

**Shire of
Ravensthorpe**

Ravensthorpe and Hopetoun Townscape Bushfire Prone Vegetation Mapping & BAL Contour Plan Review



By:
Kathryn Kinnear 18th
June 2018

DOCUMENT CONTROL

TITLE

Shire of Ravensthorpe, Ravensthorpe and Hopetoun Townsite Bushfire Prone Vegetation Mapping & BAL Contour Review

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Job No. RAV001

Client: Shire of Ravensthorpe

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Final Id 18/6/2018	Issued to Shire as Final	K.Kinnear	18/6/2018

DISCLAIMER

The recommendations and measures contained in this assessment report are based on the requirements of the Australian Standards 3959 – Building in Bushfire Prone Areas, WAPC SPP3.7, Guidelines for Planning in Bushfire Prone Areas (WAPC, 2017) and CSIRO's research into Bushfire behaviour. These are considered the minimum standards required to balance the protection of the proposed dwelling and occupants with the aesthetic and environmental conditions required by local, state and federal government authorities. They DO NOT guarantee that a building will not be destroyed or damaged by a bushfire. All surveys and forecasts, projections and recommendations made in this assessment report and associated with this proposed dwelling are made in good faith on the basis of the information available to the fire protection consultant at the time of assessment. The achievement of the level of implementation of fire precautions will depend amongst other things on actions of the landowner or occupiers of the land, over which the fire protection consultant has no control. Notwithstanding anything contained within, the fire consultant/s or local government authority will not, except as the law may require, be liable for any loss or other consequences (whether or not due to negligence of the fire consultant/s and the local government authority, their servants or agents) arising out of the services rendered by the fire consultant/s or local government authority.



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1. Introduction and Background

The Shire of Ravensthorpe (“the Shire”) commissioned Bio Diverse Solutions (Bushfire Practitioners) to review the previous vegetation assessment and update the BAL Contour Plans over the townsites of Ravensthorpe and Hopetoun. The Bushfire Prone Vegetation Mapping and the WAPC Bushfire Planning framework has increased the level of complexity when lodging development applications in the Shire and the information from this assessment guides the townsites site works and priorities contained within their “Bushfire Mitigation Plans”. The townsite(s) are located in the State Bushfire Prone Area Mapping (SLIP, 2017).

Additionally, the townsites are remote to bushfire professional services, any service usually comes with considerable travel costs added. Large areas of the townsites are required to prepare a BAL Assessment being identified as ‘bushfire prone’ by the current state-wide Bushfire Prone mapping.

This project aims to re-assess the previously mapped bushfire prone vegetation of the townsite to Australian Standard (AS) 3959-2009 and the OBRM mapping standards (2017). The dataset is then to be used to assist in refining the WA state Bushfire Prone Area Mapping over the town, map the extent of bushfire risks to the town and critical assets, assist in any future planning within the townsite and give brief comments for bushfire risk mitigation. BAL Contour plans have been generated to guide the Shire’s decision making on planning and development applications.

1.1. Statutory Conditions

This document is aligned to the following policy and guidelines:

- *Planning and Development Act 2005;*
- *Planning and Development Regulations 2009;*
- *Planning and Development (Local Planning Scheme) Regulations 2015;*
- State Planning Policy 3.7 Planning in Bushfire Prone Areas;
- Guidelines for Planning in Bushfire Prone Areas;
- *Building Act 2011;*
- *Building Regulations 2012;*
- Building code of Australia (National Construction Code);
- *Fire and Emergency Services Act 1998;*
- AS 3959-2009 “Construction of Buildings in Bushfire Prone Areas” current and endorsed standards;
- *Bushfires Act 1954;* and
- Shire of Ravensthorpe Annual Fire Break notice.

1.2. Suitably Qualified Bushfire Consultant

This document has been prepared by Kathryn Kinnear (nee White), who has 10 years operational fire experience with the (formerly) DEC (1995-2005) and has the following accreditation in bushfire management:

- Incident Control Systems;
- Operations Officer;
- Prescribed Burning Operations;
- Fire and Incident Operations;
- Wildfire Suppression 1, 2 & 3;
- Structural Modules – Hydrants and hoses, Introduction to Structural Fires, and Fire extinguishers; and
- Ground Controller.

Kathryn Kinnear currently has the following tertiary Qualifications:

- BAS Technology Studies & Environmental Management;
- Diploma Business Studies; and
- Graduate Diploma in Environmental Management.

Kathryn Kinnear is an accredited Level 2 Bushfire Practitioner (Accreditation No: BPAD30794). Bio Diverse Solutions are Silver Corporate Members of the Fire Protection Australia Association. Kathryn is a committee member of the WA Bushfire Working Group (FPAA) and Kathryn is a suitably qualified Bushfire Practitioner to prepare this Bushfire Hazard Assessment.

1.3. Consultation

Consultation has occurred with the Shire’s Bushfire Risk Planning Coordinator Melanie Haymont and Chief Executive Officer Ian Fitzgerald during the field assessment, preparation of report and review of report.

2. Aims of this Project

The aims of the project are:

- Prepare a Vegetation Classes Map for the townsites to determine Bushfire Prone Vegetation;
- Assess the extent of bushfire risks to the town and critical assets;
- Provide brief bushfire mitigation strategies to the Shire to assist with ongoing fire management of the townsite; and
- Provide BAL Contour Plans over the townsite to guide the Shire's decision making on planning and development applications.

2.1. Objectives

The objectives of this BMP are:

- Understand and document the extent of the bushfire risk and hazards to the townsite;
- Review of the bushfire prone vegetation applicable to the townsite boundary and within 150m of the boundary;
- Prepare brief observations on bushfire mitigation and management measures of all land within the subject site (s) with due regard to people, property, infrastructure and the environment; and
- Aligned to the recommended assessment procedure of AS3959-2009 Method 1 BAL Assessment procedure and WAPC Guidelines for Planning in Bushfire Prone Areas Ver 1.3 (WAPC, 2017).

2.2. Methodology

The Bushfire Attack Level (BAL) for each townsite was determined by using the “*Simplified procedure described in Clause 2.2 (AS3959-2009) (Method 1)*”. The following methodology (scope of works) was undertaken by Bio Diverse Solutions in preparing the vegetation classifications and BAL Contour Plans for the townsite (s):

1. Preparation of pre-field GIS maps with a pre-determined townsite boundary.
2. Overlay in GIS of townsite boundary .shp files and generation of 150m setback assessment boundary .shp file from the townsite boundary for field assessment, preparation of field maps and ArcGIS Mapper dataset for each townsite.
3. Detailed site assessment/review of all classifiable vegetation to AS3959-2009 within the townsite boundary and within 150m of the townsite boundary.
4. Field capture included classification of vegetation types to AS3959-2009 Section 2.2.3 to either a Forest Type A, Woodland Type B, Shrubland Type C, Scrub Type D, or Grassland Type G. All classifiable vegetation was GPS referenced (as a plot reference) in the field using a Samsung Galaxy S ArcGIS mapping application, field capture sheets (manual entry) and hand mapped on hard copy field maps.
5. Field measurement of Effective Slope (ES) as per Section 2.2.5 AS3959-2009 was undertaken using Nikon Forestry Pro with a minimum of 2 slopes measured for each plot. ES is shown on the mapping as a representation of the field capture.
6. Field assessment included assessment of “Low fuel and non-vegetated areas” to AS3959-2009 Clauses (a)-(f) Section 2.2.3.2 of AS3959-2009 and GPS capture of these.
7. GIS mapping using ArcMap software of all classifiable vegetation to AS3959-2009 within the 150m setback of the townsite boundary as per the recommended methodology by WAPC Guidelines for Planning in Bushfire Prone Areas Version 1.3 (WAPC, 2017).
8. Input of data (population of fields) to GIS .shp/.lyr .
9. Undertake BAL Contour GIS mapping from the bushfire risks to WAPC Guidelines (WAPC, 2017) methodology;
10. Quality assurance checks of all data fields in .shp/.lyr files.
11. Preparation of Metadata documentation and files associated with the .shp/lyr files for the Shire.
12. Preparation of a report outlining the aims, methodology, GIS mapping outcomes and brief bushfire mitigation strategies for each townsite.

Notes on methodology:

- In assessing the vegetation classification to AS3959-2009 consideration was given to *Table B2 AS3959-2009 (Appendix B) – Vegetation Classification and Fuel Load*. Classification of the vegetation types and the applicable model of AS3959-2009 (Table B1) were essential in the field capture process.
- Examination of the Catchpole *et al* (1998) paper which referenced information from L.McCaw regarding mallee/mulga fire behaviour predictions associated with the AS3959 model.
- Each vegetation classification to AS3959-2009 Table 2.3 was described/pictorially in plots in 2016/2017, with examples of differing plot photos/vegetative structure for each plot.
- For the purpose of the BAL Contour Plans each vegetation classification to AS3959-2009 Table 2.3 was described/pictorially represented as either a Type A - Plot 1, Type B- Plot 2, Type C- Plot 3, Type D- Plot 4 or Type G- Plot 5, with examples of differing plot photos/vegetative structure given in the report. The detailed field capture sheets and the .shp file has corresponding field capture plot numbers/identification.
- The WA State Bushfire Prone Area Mapping was not used to guide any field assessment or verification of boundaries.
- Construction requirements/advice for AS3959 BAL FZ- BAL12.5 was not within the scope of this project.

2.3. Previous Bushfire Assessment 2016/17

The original site assessment of the townsites occurred in 2016 with site assessment and field verification undertaken by Bio Diverse Solution's Accredited BAL Assessors. A report was prepared for the Shire (April 2017) which documented the vegetation classifications and

BAL Contours over the site. Areas of risk were identified and mitigation measures were implemented by the Shire through their bushfire mitigation program.

The assessment boundary has been extended in 2018 to 150m from the townsite boundary which is consistent with the updated WAPC guidelines methodology (WAPC, 2017). The Ravensthorpe townsite boundary was extended to the south east to assess and map the Recreation Centre which is the designated ‘Community Refuge Centre’ through the Local Emergency Management Arrangements (LEMA) document which outlines all EM arrangements and procedures for the Local Government Agency.

2.4. AS3959-2009 disclaimer

It should be borne in mind that the measures contained within this Standard (AS3959-2009) cannot guarantee that a building will survive a bushfire event on every occasion. This is substantially due to the unpredictable nature and behaviour of fire and extreme weather condition.

Building to AS39590-2009 is a standard primarily concerned with improving the ability of buildings in designated bushfire prone areas to better withstand attack from bushfire thus giving a measure of protection to the building occupants (until the fire front passes) as well as to the building itself. (AS3959-2009)

2.5. Structure of this report

The report has been prepared in two sections relating to each townsite. Each townsite (section) of this report details the following:

- Review of original bushfire prone vegetation classifications (additional 2017 Plot data) to AS3959-2009;
- Vegetation Classes (GIS) Map;
- Discussion on potential bushfire impacts/hazards;
- BAL Contour Plan (s);
- Brief recommendations and Works Program Map (s); and
- Original vegetation plot data (2016/17) (Appendix A).

It should be noted that the original vegetation datasets undertaken in 2016/2017 and classifications still reflect the vegetation type. Where change has occurred through bushfire mitigation works or other site works then updated Vegetation Plot data is outlined in Section 3 of this report. The original Vegetation Plot data is provided as Appendix A to this report.

3. Ravensthorpe Townsite

3.1. Vegetation Classification Ravensthorpe

Vegetation verification/re-assessment occurred on the 7th March 2018 with all vegetation within 150m of the townsite boundary classified/verified in accordance with the original 2016/17 vegetation assessment and Section 2.2.3 of AS 3959-2009. Additional plot data to the 2016/2017 information with the potential to determine the Bushfire Attack Level is identified below and shown on the Vegetation Classes Maps, Page 10 and 11. Additional plots identified in 2018 have been allocated numbering commensurate with original plot ordering. Original 2016/2017 vegetation plot data is provided in Appendix A and also refer to the associated Vegetation GIS data files.

