DYNAMIC PLANNING
AND DEVELOPMENTS

PROPOSED LOCAL STRUCTURE PLAN

LOT 7 (NO. 315) GRAY ROAD, BINDOON

Project No. 046 **APRIL 2016**

This structure plan is prepared under the provisions of the Shire of Chittering Town Planning Scheme No.6

IT IS CERTIFIED THAT THIS STRUCTURE PLAN WAS APPROVED BY RESOLUTION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION ON: 1 June 2016

Signed for and on behalf of the Western Australian Planning Commission

O'Meaghan

an officer of the Commission duly authorised by the Commission pursuant to Section 16 of *the Planning and Development Act 2005* for that purpose, in the presence of:

Witness

9/6/16.

Date

Date of Expiry: 1 June 2026

TABLE OF AMENDMENTS

Amendment No.	Summary of the Amendment	Amendment Type	Date Approved by WAPC

TABLE OF DENSITY PLANS

Density Plan No.	Area of Density Plan Application	Date Endorsed by WAPC

EXECUTIVE SUMMARY

This submission, prepared on behalf of Jane Marie Evans, Hete Pty Ltd and Amanda Lesley Deetman, the registered proprietors of Lot 7 (No. 315) Gray Road, Bindoon (herein referred to as the 'subject site') seeks support from the planning authorities to approve the proposed Local Structure Plan (LSP).

The LSP provides a framework for the future development of the subject land and a context for the consideration and approval of future subdivision applications.

The LPS has been prepared for 44.13 hectares of land located within the Bindoon Townsite Locality for adoption under the provision of the Shire of Chittering, Town Planning Scheme No. 6.

Item	Data		Structure Plan Reference (Section Number)
Total area covered by Structure Plan	44.13ha		Part 1 Section 1.0
Area of each land use proposed:	Hectares	Lot Yield	Part 2 Section 3.1
- Public Open Space	5.4464ha	3 lots	
- Residential	14.522ha	18 lots	
- Rural Residential	24.1654ha	12 lots	
Estimated Lot Yield	33 lots		Part 2 Section 3.1
Estimated Number of Dwellings	30 dwellings		Part 2 Section 3.1
Estimated Residential Site Density	Rural Residential and Residential R2		Part 2 Section 3.1
Estimated Population*	81		Part 2 Section 3.1
Number of High Schools	0		N/A
Number of Primary Schools	0		N/A
Estimated Commercial Floor Space	0		N/A
Estimated Area and Percentage of Public Open Space given over to:	Hectares	Percentage/Number of Parks	Part 2 Section 3.2
- Regional Open Space	0ha	0%	
- District Open Space	0ha	0%	
- Neighbourhood Parks	0ha	0 parks	
- Local Parks	5.4464ha	3 parks	
Estimated Percentage of Natural Area:	Hectares	Percentage	N/A
	0ha	0%	

* Based on Australian Bureau of Statistics, Census of Population and Housing 2011 which states average household size in the Shire of Chittering to be 2.7 per dwelling.

TABLE OF CONTENTS

PLANS

APPENDICES

PART ONE – IMPLEMENTATION

1.0 Local Structure Plan Area

This Local Structure Plan (LSP) shall apply to Lot 7 (No. 315) Gray Road, Bindoon, being the land contained within the inner edge of the line denoting the LSP boundary of the LSP map (Plan 3).

2.0 Local Structure Plan Content

This LSP comprises:

a) Part One – Implementation
This section contains the LSP map and the subdivision and development provisions and requirements.

b) Part Two – Explanatory Section and Technical Appendices
This section is to be used as a reference guide to interpret and justify the implementation of Part One.

c) Appendices – Technical reports, supporting plans and maps.

3.0 Interpretation and Scheme Relationship

Unless otherwise specified in this part, the words and expressions used in this LSP shall have the respective meanings given to them in the Shire of Chittering Town Planning Scheme No. 6 (TPS6) including any amendments gazetted thereto.

The LSP map (Plan 3) outlines land use, zones and reserves applicable within the LSP map area.

Pursuant to Part 4 of the deemed provisions of the *Planning and Development (Local Planning Scheme) Regulations 2015*:

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

4.0 Operation

In accordance with Part 4 of the deemed provisions of the *Planning and Development (Local Planning Scheme) Regulations 2015*, this LSP shall come into operation when it is approved by the Western Australian Planning Commission (WAPC).

5.0 Subdivision and Development Requirements

5.1 Land Use Permissibility

The LSP map (Plan 3) provides a basis to guide subdivision and development within the LSP area.

Land use permissibility within the LSP area shall be in accordance with the corresponding zone or reserve under the Scheme.

5.2 Residential

5.2.1 Dwelling Target

Objective: To provide for thirty (30) dwellings within the LSP area.

5.2.2 Density

The LSP area is zoned 'Rural Residential' and 'Residential R2' which provides for minimum lot areas of 1ha within the 'Rural Residential' zone and 5,000sqm within the 'Residential R2' zone.

PART TWO – EXPLANATORY SECTION AND TECHNICAL APPENDICES

1.0 Planning Background

1.1 Introduction and Purpose

The key objectives of the LSP are as follows:

- To provide a basis to guide the use, subdivision and development of land to create a high quality urban environment.
- To achieve an optimum housing density with an emphasis of introducing a diversity in housing choice into the locality.
- Capitalise on the natural amenity of the area afforded through the Parks and Recreation Reservation under TPS6, which is located within the subject site.

1.2 Land Description

1.2.1 Location

The subject site is located within the suburb of Bindoon, within the municipality of the Shire of Chittering.

The subject site is located approximately 82 kilometres north-east of the Perth City Centre, approximately 15.3 kilometres south-east of the Gingin Townsite and approximately 3 kilometres west of the Bindoon Townsite, which provides a range of services including retail, community and entertainment uses.

Plan 1 illustrates the subject site's location.

1.2.2 Area and Land Use

The subject site is bound by Gray Road to the north, 'Rural Residential' zoned properties to the east and south, and a 'Rural Conservation' zoned property to the west.

The subject land is approximately 44.13 hectares in area and comprises one (1) lot. The northern half of the subject site has been predominantly cleared, with the site comprising an existing dwelling and structures located in the centre of the lot. These areas can be clearly seen in Plan 2 – Aerial.

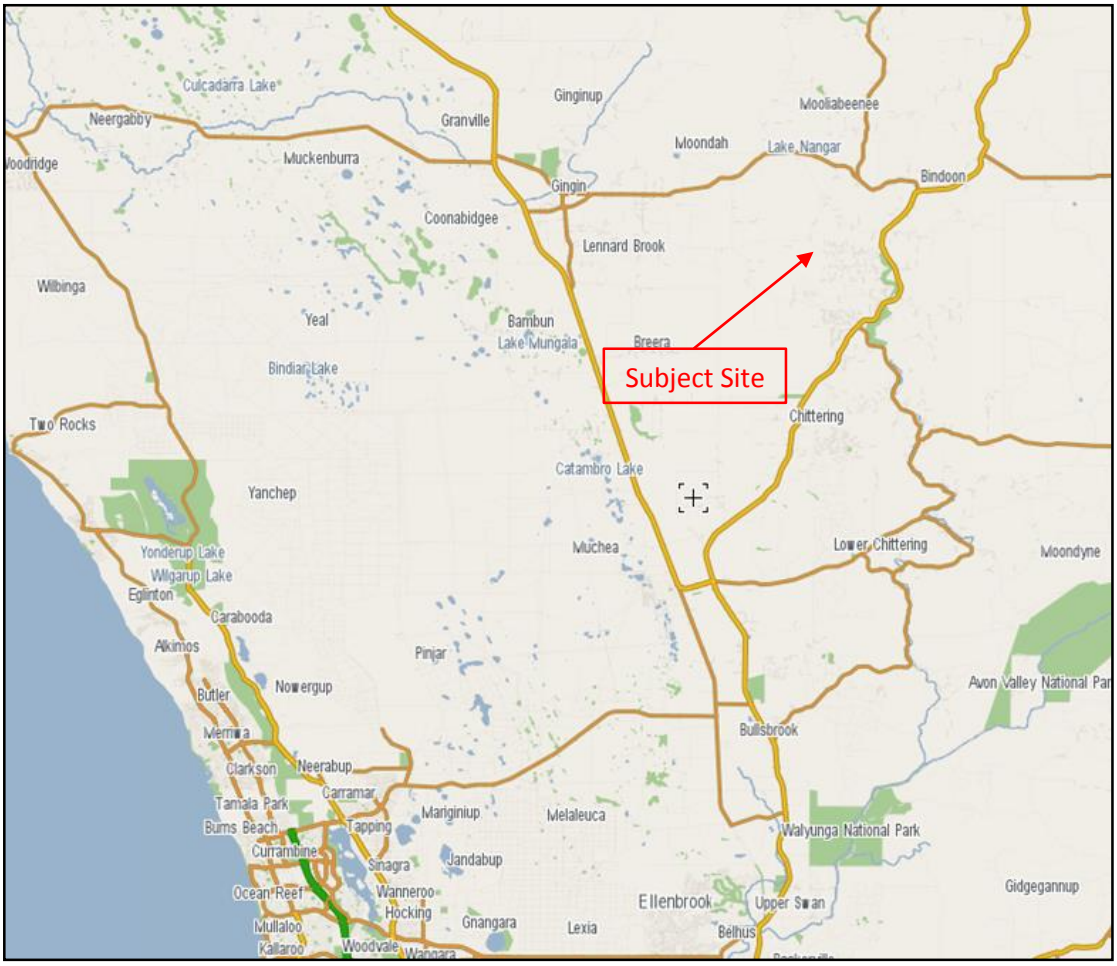
1.2.3 Legal Description and Land Ownership

The subject site has a total area of approximately 44.13 hectares. The lot forming the LSP area and the respective ownership details and outlined in the table below.

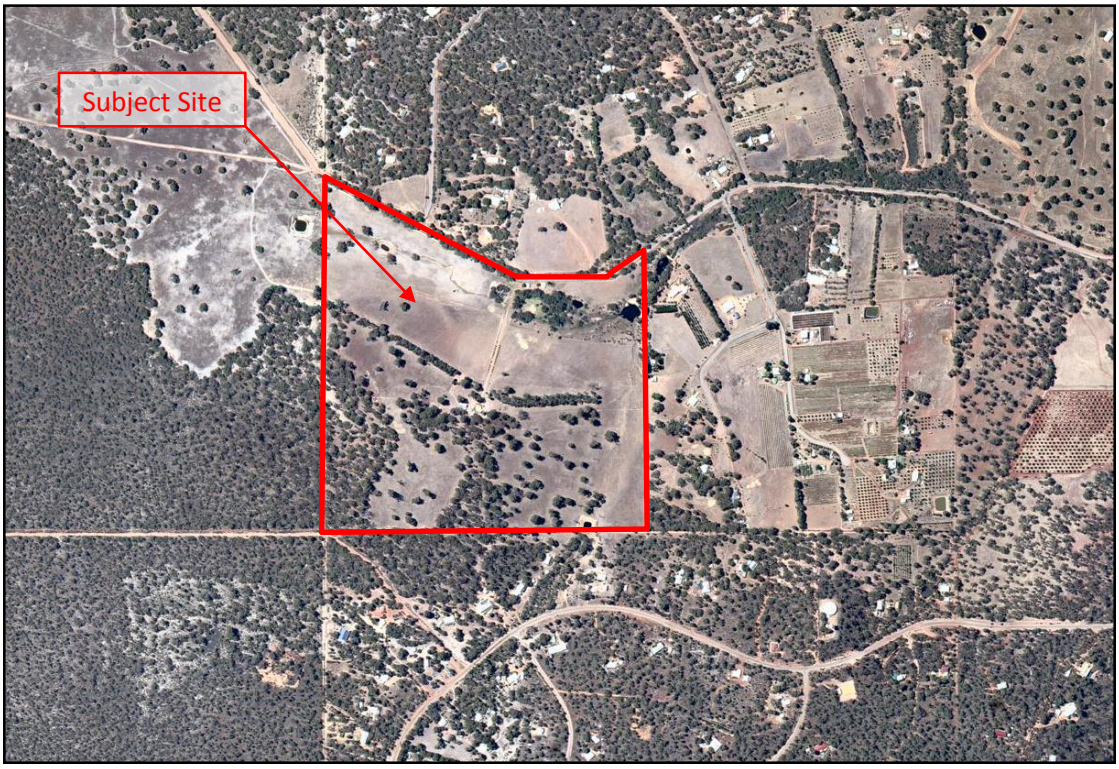
Lot	Certificate of Title	Land Ownership	Lot Area
7	7/D17255	Jane Marie Evans, Hete Pty Ltd & Amanda Lesley Deetman	44.13ha

Table 1 – Certificate of Title and Ownership details

A copy of the Certificate of Title is contained in Appendix 1.



Plan 1 – Location Plan

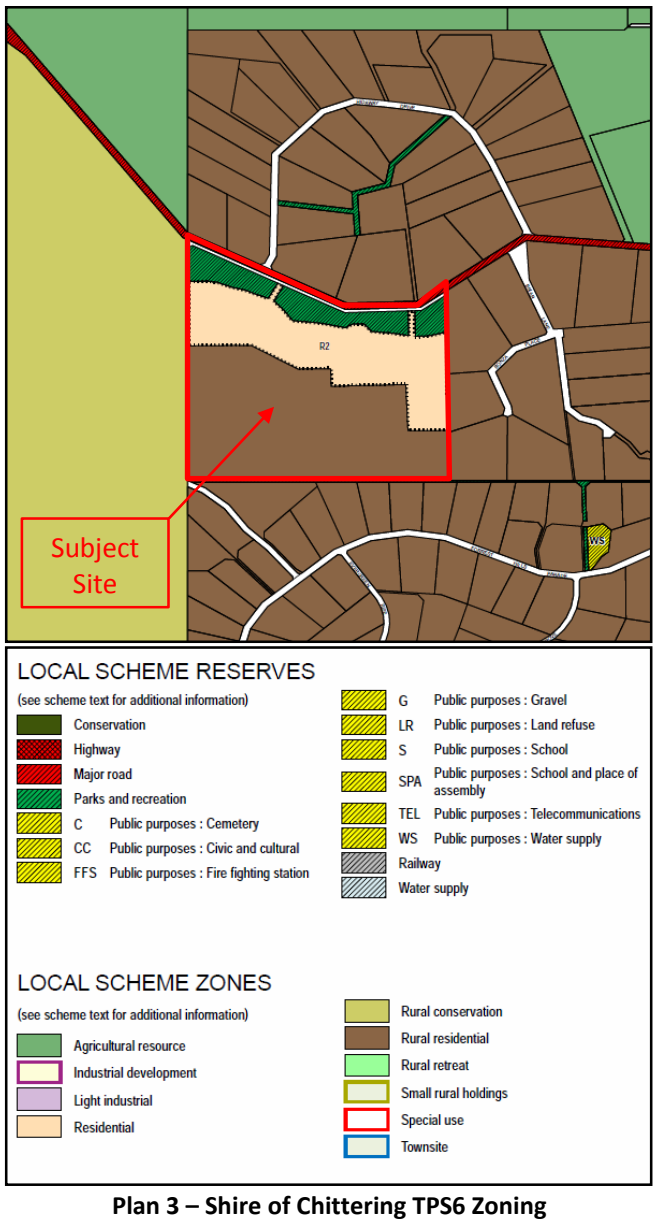


Plan 2 – Aerial Photograph

1.3 Planning Framework

1.3.1 Shire of Chittering Town Planning Scheme No. 6

Under the provisions of the Shire of Chittering Town Planning Scheme No. 6 (TPS6) the subject site is zoned 'Parks and Recreation', 'Residential R2' and 'Rural Residential'. Plan 3 illustrates the subject site's zoning.



Plan 3 – Shire of Chittering TPS6 Zoning

In accordance with TPS6, the objectives of the 'Residential R2' and 'Rural Residential' zones are as follows:

Rural Residential Zone

- *To designate areas where rural residential developments can be accommodated without detriment to the environment or the rural character of the area.*
- *To meet the demand for a rural lifestyle on small lots, generally in excess of 1 hectare.*
- *To maintain and enhance the rural character and amenity of the locality.*

Residential R2 Zone

- *To designate areas for low density residential development in a rural setting, in which natural environmental values are conserved as far as possible.*
- *To meet the demand for lifestyle lots with a minimum lot size of 5,000m^2.*
- *To ensure development is sited and designated to achieve an integrated and harmonious character within each estate.*

Although explained in much greater detail in section 3 of this report, the LSP aims to introduce an increased mix of lot sizes to the Bindoon area in order to meet housing demands and affordability needs whilst maintaining and enhancing the rural lifestyle of the locality.

1.3.2 Regional and Sub-Regional Structure Plan

There are no regional or sub-regional structure plans applicable to the subject site.

1.3.3 Planning Strategies

1.3.3.1 State Planning Strategy 2050

The State Planning Strategy 2050, was prepared by the WAPC and provides a strategic planning response to the challenges that Western Australia is likely to face in the future.

It envisages that by 2050 Western Australia will double its current population and will have a diverse range of well-connected and vibrant communities of the highest quality in the world.

The LSP will allow for the future development of land for residential and rural residential purposes which will contribute towards the goal to double the State's current population.

1.3.3.2 Liveable Neighbourhoods

Liveable Neighbourhoods is the State Government's key policy for the design and assessment of structure plans. The policy sets out a number of objectives and principle aims to ensure the design and layout of new developments:

- Facilitate ease of access, in particular walking and cycling through a network of connected streets that are safe, efficient and pleasant;
- Foster a sense of community, place and local identity;
- Support an efficient public transport system;
- Provide a variety of lot sizes, housing types and densities that support the diverse housing needs;
- Conserve and incorporate key environmental areas into designs;
- Integrate the design of open space and stormwater management systems; and
- Maximise the use of land for housing.

The implementation of these elements is fundamental to ensuring structure planning and resultant subdivisions occur in a well-considered and sustainable manner. Application of the Liveable Neighbourhoods principles is therefore relevant to all levels of planning for the site from the proposed LSP through to detailed lot and building design.

1.3.3.3 Wheatbelt Regional Planning and Infrastructure Framework

The purpose of the Wheatbelt Regional Planning and Infrastructure Framework (the Framework) is to provide an overview of regional planning issues and a basis for ongoing planning and development. The Framework sets out the vision of the Wheatbelt, which is as follows:

> *The Wheatbelt will have a diverse social and economic base, be a leader in innovation and create new opportunities that confirm it as a key contributor to the State's prosperity.*

The Framework sets out the following objectives which aim to ensure that the Wheatbelt vision is met:

Liveable Communities Objectives:

- Effective infrastructure and service delivery that:
  - Responds to local knowledge and values;
  - Accommodates the Wheatbelt's linkages to other regions;
  - Builds on the interconnectedness of settlements;
  - Assists and promote sustainable growth and cater for the needs of communities;
  - Recognises the current and changing demographics of the region; and
  - Seek to attract and retain a diverse population.

Vibrant Economy Objectives:

- A diversified and adaptive economy that:
  - Increases its contribution to the Western Australian economy;
  - Benefits from innovation in the primary production sector; and

- Enables diversification through the establishment and growth of new and innovative industries.

Valued Natural Amenity Objective:

- Environmental and landscape values that support the social, cultural and economic development of the region, and are managed for current and future generations.

The principles outlined within the Framework are fundamental to guiding local planning policies, as it is through the local level of planning that the objectives of this Framework will mostly be realised.

1.3.3.4 State Planning Policy 2.5 – Land Use Planning in Rural Areas

State Planning Policy No. 2.5 – Land Use Planning in Rural Areas (SPP2.5), applies to rural and rural living land in Western Australia, which includes the provision of creating lots for the purpose of rural living. The southern portion of the subject site is zoned 'Rural Residential' which is in keeping with the objective of SPP2.5.

1.3.3.5 Shire of Chittering – Local Planning Strategy

The Shire of Chittering Local Planning Strategy (the Strategy) is a long term strategic project designed to accommodate population growth and ensure that there is a sufficient supply of suitably zoned and serviced rural residential and residential land within the Shire.

As the site is zoned 'Rural Residential' and 'Residential R2', the Strategy will aid in accommodating population growth, which will contribute towards satisfying the identified need for the supply of suitably zoned and serviced rural residential and residential land within the Shire of Chittering.

2.0 Site Conditions and Constraints

2.1 Stormwater Management

A Stormwater Management Strategy (SMS) has been prepared by Calibre Consultants in support of the proposed LSP which analyses the subject site's pre-development ground and surface water. A copy of the SMS is contained within Appendix 2.

The fundamental stormwater management objective for this subdivision will be to detain flows leaving the site such that they do not exceed the pre-development peak flow rates. This will be achieved by introducing appropriate storage elements in the form of detention basins and swales within the overall stormwater treatment train.

In addition, this particular site features some steep sections of roadway. It will be necessary to manage stormwater runoff at a local level adjacent to these sections of roadway in order to minimise the risk of scouring.

The main watercourse running parallel to Gray Road will be contained within the POS corridor. However, the tributary that runs parallel to the eastern boundary of the site will cross through a number of proposed residential lots. Specific management strategies will need to be adopted to ensure that dwellings are appropriately located and protected from flows during high recurrence interval events, and to ensure that buildings and other improvements on the lots do not impede flows in the watercourses during major events

2.1.1 Pre-Development Surface Water

Two distinct catchments flow through the subject site, joining just upstream of the north eastern corner to create a single creek crossing that exits the site in an easterly direction under Bonza Place, via a 1200mm x 1200mm box culvert.

Catchment 1 has a total area of 116.35ha, which includes 25.16ha of the subject site.

Catchment 2 has a total area of 150.08ha, which includes 18.73ha of the subject site.

Peak runoff rates for the two existing catchments were assessed, with the modelling taking into account the catchment parameters as they currently exist (i.e. prior to development of the proposed subdivision).

The results of the Pre-Development Peak Flow Rate assessment are contained in the SMS in Appendix 2.

2.1.2 Post-Development Surface Water Management

The proposed subdivision will introduce sealed roadways, together with residential dwellings and other associated improvements. Landowners will be encouraged to capture runoff from roofed areas and store it for re-use. The individual dwelling lots will therefore be relatively neutral in terms of impact on the existing stormwater runoff regime. Management of stormwater runoff will therefore be focussed on the increased runoff generated by the roadways themselves.

