



intelligent outcomes | respected experience

Bushfire Hazard Level Assessment

Wanju, Waterloo and Picton South
District Structure Plans

DRAFT

Prepared for
Department of Planning
by Strategen

May 2017

Bushfire Hazard Level Assessment

**Wanju, Waterloo and Picton South
District Structure Plans**

DRAFT

Strategen is a trading name of
Strategen Environmental Consultants Pty Ltd
Level 1, 50 Subiaco Square Road Subiaco WA 6008
ACN: 056 190 419

May 2017

Limitations

Scope of services

This report ("the report") has been prepared by Strategen Environmental Consultants Pty Ltd (Strategen) in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Strategen. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

Reliance on data

In preparing the report, Strategen has relied upon data and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise expressly stated in the report, Strategen has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Strategen has also not attempted to determine whether any material matter has been omitted from the data. Strategen will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Strategen. The making of any assumption does not imply that Strategen has made any enquiry to verify the correctness of that assumption.

The report is based on conditions encountered and information received at the time of preparation of this report or the time that site investigations were carried out. Strategen disclaims responsibility for any changes that may have occurred after this time. This report and any legal issues arising from it are governed by and construed in accordance with the law of Western Australia as at the date of this report.

Environmental conclusions

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made.

Client: Department of Planning

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
				Form	Date
Draft Report	A	For client review	A Ennis / R Banks (Level 2 BPAD No. 36857)	Electronic (email)	4/5/2017
Final Report					

Filename: DPI17163_01 R001 Rev A - 4 May 2017

Table of contents

1. Introduction	1
1.1 Background	1
1.2 Purpose and application of the plan	1
2. Spatial consideration of bushfire threat	3
2.1 Existing site characteristics	3
2.1.1 Location, zoning and land use	3
2.1.2 Assets	3
2.1.3 Access	4
2.2 Existing fire environment	6
2.2.1 Vegetation	6
2.2.2 Site topography and slope under vegetation	7
2.3 Pre-development bushfire hazard level assessment	11
2.4 Post development bushfire hazards	16
2.5 Landscape bushfire hazards	17
3. Opportunities and constraints	22
3.1 Location and Siting	22
3.2 Vehicle access	24
3.3 Water supply	25
3.4 Environmental considerations	25
4. Summary and recommendations	26
5. References	28

List of tables

Table 1: Minimum hazard separation distances based on effective slope	22
---	----

List of figures

Figure 1: District Structure Plans	2
Figure 2: Site overview	5
Figure 3: Wanju: Vegetation class and effective slope	8
Figure 4: Waterloo: Vegetation class and effective slope	9
Figure 5: Picton South: Vegetation class and effective slope	10
Figure 6: Wanju: Pre-development hazard level assessment	13
Figure 7: Waterloo: Pre-development bushfire hazard level assessment	14
Figure 8: Picton South: Pre-development bushfire hazard level assessment	15
Figure 9: Wanju: Post development bushfire hazards	19
Figure 10: Waterloo: Post development bushfire hazards	20
Figure 11: Picton South: Post development bushfire hazards	21

List of appendices

Appendix 1 Site photographs	
-----------------------------	--

1. Introduction

1.1 Background

Department of Planning is preparing District Structure Plans (DSP) for Wanju, Waterloo and Picton South in the Shire of Dardanup and City of Bunbury. As depicted in Figure 1:

- Wanju DSP will facilitate residential, commercial, town centre, public purposes and Public Space land uses
- Waterloo DSP will facilitate industrial and Public Space land uses
- Picton South DSP will facilitate industrial; Public Space and public purposes land uses.

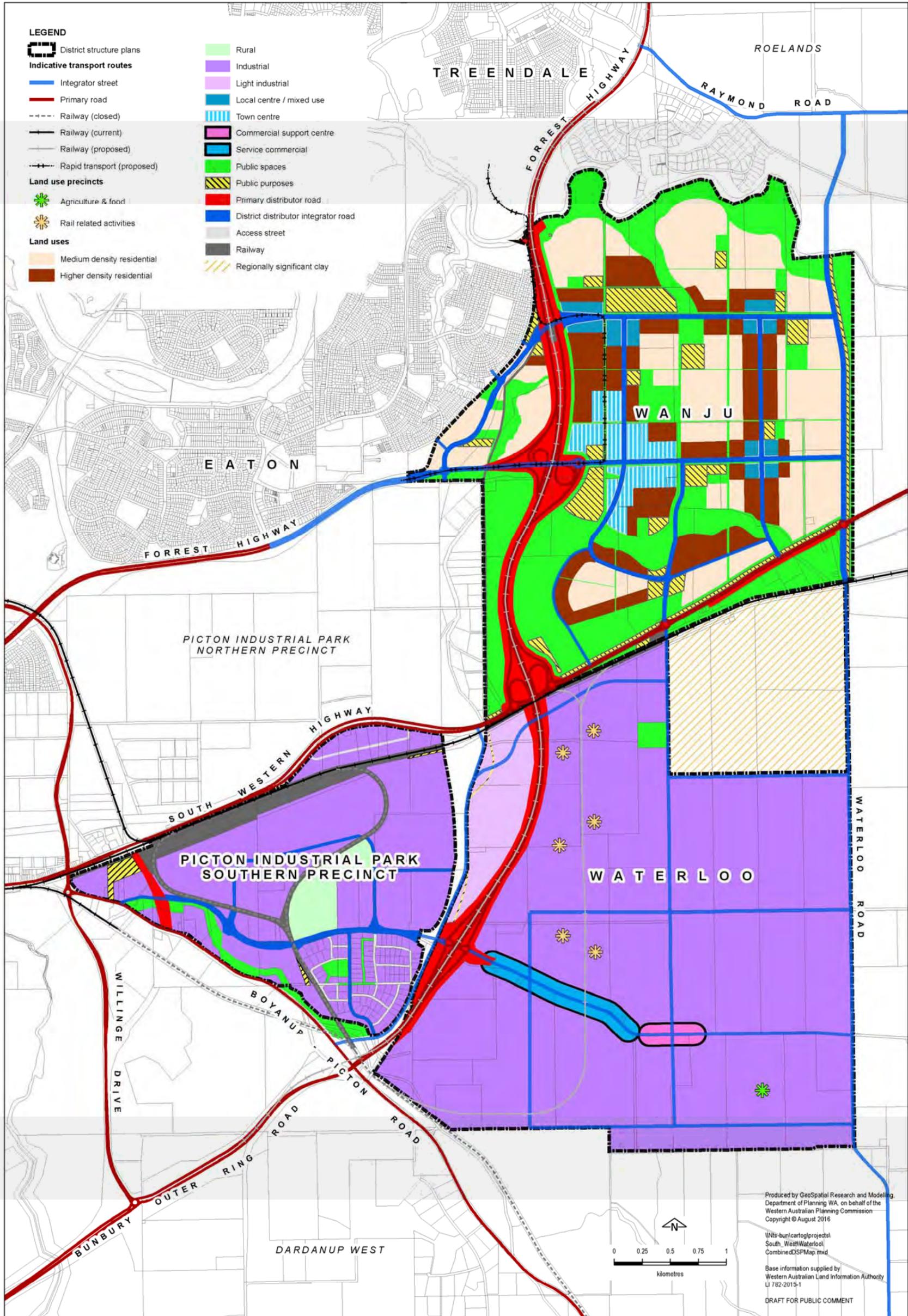
Due to the current extent of on-site and adjacent vegetation, portions of the DSP areas are designated as bushfire prone, as outlined on the Western Australian *Map of Bush Fire Prone Areas* (DFES 2017). As a result, Strategen has prepared this Bushfire Hazard Level (BHL) assessment to inform strategic planning.

Information required to accompany DSPs under *State Planning Policy 3.7 Planning in Bushfire-Prone Areas* (SPP 3.7; WAPC 2015) Policy Measure 6.3, includes results of a BHL assessment determining the applicable hazard level(s) across the subject land in accordance with methodology set out in *Guidelines for Planning in Bushfire-Prone Areas* (the Guidelines; WAPC 2017).

This BHL assessment has been prepared in accordance with the Guidelines.

1.2 Purpose and application of the plan

The purpose of this BHL assessment is to provide a high level consideration of bushfire risk within the DSP areas and provide guidance on bushfire planning and requirements at future planning and development stages.



District Structure Plans Context Map

Figure 1: District Structure Plans

2. Spatial consideration of bushfire threat

2.1 Existing site characteristics

2.1.1 Location, zoning and land use

Wanju DSP and Waterloo DSP are located in the Shire of Dardanup. Picton South DSP is located in the Shire of Dardanup and the City of Bunbury.

Wanju

Wanju DSP area is predominantly cleared, with areas of remnant vegetation being limited to the Collie River, Millers Creek, south of South Western Highway and adjacent to Australind Bypass (Figure 2). Current predominant land uses are rural.

The DSP area is currently zoned 'General Farming' under the Shire of Dardanup Town Planning Scheme No 3.

Waterloo

Waterloo DSP area is predominantly cleared, with remnant vegetation being limited to small areas of scattered trees mainly to the west and south, Ferguson River to the southwest and south of South Western Highway to the north (Figure 2). Current predominant land uses are rural.

