan to ensure the vegetation post development classification remains accurate and does not increase the BAL ratings for buildings across the Site. Establishment of the Public Open Space in accordance with an approved Landscape Management Plan is the responsibility of the developer for a period of two years, where this area will be ceded to the Crown and vested to the Shire of Augusta Margaret River for ongoing maintenance.

The revegetation of the 10m and 20m landscape buffers will also be subject to a landscape revegetation and management plan, for the purpose of this Bushfire Management Plan, these areas have been classified as Class A Forest, as a worst-case scenario, based on the plantings being spaced 4 to 5m apart with a mixture of trees and shrubs.

3 Bushfire Assessment Results

3.1 Assessment Inputs

A Site inspection was conducted on 6th February 2025 by Dani Cuthbert (BPAD Level 2) and Hayley Drake (BPAD Level 1), for the purpose of determining the Bushfire Attack Level in accordance with AS 3959-2018 Simplified Procedure (Method 1).

All vegetation within 150 m of the Site was classified and the slope under the vegetation determined in accordance with AS 3959-2018, shown in the photos below with map provided in Figure 3 for the current vegetation and Figure 4 for post development.

Plot	1	**Vegetation Classification or Exclusion Clause** - ***Pre-Development***	Class A Forest Downslope >0 to 5 Degrees
Plot	1	**Vegetation Classification or Exclusion Clause** - ***Post-Development***	Class A Forest Downslope >0 to 5 Degrees
Photo ID: 1			Photo ID: 2
Photo ID: 3			
Description / Justification for Classification:			Regrowth vegetation of trees up to 30 m high with more than 30% canopy cover at maturity, over an unmanaged understory. The Site is undulating, and some areas of this plot will be Upslope/Flat to proposed lots and Downslope >0 to 5 to others, therefore the entire plot has been classified as Downslope >0 to 5, as a worst-case scenario. The Vegetation Classification - Post Development mapping shows that this area of Class A Forest vegetation will be within the landscape buffer, therefore, will retain its Class A Forest classification post development, as a worst-case scenario. An approved Landscape Management Plan, may change the vegetation classification.

Plot	2	**Vegetation Classification or Exclusion Clause** - ***Pre-Development***	Class A Forest Downslope >0 to 5 Degrees
Plot	2	**Vegetation Classification or Exclusion Clause** - ***Post-Development***	Class A Forest Downslope >0 to 5 Degrees
Photo ID: 4			Photo ID: 5
Description / Justification for Classification:			Regrowth vegetation of trees up to 30 m high with more than 30% canopy cover at maturity, over an unmanaged understory. The Site is undulating, and some areas of this plot will be Upslope/Flat to proposed lots and Downslope >0 to 5 to others, therefore the entire plot has been classified as Downslope >0 to 5, as a worst-case scenario. The Vegetation Classification - Post Development mapping shows that this area of Class A Forest vegetation will be within the landscape buffer, therefore, will retain its Class A Forest classification post development, as a worst-case scenario. An approved Landscape Management Plan, may change the vegetation classification.

Plot	3	**Vegetation Classification or Exclusion Clause** - ***Pre-Development***	Class A Forest Downslope >0 to 5 Degrees
Plot	3	**Vegetation Classification or Exclusion Clause** - ***Post-Development***	Class A Forest Downslope >0 to 5 Degrees
Photo ID: 6			Photo ID: 7
Description / Justification for Classification:			Trees up to 30 m high with more than 30% canopy, over an unmanaged understory within an adjoining lot. The Site is undulating, and some areas of this plot will be Upslope/Flat to proposed lots and Downslope >0 to 5 to others, therefore the entire plot has been classified as Downslope >0 to 5, as a worst-case scenario. No vegetation modification will occur within this plot.

Plot	4	**Vegetation Classification or Exclusion Clause** - ***Pre-Development***	Class A Forest Downslope >0 to 5 Degrees
Plot	4	**Vegetation Classification or Exclusion Clause** - ***Post-Development***	Class A Forest Downslope >0 to 5 Degrees
Photo ID: 8			Photo ID: 9
Description / Justification for Classification:			Trees up to 30 m high with more than 30% canopy, over an unmanaged understory within road reserve and private property. The Site is undulating, and some areas of this plot will be Upslope/Flat to proposed lots and Downslope >0 to 5 to others, therefore the entire plot has been classified as Downslope >0 to 5, as a worst-case scenario. No vegetation modification will occur within this plot.

Plot	5	**Vegetation Classification or Exclusion Clause** - ***Pre-Development***	Class A Forest Downslope >0 to 5 Degrees
Plot	5	**Vegetation Classification or Exclusion Clause** - ***Post-Development***	Class A Forest Downslope >0 to 5 Degrees
Photo ID: 10			Photo ID: 11
Description / Justification for Classification:			Trees up to 30 m high with more than 30% canopy, over an unmanaged understory. The Site is undulating, and some areas of this plot will be Upslope/Flat to proposed lots and Downslope >0 to 5 to others, therefore the entire plot has been classified as Downslope >0 to 5, as a worst-case scenario. No vegetation modification will occur to vegetation outside of the Site. The Vegetation Classification - Post Development mapping shows that an area of Class A Forest vegetation within the Site will be within the landscape buffer, therefore, will retain its Class A Forest classification post development, as a worst-case scenario. An approved Landscape Management Plan, may change the vegetation classification.

Plot	6	**Vegetation Classification or Exclusion Clause** - ***Pre-Development***	Class A Forest Downslope >0 to 5 Degrees
Plot	6	**Vegetation Classification or Exclusion Clause** - ***Post-Development***	Class A Forest Downslope >0 to 5 Degrees
Photo ID: 12			Photo ID: 13
Description / Justification for Classification:			Trees up to 30 m high with more than 30% canopy, over an unmanaged understory within road reserve and private property. The Site is undulating, and some areas of this plot will be Upslope/Flat to proposed lots and Downslope >0 to 5 to others, therefore the entire plot has been classified as Downslope >0 to 5, as a worst-case scenario. No vegetation modification will occur within this plot.

Plot	7	**Vegetation Classification or Exclusion Clause** - ***Pre-Development***	Class C Shrubland Downslope >0 to 5 Degrees
Plot	7	**Vegetation Classification or Exclusion Clause** - ***Post-Development***	Class C Shrubland Downslope >0 to 5 Degrees / Excluded S 2.2.3.2 (e) or (f)

Photo ID: 14

Photo ID: 15

Photo ID: 16

Photo ID: 17

Description / Justification for Classification:	Open Shrubland vegetation of reeds up to 1m in height, over a grass understory. The Site is undulating, and some areas of this plot will be Upslope/Flat to proposed lots and Downslope >0 to 5 to others, therefore the entire plot has been classified as Downslope >0 to 5, as a worst-case scenario. Post development this majority of this plot will be excluded under S 2.2.3.2 (e) or (f). Some small areas will be within the proposed public open spaces and drainage areas and have retained their Class C Shrubland classification. A landscape management plan will be required to ensure the vegetation classification within the proposed public open space and drainage is accurate.

Plot	8	**Vegetation Classification or Exclusion Clause - *Pre-Development***	Class G Grassland >0 to 5 Degrees
Plot	8	**Vegetation Classification or Exclusion Clause - *Post-Development***	Class G Grassland >0 to 5 Degrees or Excluded S 2.2.3.2 (e) or (f)

Photo ID: 18

Photo ID: 19

Photo ID: 20

Photo ID: 21

Description / Justification for Classification:	Unmanaged grasses. The Site is undulating, and some areas of this plot will be Upslope/Flat to proposed lots and Downslope >0 to 5 degrees to others, therefore the entire plot has been classified as Downslope >0 to 5 degrees, as a worst-case scenario. The Vegetation Classification - Post Development map takes into account the post development firebreak category of the lots, with those being Residential/Rural Residential Lots 4,001m^2 and over and Lots under 4,000m^2, requiring grasses to be maintained at under 10cm in height, therefore these areas are excluded in the post development map. The areas within the neighbouring rural lots remain as Class G - Grassland post development.

Plot	9	**Vegetation Classification or Exclusion Clause - *Pre-Development***	Excluded S 2.2.3.2 (a), (e) or (f)
Plot	9	**Vegetation Classification or Exclusion Clause - *Post-Development***	Excluded S 2.2.3.2 (a), (e) or (f)

Photo ID: 22

Photo ID: 23

Photo ID: 24

Description / Justification for Classification:	Areas greater than 100m from the Site are excluded under S 2.2.3.2 (a). Non-vegetated areas including bare earth, roads and buildings are excluded under S 2.2.3.2 (e). Low threat vegetation including grasses managed at under 10cm in height, managed lawns and gardens and nature strips are excluded under S 2.2.3.2 (f). The Vegetation Classification - Post Development Map excludes grassland and shrubland within the proposed lots. The developer is responsible for establishing and maintaining the lots to Asset Protection Zone Standards (excluding any revegetation within the Landscape Buffers), including maintaining grasses at under 10cm in height until individual lots are sold, when this will become the responsibility of the individual landowners.

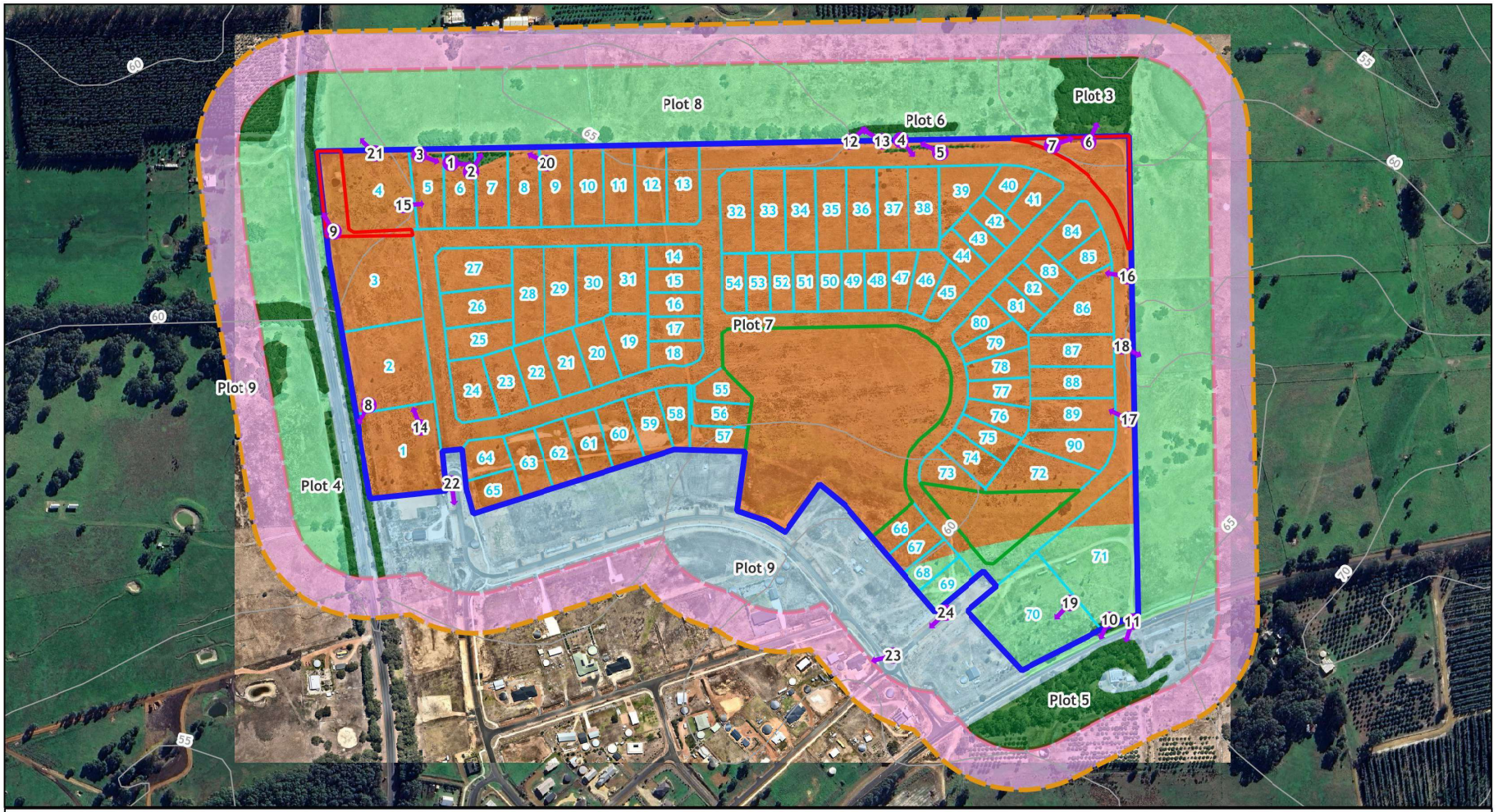


Figure 3 Vegetation Classification - Pre-Development

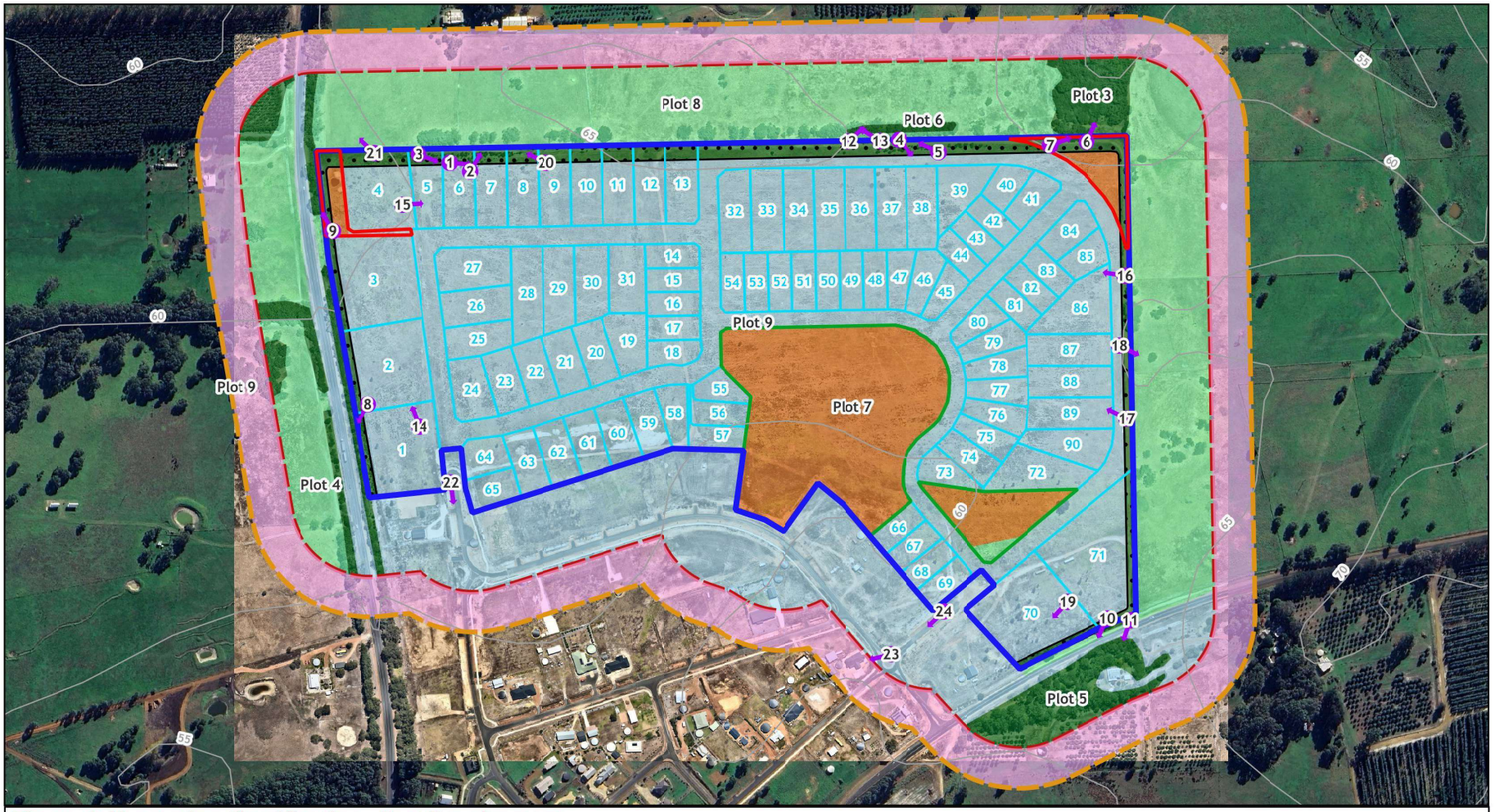


Figure 4 Vegetation Classification - Post-Development

3.2 Assessment Outputs

The results from the Site assessment are provided in Table 2. The Determined Bushfire Attack Level (highest BAL) for the Site has been determined in accordance with clause 2.5 of AS 3959- 2018 with map provided based on the Post Development Vegetation (Figure 4) in Figure 5 and detailed BAL Contour map provided in Figure 6.

Table 2 Site Assessment Result

Method 1 BAL Determination					
Fire Danger Index - 80 (AS 3959-2018 Table 2.1)					
Plot	Vegetation Classification	Maximum effective Slope Under the Classified Vegetation (degrees)	Required Distance Classified (metres)	Separation to the Vegetation	Bushfire Attack Level
1	Class A Forest	Downslope >0 to 5	27m*		BAL-29
2	Class A Forest	Downslope >0 to 5	27m*		BAL-29
3	Class A Forest	Downslope >0 to 5	27m*		BAL-29
4	Class A Forest	Downslope >0 to 5	27m*		BAL-29
5	Class A Forest	Downslope >0 to 5	27m*		BAL-29
6	Class A Forest	Downslope >0 to 5	27m*		BAL-29
7	Class C Shrubland	Downslope >0 to 5	15m*		BAL-29
8	Class G Grassland	Downslope >0 to 5	9m*		BAL-29
9	Excluded S 2.2.3.2 (a), (e) & (f)	N/A	N/A		BAL-LOW
Determined Bushfire Attack Level					BAL-29**

* This separation distance must be managed to the standards in the Planning for Bushfire Guidelines as an Asset Protection Zone.

** A lower BAL rating can be achieved based on an increased separation distance from the classified vegetation, depending on the location of the dwelling within the Lot. This determination is found using the worst-case scenario based on the plan. A detailed BAL assessment will be required prior to the construction of a dwelling.

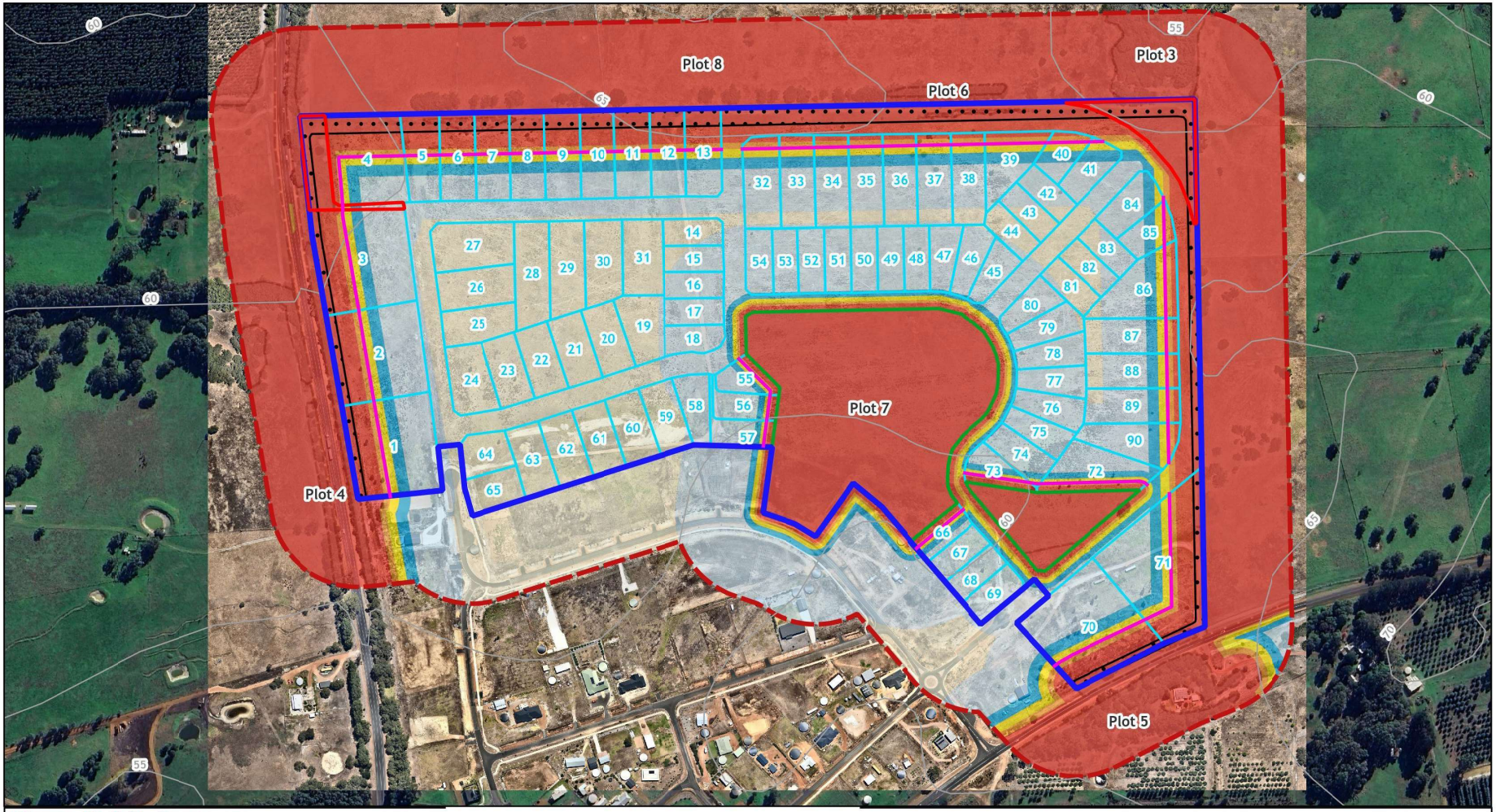


Figure 5 BAL Contour Map

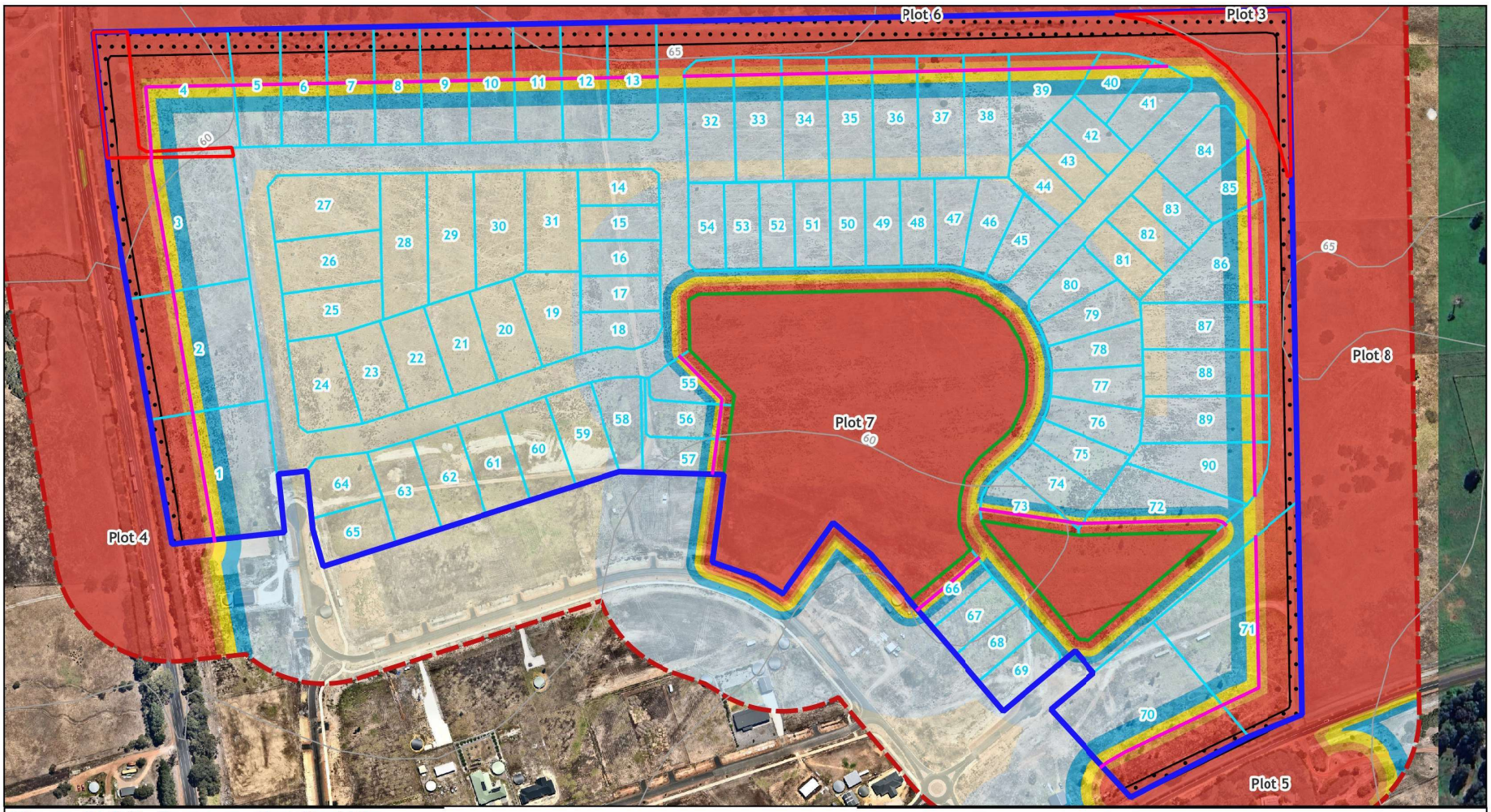
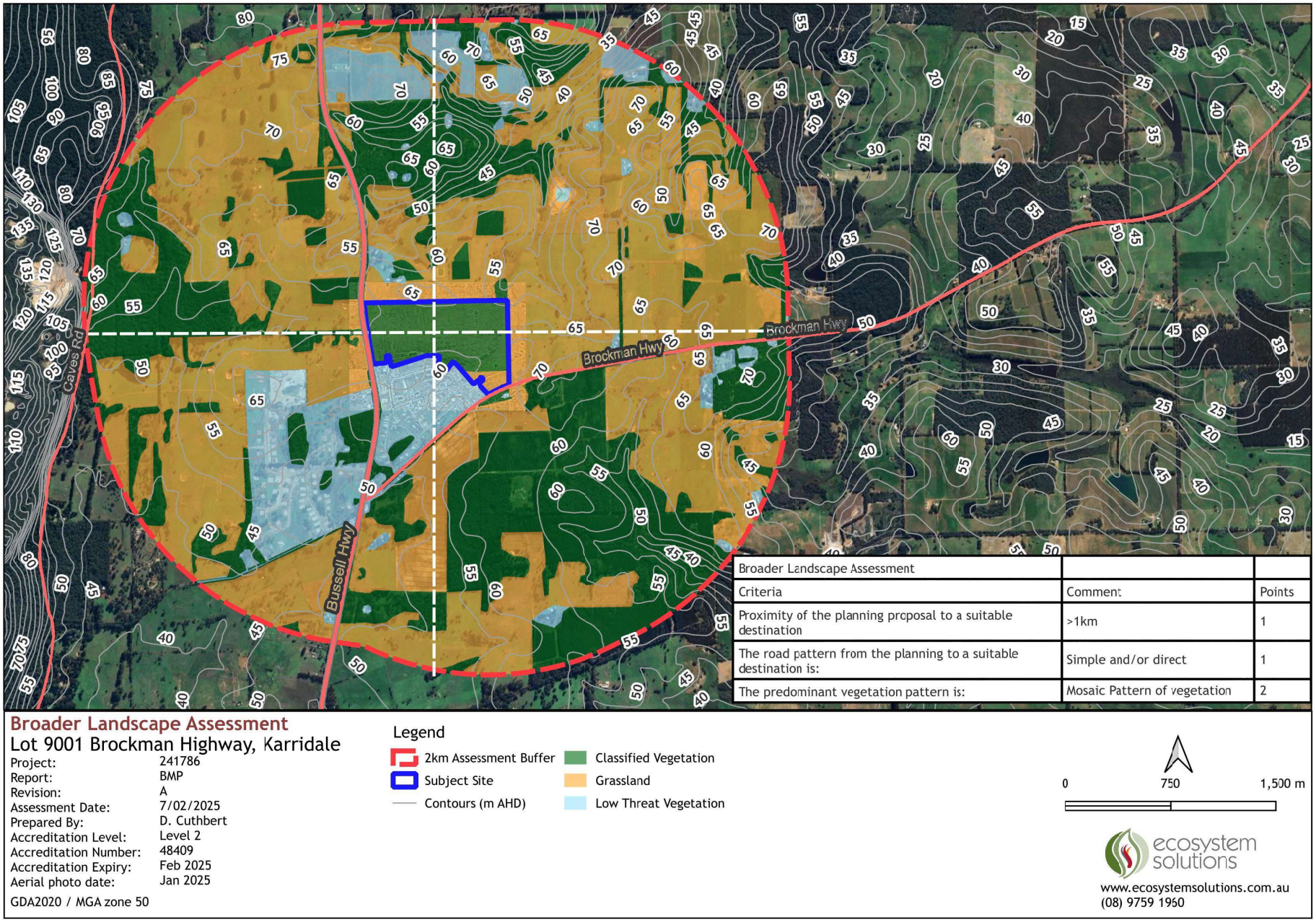


Figure 6 BAL Contour Map - Detailed View

4 Assessment Against the Bushfire Protection Criteria

4.1 Compliance with the Acceptable Solutions for each Element

Bushfire Protection Criteria - Element 1 - Location	
Outcomes: Avoid broader landscapes that present an unacceptable risk to life, property, and infrastructure.	
Acceptable Solution	**Assessment Statements**
A1.1a Broader Landscape Type A *The subject Site is located in an area that is a Broader Landscape Type A. This location satisfies the policy outcome for Element 1: Broader Location and no additional consideration is required.*	**Compliance with the Acceptable Solution is achieved.** The Broader Landscape Assessment (Figure 7) determined that the Site is located in an area that is a Broader Landscape Type A. No additional consideration is required.