2.1.2.1 Water Quality Management

The subdivision roadways will generate runoff with possible elevated levels of nutrients, particulates, and hydrocarbons. Minimising erosion within the roadside drainage structures themselves will reduce the required maintenance regime and will also minimise mobilisation of gross pollutants and particulates.

Notwithstanding the source minimisation measures, it is recommended that bioretention facilities be introduced within the stormwater treatment train to intercept and arrest any mobile pollutants before they reach the creek lines themselves. These bioretention facilities can take the form of swales or basins.

2.1.2.2 Increase in Peak Runoff Rates

The proposed subdivision will introduce sealed roadways in place of the existing pasture. As a result, this proportion of the overall site will generate stormwater runoff at a higher rate, and the runoff will reach the downstream water courses more quickly. It will be necessary to capture and store a proportion of the anticipated runoff in order to limit the peak runoff rates to those being generated in the pre-development scenario.

Runoff rates from the balance of the site will likely remain unchanged by virtue of the requirement for any new dwellings to capture roof runoff in rainwater tanks, and the sparse nature of any other improvements on the lots.

2.1.2.3 Flow Attenuation

In order to reduce the post-development peak flow rates so that they do not exceed the corresponding pre-development peak flow rates it will be necessary to introduce additional storage within the treatment train in the form of detention basins. These basins will be additional to the bioretention basins, and will feature throttled outlets to restrict the outflows.

The format of the various bioretention gardens and supplementary detention storages that will in combination make up the total aggregate storages will be a matter of detailed design.

2.2 Conveyance System

2.2.1 Roadside Conveyance System

Roadways in rural residential subdivisions such as this would typically be sealed, with rural formations incorporating V drains and culverts. Concrete kerbing would typically be confined to intersection sweeps and low points. However, given the steepness of some of the sections of proposed roadway within this particular subdivision, consideration should be given to the likely propensity for scouring of any open drains. V Drains will need to be armoured with rock lining in order to minimise the likelihood of scouring. Consideration should also be given to providing concrete kerbs and more urban style verges on the steeper sections of roadway. This will necessitate the introduction of a “pit and piped” drainage system in place of open drains on those sections of roadway deemed inappropriate for rural formation roadways.

2.2.2 Creek System

Major storm event flows have been modelled for the two creeks that cross the site. There are two primary considerations for establishing the relationship between housing construction and adjacent waterways. Firstly, there is a minimum horizontal distance that should be maintained in order to provide sufficient buffer for septic tanks and the like. This distance should be 30m from the edge of the main creek channel. Secondly, there is a minimum vertical separation that should be achieved between the 100 year water level in the creek and the floor level of the adjacent dwellings.

The creek serving Catchment 1 is contained entirely within the POS corridor that runs parallel to Gray Road. The width of this POS corridor is such that any setback requirement will have negligible impact on the location of buildings within the adjacent lots. Vertical separation should also be easily achieved.

The creek serving Catchment 2 crosses through the lots that abut the eastern boundary of the estate. As such, any setbacks from the creeks will need to be established at the detailed design stage and protected by way of easements and building restrictions/guidelines.

The projected 100 year ARI flood corridor is depicted on the Proposed Development Plan. The corridor is depicted as a solid blue line for the projected 100 year ARI flow path, with a dashed blue line for a 10m offset, and a dashed red line showing the edge of the existing terrain that sits 0.5m above the 100 year ARI flood level. It should be noted that the zone between the solid blue line and the dashed red line is the equivalent of the area designated as the Flood Fringe. As such, it would be allowable to develop within this area provided that the finished floor levels are maintained at 500mm above the projected 100 year ARI flood levels (by filling or otherwise elevating the finished floor levels). Septic installations should be located at the rear of the building areas to achieve adequate separation from the watercourse.

2.3 Bushfire Hazard

A Fire Management Plan (FMP) has been prepared by Bushfire Safety Consulting Pty Ltd in support of the proposed LSP which demonstrates compliance of the proposed LSP with all relevant criteria detailed in State Planning Policy No. 3.7 – Planning in Bushfire Prone Areas. A copy of the FMP is contained within Appendix 3.

The pre-development site is identified through the FMP as having a bushfire hazard rating of predominantly low and extreme over the site.

Low hazard occurs in all areas of managed grassland including the grazed paddocks and equine properties. These areas particularly away from tree canopies are very low in fuel loads.

Moderate bushfire hazard only occurs in the shelter belt strip of vegetation which has managed grassland fuels due to grazing.

Extreme hazard occurs in all areas of woodland. The fuel loads are highest where intact woodland occurs west and south of the site, meaning these areas provide the biggest threat,

however the disturbed woodland areas inside the grazing paddocks do have leaf and bark litter fuels accumulating on the ground.

The FMP adopts an acceptable solution and performance-based system of control for each bushfire hazard management issue, in accordance with State Planning Policy No. 3.7 – Planning in Bushfire Prone Areas.

Acceptable solutions are provided for four out of the five management issues and each illustrates one example of satisfactorily meeting the corresponding performance criteria. A performance-based approach is provided for one management issue.

Given the above, the design of the LSP has incorporated the FMP parameters to ensure the development is not exposed to an unreasonable level of bushfire related risk or threat in accordance with the requirements detailed in State Planning Policy No. 3.7 – Planning in Bushfire Prone Areas.

2.4 Heritage

A review of the Aboriginal Heritage Online Inquiry System confirmed there are no Registered Aboriginal Sites of Other Heritage Places over the subject lot.

There are no European Heritage sites currently listed on the Heritage Council of WA's (HCWA) State Register of Heritage Places or the Shire of Northam Municipal Heritage Inventory.

3.0 Land Use and Subdivision Requirements

3.1 Design and Land Use

The proposed LSP provides for rural residential and residential land uses consistent with the policy framework for the site. The rural residential and residential lots have been configured to respond to the shape of the land and solar orientation.

The proposed movement network has been design in response to the Bushfire Risk in that a 20 metre wide road reservation is proposed to ensure adequate separation distances are provided.

An overview of the LSP land uses and its key elements is provided in Table 2.

Item	Data	
Total area covered by Structure Plan	44.13ha	
Area of each land use proposed:	Hectares	Lot Yield
- Public Open Space	5.4464ha	3 lots
- Residential	14.522ha	18 lots
- Rural Residential	24.1654ha	12 lots
Estimated Lot Yield	33 lots	
Estimated Number of Dwellings	30 dwellings	
Estimated Residential Site Density	Rural Residential and Residential R2	
Estimated Population*	81	
Number of High Schools	0	
Number of Primary Schools	0	
Estimated Commercial Floor Space	0	
Number and % of Public Open Space:	Hectares	Percentage/Number of Parks
- Regional Open Space	0ha	0%
- District Open Space	0ha	0%
- Neighbourhood Parks	0ha	0 parks
- Local Parks	5.4464ha	3 parks
Estimated Percentage of Natural Area:	Hectares	Percentage
	0ha	0%

* Based on Australian Bureau of Statistics, Census of Population and Housing 2011 which states average household size in the Shire of Chittering to be 2.7 per dwelling.

Table 2 – LSP Summary

3.2 Residential

The LSP anticipates a yield of thirty (30) residential dwellings. The proposed density is intended to be sympathetic of the established rural residential character of Bindoon whilst introducing diversity of lot sizes and housing typologies to meet market and affordability demands in accordance with the strategic planning provisions. The proposed lot sizes are in keeping with the existing lot sizes located within the rural residential developments located to north, east and south of the subject site.

3.3 Movement Network

The LSP proposes two (2) road running at right angle to Gray Road.

All internal roads are proposed to meet the minimum standards of Liveable Neighbourhoods.

3.3.1 Vehicle Access

Access to the subject site is proposed via two (2) roads intersecting with Gray Road.

The indicative Development Plan proposes three (3) lots for the purpose of public open space to have frontage to Gray Road along the northern portion of the subject site. All other lots within the development have direct frontage to the proposed internal roads.

3.3.2 Parking Provision

Parking is proposed to be accommodated on-site internally throughout the development on each future lot.

3.3.3 Traffic Volumes

As a result of the forecasted subdivision and future development, traffic is expected to increase on the roads leading to and from the development; however it is not anticipated that the capacity for these roads will be exceeded.

3.3.4 Service Vehicles

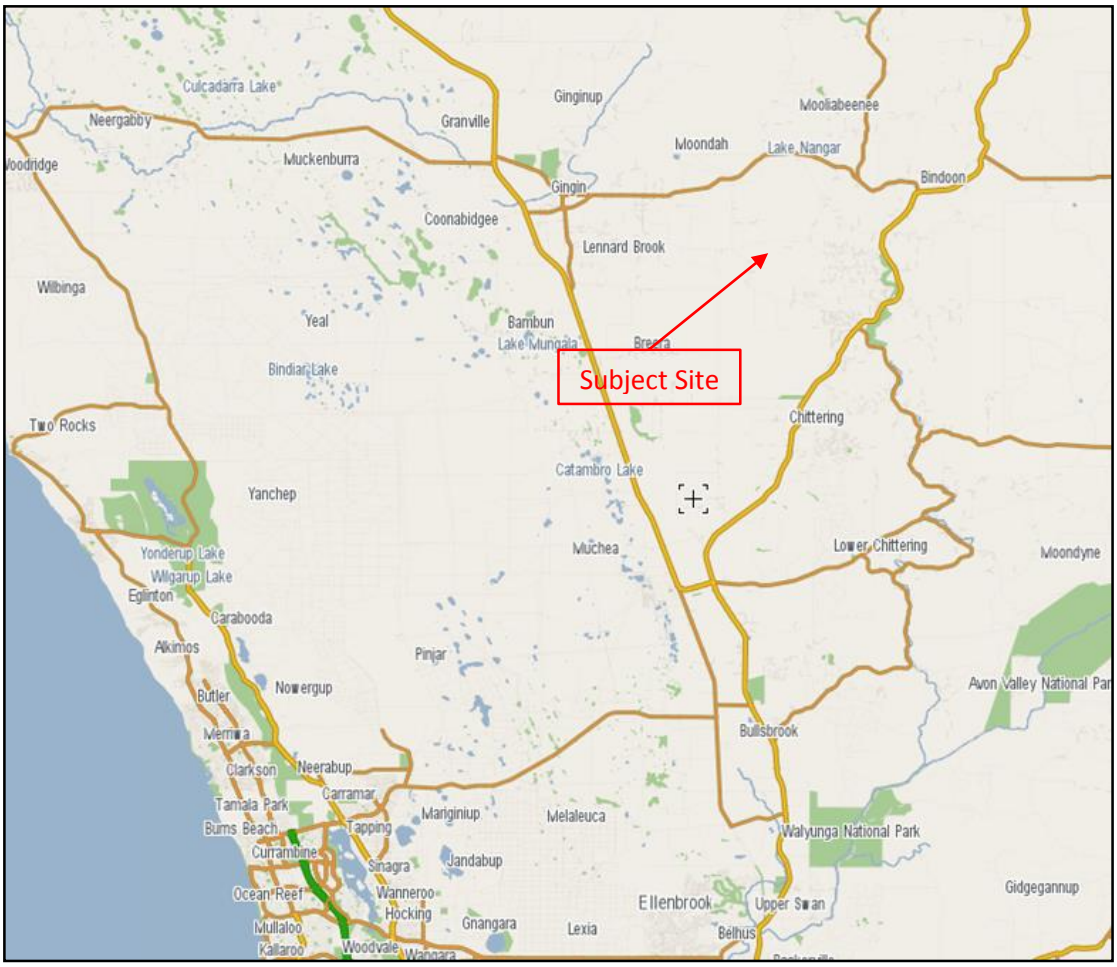
The internal layout of the proposed development will support the access and egress of service vehicles such as waste removal trucks in a forward motion.

3.4 Water Management

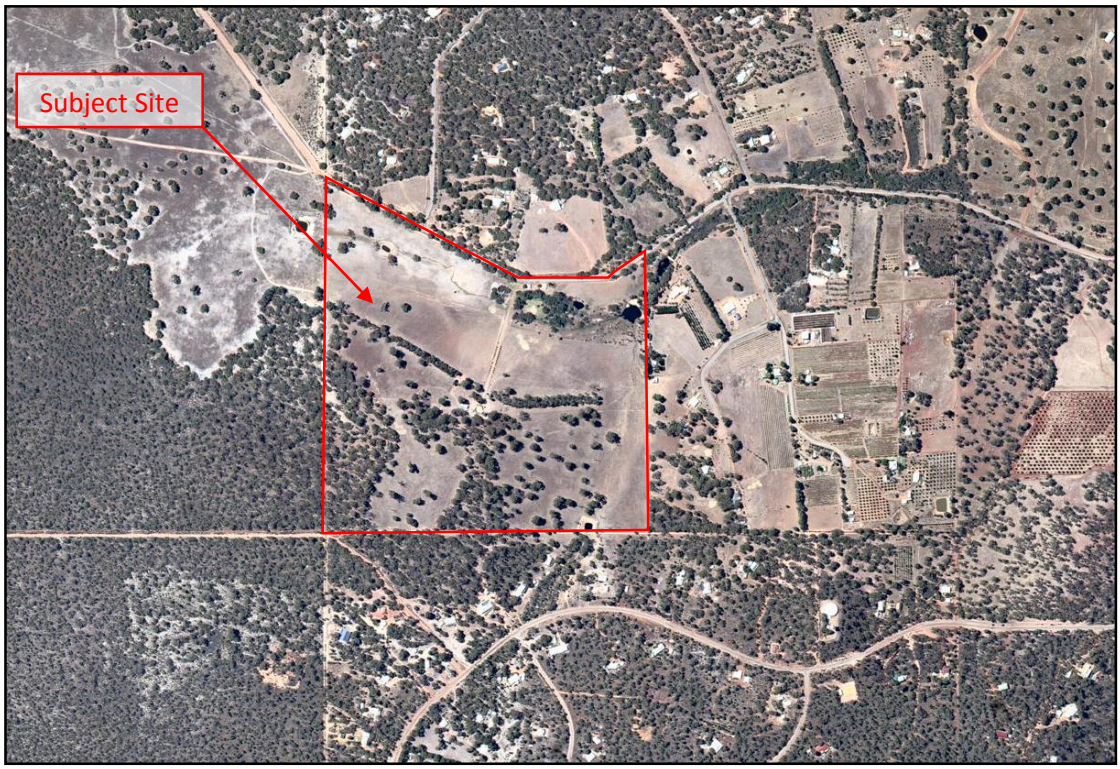
As discussed above, a SMS has been prepared by Calibre Consultants to support the proposed LSP. The SMS sets out management requirements for water management, including specific targets (design objectives) for the management of surface water quantity and quality. The SMS assists in integrating land and water planning as required by State Planning Policy 2.9 – Water Resources and Better Urban Water Management.

The water management for the proposed LSP and future development of the subject site is based upon the best practice water sensitive urban design which is achieved through maximising the sustainable use of water through the encouragement of water conservation and efficiency measures and controlling the flow of large storm events.

PLAN 1
Location Plan


Culcadarra Lake
Neergabby
Granville
Ginginup
Mooliabeenee
Moondah
Lake Nangar
Bindoon
Muckenburra
Gingin
Coonabidgee
Lennard Brook
Wilbinga
Yeal
Bambun
Lake Mungala
Subject Site
Bindiar Lake
Two Rocks
Chittering
Catambro Lake
Yanchep
Muchea
Lower Chittering
Moondyne
Yonderup Lake
Wilgarup Lake
Eglinton
Carabooda
Alkimos
Pinjar
Butler
Nowergup
Avon Valley National Par
Bullsbrook
Clarkson
Neerabup
Carramar
Tamala Park
Mariginiup
Melaleuca
Burns Beach
Tapping
Walyunga National Park
Currambine
Jandabup
Sinagra
Ocean Reef
Wanneroo
Ellenbrook
Upper Swan
Gidgegannup
Hocking
Mullaloo
Gnangara
Lexia
Belhus
Kallaroo
Woodvale

PLAN 2
Aerial Photograph


Subject Site

PLAN 3
Local Structure Plan

LEGEND

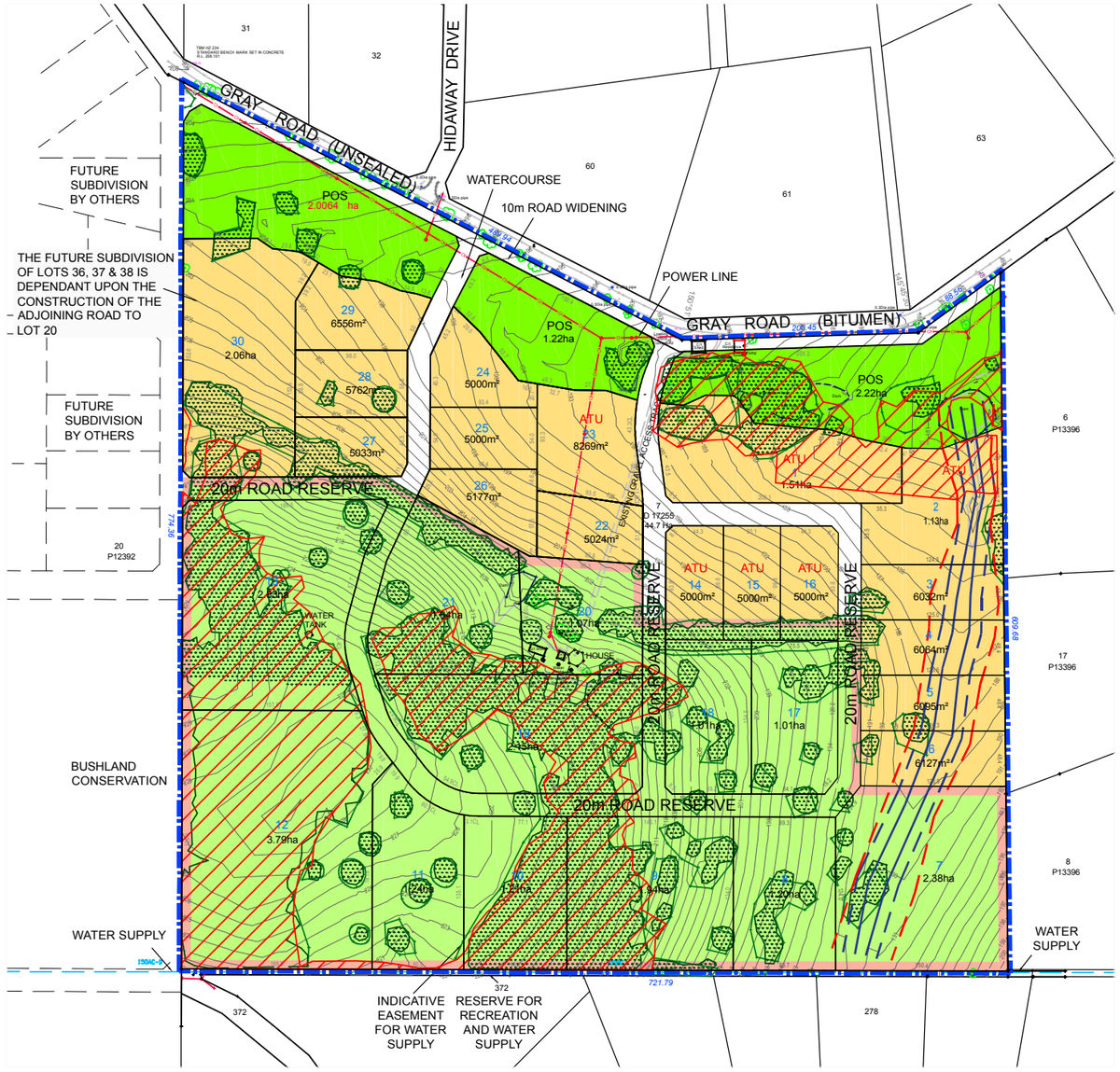
- SUBJECT AREA (TOTAL 44.7 ha)
- BUILDING ENVELOPE
- RESIDENTIAL R2 LOT
- RURAL RESIDENTIAL
- PROPOSED LOT BOUNDARY
- VEGETATION AREA
- ATU — ALTERNATIVE TREATMENT UNIT
- INDICATIVE FUTURE LOT BOUNDARY
- BUILDING EXCLUSION AREA

SUBDIVISION SUMMARY

LOT RANGE	0.5HA TO 3.79HA
TOTAL LOTS	33
TOTAL AREA	35.21HA
AVERAGE SIZE	1.17HA

PUBLIC OPEN SPACE

LOT RANGE	1.22HA TO 2.22HA
TOTAL LOTS	3
TOTAL AREA	5.4464HA
AVERAGE SIZE	1.8155HA



FLOOD LEGEND

- 100YR FLOOD LEVEL
- 10m OFFSET FROM 100 YR FLOOD LEVEL
- 0.5m ABOVE 100 YR FLOOD LEVEL

Planning Policy Requirements

Structure Plan

This Structure Plan has been endorsed by the Council of the Shire of Chittering and the Western Australian Planning Commission (WAPC). Subdivision and development should generally be in accordance with the Structure Plan.

Potable Water
Reticulated water shall be connected to lots to the satisfaction of the Water Corporation.

Environment Management
No clearing of native vegetation to occur without the written approval of the Council.

Fencing
No fencing shall be permitted or undertaken within the areas designated as Building Exclusion Areas as depicted on the Structure Plan unless approved in writing by the Council.

Waterway
30m setback of buildings required.

Building Exclusion Area
No buildings to be constructed in the Building Exclusion Area. All other development requires the written approval of Council.