The DSP area is currently zoned 'General Farming' under the Shire of Dardanup Town Planning Scheme No 3.

Picton South

Picton South DSP area is predominantly cleared, with remnant vegetation located along Ferguson River to the south, along South Western Highway, scattered trees on rural land and a larger consolidated area of bushland within the central portion of the DSP area (Figure 2). Current land uses include light and general industrial development and rural.

The DSP area is currently zoned 'General Farming', 'General Industry', 'Light Industry', 'Development' and 'Special' under the Shire of Dardanup Town Planning Scheme No 3 and 'Industry' and 'Development zone – industrial' under the City of Bunbury Town Planning Scheme No 7.

2.1.2 Assets

The DSP areas contain life and property assets associated with current rural and industrial land uses. Proposed residential development and additional industrial development will ultimately increase the critical life and property assets of the site by intensifying the number of occupiers, visitors and built assets across the DSP areas.

A flora and fauna survey undertaken for the Wanju and Waterloo DSP areas (GHD 2015) identified the following environmental values:

- vegetation complexes with less than 30% remaining
- threatened ecological community within Waterloo DSP area (Lot 310 Wireless Road)
- vegetation corridors and riparian habitat along Collie River and Millers Creek
- two priority listed flora species (Lot 310 Wireless Road and Lot 706 Clifton Road)
- potential habitat for threatened species of black cockatoo and the threatened Western Ringtail Possum within small areas of intact vegetation

The Wanju and Waterloo DSPs have been informed by and designed to minimise impacts on the above environmental values.

The Environmental Protection Authority's (EPA 2008) advice on areas of conservation significance within the Preston Industrial Park identified the following environmental values within the Picton South DSP area:

- vegetation complexes with less than 10% remaining
- priority listed flora species
- wetlands of conservation significance
- potential habitat for threatened species of black cockatoo and the threatened Western Ringtail Possum
- vegetation functioning as an ecological linkage (including along Ferguson River).

In response to presence of the above environmental values, under the proposed DSP vegetation will be retained or enhanced within an area remaining as 'Rural' under the DSP (see Figure 1) and along the Ferguson River.

2.1.3 Access

The DSP areas are currently accessed via the following surrounding access routes (Figure 2):

- Wanju – South Western Highway to the south, Hynes Road to the west and Australind Bypass to the west
- Waterloo – South Western Highway to the north, Waterloo Road to the east, Martin Pelusey Road to the west and Boyanup Picton Road to the southwest
- Picton South – South Western Highway to the north, Martin Pelusey Road to the east, Boyanup Picton Road to the south and west.

The DSP areas are also traversed by a number of internal public roads.



Figure 2: Site overview

Scale 1:30,048 at A3



Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 3/05/2017

Author: DWhite

Source: Aerial: ESRI basemap, approx. 2010. Project boundaries: Client 04/2017.



Info@strategen.com.au
www.strategen.com.au

2.2 Existing fire environment

2.2.1 Vegetation

Strategen undertook an assessment of the vegetation within the DSP areas and 100 m of surrounding land on 21 April 2017.

Pre-development vegetation class has been assessed in accordance with the *Visual guide for bushfire risk assessment in Western Australia* (DoP 2016) and *AS 3959–2009 Construction of Buildings in Bushfire-Prone Areas* (AS 3959; SA 2009). For areas that were not publicly accessible, vegetation class has been interpreted via desktop assessment of aerial imagery and classification of surrounding accessible areas of vegetation.

Wanju

Vegetation classes are depicted in Figure 3 along with the location and direction of georeferenced site photographs (refer to Appendix 1 for site photographs). The following vegetation classes were identified:

- Class A forest south of South Western Highway (Photo 1, Photo 2, Photo 3, Photo 4 and Photo 5) and to the west and north (Photo 6, Photo 7 and Photo 8)
- Class B woodland to the west, north and along Millers Creek (Photo 9, Photo 10, Photo 11, Photo 12, Photo 13, Photo 14, Photo 15 and Photo 16)
- Class D scrub at Hynes Road and Australind Bypass junction (Photo 17 and Photo 18) and along Australind Bypass (Photo 19)
- Class G grassland throughout areas of unmanaged grass (Photo 20, Photo 21 and Photo 22)
- non-vegetated areas (e.g. roads and buildings) and/or low threat managed land excluded from classification under Clause 2.2.3.2 (e) and (f) (Photo 23, Photo 24, Photo 25, Photo 26, Photo 27 and Photo 28).

The majority of cleared rural land is currently actively grazed/managed and is therefore in a minimal low fuel condition (excluded Clause 2.2.3.2 f). However, as there are some small areas of unmanaged grassland (Class G grassland) dispersed amongst these areas, Strategen has taken a precautionary approach and depicted these areas on Figure 3 as a combination of Class G grassland and excluded Clause 2.2.3.2 f.

Waterloo

Vegetation classes are depicted in Figure 4 along with the location and direction of georeferenced site photographs (refer to Appendix 1 for site photographs). The following vegetation classes were identified:

- Class A forest south of South Western Highway (Photo 1, Photo 2, Photo 3, Photo 4 and Photo 5) and southwest (Photo 29 and Photo 30)
- Class B woodland to the north (Photo 31), south (Photo 32) and west (Photo 33 and Photo 34)
- Class D scrub to the north (Photo 35)
- Class G grassland throughout areas of unmanaged grass (Photo 36 and Photo 37)
- non-vegetated areas (e.g. roads and buildings) and/or low threat managed land excluded from classification under Clause 2.2.3.2 (e) and (f) (Photo 38, Photo 39, Photo 40, Photo 41, Photo 42 and Photo 43).

The majority of cleared rural land is currently being actively grazed/managed and is therefore in a minimal low fuel condition (excluded Clause 2.2.3.2 f). However, as there are some small areas of unmanaged grassland (Class G grassland) dispersed amongst these areas, Strategen has taken a precautionary approach and depicted these areas on Figure 4 as a combination of Class G grassland and excluded Clause 2.2.3.2 f.

Picton South

Vegetation classes are depicted in Figure 5 along with the location and direction of georeferenced site photographs (refer to Appendix 1 for site photographs). The following vegetation classes were identified:

- Class A forest (south of South Western Highway (Photo 1, Photo 2, Photo 3, Photo 4 and Photo 5) and southwest (Photo 29 and Photo 30)
- Class B woodland within existing POS (Photo 53), to the south (Photo 54 and Photo 60), east (Photo 33, Photo 34, Photo 55, Photo 56 and Photo 57), to the northeast (Photo 58 and Photo 59) and along South Western Highway (Photo 61, Photo 62, Photo 63 and Photo 64)
- Class G grassland throughout areas of unmanaged grass
- non-vegetated areas (e.g. roads and buildings) and/or low threat managed land excluded from classification under Clause 2.2.3.2 (e) and (f) (Photo 65 and Photo 66).

The majority of cleared rural land is currently actively grazed/managed and is therefore in a minimal low fuel condition (excluded Clause 2.2.3.2 f). However, as there are some small areas of unmanaged grassland (Class G grassland) dispersed amongst these areas, Strategen has taken a precautionary approach and depicted these areas on Figure 5 as a combination of Class G grassland and excluded Clause 2.2.3.2 f.

Strategen emphasises that the vegetation extent discussed above and mapped in Figure 3, Figure 4 and Figure 5 demonstrate current site conditions and does not take into account vegetation clearance proposed as part of future staged development. Therefore, the extent of Clause 2.2.3.2 exclusions within the DSP areas will increase as development progresses throughout the site.

The above information has been used to inform a pre-development bushfire hazard level assessment for the DSP areas (refer to Section 2.3).

2.2.2 Site topography and slope under vegetation

Strategen has assessed site topography and effective slope under classified vegetation within the DSP areas and adjacent 100 m through assessment of topographic information and on-ground verification in accordance with AS 3959 methodology (Figure 3, Figure 4 and Figure 5).

All DSP areas are predominantly flat, with some areas of undulation related to waterways, including Collie River to the north of Wanju DSP area, Millers Creek within Wanju DSP area and Ferguson River southwest of Waterloo DSP area and south of Picton South DSP area. Predominant slope under classified vegetation has been identified as less than 10 degrees.

The above information has been used to inform a pre-development bushfire hazard level assessment for the DSP areas (refer to Section 2.3).