Broader Landscape Assessment		
Criteria	Comment	Points
Proximity of the planning proposal to a suitable destination	>1km	1
The road pattern from the planning to a suitable destination is:	Simple and/or direct	1
The predominant vegetation pattern is:	Mosaic Pattern of vegetation	2

Figure 7 Broader Landscape Assessment

Bushfire Protection Criteria - Element 2 - Siting and Design

Outcomes: Ensure siting and design solutions:

- Manage or mitigate the bushfire risk to people, property, and infrastructure; and
- Avoid, or where avoidable, minimise the clearing of native vegetation.

Acceptable Solution	Assessment Statements
A2.1 Siting and design *Ensure that each proposed and existing lot(s) contains a sufficient development Site(s) that can achieve a radiant heat impact not exceeding 29kW/m² (BAL-29).* ***A2.2 Asset Protection Zone (APZ)*** *Where a development Site cannot be wholly located within an area with a radiant heat impact not exceeding 29 kW/m² (BAL-29) in its pre-development state, an indicative APZ is to be provided and meet the following requirements;* • ***Width**: the APZ is to be measured from the development Site, and of sufficient size to ensure the radiant heat impact of a bushfire does not exceed 29kW/m² (BAL-29) in all circumstances.* • ***Location**: the APZ should be contained solely within the boundaries of the lot, except in instances where:* ◦ *the vegetation on the adjoining lot(s) is, and will continue to be, low threat as per Clause 2.2.3.2 of AS 3959 or the requirements of Appendix B.2, Table 9 - APZ technical requirements, or an alternative standard in a local planning scheme, on an ongoing basis in perpetuity as agreed upon via a substantiated management agreement between the applicable landowners and the local government; or*	**Compliance with the Acceptable Solution is achieved.** The BAL Contour for the Site (Figure 5 & 6) shows the areas within the proposed lots where a BAL-29 or lower rating can be achieved. Areas available for the construction of a habitable building within the lots are confined to areas that are BAL-29 or lower rating. There are areas of BAL-40 and BAL-FZ that encroach the proposed lots. A Landscape Management Plan is required to ensure the BAL ratings within the Bushfire Management Plan are accurate. A habitable building setback line is required where BAL-40 or BAL-FZ encroach the proposed lots, to ensure habitable dwellings are located in an area of BAL-29 or lower. Asset Protection Zones surrounding each habitable building that eventuates within the proposed lots will be established and maintained in perpetuity to meet the criteria in the Guidelines (Appendix B) with the following minimum distances required to achieve BAL-29; • 27 m to the Class A Forest Downslope >0 to 5 degrees, • 9 m to the Class G Grassland Downslope >0 to 5 degrees, and • 10 m to the Class C Shrubland Downslope >0 to 5 degrees. All proposed Lots will be established and maintained to APZ standards (excluding the Landscape Buffers) by the developer, including maintaining grasses under 10 cm in height as per the Shire of Augusta Margaret River's Firebreak and Fuel Hazard Reduction Notice (*which may*

• *the adjoining land is, and will remain in perpetuity, non-vegetated such as a sealed or unsealed road, or a water body.* • ***Management**: the APZ is managed in accordance with the requirements of Appendix B.2, Table 9 - APZ technical requirements, or an alternative standard in a gazetted local planning scheme.*	*be subject to review from time to time)* until they are sold, when ongoing maintenance will become the responsibility of the individual landowners. Establishment and management of the Public Open Space, Drainage Reserves and landscape buffers within Road Reserves will occur in accordance with a Landscape Management Plan for a period of two years by the developer. After this period, the land will be ceded to the Crown and vested to the Shire of Augusta Margaret River, with ongoing management in perpetuity the responsibility of the Shire of Augusta Margaret River. Establishment and management of the Landscape Buffers within the proposed lots will occur in accordance with a Landscape Management Plan by the developer until lots are sold, where the responsibility becomes the individual landowners. The final BAL rating of any dwelling will depend on the housing design, orientation, and location within the Lot. Once the building design has been finalised, a separate BAL Assessment is required to be completed and a certificate from a qualified Bushfire Consultant submitted at the building application stage.
A2.3 Clearing of native vegetation *The structure plan or subdivision avoids, or where unavoidable, minimises the clearing of native vegetation.*	**Compliance with the Acceptable Solution is achieved.** No modification to native vegetation is proposed as part of this development.

Bushfire Protection Criteria - Element 3 - Vehicular Access

Outcomes: Ensure the design and capacity of vehicular access and egress provide:

- For efficient and effective evacuation to a suitable destination(s) and/or
- As a contingency measure for vulnerable land uses, an on-Site shelter, where demonstrated appropriate, as a last resort option.

Acceptable Solution	Assessment Statements
A3.1 Public Roads *Public roads are to meet the technical requirements in Appendix B.3, Table 10* (Appendix B).	**Compliance with the Acceptable Solution is achieved.** The developer will construct public roads to meet the requirements of the relevant class of road in the Local Government Guidelines for Subdivisional Developments, Liveable Neighbourhoods, Austroads standards and/or applicable standards for the local government. Existing public roads in proximity to the Site are in good condition.
A3.2 Access Routes *Public road access should be provided in two different directions to two different suitable destinations, with an all-weather surface.*	**Compliance with the Acceptable Solution is achieved.** All proposed lots will have two access/egress routes from the lot boundary to two suitable destinations. The internal road network will provide two-way access for all lots within the development via a public road network which connects to Brockman Highway, ensuring multiple access routes. The Structure Plan, Figure 2, shows access roads which will be used to connect the lots within the development to the public road network and ensures multiple access routes.
A3.3a No-through roads *If the public road access to the subject Site is via a no-through road which cannot be avoided due to the demonstrated Site constraints, the public road access is to be a maximum of 200 metres from the proposed lot(s) boundary to an intersection where two-way access is provided.*	There are no no-through roads proposed as part of this development. If the subdivision is to be staged, the stages are to be designed to ensure all lots within each stage have two access and egress routes via the public road network.
A3.3b No-through road requirements *A no-through road is to meet all the following requirements:*	There are no no-through roads proposed as part of this development.

Bushfire Protection Criteria - Element 3 - Vehicular Access	
• *Requirements of a public road (Appendix B, Table 10, Column 2); and* • *Turn around area/head (Appendix B, Figure 30).*	
A3.4 Emergency access way *Where it is demonstrated that A3.2 and A3.3 cannot be achieved due to Site constraints or where an alternative design option does not exist, an emergency access way can be considered as an acceptable solution.* *An emergency access way is to meet the following requirements:* • *The requirements of Appendix B.3, Table 10, Column 3 (Appendix B);* • *Provides a through connection to a public road;* • *Is no more than 500 metres in length;* • *Connects to a public road network;* • *The proponent obtaining consent from the local government, that it will accept care, control, and management for the access way; and* • *Is signposted and, if gated, gates must open for the whole carriageway width and remain unlocked.*	There are no emergency access ways proposed as part of this development.
A3.5a Perimeter roads *A perimeter road is a public road and is to be provided for greenfield or infill development where 10 or more lots are proposed (including as part of a stages subdivision) with the aim of:* • *Separating areas of permanent classified vegetation under AS 3959 which adjoin the subject Site, from the proposed lot(s); and* • *Removing the need for battle-axe lots that*	**Compliance with the Acceptable Solution is achieved.** A perimeter road has been provided where practical. Lots in the north and east abut grassland vegetation, where a perimeter road is not required. Lots 1 to 3 and 70 and 71 abut Bussell Highway and Brockman Highway, therefore have frontage to a public road, and a perimeter road is not required in these areas.

back onto areas of classified vegetation. *A perimeter road is to meet the requirements contained in Appendix B.3, Table 10, Column 1* (Appendix B). *A perimeter road may not be required where:* • *The adjoining classified vegetation is Class G Grassland;* • *Lots are zoned for rural living or equivalent;* • *It is demonstrated that it cannot be provided due to Site constraints; or* • *All lots have frontage to an existing public road.*	
A3.5b Fire service access route *Where proposed lots adjoin classifiable vegetation under AS 3959 (excluding Class G Grassland), and a perimeter road is not required in accordance with A3.5a, a fire service access route is to be provided to provide firefighting access, where access is not available to the* classified vegetation. *A fire service access route is to meet the following requirements:* • *Requirements of Appendix B.3, Table 10, Column 4* (Appendix B); • *Be through-routes with no dead-ends;* • *Must be signposted;* • *No further than 500 metres from a public road;* • *The proponent obtaining consent from the local government that it will accept care, control, and management; and* • *If gated, gates must open the whole carriageway width and can be locked by*	**Compliance with the Acceptable Solution is achieved.** No FSAR are proposed as part of this development.

the local government and/or emergency services, if keys are provided for each gate.

A3.6 Battle-axe access legs *Where it is demonstrated that a battle-axe access leg cannot be avoided due to Site or design constraints, it can be considered as an acceptable solution.* *There are no battle-axe technical requirements where the point of the battle-axe access leg joins the effective area of the battle-axe lot, is less than 50 metres from a public road in a reticulated water supply area.* *In circumstances where the above acceptable solution is not met, or the battle-axe lot is in a non-reticulated water area, the battle-axe leg is to meet the following requirements:* • *Requirements in Appendix B.3, Table 10, Column 5* (Appendix B); • *Passing bays every 200 metres with a minimum length of 20 metres and a minimum additional carriageway width of two metres (i.e. the combined carriageway width of the passing bay and constructed private driveway to be a minimum six metres).* • *Turn-area area/head* (Appendix B).	**Compliance with the Acceptable Solution is achieved.** There are 2 battle axe lots proposed (56 & 57) as part of this development, with a maximum length of 50 metres from a public road to the effective area of the lots. To ensure that the battle-axe legs can achieve compliance with the requirements in Appendix B.3, Table 10, Column 5 (Appendix B) of the Guidelines, including a 6m horizontal clearance, a reciprocal right of access easement - private placed on the title of Lots 56 & 57 to allow reciprocal right of access. The access will be maintained compliant with the Guidelines under a Strata agreement between the landowners.

Bushfire Protection Criteria - Element 4 - Water

Outcomes: Ensure that sufficient water is available and accessible for emergency services, to enable people, property, and infrastructure to be defended from bushfire.

Acceptable Solution	Assessment Statements
A4.2 Water supply for subdivision applications *Where a reticulated water supply is existing or proposed, hydrant connection(s) should be provided in accordance with the specifications of the relevant water supply authority.* *Where these specifications cannot be met, then the following applies:* • *The provision of a water tank(s) in accordance with the requirements of* Appendix B.4, Table 11 - Water supply dedicated for bushfire fighting; and *Where the provision of a strategic water tank(s) is applicable then the following requirements apply:* • *Land to be ceded free of cost to the Crown for the placement of the tank(s);* • *The proposed reserve where the tank is to be located is identified on the plan of subdivision;* • *Tank capacity, construction, and fittings, provided in accordance with the requirements of Appendix B.4* (Appendix B); *and* • *A strategic water tank is to be located no more than a 10-minute drive from the furthest development Site (at legal road speeds).*	**Compliance with the Acceptable Solution is achieved.** Four strategic water tanks have been provided by the Developer in previous stages of the subdivision, which comply with the requirements of the *Planning for Bushfire Guidelines*, including a suitable coupling (as required by the Shire of Augusta Margaret River) and hardstand for a type 3.4 fire appliance, with all water tanks and infrastructure vested to the Local Government, free of charge. The four existing water tanks have a combined capacity of 449,842 L dedicated for firefighting. The previous Stages of the subdivision resulted in 87 lots, with this current stage proposing an additional 90 lots, totalling 177 lots. Therefore, the existing water tanks provide more than 50,000L per 25 lots, or part thereof. The location of the water tanks are provided in the Bushfire Management Strategies Map (Figure 8). This location ensures that all lots can be accessed from the water tank within 10 minutes.

4.2 Performance Based Solutions

The Site assessment was conducted in accordance with AS 3959-2018 Simplified Procedure (Method 1). The Proposal meets all the compliance requirements for the four Bushfire Protection Criteria Elements. There are no performance-based solutions proposed.

4.3 Summary of the Assessment Outcomes

This plan provides acceptable solutions and responses to the performance criteria outlined in the *Planning for Bushfire Guidelines* (WAPC, Sept 2024).

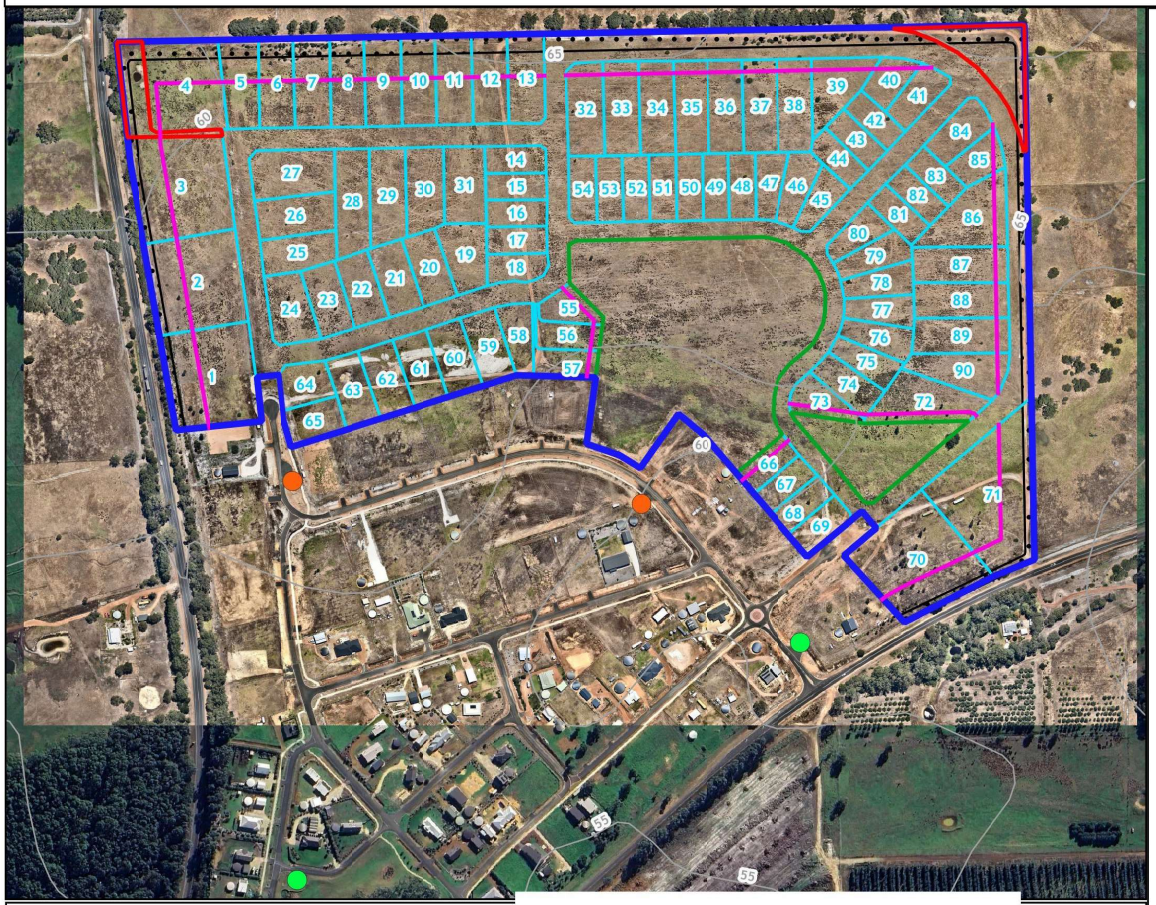
The layout and design of the development is such that no structure will be required to be exposed to a radiant heat flux in excess of 29kW/m^2 (BAL-29) provided the management as outlined in this Plan is adopted.

Any class 1, 2, 3 or associated 10a structure that are to be constructed, or additions planned to existing dwellings shall be designed and built to conform with Australian Standards AS 3959-2018:

- BAL-29: sections 3 & 7;
- BAL-19 sections 3 & 6; and
- BAL 12.5 sections 3 & 5.

A summary of the Bushfire Management Strategies to be implemented is provided in Figure 8. An individual BAL assessment may achieve a lower BAL rating, based on the exact location of a dwelling within a lot and classified vegetation.

Spatial representation of the proposed risk management measures



The Habitable Building Setback Line will ensure that any habitable building that eventuates within a proposed lot will achieve a BAL-29 or lower rating.

All proposed Lots will be established and maintained to APZ standards (excluding the Landscape Buffers) by the developer, including maintaining grasses under 10cm in height as per the Shire of Augusta Margaret River's Firebreak and Fuel Hazard Reduction Notice (which may be subject to review from time to time) until they are sold, when ongoing maintenance will become the responsibility of the individual landowners.

Establishment and management of the Public Open Space, Drainage Reserves and landscape buffers within Road reserves will occur in accordance with a Landscape Management Plan for a period of two years by the developer. After this period, the land will be ceded to the Crown and vested to the Shire of Augusta Margaret River, with ongoing management in perpetuity the responsibility of the Shire of Augusta Margaret River.

Establishment and management of the Landscape Buffers within the proposed Lots will occur in accordance with a Landscape Management Plan by the developer until lots are sold, where the responsibility becomes the individual landowners.

Public Roads will be constructed in accordance with the Guidelines.

A reciprocal right of access easement - private will be placed on the title of Lots 56 & 57.

Four Strategic Water Tanks and associated fittings, vested to the Shire of Augusta Margaret River, have be installed by the developer in previous stages of the development, with a total of 449,842 litres dedicated for fire fighting purposes. These strategic water tanks provide the adequate capacity of water for all existing and proposed lots.

Installation of the Public Roads, vegetation modification and revegetation of landscape buffers, maintenance of lots in accordance with APZ standards, establishment of the reciprocal right of access easement and compliance with an approved Landscape Management Plan is the responsibility of the developer.

Maintenance of the Lots to Asset Protection Zone Standards (excluding the Landscape Buffers) once the land is sold and construction of any dwelling to BAL Standards is the responsibility of the individual landowner.

Maintenance of the Public Open Space and Drainage Reserves will become the responsibility of the Shire of Augusta Margaret River.

Figure 8 Map of Bushfire Management Strategies

5 Responsibilities for Implementation and Management of the Required Bushfire Measures

The responsibilities for the Developer, Landowner/Occupier and Local Government are outlined in Table 3, Table 4, and Table 5, respectively.

Table 3 Developer Responsibilities

Number	Action	Due	Completed
1	Establish all lots to the dimensions, layout and standard as stated in this Bushfire Management Plan.	Post planning approval, prior to completion and prior to lot sale	☐
2	Construct public roads (A3.1) to the dimensions and standards stated in this Bushfire Management Plan.	Post planning approval, prior to completion and prior to lot sale	☐
3	Design all roads to the standards of Element 3 in accordance with the relevant class of road in the Local Government Guidelines for Subdivisional Development, Liveable Neighbourhoods, Austroad standards and/or any applicable standards for the local government area.	Post planning approval, prior to completion and prior to lot sale	☐
4	Establish and maintain the public open space, drainage reserves and landscape buffers outside of proposed lots, in accordance with a Landscape Management Plan, after a period of two years the land will be ceded to the Crown and vested to the Shire of Augusta Margaret River, with management responsibilities handed over to the Shire of Augusta Margaret River	Post Planning approval and prior to lot sale / until handover to the Shire of Augusta Margaret River	☐

Number	Action	Due	Completed
5	Maintain and maintain all lots (excluding the landscape buffers) in accordance with the Asset Protection Zone Standards, including with grass under 10 cm, year around until the lots are sold, where it becomes the responsibility of the landowners.	Post planning approval and prior to lot sale	☐
6	Establish the landscape buffers within proposed lots in accordance with the Landscape Management Plan until the lots are sold, where it becomes the responsibility of the landowners.	Post planning approval and prior to lot sale	☐
7	Establish a reciprocal right of access easement - private on the title of Lots 56 & 57.	Post planning approval and prior to lot sale	☐
8	Prepare a Local Development Plan with the appropriate Habitable Building Exclusion from the boundaries as detailed in Figure 7 - Bushfire Management Strategies, to ensure any dwelling constructed within the lot is BAL-29 or lower.	Post planning approval and prior to lot sale	☐
9	Provide a copy and obtain endorsement of this Bushfire Management Plan by those with responsibility under this plan including Builders, Landowners/Occupiers and Shire of Augusta Margaret River	Post planning approval and prior to lot sale	☐
10	Place a notice on the Certificate of Title, advising of the existence of this Bushfire Management Plan and associated maintenance obligations.	Creation of titles and deposited plan	☐

Table 4 Shire of Augusta Margaret River's Responsibilities

Number	Action	Due
1	Maintain areas of Public Open Space, Drainage and Landscape Buffers outside of the proposed lots in accordance with a Landscape Management Plan and this BMP in perpetuity.	Two years post planning approval - once responsibility is transferred from the developer.
2	Maintain water tanks vested to the Local Government in good working order.	Ongoing

Table 5 Landowner Responsibilities

Number	Action	Due
1	Maintain the lot to Asset Protection Zone standards (excluding the landscape buffer) according to the Guidelines or according to a detailed BAL Assessment.	Ongoing
2	Maintain any landscape buffer within the lot in accordance with an approved landscape management plan.	Ongoing

Appendix A Shire of Augusta Margaret River Firebreak Notice and Bushfire Information

Firebreak Notice Requirements and Bushfire Information

2024–25

amrshire.wa.gov.au

Firebreak Notice Requirements

Important Dates

Fire Control Officers

Permits to Burn

Firebreak Notice Requirements

This document contains the requirements from the Firebreak Notice (the Notice) along with other bushfire information for property owners and occupiers.

All land is to be maintained from **30 November 2024** up to and including **12 May 2025** as specified in the Notice**.**

APPOINTMENTS AND INSPECTIONS

Owners and occupiers who would like an early inspection by appointment, for reasons including biosecurity, locked gates, and dangerous animals, or for explanation on the requirements of the Notice, should contact Ranger Services on (08) 9780 5695 by **1 November 2024**. Where inspections by appointment are not requested, Rangers are appointed as Bush Fire Control Officers with the power to enter land under the *Bush Fires Act 1954* and will be inspecting properties for compliance without further notice from **1 December 2024**.

VARIATIONS

Where compliance with the Notice is not practical due to environmental considerations or site-specific constraints such as topography, water course or steep gradients, owners may apply to the Shire of Augusta Margaret River for a **Variation to the Notice**.

Variations must provide an alternative means of meeting the objectives of the Notice, including bushfire risk mitigation and property access, considering site-specific constraints and advantages and not all properties will be able to accommodate Variations.

Applications must be completed on the approved form, available upon request or downloaded via the Shire's website. Applications for a Variation must be submitted before **1 November 2024** or after **1 May 2025**.

COMPLIANCE

People who do not comply with the Notice or a Variation to the Notice may be issued with a modified penalty of $250 or prosecuted with a penalty up to $5,000. The Shire of Augusta Margaret River may carry out the required work on the land at cost to the owner/occupier.

Definitions

For the purpose of the Notice the following definitions apply:

Asset Protection Zone (APZ) means an area of land within 20 metres from the external walls of any habitable building**.** The fuel loading (flammable material) in the APZ is to be reduced and maintained to less than 2 tonnes per hectare. Trees must not be closer than 2 metres to a building, and trees must not overhang a building within 4 metres of the external roof. **APZ requirements apply to all properties (excluding vacant lots), regardless of size, and must be maintained all year round.**

Bushfire Management Plan (BMP) is a plan prepared specifically for a property in satisfaction of a development approval or subdivision condition. Properties subject to an approved BMP must comply with the requirements of their plan in addition to the requirements of the Notice.

Driveway/Access Way means the access route from a road reserve to a habitable building. This should be a minimum of 4 metres wide up to a maximum of 6 metres wide with a minimum 4 metre vertical clearance to allow emergency vehicles to access your property.

Firebreak means an area of land that has been cleared of all trees, bushes, grasses, and any other object or thing which may be flammable, leaving a bare surface to a width specified under the table on page 4, and with a 4 metre high vertical clearance.

Flammable Material means accumulated fuel such as dry grass, leaf litter, twigs, branches, trash, dead trees, firewood, stored fuels, that can be easily ignited or is likely to catch fire and burn. It includes any other thing deemed by an authorised officer to be likely to catch fire but excludes living trees, growing bushes, and plants in gardens and/or lawns under cultivation.

Habitable Building means any building people reside in and any other building within 6 metres of that building, but excludes a water tank.

Plantation means any area of planted pines, eucalypt, hardwood or softwood trees exceeding 3 hectares in area.

Trafficable means a firm, stable surface capable of allowing a 4WD fire appliance to enter, exit and turn any corner (10 metre radius) without reversing.

Summary of Firebreak Notice Requirements

All landowners/occupiers must carry out fire prevention work in accordance with the requirements of the Notice on or before **30 November 2024**. All land is to be maintained up to and including **12 May 2025**.

Please Note:

Asset Protection Zone (APZ) requirements apply to all properties (excluding vacant lots), regardless of size, and must be maintained all year round.

Clearing in excess of the requirements of the Notice or a BMP will be required to comply with the Local Planning Scheme and Clearing Regulations and may require a Permit.

Property Type	Firebreak Requirements	Asset Protection Zone (APZ)	Grass slashed/ mowed to less than 10cm	Driveway/ Access way (excludes vacant blocks)	Gutters and rooftops free of debris
All Lots 4000m² and under	• 2 metre wide firebreaks around all piles of garden refuse and/or wood stacks	✓	✓	✓	✓
Residential/ Rural Residential Lots 4001m² and over	• 3 metre wide trafficable firebreaks within 10 metres of all internal boundaries • 2 metre wide firebreaks around all piles of garden refuse/wood stacks, fuel and fodder	✓	Vacant/ cleared land that is not being actively grazed	✓	✓
Rural Lots (excluding plantations, vineyards, orchards and groves)	• 3 metre wide trafficable firebreak required within 100 metres of an internal boundary that abuts a road reserve • Where land is actively grazed or maintained to less than 10cm, a 2 metre firebreak is required • 2 metre wide firebreaks around all piles of garden refuse/wood stacks, fuel and fodder	✓	Vacant/ cleared land that is not being actively grazed	✓	✓
Plantations	• 10 metre wide internal firebreak around each cell or block - 3 metres must be trafficable • 2 metre wide firebreaks around all piles of garden refuse/wood stacks, fuel and fodder	✓	✓	✓	✓
Vineyards, Orchards and Groves	• 5 metre wide internal firebreak around each cell or block - 3 metres must be trafficable • 2 metre wide firebreaks around all piles of garden refuse/wood stacks, fuel and fodder	✓	✓	✓	✓

Can We Access Your Property?

DID YOU KNOW?

In order for fire appliances to access your property safely, internal firebreaks must be 3 metres wide and have at least 4 metres vertical clearance. Fire appliances must be able to fit through gates on your property. The average fire appliance is 9 metres in length.

DON'T FUEL FIRES

× Don't have thick vegetation near your home.

✓ Clear all flammable material from around all structures.

✓ Store firewood, timber, petrol, kerosene and all flammable liquids well away from the house.

✓ Clear all dead leaves out of gutters regularly.

✓ Remove dead trees and branches which, when burning, could drop on your roof.

✓ Rake up leaves, twigs and dead material regularly.

✓ Burn off dry grass and vegetation at the approved times and in the approved manner or consider using alternative methods to burning.

Residents can dispose of up to 2 cubic metres of uncontaminated green waste per visit at the Davis Road Recycling and Waste Management Facility.

For more info visit amrshire.wa.gov.au/greenwaste.