This Structure Plan was adopted by the Council of the Shire of Chittering on_____ pursuant to Clause 5.8.1 of the Shire of Chittering Town Planning Scheme No. 6

CHIEF EXECTUVE OFFICER _____ DATE _____

SHIRE PRESIDENT _____ DATE _____

Endorsed by the Western Australian Planning Commission

SECRETARY _____ DATE _____

TITLE: PROPOSED STRUCTURE PLAN

DETAIL: LOT 7 (315) GRAY ROAD BINDOON

SCALE: 1:5,000 @ A3 & 1:2,500 @ A1

DATE: 13th APRIL 2016

FILE: 046_13.04.2016.dwg

DRAW: -

CHECKED: -

DYNAMIC PLANNING AND DEVELOPMENTS
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INGLEWOOD WA 6052

N W E S

APPENDIX 1
Certificate of Title

WESTERN AUSTRALIA

REGISTER NUMBER	
7/D17255	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
N/A	N/A

RECORD OF CERTIFICATE OF TITLE

VOLUME 1556 FOLIO 286

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 7 ON DIAGRAM 17255

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

JANE MARIE EVANS OF 1 PEGGS PLACE, LEEMING
IN 37/100 SHARE
HETE PTY LTD OF 10 PILI AVENUE, SOUTH FORBES, MAKATI, METROMANILA, PHILIPPINES
IN 37/100 SHARE
AMANDA LESLEY DEETMAN OF 87 PRESTON POINT ROAD, EAST FREMANTLE
IN 26/100 SHARE
AS TENANTS IN COMMON

(T G952807) REGISTERED 16 NOVEMBER 1998

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

1. EXCEPT AND RESERVING METALS, MINERALS, GEMS AND MINERAL OIL SPECIFIED IN TRANSFER 8372/1935.

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----------

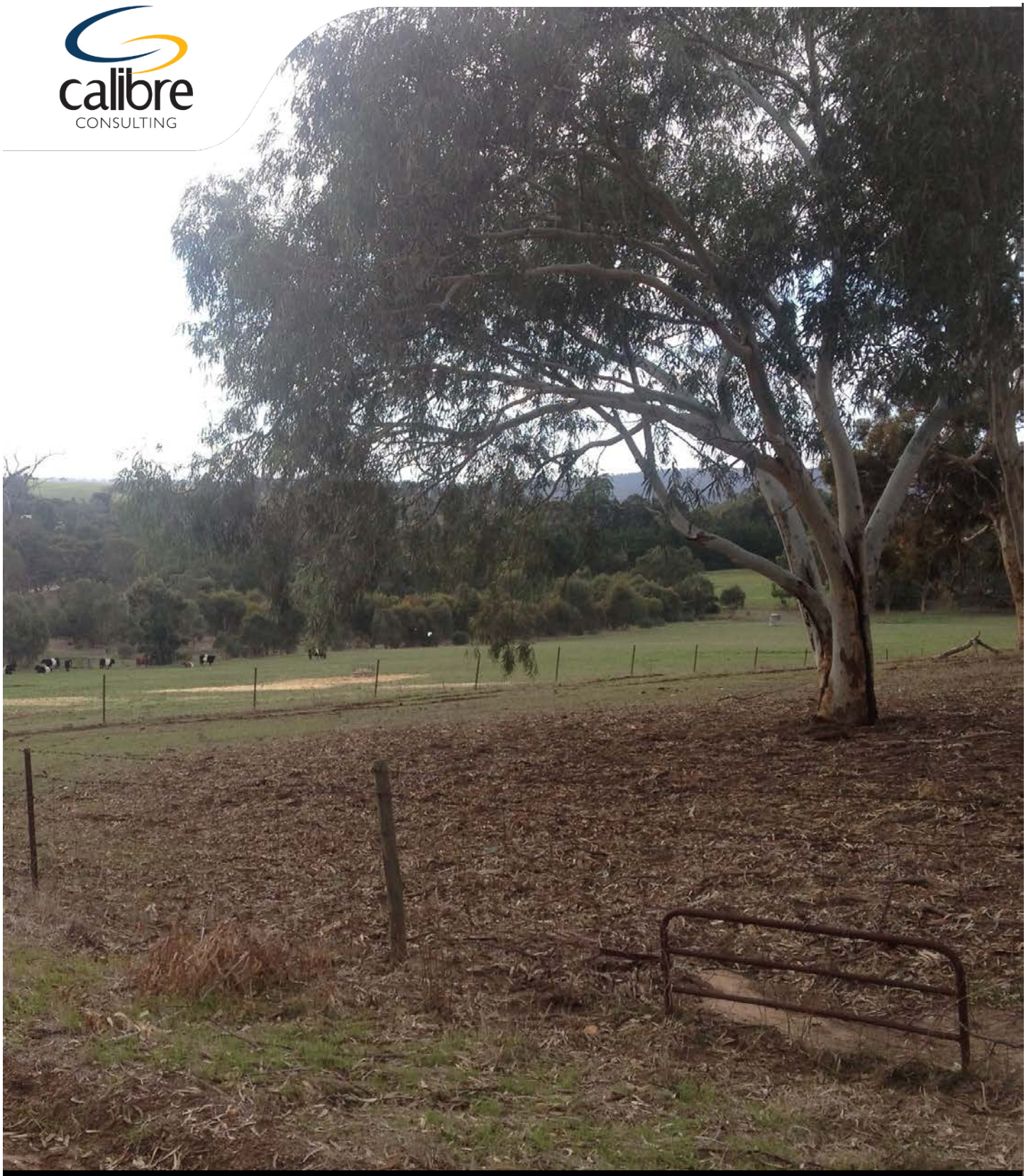
STATEMENTS:

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: 1556-286 (7/D17255).
PREVIOUS TITLE: 1177-88.
PROPERTY STREET ADDRESS: 315 GRAY RD, BINDOON.
LOCAL GOVERNMENT AREA: SHIRE OF CHITTERING.

NOTE 1: L366052 DUP CT NOT PRODUCED FOR DOCUMENT L366052.

APPENDIX 2
Local Water Management Strategy



Lot 7 Gray Road – Bindoon

Stormwater Management

Prepared by Calibre Consulting
Prepared for Dynamic Planning

April 2016

14236E

COMMERCIAL IN CONFIDENCE

TME Town Planning Management Engineering Pty Ltd Trading as

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DOCUMENT CONTROL

JOB NO.

Issue	Date	Issue Details	Author	Checked	Approved
01	24/09/15	Draft – For Client Review	SRB	TW	
02	22/02/16	Issued in support of Development Plan	SRB	TW	
03	25/04/16	Update to Lot Yield Page 3	SRB	TW	

TABLE OF CONTENTS

APPENDICES

1 INTRODUCTION

1.1 BACKGROUND

This Stormwater Management Assessment has been prepared by Calibre Consulting in support of a Proposed Development Plan for the subject site, Lot 7 (315) Gray Road, Bindoon. The Proposed Development Plan has been prepared by Dynamic Planning and Developments, and has received the support of the Shire of Chittering. The Stormwater Management Assessment was requested by WAPC as a precursor to final consideration of the associated subdivision application.

1.2 SITE DESCRIPTION AND CHARACTERISTICS

The subject site is located three kilometres to the west of Bindoon town site, and is frontal to Gray Road. The site area is 43.9ha.

Figure 1 - Locality Plan

The site is partially cleared for grazing, with stands of remnant bush in the southern and western portions. A dwelling and associated outbuildings are located near the centre of the site. The site elevation ranges from approximately 175m AHD at the north eastern corner of the site, up to 233m AHD at the summit of the hill in the south western corner of the site. A winter creek runs parallel to Gray Road, approximately 50m to 70m inside the site. A tributary to this winter creek enters the site close the south eastern corner, and runs northwards to join the winter creek near the north eastern corner of the site. The slopes vary from relatively flat along the fringes of the main winter creek to quite steep (circa 16% to 20% on the steeper edges of the hill mentioned above). A series of manmade dams has been constructed on the creek lines.

Sandy soils were observed on the northern portion of the site. Heavier soils and rock were observed on the elevated southern portions of the site.

1.3 PROPOSED DEVELOPMENT

The proposed development is depicted in the Dynamic Planning and Developments "Proposed Development Plan – Lot 7 (315) Gray Road – Bindoon", a copy of which is included in this report as Appendix A. An extract of the plan is shown below in Figure 2.

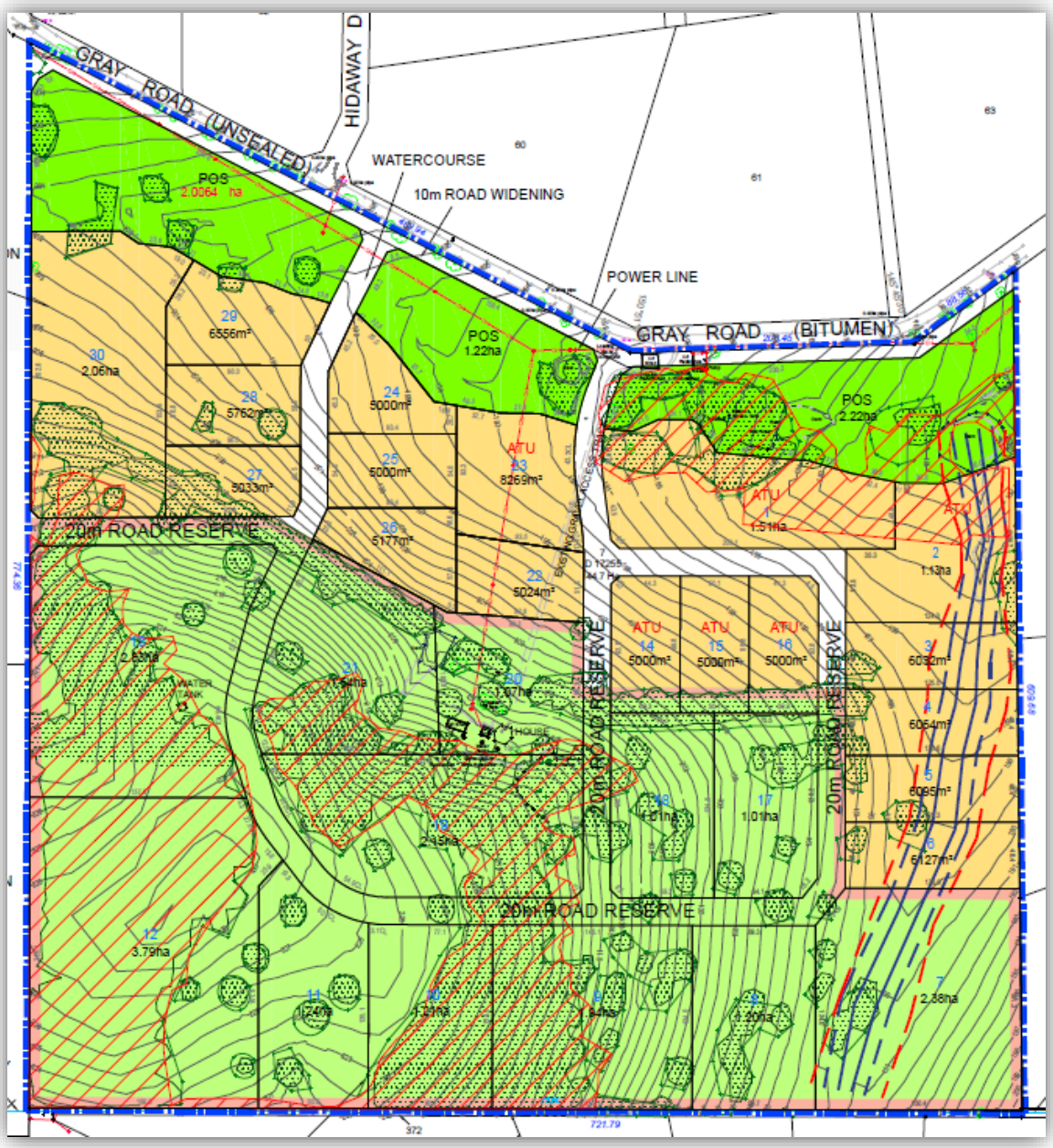


Figure 2 - Proposed Development Plan - Extract

The proposed subdivision will result in the creation of 33 residential lots ranging in size from 0.5ha to 3.79ha, with associated roadways and Public Open Space (POS). The POS runs parallel to and adjacent to the existing Gray Road reserve, encompassing the east-west watercourse.

A summary of the various subdivision elements is as follows:

Table 1 – Subdivision Elements

Element	Area
Lots	35.21 ha
POS	5.45 ha
Road Reserves	3.24 ha
	43.9 ha

Roadways will be sealed rural formation, although steeper sections of roadway may befit from the introduction of concrete kerbing (see Section 2.3.4 of this report). The lots will be connected to a reticulated water supply scheme. Notwithstanding, individual lot owners will be encouraged to install rainwater tanks to capture and re-use roof runoff.

Figure 3 - Typical Rural Formation roadway with Scour Protection and Lowpoint Kerbing

2 STORMWATER MANAGEMENT

2.1 STORMWATER MANAGEMENT OBJECTIVES

The fundamental stormwater management objective for this subdivision will be to detain flows leaving the site such that they do not exceed the pre-development peak flow rates. This will be achieved by introducing appropriate storage elements in the form of detention basins and swales within the overall stormwater treatment train.

In addition, this particular site features some steep sections of roadway. It will be necessary to manage stormwater runoff at a local level adjacent to these sections of roadway in order to minimise the risk of scouring.

The main watercourse running parallel to Gray Road will be contained within the POS corridor. However, the tributary that runs parallel to the eastern boundary of the site will cross through a number of proposed residential lots. Specific management strategies will need to be adopted to ensure that dwellings are appropriately located and protected from flows during high recurrence interval events, and to ensure that buildings and other improvements on the lots do not impede flows in the watercourses during major events.

2.2 PRE-DEVELOPMENT SURFACE WATER

Two distinct catchments flow through the subject site, joining just upstream of the north eastern corner to create a single creek crossing that exits the site in an easterly direction under Bonza Place, via a 1200mm x 1200mm box culvert.

Figure 4 - Bonza Place Culvert

The two catchments are depicted overleaf in Figure 5. Catchment 1 has a total area of 116.35ha, which includes 25.16ha of the subject site. Catchment 2 has a total area of 150.08ha, which includes 18.73ha of the subject site.

Peak runoff rates for the two existing catchments were assessed using both the Rational Method and the Indexed Flood Method. The modelling takes into account the catchment parameters as they currently exist (i.e. prior to development of the proposed subdivision).

The two methodologies yielded similar results. The Rational Method results have been adopted for the purpose of this assessment.

The results of the Pre-Development Peak Flow Rate assessment are included in this report at Appendix B, and are summarised in Table 2 below. The peak flow rates presented in Table 2 are likely to be overstated, given that the creek lines feature a number of on-line farm dams which would have the effect of attenuating the flows. It would be necessary to conduct more sophisticated modelling should it be deemed necessary at the detailed design stage to accurately reflect the impact of the existing dams. Such modelling is unnecessary at this time given the preliminary nature of this assessment.

Table 2 – Pre-Development Peak Flow Rates

	Peak Flow Rate (m^3/s)					
Catchment Element	**2 year ARI**	**5 year ARI**	**10 year ARI**	**20 year ARI**	**50 year ARI**	**100 year ARI**
Catchment 1 – Total:	**0.33**	**0.84**	**1.44**	**2.46**	**4.10**	**5.76**
Catchment 2 – Total:	**0.47**	**0.93**	**1.59**	**2.72**	**4.54**	**6.36**

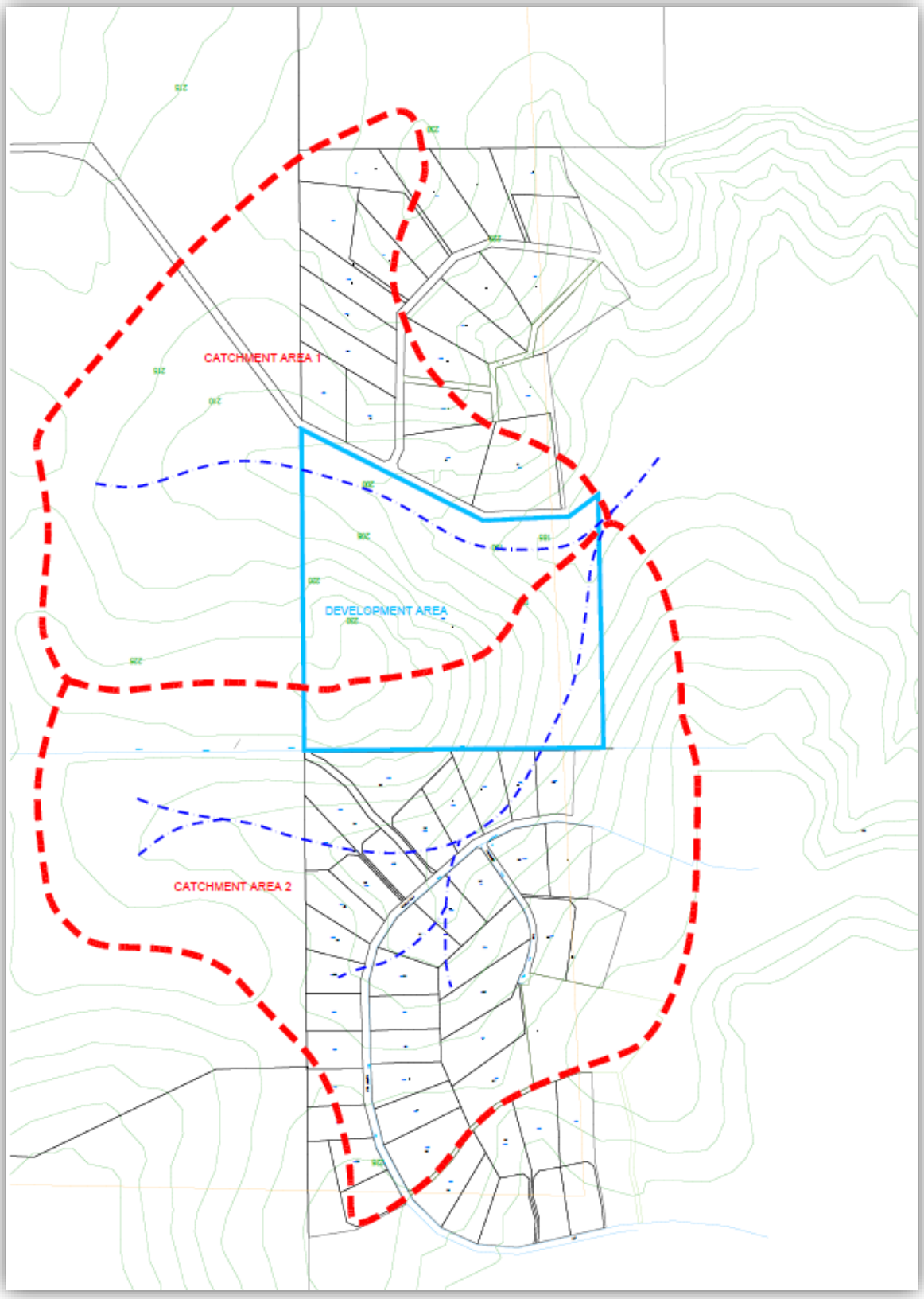


Figure 5 - Stormwater Catchment Boundaries

2.3 POST-DEVELOPMENT SURFACE WATER MANAGEMENT

The proposed subdivision will introduce sealed roadways, together with residential dwellings and other associated improvements. Landowners will be encouraged to capture runoff from roofed areas and store it for re-use. The individual dwelling lots will therefore be relatively neutral in terms of impact on the existing stormwater runoff regime. Management of stormwater runoff will therefore be focussed on the increased runoff generated by the roadways themselves.

2.3.1 Water Quality Management

The subdivision roadways will generate runoff with possible elevated levels of nutrients, particulates, and hydrocarbons. Minimising erosion within the roadside drainage structures themselves will reduce the required maintenance regime and will also minimise mobilisation of gross pollutants and particulates. Specific recommendations with regards to the treatment of roadside swales and erosion management are contained in Section 2.3.4 of this report.

Notwithstanding these source minimisation measures, it is recommended that bioretention facilities be introduced within the stormwater treatment train to intercept and arrest any mobile pollutants before they reach the creek lines themselves. These bioretention facilities can take the form of swales or basins. Flows from low recurrence interval and "first flush"events would be directed into the devices, while cleaner runoff from higher recurrence interval events would be diverted directly to the receiving water ways (in this case the creek lines). Analysis has demonstrated that the area of bioretention facilities needs to be in the order of 2% of the impervious catchment area in order to optimise treatment of the stormwater flows. The total bioretention required in order to serve the two catchments will be:

Table 3 – Bioretention Requirements for Road Catchments

	Equivalent Impervious Area	Required Aggregate Bioretention Area	Implied Volume (at 300mm deep)
Catchment 1:	**17,000 m^2**	**340 m^2**	**102 m^3**
Catchment 2:	**16,490 m^2**	**330 m^2**	**99 m^3**

Ideally, the bioretention facilities would be distributed around the catchment, as close to source as possible. However, in this particular case, the steepness of some of the roads will limit the available locations, and it may be necessary to concentrate the bioretention basins at the bottom of the sub catchments, immediately upstream of the creek lines.

Typical street-scale bioretention garden.

Typical sub catchment scale bioretention basin

2.3.2 Increase in Peak Runoff Rates

The proposed subdivision will introduce sealed roadways in place of the existing pasture. As a result, this proportion of the overall site will generate stormwater runoff at a higher rate, and the runoff will reach the downstream water courses more quickly. It will be necessary to capture and store a proportion of the anticipated runoff in order to limit the peak runoff rates to those being generated in the pre-development scenario.

Runoff rates from the balance of the site will likely remain unchanged by virtue of the requirement for any new dwellings to capture roof runoff in rainwater tanks, and the sparse nature of any other improvements on the lots.

If left unattenuated, the peak runoff rates in the post-development scenario would be increased by the amounts listed in Table 4, below:

Table 4 – Post-Development Peak Flow Rates - Unattenuated

	Peak Flow Rate (m^3/s)					
Catchment Element	**2 year ARI**	**5 year ARI**	**10 year ARI**	**20 year ARI**	**50 year ARI**	**100 year ARI**
Catchment 1 – Total:	**0.40**	**0.95**	**1.55**	**2.58**	**4.23**	**5.89**
Catchment 2 – Total:	**0.56**	**1.04**	**1.71**	**2.85**	**4.68**	**6.51**
Catchment 1 – Increase:	**0.07**	**0.11**	**0.11**	**0.12**	**0.13**	**0.13**
Catchment 2 – Increase:	**0.09**	**0.11**	**0.12**	**0.13**	**0.14**	**0.15**

2.3.3 Flow Attenuation

In order to reduce the post-development peak flow rates so that they do not exceed the corresponding pre-development peak flow rates it will be necessary to introduce additional storage within the treatment train in the form of detention basins. These basins will be additional to the bioretention basins, and will feature throttled outlets to restrict the outflows.

The overall stormwater conveyance system will include a combination of basins and pipes / channels operating in parallel and in series. Given these complexities, the dynamics of the overall system will need to be modelled at the detailed design stage using a flood routing model such as XP-STORM. However, it is sufficient for the purpose of this preliminary analysis to adopt simplified assumptions to assess the likely order of magnitude of the required aggregate storages.