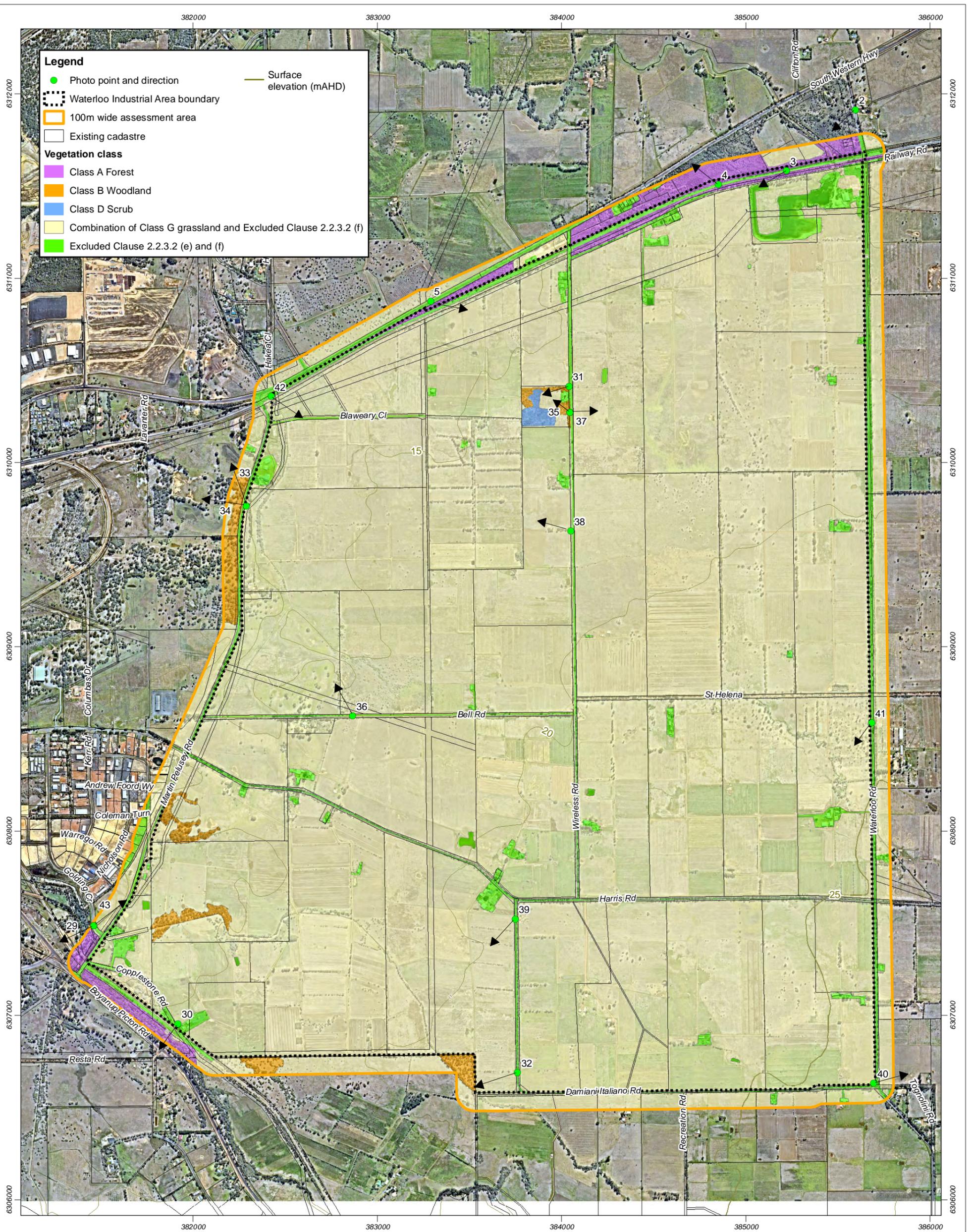


Figure 4: Waterloo: Vegetation class and effective slope

Scale 1:19,000 at A3



Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 27/04/2017

Author: jcrute

Source: Aerial image: Nearmap, flown 03/2017. Existing cadastre and surface elevation: SLIP, Landgate 2017. Layout: Client 04/2017.



Info@strategen.com.au
www.strategen.com.au

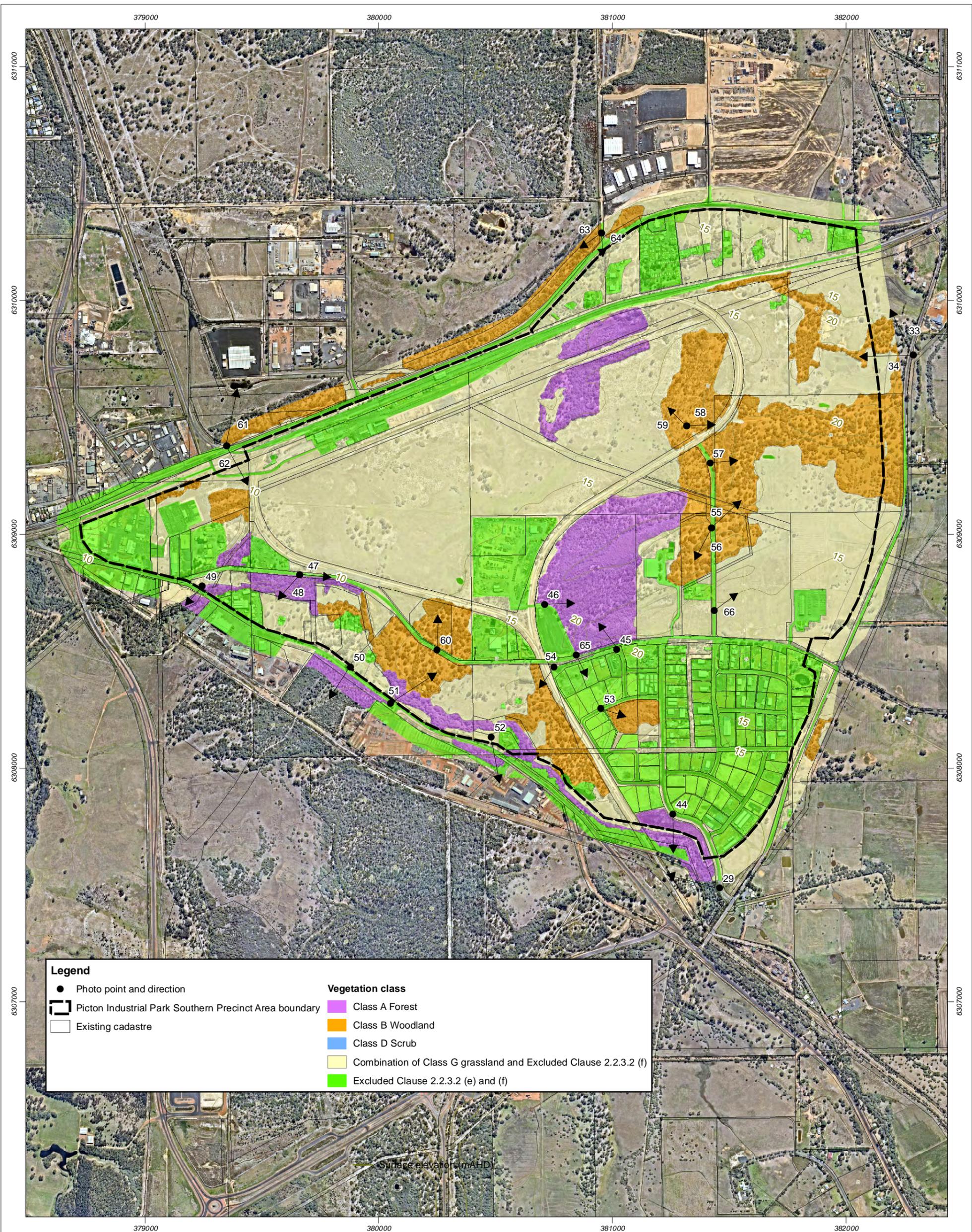
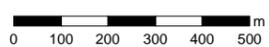


Figure 5: Picton South: Vegetation class and effective slope

Scale 1:15,000 at A3



Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 2/05/2017

Author: jcrute

Source: Aerial image: Nearmap, flown 03/2017. Existing cadastre and surface elevation: SLIP, Landgate 2017. Layout: Client 04/2017.



Info@strategen.com.au
www.strategen.com.au

2.3 Pre-development bushfire hazard level assessment

Bushfire hazard levels have been assessed for development areas in accordance with methodology contained within the Guidelines. Strategen has mapped the bushfire hazard levels within the DSP areas and adjacent 100 m as per the pre-development conditions outlined in Figure 3, Figure 4 and Figure 5.

Wanju

As depicted in Figure 6:

- all Class A forest is identified as an 'Extreme' hazard
- all Class B woodland adjoining areas of Class A forest or consisting of trees with a closed canopy is identified as an 'Extreme' hazard
- Class D scrub is identified as an 'Extreme' hazard
- areas identified as a combination of Class G grassland vegetation and areas excluded under Clause 2.2.3.2 f are identified as a 'Moderate' hazard based on a precautionary approach
- all areas within 100 m of 'Extreme' or 'Moderate' areas are identified as 'Moderate'.

The majority of Wanju DSP is located within a 'Moderate' bushfire hazard area, with small areas of 'Extreme' hazard. Given that proposed residential, commercial and town centre development will result in high density development footprints requiring in clearing of a significant proportion of the on-site vegetation extent, the post development vegetation extent will result in even lower hazard levels than those currently depicted within Figure 6. The post development hazards are discussed further in Section 2.4.