Important Dates

Firebreak Notice Requirements on Private Property to be completed

Firebreaks must be installed on or before 30 November 2024

Firebreaks must be maintained up to and including 12 May 2025

APZs must maintained all year round

RESTRICTED BURNING PERIOD - Spring/Summer

Permits Required

9 November 2024 to 22 December 2024

PROHIBITED BURNING PERIOD

Burning Prohibited

23 December 2024 to 14 March 2025

RESTRICTED BURNING PERIOD - Autumn

Permits Required

15 March 2025 to 12 May 2025

Please note, these dates can change at short notice due to variable weather conditions. Always call your area Fire Control Officer (FCO) or the Shire Rangers to check prior to lighting up.

Prohibited Burning

Burning is prohibited on days where the Fire Danger Rating (FDR) is **HIGH** or above. FDRs change daily and can be checked online at emergency.wa.gov.au or contact Shire Rangers on (08) 9780 5695.

Total Fire Ban (TFB)

A TFB may be declared by the DFES Commissioner at any time. If declared, you must not light any fire or undertake any activity that may cause a fire.

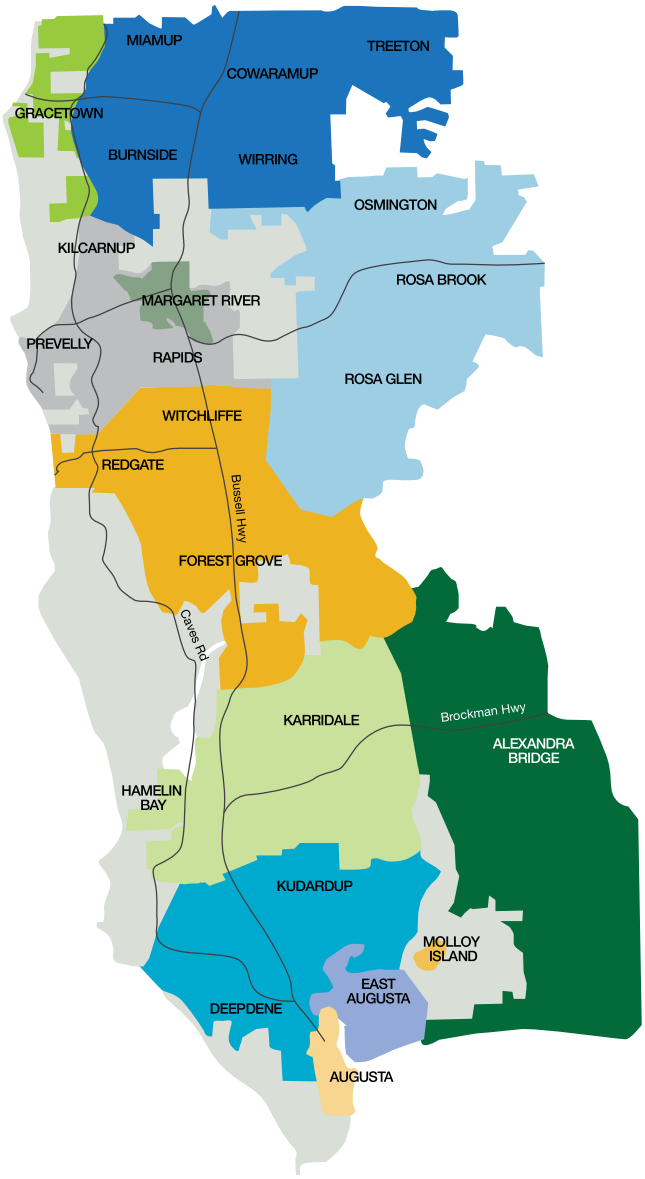
Harvest and Vehicle Movement Ban (HVMB)

A HVMB may be declared by the Shire separately, or in conjunction with a TFB, at any time. If declared, the use of engines, vehicles, plant or machinery are prohibited at particular times of the day.

Register for HVMB SMS Notifications

To register, please provide your first name, surname and mobile phone number via the form online at amrshire.wa.gov.au/fire-bans

Fire Control Officer Area Map



Fire Control Officer Contact Details

Brigade	Fire Control Officer(s)
Alexandra Bridge	**Alexandra Bridge** Tony Mostert: 0428 461 388
Augusta	**Augusta** Brendan Jordan: 0477 970 415
Cowaramup	**Burnside** Tim Garstone: 0428 555 292 **Cowaramup** Ian Earl: 0418 932 847 **Miamup** Billy Pascoe: 0405 965 447 **Treeton** Geoff Jenkins: 0407 776 920 **Wirring** Ryan Leenman: 0415 045 877
East Augusta	**East Augusta** Frank Bartoll: 0458 582 350
Gracetown	**Gracetown** Peter Delfs: 0427 555 491
Karridale	**Hamelin Bay** Simon Hanson: 0428 147 001 **Karridale** Paul Vanzetti: 0447 929 057
Kudardup	**Deepdene** Scott Hamilton: 0427 778 840 **Kudardup** Matthew Nield: 0427 772 719
Margaret River	**Margaret River** Garth Baxter: 0407 755 253
Molloy Island	**Molloy Island** Peter Nash: 0428 955 633
Rosa Brook	**Osmington** Shaun Palmer: 0448 979 041 **Rosa Brook** Mark Ridge: 0408 945 684 **Rosa Glen** Andrew Newnham: 0491 313 968
Wallcliffe	**Kilcarnup** Mark Boyd: 0418 810 327 **Prevelly** Jenny Colquhoun: 0458 231 272 **Rapids** David Kelly: 0428 387 286
Witchcliffe	**Forest Grove** Matt Holland: 0438 005 615 **Redgate** Richard Nash: 0419 951 511 **Witchcliffe** Diane Holland: 0427 930 735

Important Information on Lighting Fires

BURNING OF GARDEN REFUSE

During the **Spring/Summer Restricted Burning Period** (see page 7) you may burn one small pile up to 1 cubic metre of garden refuse without a Permit, however it can only be lit between **6pm and 11pm** and must be fully extinguished before midnight on the same day. A courtesy call to your area Fire Control Officer (FCO) is also recommended.

During the **Autumn Restricted Burning Period** (see page 7), a Permit is required to burn all garden refuse at all times.

Burning of garden refuse is NOT permitted:

- at any time during the PROHIBITED Burning Period,
- on days where the Fire Danger Rating is HIGH or above,
- during a Total Fire Ban (TFB).

The following precautions MUST be taken before burning garden refuse:

- there shall be no inflammable material within 5 metres of the fire,
- the fire must be attended at all times and fully extinguished before leaving it.

Failure to comply may result in a penalty up to $3,000.

CAMPFIRES, FIREPITS,WOOD/SOLID FUEL BBQs & PIZZA OVENS

Fires for the purposes of camping or cooking, such as campfires, firepits, wood/solid fuel BBQs and pizza ovens, are NOT permitted:

- at any time during the PROHIBITED Burning Period,
- on days where the Fire Danger Rating is HIGH or above,
- during a Total Fire Ban (TFB),
- on Shire reserves unless in a designated area.

The following precautions MUST be taken before lighting up:

- the fire shall not be lit within 3 metres of a log or stump,
- the fire must have a radius of at least 3 metres from its centre which is cleared of all bush and any other inflammable material,
- the fire must be attended at all times and fully extingished before leaving it.

Failure to comply may result in a penalty up to $3,000.

You MUST check the Burning Period dates and the Fire Danger Rating (FDR) before lighting up. The FDR changes regularly and the Important Dates listed on page 7 can also change. For the current Fire Danger Rating visit www.emergency.wa.gov.au

Permits to Burn

A Permit to Burn (Permit to Set Fire to the Bush) is required during the RESTRICTED Burning Periods.

To obtain a Permit, contact your area FCO by referring to the FCO map and list on pages 8 and 9 of this booklet. Where the FCO is unavailable the Chief Bush Fire Control Officer or the Shire Rangers can also issue Permits. **Please allow up to 72 hours for an FCO to attend your property to assess your Permit application.**

When contacting the FCO to request a Permit, please have the following information ready to provide;

- the size of your burn,
- what you are burning,
- the address of the burn,
- the name and contact number of the Permit holder.

You MUST notify your adjoining landowners of your intention to burn in accordance with Regulation 15B (3) on the back of your Permit.

Prior to burning, you MUST register your Permit with the Shire, DFES and DBCA. To do this call the numbers on the Permit and have your Permit handy as the operator will need the Permit details. If you leave a message, please state the **Permit number, property details, Permit holders name, phone number** and **time/date** of intention to burn.

Failure to;

- obtain a Permit,
- comply with all Permit conditions, or
- burn in contravention to any information provided in the *Bush Fires Act 1954*,

may result in a penalty up to $10,000.

BE PREPARED!

The preparedness of your property may make all the difference between minor damage and devastation.

For advice on preparing your property for the fire season, please call your local Bushfire Ready Facilitator Gordon Temby (North) on 0419 954 658 or Shire Rangers on (08) 9780 5695.

Key Contacts

FIREBREAKS, INSPECTIONS AND VARIATIONS

Shire Rangers
(08) 9780 5695

BURNING AND PERMITS

Fire Control Officers
See page 9 for contact details

OTHER CONTACTS

Chief Bush Fire Control Officer
0419 525 843

Deputy Chief Bush Fire Control Officer
0419 628 465

DFES Emergency Info Line
13 DFES (133 337)
Follow DFES on Twitter and Facebook
or listen to ABC Radio South West WA

DIAL 000

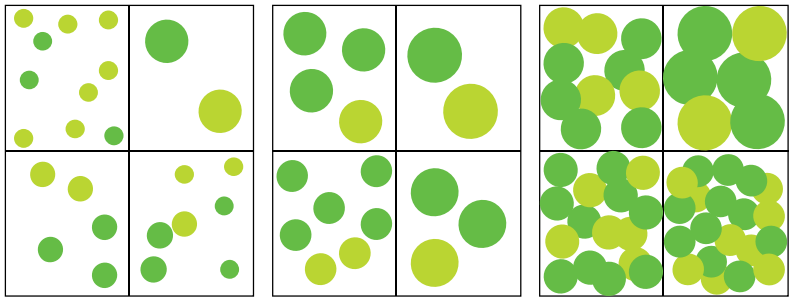
TO REPORT ALL FIRES OR LIFE THREATENING EMERGENCIES

PO Box 61, Margaret River, Western Australia 6285
T (08) 9780 5695 | F (08) 9757 2512
amrshire@amrshire.wa.gov.au | **amrshire.wa.gov.au**

MIX
Paper from responsible sources
FSC® C111891

Appendix B Technical Guidelines from the Planning for Bushfire Guidelines

Table 9: Asset Protection Zone (APZ) technical requirements

OBJECT	REQUIREMENT
Fences within the APZ	Should be constructed from non-combustible materials (for example, iron, brick, limestone, metal post and wire, or bushfire-resisting timber referenced in Appendix F of AS 3959).
Fine fuel load (combustible, dead vegetation matter less than 6 mm in thickness)	• Should be managed and removed on a regular basis to be maintained as low threat vegetation • Should be maintained at less than two tonnes per hectare (on average) • Mulches should be non-combustible such as stone, gravel, shells, rock or crushed mineral earth or wood mulch more than five millimetres in thickness.
Trees* (more than 6 m in height)	• Trunks at maturity should be a minimum distance of six metres from all elevations of the building • Branches at maturity should not touch or overhang a building or powerline • Lower branches and loose bark should be removed to a height of two metres above the ground and/or surface vegetation. • Canopy cover within the APZ should be less than 15 per cent of the total APZ area • Tree canopies at maturity should be at least 5 m apart to avoid forming a continuous canopy. Stands of existing mature trees with interlocking canopies may be treated as an individual canopy provided the total canopy cover within the APZ does not exceed 15 per cent and is not connected to the tree canopy outside the APZ. Tree canopy cover – ranging from 15 to 70 per cent at maturity  15% 30% 70%

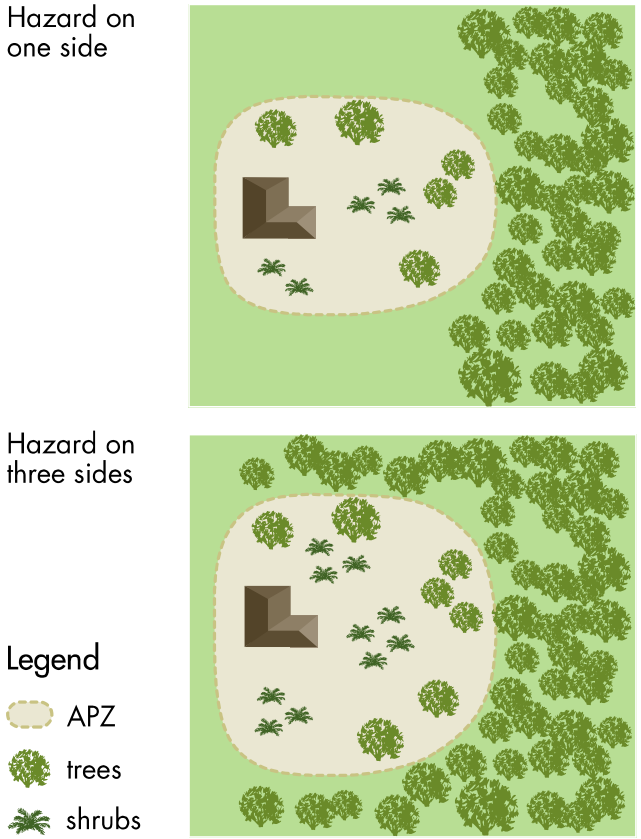
OBJECT	REQUIREMENT
Shrub* and scrub* (0.5 m to 6 m in height). Shrub and scrub more than 6 m in height are to be treated as trees.	• Should not be located under trees or within three metres of buildings • Should not be planted in clumps more than five square metres in area • Clumps should be separated from each other and any exposed window or door by at least 10 metres.
Ground cover*(less than 0.5 m in height. Ground cover more than 0.5 m in height is to be treated as shrub)	• Can be planted under trees but must be maintained to remove dead plant material, as prescribed in 'Fine fuel load' above • Can be located within two metres of a structure but three metres from windows or doors if more than 100 mm in height.
Grass	• Grass should be maintained at a height of 100 mm or less, at all times • Wherever possible, perennial grasses should be used and well-hydrated with regular application of wetting agents and efficient irrigation.
Defendable space	Within three metres of each wall or supporting post of a habitable building; the area is kept free from vegetation but can include ground cover, grass and non- combustible mulches as prescribed above.
Liquid petroleum gas cylinders	• Should be located on the side of a building farthest from the likely direction of a bushfire or on the side of a building where surrounding classified vegetation is upslope, at least one metre from vulnerable parts of a building • The pressure relief valve should point away from the house • No flammable material within six metres from the front of the valve • Must sit on a firm, level and non-combustible base and be secured to a solid structure.

Notes:
** Plant flammability, landscaping design and maintenance should be considered – refer to following explanatory notes*

Fine fuel load is the combustible, dead or dry vegetation matter on the ground, near ground, or elevated. Fine fuel includes grass, leaves, bark and twigs less than six millimetres in diameter that ignite readily and are burnt rapidly when dry.

Fine fuel should be maintained at less than 2t/ha. 100gm/m² equates to 1t/ha. To estimate a fuel load (in t/ha), collect the dry fine fuel from a representative one square meter and weigh (in grams using kitchen scales) and multiply the weight by 0.01.

Figure 25: Design of an Asset Protection Zone



Regardless of whether an Asset Protection Zone exists in accordance with the acceptable solutions and is appropriately maintained, it should be noted that fire fighters are not obliged to protect an asset if they think the separation distance between the dwelling and vegetation is unsafe.

B.2.4 PLANT FLAMMABILITY

There are certain plant characteristics that are known to influence flammability, such as moisture or oil content and the presence and type of bark. Plants with lower flammability properties may still burn during a bushfire event but may be more resistant to burning and some may regenerate faster post-bushfire.

There are many terms for plant flammability, which should not be confused, including:

- **Fire resistant** – plant species that survive being burnt and will regrow after a bushfire and, therefore, may be highly flammable and inappropriate for a garden in areas of high bushfire risk.
- **Fire retardant** – plants that can absorb more of the heat of the approaching bushfire without burning, compared to more flammable plants.
- **Fire wise –** plants that have been identified and selected based on their low flammability properties and linked to maintenance advice and planting location within a garden.

Although not a requirement of the Guidelines, local governments may develop their own list of fire wise or fire-retardant plant species that suit the environmental characteristics of an area. When developing a recommended plant species list, local governments should consult with ecologists, land care officers or environmental authorities to ensure the plants do not present a risk to threatened ecological communities, threatened or endangered species or their habitat.

When selecting plants, private landholders and developers should aim for plants within the APZ that have the following characteristics:

- grow in a predicted structure, shape and height
- are open and loose branching with leaves that are thinly spread
- have a coarse texture and low surface-area-to-volume ratio
- will not drop large amounts of leaves or limbs that require regular maintenance
- have wide, flat and thick or succulent leaves
- trees that have bark attached tightly to their trunk or have smooth bark
- have low amounts of oils, waxes and resins (which will often have a strong scent when crushed)
- do not produce or hold large amounts of fine dead material in their crowns
- will not become a weed in the area.

B.3: VEHICULAR ACCESS

State Planning Policy outcome for Element 3: Vehicular access

Ensure the design and capacity of vehicular access and egress provide:

- **for efficient and effective evacuation to a suitable destination(s) and/or**
- **as a contingency measure for vulnerable tourism land uses, an on-site shelter, where demonstrated appropriate, as a last resort option.**

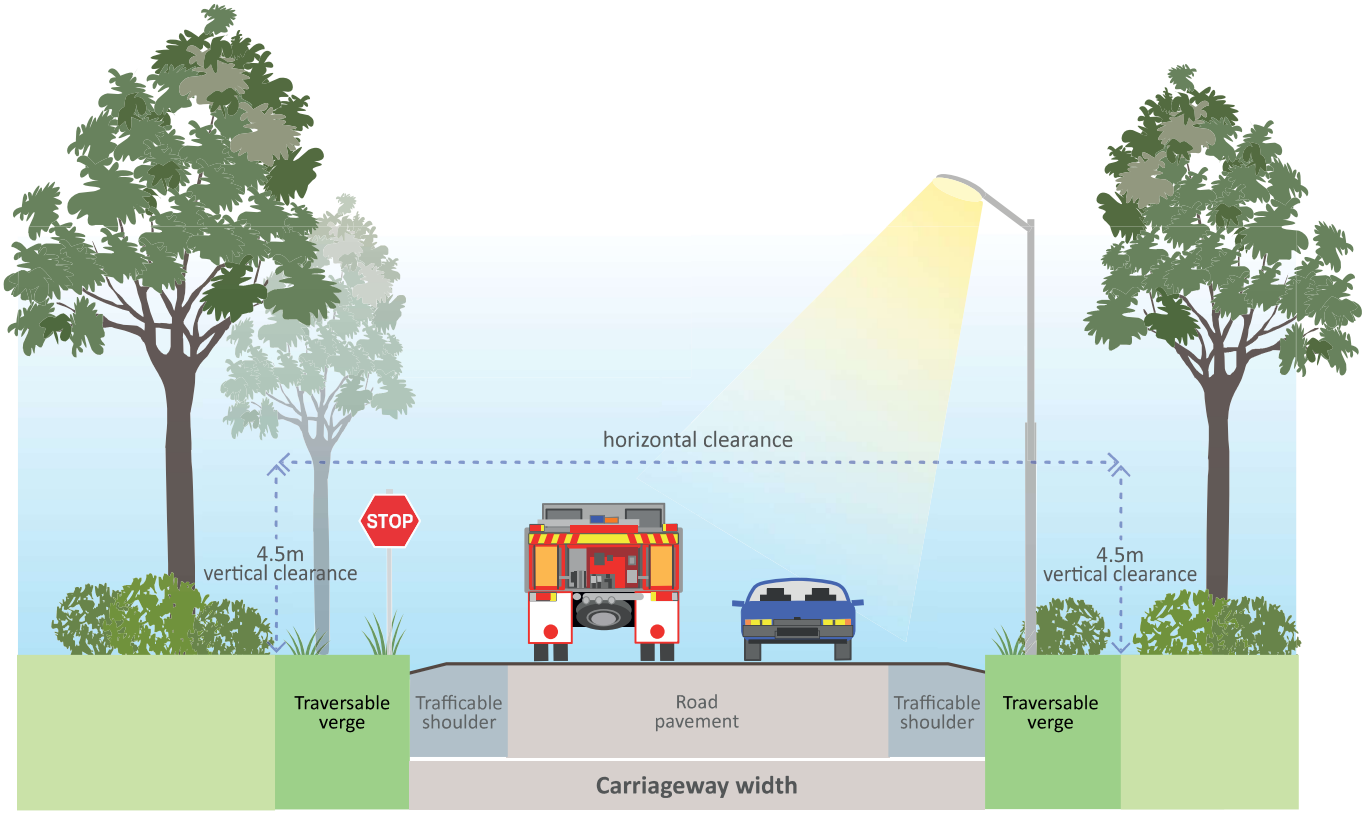
B.3.1 PUBLIC ROADS

The Guidelines do not prescribe values for the carriageway width or the horizontal clearance for public roads (except for perimeter roads). Public roads should be in accordance with the class of road as specified in the Public Works Engineering Australasia (IPWEA) subdivision guidelines, Liveable Neighbourhoods, Austroads Standards, any applicable or relevant Main Roads standards, supplements, policies and any applicable or relevant local government standards or policies.

However, it is important that public roads (and other forms of access) in bushfire prone areas, allow for emergency services vehicles to stop and operate on the side of the public road, specifically where the public road traverses large areas of classified vegetation.

It is, therefore, recommended that public roads achieve a minimum six metres horizontal clearance. Perimeter roads require additional width.

Figure 26: Area encompassing horizontal clearance and vertical clearance



Horizontal clearance: **The carriageway width (including the road pavement and trafficable shoulder) and traversable verge that provides for the movement and parking of vehicles and area required by emergency services to operate. Infrastructure and vegetation within the traversable verge should be frangible, however, non-frangible items can occur providing they do not restrict vehicular movement in the event of an emergency.**

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.

Where local or state government roads are proposed to be widened or modified by the proponent, as part of the structure planning process or at the subdivision stage, approval is required from the relevant government authority.

B.3.2 ACCESS TO A SUITABLE DESTINATION(S)

Public vehicular access in at least two different directions to at least two different suitable destinations should always be the goal within bushfire prone areas. The more options available for evacuation and for emergency services to respond to the bushfire, the better the bushfire resilience of a development and/or a community.

A suitable destination is likely to be an urban area, townsite or similar. This also includes any evacuation centre, dedicated by the local government, for use during a bushfire event.

Where a planning proposal, such as a structure plan or subdivision, proposes a large number of lots, or where the structure plan or subdivision adjoins an urban area or townsite, this could potentially result in land that is more than 100 metres from classified vegetation (BAL-LOW). In this instance, an argument could be made that the suitable destination is within the subject site or within the adjoining urban area or townsite. For example, where coastal communities are limited to one public road servicing the community, there may be an existing managed area large enough to provide an area suitable for people to locate to before, during and after a bushfire event.

There is no prescribed distance to a suitable destination as it is assumed that in the event of a bushfire, a person would travel any necessary distance to evacuate.

A suitable destination should not be confused with an on-site shelter provided for tourism land uses. On-site shelters are a last resort option, purpose built and designed, and are supported in limited circumstances to facilitate tourism within remote and/or heavily vegetated areas.

On-site shelters are not supported for residential land-uses.

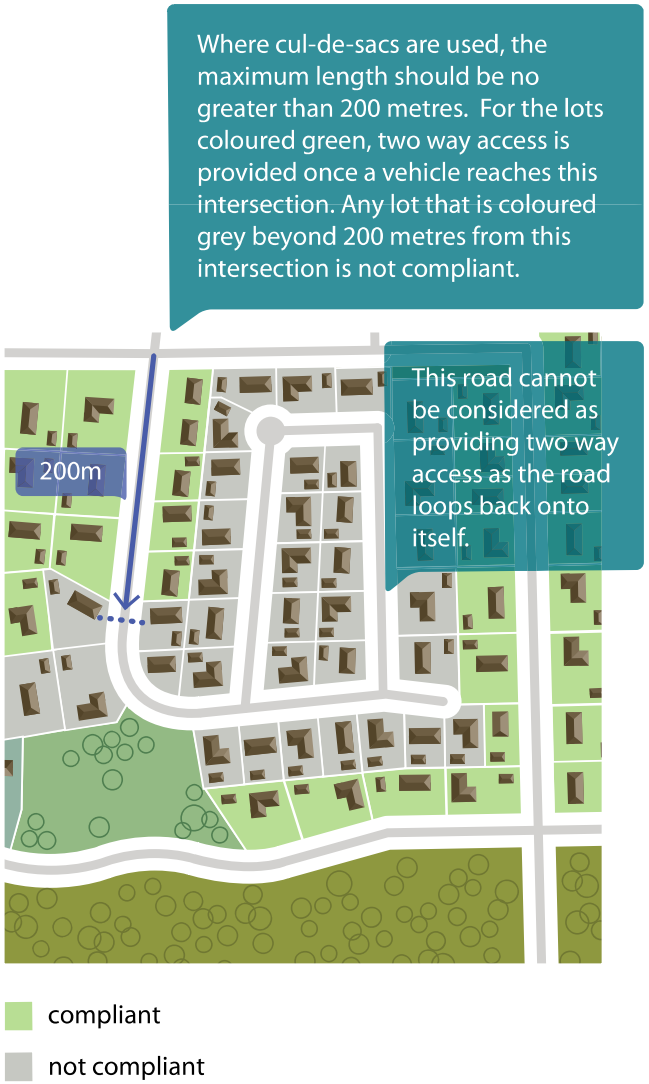
Suitable destination: An area that is not designated as bushfire prone on the *Map of Bush Fire Prone Areas* or is greater than 100 metres from classified vegetation or 50 metres from Class G Grassland, as per AS 3959, and can provide protection during and after a bushfire event.

A suitable destination is located within an urban area, townsite or similar. This also includes any evacuation centre, dedicated by the local government, for use during a bushfire event.

B.3.3 NO-THROUGH ROADS

No-through roads reduce the legibility of a road network and options available for access and egress in the event of a bushfire emergency. The inclusion of new no-through roads within subdivision or structure plan designs, in the first instance, should be avoided in bushfire prone areas.

Figure 27: Example of compliant and non-compliant two-way access



However, where it is demonstrated, to the satisfaction of the decision-maker that a no-through road cannot be avoided due to site or design characteristics, the inclusion of a new no-through road is to be treated as an acceptable solution, if it satisfies the prescribed maximum road length. Where this is not demonstrated, a decision-maker is able to request a redesign to remove the no-through road.

The acceptable solution for no-through roads in areas shown as Area 2 on the *Map of Bush Fire Prone Areas* includes a maximum of 200 metres from the lot(s) boundary to an intersection where two-way access is provided (**Figure 28**). There is no prescribed maximum length for no-through roads in areas shown as Area 1 (Urban) on the *Map of Bush Fire Prone Areas*.

B3.3.1 Outcomes-based approach – no-through roads

It becomes more challenging to comply with the acceptable solutions where the proposal includes existing no-through roads that exceed 200 metres. The 200 metres is a nationally accepted standard and support for development on existing no-through roads longer than the prescribed 200 metres, particularly within vegetation classified as Forest, should be considered carefully. They should be the exception to the rule where it is demonstrated through an outcomes-based approach that the hazards and the road network within the broader landscape are such that, in the event of a bushfire, evacuation to a suitable destination is possible.

An outcomes-based approach should demonstrate the increase in length, and/or the proposed additional lots, on an existing non-compliant no-through road and should consider:

- the broader landscape
- size and scale of the development
- whether the no-through road travels away from the source of the bushfire hazard
- evacuation in the event of a bushfire scenario
- the vegetation within and adjoining the road reserve
- legibility of the broader road network
- whether the no-through road is straight and provides a line of sight
- any improvements to the bushfire resilience of the area, including improvements to the existing road network
- the precedent within the broader area that would be set by supporting development on a non-compliant no-through road.

Figure 28: Demonstration of a lot achieving two-way access within 200 metres

B.3.4 EMERGENCY ACCESS WAY

An emergency access way is not a preferred alternative to public road access. It should be considered acceptable only where it has been demonstrated that public road access cannot be achieved due to site characteristics or environmental values; and that it will provide for the safety and performance needs of emergency services and the community.

The principal function of the emergency access way is to provide a contingency (second) public evacuation route and simultaneously provide access for emergency services in the event of a bushfire. Where an emergency access way traverses classified vegetation, it performs the secondary function of providing access for emergency services to the hazard (vegetation).