Assuming a simplified triangular hydrograph, and peak storm durations approximating the overall catchment's time of concentration, the required total storage volumes will be as follows:

Table 5 – Detention Basin Requirements

	Total Aggregate Volume	**Bioretention Volume**	**Required Extra Detention Volume**
Catchment 1 – 5 Year ARI:	**165 m^3**	**102 m^3**	**63 m^3**
Catchment 1 – 100 year ARI:	**337 m^3**	**102 m^3**	**235 m^3**
Catchment 2 – 5 Year ARI:	**160 m^3**	**99 m^3**	**61 m^3**
Catchment 2 – 100 year ARI:	**326 m**	**99 m^3**	**227 m^3**

The volumes nominated in Table 5 are the aggregate volumes for the two sub-catchments. The format of the various bioretention gardens and supplementary detention storages that will in combination make up the total aggregate storages will be a matter of detailed design. The nominated storages are quite modest, and can easily be accommodated within the road reserves and the POS areas. There may also be opportunities at the detailed design stage to convert one or more of the existing farm dams into detention basins by introducing suitable outlet structures.

2.3.4 Conveyance System – Constraints and Opportunities

2.3.4.1 Roadside Conveyance System

Roadways in rural residential subdivisions such as this would typically be sealed, with rural formations incorporating V drains and culverts. Concrete kerbing would typically be confined to intersection sweeps and low points. However, given the steepness of some of the sections of proposed roadway within this particular subdivision, consideration should be given to the likely propensity for scouring of any open drains. V Drains will need to be armoured with rock lining in order to minimise the likelihood of scouring. Consideration should also be given to providing concrete kerbs and more urban style verges on the steeper sections of roadway. This will necessitate the introduction of a "pit and piped" drainage system in place of open drains on those sections of roadway deemed inappropriate for rural formation roadways.

2.3.4.2 Creek System

Major storm event flows have been modelled for the two creeks that cross the site. There are two primary considerations for establishing the relationship between housing construction and adjacent waterways. Firstly, there is a minimum horizontal distance that should be maintained in order to provide sufficient buffer for septic tanks and the like. This distance should be 30m from the edge of the main creek channel. Secondly, there is a minimum vertical separation that should be achieved between the 100 year water level in the creek and the floor level of the adjacent dwellings. The sketch below has been extracted from the Department of Water flood plain management fact sheets. The sketch depicts a river floodplain, however the principles will be the same for the same for the creeks crossing the subject site, albeit at a smaller scale.

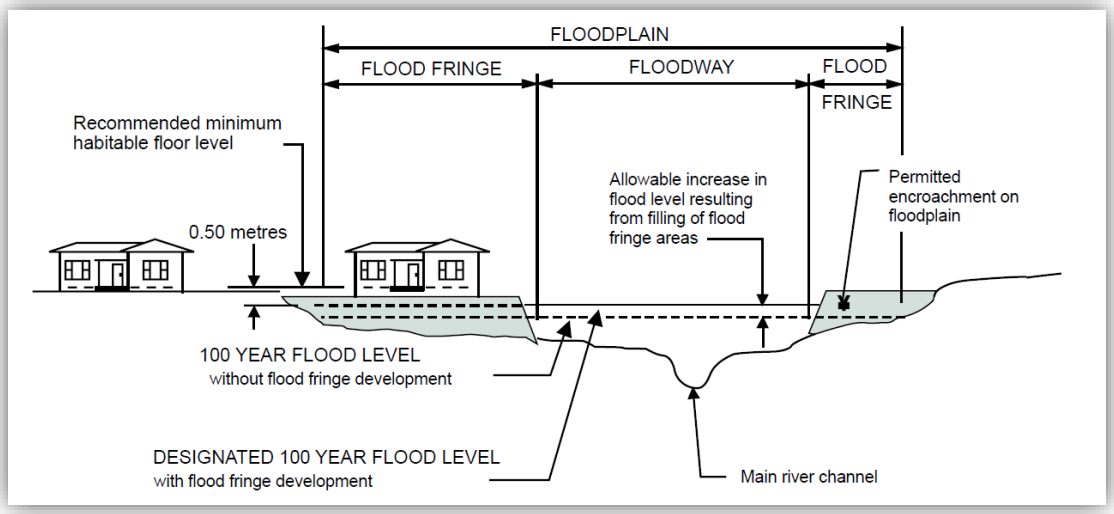


Figure 6 - Floodplain Management Strategy

The creek serving Catchment 1 is contained entirely within the POS corridor that runs parallel to Gray Road. The width of this POS corridor is such that any setback requirement will have negligible impact on the location of buildings within the adjacent lots. Vertical separation should also be easily achieved.

The creek serving Catchment 2 crosses through the lots that abut the eastern boundary of the estate. As such, any setbacks from the creeks will need to be established at the detailed design stage and protected by way of easements and building restrictions / guidelines.

The projected 100 year ARI flood corridor is depicted on the Proposed Development Plan (refer to Appendix A). The corridor is depicted as a solid blue line for the projected 100 year ARI flow path, with a dashed blue line for a 10m offset, and a dashed red line showing the edge of the existing terrain that sits 0.5m above the 100 year ARI flood level. It should be noted that the zone between the solid blue line and the dashed red line is the equivalent of the area designated as the

Flood Fringe in Figure 6. As such, it would be allowable to develop within this area provided that the finished floor levels are maintained at 500mm above the projected 100 year ARI flood levels (by filling or otherwise elevating the finished floor levels). Septic installations should be located at the rear of the building areas to achieve adequate separation from the watercourse.

APPENDIX A – PROPOSED DEVELOPMENT PLAN

LEGEND

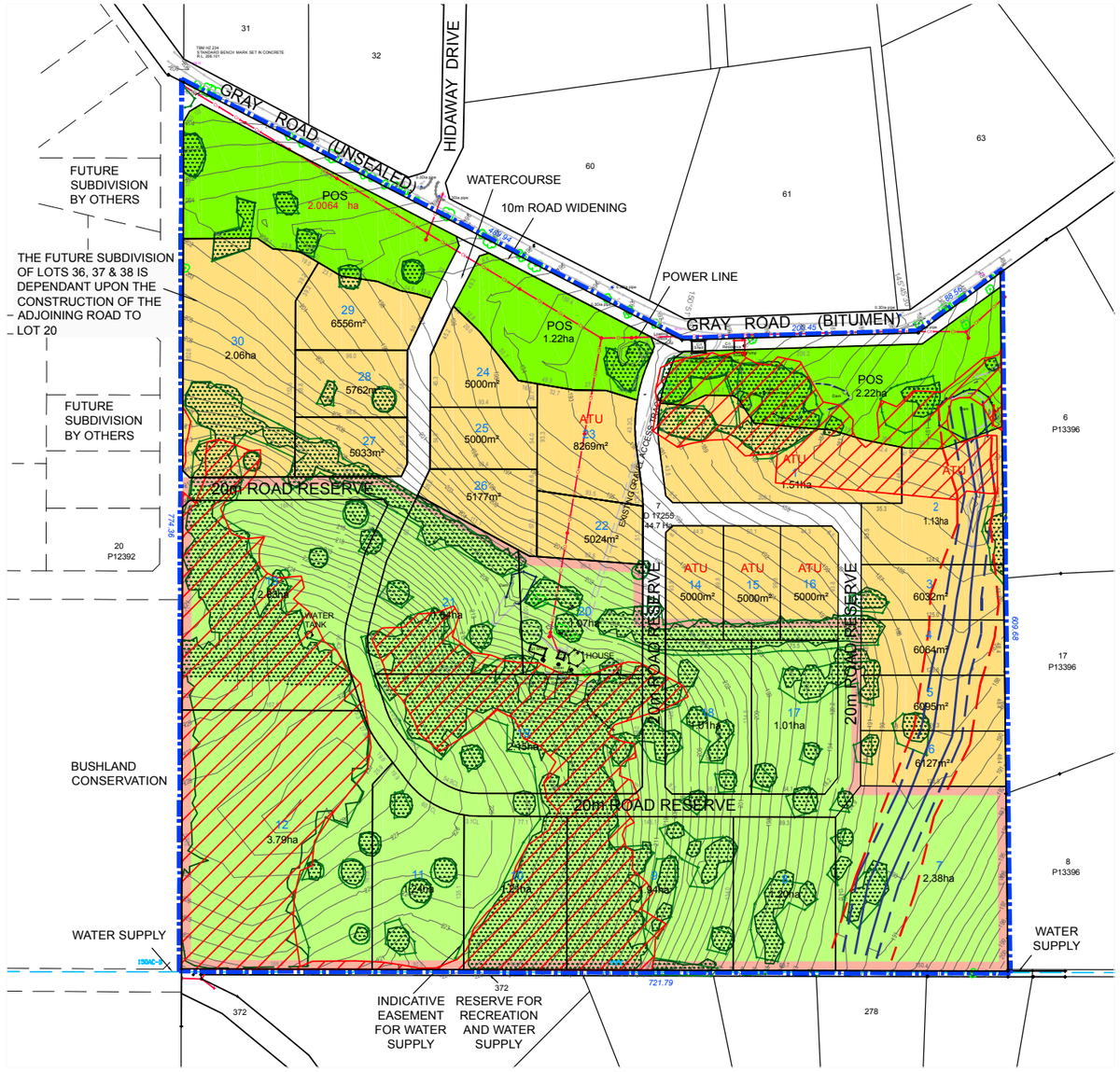
- SUBJECT AREA (TOTAL 44.7 ha)
- BUILDING ENVELOPE
- RESIDENTIAL R2 LOT
- RURAL RESIDENTIAL
- PROPOSED LOT BOUNDARY
- VEGETATION AREA
- ATU — ALTERNATIVE TREATMENT UNIT
- INDICATIVE FUTURE LOT BOUNDARY
- BUILDING EXCLUSION AREA

SUBDIVISION SUMMARY

LOT RANGE	0.5HA TO 3.79HA
TOTAL LOTS	33
TOTAL AREA	35.21HA
AVERAGE SIZE	1.17HA

PUBLIC OPEN SPACE

LOT RANGE	1.22HA TO 2.22HA
TOTAL LOTS	3
TOTAL AREA	5.4464HA
AVERAGE SIZE	1.8155HA



FLOOD LEGEND

- 100YR FLOOD LEVEL
- 10m OFFSET FROM 100 YR FLOOD LEVEL
- 0.5m ABOVE 100 YR FLOOD LEVEL

Planning Policy Requirements

Structure Plan

This Structure Plan has been endorsed by the Council of the Shire of Chittering and the Western Australian Planning Commission (WAPC). Subdivision and development should generally be in accordance with the Structure Plan.

Potable Water
Reticulated water shall be connected to lots to the satisfaction of the Water Corporation.

Environment Management
No clearing of native vegetation to occur without the written approval of the Council.

Fencing
No fencing shall be permitted or undertaken within the areas designated as Building Exclusion Areas as depicted on the Structure Plan unless approved in writing by the Council.

Waterway
30m setback of buildings required.

Building Exclusion Area
No buildings to be constructed in the Building Exclusion Area. All other development requires the written approval of Council.

This Structure Plan was adopted by the Council of the Shire of Chittering on_____ pursuant to Clause 5.8.1 of the Shire of Chittering Town Planning Scheme No. 6

CHIEF EXECTUVE OFFICER _____ DATE _____

SHIRE PRESIDENT _____ DATE _____

Endorsed by the Western Australian Planning Commission

SECRETARY _____ DATE _____

TITLE: PROPOSED STRUCTURE PLAN

DETAIL: LOT 7 (315) GRAY ROAD BINDOON

SCALE: 1:5,000 @ A3 & 1:2,500 @ A1

DATE: 13th APRIL 2016

FILE: 046_13.04.2016.dwg

DRAW: -

CHECKED: -

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UNIT 2C, 953 BEAUFORT STREET
INGLEWOOD WA 6052

N W E S

APPENDIX B – STORMWATER CALCULATIONS

14236 Pre Development Flow Rates.xlsx

Job No:	14236
Location	Bindoon, WA

CATCHMENT -1

Catchment Characteristics:

1	Vegetation	Jarrah forrest		
2	Soil Type	Loamy & Lateritic soil		
3	Catchment Area, A	1.163526	km^2	
4	Mainstream Length, L	1.433	km	
5	Stream Slope, S_e	24.50	m/km	
6	Clearing, C_L	40	%	0-100 %
7	Average Annual Rainfall, P	671.2	mm	

1 RATIONAL METHOD

Time of Concentration, t_c = $0.76 \times A^{0.38}$ h

t_c =	0.81 h

ARI (years)	2	5	10	20	50	100
I (at t_c)	16.61	27.51	31.59	37.33	45.69	52.73

$$C_{10} = 1.06 \times 10^{-1} \times L^{-0.32} \times 10^{0.0042C_L}$$

C_{10} = 0.14

ARI (years)	2	5	10	20	50	100
Frequancy factors	0.43	0.67	1	1.45	1.98	2.41

$$Q = 0.278 \times C_{10} \times (C_y/C_{10}) \times I_{t_c} \times A$$

ARI	2	5	10	20	50	100
Q (m^3/s)	0.33	0.84	1.44	2.46	4.1	5.76

2 INDEX FLOOD METHOD

$$Q_5 = 3.04 \times 10^{-1} \times A^{0.6} \, 10^{0.0052C_L}$$

Q_5 = 0.54

ARI (years)	2	5	10	20	50	100
Frequancy factors	0.5	1	1.76	3.05	5.65	10.34

ARI	2	5	10	10	50	100
Q (m^3/s)	0.27	0.54	0.95	1.65	3.05	5.58

14236 Pre Development Flow Rates.xlsx

Job No:	14236
Location	Bindoon, WA

CATCHMENT -2

Catchment Characteristics:

1	Vegetation	Jarrah forrest		
2	Soil Type	Loamy & Lateritic soil		
3	Catchment Area, A	1.500823	km^2	
4	Mainstream Length, L	1.901	km	
5	Stream Slope, S_e	15.60	m/km	
6	Clearing, C_L	40	%	0-100 %
7	Average Annual Rainfall, P	671.2	mm	

1 RATIONAL METHOD

Time of Concentration, t_c = $0.76 \times A^{0.38}$ h

t_c =	0.89 h

ARI (years)	2	5	10	20	50	100
I (at t_c)	20.42	25.91	29.71	35.08	42.87	49.42

$$C_{10} = 1.06 \times 10^{-1} \times L^{-0.32} \times 10^{0.0042C_L}$$

C_{10} = 0.128

ARI (years)	2	5	10	20	50	100
Frequancy factors	0.43	0.67	1	1.45	1.98	2.41

$$Q = 0.278 \times C_{10} \times (C_y/C_{10}) \times I_{tc} \times A$$

ARI	2	5	10	20	50	100
Q (m^3/s)	0.47	0.93	1.59	2.72	4.54	6.36

2 INDEX FLOOD METHOD

$$Q_5 = 3.04 \times 10^{-1} \times A^{0.6} \, 10^{0.0052C_L}$$

Q_5 = 0.63

ARI (years)	2	5	10	20	50	100
Frequancy factors	0.5	1	1.76	3.05	5.65	10.34

ARI	2	5	10	10	50	100
Q (m^3/s)	0.32	0.63	1.11	1.92	3.56	6.51

14236 Post Development Flow Rates.xlsx

Job No:	14236
Location	Bindoon, WA

CATCHMENT -1

Catchment Characteristics:

1	Vegetation	Jarrah forrest		
2	Soil Type	Loamy & Lateritic soil		
3	Catchment Area, A	1.143526	km^2	
4	Mainstream Length, L	1.433	km	
5	Stream Slope, S_e	24.50	m/km	
6	Clearing, C_L	40	%	0-100 %
7	Average Annual Rainfall, P	671.2	mm	

1 RATIONAL METHOD

Time of Concentration, t_c = $0.76 \times A^{0.38}$ h

t_c =	0.8 h

ARI (years)	2	5	10	20	50	100
I (at t_c)	16.61	27.51	31.59	37.33	45.69	52.73

$$C_{10} = 1.06 \times 10^{-1} \times L^{-0.32} \times 10^{0.0042C_L}$$

C_{10} = 0.14

ARI (years)	2	5	10	20	50	100
Frequancy factors	0.43	0.67	1	1.45	1.98	2.41

$$Q = 0.278 \times C_{10} \times (C_y/C_{10}) \times I_{t_c} \times A$$

ARI	2	5	10	20	50	100
Q (m^3/s)	0.4	0.95	1.55	2.58	4.23	5.89

~~2 INDEX FLOOD METHOD~~

~~$Q_e = 3.04 \times 10^{-4} \times A^{0.6} 10^{0.0052C_L}$~~

~~Q_e = 0.54~~

~~ARI (years)~~	~~2~~	~~5~~	~~10~~	~~20~~	~~50~~	~~100~~
~~Frequancy factors~~	~~0.5~~	~~1~~	~~1.76~~	~~3.05~~	~~5.65~~	~~10.34~~

~~ARI~~	~~2~~	~~5~~	~~10~~	~~10~~	~~50~~	~~100~~
~~Q (m^3/s)~~	~~0.27~~	~~0.54~~	~~0.95~~	~~1.65~~	~~3.05~~	~~5.58~~

14236 Post Development Flow Rates.xlsx

Job No:	14236
Location	Bindoon, WA

CATCHMENT -2

Catchment Characteristics:

1	Vegetation	Jarrah forrest		
2	Soil Type	Loamy & Lateritic soil		
3	Catchment Area, A	1.481423	km^2	
4	Mainstream Length, L	1.901	km	
5	Stream Slope, S_e	15.60	m/km	
6	Clearing, C_L	40	%	0-100 %
7	Average Annual Rainfall, P	671.2	mm	

1 RATIONAL METHOD

Time of Concentration, t_c = $0.76 \times A^{0.38}$ h

t_c =	0.89 h

ARI (years)	2	5	10	20	50	100
I (at t_c)	20.42	25.91	29.71	35.08	42.87	49.42

$$C_{10} = 1.06 \times 10^{-1} \times L^{-0.32} \times 10^{0.0042 C_L}$$

C_{10} = 0.128

ARI (years)	2	5	10	20	50	100
Frequancy factors	0.43	0.67	1	1.45	1.98	2.41

$$Q = 0.278 \times C_{10} \times (C_y/C_{10}) \times I t_c \times A$$

ARI	2	5	10	20	50	100
Q (m^3/s)	0.56	1.04	1.71	2.85	4.68	6.51

~~2 INDEX FLOOD METHOD~~

~~$Q_e = 3.04 \times 10^{-1} \times A^{0.6} 10^{0.0052 C_L}$~~

~~Q_e = 0.63~~

~~ARI (years)~~	~~2~~	~~5~~	~~10~~	~~20~~	~~50~~	~~100~~
~~Frequancy factors~~	~~0.5~~	~~1~~	~~1.76~~	~~3.05~~	~~5.65~~	~~10.34~~

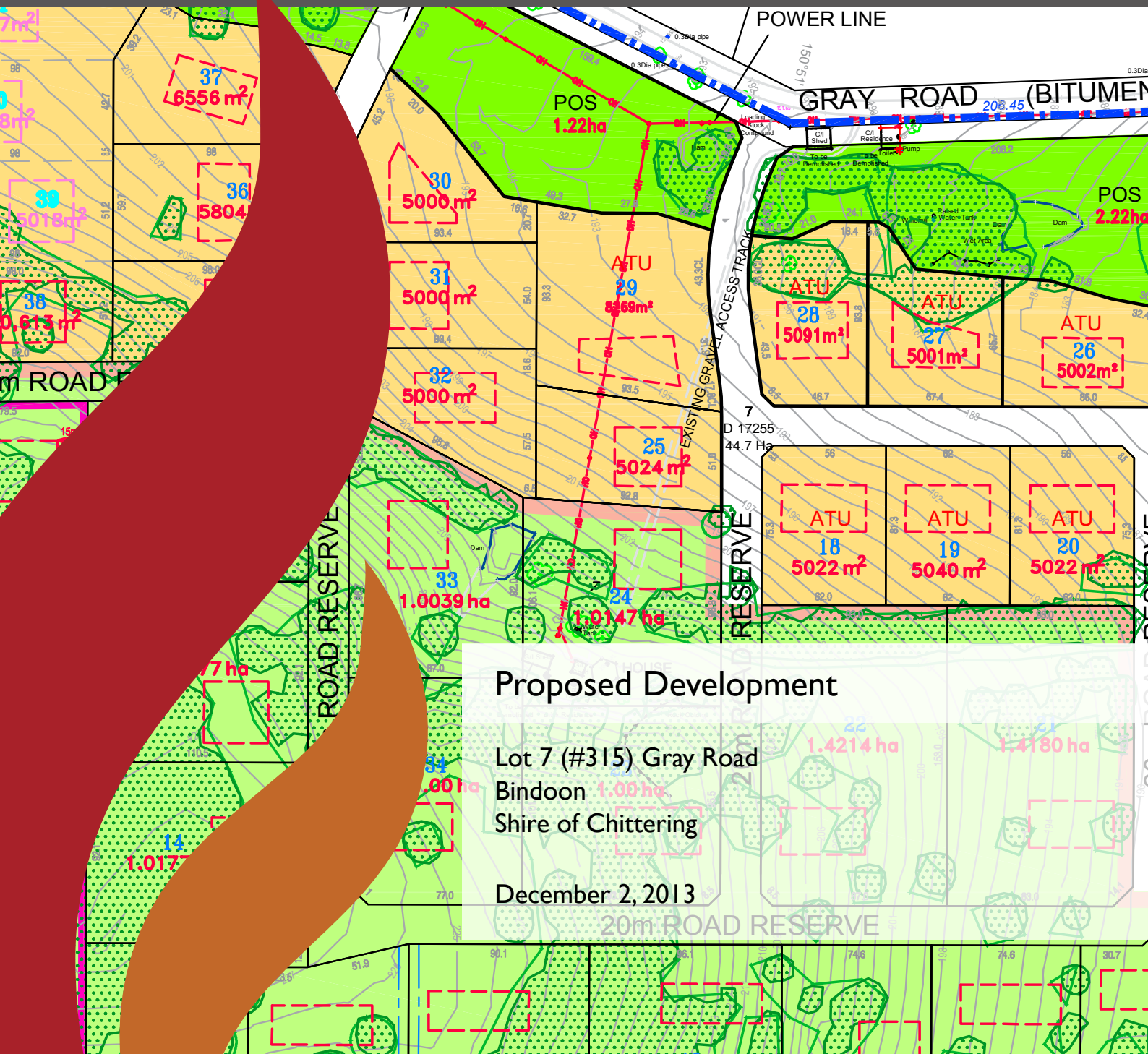
~~ARI~~	~~2~~	~~5~~	~~10~~	~~10~~	~~50~~	~~100~~
~~Q (m^3/s)~~	~~0.32~~	~~0.63~~	~~1.11~~	~~1.92~~	~~3.56~~	~~6.51~~


calibre
CONSULTING

APPENDIX 3
Bushfire Management Plan

Bushfire Safety
CONSULTING

Fire Management Plan



Proposed Development

Lot 7 (#315) Gray Road
Bindoon
Shire of Chittering

December 2, 2013

Development Proposal
Lot 7 (#315) Gray Road, Bindoon
Shire of Chittering

Front Cover Photo: Aerial photograph of development site

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Disclaimer

Table of Contents

Executive Summary

This Fire Management Plan (FMP) has been prepared following the assessment of Lot7 (#315) Gray Road, Bindoon in the Shire of Chittering. The site is located 3 kilometres west of Bindoon Townsite.