Plot	24	Classification or Exclusion Clause	Low fuel or non-vegetated Exclusion 2.2.3.2 (e)
	Location: Within townsite in built up areas. Description: Bare areas, buildings and infrastructure, roads, hardstand and tracks excluded as per exclusion clause 2.2.3.2 (e) of AS3959-2009.		
<i>Photo Id 1: View to north of the emergency generator/power station to the south west of the townsite. Note "Critical Asset".</i>			
	Location: Within townsite in built up areas. Description: Bare areas, buildings and infrastructure, roads, hardstand and tracks excluded as per exclusion clause 2.2.3.2 (e) of AS3959-2009.		
<i>Photo Id 2: View of hardstand parking areas and the Recreation Centre located on the south east of the townsite. Note this is the designated "Community Refuge Centre".</i>			

Plot	25	Classification or Exclusion Clause	Low Fuel or non-vegetated areas exclusion (f)
		 <p>W 270 300 NW 330 N 0 30 NE 60 ☈ 2°N (T) ☉ 33°34'30"S, 120°2'36"E ±30m ▲ 242m 07 Mar 2018, 16:06</p>	<p>Location: Mining camp area to the north of town.</p> <p>Description: Areas resulting from previous assessment with recommended APZ area installed. Evidence of actively maintaining the parkland area through slashing and trimming.</p> <p>Excluded as per exclusion 2.2.3.2 (f) of AS3959-2009.</p> <p>Available fuel loading: <2t/ha.</p>

Photo Id 3: View of cleared and thinned area adjacent to the mining camp quarters off Queen Street.

Plot	25	Classification or Exclusion Clause	Low Fuel or non-vegetated areas exclusion (f)
		 <p>S 150 180 SW 210 240 W 270 300 NW 330 ☈ 249°W (T) ☉ 33°34'51"S, 120°2'57"E ±165m ▲ 217m 07 Mar 2018, 16:35</p>	<p>Location: Along the strategic firebreaks north of the townsite.</p> <p>Dominant species & description: Areas where the Shire is actively maintaining the parkland area through strategic slash breaks.</p> <p>Excluded as per exclusion 2.2.3.2 (f) of AS3959-2009.</p> <p>Available fuel loading: <2t/ha.</p> <p>Note: Previously classified as Grassland Type G.</p>

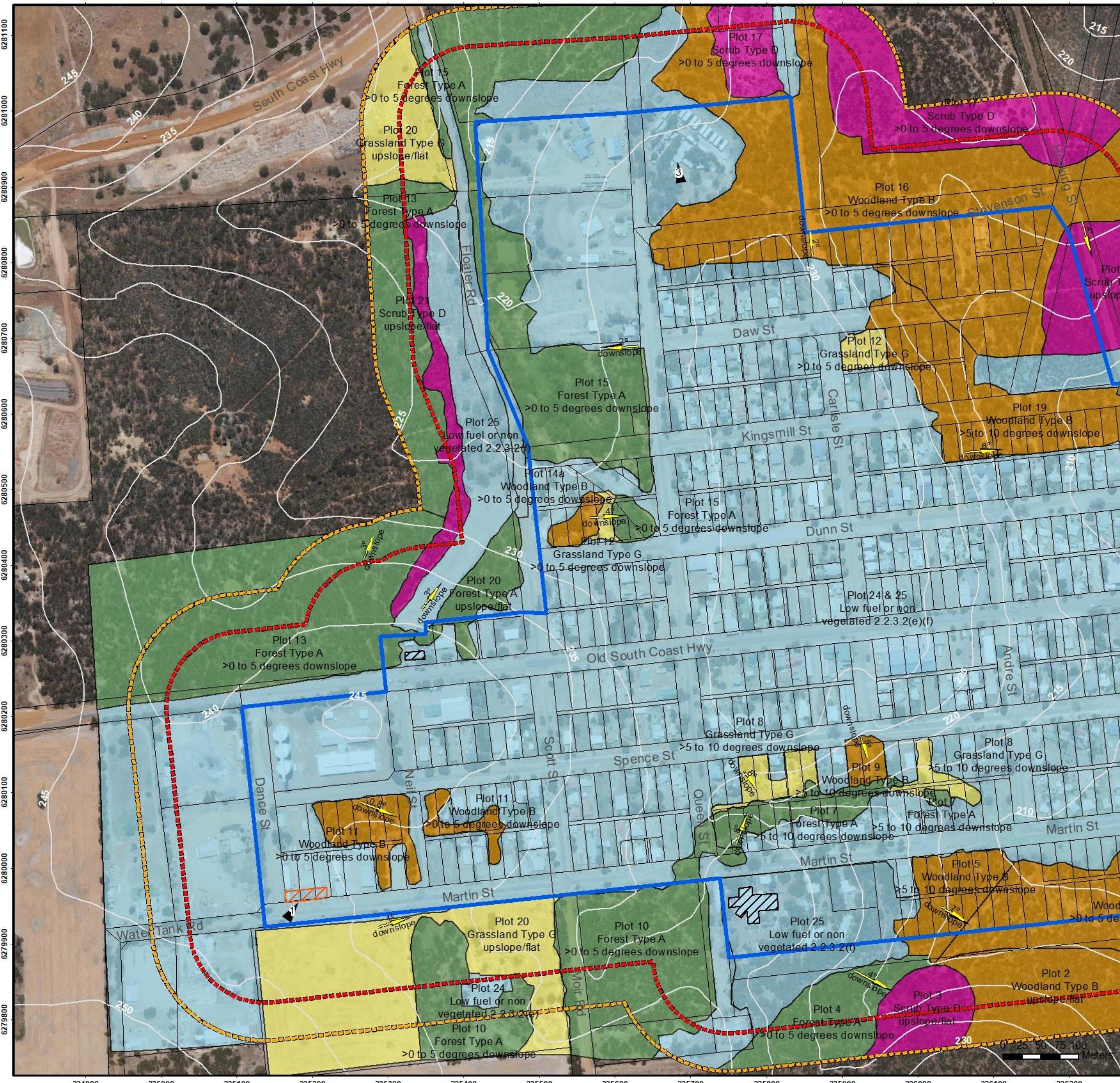
Photo Id 4: View of mowed/slashed area north east of the townsite.

Plot	2	Classification or Exclusion Clause	Woodland Type B
		 <p>07 Mar 2018, 16:50</p>	<p>Location: South east of town between recreation centre and Martin Street.</p> <p>Dominant species & description: Eucalypt trees with a sparse understorey of sedges and grasses (100-200mm). Not multilayered.</p> <p>Note previously mapped in the eastern area of the plot extended to the west of the recreation centre.</p> <p>Average vegetation height: Trees 10-12m.</p> <p>Vegetation Coverage: 10-30% foliage cover.</p> <p>Available fuel loading: 15-25t/ha.</p> <p>Effective Slope: Upslope.</p>

Photo Id 5: View of Woodland Type B located to west of the recreation centre.

Plot	26	Classification or Exclusion Clause	Forest Type A
		 <p>07 Mar 2018, 16:47</p>	<p>Location: South east of town adjacent to recreation centre.</p> <p>Dominant species & description: Eucalypt trees, Midstorey of Acacias and various scrubs, understorey of herbs, sedge and grasses. Multilayered.</p> <p>Average vegetation height: Trees 10-12m.</p> <p>Vegetation Coverage: >30-70% foliage cover.</p> <p>Available fuel loading: 25-35t/ha.</p> <p>Effective Slope: Downslope >0-5 degrees.</p>

Photo Id 6: View to the south along drain located to the west of the Recreation Centre.



This BAL Plan was prepared by:
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Jurisdiction: Level 2 - WA



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Overview Map Scale 1:100,000

Legend

- Subject Site (Blue Box)
- 100m Assessment Boundary (Red Dashed Line)
- 150m Assessment Boundary (Yellow Dashed Line)
- Critical Asset (Power Station) (Orange Box)
- Community Refuge Centre (Cross-hatch)
- Vulnerable Landuse (Shaded)
- Cadastre (Shaded)
- Photo Point (Black Triangle)
- Slope Degrees (Yellow Arrow)
- 5m Contours (White Lines)

Vegetation

- Forest Type A (Green)
- Woodland Type B (Orange)
- Scrub Type D (Pink)
- Grassland Type G (Yellow)
- Low fuel or non vegetated 2.2.3.2 (Light Blue)



Scale
1:5,000 @ A3
GDA MGA 94 Zone 50

Data Sources

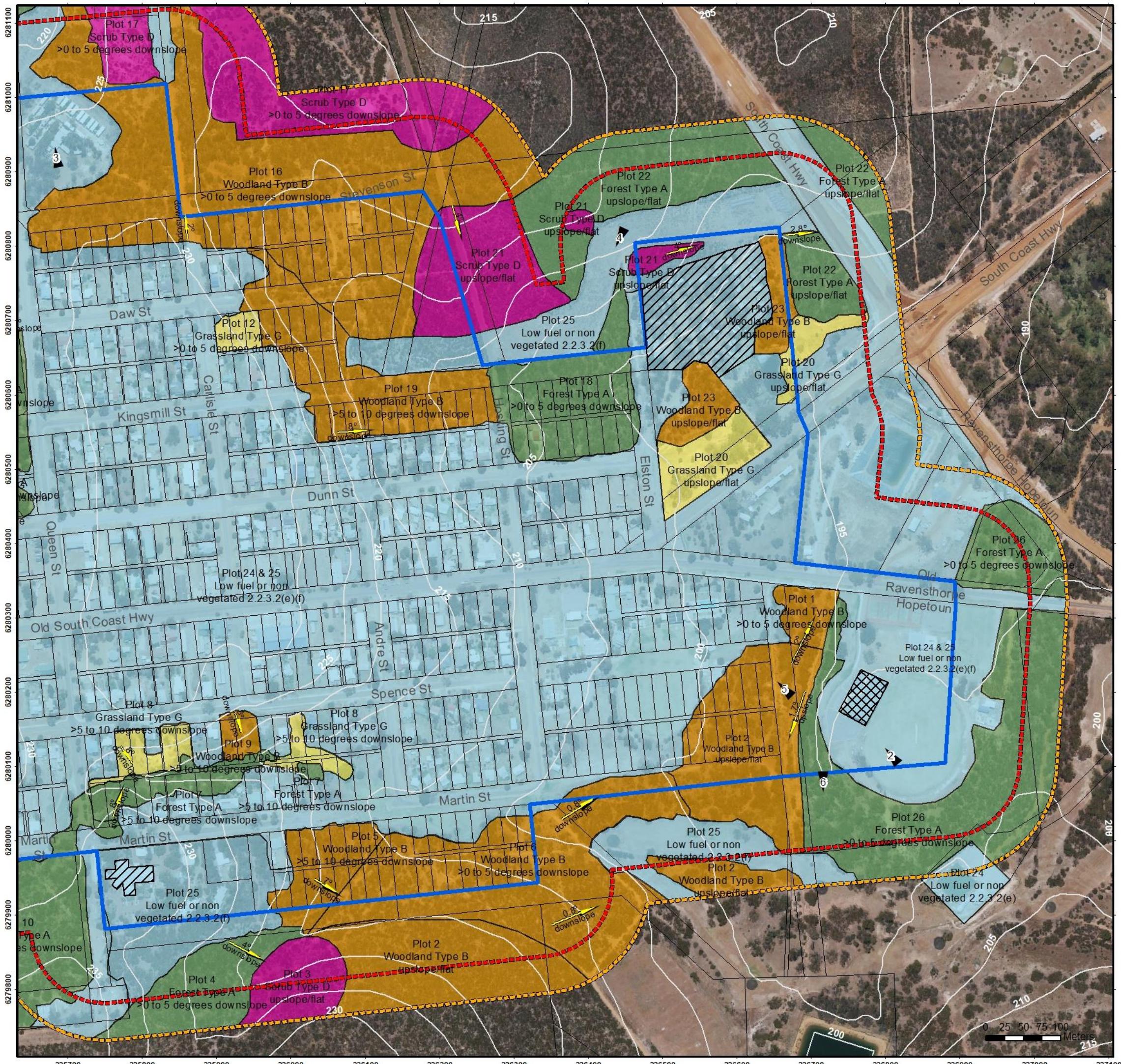
Aerial Imagery: WA Now, Landgate Subscription Imagery
Cadastre, Relief Contours and Roads: Landgate 2017
IRIS Road Network: Main Roads Western Australia 2017
Overview Map: World Topographic map service, ESRI 2012