Waterloo

As depicted in Figure 7:

- all Class A forest is identified as an 'Extreme' hazard
- Class B woodland adjoining areas of Class A forest or Class D scrub or consisting of trees with a closed canopy is identified as an 'Extreme' hazard
- Class B woodland consisting of an open woodland with a grassy understorey (no midstorey) is identified as a 'Moderate' hazard
- Class D scrub is identified as an 'Extreme' hazard
- areas identified as a combination of Class G grassland vegetation and areas excluded under Clause 2.2.3.2 f are identified as a 'Moderate' hazard based on a precautionary approach
- all areas within 100 m of 'Extreme' or 'Moderate' areas are identified as 'Moderate'.

The majority of Waterloo DSP is located within a 'Moderate' bushfire hazard area, with small areas of 'Extreme' hazard. Given that proposed industrial development will result in high density development footprints requiring clearing of a significant proportion of the on-site vegetation extent, the post development vegetation extent will result in even lower hazard levels than those currently depicted within Figure 7. The post development hazards are discussed further in Section 2.4.

Picton South

As depicted in Figure 8:

- all Class A forest is identified as an 'Extreme' hazard
- Class B woodland adjoining areas of Class A forest or consisting of trees with a closed canopy is identified as an 'Extreme' hazard
- Class B woodland consisting of an open woodland with a grassy understorey (no midstorey) is identified as a 'Moderate' hazard
- areas identified as a combination of Class G grassland vegetation and areas excluded under Clause 2.2.3.2 f are identified as a 'Moderate' hazard based on a precautionary approach
- all areas within 100 m of 'Extreme' or 'Moderate' areas are identified as 'Moderate'.

The majority of Picton South DSP is located within a 'Moderate' bushfire hazard area, with some areas of 'Extreme' hazard. Given that proposed industrial development will result in high density development footprints requiring clearing of a significant proportion of the on-site vegetation extent, the post development vegetation extent will result in even lower hazard levels than those currently depicted within Figure 8. The post development hazards are discussed further in Section 2.4.

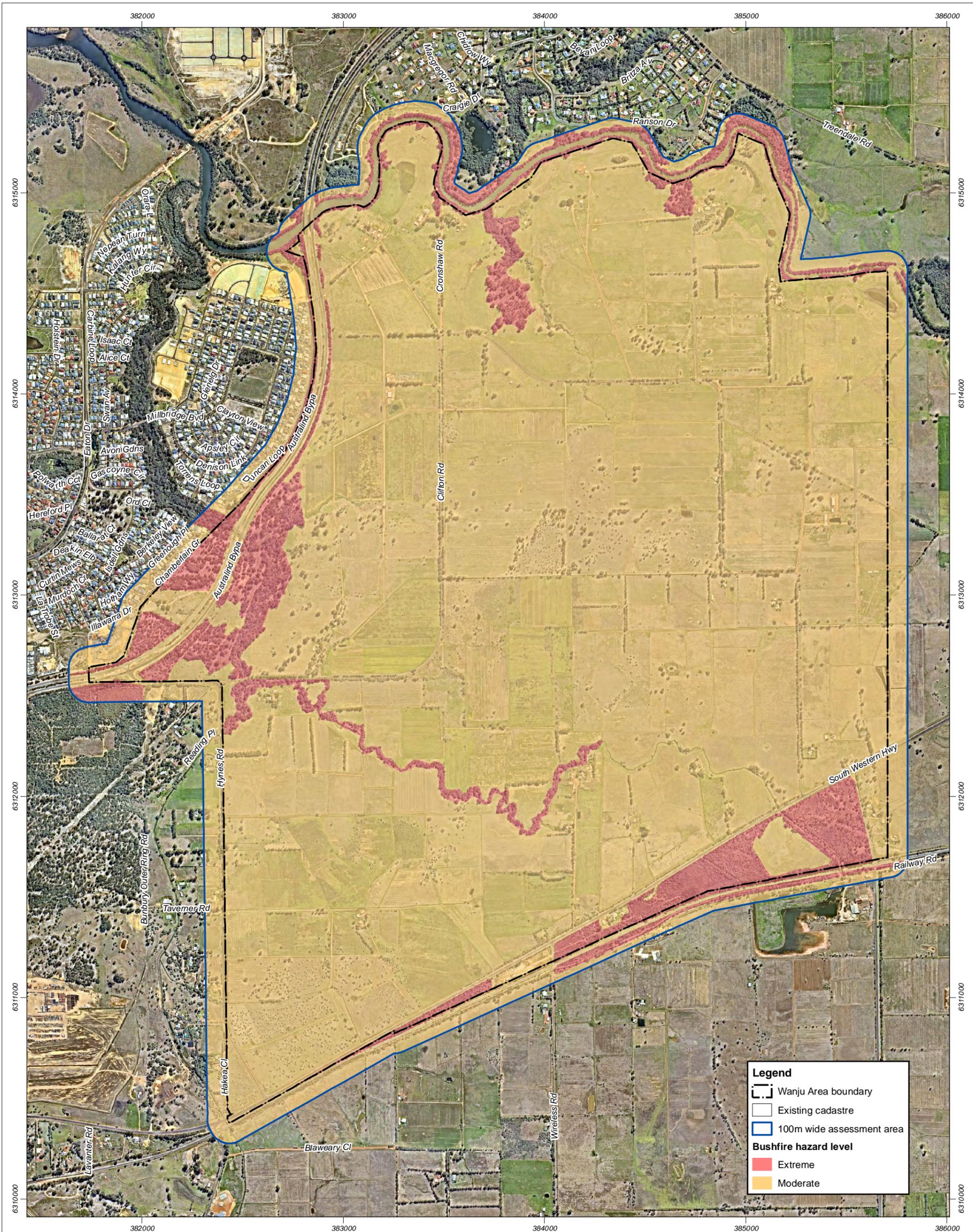


Figure 6: Wanju: Pre-development hazard level assessment

Scale 1:17,441 at A3



Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 28/04/2017

Author: jcrute

Source: Aerial image: Nearmap, flown 03/2017. Existing cadastre and surface elevation: SLIP, Landgate 2017. Layout: Client 04/2017.



Info@strategen.com.au
www.strategen.com.au

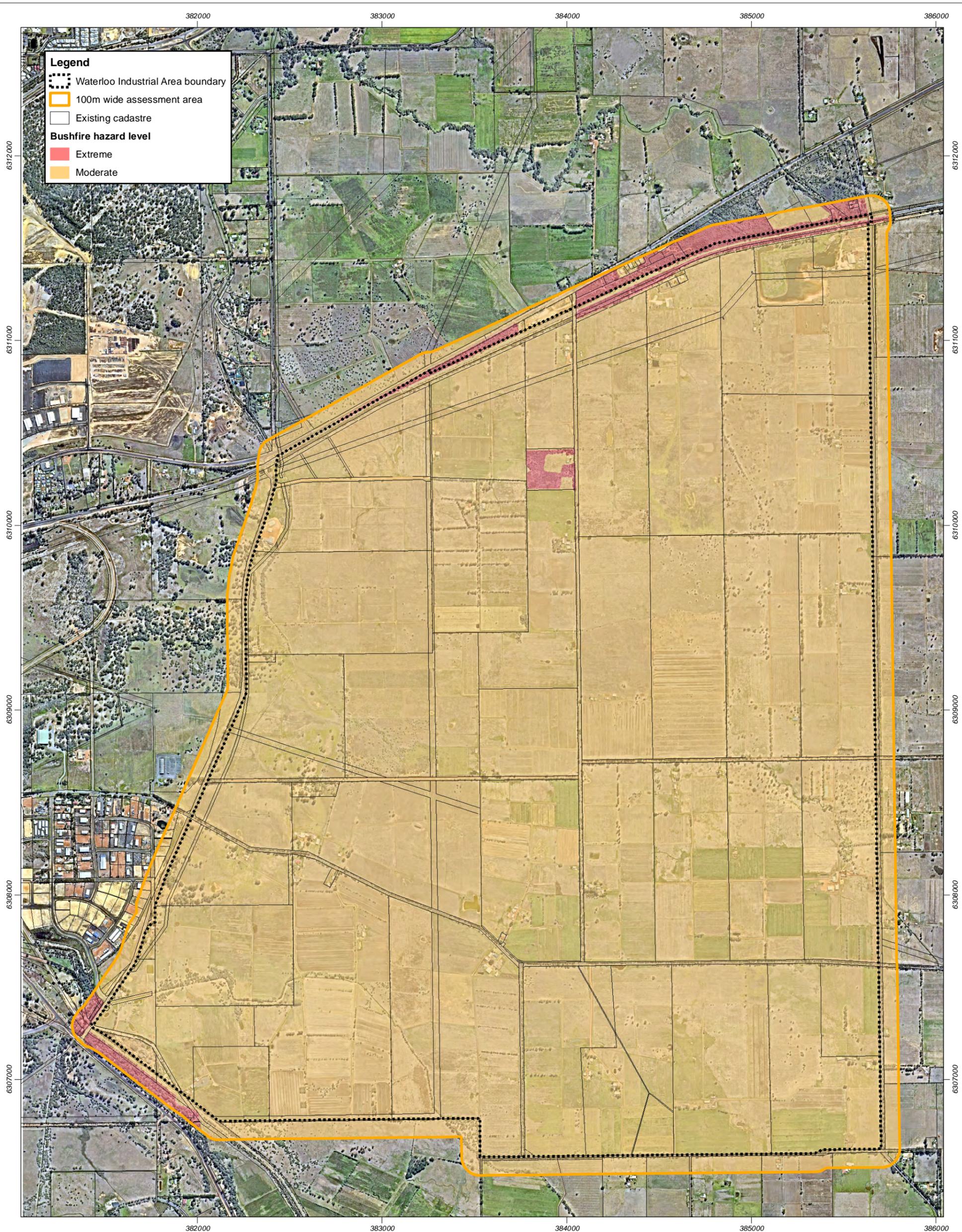


Figure 7: Waterloo: Pre-development bushfire hazard level assessment

Scale 1:19,000 at A3



Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 28/04/2017

Author: jcrute

Source: Aerial image: Nearmap, flown 03/2017. Existing cadastre and surface elevation: SLIP, Landgate 2017. Layout: Client 04/2017.