The development site has been assessed for vegetation class and bushfire hazard rating levels. **It has been determined that all proposed dwellings will fall within the acceptable level of risk**. All dwellings will have a compliant 20 m minimum building protection zone or overlapping BPZ with adjacent properties and comply with the Shire of Chittering Firebreak Notice.

This Plan includes a table on page 28 showing responses to the Performance Criteria outlined in the Planning for Bushfire Protection Guidelines - Edition 2 (WAPC et al. 2010).

Currently, the site's bushfire hazard level is rated as low and extreme. Extreme areas of hazard will be fuel reduced prior to the creation of titles and as the development occurs, management of fuels will maintain reduced hazard levels in the woodland areas. Residual hazard will remain in unmanaged fuels external to the site.

Access and egress from all proposed lots will adequately service the development.

Water supply is likely to be provided via water mains and hydrants. If a reticulated system is not achieved, 2 X 50,000 litre concrete water tanks will be provided and all new dwellings will contain a minimum of 10,000 litres in their domestic water tanks for property defence.

Both the Shire of Chittering and Department of Fire and Emergency Services of Western Australia (DFES) have a public education program to raise the community's awareness to its responsibilities regarding preparing homes for a bushfire attack and what to do if an event happens.

If there is a bushfire within or near the site, implementing this Fire Management Plan will reduce the threat to residents and fire fighters.

1. Introduction

The subject land covers 32.0044 ha and comprises of one title being Lot 7 (#314) Gray Road, Bindoon in the Shire of Chittering. The site is generally bounded by Gray Road to the north, rural residential properties to the east and south and rural land to the west.

The site is located 3 kilometres west of the Bindoon Townsite (Appendix A). The site has recently been rezoned from "Agricultural Resource" to 'Rural Residential', Parks and Recreation' and Residential R2'.

This Fire Management Plan (FMP) covers the entire site and assesses the bushfire safety issues against the proposed subdivision guide plan (Appendix B). The subject land is proposed to be subdivided into 41 lots.

A Development Plan for the site has been prepared by Dynamic Planning and Developments for submission to the Shire of Chittering. The Shire of Chittering have requested that a bushfire hazard assessment be submitted in support of the Development Plan. However, given that a Fire Management Plan is likely to be a condition at subdivision application stage, this assessment has been completed to minimise duplication.

This FMP has been prepared to satisfy this requirement. It achieves this by providing responses to the performance criteria that fulfil the intent of the bushfire hazard management issues outlined in the Planning for Bushfire Protection Guidelines - Edition 2 (WAPC et al. 2010) and the Shire of Chittering Local Planning Policy No. 21 – Fire Management Plans.

Community bushfire safety is a shared responsibility between governments, fire agencies, communities and individuals. The planning and building controls outlined in this Plan, when implemented, will reduce the risk to people and property. How people interpret the risk, prepare and maintain their property and buildings and what decisions and actions they take (i.e. evacuate early or stay and defend or other) greatly influence the outcome in a bushfire.

1.1 The Proposal

The proposed subdivision guide plan (Appendix B) outlines the creation of 41 lots, 23 lots are zoned 'Residential R2 and 18 lots are 'Rural Residential' (Appendix B). The proposed road network is designed to connect with a proposed subdivision immediately west of the site. The future subdivision of lots 39, 40 and 41 is dependent on the construction of the road in the adjoining lot 20.

A 20 metre internal loop road reserve will be constructed with two intersections with Gray Road. Water supply will be provided either by a reticulated hydrant system or 2 X 50,000 litre concrete tanks sited with a hydrant that provides a minimum flow rate of 600 litres / minute.

1.2 Objectives

The purpose of this FMP is to support the Development Plan and address an anticipated subdivision approval condition. The FMP will also identify and respond to the bushfire management issues within the proposed development. If there is a bushfire within or near the site, implementing the FMP will reduce the threat to residents, property and emergency response personnel.

Achievable and measurable goals of this Plan include ensuring:

- The development is located in an area where the bushfire hazard does not present an unreasonable level of risk to life and property;
- Vehicular access to the development is safe, if there is a bushfire occurring;
- Water is available to the development so that life and property can be protected from bushfire;
- The development is sited to minimise the effects of a bushfire; and
- The development design will minimise the effects of a bushfire.

This document sets out the roles and responsibilities of the developer, residents, the Shire of Chittering and DFES. It is important that the measures and procedures outlined in this FMP are reviewed as necessary.

This FMP includes:

- A description of the site, the surrounding area, fire climate and bushfire history;
- A summary of research into the related effects of a bushfire;
- A bushfire hazard assessment;
- Means of addressing vehicular access;
- Siting of buildings to include building protection and hazard separation zones; and
- Water supply; and maps and plans of fire reduction measures.

2. Statutory and Policy Framework

Relevant key legislation, policy and guidelines include the following:

2.1 Bush Fires Act

The Act sets out provision to reduce the dangers resulting from bushfires; prevent, control and extinguish bushfires; and for other purposes. The Act addresses various matters including prohibited burning times, enabling Local Government to require landowners and/or occupiers to plough or clear fire breaks, to control and extinguish bushfires and establish and maintain Bush Fire Brigades.

2.2 State Planning Policy No. 3.4 Natural Hazards and Disasters

The objectives of this Policy are to:

- Include planning for natural disasters as a fundamental element when preparing all statutory and non-statutory planning documents, specifically town planning schemes and amendments, and local planning strategies, and;
- Use these planning instruments to minimise the adverse effects of natural disasters on communities, the economy and the environment.

The Policy determines those areas that are most vulnerable to bushfire and where development is appropriate and not appropriate. The provisions and requirements contained in Planning for Bush Fire Protection Guidelines - Edition 2 (WAPC et al. 2010) were used in this determination.

2.3 Planning for Bush Fire Protection Guidelines (2010)

DFES, the Western Australian Planning Commission (WAPC) and the Department of Planning prepared these Guidelines. The document is the foundation for fire risk management planning on private land in Western Australia.

The document addresses important fire risk management and planning issues and sets out performance criteria and acceptable solutions to minimise the risk of bushfires in new subdivisions and developments. It addresses management issues including the location, the design, the development site, vehicular access and water.

2.4 Shire of Chittering: Local Planning Policy No. 21

This local policy is enabled under Part 2 of the Shire of Chittering Town Planning Scheme No. 6 and applies to all land zoned Rural Residential, Rural Retreat and Small Rural Holdings. The objectives of this policy are to protect life and property and maintain the real rural character of the Shire. General requirements in the policy outlined bushfire safety issues which must be addressed in a fire management plan such as access, firebreaks, water supply and hazard reduction.

3. Bushfire Impacts

Reliable records began in 1900 and since then there have been 729 civilian fatalities from bushfires in Australia, of those 21 (or 3 per cent of the national total) have occurred in Western Australia. Bushfires have killed more people in Australia than any other natural disaster.

3.1 Building Survival

Buildings survive bushfires due to a number of factors. Some relate to the way a bushfire behaves at a site, others to the design and construction materials in the building and siting of surrounding elements. Infrastructure, utilities and human behaviour are also factors. Leonard (2009) identified the following factors:

- Terrain (slope);
- Vegetation - overall fuel load, steady state litter load, bark fuels, etc;
- Weather (temperature, relative humidity and wind speed);
- Distance of building from unmanaged vegetation;
- Individual elements surrounding the building that are either a shield or an additional fuel source;
- Proximity to surrounding infrastructure;
- Building design and maintenance;
- Human behaviour - ability to be present and capacity to fight the fire;
- Access to the building and how that influences human behaviour;
- Water supply for active and/or passive defence; and
- Power supply.

It is likely that buildings are lost because of their vulnerability to the mechanisms of bushfire attack. Buildings constructed to Australian Standard (AS 3959) are more likely to survive a bushfire compared to buildings with no construction standards however, building survival is not guaranteed.

3.2 Human Fatalities

The final report of the Victorian Bushfires Royal Commission (VBRC) into the Black Saturday bushfires, handed down on 31 July 2010, is the most comprehensive evidence ever assembled about the circumstances surrounding fatalities in an Australian bushfire.

Where people died on Black Saturday contrasts strikingly with studies from previous bushfire fatalities (VBRC 2010). Historically about 32 per cent of people have died in late evacuations (Risk Frontiers et al. 2008). However, on Black Saturday the majority of people (113 out of 173) died inside or close to structures. In a "Black Saturday" type of bushfire, safety can only be assured if people leave early, well before any fire arrives. When the Fire Danger rating is "Catastrophic" most buildings cannot be defended.

Most people die in bushfires from being exposed to radiant heat. Protection is provided by wearing long sleeved natural fibre clothing, having solid barriers and maintaining a long distance between people and the fire (i.e. source of radiant heat).

Bushfires also generate enormous amounts of smoke and wind, and when these factors are combined with the fire, they can cause many trees to come down. If people do not evacuate early before a fire arrives, road conditions become extremely hazardous. Many fatalities have occurred during late evacuation or when fleeing the fire.

4. Description of the Area

The Shire of Chittering covers an area of 1220km2 and has approximately 3,520 people residing in it (cf: Shire of Chittering website). Land use within the Shire includes grazing, cropping and timber production. The Shire services the town sites of Muchea, Bindoon and Wannamal.

Bindoon is located 84 km north of Perth on the Great Northern Highway. The subject land is bounded by rural land to the west and rural residential land in all other directions. Equine properties are common to the east of the site.

4.1 Description of the Subject Land

The subject land covers over 32 hectares and is approximately 700 m wide and 700 m long (Appendix C). The square shape of the development site will allow eighteen

"Rural Residential" lots and 23 'Residential R2' lots to be created. It is consistent with surrounding land uses and proposed development to the west.

This FMP focuses on the subject land and immediate surrounding area (Appendix B & C).

In summary this land is:

- Undeveloped and generally vegetated in grassland and woodland with a cleared understorey reflecting the current land use of cattle grazing;
- Gently sloping, downhill from the highest point in the south west corner of the site; and
- Surrounded by similar rural properties to the west and Rural residential estates to the north, east and south.

4.2 Fire Climate

The behaviour of bushfires is significantly affected by weather conditions and they burn more aggressively when high temperatures combine with low humidity and strong winds. In Perth and surrounding coastal areas, the fire risk is greatest from summer through autumn, when the moisture content in vegetation is low. Summer and autumn days with high temperatures, low humidity and strong winds are particularly conducive to the spread of fire. This threat is enhanced if thunderstorms develop accompanied by lightning and little or no rain.

Research indicates that virtually all house losses occur during severe, extreme or catastrophic conditions (i.e. when the Fire Danger Index is over 50) (Blanchi et al. 2010).

The Bureau of Meteorology website[1] states that extreme fire weather conditions in the Perth region typically occur with strong easterlies or north easterly winds associated with a strong high to the south of the state and a trough offshore. Easterly winds represent about 60 per cent of extreme fire weather days (events) compared to less than 5 per cent associated with southerly winds. About 15 per cent of Perth events occurred in a westerly flow following the passage of a trough.

Very dangerous fire weather conditions often follow a sequence of hot days and easterly winds that culminate when the trough deepens near the coast and moves

[1] www.bom.gov.au/weather/wa/sevwx/perth/bushfires.shtml

inland. Winds can change from easterly to northerly and then to westerly during this sequence of climatic events.

Data from the Bureau of Meteorology research station at Gingin (24 km from the study site) indicate the area experiences warm dry summers and cool wet winters (Figure 1), and is classified as a Mediterranean climate. Mean maximum temperatures vary from 33 degrees Celsius in February to 19 degrees Celsius in July.

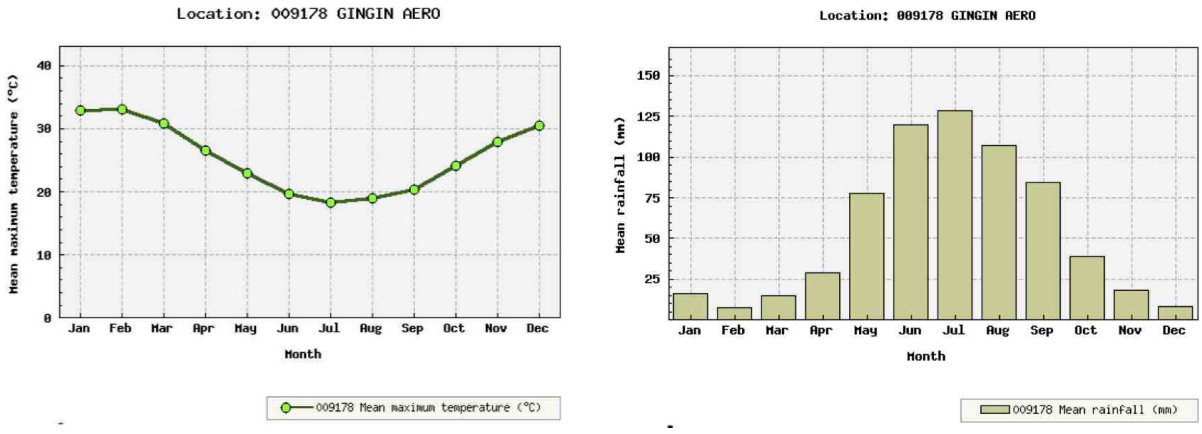

Figure 1: Mean maximum recorded temperatures and mean rainfall for Gingin Aero Meteorology Station between 1996 and 2011

Data from the Bureau of Meteorology weather station at Gingin indicate that the predominant winds in the summer months at 3 pm near the study site are south-westerly (Figure 2). Wind strength, direction and frequency of the south-west wind are clearly dominant and occur 40-60 per cent of the time. Winds from the west and south-east occur approximately 10% to 15% of the time.

Figure 2: Rose of wind direction and wind speed in km/hr for December, January and February between 1996 and 2010 at the Gingin Aero Bureau of Meteorology Station

Interpreting Figure 2 - Wind speed Vs Direction Plot

Wind roses summarize the occurrence of winds at a location, showing their strength, direction and frequency. The percentage of calm conditions is represented by the size of the centre circle - the bigger the circle, the higher is the frequency of calm conditions. Each branch of the rose represents wind coming from that direction, with north to the top of the diagram. Eight directions are used. The branches are divided into segments of different thickness and colour, which represent wind speed ranges in that direction. Speed ranges of 10 km/hr are used. The length of each segment within a branch is proportional to the frequency of winds blowing within corresponding range of speeds from that direction (BOM 2010).

4.3 Bushfire Fuels

The study site is vegetated in grass and woodland fuels with a grassy ground layer. Leaf, twig and bark litter accumulate under the canopy of woodland trees and add to litter fuel levels. Heavier fuel loads are found in the adjoining properties with more intact natural woodland vegetation.

4.4 Assets

When the site is fully developed it will contain 41 new dwellings. The lot adjacent to intact woodland vegetation on the perimeter of the site are more exposed than centrally located lots.

4.5 Access

The subdivision will be serviced by a 20 m wide road reserve that loops through the estate. Gray Road provides two way sealed public road access and the subdivision design include two intersections with Gray Road. The proposed subdivision allows for future roads to link with a subdivision to the west of the site.

4.6 Water Supply

The site is located in a non-reticulated area, however a water main is likely to be installed thereby providing reticulated water. If this is not achieved, 2 X 50,000 litre concrete water tanks will be sited in an elevated position at the site, adjacent to a road and accessible. A milcock hydrant will be located downslope from the tank, adjacent to a road, to gravity feed the outlet with a minimum flow rate of 600 litres per minute.

4.7 Bushfire History

A recent study has concluded that bushfires may have been in the Australian landscape for 50 million years longer than previously thought. The adaption of eucalypts that allows them to recover from bushfires has been traced back more than 60 million years (Crisp et al. 2011), indicating fire has been in the Australian landscape since that time.

Bushfires are common in the Shire of Chittering. Recent bushfire history includes but is not limited to:

- 29 January 2012, a fire was reported on a rural property (named the Wannamal fire) which was fanned by strong and gusty south-east winds. Over 100 fire fighters were required to control the blaze and three helicopters and 2 fixed wing aircraft were used. The cause of the fire was believed to be suspicious. It burnt 1650 hectares with the loss of livestock, fencing, one shed, two caravans and four items of machinery (Shire of Chittering media release).

- At the same time as the Wannamal fire there was a fire which burnt 40 hectares in Julimar State Forest (attended by DEC and Toodyay brigades) and a pole top fire on Stephens Road (Chittering Bushfire Advisory Committee Meeting Minutes, February 2012).

- Prior to Christmas 2012, electrical storms ignited the woodland in three separate locations near the site. Local brigades from Chittering and Bindoon attended and suppression was hampered due to access being only suitable for light vehicles due to the sandy soils. A number of large trees burnt for several days and required monitoring.

- On February 21, 2013 a large fire started by lightning threatened large parts of Bindoon, Upper Chittering, Mooliabeenee, Lennard Brook and Breera. Over 200 hectares were burnt and over 150 fire fighters and 62 appliances were used to contain the fire.

5. Bushfire Hazard Assessment

Assessing bushfire hazards at a strategic level takes into account the predominant class of vegetation on the site and surrounding area for a minimum of 100 metres. The vegetation class map for the site and surrounding area for a minimum of 100 metres is shown in Appendix D. Fuel layers in a typical forest environment can be broken-down into five obvious segments as shown in Figure 3. These defined fuel layers are used in the following descriptions regarding vegetation types, fuel structure and bushfire hazard levels.

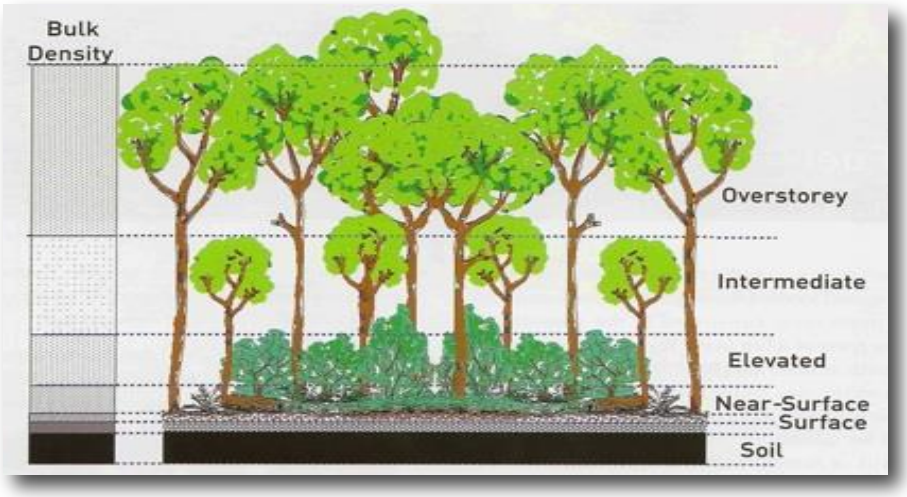

Figure 3: The five fuel layers in a forest environment that could be associated with fire behaviour (Gould et al. 2007)

5.1 Vegetation Type and Structure

The site assessment undertaken for this study identified predominantly two vegetation types as shown and mapped in Appendix C.

The property has been largely cleared of native vegetation for agricultural purposes. The vegetation on the site is dominated by pasture grasses and cattle grazing occurs over virtually the whole area. This maintains grass fuels in very low fuel condition (Figure 4). In the southern half of the property, numerous mature woodland trees stand isolated in the middle of paddocks. These areas are classed as grassland because the woodland foliage is less than 10%, therefore are classified according to its understorey.

Remnant woodland areas occur on the site in the south-western corner and in the central south section. The woodland is dominated by Wandoo trees species that are on average 8-10 metres in height. Jarrah (*Eucalyptus marginata*) and to a lesser extent Marri (*Eucalyptus gomphocephala*) also occur in the Wandoo woodland.

In isolated areas Parrotbush (*Banksia sessilis*) occurs and occupies the intermediate fuel layer and open shrubland occupies the elevated fuel layer. The woodland is generally very clear and open on the site reflecting the impact of cattle grazing (Figure 5). Bushfire litter (near surface) fuels are higher in woodland areas due to the accumulation of leaf and bark fuels under the tree canopies (Figure 6). In the gully that runs parallel to Gray Road, the woodland trees are Flooded Gum (*Eucalytpus rudis*).

A shelter belt woodland extends east – west across the site and consists of three rows of trees. Grass fuels are low in the shelterbelt but some leaf and bark fuels exist (Figure 7). A small area has been actively revegetated in the gully in the north east corner of the site. It consist of numerous young Eucalypt trees that are anticipated to grow in to a Woodland vegetation type. Cattle are maintaining grass feels in this area (Figure 8).

East of the site, a number of equine properties are located that are in a very low fuel condition. The woodland trees that exist are generally isolated and near fuels are very low (Figure 9). Woodland vegetation occurs adjacent to the far north east and south east perimeter. The woodland vegetation south of the site exists on rural residential properties, most have intact Wandoo and Jarrah woodland with elevated open heath fuels (Figure 10). This vegetation type and structure continues in the woodland vegetation west of the site. This area has the most intact woodland vegetation and without any grazing pressure to reduce the litter fuel loads.

North of Gray Road in the rural residential properties, there is a mixture of woodland and managed grassland vegetation. A small area of Grass Tree shurbland occurs northwest of the site (Figure 11). Vegetation will be removed and managed to create building envelopes, building protection zones and firebreaks and fuel loads will be managed in the building protection and hazard separation zones. This will reduce the overall bushfire hazard on the site.