CLIENT

Shire of Ravensthorpe
PO Box 43
Ravensthorpe, WA 6346

Vegetation Classes/Ravensthorpe West

BAL Assessor	QA Check	Drawn by
KK	BT	SA
STATUS	FILE	DATE
FINAL	RAV001	17/05/2018



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Overview Map Scale 1:100,000

Legend

- Subject Site
- 100m Assessment Boundary
- 150m Assessment Boundary
- Critical Asset (Power Station)
- Community Refuge Centre
- Vulnerable Landuse
- Cadastre
- Photo Point
- Slope Degrees
- 5m Contours

Vegetation

- Forest Type A
- Woodland Type B
- Scrub Type D
- Grassland Type G
- Low fuel or non vegetated 2.2.3.2(f)



Scale
1:5,000 @ A3
GDA MGA 94 Zone 50

Data Sources

Aerial Imagery: WA Now, Landgate Subscription Imagery
Cadastre, Relief Contours and Roads: Landgate 2017
IRIS Road Network: Main Roads Western Australia 2017
Overview Map: World Topographic map service, ESRI 2012

3.2. Identification of Bushfire Impacts Ravensthorpe

The bushfire threats associated with the townsite include:

- The vegetated “wicks” which are present from the creek areas entering the town site form the north west (Floater Road), south east (adjacent to Recreation Centre along the drain) and the south (Martin Street and Queen Street).
- Large remnant vegetation areas associated with Crown reserves to the north east, north, north west and the south.
- Small areas of remnant/overgrown vegetation in private property lots in the south and north (central) of the townsite.
- Some continuous vegetation links exist adjacent to the strategic firebreaks linking external bushfire risks into the townsite.

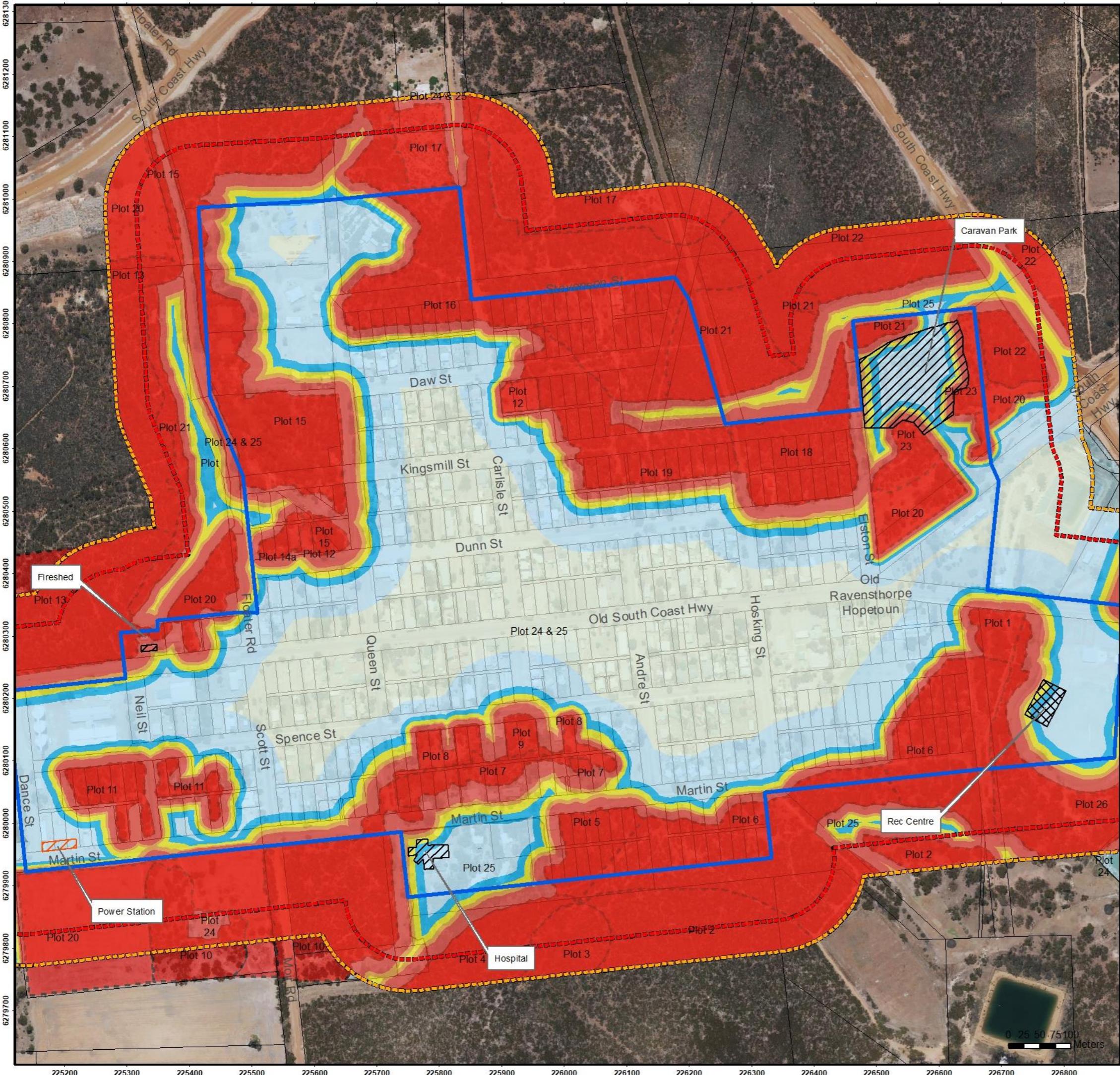
These remnant vegetation (bushfire prone vegetation) areas can carry bushfire from the north and south into the town site. The town centre and western and eastern entry points are generally low fuel in nature and present limited risk of bushfire along the highway entry/exit points.

A summary of the bushfire issues pertinent to Ravensthorpe townsite is provided below:

- Large strategic firebreaks along the north east, north and north west are designed to protect the townsite at large from bushfire. Separation of these links by 20m minimum separation will reduce impact onto the townsite. Particularly noted near the fire shed at Morgan Street and east end of Kingsmill/Daw Street whereby there is linking vegetation in front of the strategic breaks which could lead to ember and radiant heat impact to adjacent dwellings/buildings.
- Strategic work along the north of dwellings along Daw Street and adjacent to the Hospital has seen a marked reduction in BAL allocation in these areas.
- Risk of bushfire attack over the townsite are from the south and north where continuous bushfire vegetation exists. Specifically, from the following Plots:
 - Woodland Type B – Plot 2, 19, 16 and 23.
 - Forest Type A – all Plots identified.
 - Grassland Type G – Plot 8 and 20.
- Creek areas present continuous bushfire fuels but also present problems for fuel reduction as removal of vegetation will increase scouring, erosion and slumping of the creek beds.
- The Critical asset of the Power station is noted to be in BAL 29 or less area (BAL12.5). The Hospital is now located in BAL29, the Recreation Centre is located in BAL 40.
- The Caravan Park (Vulnerable land use) has areas of classifiable vegetation within 100m of the existing buildings and infrastructure. Bushfire attack from the north east and north would impact this site, BAL FZ does prevail over some sites in the caravan park.

3.3. BAL Contour Plan

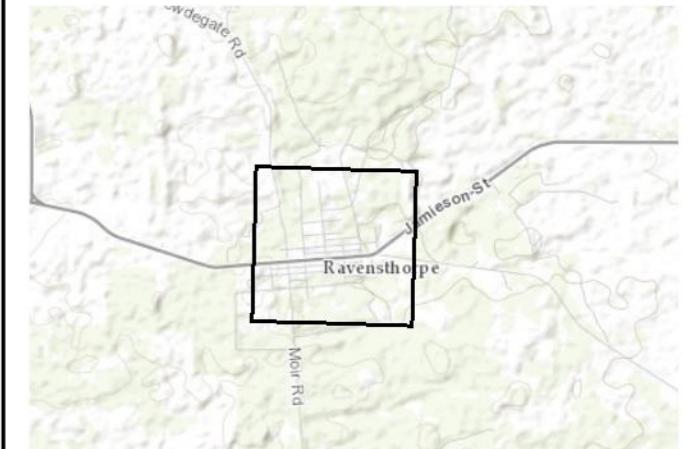
BAL was assigned from each distinctive vegetation plot as classified to AS3950 and shown as a series of BAL Contours. The broad scale of the presented map is for diagrammatic purposes only. The detailed GIS mapping dataset provided to the Shire should be consulted for any planning and development considerations.



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Overview Map Scale 1:100,000

Legend

- The legend includes the following entries:

 - Subject Site**: Blue rectangle.
 - 100m Assessment Boundary**: Red dashed rectangle.
 - 150m Assessment Boundary**: Yellow dashed rectangle.
 - Critical Asset (Power Station)**: Orange diagonal hatching.
 - Community Refuge Centre**: Black cross-hatching.
 - Vulnerable Landuse**: White with black diagonal hatching.
 - Cadastre**: White rectangle.