Info@strategen.com.au
www.strategen.com.au

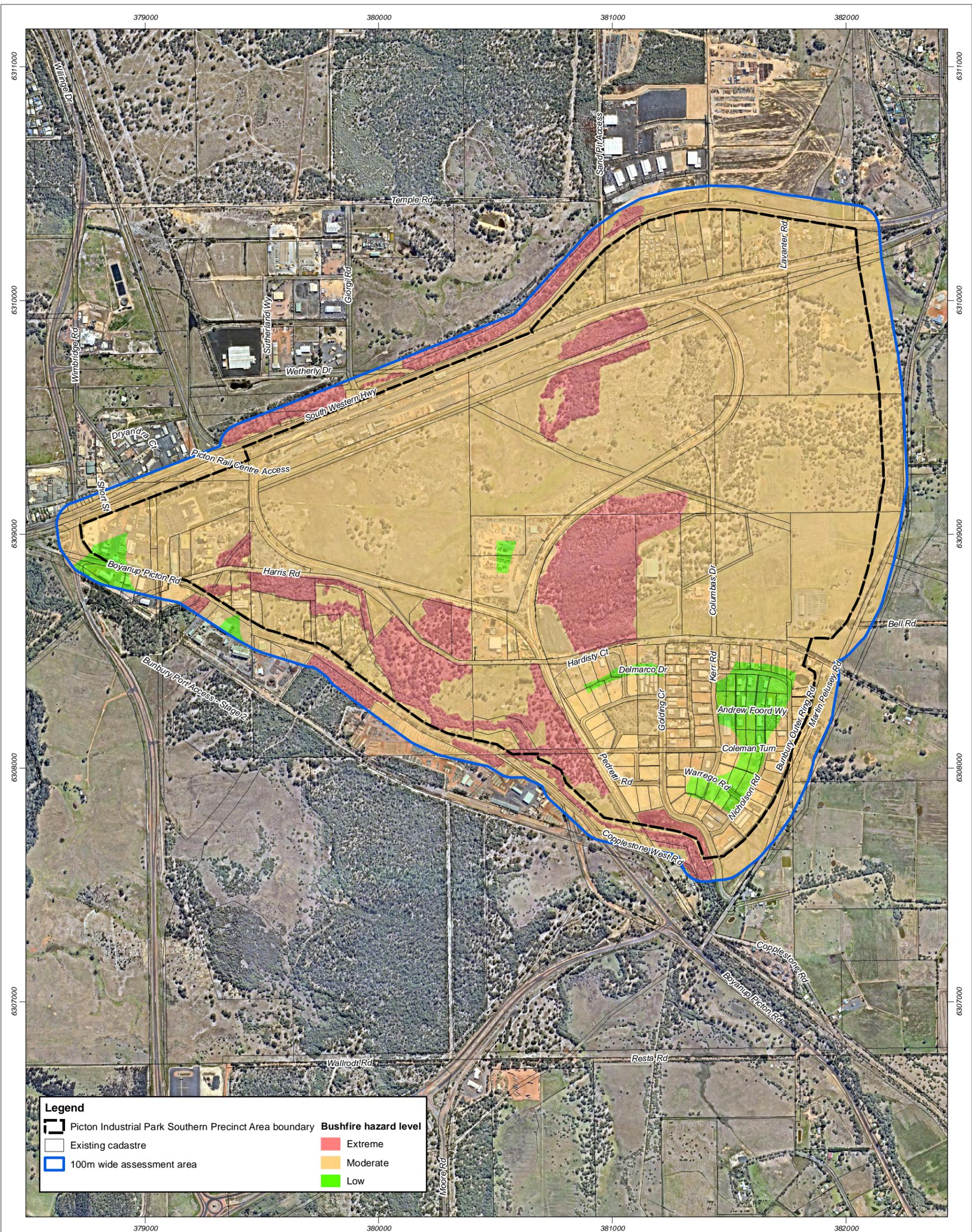


Figure 8: Picton South: Pre-development bushfire hazard level assessment

Scale 1:15,000 at A3



Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 3/05/2017

Author: jcrute

Source: Aerial image: Nearmap, flown 03/2017. Existing cadastre and surface elevation: SLIP, Landgate 2017. Layout: Client 04/2017.



Info@strategen.com.au
www.strategen.com.au

2.4 Post development bushfire hazards

Wanju

The potential post development classified vegetation extent is depicted in Figure 9. The majority of vegetation posing an 'Extreme' hazard will be retained within areas of Public Space. Section 3.1 identifies management measures for any development areas at the interface of this post development vegetation.

Under the proposed DSP the assumption is that current vegetation extent will be cleared within the following areas:

- Primary Road
- Integrator Street
- Railway Station
- Medium and higher density residential
- Public purposes
- Local centre/mixed use
- Town centre.

Revegetation is proposed within areas of Public Space as depicted in Figure 9, including along the Collie River and Millers Creek. Revegetation is also likely to occur within any detention basins and swales for drainage purposes.

It is likely that some of the Collie River and Millers Creek Public Space will be active recreation areas and therefore these areas will not be completely revegetated. As the extent and composition of proposed revegetation has not been identified at this strategic planning stage, Figure 9 identifies all of the Public Space as potential revegetation areas.

Areas of Public Space not identified as containing post development classified vegetation in Figure 9 will consist of active recreation areas that will be subject to ongoing management to achieve a minimal low fuel condition.

Waterloo

The potential post development classified vegetation extent is depicted in Figure 10. A small area of vegetation posing an 'Extreme' hazard will be retained within areas of Public Space. Section 3.1 identifies management measures for any development areas at the interface of this post development vegetation.

Under the proposed DSP the assumption is that current vegetation extent will be cleared within the following areas:

- Primary Road
- Integrator Street
- Railway Station
- Industrial and light industrial
- Public purposes.

Revegetation is likely to occur within any detention basins and swales for drainage purposes.

Picton South

The potential post development classified vegetation extent is depicted in Figure 11. Portions of vegetation posing an 'Extreme' hazard are likely to be retained within areas of Public Space, a 'Rural' area and portion of the existing Railway land. Section 3.1 identifies management measures for any development areas at the interface of this post development vegetation.

Under the proposed DSP the assumption is that current vegetation extent will be cleared within the following areas:

- Primary Road
- Integrator Street
- Access street
- Industrial
- Public purposes.

Revegetation is proposed within areas of Public Space along the Ferguson River, as depicted in Figure 11. Revegetation is also likely to occur within any detention basins and swales for drainage purposes.

2.5 Landscape bushfire hazards

Worst case (adverse) bushfire weather conditions can occur during the summer months in southwest WA when a low pressure trough forms off the west coast and strong winds develop from the north or northeast. These conditions are sometimes associated with 'Extreme' or 'Catastrophic' fire dangers, which are consistent with very high temperatures, low relative humidity and very strong winds. Based on the predominant summer climatic conditions of the local area, 'Extreme' and 'Catastrophic' fire dangers normally occur less than 5% of the time during the designated bushfire season, which equates to around six days between December and March (McCaw & Hanstrum 2003).

Predominant bushfire weather conditions (those that occur 95% of the time during the designated bushfire season) for Picton East generally correlate with average January climatic conditions. The January prevailing summer winds for the area are from the east and southeast in the morning and west in the afternoon (BoM 2017). The predominant bushfire weather conditions correlate with an average Fire Danger Index (FDI) rating of 'High', as determined using the Commonwealth Science and Industrial Research Organisation (CSIRO) Fire Danger and Fire Spread Calculator (CSIRO 1999).

Bushfire runs to the north are limited to an area of bushland within the Picton Industrial Park Northern Precinct north of Picton South DSP. However, a potential bushfire run from the north will be broken up and moderated by areas of cleared rural land and South Western Highway to the north of the DSP area.

There are no long bushfire runs through dense vegetation or steep terrain to the east of any of the DSP areas.

Long bushfire runs through dense vegetation to the southeast are limited to an area of bushland within Regional Open Space south of Picton South DSP.

Bushfire runs to the west are limited to an area of bushland within the Picton Industrial Park Northern Precinct west of the southern portion of Wanju DSP. However, a potential bushfire run from the west will be broken up and moderated by areas of cleared rural land to the west of the DSP area and a Primary distributor road and managed playing fields within Public Space within the DSP area.