Figures 4 and 5: Cattle grazed paddocks with managed fuel loads on the site (left) and areas of remnant woodland on the site are usually open structure with minimal elevated or intermediate fuels (right)

Figures 6 & 7: Near surface fuels of leaf and bark litter accumulate under tree canopies (left) as has occurred under the woodland shelterbelt (right)

Figures 8 & 9: Eucalypt revegetation in the gully area (left) and very low near surface fuels on the equine properties east of the site (right)

Figures 10 & 11: The woodland south and west of the site has the most intact vegetation and highest fuel loads (left) and a small area of grass tree shrubland occurs north west of the site (right)

5.2 Slope

The topography of the site is dominated by the hill situated in the south west corner of the site and the landscape falls away in all directions from this location. A drainage line runs east west through the site parallel to Gray Road and a broad valley runs

downslope from the equine property on the south boundary north towards the dam sited in the north east corner. Slopes throughout the site average between 0 – 6 degrees. The steepest land is sited west of the existing dwelling and was measured to be 12 degrees. The topography of the site is outlined in Appendix D.

5.3 The Bushfire Hazard Assessment Levels

The vegetation class map (Appendix C) outlines the dominant vegetation types on the study site and on surrounding area (for a minimum of 100 metres). Descriptions of the vegetation class, structure and dominant species are outlined in Section 5.1 Vegetation Type and Structure.

The bushfire hazard assessment levels were determined using Appendix 1 of the Planning for Bushfire Protection Guidelines - Edition 2 (WAPC et al. 2010).

The study site has a bushfire hazard rating of predominantly low and extreme. Moderate bushfire hazard only occurs in the shelter belt strip of vegetation which has managed grassland fuels due to grazing.

Low hazard occurs in all areas of managed grassland including the grazed paddocks and equine properties. These areas particularly away from tree canopies are very low in fuel loads. Extreme hazard occurs in all areas of woodland. The fuel loads are highest where intact woodland occurs west and south of the site, meaning these areas provide the biggest threat, however the disturbed woodland areas inside the grazing paddocks do have leaf and bark litter fuels accumulating on the ground.

Prior to the creation of titles, the developer will liaise with the Bindoon volunteer Bush Fire Brigade to undertake a fuel reduction burn to ensure the litter fuels in the woodland areas is reduced. As the site develops, building envelopes and building protection zones will be established and vegetation will be intensively managed around dwellings. However the removal of livestock off from the property could result in increased grass fuels and the re-establishment of shrubs and trees in the long term. Rural residential lots also could be revegetated with various native species that unless managed actually increase fuel loads (and hazard) in areas across the entire site.

Long-term hazard will remain in the adjoining rural residential properties to the south and the rural land west of the site. Changes in land management on surrounding properties could obviously change vegetation and hazard levels.

The bushfire hazard-rating map for the site and surrounding area is shown in Appendix E.

5.3.1 Fuel accumulation rates in Wandoo Woodland

The level of fuels in a woodland is related to the total foliage cover, the presence or absence of intermediate and elevated fuels and if near ground fuels are annual grasses or leaf and bark litter only. Research conducted in the Wandoo woodland at Dryandra Forest (Burrows et al. 1987) established that the rate of fuel litter accumulation is variable, but is generally slow because it depends on canopy density. For areas of Wandoo woodland in Dryandra with 20m3/ha basal area, litter fuel accumulation rates are typically in the order of 1 tonnes per year over the first ten years (Figure 9). Rates slow as tree canopies and time since fire increases.

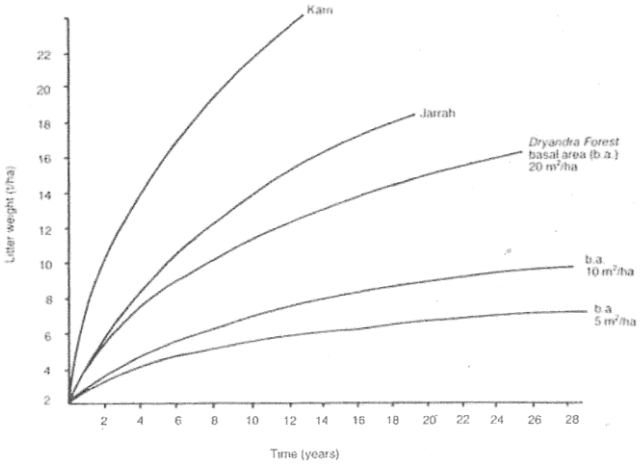

Figure 12: Litter fuel accumulation for three levels of forest stand density at Dryandra (5, 10, 20m2/ha of overstorey basal area) compared to Jarrah and Karri forest (data from Peet 1971).

One study of a Wandoo woodland at Dryandra Forest with 10m^2 of overstorey basal area showed that after approximately 14 years the woodland had reached 100% litter accumulation rate. This equates to about 8 tonnes per hectare. 80% fuel loads were achieved after 10 years and 50 % after 5 years (Table 1).

Litter Fuel accumulation Rates %	Year since last Burn	Litter weight (tonnes per hectare)
100	14	8
80	10	6.4
50	5	4
30	1	2.4

Table 1: Fuel litter accumulation rates at Dryandra Forest (Burrows et al 1997)

This woodland environment, fuel reduction burn every 8 – 10 years under the woodland canopy is likely to ensure fuel litter loads remain below 6-8 tonnes per hectare.

6. Fire Mitigation Strategies

This report adopts an acceptable solution and performance-based system of control for each bushfire hazard management issue. This approach is consistent with Appendix 2 of the Planning for Bushfire Protection Guidelines - Edition 2 (WAPC et al. 2010). The management issues are:

- Location of the development;
- Vehicular Access;
- Water;
- Siting of the development (including fuel management strategies); and
- Design of the development.

Acceptable solutions are provided for four out of the five management issues and each illustrates one example of satisfactorily meeting the corresponding performance criteria. A performance-based approach is provided for one management issue.

6.1 Element: Location of the Development

Intent

To ensure that development/intensification of land use is located in areas where bush fire hazard does not present an unreasonable level of risk to life and property.

Acceptable Solution

Bushfire hazard levels are rated as extreme and low on the development site due to vegetation being woodland and grazed pasture grasses.

- The maximum Bushfire Attack Level (BAL) is predicted to be BAL-29 for one dwelling.
- The vast majority of dwellings are exposed to BAL-LOW or BAL-12.5.

Hazard Separation Zones (HSZs) exist to reduce fire intensity on dwellings and are incorporated extensively across the site. Construction standards will be increased to align with the appropriate BAL to offset the reduced size of the HSZ.

The site will be provided with an adequate water supply and vehicular access to fight fires. All exposed dwellings should be constructed to AS 3959 standards.

6.2 Element: Vehicular Access

Intent

To ensure vehicular access serving a subdivision development is safe if a bushfire occurs.

Background

The development site is located in the interface between rural and rural residential lots. Gray Road borders the northern boundary of the entire subdivision and is a two-lane public road providing two access routes.

The proposed internal road system includes a loop circuit road that intersects with Gray Road in two locations. There is one proposed dead-end road that is 195 m in length, this however is likely to be linked to a proposed subdivision west of the site thereby providing through access at a later date. Until this adjacent development occurs, a compliant turn around cul-de-sac head will be provided

The road network in the site is shown in the proposed subdivision guide plan (Appendix B).

This proposal complies with the performance criteria by applying the following acceptable solutions:

Acceptable Solution A2.1: Two Access Routes

All lots within the subdivision have direct driveway access to a public road and the internal road system contains loop roads to provide 2 access options. One cul-de-sac is proposed on the western perimeter that is likely to link with an adjoining road in a proposed subdivision thereby providing an additional access route. In the interim it will comply with cul-de-sac standards.

The proposed subdivision has loop roads that intersect with Gray Road. This provides two access options. This complies with the requirements for two access routes.

Acceptable Solution A2.2: Public Roads

New public roads in the site will comply with minimum standards for public roads. Gray Road also complies. The public road standards are:

- Minimum trafficable surface: 6 m;
- Horizontal clearance: 6 m;
- Vertical clearance: 4 m;
- Maximum grades: 1 in 8;

- Maximum grades over 50 m: 1 in 5;
- Maximum average grade: 1 in 7;
- Minimum weight capacity: 15 tonnes;
- Maximum crossfall: 1 in 33; and
- Minimum inner radius of curves: 12 m.

Acceptable Solution A2.3: Cul-de-sacs (including dead end roads)

One temporary cul-de-sac is proposed on the western perimeter of the subdivision to enable fire service vehicles to turn around. The road reserve is 20 m wide so the temporary cul-de-sac will extend into Lot 17 to enable a 21 m minimum turn-around to be provided. The following standards apply:

- Maximum length: 200 metres, but can be extended to 600 metres if less than eight lots are serviced and if alternative emergency access is provided;
- Minimum trafficable surface: 6 m;
- Horizontal clearance: 6 m;
- Maximum grades: 1 in 8;
- Maximum grades over 50 m: 1 in 5;
- Maximum average grade: 1 in 7;
- Minimum weight capacity: 15 tonnes;
- Maximum crossfall: 1 in 33;
- Minimum inside radius of curves: 12 m; and
- Turn around area requirements: (see Appendix F).

Acceptable Solution A2.5: Private Driveways

It is unlikely private driveways will exceed 50 m in length, however if they do on any lots the following minimum standards apply:

- Minimum trafficable surface: 4 m;
- Horizontal clearance: 6 m;
- Vertical clearance: 4 m;
- Maximum grades: 1 in 8;
- Maximum grades over 50 m: 1 in 5;
- Maximum average grade: 1 in 7;
- Minimum weight capacity: 15 tonnes;
- Maximum crossfall: 1 in 33;
- Minimum inside radius of curves: 12 m; and
- Turn around area designed to accommodate 3.4 fire appliances and to enable them to turn around safely within 50 metres of a house (requirements outlined in Appendix F).

Acceptable Solution A2.9: Firebreak Widths

Shire of Chittering compliant firebreaks are required inside the perimeter of each rural residential lot boundary and will be installed by the Developer. The firebreaks will be 3 metres wide. The annual Shire of Chittering firebreak notice provides minimum requirements for firebreaks.

6.3 Element: Water

Intent

To ensure water is available to the development to enable life and property to be defended from bushfire.

Background

The development is currently in a non-reticulated area, however the site is likely to be serviced from water mains. If this is not achieved then water supply and infrastructure standards will be achieved for non-reticulated areas.

Acceptable Solution A3.1: Reticulated Area

The site could be provided with a reticulated water supply. This involves achieving fire hydrants standards that meet the specifications of the Water Corporation Design Standard DS 63 and DFES. Residential dwellings (Class 1a) require fire hydrants to be sited within (or every) 200 metres in land zoned residential. Residential dwellings (Class 1a) require fire hydrants to be sited within (or every) 400 metres in land zoned rural-residential.

At subdivision approval stage, the developer is to provide detailed hydrant plans to the Shire of Chittering and the local Bushfire Brigade for monitoring. The Water Corporation is responsible for all hydrant repairs. Fire services require ready access to an adequate water supply during fire emergencies.

Acceptable Solution A3.2: Non Reticulated Area

Two concrete water tanks of 50,000 litre capacity (Figure 13) will be sited at an elevated position in the development so that a Milcock fire hydrant (Figure 14) can be positioned downslope adjacent to a public road with good access for fire appliances. The hydrant will need to achieve a minimum flow rate of 600 litres per minute and the system will need to be designed and signed off by an engineer to ensure compliance

with this standard.

Figure 13 & 14: Example infrastructure including a 50,000 litre concrete water tank clearly identified for emergency use only (left) with the Milcock hydrant located downslope adjacent to a public road (right)

The developer will need to install the water tank and hydrant and an agreement needs to be reached between the developer and the Shire of Chittering to maintain the tank at full capacity at all times. The water tank and hardstand area will preferably be vested with the Shire of Chittering.

Additional to this, as identified in the Shire of Chittering Local Planning Policy 21 (Fire Management Plans - Section 5.4 Water Supply b) water supply shall be provided on-site as follows:

In the case of buildings intended for residential use, in accordance with TPS No. 6 requirements for 120,000 litres capacity water supply, of which 10,000 litres is to be held in reserve for fire fighting purposes, provided that where bore water is available with an independent power supply, this requirement may be reduced to 110,000 litres with 10,000 litres held in reserve. All water tanks intended to reserve 10,000 litres for fire fighting purposes are to install a 50mm male Camlock fitting to the floor of the tank and the draw point for residential purposes is to be 10,000 litres above the floor of the tank.

6.4 Element: Siting of the Development

Intent

To ensure the siting of the development minimises the level of bushfire impact.

Acceptable Solution: Building Protection Zone (BPZ)

One of the most important fire protection measures influencing the safety of people and property is to create a BPZ around buildings. The BPZ is a low fuel area immediately surrounding a building. Non-flammable features such as driveways, roads, road reserves, footpaths, lawn or landscaped gardens (including deciduous trees) can form parts of a BPZ.

World first research into land management and house losses during the Black Saturday Victorian bushfires concluded that the action of private landholders, who managed fuel loads close to their houses, was the single most important factor to determine house survival when compared with other land management practices such as broad scale fuel reduction burning remote from residential areas (Gibbons et al. 2012).

Creating a BPZ will ensure vegetation and fuels within close-proximity to dwellings are managed to reduce predicted levels of radiant heat flux and improve the survival of buildings.

Managing vegetation in the BPZ has two main purposes. To reduce:

- direct flame contact and radiant heat from igniting the building during the passage of a fire front; and
- ember attack and provide a safer space for people to defend (if required) before, during and after a fire front.

Prior to the creation of titles, the developer will liaise with the Bindoon Volunteer Bush Fire Brigade to undertake a fuel reduction burn to ensure the litter fuels in the woodland areas is reduced. This will result in an immediate reduction in fuel litter levels under tree canopy areas to less than 2 tonnes per hectare depending on the quality of burn achieved.

A permanent BPZ will be established around every dwelling. It must be a minimum of 20 metres wide or overlap with the adjacent lot where 20 metres cannot be achieve within the lot boundary. This creates an overlapping BPZ which provides additional protection for groups of dwellings. Additionally, lots on the southern and south western perimeter of the site adjacent to intact woodland vegetation require a minimum 30 m building protection zone between the dwelling and the extreme bushfire hazard. This includes lot numbers 6-15, 17, 40 and 41. Every lot on the northern perimeter of the site adjacent to the proposed POS achieves a minimum 20 m BPZ between the building envelope and the POS.

The BPZ must be established and maintained to the following standards:

- Width: 20 metre minimum surrounding each dwelling or to the lot boundary where it overlaps with the adjacent property, but not less than 20 metres for lots facing the POS and a minimum of 30m for lots facing intact woodland vegetation on the south and west perimeter as indicated in Appendix G;
- Fuel load: reduced to and maintained at 2 tonnes per hectare;
- All tree crowns are a minimum of 10 metres apart;

- All trees to have lower branches pruned to a height of 2 metres;
- All tall shrubs or trees are not to be located within 2 metres of a building (including windows);
- No tree crowns or foliage is to be within 2 metres of any building. This includes existing trees and shrubs and new plantings;
- All fences and sheds are constructed of non-combustible materials (i.e. Colorbond, brick or limestone);
- All shrubs to contain no dead material within the plant;
- No tall shrubs are to be in clumps within 3 metres of the building; and
- No trees are to contain dead material in the crown or on the bole.

Vegetation removal and management in the fuel structure to establish BPZ standards will include predominantly the management of grass, bark and leaf litter fuels under areas of tree canopy. Some trees will need to be removed to establish the building envelope and sufficient canopy setback from dwellings, however the management of near surface fuels that accumulate on the ground will be the most important strategy in the BPZ.

Elevated and intermediate fuels are minimal on the site and require minimal modification.

It is the responsibility of each new landowner to establish and maintain the BPZ.

Acceptable Solution: Hazard Separation Zone (HSZ)

A Hazard Separation Zone (HSZ) is an additional fuel managed zone to create further separation between dwellings and bushfire hazard. It can extend out to 100 metres from buildings. The HSZ will occupy all remaining land within each lot outside of the BPZ. Lot 17 requires a 30 m HSZ located south of the BPZ.

This strategy results in an overlapping HSZ linking between lots and providing increased protection for the entire subdivision. Cleared areas on the site which are currently grazed by livestock do not require any additional work to establish the HSZ, however fuel litter loads under tree canopies do require some fuel reduction work to achieve the standard. Following the removal of livestock after titles are created and people reside on the site grass fuels are likely to increase. Dwellings sited in grassland areas will then be required to do some fuel management to maintain the HSZ standards such as mowing and slashing. Dwellings closer to woodland fuels and leaf and bark accumulated material will require on-going management to maintain fuel load standards.

The HSZ will meet the following standards:

- Dimensions: as outlined in Appendix G;
- Location: within the boundary of the lot on which the building is located;
- Fuel load: maintained at between 5 and 8 tonnes per hectare;
- Tree crowns: minimum of 10 metres apart; and
- Trees have no dead material within the plant's crown or on the bole.

The reduced HSZ design feature is offset by an increase in construction standards and compliance with AS 3959-2009 (Construction of Buildings in Bushfire-Prone Areas).

It is the responsibility of the developer to liaise with the Shire of Chittering and the Bindoon Volunteer Bush Fire Brigade to assess the site for a fuel reduction burn and undertake a burn if possible.

The following Bushfire Attack Level (BAL) assessment demonstrates that the proposed fuel management zones combined with increased dwelling construction standards will achieve acceptable levels of risk for the development.

Strategies to maintain fuel loads in a woodland to HSZ standards include fuel reduction burning when fuel levels reach 8 tonnes per hectare which equates to approximately to 8-10 year rotations depending on canopy foliage cover.

Smooth barked eucalypts such as Wandoo are very sensitive to fire and easily killed by low scorch (Burrows et al 1990). Young trees are particularly susceptible so care needs to be taken when burning.

By achieving these standards, it will be possible to construct dwellings to an appropriate standard (i.e. BAL-29 or less) under the Australian Standard (AS 3959-2009: Construction of Buildings in Bushfire-Prone Areas).

6.4.1 Building Siting and Predicted Bushfire Attack Levels

The following Bushfire Attack Level (BAL) assessment demonstrates that the fuel management surrounding dwellings achieves acceptable levels of risk.

The AS 3959-2009 has six categories of BAL, namely BAL-LOW, BAL-12.5, BAL-19, BAL-29, BAL-40 and BAL-FZ. These categories are based on heat flux exposure thresholds.

The method for determining the BAL involves a site assessment of vegetation and local topography. The assumed Fire Danger Index (FDI) for Western Australia is 80.

The BAL identifies the appropriate construction standard that applies as a minimum standard in Construction of Buildings in Bushfire-Prone Areas (AS 3959-2009).

Methodology and Assumptions

The following indicative BAL assessments for the proposed building envelopes in Table 2 were determined using the methodology in Appendix A of AS 3959-2009. This methodology is also outlined in the Planning for Bush Fire Protection Guidelines. Indicative BAL assessments were established by inspecting each lot building envelope (Appendix H).

The criteria to determine the BAL is outlined as follows:

Designated FDI : 80
Flame Temperature: 1090
Slope : Upslope and Downslope (See Table 2)
Vegetation Class : Woodland
Setback distances : Various (See Table 2)

Lot No.	Setback (metres)	Vegetation	Slope	BAL	Lot No.	Setback (metres)	Vegetation	Slope	BAL
1	20	Woodland	Down 2	29	22	>100	Woodland	-	LOW
2	74	Woodland	Down 2	12.5	23	>100	Woodland	-	LOW
3	133	Woodland	Down 2	LOW	24	>100	Woodland	-	LOW
4	> 100	Woodland	-	LOW	25	104	Woodland	Flat	LOW
5	112	Woodland	Upslope	LOW	26	20	Woodland	Flat	19
6	54	Woodland	Upslope	12.5	27	20	Woodland	Flat	19
7	95	Woodland	Upslope	12.5	28	33	Woodland	Flat	12.5
8	98	Woodland	Down 3	12.5	29	66	Woodland	Flat	12.5
9	82	Woodland	Down 5	12.5	30	109	Woodland	Upslope	LOW
10	95	Woodland	Down 7	12.5	31	>100	Woodland	-	LOW
11	89	Woodland	Down 7	12.5	32	>100	Woodland	-	LOW
12	82	Woodland	Down 7	12.5	33	>100	Woodland	-	LOW
13	27	Woodland	Flat	19	34	>!00	Woodland	-	LOW
14	62	Woodland	Down 2	12.5	35	>100	Woodland	-	LOW
15	57	Woodland	Down 2	12.5	36	>100	Woodland	-	LOW
16	71	Woodland	Down 2	12.5	37	119	Woodland	Upslope	LOW
17	43	Woodland	Down 1	12.5	38	41	Woodland	Flat	12.5
18	>100	Woodland	-	LOW	39	44	Woodland	Flat	12.5
19	106	Woodland	Flat	LOW	40	44	Woodland	Upslope	12.5
20	102	Woodland	Flat	LOW	41	92	Woodland	Upslope	12.5
21	>100	Woodland	-	LOW					

Table 2: Indicative Bushfire Attack Level (BAL) Assessment for all building envelopes (See Appendix H for site details)

One building envelope is exposed to BAL-29 and the risk is considered to be high. There is an increased risk of ember attack and burning debris ignited by windborne embers and a likelihood of exposure to an increased level of radiant heat. . It is expected that the construction elements will be exposed to a radiant heat flux not greater than 29kW/m^2. The recommended construction Sections are 3 and 7 in AS 3959-2009. .

Three building envelopes are exposed to BAL-19 and the risk is considered to be moderate. There is a risk of ember attack and burning debris ignited by wind borne embers and a likelihood of exposure to radiant heat (Standards Australia 2009). . It is expected that the construction elements will be exposed to a radiant heat flux not greater than 19kW/m^2. The recommended construction Sections are 3 and 6 in AS 3959-2009.

Seventeen lots are exposed to BAL–12.5 and the risk is considered to be low. There is a risk of ember attack (Standards Australia 2009). It is expected that the construction elements will be exposed to a radiant heat flux not greater than 12.5kW/m^2. The recommended construction Sections are 3 and 5 in AS 3959-2009.

Twenty building envelopes are exposed to BAL-LOW which means the risk is considered to be very low. There is insufficient risk to warrant any specific construction requirements but there is still some risk.

This indicative assessment demonstrates that all proposed buildings will fall within the acceptable level of risk (i.e. BAL-29 and lower) and will need to have construction standards increased to meet AS 3959 requirements. All lots require a BAL assessment at building licence application stage to confirm setback distances. The exact location of dwellings on the building envelopes is required to make an accurate BAL assessment.