BAL Contours

BAL-FZ	Red
BAL-40	Orange
BAL-29	Yellow
BAL-19	Blue
BAL-12.5	Light Blue
BAL-LOW	Light Green/Yellow



Scale
1:6,000 @ A3
GDA MGA 94 Zone 50

Data Sources
Aerial Imagery: WA Now, Landgate Subscription Imagery
Cadastre, Relief Contours and Roads: Landgate 2017
IRIS Road Network: Main Roads Western Australia 2017
Overview Map: World Topographic map service, ESRI 2012

CLIENT Shire of Ravensthorpe
PO Box 43
Ravensthorpe, WA 6346

BAL Contour / Ravensthorpe

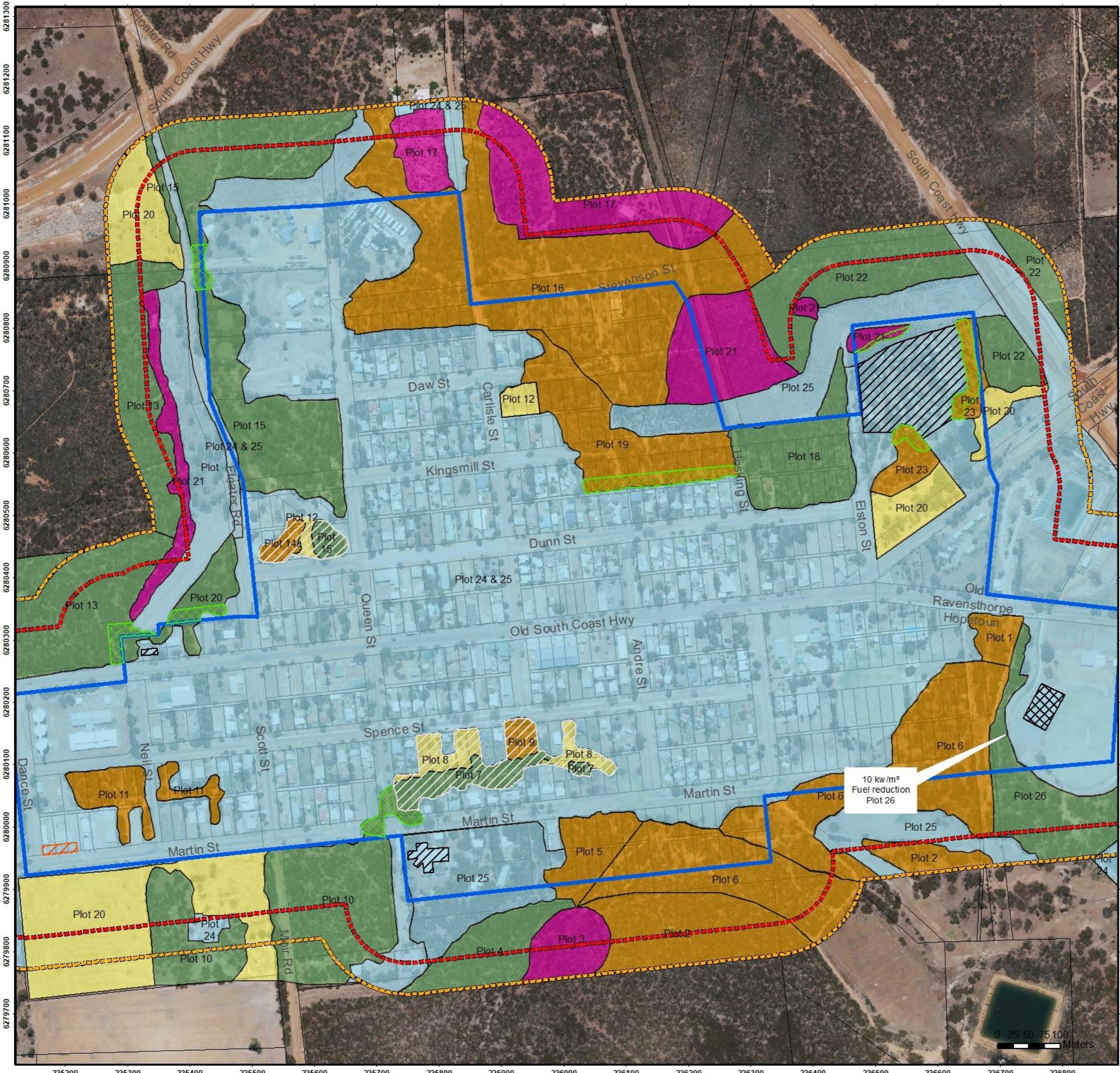
BAL Assessor KK	QA Check BT	Drawn by SA
STATUS FINAL	FILE RAV001	DATE 23/05/2018

3.4. Recommendations for bushfire management/mitigation Ravensthorpe

The assessment of Ravensthorpe townsite has determined the following recommendations for bushfire mitigation, also refer to Figure 5 “Works Program”:

- The Vulnerable land use of the Ravensthorpe Caravan Park should have fuel reduction strategies deployed internal to the site to the north west, east and south. A minimum of 20m to any structures is recommended. Fuel reduction standards (*note this is not broad scale clearing*) are to be as per the WAPC recommended standards, refer to Section 5.0 of this report and Appendix B.
- The Recreation Centre is a designated Community Refuge Centre as per the LEMAC planning requirements. Under the Department of Planning Lands and Heritage (DPLH) Draft Position Statement: *Tourism land uses within bushfire prone areas* (DPLH, 2018) “*.. a refuge building needs to have sufficient separation distance from the predominant bushfire prone vegetation to avoid exposure to a radiant heat flux exceeding 10kW/m² or less..*”. The BAL contour plan indicates BAL 40 would prevail. Consideration to achieve a radiant heat impact of 10kW/m² or less through fuel reduction on the western side of the building is recommended. Calculation from a Level 3 Bushfire Practitioner would be required to achieve BAL 10kW/m² and define the separation distance required. [Note to Shire this can be organised by BDS if agreed].
- Crown Land within management of the Shire adjacent to private dwellings/lodgings should be fuel reduced to a minimum of 20m to assist in Asset Protection Zones to the townsites dwellings and further protection of life and property from bushfire events. Slashing should occur for a minimum of 20m where vegetation is not attributable to creek protection areas.
- In the creeks to the north west and south 20m separation areas via low fuel slashing has been identified. This separation may then enable further exclusions to AS3959 if a 20m or greater separation is utilised.
- It is recommended that land owners of vacant land are required under the annual bushfire notice to maintain cleared land to <100mm in height and removable of dead and flammable material. Review may be required of the annual fire break notice to ensure urban land <2000m² is not a bushfire hazard to adjacent properties. Provision of this through the gazetted annual fire break notice pursuant to Section 33 of the *Bushfires Act 1953*.
- It is recommended that the Shire ensures land owners implement an Asset Protection Zone Standards to a min of 20m around existing buildings within the townsite/Shire. Provision of this through the gazetted annual fire break notice pursuant to Section 33 of the *Bushfires Act 1953*. Refer to Section 5.0 and Appendix B.
- It is recommended the Shire implements APZ standards to their maintenance of street verges, parks and gardens adjacent to bushfire prone (classifiable vegetation) to ensure these maintained areas are not linking into the townsites as “wicks” or encourage ember establishment in bushfire conditions. Refer to further information Section 5.0 of this document.

A “Works Program” has been developed over the page (Page 15) to help assist for townsite bushfire mitigation works.



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Overview Map Scale 1:100,000

Legend

- Subject Site
- 100m Assessment Boundary
- Fuel Reduction (20m width)
- Apply Firebreak Notice
- Critical Asset (Power Station)
- Community Refuge Centre
- Vulnerable Landuse
- Cadastre

Vegetation

- Forest Type A
- Woodland Type B
- Scrub Type D
- Grassland Type G
- Low fuel or non vegetated 2.2.3.2



Scale
1:6,000 @ A3
GDA MGA 94 Zone 50

Data Sources

Aerial Imagery: WA Now, Landgate Subscription Imagery
Cadastre, Relief Contours and Roads: Landgate 2017
IRIS Road Network: Main Roads Western Australia 2017
Overview Map: World Topographic map service, ESRI 2012

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Ravensthorpe, WA 6346

Works Program / Ravensthorpe

BAL Assessor	QA Check	Drawn by
KK	BT	SA
STATUS	FILE	DATE
FINAL	RAV001	17/05/2018

4. Hopetoun Townsite

4.1. Vegetation Classification

Vegetation verification/re-assessment occurred on the 7th March 2018 with all vegetation within 150m of the townsite boundary was classified/verified in accordance with the original 2016/17 vegetation assessment and Section 2.2.3 of AS 3959-2009. Additional plot data to the 2016/2017 information with the potential to determine the Bushfire Attack Level is identified below and shown on the Vegetation Classes Maps, Page 20 and 21. Additional plots identified in 2018 have been allocated numbering commensurate with original plot ordering. Original vegetation plot data is provided in Appendix A and also refer to the associated Vegetation GIS data files.

Plot	16	Classification or Exclusion Clause	Low fuel or non-vegetated Exclusion 2.2.3.2 (e)
			<p>Location: Within townsite in built up areas.</p> <p>Description: Bare areas, buildings and infrastructure, roads, hardstand and tracks excluded as per exclusion clause 2.2.3.2 (e) of AS3959-2009.</p>
<i>Photo Id 1: View of buildings and driveway located in Seaview Village (off Canning Boulevard) to the south west of the townsite.</i>			
Plot	16	Classification or Exclusion Clause	Low fuel or non-vegetated Exclusion 2.2.3.2 (e)
		<p>SE 150 S 180 SW 210 W 240 270 300 NW ☽ 234°SW (T) ☺ 33°56'31"S, 120°6'58"E ±165m ▲ 10m</p>	<p>Location: Within townsite in built up areas.</p> <p>Description: Bare areas, buildings and infrastructure, roads, hardstand and tracks.</p> <p>Excluded as per exclusion clause 2.2.3.2 (e) of AS3959-2009.</p>
<i>Photo Id 2: View to the south west along the road reserve of Canning Boulevard.</i>			

Plot	17	Classification or Exclusion Clause	Low Fuel or non-vegetated areas exclusion (f)
		 <p>SE 120 150 S 180 SW 210 240 W 270 ☀ 215°SW (T) ● 33°56'40"S, 120°7'3"E ±165m ▲ 16m 08 Mar 2018, 11:08</p>	<p>Location: Seaview Village urban areas (off Canning Boulevard) to the south west of town.</p> <p>Description: Areas resulting from previous assessment with recommended APZ area installed. Evidence of actively maintaining the parkland area through slashing and trimming.</p> <p>Excluded as per exclusion 2.2.3.2 (f) of AS3959-2009.</p> <p>Available fuel loading: <2t/ha.</p>
<i>Photo Id 3: View of cleared and thinned area adjacent to the mining owned quarters off Canning Boulevard.</i>			
Plot	17	Classification or Exclusion Clause	Low Fuel or non-vegetated areas exclusion (f)
		 <p>S 180 SW 210 240 W 270 NW 300 330 ☀ 267°W (T) ● 33°56'28"S, 120°7'7"E ±100m ▲ 15m 08 Mar 2018, 11:42</p>	<p>Location: Along the strategic firebreaks north of the townsite.</p> <p>Dominant species & description: Areas where the Shire is actively maintaining the parkland area through strategic slash breaks.</p> <p>Excluded as per exclusion 2.2.3.2 (f) of AS3959-2009.</p> <p>Available fuel loading: <2t/ha.</p>
<i>Photo Id 4: View of mowed/slashed area north west of the townsite.</i>			

Plot	17	Classification or Exclusion Clause	Low Fuel or non-vegetated areas exclusion (f)
		 <p>248°W (T) 33°56'36"S, 120°6'54"E ±30m ▲ 12m</p>  <p>08 Mar 2018, 11:12</p>	<p>Location: Along the strategic firebreaks west of the townsite.</p> <p>Dominant species & description: Areas where the Shire is actively maintaining the parkland area through strategic slash breaks.</p> <p>Excluded as per exclusion 2.2.3.2 (f) of AS3959-2009.</p> <p>Available fuel loading: <2t/ha.</p>