Strategen therefore considers a fire front approaching Picton South DSP area from the southeast to be the worst case bushfire scenarios due to the presence of long bushfire runs in this direction consisting of forest and woodland vegetation within Regional Open Space, which will remain post development of the site.

The bushfire risk or fire run within the DSP areas post development is limited to areas of Public Space and can be managed in accordance with measures identified in this report and BMPs to be prepared at future stages and therefore will be limited. Vegetation clearing throughout project staging will play an important role in managing the bushfire risk posed by on-site temporary vegetation during roll out of individual development stages.

A pre-development bushfire hazard level assessment identifies the majority of the DSP areas as having a Moderate bushfire hazard level, reflecting that the majority of native vegetation has been cleared from the area and confirming that development can avoid areas of Extreme bushfire hazard level. Section 3 of this report identifies a number of measures for managing bushfire risks at the direct development area-vegetation interface.

There are also emergency service resources in the City of Bunbury and Shire of Dardanup that could provide a prompt bushfire suppression response to the project area within 30 minutes, including bushfire brigades at Bunbury, Waterloo and Burekup and fire and rescue services at Bunbury and Eaton.

Strategen considers that bushfire risks to proposed development posed by post development hazards can be managed through standard application of acceptable solutions under the Guidelines, including provision for and implementation of Asset Protection Zones (APZs), relevant bushfire construction standards, provision of adequate emergency water supply and vehicular access, as well as through a direct bushfire suppression response if required.

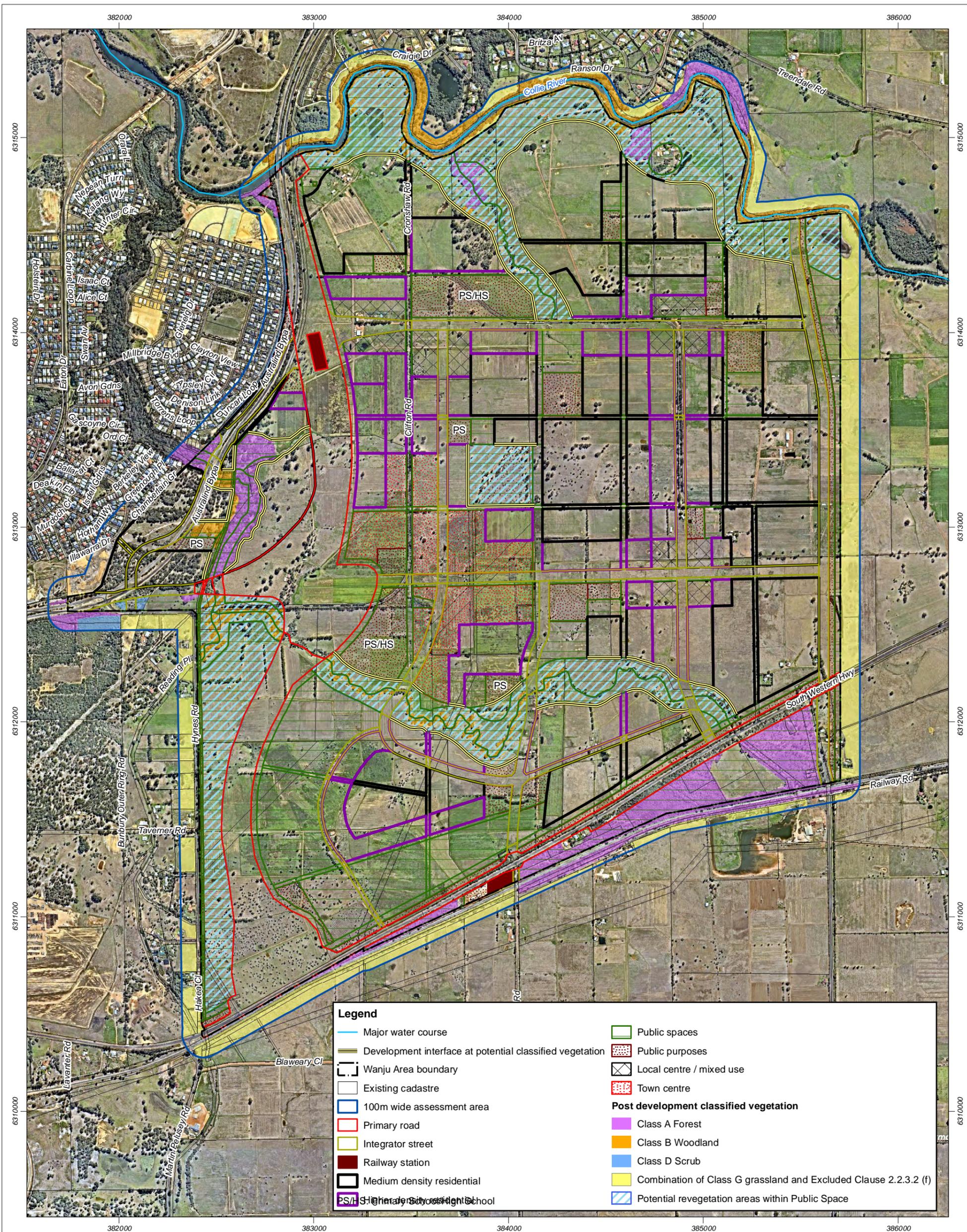


Figure 9: Wanju: Post development bushfire hazards

Scale 1:18,000 at A3



Coordinate System: GDA 1994 MGA Zone 50
 Note that positional errors may occur in some areas
 Date: 3/05/2017
 Author: jrcrute

Source: Aerial image: Nearmap, flown 03/2017. Existing cadastre and surface elevation: SLIP, Landgate 2017. Layout: Client 04/2017.



info@strategen.com.au
 www.strategen.com.au

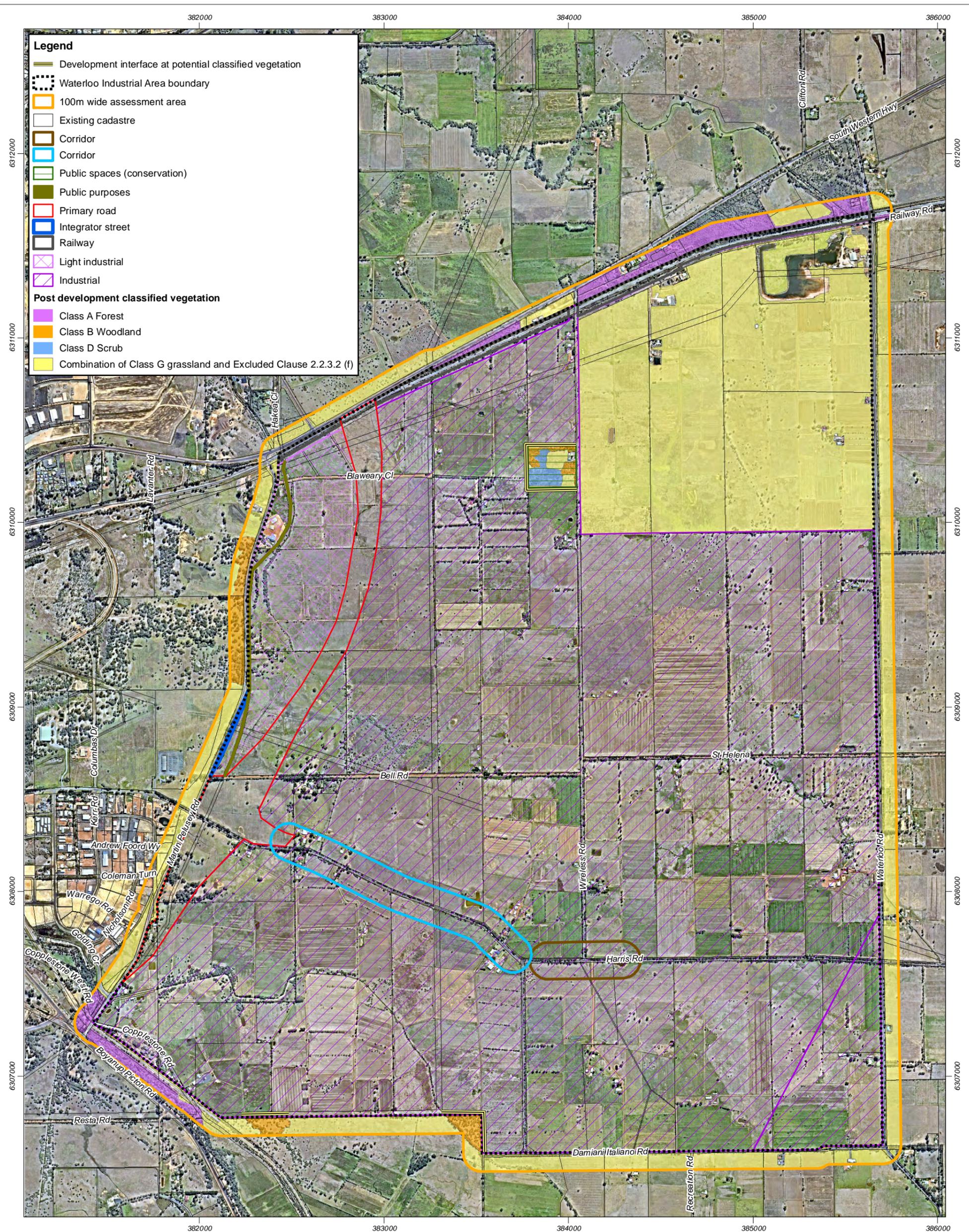


Figure 10: Waterloo: Post development bushfire hazards

Scale 1:19,000 at A3



Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 3/05/2017

Author: jcrute

Source: Aerial image: Nearmap, flown 03/2017. Existing cadastre and surface elevation: SLIP, Landgate 2017. Layout: Client 04/2017.