6.4.2 Landscaping Considerations

Landscaping can both assist in the survival of the building and be a determining measure in its destruction. Landscaping can protect buildings by forming a barrier or deflector for wind borne debris and radiant heat. It can also bring the fire directly to the building, so a degree of care needs to be exercised when selecting and locating landscaping.

All plants will burn under the right conditions and plants do not achieve a “fire resistance level” to meet the Building Code of Australia (BCA). Placing plants too close to a building, under timber decks or next to windows will provide a direct threat to the building. Having a clearance around the building will achieve the desired effect

of creating a break between the vegetation and the building. A pathway around the building may be one way to achieve this requirement. The landscaping can then be provided established at a suitable distance from the building.

Bark chips and combustible mulch near a building is not recommended and is a particular problem when the windows have low sill heights. The DFES document titled "Plant Guide within the Building Protection Zone" provides a useful list of species and spacing requirements to achieve compliance with vegetation within a building protection zone in the Swan Coastal Plain. It can be downloaded at http://www.dfes.wa.gov.au/safetyinformation/fire/bushfire/BushfireProtectionPlanningPublications/FESA%20Plant%20Guide-BP%20Zone-Final-w.pdf. It will provide guidance for appropriate revegetation of the site.

Work by Ramsay and Rudolf (2003) has identified 14 major plant attributes that assist people to determine suitable plant species for gardens surrounding buildings (i.e. in the Building Protection Zone). This is a useful reference book for residents to plan their garden design and select suitable plant species.

6.5 Design of the Development

Performance Criteria

The design of the development is appropriate to the level of bushfire hazard that applies to the site.

Acceptable Solution

All on-site development is to comply with the performance criteria or acceptable solutions 1 to 4 in "Planning for Bushfire Protection" Guidelines. The buildings are to comply with AS 3959-2009: Construction of Buildings in Bushfire-Prone Areas. The Shire of Chittering has the responsibility of ensuring dwellings meet this standard.

The predicted highest BAL level for any dwelling is BAL-29 which will be mitigated by compliance with the Australian Standard AS3959 for building construction.

6.6 Public Education and Community Awareness

Community bushfire safety is a shared responsibility between individuals, the community, government and fire agencies. The Shire of Chittering has six bushfire brigades including one in Muchea. Contact details and information is provided on the Shire's website (http://www.chittering.wa.gov.au/chittering-fire-services/default.aspx).

There are also links to the DFES website. DFES has an extensive Community

Bushfire Education Program including a range of publications, a website and Bushfire Ready Groups. The 30 page booklet 'Prepare, Act, Survive' provides excellent advice on preparing for and surviving the bushfire season. Other downloadable brochures include 'Fire Danger Ratings and what they mean for you' and 'Bushfire Warnings and what you should do'.

The Shire's website provides details for someone wanting to become a member of a local brigade.

Burning notices and the annual firebreak notice are posted on to the Shire of Chittering website.

Research into the devastating bushfires on the Eyre Peninsula in South Australia confirmed residents were much more likely to make good decisions if they were current or past members of the local bushfire brigade, as invaluable experience can be gained by being a member. Professional consultants also offer bushfire safety advice and relevant services to residents and businesses in high risk areas.

6.7 Community Fire Refuges and Fire Safer Areas

There are no designated Community Fire Refuges in the Shire of Chittering. However, at the time of an emergency, the relevant authorities can select an evacuation centre and DFES, the Shire and Police will provide this information to residents.

A predetermined centre cannot be nominated because there are no purpose built structures (such as bunkers) designed to withstand the impacts of a bushfire. This means the authorities will not determine the location of an evacuation centre until the position of the fire and the characteristics of a specific event are considered. There would be nothing more dangerous than sending residents to a centre which is in the direct path of a fire.

The safest place to be during a bushfire is away from it. Where to go is an important element when people are relocating during a time of emergency (NSW Rural Fire Service 2004). The preferred option for residents is to designate a destination that is not in a bushfire-prone area and will be safe to travel to before a bushfire threatens.

Those who find themselves threatened by a bushfire need options (VBRC 2009). This may be because their plan to leave is no longer possible because they cannot reach a place away from the fire front, or their plan to defend their property fails. Residents may also be caught away from their home when a bushfire threatens.

The concept of a “Neighbourhood Safer Place” and Neighbourhood Safer Precincts” has arisen from recommendations by the Victorian Bushfire Royal Commission into the Black Saturday bushfires.

A non-bushfire-prone area can provide a safe location for people during a bushfire, but there are no official criteria to determine these areas. As there is no specific criteria to guide this process, DFES’s general advice is for residents, when their household bushfire survival plans have failed, to go to a safer place such as a local open space or building where they may seek shelter from a bushfire (DFES 2010).

7. Conclusion

This Plan provides acceptable solutions and responses to the performance criteria that fulfil the intent of the bushfire hazard management issues outlined in Planning for Bushfire Protection Guidelines - Edition 2 (WAPC et al. 2010). However, community bushfire safety is a shared responsibility between governments, fire agencies, communities and individuals.

The planning and building controls outlined in this Plan will reduce the risk of bushfire to people and property. It will not remove all risk. How people interpret the risk, prepare and maintain their properties and buildings and the decisions and actions they take (i.e. evacuate early or stay and defend or other) greatly influence their personal safety. Residents need to be self-reliant and not expect warnings or assistance from emergency services.

7.1 Compliance Checklist

Performance Criteria and Acceptable Solutions

Element	Question	Answer
1: Location	Does the proposal comply with the performance criteria by applying acceptable solution A1.1?	Yes

Element	Question	Answer
2: Vehicular access	Does the proposal comply with the performance criteria by applying acceptable solution A2.1?	Yes
	Does the proposal comply with the performance criteria by applying acceptable solution A2.2?	Yes
	Does the proposal comply with the performance criteria by applying acceptable solution A2.3?	Yes – temporary cul-de-sac will comply
	Does the proposal comply with the performance criteria by applying acceptable solution A2.4?	Not Applicable
2: Vehicular access	Does the proposal comply with the performance criteria by applying acceptable solution A2.5?	Yes
	Does the proposal comply with the performance criteria by applying acceptable solution A2.6?	Not Applicable
	Does the proposal comply with the performance criteria by applying acceptable solution A2.7?	Not Applicable
	Does the proposal comply with the performance criteria by applying acceptable solution A2.8?	Not Applicable
	Does the proposal comply with the performance criteria by applying acceptable solution A2.9?	Yes
	Does the proposal comply with the performance criteria by applying acceptable solution A2.10?	Not Applicable

Element	Question	Answer
3: Water	Does the proposal comply with the performance criteria by applying acceptable solution A3.1?	Yes
	Does the proposal comply with the performance criteria by applying acceptable solution A3.2?	Yes
	Does the proposal comply with the performance criteria by applying acceptable solution A3.3?	Not Applicable
4: Siting of the Development	Does the proposal comply with the performance criteria by applying acceptable solution A4.1?	Yes - Construction standards are increased to align with site bushfire attack level.
	Does the proposal comply with the performance criteria by applying acceptable solution A4.2?	Yes
	Does the proposal comply with the performance criteria by applying acceptable solution A4.3?	Yes
	Does the proposal comply with the performance criteria by applying acceptable solution A4.4?	No - However the proposal does satisfactorily comply with performance criterion P4 because building construction standards are to be increased to comply with AS 3959-2009 to offset the reduced Hazard Separation Zone. Construction standards will achieve a maximum of BAL-29.
	Does the proposal comply with the performance criteria by applying acceptable solution A4.5?	N/A - Shielding not applicable.

Element	Question	Answer
5: Design of the Development	Does the proposal comply with the performance criteria by applying acceptable solution A5.1?	No - However the proposal does comply with the performance criterion P5 because building construction standards will be increased to comply with AS 3959-2009 to offset the reduced HSZ. BAL-29 is not exceeded.
	Does the proposal comply with the performance criteria by applying acceptable solution A5.2?	Yes - The proposal complies as the development will meet the performance criteria because of compliance with AS 3959 and BAL-29 is not exceeded.

Applicant Declaration

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

Rohan Carboon

2/12/13

8. Implementing the Fire Management Plan

8.1 Developer's Responsibilities

To maintain a reduced level of risk from bushfire, the developer's responsibilities are to:

- Install the public roads and turn around area to standards outlined in Element 6.2 Vehicular Access;
- Install compliant water supply that complies with Element 6.3 Water;
- Lodge a Section 70A Notification on each Certificate of Title exposed to AS 3959 construction standards, proposed by this subdivision. The notification shall alert purchasers and successors in title, to these exposed lots, of the responsibilities of the Fire Management Plan and bush fire building construction requirements;
- Install firebreaks on all lots as per the shire of Chittering Firebreak Notice, prior to sale;
- Liaise with and arrange the Bindoon Bush Fire Brigade to undertake a fuel reduction burn on areas of the site that have extreme fuel litter loads prior to the creation of titles;
- Comply with the Shire of Chittering's Fire Control Notice as published, on all vacant land; and
- Supply a copy of this Fire Management Plan and The Homeowners Bush Fire Survival Manual, Prepare, Act, Survive (or similar suitable documentation) and the Shire of Chittering's Fire Break Notice to each lot owner.

8.2 Property Owners' Responsibilities

The owners/occupiers of the site, as created by this proposal, are to maintain a reduced level of risk from bushfire, and will be responsible for undertaking, complying and implementing measures to protect their own assets (and people under their care) from the threat and risk of bushfire. The owners' will be responsible for:

- Ensuring that all lots comply with the Shire of Chittering's Firebreak Notice;
- Construct driveways to minimum standards outlined in Section 6.2;
- Installing couplings on each domestic water tank that comply with Section 3 Water and ensuring 10,000 litres is always available for fire suppression purposes;
- Ensuring construction of dwellings complies with AS 3959; and
- Establishing and maintaining the BPZ and HSZ at the property owner's/occupier's own cost.

As part of the building license application, the property owner or the Shire of Chittering (at the property owner's expense) shall have the proposed dwelling re-assessed for Bushfire Attack Level (at the time of construction) with results to be submitted as part of the building licence application.

8.3 Shire of Chitterling's Responsibilities

The responsibility for compliance with the law rests with individual property owners and occupiers and the following conditions are not intended to unnecessarily transfer some of the responsibilities to the Shire of Chittering.

The Shire of Chittering shall be responsible for:

- Providing fire prevention and preparedness advice to landowners upon request;
- Monitoring bush fuel loads in all areas of public open space, road reserve sites and liaising with relevant stakeholders to maintain fuel loads at safe levels;
- Maintaining in good condition the fire water supply and infrastructure;
- Maintaining public roads to appropriate standards and ensuring compliance with the Shire of Chittering's Fire Control Notice;
- Ensuring dwellings are constructed to AS 3959 where applicable; and
- Endorsing a section 70A notification on each Certificate of Title affected by this Fire Management Plan.

9. References

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Appendix A: Site Location

Lot 7 Gray Road
Bindoon
Shire of Chittering

Bushfire Safety CONSULTING

LEGEND

- SUBJECT AREA (TOTAL 44.7 ha)
- BUILDING ENVELOPE
- RESIDENTIAL R2 LOT
- RURAL RESIDENTIAL
- BUSHLAND CONSERVATION
- PROPOSED LOT BOUNDARY
- VEGETATION AREA
- ATU — ALTERNATIVE TREATMENT UNIT
- INDICATIVE FUTURE LOT BOUNDARY
- INDICATIVE FUTURE BUILDING ENVELOPE

SUBDIVISION SUMMARY

LOT RANGE	5001 TO 14214
TOTAL LOTS	41
TOTAL AREA	320044
AVERAGE SIZE	7806

PUBLIC OPEN SPACE

LOT RANGE	9212 TO 24473
TOTAL LOTS	2
TOTAL AREA	54464
AVERAGE SIZE	27232

BUSH CONSERVATION

LOT RANGE	13500 TO 13500
TOTAL LOTS	1
TOTAL AREA	13500
AVERAGE SIZE	13500

Planning Policy Requirements

Development Plan

This Development Plan has been endorsed by the Council of the Shire of Chittering and the Western Australian Planning Commission (WAPC). Subdivision and development should generally be in accordance with the Development Plan.

Development Requirements and Lot Sizes
In considering development and subdivision on the land, the requirements of the Shire of Chittering Town Planning Scheme No. 6 for the 'Rural Residential' zone and 'Residential R2' zone apply, unless otherwise provided for within this Development Plan.

Vegetation Preservation
No clearing is permitted outside of the designated building envelope specified for each lot on the Development Plan, unless planning consent is obtained from the Shire of Chittering or, unless those trees are diseased or present danger to life or property or require removal as specified within an approved Fire Management Plan.

Building Envelopes
Buildings, water tanks, waste disposal and a building protection zone for fire management are to be contained within a cleared building envelope area as depicted on the Development Plan. Buildings, water tanks, etc. that are to be located outside the nominated building envelope shall require planning consent from the Shire of Chittering and shall be considered on the individual merits of the proposal. It is however noted that the placement of built features outside the building envelope will generally not be supported unless extenuating circumstances exist.

Crossovers
The construction of a crossover to each lot is the be in accordance with Council's specifications.

Potable Water
Where a reticulated water supply is not available, each dwelling will have a water supply from roof catchment of a minimum of 120,000 litres, of which 10,000 litres is to be kept in reserve for fire fighting purposes.

Land Management
The maintenance of any drainage swales, easements, fire breaks and vegetation/revegetation areas on private property is the responsibility of the owner/occupier of the respective lot.

Bores, Dams and Water Courses
The sinking of bores, construction of dams and extraction of surface water is not permitted without prior approval from the Shire and/or any relevant government/service authority.

Landowners shall maintain natural drainage lines to prevent erosion and soil exports to adjoining lots. There shall be no alteration to natural drainage lines without the prior approval of the Council or other relevant service/government authority.

Fire Control
A Fire Management Plan (dated 27 May 2013) has been prepared by Bushfire Safety Consulting Pty Ltd and shall apply to the development and ongoing use of the land.

Permitted ('P') Uses
A single house, associated outbuildings and water storage tanks are the only permitted uses. Other uses specified in the Shire's Town Planning Scheme No. 6 (as amended) may be considered and determined in accordance with the provisions of Town Planning Scheme No. 6 and associated local planning policies.

Stocking Restrictions
Subject to obtaining the prior approval of the Shire, the keeping of stock shall be restricted to previously cleared areas. If in the opinion of the Council of the Shire that any lot becomes overgrazed and/or constitutes land degradation or a threat to watercourses, it may order the owner to remove any or all stock from the lot, either temporarily or permanently, until the remedial works carried out by the owner to render the land stable to the satisfaction of the Shire.

Stock shall be prevented from access to any public open space or the Bushland Conservation Lot.

Bushland Conservation Lot
The Bushland Conservation lot is to be developed only for the purpose of accommodating one (1) single house with ancillary outbuildings, within the prescribed building envelope.

Effluent Disposal
All lots shall be provided with conventional effluent disposal systems, with the exception of lots identified on the Development Plan requiring an Alternative Treatment Unit (ATU) effluent disposal system.

Domestic Pets
The keeping of domestic cats in not permitted.

Non-reflective Materials
All buildings shall be constructed of non-reflective materials.

Vendor Responsibility
The developer/vendor shall inform prospective purchasers of the lots, in writing, of the application and management requirements of the Development Plan which applies to the land.

This Development Plan was adopted by the Council of the Shire of Chittering on _____ pursuant to Clause 5.8.1 of the Shire of Chittering Town Planning Scheme No. 6

CHIEF EXECUTIVE OFFICER _____ DATE _____

Endorsed by the Western Australian Planning Commission

SECRETARY _____ DATE _____

Appendix B

TITLE: PROPOSED DEVELOPMENT PLAN

DETAIL: LOT 7 (315) GRAY ROAD BINDOON

SCALE: 1:5,000 @ A3 & 1:2,500 @ A1

DATE: 14th NOVEMBER 2013

FILE: 946_14.11.2013.dwg

DRAWN: -

CHECKED: -

DYNAMIC PLANNING AND DEVELOPMENTS
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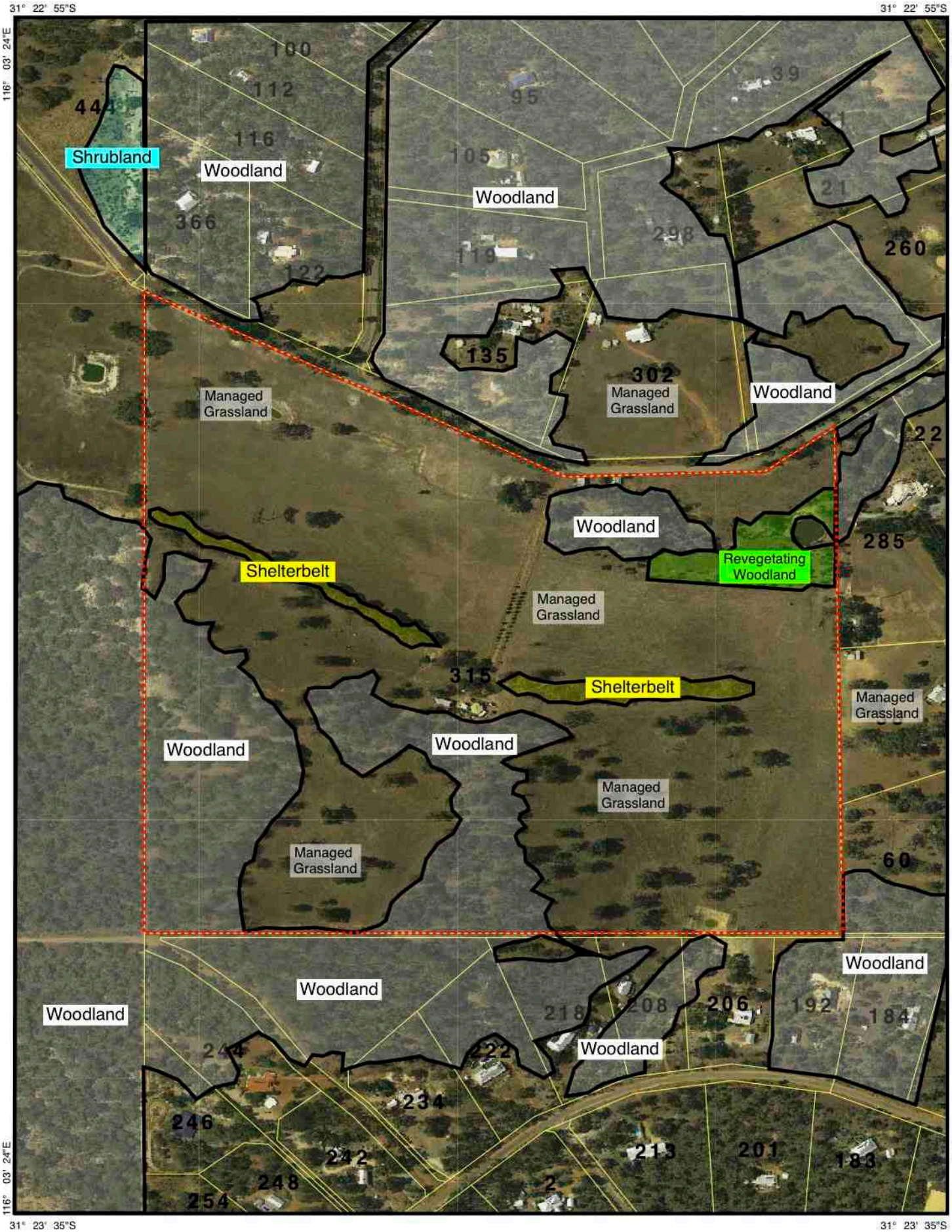
51 FORREST STREET
SUBIACO WA 6008

N W E S



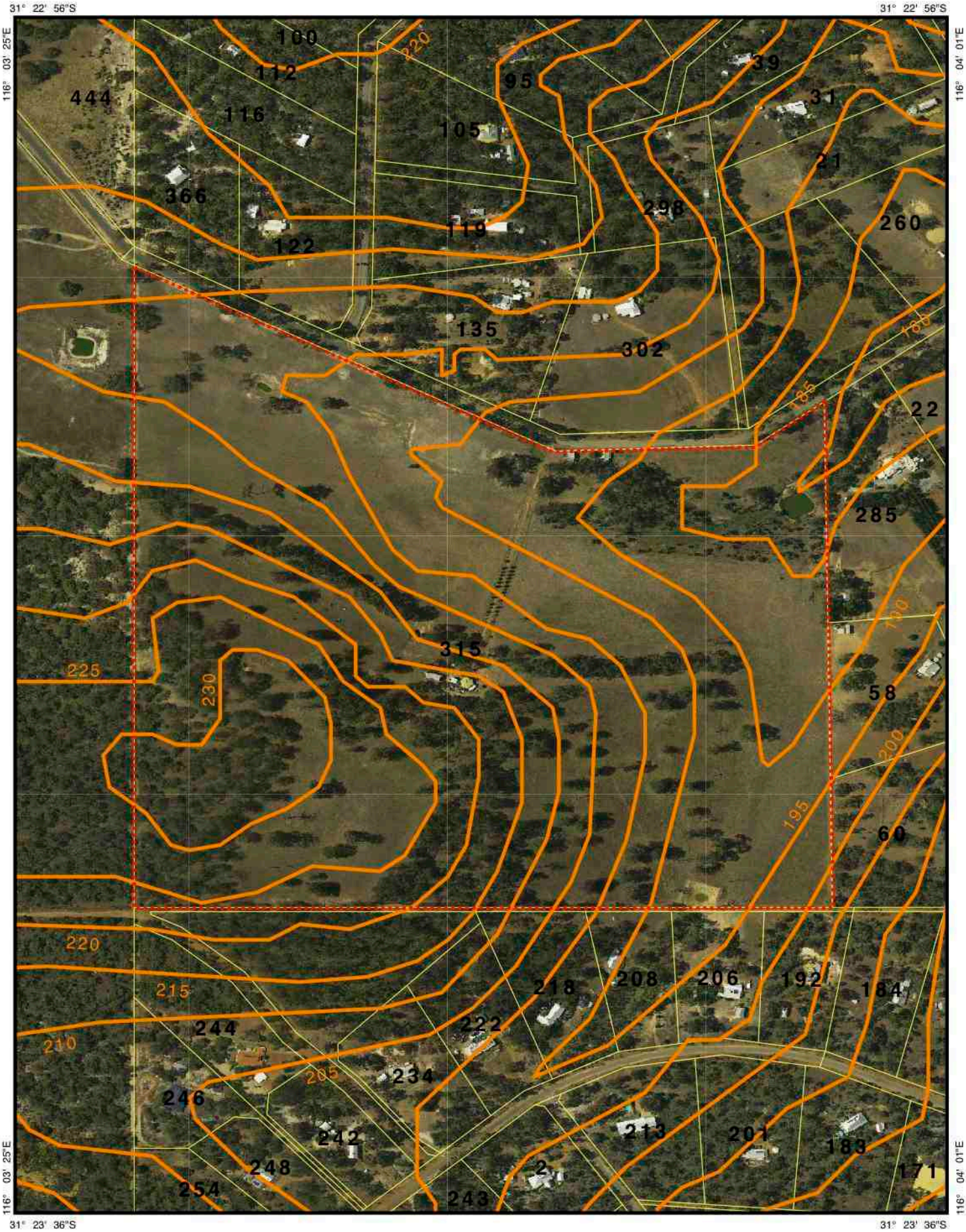
Appendix C: Vegetation Class

Lot 7 Gray Road
Bindoon
Shire of Chittering

Site boundary .....