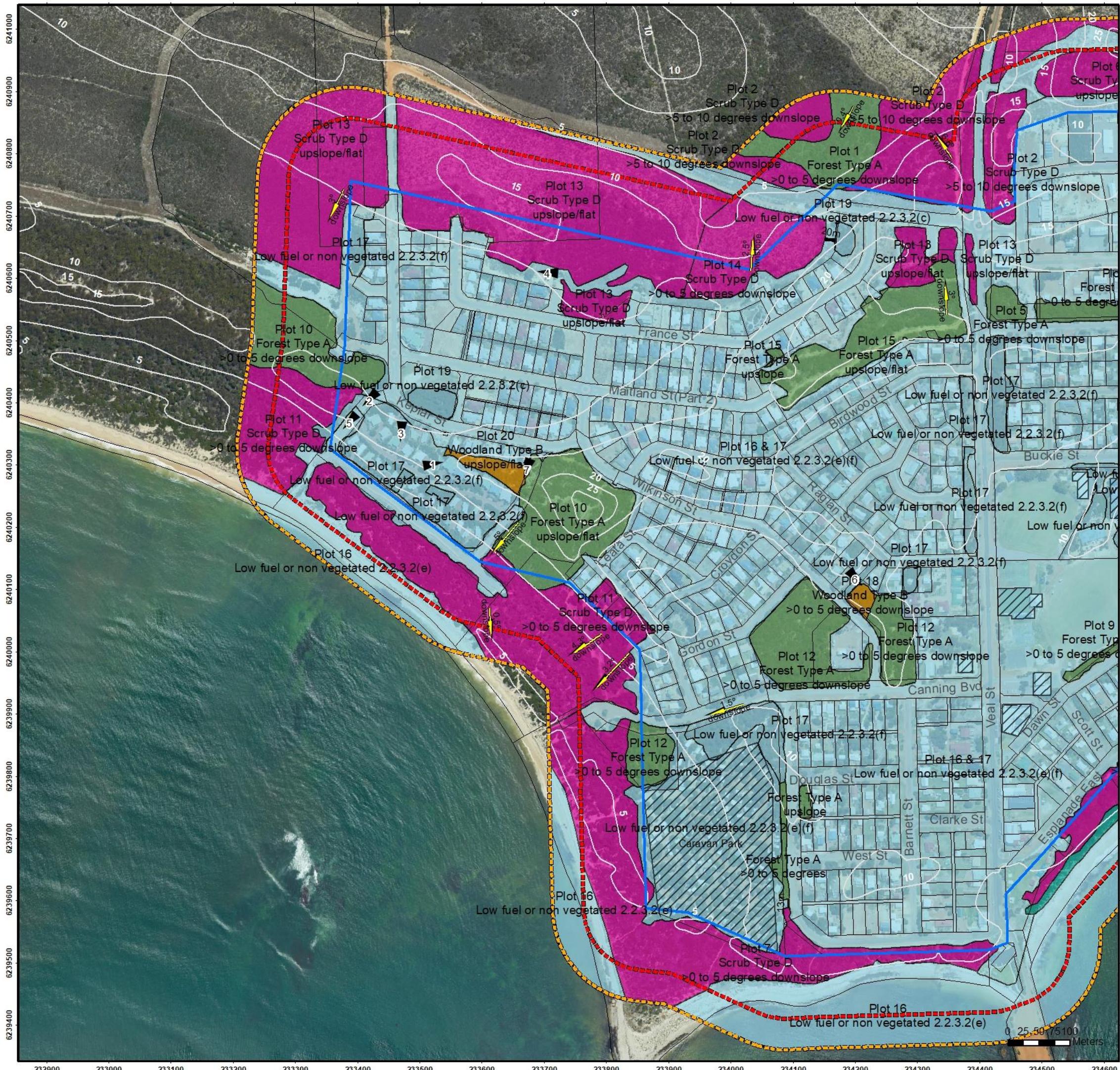
Photo Id 5: View of mowed/slashed area south west of the townsite along Canning Boulevard.

Plot	18	Classification or Exclusion Clause	Woodland Type B
		 <p>141°SE (T) 33°56'45"S, 120°7'28"E ±1414m ▲ 10m</p>  <p>08 Mar 2018, 08:56</p>	<p>Location: Central of town along Wilkinson Street in crown reserve.</p> <p>Dominant species & description: Eucalypt trees with a sparse understorey of sedges and grasses (100-200mm). Not multilayered.</p> <p>Note portion of site previously mapped as Forest Type A.</p> <p>Average vegetation height: Trees 10-12m.</p> <p>Vegetation Coverage: 10-30% foliage cover.</p> <p>Available fuel loading: 15-25t/ha.</p> <p>Effective Slope: Upslope.</p>

Photo Id 6: View of Woodland Type B located to north of Wilkinson Street.

Plot	19	Classification or Exclusion Clause	Low fuel or non-vegetated areas exclusion 2.2.3.23 (c)
		No photo available	<p>Location: Areas central to the townsite.</p> <p>Description: Areas of vegetation not connected to classifiable vegetation by 20m and not within 20m of the site (dwellings).</p> <p>As per AS3959-2009 exclusion clause 2.2.3.2 (c).</p>
Plot	20	Classification or Exclusion Clause	Woodland Type B
			<p>Location: Central of Seaview Estate.</p> <p>Dominant species & description: Eucalypt trees with a sparse understorey of sedges and grasses (100-200mm). Not multilayered.</p> <p>Note Site previously mapped as Forest Type A, understorey and Midstorey fuel reduction has occurred.</p> <p>Average vegetation height: Trees 10-12m.</p> <p>Vegetation Coverage: 10-30% foliage cover.</p> <p>Available fuel loading: 15-25t/ha.</p> <p>Effective Slope: Upslope.</p>

Photo Id 7: View of Woodland Type B located in Seaview Village.



This BAL Plan was prepared by:
Kathryn Kinnear, Bio Diverse Solutions
Accreditation No: BPAD30794
Jurisdiction: Level 2 - WA



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Overview Map Scale 1:100,000

Legend

- Subject Site
- 100m Assessment Boundary
- 150m Assessment Boundary
- Vulnerable Landuse
- Cadastre
- Separation Distance
- > Slope Degrees
- ▲ Photo Point
- 5m Contours

Vegetation

- Forest Type A
- Woodland Type B
- Shrubland Type C
- Scrub Type D
- Low fuel or non vegetated 2.2.3.2



Scale
1:6,000 @ A3
GDA MGA 94 Zone 50

Data Sources

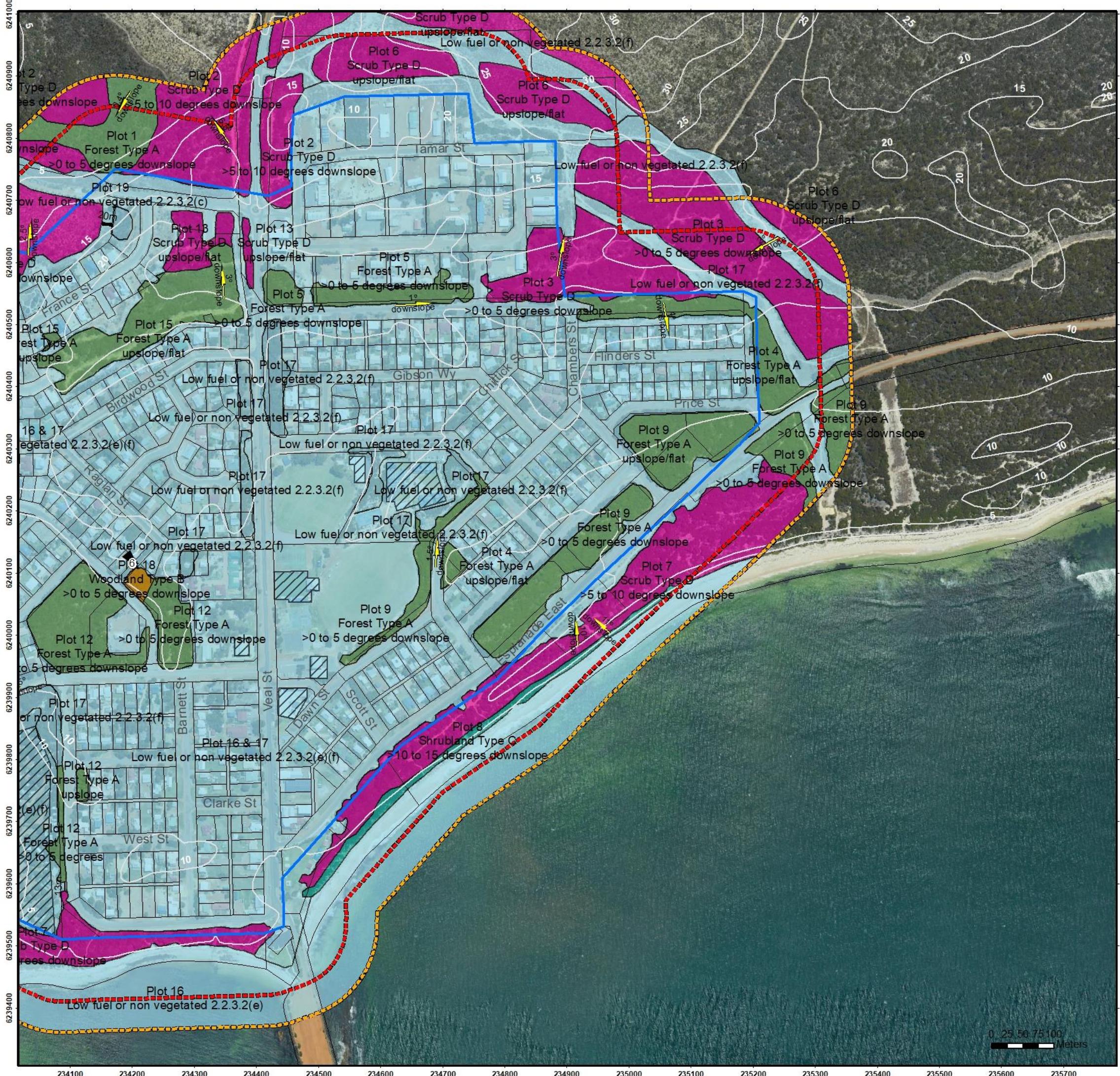
Aerial Imagery: WA Now, Landgate Subscription Imagery
Cadastre, Relief Contours and Roads: Landgate 2017
IRIS Road Network: Main Roads Western Australia 2017
Overview Map: World Topographic map service, ESRI 2012

CLIENT

Shire of Ravensthorpe
PO Box 43
Ravensthorpe, WA 6346

Vegetation Classes / Hopetoun West

BAL Assessor	QA Check	Drawn by
KK	BT	SA
STATUS	FILE	DATE
FINAL	RAV001	23/05/2018



4.2. Identification of Bushfire Impacts Hopetoun

The bushfire threats associated with the townsite include:

- The vegetated “wicks” which are present from the remnant verge vegetation areas entering the town site from the north (Culham Street and Veal Street) and the south east/south west (adjacent to foreshore areas).
- Large remnant vegetation areas associated with Crown reserves area adjacent to the townsite to the north, west and the east.
- Central Crown reserves, Water Corporation WA and Landcorp Reserves central to the townsite.
- Small areas of remnant/overgrown vegetation in private property lots in the south, and north of the townsite.
- Some continuous vegetation links exist adjacent to the strategic firebreaks linking external bushfire risks into the townsite.

These remnant vegetation (bushfire prone vegetation) areas can carry bushfire from the north, east and west into the townsite. The town centre and the south points are generally low fuel in nature and present limited risk of bushfire from the ocean.

A summary of the bushfire issues pertinent to Hopetoun townsite is provided below:

- Large strategic firebreaks along the west, north and east are designed to protect the townsite at large from bushfire. Separation of these links by 20m minimum separation will reduce impact onto the townsite. Particularly noted near Pirra Way whereby there is linking vegetation between the strategic breaks and dwellings which could lead to ember and radiant heat impact to adjacent dwellings.
- Strategic work along Canning Boulevard and the north east of the Caravan Park has seen a marked reduction in BAL Allocation in these areas.
- Risk of bushfire attack over the townsite are from the east and west where continuous bushfire vegetation exists. Specifically, from the following Plots:
 - Scrub Type D – all Plots identified.
 - Forest Type A – all Plots identified.
- Linking foreshore areas present continuous bushfire fuels but also present problems for fuel reduction as removal of vegetation will increase erosion and changes to the fragile environment.
- The undeveloped land of Landcorp's between France Street and Birdwood Street has undergone fuel reduction along the southern areas adjacent to private property. The fuel reduction is not complete along the north whereby fuels are linking back onto properties and into an undeveloped lot off France Street.
- Vulnerable assets (Health Centre, Aged care and Recreation Centre are noted to be in BAL 29 or less areas. Fire station has small area of BAL FZ.
- The Caravan Park (Vulnerable land use) and the Primary School both have areas of classifiable vegetation within 20m of the existing buildings and infrastructure. Bushfire attack would impact these sites. Internally work has been undertaken to fuel reduce (especially noted at the school) however more is required on the south to ensure bushfire impact is reduced.