Figure 29: Example of a site on a no-through road greater than 200 metres but within 200 metres of BAL-LOW

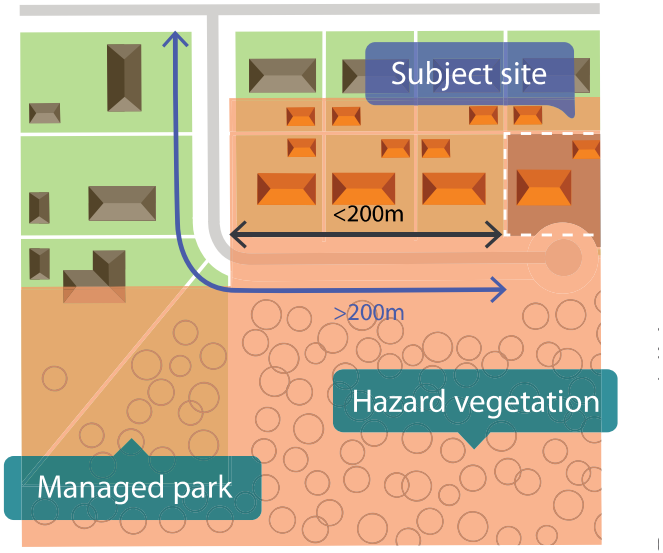
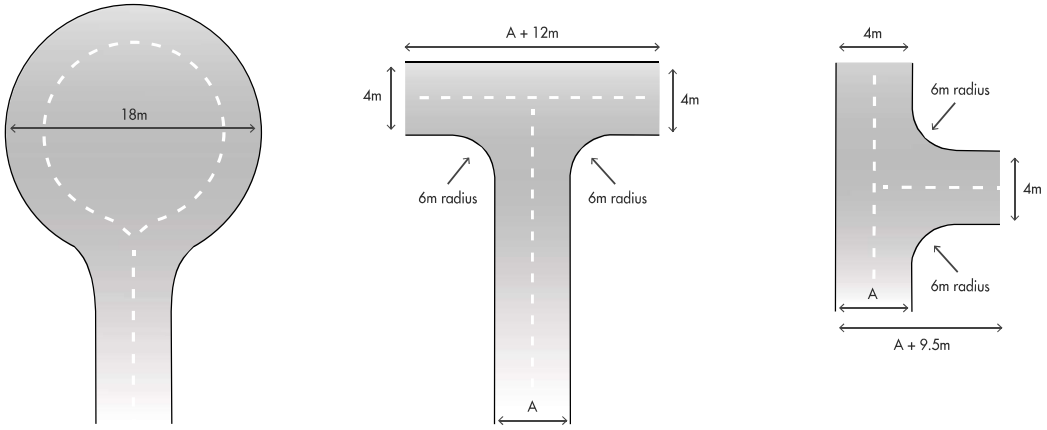


Figure 30: Design requirements for a turn-around area



Where the emergency access way is located within an area shown as Area 2 on the *Map of Bush Fire Prone Areas*, a horizontal clearance of 10 metres should be provided. The 10 metres is to provide access for emergency services to any classified vegetation, including grassland, adjoining the easement (**Figure 31**).

A six metre horizontal clearance should be provided within an area shown as Area 1 (Urban) on the *Map of Bush Fire Prone Areas*.

Emergency access ways should connect to a public road. An emergency access way should not exceed 500 metres in length as there are often issues of legibility and safety. Emergency access ways are generally not part of the formal road network and many are not identified on various online or other mapping platforms, which may limit emergency services and/or the community finding their way through the network in an emergency.

B.3.4.1 Outcomes-based approach emergency access way (width and/or length)

An outcomes-based approach may be used to demonstrate to the satisfaction of the decision-maker that a reduction in the width and/or an extension of the length of the emergency access way provides for the efficient and effective evacuation to a suitable destination(s).

Figure 32 and **Figure 33** are examples where the width of an emergency access way could potentially be reduced. **Figure 32** depicts classified vegetation on one side of the easement and **Figure 33** depicts an easement with lots on either side. An outcomes-based approach could be used to demonstrate that the reduced width satisfies the policy outcome and policy measure 7.5 of SPP 3.7.

Figure 31: Example of a 10 metre wide emergency access way

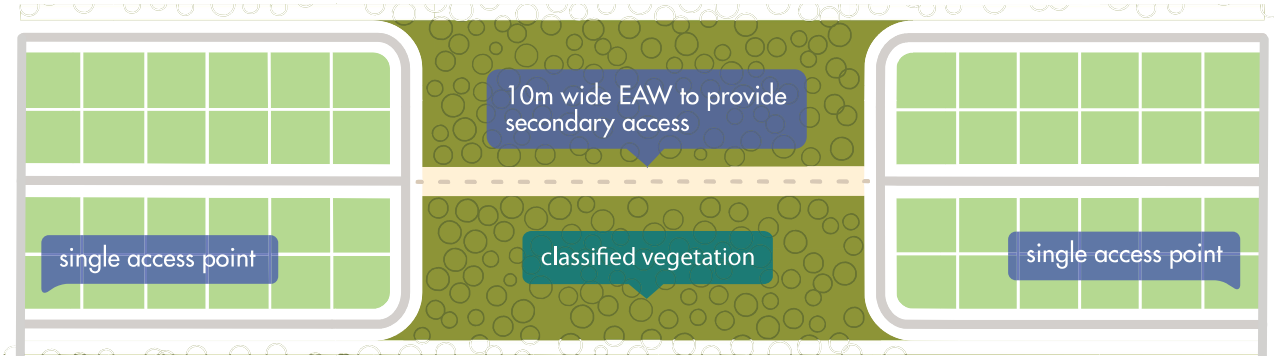
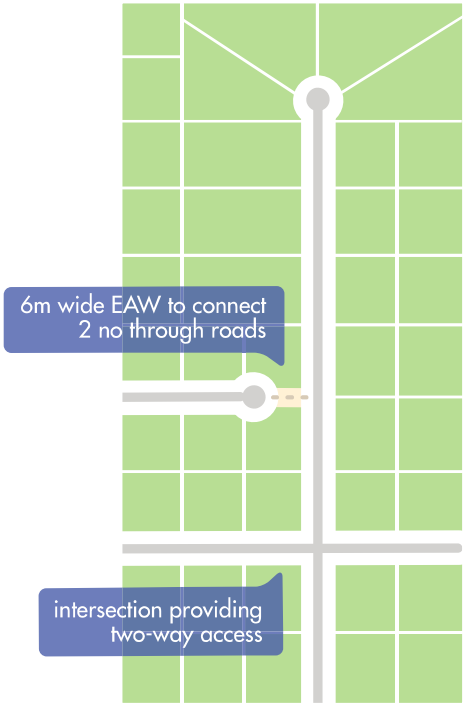


Figure 32: Example of a reduced emergency access way

Figure 33: Example of a 6 metre wide emergency access way



B.3.4.2 Permanent public emergency access way

A public emergency access way can be provided as either a public easement in gross or a right-of-way.

In both approaches, the care, control and management of the emergency access way should be the responsibility of the local government as the grantee of the easement or management body of the right-of-way (ceded to the Crown).

If the emergency access way is provided as an easement, it should be provided as a public easement in gross under sections 195 and 196 of the *Land Administration Act 1997* in favour of the local government and/or public authority, to ensure accessibility by fire emergency services and the public at all times. If the emergency access way traverses an adjoining private lot(s), support will be necessary from the adjoining lot owner(s).

To be provided as a right-of-way, the emergency access way should be vested as such in the Crown under section 152 of the *Planning and Development Act 2005*. Such land should be ceded free of cost and without any payment or compensation by the Crown.

The proponent should obtain written consent from the local government that it will accept care, control and management of the easement or right-of-way.

This should be provided to the decision-maker prior to granting planning approval. Consultation with the Department of Planning, Lands and Heritage (Land Use Management division) should also be undertaken if the land is to be ceded to the Crown.

If gates are used to control traffic flow during non-emergency periods, these will be managed by the local government and should not be locked. They should be double gates wide enough to access the whole carriageway width and accommodate type 3.4 fire appliances with the design and construction to be approved by the relevant local government.

B.3.4.3 Right-of-carriageway emergency access way

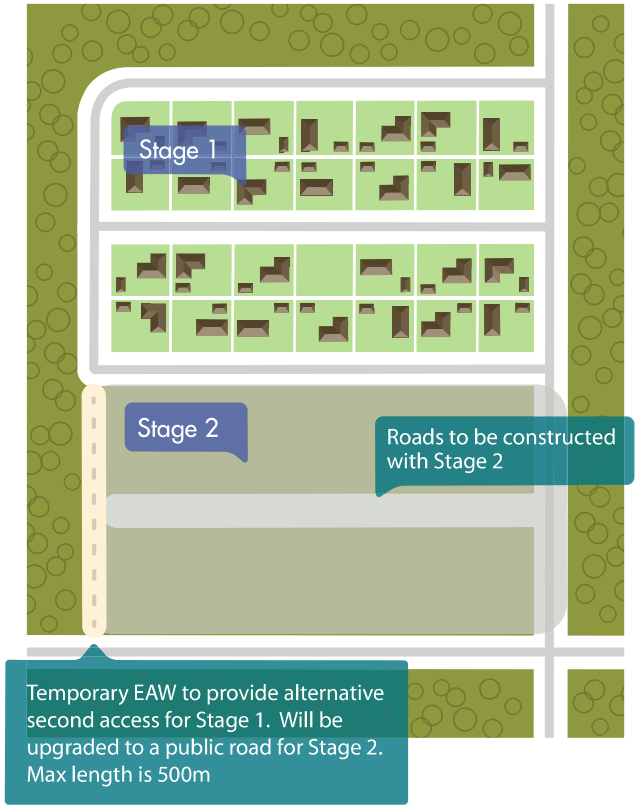
There may be instances where a proposed development is limited to secondary access through the adjoining lot(s). A right-of-carriageway easement can be provided under section 195 of the *Land Administration Act 1997*, which restricts the use of the emergency access way to the lot owner(s) and emergency services and is not available to the public.

Written support is required from the adjoining lot owner(s). Approval for the use of these types of right-of-carriageway is on a case-by-case basis and at the discretion of the decision-maker. The easement is to be granted to the local government and its management should be agreed to by all parties and included within the deed. If gated, the easement area can be locked to restrict day-to-day vehicular access.

B.3.4.4 Temporary emergency access way

A temporary emergency access way may be proposed to facilitate the staging arrangements of a subdivision. The provision of two public roads may not be possible or feasible in the first stage of the subdivision and an emergency access way can be provided as an interim access route, until the second public road is constructed in the subsequent stage of the subdivision (**Figure 34**).

Figure 34: Example of where an emergency access way may be provided



B.3.4.5 Restricted public emergency access way

Emergency access ways should not be gated, or where they are gated should not be locked. However, there may be instances where the local government or Main Roads Western Australia will request that the gate be locked and public vehicular access restricted, except during an emergency. This is usually due to concern regarding the additional vehicular movements onto an existing local or state road. If the emergency access way is locked to restrict access, a common key system should be used. Keys should be available to emergency services and designated fire officers within the local government area and/or surrounding district.

In this scenario, the emergency access way can be provided as an easement under section 195 of the *Land Administration Act 1997*, as public access in the event of a bushfire emergency, or vested in the Crown as a reserve under section 152 of the *Planning and Development Act 2005*. Where vested, such land is to be ceded free of cost without any payment or compensation by the Crown.

The proponent should obtain written consent from the local government accepting care, control and management of the proposed easement or reserve and agree to the terms of the Management Order Conditions (if applicable); this should be provided to the decision-maker prior to granting development approval.

The reserve should be for a public purpose specified in the condition related to the subdivision, for example, for emergency access only or for emergency access and recreation. A reserve for emergency access and recreation optimises the land-use by providing vehicular access in the event of a bushfire emergency and daily access by the public (on foot) as a recreation link. Appropriate signage can ensure the public is aware of the purpose of the reserve.

B.3.5 PERIMETER ROADS

Hazard separation should be provided in the form of a perimeter road where a strategic planning proposal or subdivision application includes the creation of 10 or more lots adjacent to each other, which adjoin classified vegetation under AS 3959 with the exception of Class G Grassland, as part of a greenfield development or large urban infill site.

The creation of 10 or more lots includes cumulative subdivision applications where the subdivision application may be part of a staged subdivision.

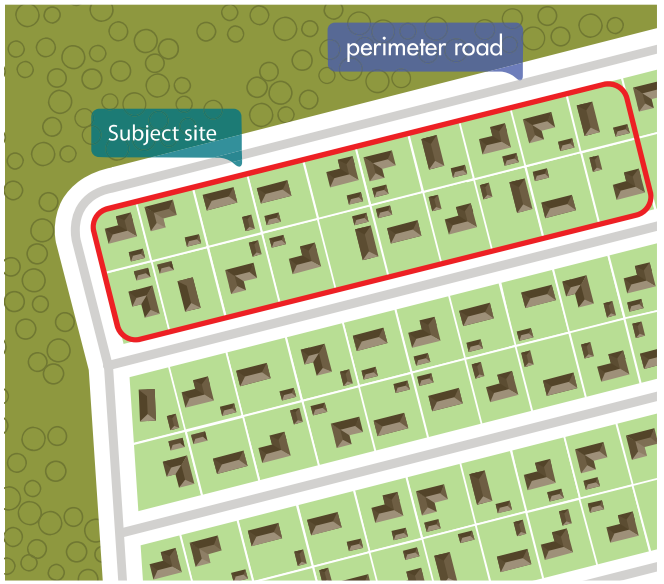
As the road is likely to function as a key neighbourhood distributor or similar, it is important to provide additional width to allow emergency services vehicles to stop and operate on the side of the perimeter road, whilst simultaneously providing for community evacuation. This is reflected in **Table 10**, Column 1 requirements.

When designing a strategic planning proposal and/or subdivision, there are many benefits in creating a large setback between classified vegetation and proposed lots with a perimeter road and orientating habitable buildings to front rather than back onto areas of vegetation.

They include:

- passive surveillance
- defendable space for firefighting and emergency management purposes
- reducing the radiant heat that may impact a habitable building in a bushfire event
- reducing the need for battle-axe lots
- unconstrained public access/egress for the community in the event of a bushfire.

Figure 35: Example of a perimeter road



In developments where no perimeter road exists, property defence in a bushfire event is difficult and can be impossible. Where proposed lots have frontage to an existing public road and abut the hazard at the rear or side, it may be an undesirable planning outcome to create lots that front the existing public road and back onto a perimeter road. In this instance, consideration should be given to a fire service access route.

B.3.6 FIRE SERVICE ACCESS ROUTE

Where a planning proposal adjoins classified vegetation (excluding Class G Grassland) and where a perimeter road is not appropriate and/or not required, there may be a need to provide access for emergency services vehicles to classified vegetation for firefighting and fire management purposes.

This route is not intended to provide residents and the public with emergency egress and, therefore, is not a suitable second access or substitute for a public road.

Where the fire service access route is within an area shown as Area 2 on the *Map of Bush Fire Prone Areas*, a minimum horizontal clearance of 10 metres should be provided to allow access for emergency services to any classified vegetation adjoining the fire service access route. A minimum six metres horizontal clearance should be provided where the area is shown as Area 1 on the *Map of Bush Fire Prone Areas*.

A fire service access route can be provided as either an easement in gross over private or Crown land or ceded to the Crown as a reserve. In both approaches, the management of the fire service access route is by the local government as the grantee of the easement or management body of the reserve. Determining which approach to take depends on the intended tenure of the fire service access route, which is explained below. The proponent should obtain written consent from the local government that it will accept care, control and management of the easement or reserve and agree to the terms of the Management Order Conditions (if applicable). This should be provided to the decision-maker prior to granting approval. The approach taken is at the discretion of the decision-maker and/or the local government. Consultation with Land Use Management Division of the Department of Planning, Lands and Heritage should also be considered if the land is to be ceded to the Crown or if the local government is uncertain of which approach to take.

Where gates are used, they should be double gates wide enough when open to allow vehicles to access the whole carriageway width and accommodate type 3.4 fire appliances. The design and construction are to be approved by the relevant local government.

Gates on fire service access routes may be locked to restrict access provided a common key system is used. Keys are to be available to emergency services and designated fire officers within the local government area and/or surrounding district. Gates should be installed where fences intersect or cross over with fire service access routes. If an easement in gross is proposed, such arrangements for gates should be included in the deed of easement and be agreed to by the local government.

B.3.6.1 Fire service access route to remain in private ownership of multiple landowners

Where a fire service access route will traverse multiple private lots intended to remain in multiple private ownership, it should be provided as an easement in gross under section 195 of the *Land Administration Act 1997*, to ensure accessibility for fire emergency services and not for use by the public. The easement is to be granted to the local government and/or public authority for firefighting and emergency management purposes.

B.3.6.2 Fire service access route to be created under State ownership

Where a fire service access route is proposed to traverse multiple private lots but the decision-maker and/or local government prefer for it in a single parcel for management purposes, the route can be vested in the Crown under section 152 of the *Planning and Development Act 2005* as a reserve. Such land is to be ceded free of cost without any payment or compensation by the Crown. The reserve should be for a public purpose specified in the condition related to the subdivision, for example, for vehicular access for emergency services and the local government only, or for vehicular access for emergency services and the local government and recreation. A reserve for emergency services access and recreation optimises the land-use by providing vehicular access for emergency services and daily access by the public (on foot) as a recreation link.

Appropriate signage will ensure the public is aware of the purpose of the reserve. The approach taken is at the discretion of the decision-maker and/or local government.

Figure 36: Example of a fire service access route (FSAR)

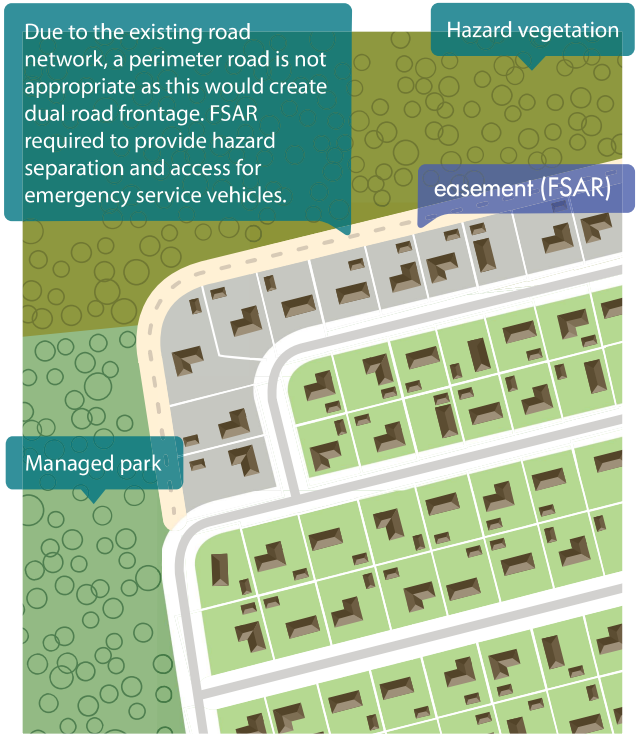
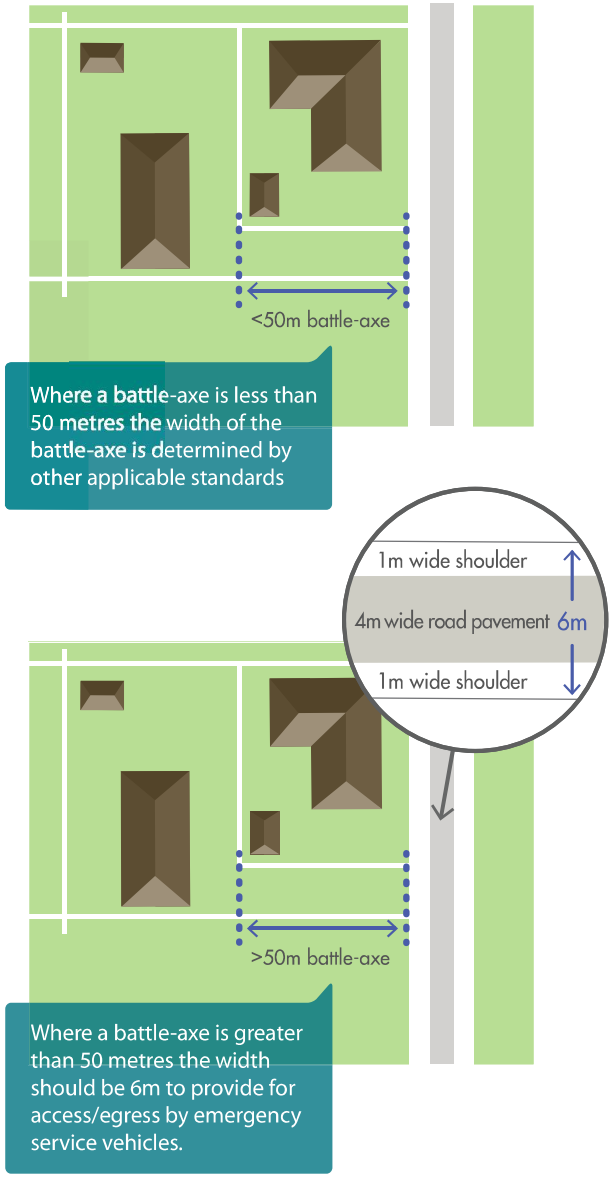


Figure 37: Battle-axe design requirements



3.7 BATTLE-AXE ACCESS LEG

In bushfire prone areas, lots with battle-axe access legs should be avoided because they:

- do not enable the habitable building to be located close to a public road where it is visible to emergency services
- result in longer than necessary access routes for evacuation and the response by emergency services
- may be blocked by falling trees or debris
- may not provide certainty for emergency services regarding the width, length and ability to turn around emergency services vehicles
- In some instances, battle-axe access legs may be appropriate to overcome specific site or design constraints created by the existing road network or lot layout
- The BMP should provide justification for proposed battle- axe access leg(s) and the decision-maker should determine whether the justification is valid
- Where the use of battle-axe access legs is considered appropriate, the measurement should be from the edge of the public road to where the access leg joins the effective area of the battle-axe lot. Effective lot area means that part of the battle-axe lot that is capable of development and excludes the access leg and associated truncations for vehicle maneuverability
- The battle-axe lot should allow safe access and egress for type 3.4 fire appliances to attend the future development site.

B.3.8 PRIVATE DRIVEWAYS

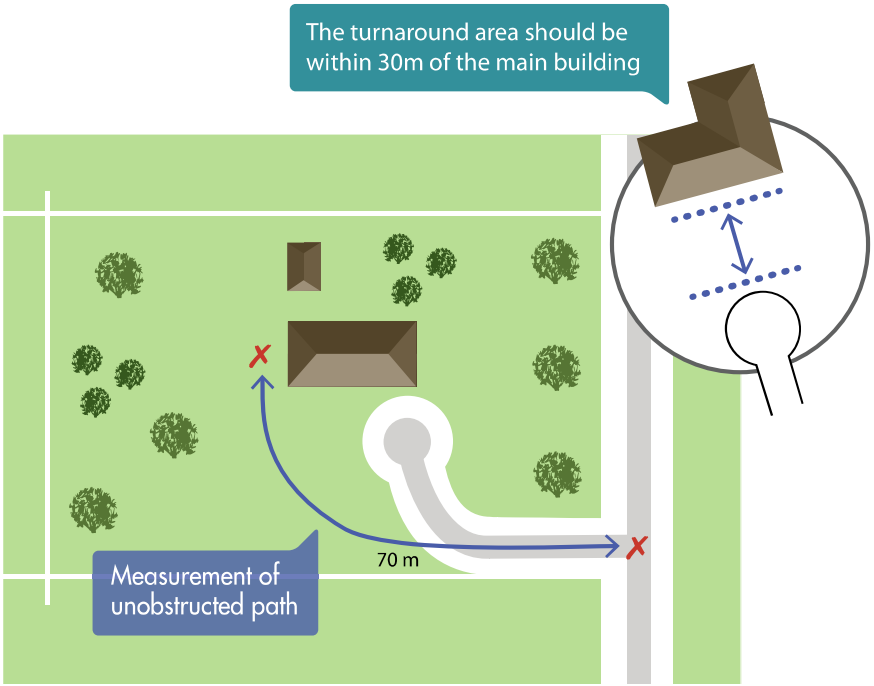
Emergency services vehicles typically operate from the street frontage in areas serviced by reticulated water and where the distance from the public road to the farthest part of the habitable building is no greater than 70 metres.

In the event the habitable building cannot be reached by hose reel from the public road, emergency services vehicles will need to gain access via the driveway to the property. Emergency services vehicles will also need to gain access to the property where access to water is provided by onsite water tanks. In these situations, the driveway and battle-axe access leg (if applicable) will need to be wide enough for access by an emergency services vehicle and a vehicle to evacuate.

It is acceptable for a private driveway to have a carriageway width of four metres with a traversable verge of one metre on either side of the carriageway.

Turn-around areas (**Figure 38**) should be available for conventional two-wheel drive vehicles and type 3.4 fire appliances and should be located within 30 metres of habitable buildings. Circular and loop driveway design may also be considered.

Figure 38: Design requirements for a private driveway where required



B.4: WATER SUPPLY

State Planning Policy outcome for Element 4: Water Supply

Ensure that sufficient water is available and accessible for emergency services use, to enable people, property and infrastructure to be defended from bushfire.

B.4.1 CONSTRUCTION AND DESIGN

An above-ground tank and associated stand should be constructed of non-combustible material.

Below-ground tanks should have a 200 millimetres diameter access hole to allow tankers or emergency services vehicles to refill direct from the tank, with the outlet location clearly marked on the surface.

Above and below ground tanks may need to comply with AS/NZS 3500.1:2018.

An inspection opening may double as the access hole provided that the inspection opening meets the requirements of AS/NZS 3500.1:2018.

Where an outlet for an emergency services vehicle is provided, then an unobstructed, hardened ground surface is to be supplied within four metres of any water supply.

B.4.1.1 Pipes and fittings

All above-ground, exposed water supply pipes and fittings should be metal. Fittings should be located away from the source of bushfire hazard and be in accordance with the applicable section below, unless otherwise specified by the local government.

B.4.1.2 Fittings for above-ground water tanks:

- Commercial land uses: 125 millimetres Storz fitting; or
- Strategic water tanks: 50 millimetres or 100 millimetres (where applicable and adapters are available) male camlock coupling with full flow valve; or
- Standalone water tanks: 50 millimetres male camlock coupling with full flow valve; or
- Combined water tanks: 50 millimetres male camlock coupling with full flow valve or a domestic fitting, being a standard household tap that enables an occupant to access the water supply with domestic hoses.

B.4.1.3 Remote outlets

In certain circumstances, it may be beneficial to have the outlet located away from the water supply. In instances in which a remote outlet is to be used, the applicant should consult the local government and DFES on their proposal.

B.4.2 USE OF WATER SUPPLY

Water supply for firefighting in the event of a bushfire can be provided on a lot for use by emergency services or for use by the landowner, if their **Bushfire Survival Plan** is to stay and defend their property.

The combination of drinking water and water for firefighting purposes is not recommended, as stagnant water may alter the quality of the drinking water and the emergency services, by law, may not be able to take water from the water supply to suppress a bushfire.

Combining drinking water and water for firefighting purposes is contrary to provisions within clause 4.2.3 of AS/NZS 3500.1:2021.

B.4.3 INDEPENDENT WATER AND POWER SUPPLY

Bushfires can directly impact a water service provider's equipment or pipes. As such, a reticulated water supply may not be reliable due to a reduction in water pressure or loss of supply. Where development is in an area shown as Area 2 on the *Map of Bush Fire Prone Areas* and/or where the local government area has known issues with water supply or pressure, it is recommended that the landowner consider providing a water tank in accordance with **Table 11**, Water supply dedicated for bushfire firefighting purposes.

In non-reticulated water supply areas, it is recommended that any pumping equipment be powered by means other than the electricity network. The pumping equipment could be a diesel or petrol-powered pump, or an electric pump if there is an onsite generator or backup power supply independent of the electricity network grid.

It is recommended that combustion pumps should be a minimum five hp or three kW diesel or petrol-powered pump and should be shielded against bushfire attack.

Where an electric pump is used, a backup power supply independent of the electricity network grid should be provided. A 3.7 kW/12k W/h sized battery (14.8 kW/h reserved solely for bushfire will power a 3.7 kW system for four hours) with blackout protection or a generator should be provided.

Table 11: Water supply dedicated for bushfire firefighting purposes

SECTIONS FROM THE PLANNING FOR BUSHFIRE GUIDELINES					
SECTION 5[2] STRUCTURE PLANS AND SUBDIVISION APPLICATIONS		**SECTION 6[2] DEVELOPMENT – RESIDENTIAL**	**SECTION 7[2] DEVELOPMENT – COMMERCIAL & INDUSTRIAL**	**SECTION 8[2] – DEVELOPMENT – VULNERABLE LAND USES**	
One additional lot	10,000 litre water tank per lot	10,000 litre water tank per habitable building	For each habitable building - 10,000 litre per 1,500 m^2 of floor space up to 50,000 litre. Provided in a water tank	Camping ground	At the discretion of the local government
Three to 24 lots	10,000 litre water tank per lot[1] **or** 50,000 litre strategic water tank				
25 lots or more	50,000 litre per 25 lots or part thereof, provided as a strategic water tank(s) **and/or** 10,000 litre water tank per lot			Other vulnerable land uses	For each habitable building - 10,000 litre per 500 m^2 of floor space up to 50,000 litre. Provided in a water tank

Notes:

[1] Evidence that the identified water supply amounts in either column denoted is to be provided at the relevant planning stage.