N

Bushfire Safety CONSULTING



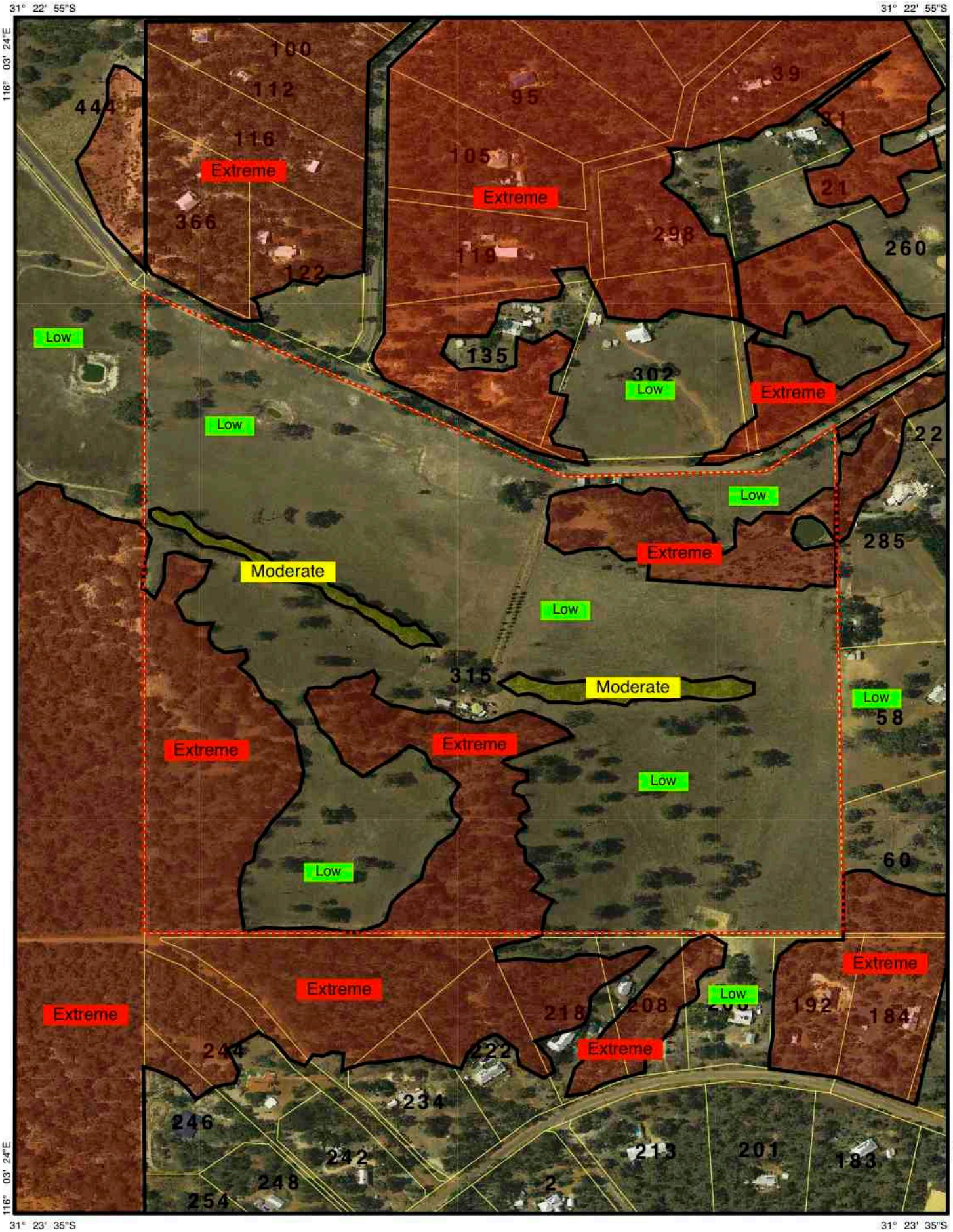
Appendix D: Site Topography

Lot 7 Gray Road
Bindoon
Shire of Chittering

Site boundary

N

Bushfire Safety
CONSULTING



Appendix E: Hazard Rating

Lot 7 Gray Road
Bindoon
Shire of Chittering

Site boundary .....

N

Bushfire Safety CONSULTING

LEGEND

- SUBJECT AREA (TOTAL 44.7 ha)
- BUILDING ENVELOPE
- RESIDENTIAL R2 LOT
- RURAL RESIDENTIAL
- BUSHLAND CONSERVATION
- PROPOSED LOT BOUNDARY
- VEGETATION AREA
- ATU — ALTERNATIVE TREATMENT UNIT
- INDICATIVE FUTURE LOT BOUNDARY
- INDICATIVE FUTURE BUILDING ENVELOPE

SUBDIVISION SUMMARY

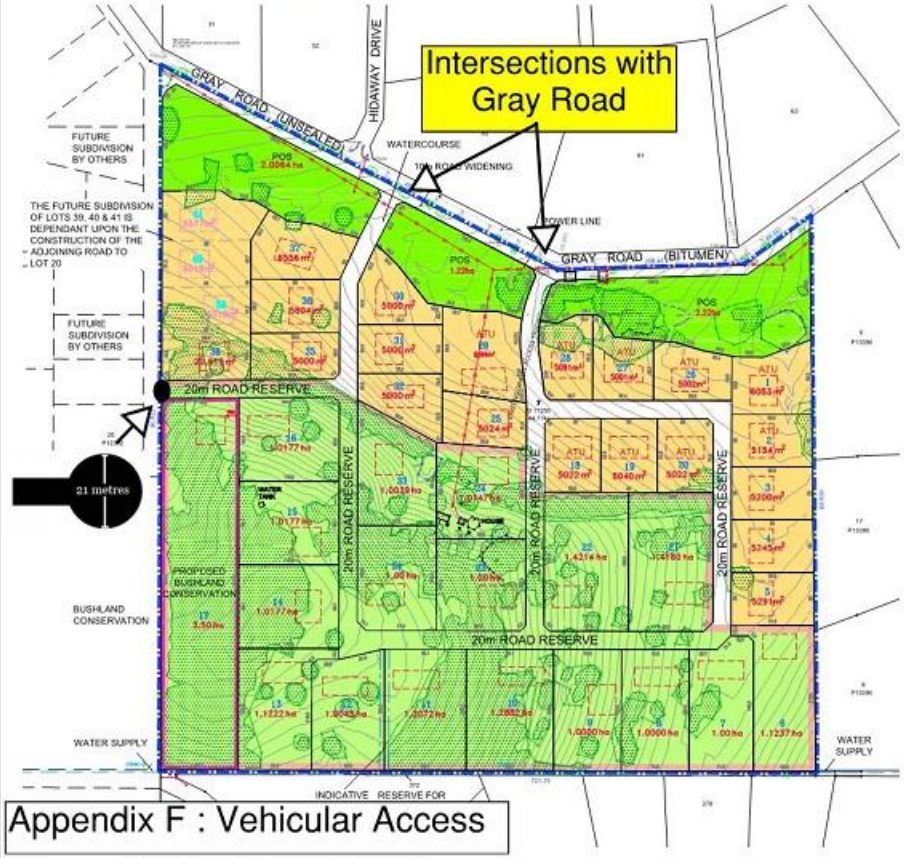
LOT RANGE	5001 TO 14214
TOTAL LOTS	41
TOTAL AREA	320044
AVERAGE SIZE	7806

PUBLIC OPEN SPACE

LOT RANGE	9212 TO 24473
TOTAL LOTS	2
TOTAL AREA	54464
AVERAGE SIZE	27232

BUSH CONSERVATION

LOT RANGE	13500 TO 13500
TOTAL LOTS	1
TOTAL AREA	13500
AVERAGE SIZE	13500



Appendix F : Vehicular Access

Planning Policy Requirements

Development Plan

This Development Plan has been endorsed by the Council of the Shire of Chittering and the Western Australian Planning Commission (WAPC). Subdivision and development should generally be in accordance with the Development Plan.

Development Requirements and Lot Sizes
In considering development and subdivision on the land, the requirements of the Shire of Chittering Town Planning Scheme No. 6 for the 'Rural Residential' zone and 'Residential R2' zone apply, unless otherwise provided for within this Development Plan.

Vegetation Preservation
No clearing is permitted outside of the designated building envelope specified for each lot on the Development Plan, unless planning consent is obtained from the Shire of Chittering or, unless those trees are diseased or present danger to life or property or require removal as specified within an approved Fire Management Plan.

Building Envelopes
Buildings, water tanks, waste disposal and a building protection zone for fire management are to be contained within a cleared building envelope area as depicted on the Development Plan. Buildings, water tanks, etc. that are to be located outside the nominated building envelope shall require planning consent from the Shire of Chittering and shall be considered on the individual merits of the proposal. It is however noted that the placement of built features outside the building envelope will generally not be supported unless extenuating circumstances exist.

Crossovers
The construction of a crossover to each lot is to be in accordance with Council's specifications.

Potable Water
Where a reticulated water supply is not available, each dwelling will have a water supply from roof catchment of a minimum of 120,000 litres, of which 10,000 litres is to be kept in reserve for fire fighting purposes.

Land Management
The maintenance of any drainage swales, easements, fire breaks and vegetation/revegetation areas on private property is the responsibility of the owner/occupier of the respective lot.

Bores, Dams and Water Courses
The sinking of bores, construction of dams and extraction of surface water is not permitted without prior approval from the Shire and/or any relevant government/service authority.

Landowners shall maintain natural drainage lines to prevent erosion and soil exports to adjoining lots. There shall be no alteration to natural drainage lines without the prior approval of the Council or other relevant service/government authority.

Fire Control
A Fire Management Plan has been prepared by Bushfire Safety Consulting Pty Ltd and shall apply to the development and ongoing use of the land.

Permitted ('P') Uses
A single house, associated outbuildings and water storage tanks are the only permitted uses. Other uses specified in the Shire's Town Planning Scheme No. 6 (as amended) may be considered and determined in accordance with the provisions of Town Planning Scheme No. 6 and associated local planning policies.

Stocking Restrictions
Subject to obtaining the prior approval of the Shire, the keeping of stock shall be restricted to previously cleared areas. If in the opinion of the Council of the Shire that any lot becomes overgrazed and/or constitutes land degradation or a threat to watercourses, it may order the owner to remove any or all stock from the lot, either temporarily or permanently, until the remedial works carried out by the owner to render the land stable to the satisfaction of the Shire.

Stock shall be prevented from access to any public open space or the Bushland Conservation Lot.

Bushland Conservation Lot
The Bushland Conservation lot is to be developed only for the purpose of accommodating one (1) single house with ancillary outbuildings, within the prescribed building envelope.

Effluent Disposal
All lots shall be provided with conventional effluent disposal systems, with the exception of lots identified on the Development Plan requiring an Alternative Treatment Unit (ATU) effluent disposal system.

Non-reflective Materials
All buildings shall be constructed of non-reflective materials.

Vendor Responsibility
The developer/vendor shall inform prospective purchasers of the lots, in writing, of the application and management requirements of the Development Plan which applies to the land.

This Development Plan was adopted by the Council of the Shire of Chittering on _____ pursuant to Clause 5.8.1 of the Shire of Chittering Town Planning Scheme No. 6

_____ _____
CHIEF EXECTUVE OFFICER DATE

_____ _____
SHIRE PRESIDENT DATE

Endorsed by the Western Australian Planning Commission

_____ _____
SECRETARY DATE

TITLE:
DETAIL:

PROPOSED DEVELOPMENT PLAN
LOT 7 (315) GRAY ROAD
BINDOON

SCALE: 1:5,000 @ A3 & 1:2,500 @ A1
DATE: 26th NOVEMBER 2013
FILE: 946_26.11.2013.dwg
DRAWN: -
CHECKED: -

DYNAMIC PLANNING AND DEVELOPMENTS
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m: 0431 111 659
PO Box 1616
SUBIACO WA 6904
51 FORREST STREET
SUBIACO WA 6008

N W E S

LEGEND

- SUBJECT AREA (TOTAL 44.7 ha)
- BUILDING ENVELOPE
- RESIDENTIAL R2 LOT
- RURAL RESIDENTIAL
- BUSHLAND CONSERVATION
- PROPOSED LOT BOUNDARY
- VEGETATION AREA
- ATU — ALTERNATIVE TREATMENT UNIT
- INDICATIVE FUTURE LOT BOUNDARY
- INDICATIVE FUTURE BUILDING ENVELOPE

SUBDIVISION SUMMARY

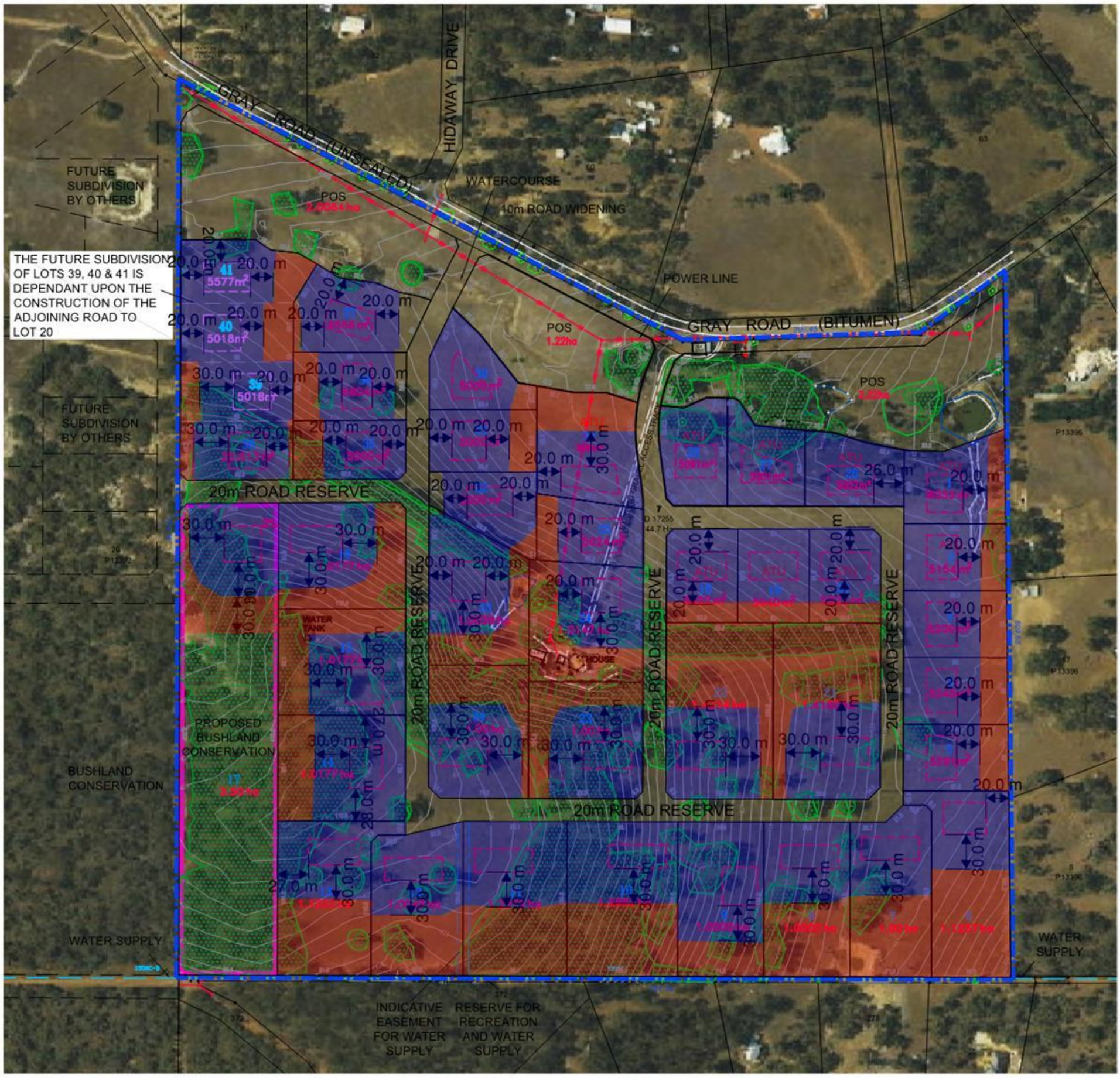
LOT RANGE	5001 TO 14214
TOTAL LOTS	41
TOTAL AREA	320044
AVERAGE SIZE	7806

BUSH CONSERVATION

LOT RANGE	13500 TO 13500
TOTAL LOTS	1
TOTAL AREA	13500
AVERAGE SIZE	13500

PUBLIC OPEN SPACE

LOT RANGE	9212 TO 24473
TOTAL LOTS	2
TOTAL AREA	54464
AVERAGE SIZE	27232



TITLE: Appendix G: Vegetation Management Zones

DETAIL:

Lot 7 Gray Road
Bindoon
Shire of Chittering

- Building Protection Zone
- Hazard Separation Zone

Bushfire Safety CONSULTING

LEGEND

- SUBJECT AREA (TOTAL 44.7 ha)
- BUILDING ENVELOPE
- RESIDENTIAL R2 LOT
- RURAL RESIDENTIAL
- BUSHLAND CONSERVATION
- PROPOSED LOT BOUNDARY
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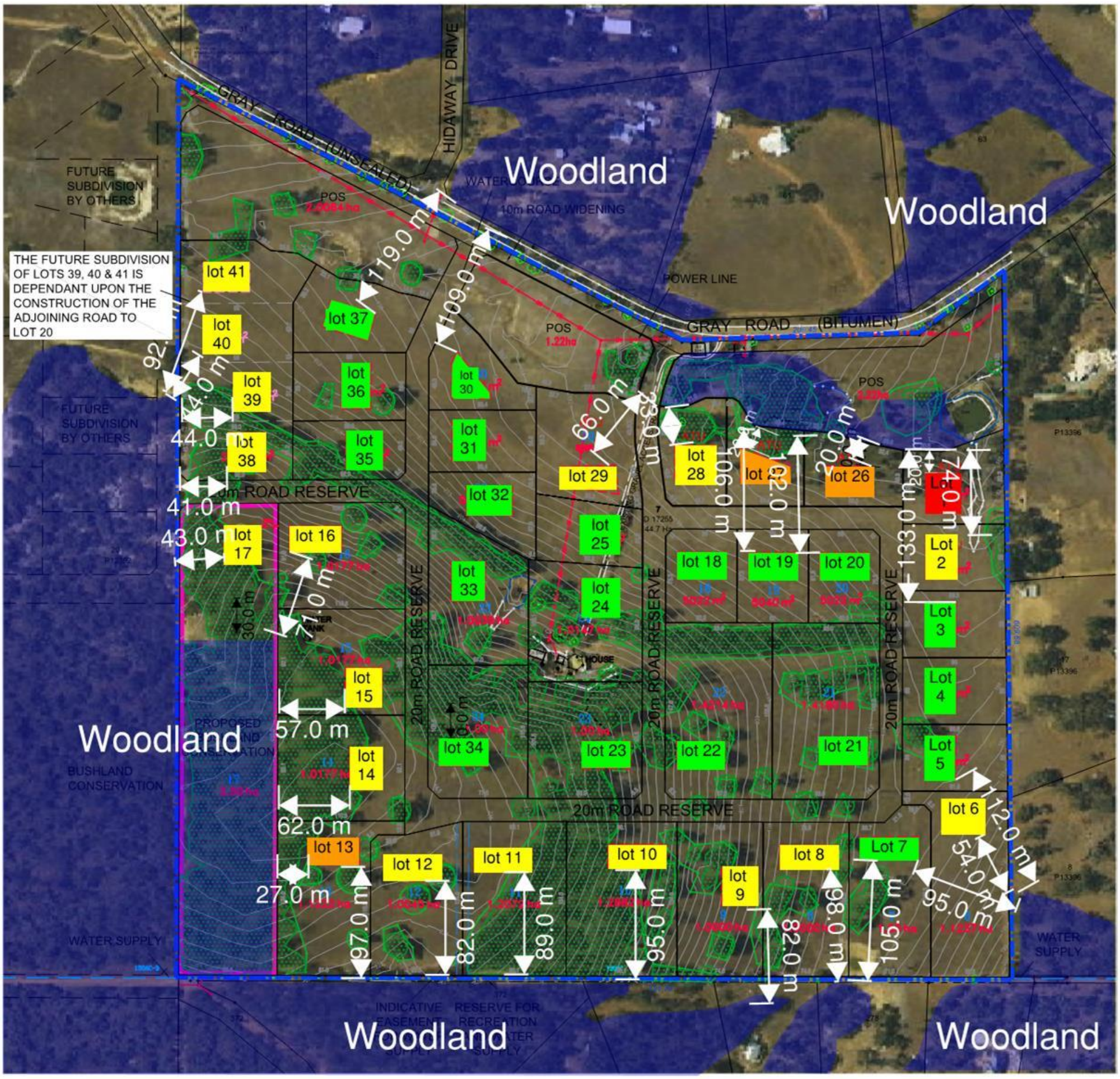

TITLE: Appendix H: Bushfire Attack Level Outcomes

DETAIL:

Lot 7 Gray Road
Bindoon
Shire of Chittering

- BAL-LOW
- BAL-12.5
- BAL-19
- BAL-29

Bushfire Safety CONSULTING