info@strategen.com.au
www.strategen.com.au

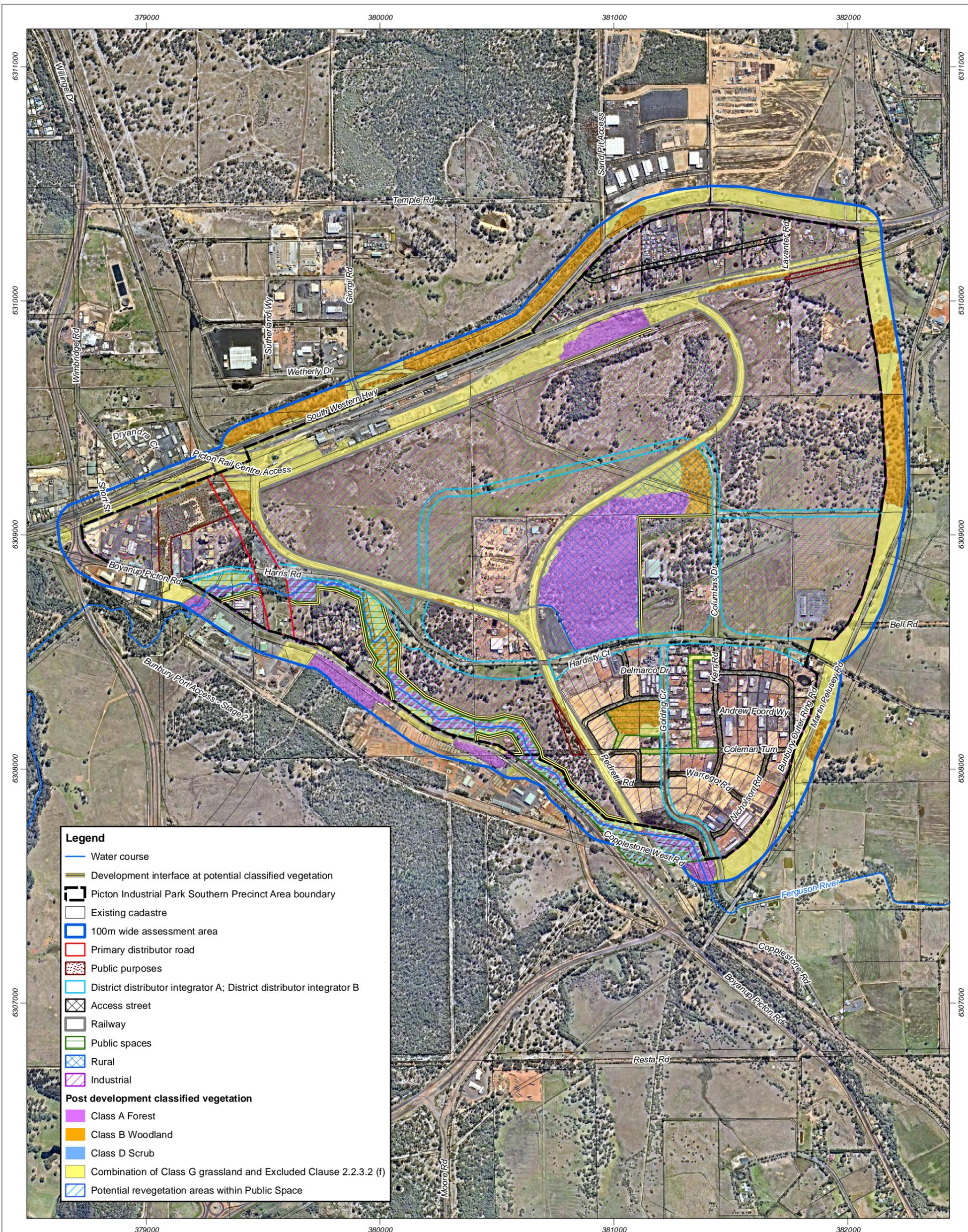


Figure 11: Picton South: Post development bushfire hazards

Scale 1:15,000 at A3



Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 3/05/2017

Author: jrcrute

Source: Aerial image: Nearmap, flown 03/2017. Existing cadastre and surface elevation: SLIP, Landgate 2017. Layout: Client 04/2017.



info@strategen.com.au
www.strategen.com.au

3. Opportunities and constraints

Strategen has assessed opportunities and constraints within the DSP areas against bushfire planning requirements of the Guidelines and identified bushfire management measures for incorporation into future planning design to ensure the DSP areas achieve compliance with the Guidelines. It should be noted that these measures are being provided at the strategic level in the absence of detailed subdivision or development plans and that a Bushfire Management Plan will need to be prepared to align with future planning stages on provision of greater levels of detail.

3.1 Location and Siting

A BAL contour assessment will need to be undertaken at future planning stages (i.e. to accompany each stage of subdivision application) and BMPs prepared to reflect the outcomes of the assessment, including requirements that any proposed development consisting of habitable buildings located within 100 m of classified post development vegetation may require application of AS 3959 and increased building construction standards in response to assessed BAL.

All future habitable development within the DSP areas will need to meet minimum separation distances (APZs) from post development classified vegetation necessary for a BAL-29 or lower rating (Table 1).

Table 1: Minimum hazard separation distances based on effective slope

Classified vegetation	Effective slope	Minimum hazard separation distance (APZ)	Corresponding separation distance range from Table 2.4.3 of AS 3959	Corresponding maximum BAL rating
Class A forest	Up-slope and flat	21 m	21-<31 m	29
Class B woodland	Up-slope and flat	14 m	14-<20 m	29
Class C shrubland	Up-slope and flat	9 m	9-<13 m	29
Class D scrub	Up-slope and flat	13 m	13-<19 m	29
Class G Grassland	Up-slope and flat	8 m	8-<12 m	29

Wanju

Figure 9 identifies a number of residential, public purposes and town centre development areas that have a direct interface with areas of potential post development classified vegetation. The majority of these development areas are at the potential revegetation interface within Public Space including the Collie River and Millers Creek. At this strategic planning stage the extent and composition of proposed revegetation has not been identified and it is likely that some of the Collie River and Millers Creek Public Spaces will be active recreation areas and therefore will not be revegetated.

It is recommended that revegetation plans at the Public Space-habitable development interfaces provide for a managed active recreation area that achieves an ongoing low fuel separation to achieve minimum separation distances identified in Table 1. If there are any areas of proposed revegetation where this is not achievable, it is recommended public roads be located at the vegetation and development interface to provide a low fuel separation between revegetation areas and habitable development to achieve minimum separation distances identified in Table 1.

Figure 9 also identifies where the development-vegetation interfaces are at proposed primary or high school sites. Given that schools are considered to be a vulnerable land use, it is recommended that the school development areas be designed to have capacity to achieve internal building setbacks from adjacent classified vegetation in addition to the low fuel Public Space and/or public road separation distances recommended above.

The proposed medium density residential development areas near the western boundary of the DSP also adjoin existing areas of Class A forest and Class B forest within proposed Public Space. Based on the assumption that the existing vegetation extent will be retained with the subject Public Space (see Figure 9), perimeter public roads are recommended at the development-vegetation interface to ensure that minimum separation distances for a BAL-29 can be achieved (see Table 1).

Waterloo

Figure 10 identifies a small portion of industrial development areas that have a direct interface with areas of potential post development classified vegetation, including the threatened ecological community to be retained at Lot 310 Wireless Road.

The proposed industrial development areas are large enough to ensure that lots adjacent to these areas can be designed to accommodate building setbacks to achieve minimum setbacks identified in Table 1. If this is not achievable, perimeter public roads are recommended at the development-vegetation interface to ensure that minimum separation distances for a BAL-29 can be achieved.

The presence or location of any potential high risk land uses^[1] is not known at this strategic planning stage, however it is recommended that high risk land uses be avoided within future lots that have a direct interface with areas of post development classified vegetation.

Picton South

Figure 11 identifies a number of industrial development areas that have a direct interface with areas of potential post development classified vegetation. This includes the Ferguson River Public Space to the south and a central area remaining as 'Rural' under the DSP.

Given that the existing vegetation extent within the 'Rural' area has been identified by the EPA (2008) as warranting reservation, the existing vegetation extent is likely to remain. It is therefore recommended that a public road be located at this vegetation-development area interface to ensure that minimum separation distances for a BAL-29 can be achieved (see Table 1).