[2] where more than one habitable building is proposed, strategic water tanks are to be provided in accordance with Section 5 requirements and at the discretion of the Local Government.

B.4.4 STRATEGIC WATER SUPPLIES

Many local governments have a well-developed network of strategic water tanks for firefighting within their local government area. Given this, it is at the discretion of the local government to determine if the water supply within a locality is sufficient to cater for an increasing population when a subdivision is proposed. Local governments are encouraged to work with local emergency services to ensure the water supply needs for firefighting are understood.

Where a structure plan or subdivision proposes to create more than three but fewer than 24 lots, it is at the discretion of the local government whether it requires a strategic water tank or for each lot to be provided with a 10,000-litre tank.

A strategic water tank should preferably be located no more than 10 minutes from the farthest development site (20 minute turnaround time at a maximum). The turnaround time is the time it takes an emergency services vehicle to travel at legal road speeds from a lot to the water supply and back to the lot. Where a strategic water tank has been provided at the subdivision stage, the local government should consider whether the tank has the capacity to serve applications for development approval.

A landowner should enquire with their local government to determine whether a private water tank on their lot will be required.

When there is fragmented ownership of a structure plan area, or when staging of a subdivision is to occur and the local government has determined that a strategic water tank is required, then the first stage should include arrangements for the installation of a strategic water tank and the identification of land to be ceded. This should occur free of cost, without any payment or compensation by the Crown, as a Crown reserve for 'strategic water supply for firefighting purposes' (if applicable). Where local planning scheme provisions provide for developer contributions for public infrastructure and the local government is supportive, then a cash-in-lieu arrangement may be established for the provision of a strategic water tank.

B.4.5 LOCATION OF WATER TANKS AND HYDRANTS

Surrounding vegetation should be considered when locating a water tank. Avoid locations where the tank will be situated underneath existing vegetation or where vegetation will grow against or overhang the tank, (**Figure 39**). Where a tank is on the bushfire hazard side of a building, sufficient shielding for the protection of firefighters should be provided. In addition to the tank location, the fitting should be positioned and/or shielded from the bushfire hazard to allow access by emergency services.

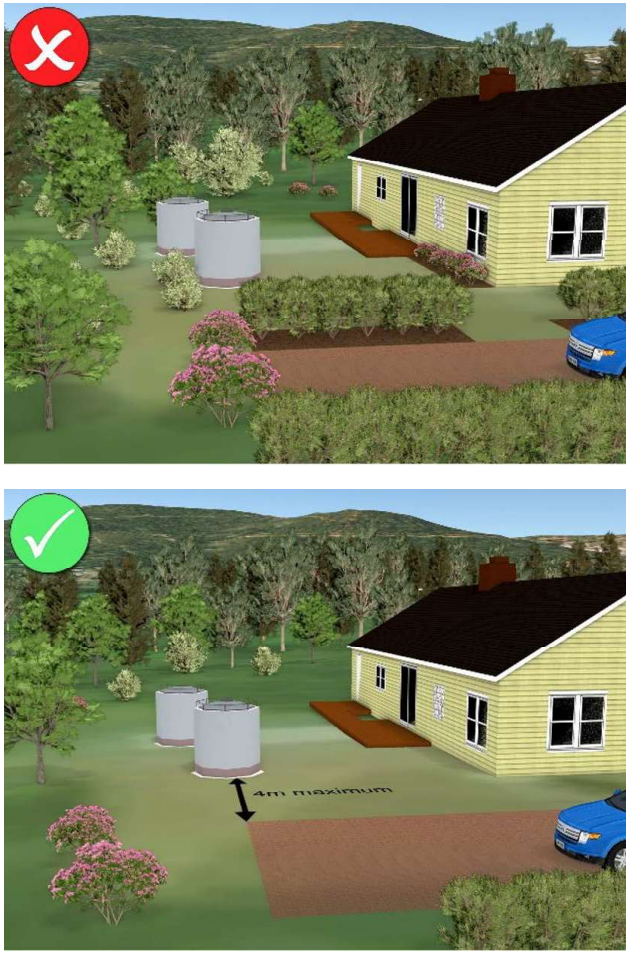
In areas serviced by reticulated water, where the distance from the public road to the farthest part of the habitable building is greater than 70 metres, emergency services vehicles will need to gain access within the property and be provided with a water supply for firefighting purposes. This is because access to reticulated water (fire hydrants) is not possible further than 70 metres, due to the length of the hose reel.

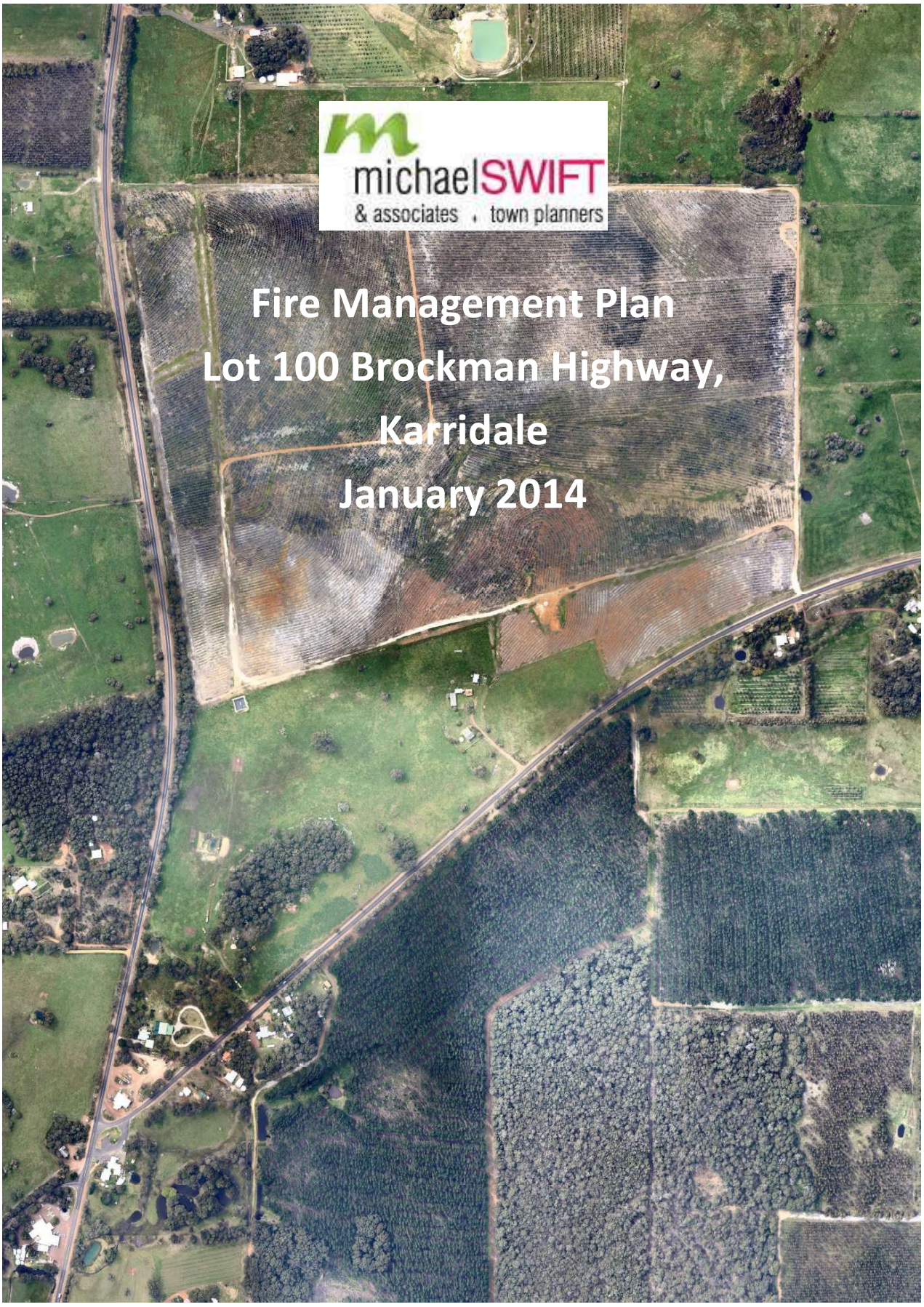
B.4.6 OUTCOMES BASED APPROACH

A dam, river or other source may be considered a firefighting water source for emergency services if it complies with **DFES guidelines for acceptable sources of water**, and it can be demonstrated that the water level will be maintained above the top of the highest fire brigade suction point.

Approval for the use of these types of water supplies is on a case-by-case basis and at the discretion of the decision-maker, in consultation with emergency services and local government.

Figure 39: A good and bad example of landscaping around a water tank





michaelSWIFT
& associates , town planners

Fire Management Plan
Lot 100 Brockman Highway, Karridale
January 2014

Fire Management Plan
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January 2014

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1. Introduction

The purpose of this Fire Management FMP (FMP) is to outline the planning and management of the proposed subdivision of Lot 100 Brockman Highway, Karridale as it relates to bush fire risks, management and mitigation.

The FMP is submitted in conjunction with a Local Structure Plan which proposes the subdivision of the subject land into approximately 87 lots comprising between 2000m^2 and 2ha with a residual rural lot comprising approx. 44.87ha.

The FMP will be implemented by the developer of the subdivision in the first instance, with ongoing mitigation and management responsibilities passing to the individual lot owners and the Shire of Augusta – Margaret River (as outlined in the FMP) once the titles of the subdivision have been created. It is anticipated that the Shire will adopt and enforce this FMP under its Annual Bush Fire Notice.

This FMP is prepared in compliance with the Planning for Bush Fire Protection Guidelines (Edition 2) (the Guidelines).

2. Aim

The aims of the FMP are:

- to reduce the occurrence of, and minimise the impact of bush fires, thereby reducing the threat to life, property and the environment in the area to which the FMP applies; and
- to document fire prevention requirements for the land to which it applies.

3. Objectives

The objectives of this FMP are to:

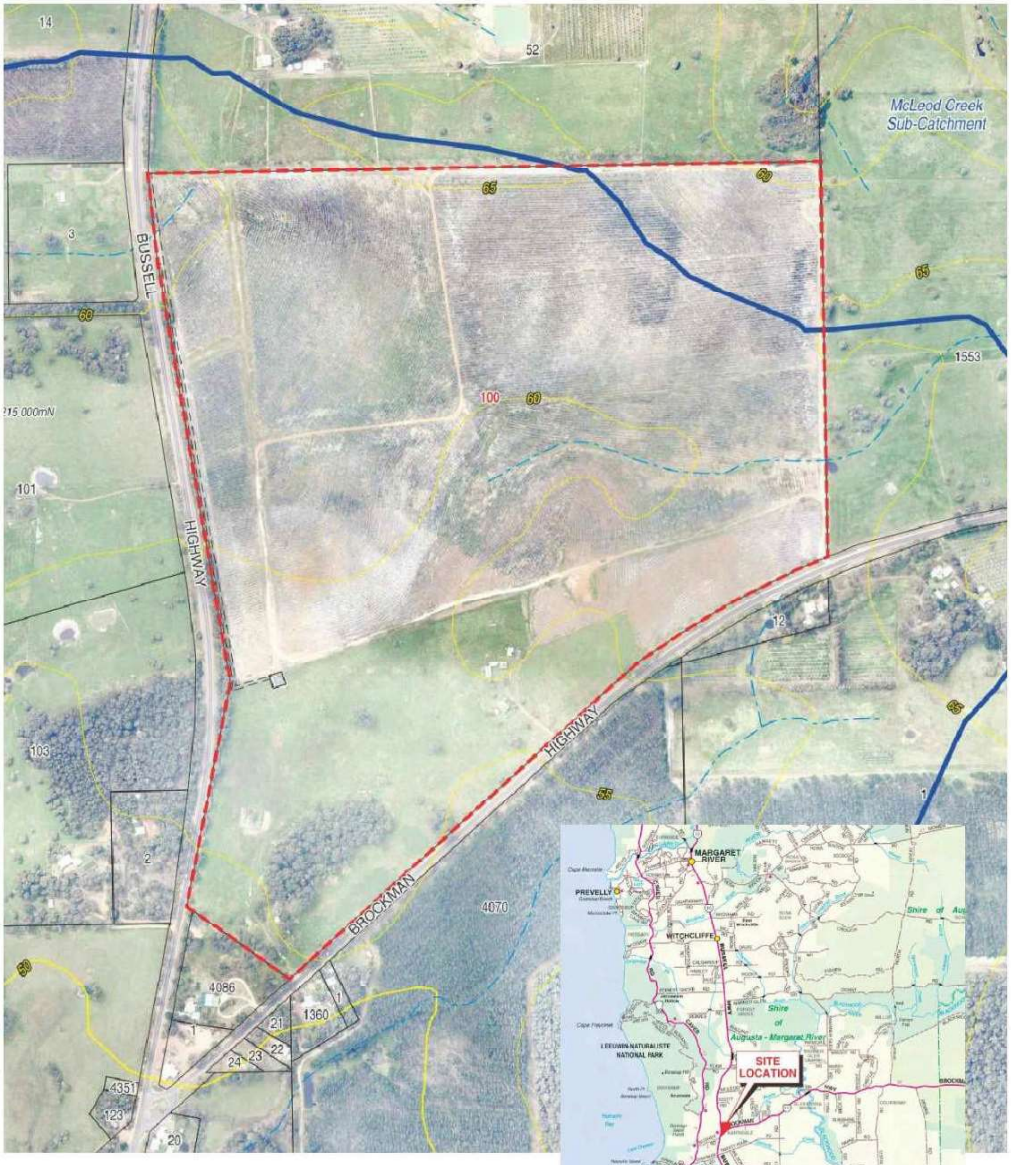
- Reconcile environmental and fire safety objectives for the site
- Define the fire hazard risk for the site
- Nominate individuals and organisations responsible for fire management and associated works within the area of the FMP.
- Propose fire management strategies for all land, with due regard for life, property and the environment.
- Define an assessment procedure which will evaluate the effectiveness and impact of proposed, as well as existing, fire prevention work and strategies.
- Achieve all performance criteria and, where practical, the acceptable solutions for all fire management work.

4. Description of the area

4.1 General

The subject land is adjoined to the south, east and north by broad acre agricultural holdings which typify the broader locality. Bordering to the west, on the opposite side of Bussell Highway, is a recently proposed rural residential subdivision known as 'Karridale West'. The subject land will have primary access from Brockman Highway which will be the primary emergency access route along the southern boundary of the FMP area.

Site and Locality



4.2 Climate

The Mediterranean climate experienced by this area is such that the majority of rain falls in late autumn through to early spring. This rainfall supports substantial vegetation growth, which dries off in Summer/Autumn.

The pattern of wind in the drier months revolves around daily sea breezes from the south west, but with sometimes extended periods of dry easterly winds. Indeed, the easterly and south easterly wind patterns dominate the overall percentage of hours in the summer months.

Average temperature, rainfall and wind data based on records from the Bureau of Meteorology is provided at **Appendix 7.1**

4.3 Topography

The site contains slight slopes generally from north-east to south-west, draining generally towards the Karridale crossroads.

4.4 Bush fire fuels

The northern portion of the subject land is currently utilised as a blue gum plantation. The plantation will be harvested to allow the subdivision to proceed resulting in an the area being typified by open pasture, but subject to active fire management in the interim as outlined at Part 6 – Fire Mitigation Strategies.

A description of the broadly defined vegetation characteristics of the remainder of the FMP area is provided in the Flora and Vegetation Report by Bennett Environmental Consulting Pty Ltd that accompanies the LSP, as follows:

The vegetation at the site varied according to the amount of clearing that had occurred. Three quadrats were recorded but the vegetation was the same. Tall Forest of *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* over Low Woodland A of *Agonis flexuosa* var. *flexuosa* in sandy loam. Quadrat 1 recorded a higher cover of *Corymbia calophylla* and no *Agonis flexuosa* var. *Flexuosa* than quadrat 1. Quadrat 2 recorded not as high a cover of *Corymbia calophylla* an quadrat 1, but a higher cover of *Eucalyptus marginata* subsp. *marginata* and low trees of *Agonis flexuosa var. flexuosa.* Quadrat 3 consisted of a dense cover of *Agonis flexuosa* var. *flexuosa* and only scattered trees of *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla*.

(Extract – Flora and Vegetation Report)

4.5 Land use

The subject land has historically been used for conventional farming (grazing) activities. More recently the northern portions have been utilised for a blue gum plantation which will be wound up and the area rehabilitated (most likely) concurrent with the occupation of the first dwellings being constructed in Stage 1 of the adjoining rural residential estate and to allow development of Stage 2 of the subdivision.

The land use of the surrounding area has historically been predominantly rural, with pockets of village retail/services at the Karridale crossroads. The advent of the Karridale Hamlet settlement strategy will see reinforcement of the village centre and low density residential settlement occurring generally within a 500m radius of the village core on both sides of Bussell Highway.

A map of the area of the FMP showing the proposed lot layout within the subject land is attached (**Annexure 7.2.1**).

4.6 Assets

The existing assets within the FMP area are minor, being improvements associated with the agricultural use of the land (fencing, tracks, pumps etc.), a rural dwelling and associated sheds. The blue gum plantation is an existing asset that will be realised and removed prior to the completion of the development.

The proposed subdivision will result in development of 87 new dwellings on the respective lots, all of which will be required to comply with AS 3959 based on an assessment (at building licence stage) of the vegetation conditions at the particular location within the building envelope at which the dwelling is to be constructed.

It is possible that the residue rural lot will be subject of proposals for low-key tourist uses in the future, the exact nature and extent of which is not known at this time and will be subject to a separate future assessment and approval process.

The subdivision will also result in the introduction of other assets to service the subdivision, such as lot access roads, emergency water supply points (tanks) and power and telecommunications infrastructure.

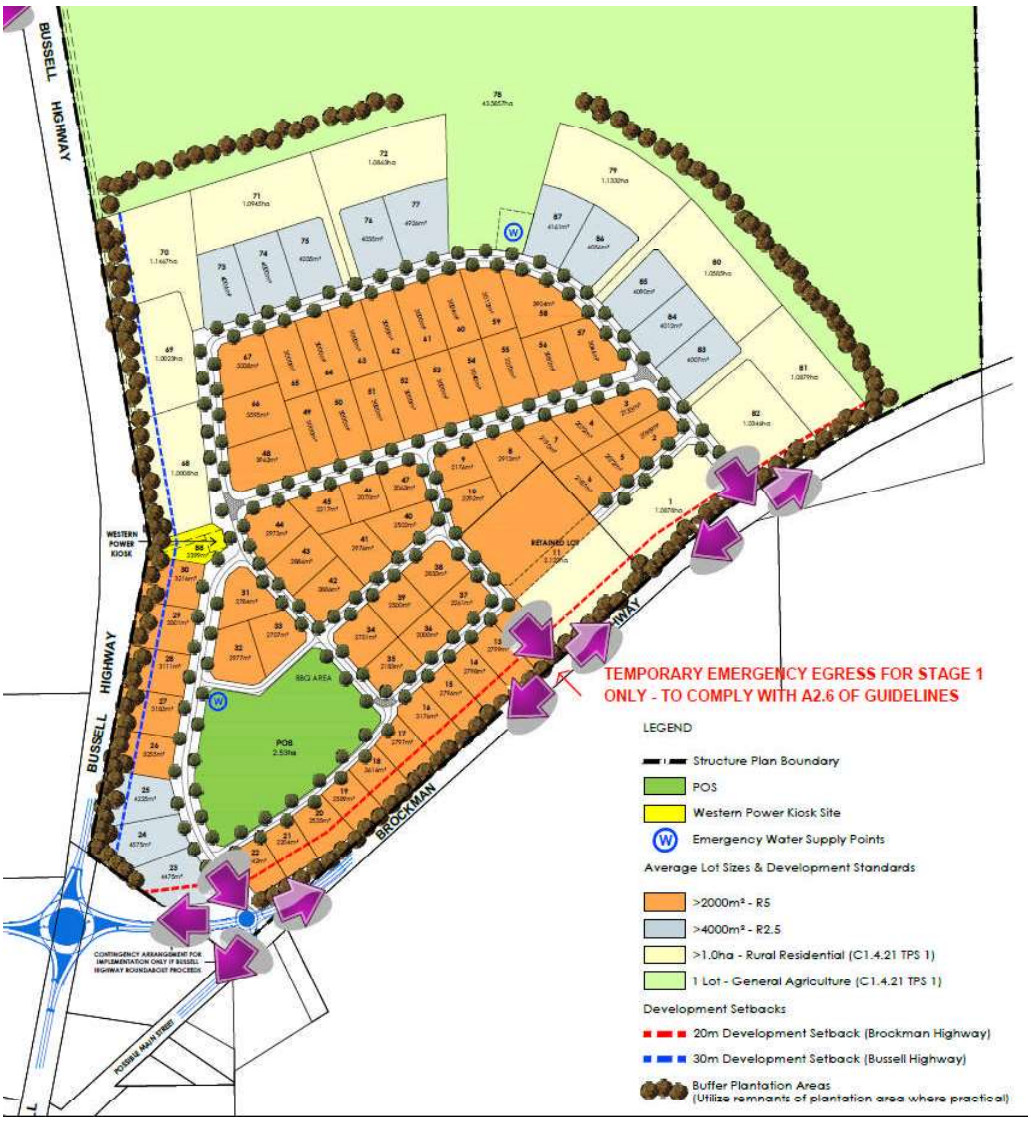
4.7 Access

Primary access to the proposed subdivision will be from the south via Brockman Highway.

The subdivision will create a network of public roads and internal firebreaks to provide multiple options for emergency access and egress for every lot, as shown on the below annotated extract of the LSP.

All access will be constructed to a much higher standard than the minimum all-weather 2 wheel drive standard, and which is suitable for 2.4 fire appliances used by brigades in this locality. Construction standards are to be in accordance with Element 2 – Access as shown in Appendix 2 to the Planning for Bushfire Protection Guidelines (Edition 2). Specifically for those access options shown on the FMP map:

- Public roads will be constructed in accordance with Acceptable Solution A2.2 of the Guidelines;
- Battle-axe driveways will be constructed in accordance with Acceptable Solution a2.4 of the Guidelines; and
- Internal firebreaks will be constructed in accordance with Acceptable Solution A2.9 of the Guidelines and the Shire of Augusta Margaret River Firebreak and Fuel Hazard Reduction Notice, whichever is the higher standard from time to time.



4.8 Water supply

A reticulated water service is not available in Karridale. The dwellings within the subdivision will be serviced by 135 kl water tanks fitted with 100mm male 'Camlock' couplings with full flow valves for emergency fire-fighting purposes such that minimum 10,000 litres is available on every lot for emergency purposes at any time. This will result in excess of 600 kl of water being available on site in emergency situations.

The subdivider will also install emergency water supply points in the form of tanks with the requisite couplings to provide 50,000 litres per 25 dwellings and accessible by 2.4 appliances in accordance with Acceptable Solution A3.2 of the Guidelines. The locations of the emergency water supply points are shown on the FMP (**Annexure 7.2.1**)

5. Fire problem

5.1 Bush fire history

There has not been a bush fire in proximity of the subject land for over a decade.

The most significant bush fire in the locality occurred in 1961. In the interim period Karridale has not been exposed to threat of a major bushfire, although significant events have occurred at Nannup and Kudardup, and more recently at Margaret River/Prevelly.

The local volunteer fire brigade and long term residents consider that the comparative fire safety of Karridale is due to the expanses of open pasture and the advent of blue gum plantations which are protected by commercially driven diligent fire mitigation and protection practices.

5.2 Bush fire risk

The bush fire risk in the area of the FMP is assessed as primarily arising from human activity in a vegetated area. This can be associated with accidental ignition of fires arising from farming, building or hobby activities through to increased population leading to incrementally increased risk of arson.

5.3 Bush fire hazard

The inherent bush fire hazard on this site and in the general locality is the extent and proximity of remnant vegetation to places of human occupation and other property and infrastructure. The locality is typified by a predominance of open pasture with small pockets of remnant vegetation and areas of blue gum plantation.

The subject land is borders to the east and north by areas of low –risk open pasture. Bussell Highway borders the west of the property, beyond which is the Karridale West subdivision area characterised by damp pasture and with a pocket of remanet vegetation adjacent to Bussell Highway that will be subject of a separate fire management plan to mitigate and minimise bush fire risk. Brockman Highway provides a high standard strategic firebreak along the southern boundary of the site, separating future development from a commercial blue gum plantation to the south. That plantation is subject to its own fire management plan.

A blue gum plantation exists with the northern portions of the subject land and is subject of a fire management plan (**Appendix 7.2.2** - Warrenella (354) Operations Plan) pending its removal concurrent with the proposed

subdivision. The plantation land will be left as open pasture with possibly some minor stands of trees left for aesthetic purposes.

A small copse of remnant vegetation exists in the south west of the subject land and will be retained as public open space in the subdivision of the site. The vegetation is detached from other fire sources and will be bordered on 3 sides by a system of public roads as part of the development process.

A bushfire hazard and risk assessment map reflecting the above has been prepared in accordance with the Guidelines and is attached as Appendix 7.2.3.

5.4 Bush fire threat

The bush fire threat within the subject land is assessed as being low, based solely on vegetation type and proximity to property at the conclusion of development.

The primary threat is from fires originating from the plantations to the south and remnant vegetation on private land to the west, both of which are separated from the subject land by significant strategic fire breaks in the form of Brockman Highway and Bussell Highway respectively. The small copse of remnant vegetation with the site is designated as future public open space and will be presented to the Shire in fire-safe condition at the completion of development and maintained by the developer for a period of at least 2 years thereafter. Importantly, the Western Power traversing the site is located with existing cleared land and land that will be cleared prior to development.

The threat that does exist is also mitigated for the subject land and the locality by the introduction of increased emergency water supplies and the connected network of public roads, strategic firebreaks and easements associated with the proposed subdivision. The threat applies primarily to new dwellings and their occupants and to a lesser degree to stock and native animals.

5.5 Summary of bush fire potential issues

The primary bush fire issue arises from the increased interaction of humans and bush in the locality, and the associated introduction of new dwellings and other assets that are susceptible to damage.

6. Fire mitigation strategies

6.1 Hazard management

This FMP imposes Restricted Building Areas to prohibit buildings in areas of risk in the initial stages of development pending removal of the blue gum plantation. It also imposes requirements for vegetation and fuel management within the area of proposed Public Open Space and for every dwelling in the subdivision area (in accordance with the Shire's Annual Fuel Hazard Reduction and Firebreak Notice). The requirements are based on contemporary standards for the nature of the land use and the assessed fire hazard, including compliance with AS3959 for each dwelling based on individual assessments at building licence stage.

The FMP specifies the role of the developer, lot owners and the Shire of Augusta Margaret River in the implementation and maintenance of hazard management measures. Legal enforcement will be achieved via the

subdivision clearance process and thereafter by application of the Shire's Annual Fuel Hazard Reduction and Firebreak Notice.

6.2 Bush fire risk management

The aim is of reducing the number of fires occurring and to reduce the impact of those that do occur is to be addressed by the following measures:

- Restrictions on the use of machinery (eg vehicle movement on fire danger days above 'very high' imposed by the Shire of Augusta Margaret River under the Bush Fire Act and its Annual Fuel Hazard Reduction and Firebreak Notice when conditions warrant).
- Restrictions on the use of reserves and national parks on fire danger days above 'very high' at the discretion of the Department of Environment and Conservation and the Shire of Augusta Margaret River.
- Public education/community awareness via Shire initiated publicity.
- Timing and implementation of restricted and prohibited burning times via the Shire's Annual Fuel Hazard Reduction and Firebreak Notice.
- Lot owner awareness and responsibilities via implementation of this FMP.

6.3 Future development

The FMP map (**Annexure 7.2.1**) forming part of this FMP prescribes the location, layout and management of future development to reduce fire threat. The specifications include:

- Restricting new development to lower fire threat areas (i.e. cleared land) and, the specification of minimum standards for access.
- Requirements for low fuel areas and fire breaks, water supply and building standards for development in bush fire prone areas.
- Construction standards of buildings are to be in accordance with the BAL rating specified for the particular building location on the FMP map and to otherwise accord with Australian Standard AS 3959.

Importantly, all new residential and rural residential lots will be presented by the developer to Building Protection Zone standard (noting that they will be on already cleared land), with planted buffers on the perimeter of those lots adjacent to Bussell and Brockman Highways considered to be an 'Exclusion – Low Threat Vegetation' presented in compliance with Clause 2.2.3.2(d) and pursuant to Clause 2.2.3.2(f) of AS 3959.

The one area of interface with remaining vegetation is that adjacent to the POS in the south west of the site. Assessment of this area is based on the vegetation being classified as Woodland, separated from development by roads plus internal lot setbacks from minimum 12m - 15m from the road plus cleared land within the POS for the northern and eastern adjacent lots. The assessment results in proposed BAL ratings of 12.5 for the western, northern and eastern interfacing lots to the POS and BAL 19 for the southern interfacing lots (due to narrower road width in this location).