4.3. BAL Contour Plan

BAL was assigned from each distinctive vegetation plot as classified to AS3950 and shown as a series of BAL Contours. The broad scale of the presented map on page 23 is for diagrammatic presentation purposes only. The detailed GIS mapping dataset provided to the Shire should be consulted for any planning and development considerations.



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Legend

- Subject_site_Hopetoun** (Blue line)
- 100m Assessment Boundary** (Red dashed line)
- 150m Assessment Boundary** (Yellow dashed line)
- Vulnerable Landuse** (Hatched area)
- Cadastre** (White area)
- BAL Contours**
 - BAL-FZ (Red)
 - BAL-40
 - BAL-29
 - BAL-19
 - BAL-12.5
 - BAL-LOW (Light Green)



Scale
1:7,000 @ A3
GDA MGA 94 Zone 50

Data Sources
Aerial Imagery: WA Now, Landgate Subscription Imagery
Cadastre, Relief Contours and Roads: Landgate 2017
IRIS Road Network: Main Roads Western Australia 2017
Overview Map: World Topographic map service, ESRI 2012

CLIENT
Shire of Ravensthorpe
PO Box 43
Ravensthorpe, WA 6346

BAL Contour / Hopetoun

BAL Assessor KK	QA Check BT	Drawn by SA
STATUS FINAL	FILE RAV001	DATE 23/05/2018

4.4. Recommendations for bushfire management/mitigation Hopetoun

The assessment of Hopetoun townsite has determined the following recommendations for bushfire mitigation, also refer to Figure 6 “Works Program”:

- The Vulnerable land use of the Hopetoun Caravan Park and the School should have fuel reduction strategies deployed internal to the site to APZ standards at all times. Fuel reduction standards (*note this is not broad scale clearing*) are to be as per the WAPC recommended APZ standards, refer to Section 5.0.
- Crown Land within management of the Shire adjacent to private dwellings/lodgings should be fuel reduced to a minimum of 20m to assist in Asset Protection Zones to the townsites dwellings and further protection of life and property from bushfire events. Slashing should occur for a minimum of 20m where vegetation is not attributable to foreshore protection areas.
- If areas of fuel reduction occurred to 20m separation adjacent to the strategic slashed breaks then exclusions to AS3959 could occur. I.e. if a 20m or greater separation is utilised, exclusion (c) or (d) of AS3959.
- Landcorp to provide clear separation from bushfire hazards on their land to adjacent dwellings along France Street a minimum of 20m is recommended.
- Consider prescribed burning by local brigades to fuel reduce remnant vegetation in Landcorp and Water Corporation WA undeveloped land.
- It is recommended that land owners of vacant land are required under the annual bushfire notice to maintain cleared land to <100mm in height and removable of dead and flammable material. Review may be required of the annual fire break notice to ensure urban land <2000m² is not a bushfire hazard to adjacent properties. Provision of this through the gazetted annual fire break notice pursuant to Section 33 of the *Bushfires Act 1953*.
- It is recommended that the Shire ensures land owners implement an Asset Protection Zone Standards to a min of 20m around existing buildings within the townsite/Shire. Provision of this through the gazetted annual fire break notice pursuant to Section 33 of the *Bushfires Act 1953*. Refer to Section 5.0.
- It is recommended the Shire implements APZ standards to their maintenance of street verges, parks and gardens adjacent to bushfire prone (classifiable vegetation) to ensure these maintained areas are not linking into the townsites as “wicks” or encourage ember establishment in bushfire conditions. Refer to further information Section 5.0 of this document.

A “Works Program” has been developed over the page (Page 25) to help assist for townsite bushfire mitigation works.



5. Asset Protection Zones

An Asset Protection Zone (APZ) is an area surrounding a building or asset that is managed to reduce the bushfire hazard to an acceptable level (WAPC, 2017). This is also defined as a “defendable space” which is area adjoining the asset within which firefighting operations can be undertaken to defend the structure (WAPC, 2017). Habitable buildings, sheds, water tanks and other assets should have an APZ utilising low threat or non-vegetated areas (roads, driveways, hardstand areas, maintained gardens, mowed lawns, slashing, trimming etc).

In the absence of any other DFES standards the WAPC APZ standard should be defined in the annual gazetted fire break notice to buildings. Any replanting, revegetation and landscaping in bushfire prone areas is recommended to be to an APZ standard as per WAPC Guidelines V 1.3 (WAPC, 2017). The WAPC APZ standard is provided in Appendix B.

The Shire should ensure their personnel responsible for implementing and maintaining Shire managed verges, reserves and parks are aware of the WAPC APZ standards. Design of new areas, infill planting and maintenance works adjacent to remnant (Bushfire prone) vegetation should also utilise fire retardant species. A list of fire retardant species for the south coast region is provided in Appendix C. The CFA “*Landscaping for Bushfire – Garden Design And Plant Selection*” (CFA, 2011) is a recommended guide for landscapers and maintenance workers involved with management of Public parks, verges and garden areas.

Contractors for the Shire tasked with fuel reduction in parks and gardens and street verges to APZ standards are to be aware and understand the WAPC APZ required standards (see Appendix B). It is particularly vital they understand the requested works area is not to be devasted by broadscale clearing, trees can remain and be trimmed and fuel reduced, clumps of shrubs can remain in areas 5m² etc. The WAPC APZ standard can form a briefing or guide for the contractual documentation when contractors are appointed by the Shire for fuel reduction. (Note for large strategic firebreak slashing this would not be required). Contractors should be briefed from project managers to ensure they understand the required works for fuel reduction.

6. References

AS 3959-2009 Australian Standard inc Amendments No 1, 2 and 3, *Construction of buildings in bushfire-prone areas*, Building Code of Australia, Primary Referenced Standard, Australian Building Codes Board and Standards Australia.

Catchpole WR, Bradstock RA, Choate J, Fogarty LG, Gellie N, McCarthy GJ, MCaw WL, Mardsend-Smedley JB and Pearce G co-operative Development of equations for heathland fire behaviour. In 'Proc. 3rd Int. Conf. Forest Fire Research and 14th Conf. On fire and Forest Meteorology. (ED VIEGAS DX) Luso Coimbra Portugal: 1998, 631-645pp.

Country Fire Service (CFA) Victoria (2011) Landscaping for Bushfire – Garden Design And Plant Selection. Victorian Government.

OBRM Bushfire mapping Standard accessed from the Department of Fire and Emergency Services Website accessed January 2018:

<http://www.dfes.wa.gov.au>

Western Australian Planning Commission (WAPC) (2017) Guidelines for Planning in Bushfire Prone Areas Version 1.3. Western Australian Planning Commission and Department of Planning WA, Government of Western Australia.

Western Australian Planning Commission (WAPC) (2015) State Planning Policy 3.2 Planning in Bushfire Prone Areas. Department of Planning WA and Western Australian Planning Commission.

State Land Information Portal (SLIP) (2017) Map of Bushfire Prone Areas. Office of Bushfire Risk management (OBRM) data retrieved from:

<https://maps.slip.wa.gov.au/landgate/bushfireprone/>

Appendix A

Vegetation Classification original plot data
(BDS, 2017)

Ravensthorpe Townsite Vegetation Classification 2016/2017

All vegetation within 150m of the site / proposed development was classified in accordance with Clause 2.2.3 of AS 3959-2009. Each distinguishable vegetation plot with the potential to determine the Bushfire Attack Level is identified below.

Plot	Classification or Exclusion Clause	Forest Type A
7		Eucalypts at various growth stages. Average tree height > 12m. Canopy cover > 30 – 70 %. Understorey of various acacias. Dead tree limbs and deep layer of bark litter. Fuel loading 25 – 35 t/ha. Effective Slope Downslope >5-10 degrees.
Photo ID: Photo RAV1-within Plot 7- view of Forest Type A located between Martin / Queen and Spence Street.		
Plots	Classification or Exclusion Clause	Forest Type A
4,10,13,15,18		Multi layered. Eucalypts and Acacias dominant. Average tree height > 13m. Canopy cover > 30 – 70 %. Understorey of native grasses and low trees. Fuel loading 25 – 35 t/ha. Effective Slope Downslope >0-5 degrees.
Photo ID: Photo RAV2-within Plot 4-view of Forest Type A on southern boundary of assessment zone intersection of Martin & Neil Streets.		
Plots	Classification or Exclusion Clause	Forest Type A
4,10,13,15,18		Multi layered. Eucalypts dominant. Average tree height > 7 – 8m. Canopy cover > 30 – 50%. Understorey of Acacias, low trees and shrubs. Fuel loading 25 – 35 t/ha. Effective Slope Downslope >0-5 degrees.
Photo ID: Photo RAV3-within Plot 18 view of Forest Type A on north-eastern corner of assessment zone along Hosking Street.		