6.4 Access and fire breaks

A comprehensive network of access and fire breaks is depicted on the FMP maps. The works are to be constructed to comply with Appendix 2, Element 2 – Vehicular Access of the Guidelines by the developer of the subdivision prior to the creation of titles and maintained thereafter by the Shire.

The Shire will be responsible for annual inspection of all dwellings to ensure ongoing compliance with this FMP under its Annual Fuel Hazard Reduction and Firebreak Notice. The developer will contribute to the implementation of other fire mitigation measures beyond the subject land and to the equipment needs of local bush fire brigades via a cash contribution made in accordance with Shire policy to the Shire at subdivision clearance stage.

6.5 Public education and community awareness

Broader public education and community awareness is at the discretion of the Shire of Augusta Margaret River and DFES. This might may include school-based education, fire awareness campaigns such as open days, field days and seminars, electronic media or signage visible from major access roads or other suitable location. Also, the Shire's Annual Fuel Hazard Reduction and Firebreak Notice is issued to every landowner in the Shire with rates notices every year and is publicised in the local press.

6.6 Fire safer areas

The Shire has implemented a system of designating and signposting directions to bush fire safer areas throughout the District. The developer and individual lot owners will contribute financially to the expansion of this program, as deemed necessary by the Shire, via the above mentioned development contributions and State Government emergency services levy mechanisms.

6.7 Assessment of fire management strategies

This Fire Management FMP has been devised to achieve the performance criterion outlined in the Planning for Bush Fire Protection Guidelines (Edition 2). Achieving a balance of the often competing principles of environmental protection and bush fire safety has been a key consideration in the formulation of the FMP.

Assessment of the FMP and associated strategies will occur in three stages:

1. Assessment and approval of the Fire Management FMP (for implementation) by the Shire of Augusta Margaret River pursuant to conditions of the imminent Local Structure Plan and subdivision approval ;
2. Approval and acceptance of the works and measures to be implemented by the developer under the FMP prior to the clearance of conditions of the subdivision to facilitate the issue of titles for the new lots to be created; and
3. A future broader assessment of this FMP and the Shire's Annual Fuel Hazard Reduction and Firebreak Notice and bush fire management practices by the Shire and DFES as part of a program of continual improvement to fire mitigation and management regimes.

6.8 Implementation of FMP

The responsibilities of parties to the FMP are as follows:

Owners/Occupiers

The owners/occupiers of the lots created by the proposal will be responsible for undertaking fire mitigation maintenance works in compliance with the FMP to implement measures protecting their assets and the locality from the threat and risk of bush fire.

The owners/occupiers will be responsible for:

- maintain fire mitigation measures on their property in accordance with this FMP and the annual Shire of Augusta Margaret River Firebreak Notice;
- ensure individual dwellings on each lot are designed and built to conform with:
    - The Home Owners Bush Fire Survival Manual Guidelines;
    - The Shire of Augusta Margaret River Specification and Requirements;
- All dwellings to be equipped with a 135,000 litre water tank fitted with a 100mm male 'Camlock' full flow coupling for emergency firefighting purposes such that minimum 10,000 litres is available for emergency purposes at any time..
- implement and maintain a Building Protection Zone through measures such as:
    - width: 20 metres measured from any external wall of the building
    - location: within the boundaries of the lot on which the building is situated
    - fuel load: reduced to and maintained at 2 tonnes per hectare
    - trees (crowns) are a minimum of 10 metres apart
    - trees are low pruned at least to a height of 2 metres
    - no tall shrub or tree is located within 2 metres of a building (including windows)
    - there are no tree crowns overhanging the building
    - fences and sheds within the building protection zone are constructed using non-combustible materials (e.g. colourbond iron, brick, limestone)
    - shrubs in the building protection zone have no dead material within the plant
    - tall shrubs in the building protection zone are not planted in clumps close to the building ie within3 metres
    - trees in the building protection zone have no dead material within the plant's crown or on the bole.
- Implement and maintain Hazard Separation Zone through measures such as:
    - A 25 metre Hazard Separation Zone (or extending to the property boundary if the building is closer than 25 metres) excluding a 20 metre Building Protection Zone is to be maintained around all buildings.
    - Within the Hazard Separation Zone fuels are to be maintained below 4-6 tonnes/ha. Fuels may be modified by slashing ground cover to 100mm to create a 'parkland cleared' effect.
    - trees (crowns) are a minimum of 10 metres apart
    - trees in the hazard separation zone have no dead material within the plant's crown or on the bole.
- Implement other hazard reduction through measures such as:
    - Remnant vegetation bush fuels shall be maintained below 6-8 tonnes/ha of ground and scrub fuels.
- Maintain internal lot firebreaks as shown on the FMP.

The Developer

The Developer shall be required to carry out works prior to the clearance of titles as follows:

- Installation of any internal lot and strategic firebreaks as shown on the FMP;
- Install Emergency Water Supply Points generally as shown on the FMP to provide 50,000 litres of emergency water supply per 25 dwellings or part thereof in accordance Acceptable Solution A3.2 of the Planning for Bushfire Guidelines (Edition 2);
- Ensure implementation of the fire management plan for the blue gum plantation within the subject land pending harvesting of the plantation;
- Carry out fire mitigation works, including a 'cool burn', over the public open space prior to ceding;
- Present all residential lots in a manner compliant with Building Protection Zone standards prior to clearance of titles;
- Creation of a section 70A Notification on each title proposed for this subdivision. The notification shall alert purchasers of land and successors in title of their responsibilities as identified in the Fire Management FMP; and
- Supply a copy of this Fire Management FMP and the Homeowners Bush Fire Survival Manual to each property owner on the sale of each lot.

Shire of Augusta Margaret River

The Shire of Augusta Margaret River shall be responsible for:

- Reviewing and certifying compliance with this FMP prior to the clearance of conditions of subdivision approval to facilitate the issue of titles for new lots;
- Endorsing a Section 70A Notification on each Certificate of Title affected by this FMP;
- Developing and maintaining District Fire Fighting Facilities;
- Maintaining the condition of district water tanks and emergency water supply points and other apparatus that is Local Government infrastructure for firefighting purposes;
- Maintaining road reserves serving the land;
- Periodical review of the FMP and broader fire policies and practices to assess their effectiveness; and
- Enforcement of the Annual Fuel Hazard Reduction and Firebreak Notice.

7. Appendix

7.1 Meteorological data

7.2 Maps (attached)

7.2.1 Fire Management Plan

7.2.2 Warrenella (354) Operations Plan

7.2.3 Bushfire Risk Assessment Map

7.3 Guidelines, specifications and minimum standards

Specifications or standards relevant to this FMP are derived from and consistent with:

- Planning for Bush Fire Protection Guidelines (Edition 2);
- Australian Standard 3959 Construction in bush fire-prone areas; and
- Shire of Augusta Margaret River Firebreak and Fuel Hazard Reduction Notice 2013-2014 (copy attached).

7.4 Glossary

The terminology used in this document is as per "The Australasian Fire Authorities Council's 'Glossary of Rural Fire Terminology' ".

7.5 References

- Planning for Bush Fire Protection Guidelines (Edition 2) – WAPC, Department of Planning & DFES
- Shire of Augusta Margaret River Firebreak and Fuel Hazard Reduction Notice 2013-2014
- Warrenella (354) Operations Plan 15 August 2009

ANNEXURE 7.1

Summary statistics for all years

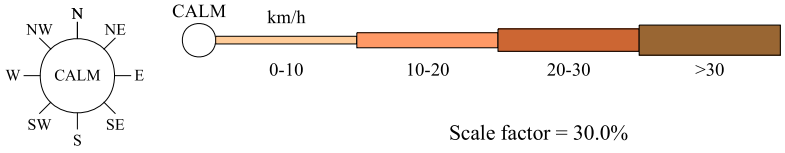
Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	14.4	14.7	28.9	72.6	156.9	222.2	222.2	164.2	113.2	74.5	44.1	19.8	1151.5
Lowest	0.0	0.0	0.0	6.8	38.1	92.8	86.2	57.2	21.3	0.0	1.8	0.0	759.6
5th %ile	0.0	0.0	0.9	14.2	64.4	123.8	134.0	83.8	53.3	29.5	7.5	0.2	911.8
10th %ile	0.5	1.2	2.3	23.9	75.3	133.9	154.1	98.2	61.0	35.7	8.8	2.5	960.5
Median	8.1	7.6	19.4	59.8	152.6	218.9	218.1	155.2	104.9	67.8	39.0	15.4	1136.8
90th %ile	40.3	43.4	57.8	127.6	229.9	311.0	300.0	231.5	174.9	120.3	75.2	44.1	1329.7
95th %ile	51.3	59.3	82.0	161.3	269.7	352.9	330.7	258.8	195.4	144.9	106.5	56.5	1457.5
Highest	82.4	85.0	170.7	228.4	378.1	394.4	472.9	340.6	247.0	219.0	131.2	73.0	1635.4

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years		Plot	Map
Temperature																	
Mean maximum temperature (°C)	26.3	27.0	26.0	22.5	19.9	17.4	16.4	16.7	17.3	19.2	22.7	24.6	21.3	13	1999 2012		
Mean minimum temperature (°C)	13.9	14.5	12.9	10.9	9.7	8.8	8.0	8.0	8.6	9.1	10.9	12.3	10.6	13	1999 2012		

WIND FREQUENCY ANALYSIS (in km/h)

CAPE LEEUWIN STATION NUMBER 009518

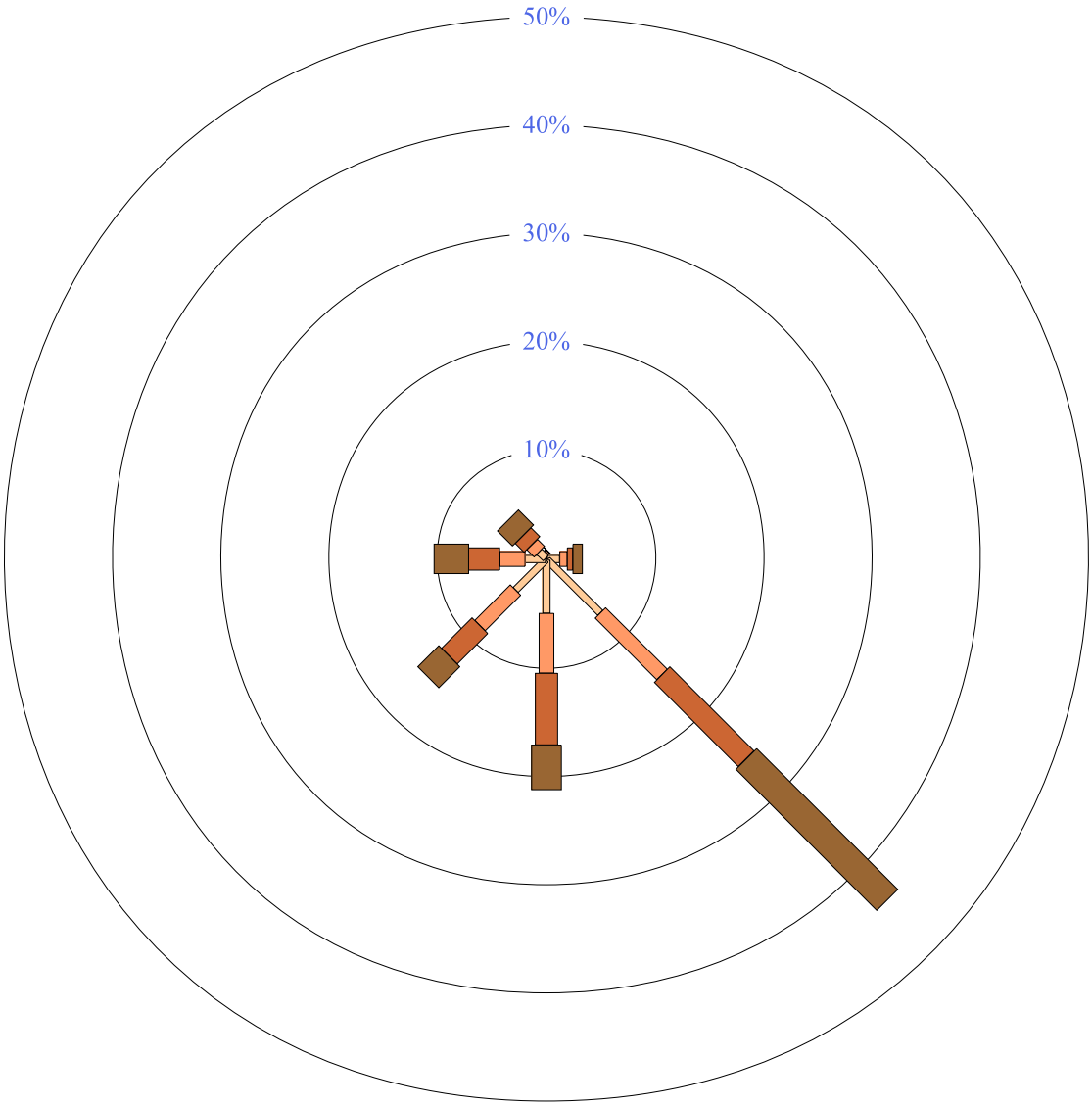
Latitude: -34.37 ° Longitude: 115.14 °



3 pm Summer
8555 Total Observations (1907 to 2004)

Scale factor = 30.0%

Calm *



Wind directions are divided into eight compass directions. Calm has no direction.
An asterisk (*) indicates that calm is less than 1% .
An observed wind speed which falls precisely on the boundary between two divisions (eg 10km/h) will be included in the lower range (eg 1-10 km/h). Only quality controlled data have been used.

Australian Government
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WIND FREQUENCY ANALYSIS (in km/h)

CAPE LEEUWIN STATION NUMBER 009518

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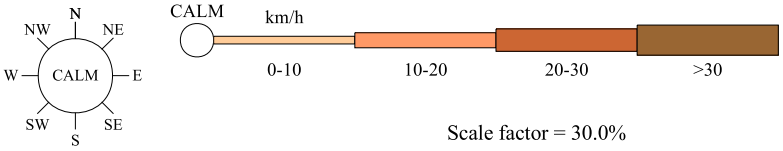
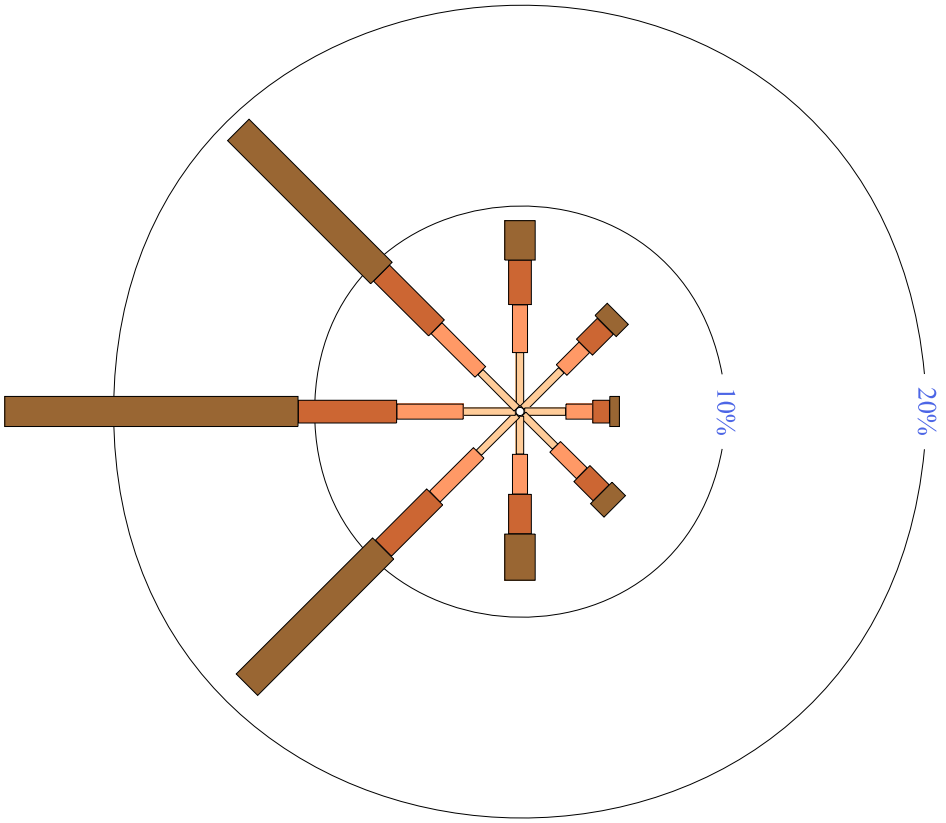


Scale factor = 30.0%

3 pm Winter
8910 Total Observations (1907 to 2004)

Calm 1%



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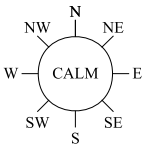
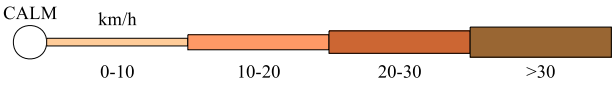
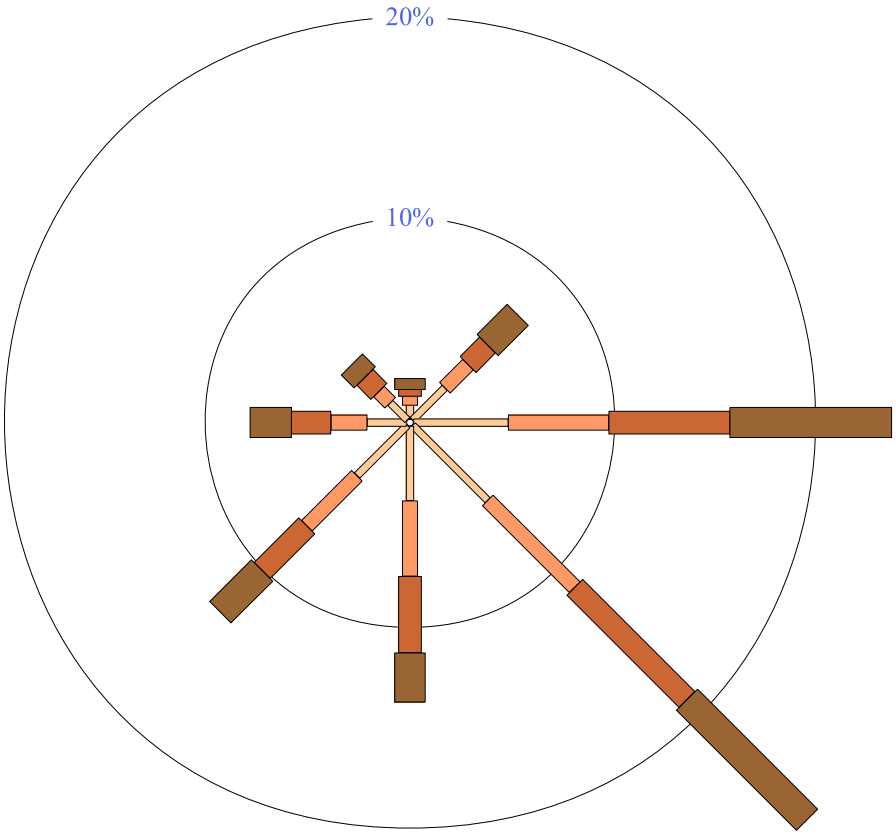




Scale factor = 30.0%

9 am Summer
8563 Total Observations (1907 to 2004)

Calm 1%



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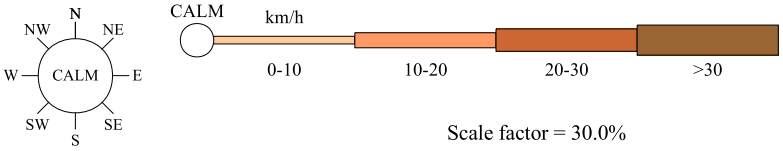
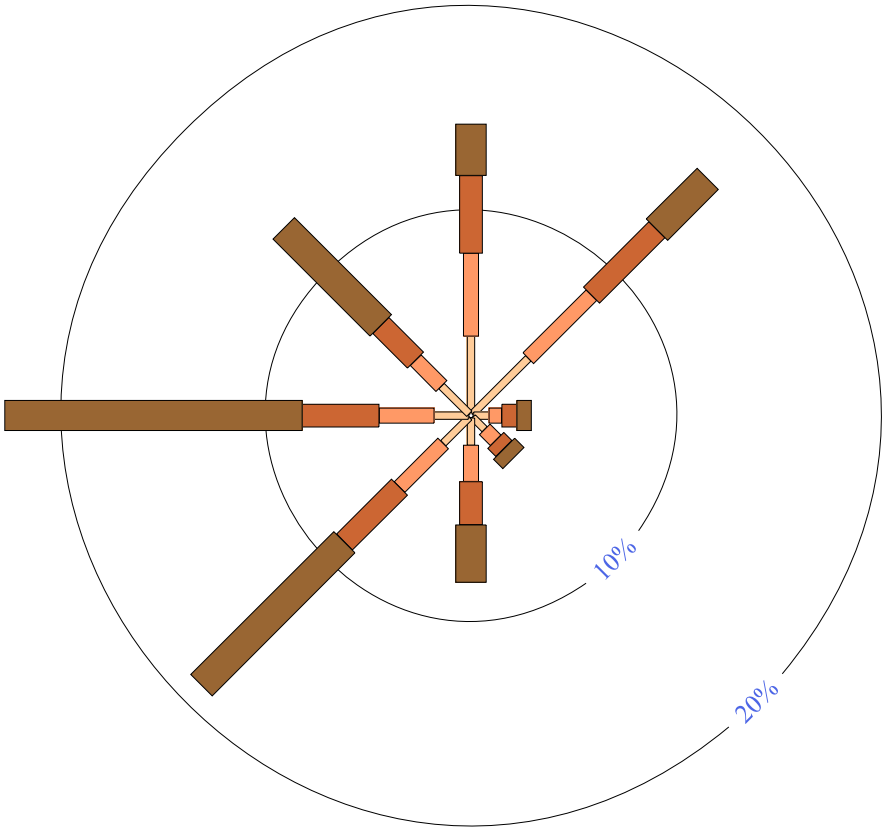


Scale factor = 30.0%

9 am Winter
8910 Total Observations (1907 to 2004)

Calm 1%



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CAPE LEEUWIN STATION NUMBER 009518

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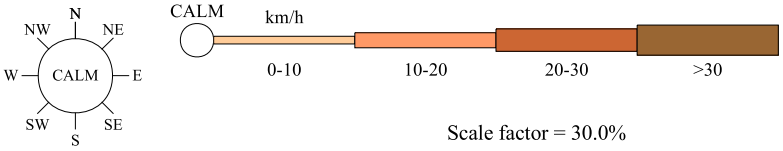
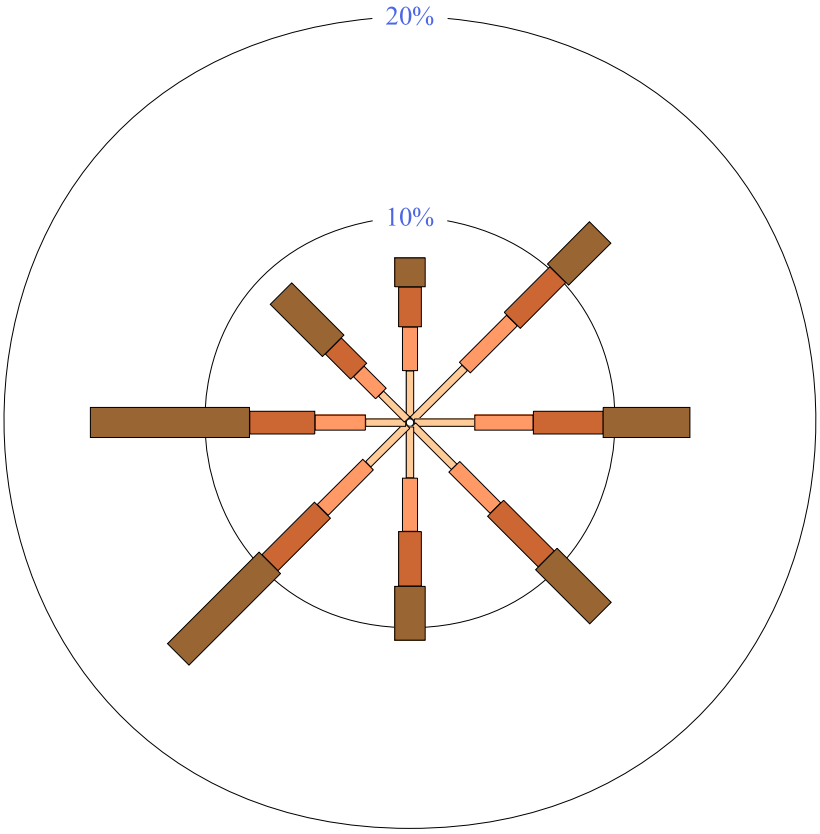


Scale factor = 30.0%

9 am
35116 Total Observations (1907 to 2004)

Calm 1%



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ANNEXURE 7.2.1

Responsibilities of Parties to the FMP:

Owners/Occupiers

The owners/occupiers of the lots created by the proposal will be responsible for undertaking fire mitigation maintenance works in compliance with the FMP to implement measures protecting their assets and the locality from the threat and risk of bush fire.

The owners/occupiers will be responsible for:

- maintain fire mitigation measures on their property in accordance with this FMP and the annual Shire of Augusta Margaret River Firebreak Notice;
- ensure individual dwellings on each lot are designed and built to conform with:
  - The Home Owners Bush Fire Survival Manual Guidelines;
  - The Shire of Augusta Margaret River Specification and Requirements;
- All dwellings to be equipped with a 135,000 litre water tank fitted with a 100mm male 'Camlock' full flow coupling for emergency firefighting purposes such that minimum 10,000 litres is available for emergency purposes at any time..
- implement and maintain a Building Protection Zone through measures such as:
  - width: 20 metres measured from any external wall of the building
  - location: within the boundaries of the lot on which the building is situated
  - fuel load: reduced to and maintained at 2 tonnes per hectare
  - trees (crowns) are a minimum of 10 metres apart
  - trees are low pruned at least to a height of 2 metres
  - no tall shrub or tree is located within 2 metres of a building (including windows)
  - there are no tree crowns overhanging the building
  - fences and sheds within the building protection zone are constructed using non-combustible materials (e.g. colourbond iron, brick, limestone)
  - shrubs in the building protection zone have no dead material within the plant
  - tall shrubs in the building protection zone are not planted in clumps close to the building ie within 3 metres
  - trees in the building protection zone have no dead material within the plant's crown or on the bole.
- Implement and maintain Hazard Separation Zone through measures such as:
  - a 25 metre Hazard Separation Zone (or extending to the property boundary if the building is closer than 25 metres) excluding a 20 metre Building Protection Zone is to be maintained around all buildings.
  - within the Hazard Separation Zone fuels are to be maintained below 4-6 tonnes/ha. Fuels may be modified by slashing ground cover to 100mm to create a 'parkland cleared' effect.
  - trees (crowns) are a minimum of 10 metres apart
  - trees in the hazard separation zone have no dead material within the plant's crown or on the bole.
- Implement other hazard reduction through measures such as:
  - Remnant vegetation bush fuels shall be maintained below 6-8 tonnes/ha of ground and scrub fuels.
- Maintain internal lot firebreaks as shown on the FMP.

The Developer

The Developer shall be required to carry out works prior to the clearance of titles as follows:

- Installation of any internal lot and strategic firebreaks as shown on the FMP;
- Install Emergency Water Supply Points generally as shown on the FMP to provide 50,000 litres of emergency water supply per 25 dwellings or part thereof in accordance Acceptable Solution A3.2 of the Planning for Bushfire Guidelines (Edition 2);
- Ensure implementation of the fire management plan for the blue gum plantation within the subject land pending harvesting of the plantation;
- Carry out fire mitigation works, including a 'cool burn', over the public open space prior to ceding;
- Present all residential lots in a manner compliant with Building Protection Zone standards prior to clearance of titles;
- Creation of a section 70A Notification on each title proposed for this subdivision. The notification shall alert purchasers of land and successors in title of their responsibilities as identified in the Fire Management FMP; and
- Supply a copy of this Fire Management FMP and the Homeowners Bush Fire Survival Manual to each property owner on the sale of each lot.

Shire of Augusta Margaret River

The Shire of Augusta Margaret River shall be responsible for:

- Reviewing and certifying compliance with this FMP prior to the clearance of conditions of subdivision approval to facilitate the issue of titles for new lots;
- Endorsing a Section 70A Notification on each Certificate of Title affected by this FMP;
- Developing and maintaining District Fire Fighting Facilities;
- Maintaining the condition of district water tanks and emergency water supply points and other apparatus that is Local Government infrastructure for firefighting purposes;
- Maintaining road reserves serving the land;
- Periodical review of the FMP and broader fire policies and practices to assess their effectiveness; and
- Enforcement of the Annual Fuel Hazard Reduction and Firebreak Notice.