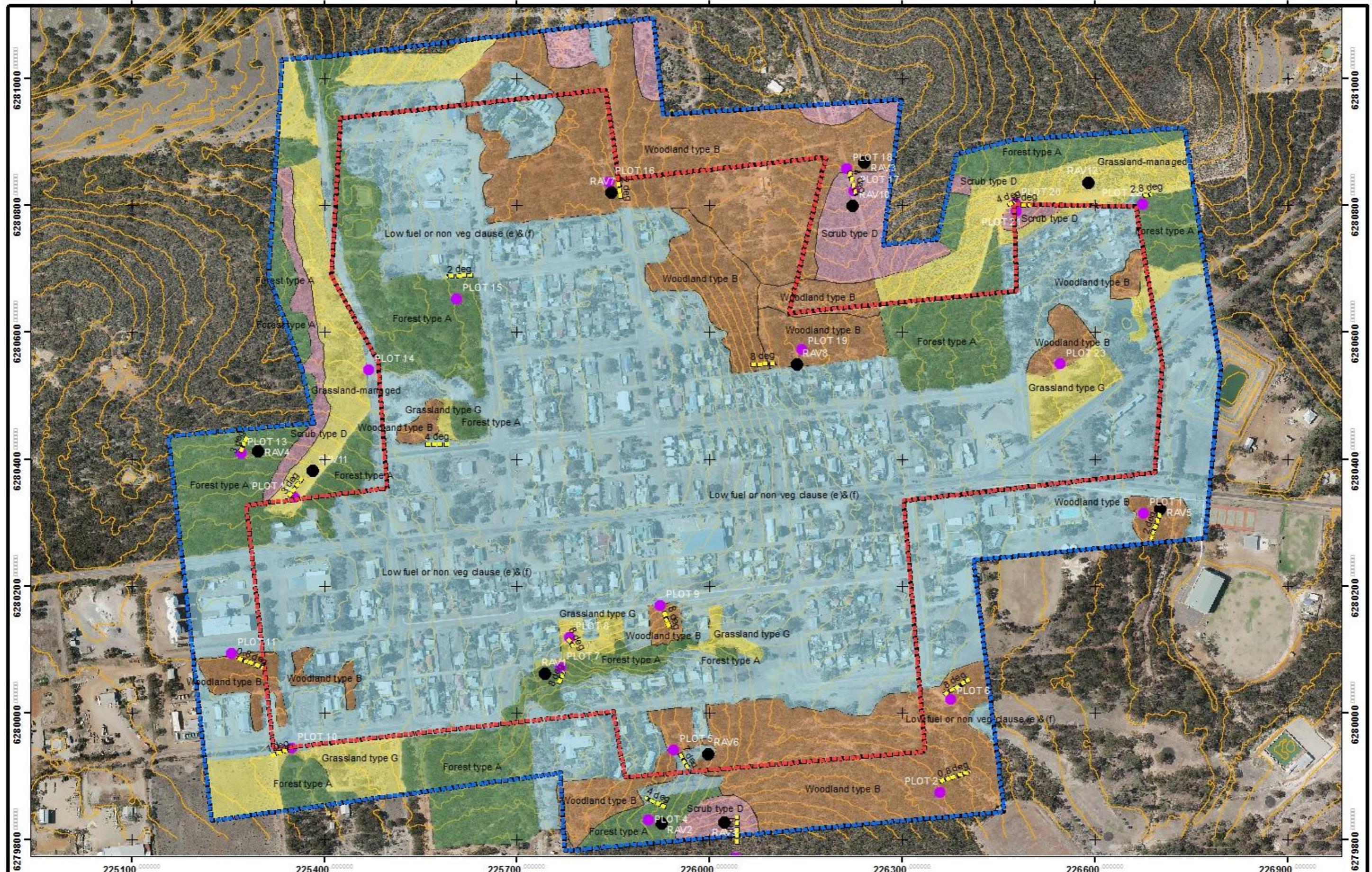
Plots	Classification or Exclusion Clause	Forest Type A
4,7,10,13,15,18		<p>Multi layered. Eucalypts as various growth stages. Average tree height > 5m. Canopy cover >30 – 70 %. Understorey consisting of small trees Acacias and shrubs. Fuel loading 25 – 35 t/ha. Effective Slope Downslope >0-5 degrees.</p> 
Photo ID: Photo RAV4 –within plot 13-view of Forest Type A north west corner of assessment zone corner of South Coast Highway & Floater Street.		
Plots	Classification or Exclusion Clause	Woodland Type B
1,2,5,6,9,11,14,16,23,19		<p>Open woodlands. Eucalypts being the dominant vegetation. Average tree height >6 – 8m. Canopy cover > 10 – 30 %. Understorey consisting of Acacias and low shrubs. Fuel load 15 – 25 t/ha. Effective Slope Downslope >0-5 degrees (Plots 1,6,11,14 and 16). Upslope/flat (Plots 2 and 23). Downslope >5-10 degrees (Plots 5,9 and 19).</p> 
Photo ID: Photo RAV5 –within plot 1 view of Woodlands Type B on eastern boundary of assessment zone adjacent sports complex.		
Plots	Classification or Exclusion Clause	Woodland Type B
1,2,5,6,9,11,14,16,23,19		<p>Open woodlands. Dominated by Eucalypts. Average tree height >16m. Canopy cover 10%. Understorey Acacias, occ low tree and low shrubs. Fuel loading 15 t/ha. Effective Slope Downslope >0-5 degrees (Plots 1,6,11,14 and 16). Upslope/flat (Plots 2 and 23). Downslope >5-10 degrees (Plots 5,9 and 19).</p> 
Photo ID: Photo RAV6 –within plot 5-View of Woodland Type B located at rear of the hospital to the south west of the township.		

Plots	1,2,5,6,9,11,14,16,23,19	Classification or Exclusion Clause	Woodland Type B
			<p>Open woodlands. Multi stemmed Eucalypts dominant. Average tree height 7m. Canopy cover 10 – 30 %. Understorey consisting of Hakeas and Acacia >1 – 2 m. and low shrubs. Fuel load 15 t/ha. Effective Slope Downslope >0-5 degrees (Plots 1,6,11,14 and 16). Upslope/flat (Plots 2 and 23). Downslope >5-10 degrees (Plots 5,9 and 19).</p>
Photo ID: Photo RAV7 –within plot 16-view of Woodland Type B on northern boundary of assessment zone Carlisle and Queen Street.			
Plots	1,2,5,6,9,11,14,16,23,19	Classification or Exclusion Clause	Woodland Type B
			<p>Open woodlands. Eucalypts with Acacias and Hakeas interspersed throughout. Average tree height > 7m. Canopy cover > 10 – 30%. Understorey native grasses and shrubs < 0.5m. Fuel load 15 – 25 t/ha. Effective Slope Downslope >0-5 degrees (Plots 1,6,11,14 and 16). Upslope/flat (Plots 2 and 23). Downslope >5-10 degrees (Plots 5,9 and 19).</p>
Photo ID: Photo RAV8 –within plot 19 view of Woodland Type B north of residences fronting Dunn Street.			
Plots	3,17,21	Classification or Exclusion Clause	Scrub Type D
			<p>Acacia and Melaleuca scrubs > 2 – 3m. Occasional eucalypts > 4m. Dense continuous vegetative structure. >30% vegetative cover. Fuel load 25 t/ha. Effective Slop Upslope.</p>
Photo ID: Photo RAV9-within plot 3- view of Scrub Type D southern boundary of assessment zone.			

Plots	3,17,21	Classification or Exclusion Clause	Scrub Type D
			 <p>Scrubs >2 – 3m of mixed species composition. Dense continuous vegetative structure. >30% vegetative cover. Fuel loading 25 t/ha. Effective Slope Upslope.</p>
Photo ID: Photo RAV10-within plot 17- view of Scrub Type D on north eastern boundary of assessment zone fronting Hosking Street.			
Plots	8,12,20	Classification or Exclusion Clause	Grassland Type G
			 <p>Managed grasses interspersed with Acacias, Hakeas and coppicing Eucalypts. Signs of mowing are evident however grasses currently in excess of 200mm. Effective Slope Downslope >5-10 degrees (Plot 8). Downslope >0-5 degrees (Plot 12). Upslope (Plot 20).</p>
Photo ID: Photo RAV11-within plot 12-view of Grassland Type G at rear of St John ambulance centre.			
Plots	8,12,20	Classification or Exclusion Clause	Grassland Type G
			 <p>Unmanaged native grasses, Hakeas and Acacias. Obvious buffer zone however at present vegetation in excess of 200mm in height. Downslope >5-10 degrees (Plot 8). Downslope >0-5 degrees (Plot 12). Upslope (Plot 20).</p>
Photo ID: Photo RAV12-within plot 20 view of Grassland Type G on eastern boundary behind Caravan Park.			

Comments on Effective Slope

There are two dominant hills in the townsite assessment boundary – one in the central area of the townsite and one to the south. Effective slopes were generally upslope and <5 degrees across the townsite and in northern areas. To the south and central east ES were between 7- 8 degrees (Downslope >5 to 10 degrees) due to the sloping nature of this area of the Creek in the townsite.



Legend	Scale 1: 5,500 @ A3 MGA GDA 94 Zone 51	This BAL Contour Plan was prepared by: Kathryn Kinnear, Bio Diverse Solutions Accreditation No: BPAD30794	CLIENT Shire of Ravensthorpe 65 Morgans Street Ravensthorpe WA 6346						
Veg_A S3959_SORZ51 Table_2_3 Forest type A Grassland type G	100m Assessment Boundary Town bndy Low fuel or non veg clause (e) & (f) RAV-HPTN-Photo Points RAVEY-plots Ravensthorpe_2m_contours	 Tel: 08 9841 3936 Fax: 08 9841 3936 Mob: 0447 555 516	Ravensthorpe Vegetation Classes <table border="1"> <thead> <tr> <th>STATUS</th> <th>FILE</th> <th>DATE</th> </tr> </thead> <tbody> <tr> <td>FINAL</td> <td>JER005</td> <td>11/5/2017</td> </tr> </tbody> </table>	STATUS	FILE	DATE	FINAL	JER005	11/5/2017
STATUS	FILE	DATE							
FINAL	JER005	11/5/2017							
Ravensthorpe Vegetation Classes									

Hopetoun Townsite Vegetation Classification

All vegetation within 150m of the site / proposed development was classified in accordance with Clause 2.2.3 of AS 3959-2009. Each distinguishable vegetation plot with the potential to determine the Bushfire Attack Level is identified below.

Plots	1,4,5,9,10,12,15	Classification or Exclusion Clause	Forest Type A
			<p>Multi layered. Brown Mallet and Marlock forest. >30 – 70 % canopy cover. >30-70 % vegetative cover. Trees average height of 8m. Multi layered mid and understorey. Fuel loading of 25 – 35 t /ha. Effective Slope Downslope >0-5 degrees (Plots 1,5,10 and 15). Upslope (Plots 4, 9 and 12).</p>

Photo ID: Photo HPT1 view of Forest Type A on the northern boundary of the assessment zone Mary Ann Drive.

Plots	1,4,5,9,10,12,15	Classification or Exclusion Clause	Forest Type A
			<p>Multi layered. Eucalyptus forest with >30 – 90 % canopy cover. Average tree height 6 – 7m. Mid and understorey comprising of Acacias > 4m native shrubs and grasses, leaf and bark litter > 30mm. Fuel loading of 25 – 35 t/ha. Effective Slope Downslope >0-5 degrees (Plots 1,5,10 and 15). Upslope (Plots 4, 9 and 12).</p>

Photo ID: Photo HPT2 within plot 4 of Forest Type A to the east of assessment zone rear of dwellings on Flinders Street.

Plots	1,4,5,9,10,12,15	Classification or Exclusion Clause	Forest Type A
			<p>Multi layered. Eucalyptus forest with Acacias > 2.4m Average tree height of 6m >30 – 70% canopy cover. Mid and understorey consisting of shrubs to 1.5m. Native grasses leaf and bark litter > 150mm. Fuel loading of 25 – 35 t/ha. Effective Slope Downslope >0-5 degrees (Plots 1,5,10 and 15). Upslope (Plots 4, 9 and 12).</p>

Photo ID: Photo HPT3 within plot 9-view of Forest Type A at rear of Primary School and Chambers Street.

Plots	1,4,5,9,10,12,15	Classification or Exclusion Clause	Forest Type A
			<p>Multi layered. Eucalyptus trees 5-10m. Acacias >2.4m. Average tree height 5m. >30-70% canopy cover. Understorey consisting of shrubs > 0.75m. Fuel loading of 25 – 35 t/ha. Effective Slope Downslope >0-5 degrees (Plots 1,5,10 and 15). Upslope (Plots 4, 9 and 12).</p>

Photo ID: Photo HPT4-within plot 12 views of Forest Type A north of Caravan Park and Canning Boulevard.

Plots	2,3,6,7,11,13,14	Classification or Exclusion Clause	Scrub Type D
			<p>Occasional eucalypt > 3.8m. Majority of the vegetation consisting of Acacias and shrubs ranging from 1.5 – 2.5m. Canopy coverage > 30%. Fuel loading 15 – 25 t/ha. Effective Slope Downslope >0-5 degrees (Plots 3, 11 and 4). Downslope >5-10 degrees (Plots 2 and 7). Upslope (Plots 6 and 13).</p>

Photo ID: Photo HPT5-within plot 3-view of Scrub Type D south east of LIA adjoining Tamar Street.

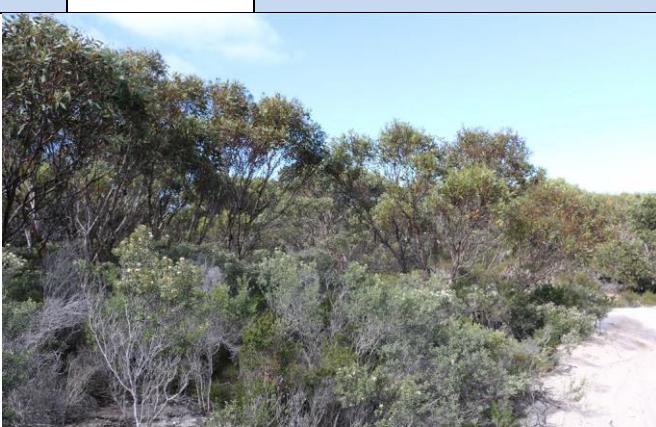
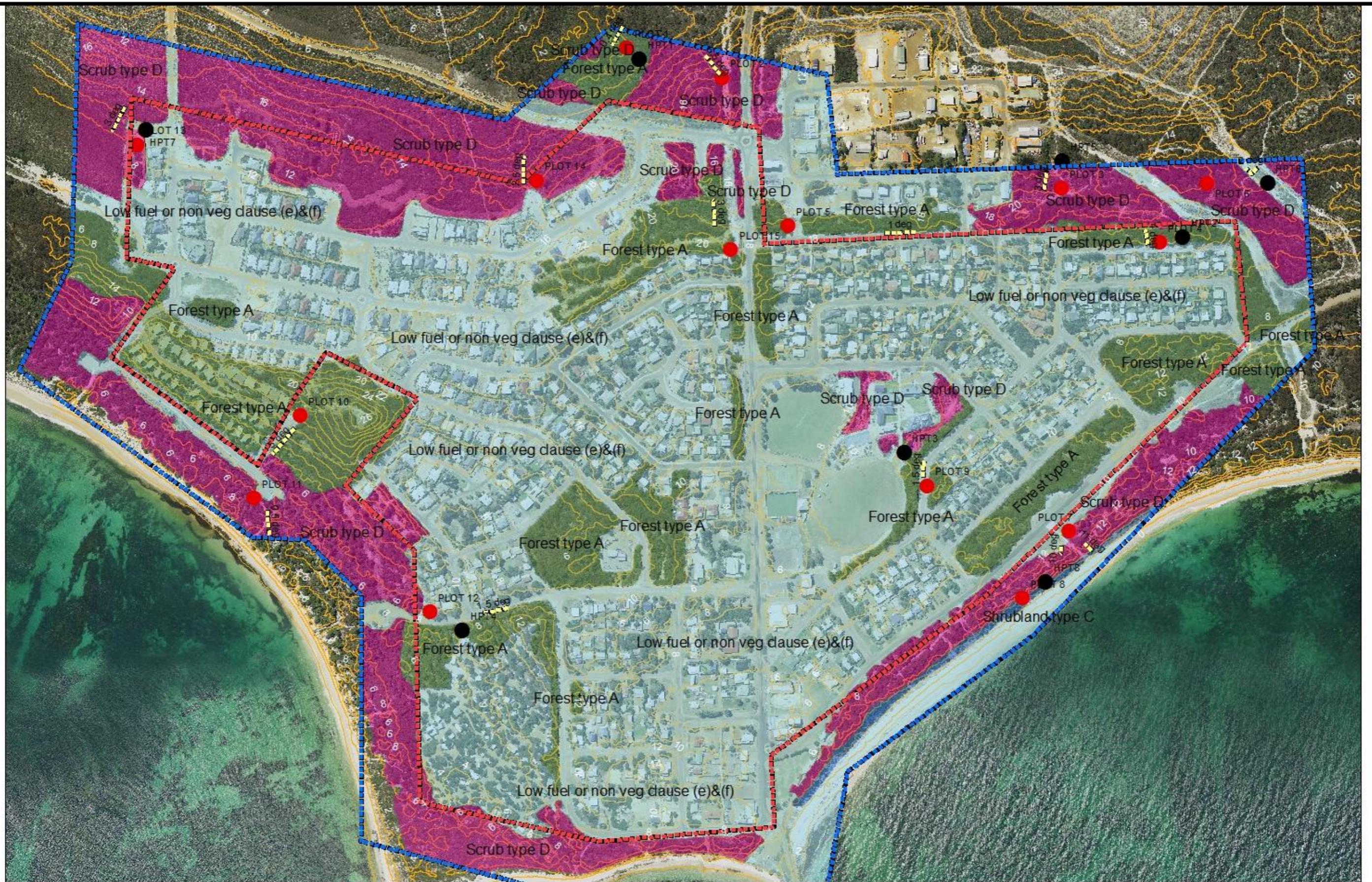
Plots	2,3,6,7,11,13,14	Classification or Exclusion Clause	Scrub Type D
			<p>Multi stemmed Mallee averaging 3m. Occasional tree obtaining 4m. Melaleuca and Acacia scrubs. Vegetative cover > 30%. Fuel loading 25 t/ha. Effective Slope Downslope >0-5 degrees (Plots 3, 11 and 4). Downslope >5-10 degrees (Plots 2 and 7). Upslope (Plots 6 and 13).</p>

Photo ID: Photo HPT6- within plot 6- view of Scrub Type D north eastern corner of assessment zone.

Plots	2,3,6,7,11,13,14	Classification or Exclusion Clause	Scrub Type D
			Scrubs 2 – 3 m occasional Mallee tree > 4m. Tallerack, Melaleuca and Acacia scrubs. Dense continuous vegetative structure. >30% vegetative cover. Fuel load 15 – 25 t/ha.
Photo ID: Photo HPT7-within plot 13- view of Scrub Type D north west of dwellings on Eucla Way.			
Plot	8	Classification or Exclusion Clause	Shrubland Type C
			Coastal heath running along foreshore on southern boundary of assessment zone. Heaths < 1m with occasional Melaleuca > 1.5m. 90 – 100 % vegetative cover. Fuel loading 15 t/ha.
Photo ID: Photo HPT8-within plot 8- view looking west towards township along southern boundary of assessment zone.			

Comments on Effective Slope

Effective slopes were variable across the townsite with small coastal dunes having upslope and downslope generally <5 degrees. The coastal Shrubland Type C in the south east of the townsite recorded the highest ES being 11 degrees. The majority of the ES were downslope of the townsite giving the higher BAL rating.



Legend

Slope-raw-hptn-Z51	Veg_AS3959_SORZ51	Low fuel or non veg clause (e)&(f)
100m Assessment Boundary		Scrub type D
Town bndy		Shrubland type C
Table_2_3		Woodland type B
HOPEY	Forest type A	
RAV-HPTN-Photo Points	Grassland-managed	
Hopetoun_2m_contours	Grassland-unmanaged	

Scale1: 6,000 @ A3
MGA GDA 94 Zone 51



0 50 100 200 300 400 500 Meters

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Hopetoun Vegetation Classes

STATUS	FILE	DATE
FINAL	JER005	

Appendix B
APZ standards to apply
(WAPC, 2017)

Asset Protection Zone (APZ): Every habitable building is surrounded by, and every proposed lot can achieve, an APZ depicted on submitted plans, which meets the following requirements:

- **Width:** Measured from any external wall or supporting post or column of the proposed building, and of sufficient size to ensure the potential radiant heat impact of a bushfire does not exceed 29kW/m^2 (BAL-29) in all circumstances.
- **Location:** The APZ should be contained solely within the boundaries of the lot on which the building is situated, except in instances where the neighbouring lot or lots will be managed in a low-fuel state on an ongoing basis, in perpetuity (see explanatory notes).
- **Management:** The APZ is managed in accordance with the requirements of 'Standards for Asset Protection Zones'. (WAPC, 2017)

WAPC Guidelines for an APZ (WAPC, 2017)

Fences: Within the APZ are constructed from non-combustible materials (e.g. iron, brick, limestone, metal post and wire). It is recommended that solid or slatted non-combustible perimeter fences are used.

Objects: Within 10 metres of a building, combustible objects must not be located close to the vulnerable parts of the building i.e. windows and doors.

Fine Fuel load: Combustible dead vegetation matter less than 6 millimetres in thickness reduced to and maintained at an average of two tonnes per hectare.

Trees (> 5 metres in height): Trunks at maturity should be a minimum distance of 6 metres from all elevations of the building, branches at maturity should not touch or overhang the building, lower branches should be removed to a height of 2 metres above the ground and or surface vegetation, canopy cover should be less than 15% with tree canopies at maturity well spread to at least 5 metres apart as to not form a continuous canopy. See Figure 6 (WAPC Figure 16, Appendix 4) below.

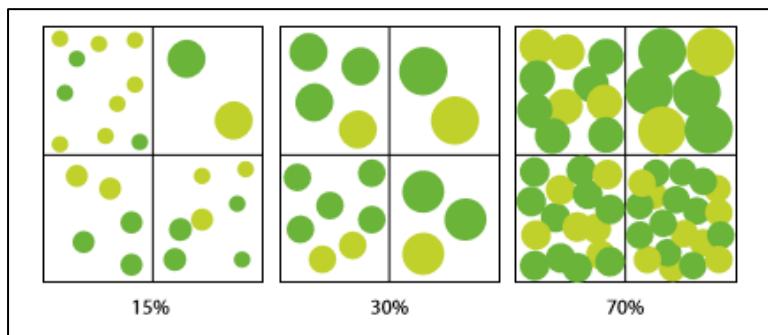


Figure 6: Tree Canopy Coverage – ranging from 15 to 70% at maturity (WAPC, 2017).

Shrubs (0.5 metres to 5 metres in height): Should not be located under trees or within 3 metres of buildings, should not be planted in clumps greater than 5m^2 in area, clumps of shrubs should be separated from each other and any exposed window or door by at least 10 metres. Shrubs greater than 5 metres in height are to be treated as trees.

Ground covers (<0.5 metres in height): Can be planted under trees but must be properly maintained to remove dead plant material and any parts within 2 metres of a structure, but 3 metres from windows or doors if greater than 100 millimetres in height. Ground covers greater than 0.5 metres in height are to be treated as shrubs.

Grass: Should be managed to maintain a height of 100 millimetres or less.

(WAPC, 2017).

Appendix C
Forever Project
Fire retardant species



The Forever Project

Fire: Recovery and Resilience

Native Fire Retardant Species

These are species that either don't burn or burn very slowly provided that they are well managed and not 'choked' in dead weeds or fallen branches!

Natives:

Trees:

Brachychiton populneus – Kurrajong *
Brachychiton x Rosea – Hybrid Flame Tree
Callitris preissii – Rottnest Island Pine
Casuarina obesa – Swamp Sheoak
Corymbia maculata – Spotted Gum *
Eucalyptus spathulata – Swamp Mallet
Grevillea robusta – Silky Oak *
Hymenosporum flavum - Native Frangipani
Lophostemon confertus - Brushbox *
Melaleuca lanceolata – Rottnest Island Tea Tree
Pittosporum phyllarioides – Native Apricot

Tall Shrubs:

Acacia cyclops – Coastal Wattle
Acacia saligna – Golden Wreath Wattle
Acmena smithii - lilly Pilly *
Hakea drupacea - Hakea

Small Shrubs:

Anigozanthos species – Kangaroo paws
Atriplex species – Salt Bushes
Correa pulchella – Salmon Correa
Crowea exalata – Small Crowea
Dianella species – Dianellas
Eremophila spp – Poverty Bush
Lomandra longifolia – Spiny headed mat rush
Maireana spp - Bluebushes
Olearia species – Coastal daisies
Orthrosanthus sp
Patersonia spp - Native flag Iris
Westringia fructosa – Coastal Rosemary

Creepers/ground covers:

Atriplex cinerea – Grey Salt Bush
Banksia blechnifolia – Creeping Banksia
Brachyscome multifida – Cut Leaf Daisy
Carbobrotus virescens – Native Pig Face
Chrysocephalum apiculatum – Common Everlasting
Correa alba – prostrate form – Dwarf White Correa
Dampiera linearis – Common Dampiera
Dichondria repens – Dichondria
Festuca glauca – Blue Fescue
Hardenbergia comptoniana – Native Wisteria
Kennedia prostrata – Running Postman
Kennedia coccinea – Coral Pea Vine
Myoporum parvifolium – Booboolia
Rhagodia spp - Berry Salt Bush
Scaevola albida – Mauve Clusters
Zygophyllum billardieri – Coast Twin Leaf