FIRE MANAGEMENT PLAN FOR JUVENTUS PTY LTD

Lot 100 Brockman Highway, Karridale
Shire of Augusta - Margaret River

michaelSWIFT & associates , town planners

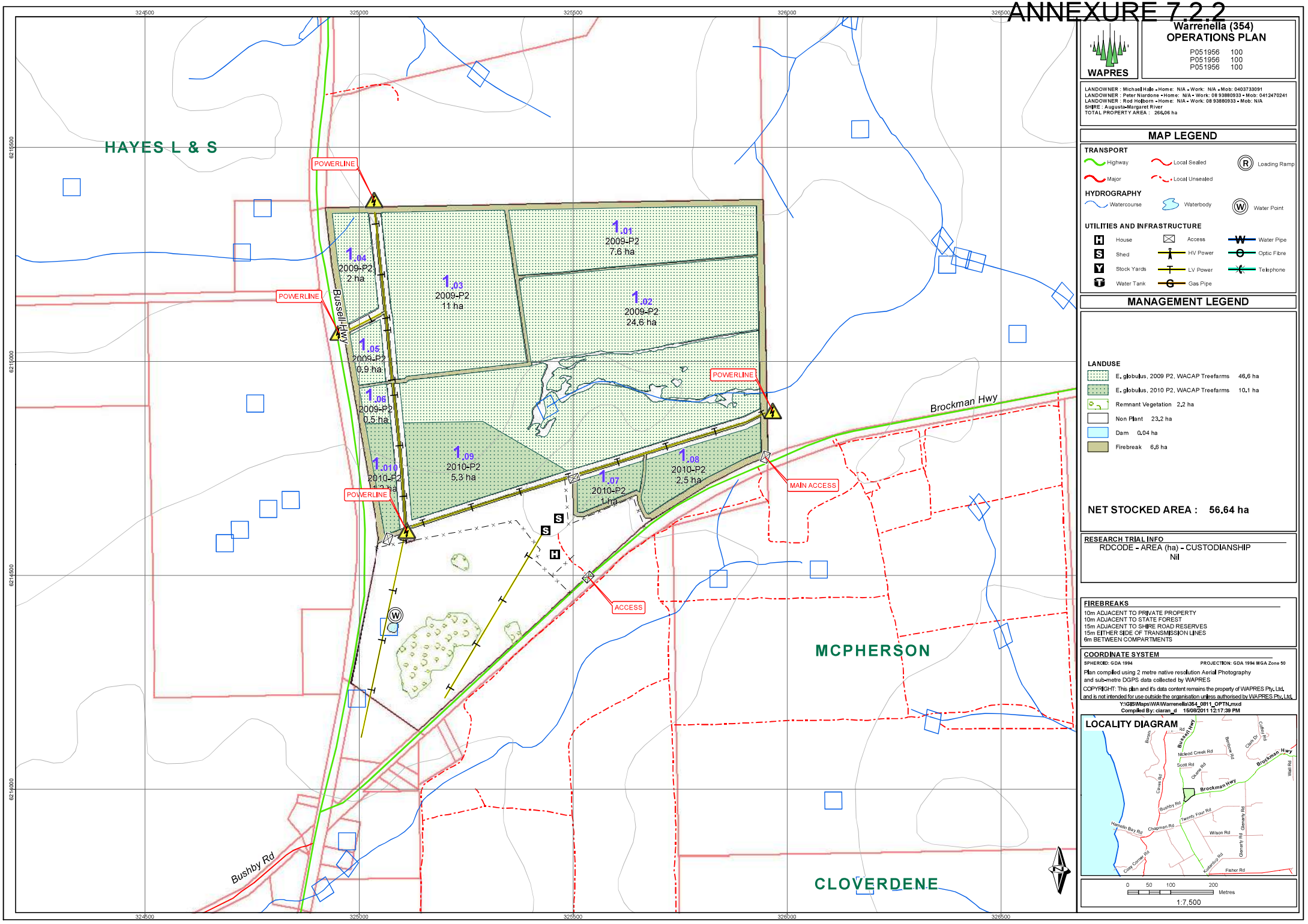
PLAN: JOB 012 006D
DATE: 140120
PROJECT: JOB 012
DESIGNED: MS

SCALE: 1:5000 @A3

0 50 100 150 200 metres

N

ANNEXURE 7.2.2



Warrenella (354)
OPERATIONS PLAN

P051956 100
P051956 100
P051956 100

WAPRES

LANDOWNER : Michael Hale - Home: N/A - Work: N/A - Mob: 0403733091
LANDOWNER : Peter Riordone - Home: N/A - Work: 08 93880933 - Mob: 0412470241
LANDOWNER : Rod Holborn - Home: N/A - Work: 08 93880933 - Mob: N/A
SHIRE : Augusta-Margaret River
TOTAL PROPERTY AREA : 266.06 ha

MAP LEGEND

TRANSPORT
Highway, Local Sealed, Loading Ramp, Major, Local Unsealed

HYDROGRAPHY
Watercourse, Waterbody, Water Point

UTILITIES AND INFRASTRUCTURE
House, Access, Water Pipe, Shed, HV Power, Optic Fibre, Stock Yards, LV Power, Telephone, Water Tank, Gas Pipe

MANAGEMENT LEGEND

LANDUSE

E. globulus, 2009 P2, WACAP Treefarms	46.6 ha
E. globulus, 2010 P2, WACAP Treefarms	10.1 ha
Remnant Vegetation	2.2 ha
Non Plant	23.2 ha
Dam	0.04 ha
Firebreak	6.6 ha

NET STOCKED AREA : 56.64 ha

RESEARCH TRIAL INFO
RDCODE - AREA (ha) - CUSTODIANSHIP
Nil

FIREBREAKS
10m ADJACENT TO PRIVATE PROPERTY
10m ADJACENT TO STATE FOREST
15m ADJACENT TO SHIRE ROAD RESERVES
15m EITHER SIDE OF TRANSMISSION LINES
6m BETWEEN COMPARTMENTS

COORDINATE SYSTEM
SPHEROID: GDA 1994 PROJECTION: GDA 1994 MGA Zone 50

Plan compiled using 2 metre native resolution Aerial Photography and sub-metre DGPS data collected by WAPRES

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Y:\GIS\Maps\WA\Warrenella\354_0811_OPTN.mxd
Compiled By: ciaran_d 15/08/2011 12:17:39 PM

LOCALITY DIAGRAM

0 50 100 200 Metres
1:7,500

WAPRES

FIRE PROTECTION MANAGEMENT POLICY

As owners and manager of a substantial investment in plantations and as a processor and exporter of large quantities of high quality woodchips WAPRES has a strong interest in ensuring that the plantations it manages remain free of damaging agents including fire. WAPRES and its predecessor Bunnings Treefarms have been leaders within the plantation industry in Western Australia in fire protection management and this is reflected in the minimal losses that have occurred since the first eucalypt plantation was established near Manjimup in 1980. To ensure that this excellent record is maintained WAPRES continues to place great emphasis on fire protection management and conforms to the Fire Protection Management Policy below.

- **DUTY ROSTER**

WAPRES will maintain a seven days a week, 24 hour a day duty roster throughout the fire season, coordinated by experienced Duty Officers. A dedicated telephone number will be maintained for duty officer contact and this number will be made available to all lessors, neighbours, local authorities, bushfire brigades and other relevant individuals and group. The Duty Officer is responsible for placing suppression crews and equipment on standby across WAPRES's entire operational area in accordance with Fire Weather Forecasts and fire activity.

- **EQUIPMENT**

WAPRES will strategically position its own fire suppression equipment throughout the operational area with much of the larger (heavy duty and medium duty) equipment being centrally located in Manjimup. The Duty Officer will in accordance with priorities manage the deployment of this equipment. All equipment must be regularly checked during the fire season (at least once per week) with a major annual maintenance program carried out prior to the commencement of each fire season.

- **TRAINING**

WAPRES will ensure that all personnel involved in fire control activities are trained to at least the minimum accredited level in accordance with the Australian Fire Authority National Standards.

- **FIREBREAKS**

WAPRES will install firebreaks in accordance with the relevant local authority firebreak orders with a minimum standard of 10 metres width for both internal and external firebreaks where the local authority requirements are less than this. It will also ensure that setbacks from powerlines conform to Western Power requirements. Firebreaks will receive a maintenance grade where required during the life of the plantation to minimise the potential for erosion and to ensure that trafficability for fire equipment is maintained.

- **MAPS**

WAPRES will produce detailed maps for all the plantations under its management showing as a minimum, the main access point, compartment boundaries, firebreaks, roads, water points, powerlines native bush and details of adjoining properties including names and contact details where possible. The maps are then to be distributed to the property owner, bushfire brigade, local authority and any other appropriate fire agency e.g. Conservation and Land Management (CALM).

- **WATER POINTS**

WAPRES will where required develop new or upgrade existing water points to ensure that water is always readily available for the refilling of fire units. Where this is impractical (generally on a small plantation) it will ensure that water is available within a 20 minute turn-around time outside the plantation. Water points will be monitored regularly throughout the life of a plantation to ensure that water levels remain adequate.

- **SIGNAGE**

WAPRES will signpost all plantations under its management with water point and general access signs to ensure safe access and egress. In particular it will ensure that signs are erected in areas where summer access is 4WD only, where steep slopes exist and where access is impossible past a certain point to ensure fire crews can retreat readily if required.

- **COMMUNICATIONS**

WAPRES will install VHF radios in all fire units allowing communication with all other fire suppression agencies including local authorities, bushfire brigades and CALM. WAPRES will also install mobile telephones in all key fire units to further improve communications capability.

- **BUSHFIRE BRIGADES**

WAPRES will join all active bushfire brigades servicing areas where plantations under its management are established and will pay the relevant subscription fees. Where possible a WAPRES employee will attend brigade meetings (as well as local authority fire advisory meetings), and where appropriate WAPRES will make donations to assist in the purchase of essential equipment or the construction of key facilities. Because in most cases WAPRES will rely on the bushfire brigades to provide the initial fire suppression capability in the event of a wildfire occurring on or near on of its plantation, it will make it clear to all relevant brigades that it is willing to assist in brigade prescribed burning activities and is available to carry out fire suppression activities in these brigade areas, even where fires are not directly threatening one of its plantations. Where WAPRES is notified of a wildfire in one of the relevant brigades areas and where assistance is requested, the duty office will authorise the appropriate equipment to be despatched if this equipment is not already committed.

- **INSURANCE**

WAPRES will maintain a comprehensive fire insurance cover for its own plantation estate.

- **FINANCIAL ASSISTANCE**

WAPRES will provide funding for the purchase of jointly owned strategic fire equipment where appropriate mechanisms have been put in place to ensure the contributions are equitable (e.g. Lower Great Southern Fire Advisory) and where WAPRES's own equipment is not located within approximately 45 minutes travel time.

4. FIRE SUPPRESSION RESOURCES SUMMARY

4 a. WAPRES

Manjimup

Manpower	10	Staff		
	8	Crew		
Equipment	1	Heavy duty unit (HDU)	4x4	3,600 litres
	2	Heavy duty unit	4x4	2,700 litres
	2	Light duty units (LDU)	4x4	700 litres
	2	Light duty units	4x4	450 litres

Albany

Manpower	1	Contractor		
Equipment	1	Light duty unit	4x4	450 litres

Bunbury

Manpower	4	Staff		
Equipment	2	Light duty units (LDU)	4 x 4	450 litres
	1	Light duty unit (LDU)	4 x 4	600 litres
	1	Medium duty unit (MDU)	4 x 4	1,200 litres

Cundinup

Equipment	1	Light duty unit 700 litres supplied to Brigade

Karridale

Equipment	1	450 litre LDU supplied to employee of WA Plantation Resources

Mount Barker

Manpower	1	Staff
Equipment	1	450 litre LDU on 4 x 4

Capel

Equipment	1	600 litre LDU supplied to employee of WA Plantation Resources

Collie

Manpower	1	Staff
Equipment	1	4 x 4 450 litre LDU
	2	Contractors
	2	4 x 4 450 litre LDU

4 b. WAPRES CONTRACTORS

DOUST	1 x 950 LOADER 1 x WATER TRUCK (12,000 LITRE)
PLANTATION LOGGING	GRADERS & LOADERS
AITKEN	930 LOADER
T & L DOZING	2x DOZERS & TRAINED OPERATORS LOW LOADER
AGROFORESTRY AUST	LOW LOADER, LIGHT DUTY FIRE UNITS & TRAINED OPERATORS
ALF BROOKES	DOZER
PETER MCDONALD	LOADER, GRADER & TRAINED OPERATORS
RIVERMOUTH HOLDINGS	DOZERS & TRAINED OPERATORS
SOUTH WEST FIRE UNITS	PERSONNEL, FIRE UNITS & TRAINED OPERATORS
SOUTH WEST HAULAGE	10 PERSONNEL – SKIDDERS & DOZERS LOADERS & LOWLOADER
WILSON TRANSPORT	6 PERSONNEL – SKIDDERS, LOADERS & LOW LOADER 2 x 4 x 4 900 LITRE FIRE UNITS

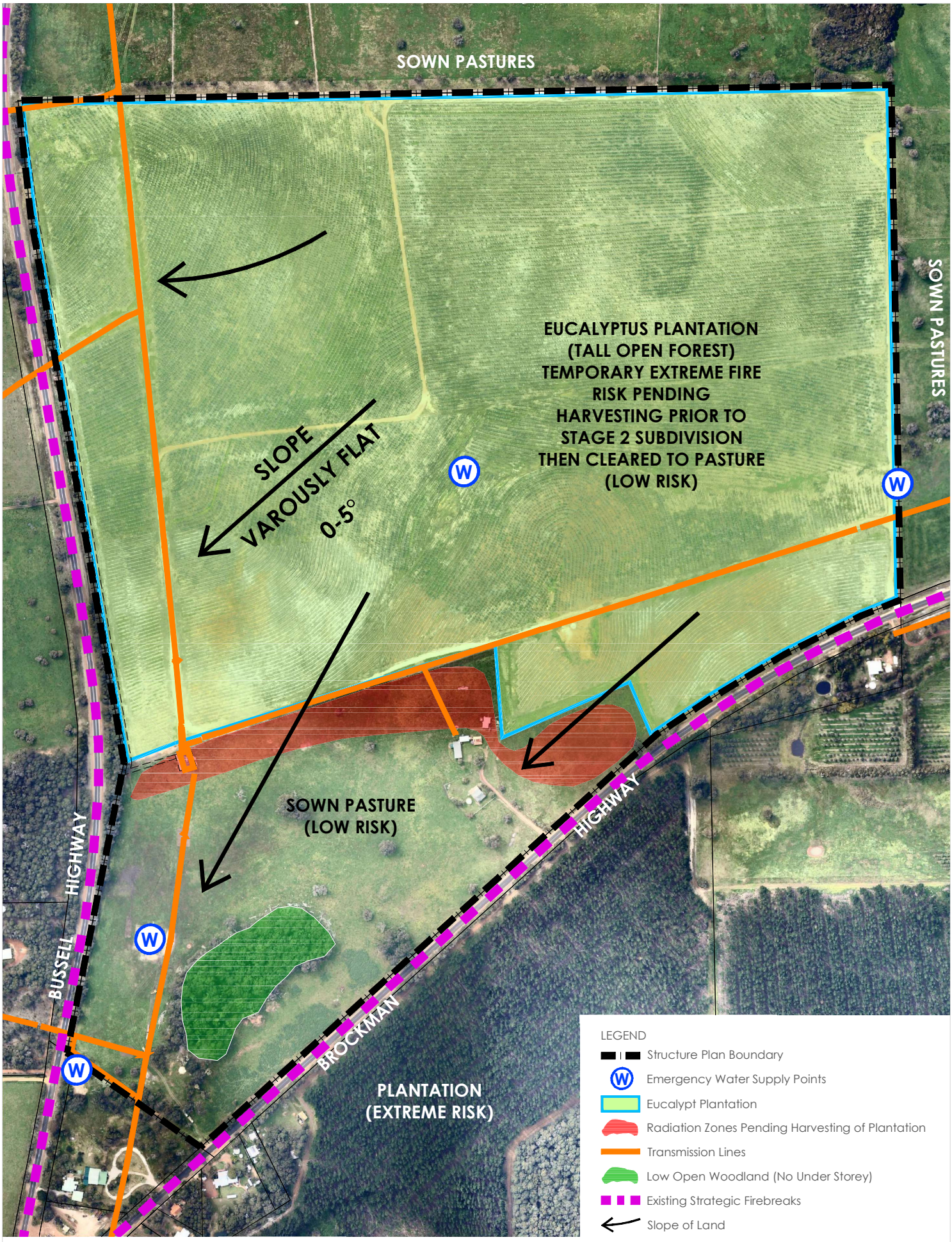
4 c. STRATEGIC EQUIPMENT

WAPRES has contributed funding to assist in provision of strategically located heavy duty fire equipment.

Heavy Duty Units (HDU) funded and in place.

1	4x4	HDU	2700 litres	MANYPEAKS
1	4X4	HDU	2700 litres	ROCKY GULLY
1	4X4	HDU	2700 litres	DENBARKER
1	4X4	HDU	2700 litres	NARRIKUP
1	4X4	HDU	2700 litres	FRANKLAND
1	4X4	HDU	2700 litres	UNICUP/BROKERUP
1	4X4	HDU	2700 litres	WELSTEAD
1	4X4	LDU	600 litres	CARMARTHEN
1	4X4	HDU	2700 litres	MIDDLEWARD

ANNEXURE 7.2.3



BUSHFIRE RISK ASSESSMENT PLAN

Lot 100 Brockman Highway, Karridale

Shire of Augusta - Margaret River

0m 100m 200m

Scale 1:4000 @ A3

SCALE 1:4000 @ A3

JOB 012 007A Date - 22.03.2013

N

michaelSWIFT & associates , town planners

SHIRE of AUGUSTA
MARGARET RIVER

FIRST AND FINAL NOTICE IS HEREBY SERVED TO ALL RESIDENTS AND RATEPAYERS.

Fuel Hazard Reduction & Firebreak Notice 2013-2014

If you own land in this Shire the contents of this Notice apply to you.

Failure to comply with this Notice may result in a $5000 fine.

This notice and information takes effect from 9 November 2013.
All previous Notices are hereby cancelled.
By order of G Evershed CEO

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IMPORTANT DATES*

***Dates are subject to change.** To confirm restriction dates prior to burning contact the Shire of Augusta-Margaret River. Contacts details are listed at the back of the Notice.*

	9 November 2013*	Restricted burning period commences. A Permit is required to burn.
	9 November 2013	Last day to submit an application for variation.
MAINTENANCE PERIOD**	22 November 2013*	Residential firebreak installation and fuel hazard reduction must be completed.
	22 December 2013*	Prohibited burning period commences.
	22 December 2013*	Rural, rural residential, lots over 4000sqm, vineyards and plantations — firebreak installation and fuel hazard reduction must be completed.
	28 February 2014*	Last day of prohibited period.
	1 March 2014*	Restricted burning period commences. You need to request a burning permit if you wish to burn.
	12 May 2014*	Restricted burning period finishes.
	13 May 2014*	No burning restrictions. Permits not required.

***Maintenance period: During this time all properties must be maintained and be compliant as per this notice.*

It is the landowners responsibility to ensure the property is compliant throughout the maintenance period. Failure to do so may result in a on-the-spot fine of $250.

Please Read Carefully

These are your legal requirements

BUSHFIRES ACT 1954 (as amended)
SHIRE OF AUGUSTA-MARGARET RIVER

You are hereby required, and are therefore ordered by the local government as a property owner to comply with this Notice and/or an approved Fire Management Plan (FMP) by 22 November (Residential) or 22 December (Rural/Rural Residential/Lots Over 4000sqm/Vineyards/Plantations) each year and maintain compliance until midnight 12 May the following year. These requirements are defined further in this Notice within your relevant area (Pages 11-18).

Pursuant to the powers contained in section 33 of the Bush Fires Act 1954 (as amended) you are hereby required on or before 22 November (Residential) or 22 December (Rural/Rural Residential/ Lots Over 4000sqm/Vineyards/Plantations) to remove from your land, whether owned or occupied by you, all flammable material, to install unobstructed mineral earth firebreaks, if required, that can be trafficable. Thereafter, maintain the land up to and including 12 May, in such positions/dimensions as specified within the Notice, or approved in writing by Council or its authorised officers.

Landowners should note that restrictions exist on clearing native vegetation under other legislation. Clearing should be limited to the extent necessary to comply with the Notice.

FAILURE TO COMPLY MAY RESULT IN A $5000 FINE.

FIREBREAK INSTALLATION GUIDE

The purpose of this guide is to give an understanding of the principal locations of firebreaks on properties. Council acknowledges that not all properties are the same and has introduced a variation to firebreak system. This allows property owners to apply for a variation to manage their properties reasonably within the environment they live in, in accordance with the Notice.

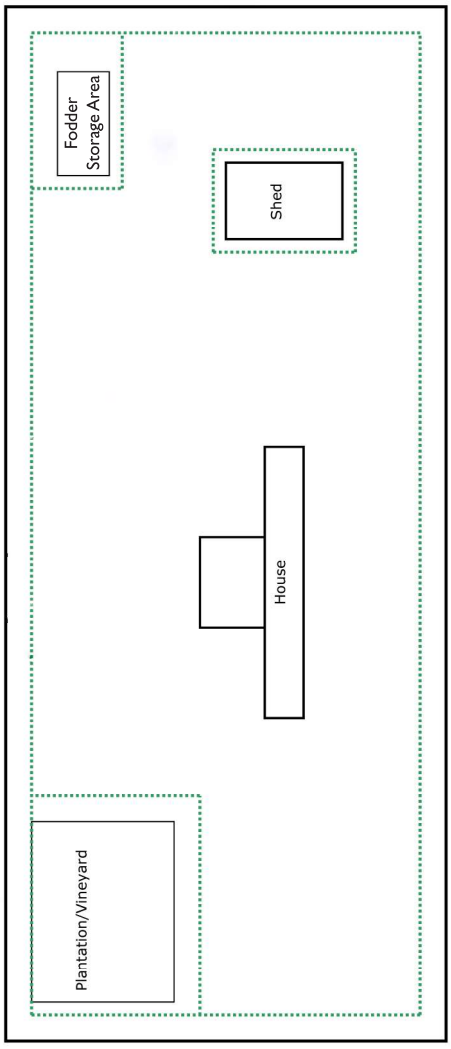
As a guide the picture below gives an indication of where firebreaks should be installed to meet the requirements of the Notice.

The picture below gives an indication of where firebreaks should be installed to meet the requirements of the Council Firebreak Notice.

Firebreak Line

Buildings and Boundaries

Please note distances may vary according to your legal requirements.



The installation of a firebreak is only one element of the fire prevention picture. Firebreaks are required to be installed and maintained as per the important dates on Page 2 each and every year. In some cases **firebreaks may have to be reinstalled several times in one year.**

It is the property owner, not the contractor, that is responsible for the standard and quality of the firebreaks.

The installation of firebreaks need to be in harmony with total fire prevention activities of which some are highlighted below.

Maintenance of firebreak, accesses and vegetation:

Once your firebreaks, accesses and vegetation have been managed to meet your legal requirements of the Notice please ensure that these conditions are maintained all the way through until 12 May the following year.
It is normal for regrowth to occur between November and May, so keep mineral earth firebreaks and accesses free from obstructions such as fallen tree limbs and ensure vegetation is maintained to appropriate levels.

Effective firebreaks: Firebreaks are there to provide safe access on your property for firefighters.

Firefighters need to be able to use the firebreak as a place of safety for themselves and their vehicles where the fire will not travel under their vehicles or underfoot.
On days of strong winds or extreme conditions it is fully accepted that a 2 metre firebreak will be unlikely to stop a wildfire. The more fire prevention work you undertake, the greater the chance of your family and property surviving the impacts of fire.

FUEL AND HAZARD REDUCTION

Reduction of fuels does not have to be as drastic as removing all vegetation. Environmentally this would be disastrous and often trees and plants can provide you with some bushfire protection from strong winds, intense heat and flying embers.

The Shire, in recognising our responsibility to the biodiversity of our region, can provide information on fuel reduction without degrading the environment. For more information on hazard reduction, including suggested timing, see Page 20 and the Fire and Biodiversity Guidelines produced by the Shire's Environmental Health Officer.

Methods of hazard reduction:

- Hazard reduction burning;
- Hand clearing;
- Mechanical clearing;
- Chemical spraying (should be undertaken June – September)

HAZARD REDUCTION BURN

Raking or manual removal of fine fuels: remove fuels such as fallen leaves, twigs and bark on a regular basis.

Mowing grass: keep grass short, green and well watered.

Ploughing and grading: these methods can produce effective firebreaks, however they need constant maintenance. Loose soil may erode in steep areas, particularly where there is high rainfall and strong winds.

Slashing and mulching: this is an economical method of fuel reduction. To be effective, the cut material must either be removed, be no greater than 5cm in depth or allowed to rot before summer starts. Slashing and mowing may leave grass in rows, increasing fuel loading in some places. Mulching or mowing, also mulches the vegetation leaving the fuel where it is cut, potentially creating a further hazard if greater than 5cm.

Environmental considerations

Please note that while land clearing and fuel modification undertaken in accordance with the Notice is generally exempt from the need to obtain further approval to undertake these works, the following is also relevant:

Clearing to reduce fuel loads reduces risk and lessens construction standards for new dwellings. Planning approval may be required when clearing is greater than what is stated in the Notice.

The Shire should be contacted to discuss clearing associated with new dwellings or when clearing is greater than what is required by the Notice.

Clearing permits under the Environmental Protection (Land Clearing) Regulations are not required for any fuel modification that is directed by the Notice, unless the vegetation is within an Environmentally Sensitive Area prescribed under that legislation.

Details can be viewed at:

www.der.wa.gov.au/your-environment/native-vegetation

Guidelines on these exemptions are available at:

www.der.wa.gov.au/your-environment/native-vegetation
or by contacting the Department of Environmental Regulation on 6467 5000.

DEFINITIONS

Firebreak: Means a strip of land that has been cleared of all trees, bushes, grasses and any other object or thing or flammable material leaving clear bare mineral earth 2 metres wide and 4 metres vertical clearance. This includes the trimming back of all overhanging trees, bushes, shrubs and any other object or thing over the firebreak area.

NON-COMPLIANT FIREBREAK

COMPLIANT FIREBREAK

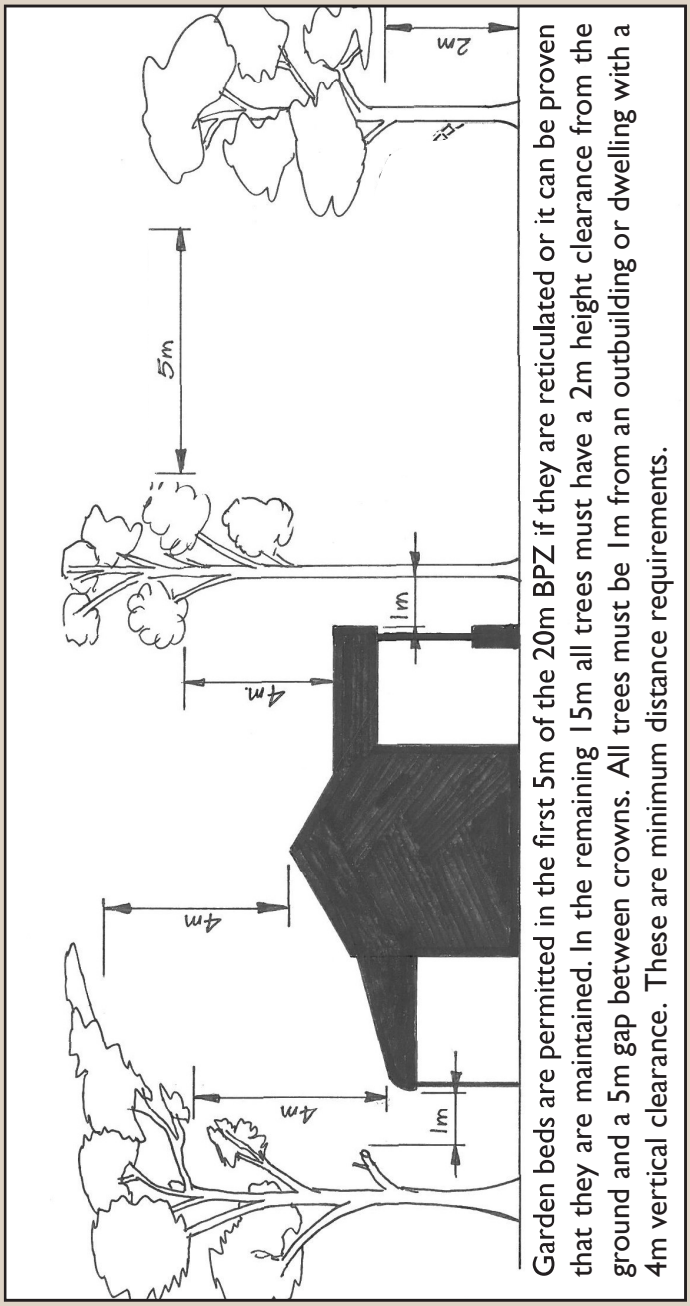
Trafficable: Means to be able to travel from one point to another in a 4x4 fire vehicle on a firm and stable surface, unhindered and without any obstruction that may endanger resources. No firebreak is to terminate without provision for egress to a safe place or a cleared turn around area of not less than a 19 metre radius.

Ungrazed pastureland: Where stock does not maintain the length of grass to 10cm or less.

Hazardous/Flammable: Means any bush, plant, tree, grasses, vegetable matter, substance, object, thing or material that may or is likely to catch fire and burn. Excludes living plants and trees.

Hazard separation zone: A hazard separation zone must be provided between extreme bush fire hazards and buildings to create a minimum separation distance of up to 100 metres if land is available between the buildings and the hazard in order to protect them from burning debris (spotting, airborne embers), radiant heat and direct flame contact.

Building Protection Zone (BPZ): A Building Protection Zone is a low fuel area immediately surrounding a dwelling/ outbuilding and is designed to minimise the likelihood of flame contact with buildings. Building Protection Zones must be a minimum of 20 metres on flat land with the zone increasing as the slope increases.



Garden beds are permitted in the first 5m of the 20m BPZ if they are reticulated or it can be proven that they are maintained. In the remaining 15m all trees must have a 2m height clearance from the ground and a 5m gap between crowns. All trees must be 1m from an outbuilding or dwelling with a 4m vertical clearance. These are minimum distance requirements.

Leaf litter: This is an accumulation of leaves on the ground. As a gauge scrap your foot along the ground. If mineral earth is exposed you most likely have compliant leaf litter. If your foot cannot be seen through the leaves you have excessive leaf litter.

NON-COMPLIANT
LEAF LITTER
5cm or greater in depth

COMPLIANT
LEAF LITTER
Less than 5cm in depth

Plantations: Any area of planted pines of eucalyptus species exceeding 3 hectares.

Ground fuels: This means anything on the ground that is not living such as logs, fallen trees, branches, sticks, twigs and leaves.

COMPLIANT GROUND FUEL
Less than 5cm in depth

The townsites of: Augusta, Margaret River, Witchcliffe, Rosabrook and Cowaramup.

YOUR LEGAL REQUIREMENTS ARE:

Compliance Date: 22 November through to 12 May inclusive.

Compliance	Compliance requirements
Fuel Reduction	Where your land is under 4000 square metres: All hazardous material is to be removed from the land excluding living plants and trees.
Vacant land – Cleared blocks	Where you have a vacant block that has been cleared: Grasses are to be slashed, mowed or by other means, maintained below 10cm.
Vacant land – Timbered or Bush Block	Where you have a vacant block that is timbered or bush: Hazardous material is to be removed from the land excluding living plants and trees. This includes dead branches, trees, leaf litter, twigs and bark to an acceptable standard.
Garden refuse and or wood stacks/ piles	1 metre firebreak is required around all piles of garden refuse and or wood.
Dwellings and outbuildings	Gutters to be free of excessive twigs, leaves, grass, etc.

Please note: If your block is 4000 sqm or greater, please refer to Page 13.

The townsites of: Gnarabup, Prevelly and Light Industrial.

YOUR LEGAL REQUIREMENTS ARE:

Compliance Date: 22 November through to 12 May inclusive.

Compliance	Compliance requirements
Clearance around Dwellings and Outbuildings (Example Page 9)	1 metre firebreak around all dwellings and outbuildings. These include, sheds, garages, water tanks, storage containers etc. Garden beds are allowed within this area if they are reticulated and maintained.
Building Protection Zone – 20 metres from all dwellings	Hazardous material is to be removed excluding living plants and trees. This includes dead branches, trees, leaf litter, twigs and bark to no more than 5cm in depth. The first 5 metres from the dwelling shall be free from garden beds, shrubs, plants and grasses unless they can be demonstrated to be reticulated and/or regularly maintained. Refer to BPZ on Page 9.
Vacant land – Cleared blocks	Where you have a vacant block that has been cleared: Grasses are to be slashed, mowed or by other means, maintained below 10cm.
Vacant land – Timbered or Bush Block	Where you have a vacant block that is timbered or bush: Hazardous material is to be removed from the land excluding living plants and trees. This includes dead branches, trees, leaf litter, twigs and bark as required. See Page 8.
Garden refuse, ground fuels and/or wood	2 metre firebreak is required around all piles of garden refuse and or wood.
Mineral Earth Firebreaks	2 metre wide firebreak on all boundaries where land is vacant. Slashed firebreaks (not mineral earth) will be accepted for the 2013-2014 Notice only.

The townsites of: Gracetown, Parkwater, and Ironstone.

YOUR LEGAL REQUIREMENTS ARE:

Compliance Date: 22 November through to 12 May inclusive.

Compliance	Compliance requirements
All subdivisions with Fire Management Plans and/or variations to the Notice	Properties to comply with Fire Management Plans, approved variations and the Notice.
Clearance around Dwellings and Outbuildings (Example Page 9)	1 metre firebreak around all dwellings and outbuildings. These include sheds, garages, water tanks, storage containers etc. Garden beds are allowed within this area if they are reticulated and maintained.
Building Protection Zone – 20 metres from all dwellings	Hazardous material is to be removed excluding living plants and trees. This includes dead branches, trees, leaf litter, twigs and bark to no more than 5cm in depth. The first 5 metres from the dwelling shall be free from garden beds, shrubs, plants and grasses unless they can be demonstrated to be reticulated and/or regularly maintained. Refer to BPZ on Page 9.
Vacant land – Cleared blocks	Where you have a vacant block that has been cleared: Grasses are to be slashed, mowed or by other means, maintained below 10cm.
Vacant land – Timbered or Bush Block	Where you have a vacant block that is timbered or bush: Hazardous material is to be removed from the land excluding living plants and trees. This includes dead branches, trees, leaf litter, twigs and bark as required. See Page 8.
Garden refuse, ground fuels and/or wood	A 2 metre firebreak is required around all piles of garden refuse and or wood.

The townsite of: Molloy Island

YOUR LEGAL REQUIREMENTS ARE:

Compliance Date: 22 November through to 12 May inclusive each and every year.

Compliance	Compliance requirements
Clearance around Dwellings and Outbuildings (Example Page 9)	1 metre firebreak around all dwellings and outbuildings. These include sheds, garages, water tanks, storage containers etc. Please note this includes overhanging branches and or trees. Garden beds are allowed within this area if they are reticulated and maintained.
Building Protection Zone – 20 metres from all dwellings	Hazardous material is to be removed excluding living plants and trees. This includes dead branches, trees, leaf litter, twigs and bark to no more than 5cm in depth. The first 5 metres from the dwelling shall be free from garden beds, shrubs, plants and grasses unless they can be demonstrated to be reticulated and/or regularly maintained. Refer to BPZ on Page 9.
Vacant land – Timbered or Bush Block	Where you have a vacant block that is timbered or bush: Hazardous material is to be removed from the land excluding living plants and trees. This includes dead branches, trees, leaf litter, twigs and bark to an acceptable standard. Grasses are to be slashed, mowed or by other means, maintained below 10cm.
Garden refuse, ground fuels and/or wood	A 2 metre firebreak is required around all piles of garden refuse and or wood.

East Augusta, Rural Residential and all Residential lots 4000sqm or greater.

YOUR LEGAL REQUIREMENTS ARE:

Compliance Date: 22 December through to 12 May inclusive.

Compliance	Compliance requirements
All subdivisions with Fire Management Plans and/or variations to the Notice	Properties to comply with Fire Management Plans, approved variations and the Notice.
Mineral Earth Firebreaks	Minimum 2 metre firebreak immediately inside all boundaries (can be extended to within 6 metres of a boundary) or as stated in your approved Fire Management Plan.
Clearance around Dwellings and Outbuildings (Example Page 9)	1 metre firebreak around all dwellings and outbuildings. These include sheds, garages, water tanks, storage containers etc. Garden beds are allowed within this area if they are reticulated and maintained.
Building Protection Zone – 20 metres from all dwellings	Hazardous material is to be removed excluding living plants and trees. This includes dead branches, trees, leaf litter, twigs and bark to no more than 5cm in depth. The first 5 metres from the dwelling shall be free from garden beds, shrubs, plants and grasses unless they can be demonstrated to be reticulated and/or regularly maintained. Refer to BPZ on Page 9.
Hazard Separation Zone	Ground fuels (less than 5cm in depth) up to a distance of 100 metres between the buildings and the hazard if land is available.
Ungrazed Pastureland	To be slashed or mowed and maintained to 10cm or less.
Garden refuse, ground fuels and/or wood	A 2 metre firebreak is required around all piles of garden refuse and or wood.
Fuel and fodder storage areas	2 metre firebreak immediately around fuel storage tanks or gas cylinders. 2 metre firebreak no closer than 6 metres around fodder.

Rural

YOUR LEGAL REQUIREMENTS ARE:

Compliance Date: 22 December through to 12 May inclusive.

Compliance	Compliance requirements
All subdivisions with Fire Management Plans and/or variations to the Notice	Properties to comply with Fire Management Plans, approved variations and the Notice.
Clearance around Dwellings and Outbuildings (Example Page 9)	1 metre firebreak around all dwellings and outbuildings. These include sheds, garages, water tanks, storage containers etc. Garden beds are allowed within this area if they are reticulated and maintained.
Building Protection Zone – 20 metres from all dwellings	Hazardous material is to be removed excluding living plants and trees. This includes dead branches, trees, leaf litter, twigs and bark to no more than 5cm in depth. The first 5 metres from the dwelling shall be free from garden beds, shrubs, plants and grasses unless they can be demonstrated to be reticulated and/or regularly maintained. Refer to BPZ on Page 9.
Hazard Separation Zone	Low fuel area (up to 5cm in depth) up to a distance of 100 metres between the buildings and the hazard if land is available.
Ungrazed Pastureland	Where pastureland is not maintained to 10cm or less, a 15 metre slashed firebreak is required immediately inside the mineral earth firebreak.
Garden refuse, ground fuels and/or wood	2 metre firebreak is required around all piles of garden refuse and or wood.
Mineral Earth Firebreaks	Minimum 2 metre firebreak within 100 metres of a boundary abutting a road reserve.
Fuel and fodder storage areas	2 metre firebreak immediately around fuel storage tanks or gas cylinders. 2 metre firebreak no closer than 6 metres around fodder.

Vineyards (including Vineyard Tourist Chalets)

YOUR LEGAL REQUIREMENTS ARE:

Compliance Date: 22 December through to 12 May inclusive.

Compliance	Compliance requirements
All subdivisions with Fire Management Plans and/or variations to the Notice	Properties to comply with Fire Management Plans, approved variations and the Notice.
Clearance around Dwellings and Outbuildings (Example Page 9)	1 metre firebreak around all dwellings and outbuildings. These include, sheds, garages, water tanks, storage containers etc. Garden beds are allowed within this area if they are reticulated and maintained.
Building Protection Zone – 20 metres from all dwellings	Hazardous material is to be removed excluding living plants and trees. This includes dead branches, trees, leaf litter, twigs and bark to no more than 5cm in depth. The first 5 metres from the dwelling shall be free from garden beds, shrubs, plants and grasses unless they can be demonstrated to be reticulated and/or regularly maintained. Refer to BPZ on Page 9.
Hazard Separation Zone	Low fuel area (up to 5cm in depth) up to a distance of 100 metres between the buildings and the hazard if land is available.
Mineral earth firebreak	5 metre wide firebreak around vineyards. Each cell or block is required to have its own firebreak. 2 metre firebreak within 100 metres of a boundary abutting a road reserve.
Garden refuse, ground fuels and/or wood	2 metre firebreak is required around all piles of garden refuse and or wood.

Plantations

YOUR LEGAL REQUIREMENTS ARE:

Compliance Date: 22 December through to 12 May inclusive.

Compliance	Compliance requirements
All subdivisions with Fire Management Plans and/or variations to the Notice	Properties to comply with Fire Management Plans, approved variations and the Notice.
Clearance around Dwellings and Outbuildings (Example Page 9)	1 metre firebreak around all dwellings and outbuildings. These include, sheds, garages, water tanks, storage containers etc. Garden beds are allowed within this area if they are reticulated and maintained.
Building Protection Zone – 20 metres from all dwellings	Hazardous material is to be removed excluding living plants and trees. This includes dead branches, trees, leaf litter, twigs and bark to no more than 5cm in depth. The first 5 metres from the dwelling shall be free from garden beds, shrubs, plants and grasses unless they can be demonstrated to be reticulated and/or regularly maintained. Refer to BPZ on Page 9.
Hazard Separation Zone	Low fuel area (up to 5cm in depth) up to a distance of 100 metres between the buildings and the hazard if land is available.
Mineral earth firebreak (plantings)	10 metre wide mineral earth firebreak around plantations. At least 5 metres of this must be trafficable. Each cell or block is required to have its own mineral earth firebreak.
Garden refuse, ground fuels and/ or wood	2 metre firebreak is required around all piles of garden refuse and or wood.

BURNING INFORMATION

Please note: On any day during the restricted burning period where the fire danger rating is **Catastrophic, Severe, Extreme** and **Very High,** garden refuse, wood, solid fuel barbecues or Webbers are **NOT** permitted to be used under any circumstances. Permits are automatically cancelled on these days. Due to unseasonable weather conditions these dates may be extended or shortened.

You must check the local newspaper, call the Shire on 9780 5255 or visit www.amrshire.wa.gov.au for further information. The fire danger rating can be found by calling the weather information line 1196.

WHAT CAN I BE FINED IF I DON'T COMPLY?

Property requirements non-compliant on first inspection	$250
Property requirements non-compliant on second inspection	$250 + cost of works if contractor engaged
Property requirements non-compliant on third inspection	$250 + cost of works when contractor engaged
Burning during prohibited times	$250
Failure to produce a Permit To Burn	$100
Failure to extinguish a bush fire	$100
Burning garden refuse during limited burning times	$250
Refusal to state name and abode or stating false name or abode	$100

The fines above are a modified penalty issued by the local government and are 10% of the maximum penalty that would apply should the matter proceed to court.

FIRE PERMITS

Before you call a Fire Control Officer ensure you have the following information

- Ensure you give 72 hours notice to the Fire Control Officer;
- Notify your neighbours 72 hours prior to commencing your burn.
- Who will be the three able-bodied people in attendance at all times?
- What is the address of the property?
- What fire-fighting equipment and resources will you have and is it in good working order?
- What is the size of the burn to take place?
- What material are you burning?

For more information contact the Shire on 9780 5255.

HAZARD REDUCTION PROGRAM

Autumn to Winter (May – August)

- Tree pruning – remove lower branches, check that power lines are clear. Use a professional contractor;
- Reduce fuel levels around the house, clear long grass, leaves, twigs and flammable shrubs;
- Ensure petrol and other flammables are safely stored away from the main dwelling;
- Make sure your fire-fighting equipment is in good working order and serviced when required;
- Accommodation providers must make sure all guests are aware of emergency plan, including evacuation routes.

Spring (September – November)

- Move wood piles and stack timber away from the main dwelling;
- Keep grass short;
- Install firebreaks in accordance with the Notice, your approved variation to this Notice or your approved Fire Management Plan.

Summer (November – May)

- Water lawns, trees and shrubs near buildings to keep green;
- Recheck fire-fighting equipment, screens, water supplies and that gutters remain clear.

Long term precautions

- Ensure firebreaks are prepared in accordance with the Notice or any submitted and approved variation to this Notice or Fire Management Plan endorsed by Council;
- Ensure that the planting of windbreaks or trees is in accordance with this Notice and will not be detrimental to fire suppression requirements in years to come;
- Make sure that buildings are safe – fit wire fly screens and shutters, fill gaps into roof/wall spaces, fit fire screens to evaporative air conditioners and have them operable to provide a water supply;
- Give consideration to installing external building sprinkler systems and back up power for emergencies;
- Ensure that access to emergency water supplies has the correct fittings, is unobstructed and trafficable;
- Get basic training in fire-fighting from your local bushfire brigade or even join your local brigade;
- Join or start a Bushfire Ready Group (BRG).

VARIATION GUIDELINES

The following guidelines are acceptable categories for which a variation to firebreak may be applied for:

1. The topography makes the normal placement of a firebreak impracticable or dangerous and alternative firebreak emergency access and fire prevention methods that meet the intention of the Notice is provided and demonstrated.
2. The topography/composition makes the normal methods of construction impracticable (cap stone, rocky or water logged) and alternative firebreak emergency access and fire prevention methods that meet the intention of the Notice is provided and demonstrated.
3. An approved Fire Management Plan for the property is in place and being conformed to and meets the intention of the Notice.
4. The firebreak variation only applies to a portion of the property that is reticulated lawn that is kept green and it can be demonstrated that it is maintained regularly to less than 10cm as per important dates on Page 2.
5. The variation only applies to the portion of the property that has reticulated garden beds, lawns, orchards or other accepted sustained cultivation. Unless it is deemed by Council or its authorised officer that the fuel type/loadings are a hazard.
6. Cleared access provided to enable emergency vehicular access to buildings and outbuildings and all parts of the property in accordance with the Notice.
7. Firebreaks are provided in agreed alternative locations to negate natural obstructions.
8. Constructed driveways may where authorised substitute for firebreaks as long as it remains trafficable for the firebreak as a whole and is maintained clear of all flammable materials at all times in accordance with the Notice.
9. Where clearing for fire management is likely to impact vegetation within creekline riparian areas. These areas are recognised as Landscape Protection Areas in the Local Planning Scheme No.1 and include a 20 metre protection zone around watercourses.
10. Where clearing is likely to impact upon areas of Declared Rare Flora, Threatened Ecological Communities or Environmentally Sensitive Areas as defined under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004.

All requests must be made by the property owner or person authorised to act upon the owners behalf. Individual requests are required for each property and must be submitted on the approved document/application form by 9 November. Please note variation approvals only carry over into future fire seasons if confirmed in writing by the Shire.

The authorising officer has the right to grant, refuse, alter or add any conditions to an application, where alterations or additions are applicable. Failure to comply within the time frames provided by the authorised officer will result in the refusal of the application and prosecution as if a firebreak/hazard reduction works had not been installed/ conducted in accordance with the Notice.

Where refusal of an application takes place the owner has fourteen (14) days in which to conform to the normal requirements of the Notice.

Please note: You must have your variation in place and operational as per important dates on Page 2. It is your responsibility to demonstrate that the variation will be maintained for the entire restricted and prohibited burning times. Failure to demonstrate compliance and the ability to maintain the alternative solutions approved with in the variation will automatically require total compliance with the Notice

ADDITIONAL INFORMATION

Emergency access ways: These are for Emergency Services vehicles only and are not to be considered as a firebreak or escape route.

Trees - live/standing trees: Council does not expect you to remove large trees from or adjacent to boundaries so as to install the firebreak. The firebreak can simply detour around the tree/trees so as to afford safe access. This procedure does not require a variation to firebreak order as long as the normal dimensions of the firebreak exist.

Roads, verges, bridle paths, footpaths, dual use access ways and reserves: None of the above can be classified as a firebreak for your property. Firebreaks must be on your own property to conform to the Notice. However, any additional fire prevention activities on verges etc, can be completed on application to Council in writing and approval received. Removal of indigenous and substantive trees/vegetation requires Council approval.

APPLICATION FOR VARIATION TO THE FUEL HAZARD REDUCTION & FIREBREAK NOTICE

Bush Fires Act 1954 (as amended)

Land Owner Details	
Surname	
Other Names	
Postal Address	
Property Address	
Phone Number	

Hereby make application to vary the requirements of the Shire of Augusta-Margaret River Fuel Hazard Reduction & Firebreak Notice 2013-2014, as follows:

If additional space is required please attach separately.

Sign: Date:

(Applicant)

OFFICE USE ONLY:

Variation approved for: ☐ 1 year ☐ 4 years

Sign: Date:

(Area FCO)

Sign: Date:

(Shire Ranger)

FIRE CONTROL OFFICERS

To obtain a Permit to Burn you must contact your area Fire Control Officer (FCO) as listed below.

Alexandra Bridge	Ray Gilchirst	0428 182 285
Augusta Townsite	Rangers	0419 902 540
Burnside	Tim Garstone	0428 555 292
Cowaramup Townsite	Ian Earl	0418 932 847
East Augusta	Peter Brindley	0439 869 680
Forest Grove	Nick Dornan	0438 661 913
Gracetown	Peter Delfs	9755 5491
Hamelin Bay	Simon Hanson	0428 147 001
Karridale	John Teahan	0409 082 769
Kilcarnup	Rod Dilkes	0428 321 865
Kudardup	Brendan Jordan	0419 905 285
Margaret River Townsite	Leith Jones	0417 960 514
Miamup	Billy Pascoe	0405 965 447
Molloy Island	John Matten	0427 440 620
Osmington	Keith Scott	0407 880 877
Prevelly	Greg West	0418 937 191
Rapids	Dave Kelly	0428 387 286
Rosa Brook	Nathan Bailey	0400 215 850
Rosa Glen	Nathan Bailey	0400 215 850
Treeton	Geoff Jenkins	0407 776 920
Wirring	Shane Ablett	0438 931 613
Witchcliffe East	Damon Gherardi	0428 666 656
Witchcliffe West	Diane Holland	0427 930 735

TO REPORT ANY FIRE

DIAL 000

DON'T DELAY

BURN PERIOD*

PENALTIES APPLY FOR NON-COMPLIANCE WITH BURNING CONDITIONS

CONDITION	*START (12.01am)*	*END (Midnight)*
RESTRICTED	9 November	21 December
PROHIBITED	22 December	28 February
RESTRICTED	1 March	12 May

**All dates are subject to change. Contact the Shire*

What do I want to burn and when can I burn it?

Grass, paddock, land, bonfire, bush	Wood/solid fuelled BBQ, pizza oven for cooking purposes only	Garden refuse one cubic metre 6pm-11pm ONLY	Gas fuelled cooker, pizza oven or BBQ
Do I need a permit to burn? YES Contact your area FCO.	**Do I need a permit to burn?** NO between 6pm and 11pm YES outside of the hours 6pm and 11pm.	**Do I need a permit to burn?** NO You must have one person in attendance at all times and the fire must be completely extinguished by midnight of the same day. A courtesy call to your area FCO is appreciated.	**Do I need a permit to burn?** NO You are permitted to use gas only fuelled food cooking appliances without a permit.
If the fire danger rating is VERY HIGH or above NO fires/burning permitted. All permits are suspended during this time.			
BURNING IS PROHIBITED **NO PERMITS WILL BE ISSUED** **PENALTIES WILL APPLY FOR BURNING**			You are permitted to use gas only fuelled food cooking appliances without a permit.
If the fire danger rating is VERY HIGH or above NO fires/burning permitted. All permits are suspended during this time.			
Do I need a permit to burn? YES Contact your area FCO.	**Do I need a permit to burn?** NO between 6pm and 11pm YES outside of the hours 6pm and 11pm.	**Do I need a permit to burn?** NO You must have one person in attendance at all times and the fire must be completely extinguished by midnight of the same day. A courtesy call to your area FCO is appreciated.	**Do I need a permit to burn?** NO You are permitted to use gas only fuelled food cooking appliances without a permit.

or your FCO (Fire Control Officer) before commencing burning.

TAKE ACTION NOW

Are you and your family at risk? You need to think about the bushfire risk to your family and home:

- Do you live in or near bush?
- Does your local area have a bushfire history?
- Do you have trees and shrubs within 20 metres of your house?
- Is your house built on a slope?
- Is your bushfire survival plan more than 1 year old?

If you answered yes to one or more of these questions then bushfire Is a real risk for you and your family.

When developing your bushfire survival plan, you and your family need to think about:

- What are your triggers to leave?
- If you plan to leave for a safer place where will you go and how will you get there?
- Know where you will go and never "wait and see". Relocating at the last minute can be deadly.
- Does your household include elderly relatives, young children, people with disabilities or illness?
- Do you need to consider anyone else in your plan? Think about housemates, neighbours or friends that will need to help or that you may need to help you.
- What will you do with your pets and livestock?
- Can your home be defended? Is it in a location that makes it difficult or dangerous to actively defend?
- Will your home provide shelter if you have to or decide to stay?
- Are you capable of defending your home without the support of fire fighters?
- Do you have the skills, knowledge, resources and capacity to check for and put out spot fires for up to 10 hours after the fire front has passed?
- Do you have the right equipment and resources to actively defend?
- Will you cope with the noise and stress of a bushfire if you decide to actively defend?
- Being in a bushfire may be the most traumatic experience of your life.

PUT YOUR PLAN IN PLACE
STICK TO IT
TELL YOUR FAMILY

PREPARE — ACT — SURVIVE

TO REPORT ANY FIRE

DIAL 000

DON'T DELAY

KEY CONTACTS

General Enquiries
(08)9780 5255

Rangers
0419 902 540

Chief Bush Fire Control Officer
0419 525 843

Deputy Chief Bush Fire Control Officer
0419 628 465

DFES Emergency Info Line
1300 657 209

Margaret River Civic Centre
41 Wallcliffe Rd, Margaret River
PO Box 61, Margaret River 6285
P: 9780 5255, F: 9757 2512
E: amrshire@amrshire.wa.gov.au

www.amrshire.wa.gov.au

FIRE MANAGEMENT PLAN
Lot 100 Brockman Highway, Karridale

Compliance checklist for performance criteria and acceptable solutions

Element 1: Location

Does the proposal comply with the performance criteria by applying acceptable solution A1.1?

Yes/No

Element 2: Vehicular access

Does the proposal comply with the performance criteria by applying acceptable solution A2.1?

Yes/No

Does the proposal comply with the performance criteria by applying acceptable solution A2.2?

Yes/No

Does the proposal comply with the performance criteria by applying acceptable solution A2.3?

Yes/No

Does the proposal comply with the performance criteria by applying acceptable solution A2.4?

Yes/No

Does the proposal comply with the performance criteria by applying acceptable solution A2.5?

Yes/No

Does the proposal comply with the performance criteria by applying acceptable solution A2.6?

Yes/No

Does the proposal comply with the performance criteria by applying acceptable solution A2.7?

Yes/No

Does the proposal comply with the performance criteria by applying acceptable solution A2.8?

Yes/No **Not Applicable**

Does the proposal comply with the performance criteria by applying acceptable solution A2.9?

Yes/No

Does the proposal comply with the performance criteria by applying acceptable solution A2.10?

Yes/No

Element 3: Water

Does the proposal comply with the performance criteria by applying acceptable solution A3.1?

Yes/No **Not Applicable**

Does the proposal comply with the performance criteria by applying acceptable solution A3.2?

Yes/No

Does the proposal comply with the performance criteria by applying acceptable solution A3.3?

Yes/No **Not Applicable**

Element 4: Siting of development

Does the proposal comply with the performance criteria by applying acceptable solution A4.1?

Yes/**No**

The FMP complies with the performance criteria by means other than applying acceptable solution A4.1, as follows:

- *The site is separated from vegetation that possibly represents an extreme fire risk by Bussell Highway and Brockman Highway, both of which are substantial strategic firebreaks that provide excellent access and defence lines to prevent fires crossing the Highways into the subject land;.*

- *The vegetated land on adjacent properties and within the subject land are subject of contemporary bush fire management and mitigation plans and procedures; and*

- *The Fire Management Plan requires that development with the site must achieve BAL rating protection criteria according to the conditions in accordance with acceptable solution A4.5*

Does the proposal comply with the performance criteria by applying acceptable solution A4.2?

Yes/No

Does the proposal comply with the performance criteria by applying acceptable solution A4.3?

Yes/No

The proposed fire perimeters provide a balance between environmental and bushfire considerations. The FMP requires that buildings comply with AS3959. It is expected that the Shire of Augusta Margaret River will impose building standards appropriate to the fire perimeters in accordance with acceptable solution A4.1, thereby achieving compliance with Performance Criterion P4.

Does the proposal comply with the performance criteria by applying acceptable solution A4.4?

Yes/No

The proposed fire perimeters provide a balance between environmental and bushfire considerations. The FMP requires that buildings comply with AS3959. It is expected that the Shire of Augusta Margaret River will impose building standards appropriate to the fire perimeters in accordance with acceptable solution A4.1, thereby achieving compliance with Performance Criterion P4.

Does the proposal comply with the performance criteria by applying acceptable solution A4.5?

Yes/No

Element 5: Design of development

Does the proposal comply with the performance criteria by applying acceptable solution A5.1?

Yes/**No**

The FMP complies with the performance criteria by means other than applying acceptable solution A4.1, as outlined above.

Does the proposal comply with the performance criteria by applying acceptable solution A5.2?

Yes/No

Performance criteria P5 is met by the Fire Management Plan.

Applicant Declaration

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

Full name: Michael Swift (Director, Michael Swift and Associates) on behalf of Juventus Pty Ltd

Applicant signature: .....

Date: 22 January 2014

About Cardno

Cardno is an ASX200 professional infrastructure and environmental services company, with expertise in the development and improvement of physical and social infrastructure for communities around the world. Cardno's team includes leading professionals who plan, design, manage and deliver sustainable projects and community programs. Cardno is an international company, listed on the Australian Securities Exchange [ASX: CDD].

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