The proposed Ferguson River Public Space is unlikely to include managed active recreation areas, given that surrounding land use will be industrial and the limited width of the Public Space. On this basis perimeter public roads are recommended at the development-vegetation interface to ensure that minimum separation distances for a BAL-29 can be achieved.

The presence or location of any potential high risk land uses is not known at this strategic planning stage, however it is recommended that high risk land uses be avoided within future lots that have a direct interface with areas of post development classified vegetation.

The EPA's 2008 advice also recommended some areas of existing vegetation, north of the 'Rural' area and west of the rail reserve, be retained as part of future planning proposals. Under the DSP these areas are currently identified for industrial development and therefore assumed to be cleared. Should these areas of vegetation be identified at later planning stages for retention, minimum separation distances from habitable buildings will need to be accommodated either via lots that are large enough to accommodate building setbacks or perimeter public roads.

Retention basins and drainage swales

Revegetation to achieve drainage outcomes is not considered to be consistent with a low bushfire fuel condition. Therefore where revegetation is proposed within detention basins or swales it is recommended the following be adopted at future planning stages to ensure that these areas do not introduce a non-compliant bushfire risk to adjacent habitable development:

^[1] High risk land uses may include, but are not limited to: service stations, landfill sites, bulk storage of hazardous materials, fuel depots and certain heavy industries as well as military bases, power generating land uses, saw-mills, highways and railways, among other uses meeting the definition.

- revegetation areas are designed to meet one of the following exclusion clauses under AS 3959:
 - * revegetation areas are less than 0.25 ha and not within 20 m of other classified vegetation or habitable development
 - * revegetation areas are less than 20 m wide and not within 20 m of other classified vegetation or habitable development
 - * revegetation areas are less than 1 ha in size and not within 100 m of other classified vegetation

OR

- revegetation areas are separated from habitable development via a permanent low fuel area such as a road or managed Public Space, to meet minimum separation distances identified in Table 1.

3.2 Vehicle access

If proposed development within the DSP areas is to be staged, vehicular access arrangements in the short, medium and long term duration of development will need to ensure that all occupiers and visitors are provided with at least two vehicular access routes at all times.

Wanju

The DSP area is currently surrounded by South Western Highway to the south and Hynes Road and Australind Bypass to the west.

Proposed Primary Roads and Integrator Streets as identified on the DSP (Figure 1) will ensure that the DSP area will have access and egress to at least two different destinations, including east and west via South Western Highway to the south, north and south via Forrest Highway/Australind Bypass to the west and north and south via a new Integrator Street to the east (connecting to Raymond Road in the north and South Western Highway in the south).

The proposed internal local vehicular access network cannot be identified at this strategic planning stage, due to proposed development lot layout being unknown. The local vehicular access network within development areas, to be identified at subsequent planning stages, will be required to link to the adjacent strategic road network and provide occupiers with at least two vehicular access routes, including during development staging.

Section 3.1 of this report includes a number of recommendations in relation to the location of the local access network at the potential post development vegetation-development area interface.

Waterloo

The DSP area is currently surrounded by South Western Highway to the north, Waterloo Road to the east, Martin Pelusey Road to the west and Boyanup-Picton Road to the southwest.

Proposed Primary Roads and Integrator Street as identified on the DSP (Figure 1) will ensure that the DSP area will have access and egress to at least two different destinations, including east and west via South Western Highway to the north, north and south via Bunbury Outer Ring Road to the west and north and south via Waterloo Road to the east (connecting to South Western Highway in the north and Ferguson Road in the south).

The proposed internal local vehicular access network cannot be identified at this strategic planning stage, due to proposed development lot layout being unknown. The local vehicular access network within development areas, to be identified at subsequent planning stages, will be required to link to the adjacent strategic road network and provide occupiers with at least two vehicular access routes, including during development staging.

Section 3.1 of this report includes a number of recommendations in relation to the location of the local access network at the potential post development vegetation-development area interface.

Picton South

The DSP area is currently surrounded by South Western Highway to the north, Martin Pelusey Road to the east and Boyanup Picton Road to the south and west.

Proposed Primary Roads and Integrator Street as identified on the DSP (Figure 1) will ensure that the DSP area will have access and egress to at least two different destinations, including north and south via Boyanup Picton Road to the south, east via Harris Road to the east and north and south via Martin Pelusey Road and Bunbury Outer Ring Road to the east.

The proposed internal local vehicular access network cannot be identified at this strategic planning stage, due to proposed development lot layout being unknown. The local vehicular access network within development areas, to be identified at subsequent planning stages, will be required to link to the adjacent strategic road network and provide occupiers with at least two vehicular access routes, including during development staging.

Section 3.1 of this report includes a number of recommendations in relation to the location of the local access network at the potential post development vegetation-development area interface.

3.3 Water supply

As reticulated water supply will be available to all DSP areas, the reticulated system will ensure an all year round supply of water is provided for all development areas to meet minimum domestic and emergency water supply requirements.

At development stage a network of hydrants will need to be identified and provided along the internal road network at locations which meet relevant water supply authority and DFES requirements, in particular the Water Corporation Design Standard DS 63 'Water Reticulation Standard Design and Construction Requirements for Water Reticulation Systems up to DN250'. This standard will guide construction of the internal reticulated water supply system and fire hydrant network, including spacing and positioning of fire hydrants so that the maximum distance between a hydrant and the rear of a building envelope (or in the absence of a building envelope, the rear of the lot) shall be 120 m and the hydrants shall be no more than 200 m apart.

3.4 Environmental considerations

The key environmental assets within the DSP areas are outlined in Section 2.1.2.

Environmental values identified within the DSP areas are being retained and enhanced within proposed Public Space. Where development areas have a direct interface with these areas of Public Space, Section 3.1 of this report identifies management measures such as public roads and setbacks to ensure that environmental values being retained or enhanced will not need to be subject to clearing for bushfire management.

Future planning stages will require specific environmental management plans be developed in association with future subdivision and/or development applications to ensure optimal environmental management outcomes are achieved and maintained.

The presence of and potential impacts on environmental assets will also be considered as part of standard referral requirements at the relevant planning and development stages under the *Environment Protection and Biodiversity Conservation Act 1999* and *Environmental Protection Act 1986*.

4. Summary and recommendations

The pre-development bushfire hazard level assessment identifies (see Section 2.3):

- Wanju DSP is located within a Moderate' bushfire hazard area, with some small areas of 'Extreme' hazard
- Waterloo DSP is located within a Moderate' bushfire hazard area, with some small areas of 'Extreme' hazard
- Picton South DSP is located within a Moderate' and 'Extreme' bushfire hazard area.

The assessment of post development bushfire hazards identifies (see Section 2.4):

- Wanju DSP area will retain areas of 'Extreme' bushfire hazard within some areas of Public Space, including areas subject to revegetation. An opportunities and constraints assessment has identified development areas adjacent to these areas of 'Extreme' hazard and mechanisms for ensuring that development is sited and designed to manage bushfire risks.
- Waterloo DSP will retain a small area of 'Extreme' hazard within an area of Public Space to the north (Lot 310 Wireless Road). An opportunities and constraints assessment has identified development areas adjacent to this area of 'Extreme' hazard and mechanisms for ensuring that development is sited and designed to manage bushfire risks.
- Picton South DSP will retain areas of 'Extreme' bushfire hazard within the Ferguson River Public Space, including areas subject to revegetation, and existing vegetation to be retained within a central 'Rural' area. An opportunities and constraints assessment has identified development areas adjacent to these areas of 'Extreme' hazard and mechanisms for ensuring that development is sited and designed to manage bushfire risks.

Proposed post development bushfire hazards can be managed subject to implementation of the following recommendations identified in this report, ensuring that all development will be limited to areas of 'Low' or 'Moderate' bushfire hazard:

- Wanju
 - * implementation of managed active recreation areas within Public Space-habitable development interface and/or perimeter roads as outlined in Section 3.1
 - * school development areas be designed to have capacity to achieve additional internal building setbacks from adjacent classified vegetation as outlined in Section 3.1
 - * implementation of perimeter roads at the interface of medium density residential development areas and classified vegetation within Public Space near the western boundary of the DSP as outlined in Section 3.1
- Waterloo
 - * lots at development-vegetation interface to be designed to have capacity for building setbacks to achieve minimum separation distances as outlined in Section 3.1
 - * high risk land uses to be avoided within future lots that have a direct interface with areas of post development classified vegetation as outlined in Section 3.1
- Picton South
 - * implementation of perimeter roads at the development interface with existing vegetation being retained within the central 'Rural' area identified on the DSP as outlined in Section 3.1
 - * implementation of perimeter roads at the development interface with the Ferguson River Public Space as outlined in Section 3.1
 - * high risk land uses be avoided within future lots that have a direct interface with areas of post development classified vegetation as outlined in Section 3.1
- detention basins and drainage swales
 - * revegetation be designed to ensure that no additional non-compliant bushfire risk is introduced as outlined in Section 3.1

- vehicle access
 - * implementation of access arrangements in the short, medium and long term duration of development will need to ensure that all occupiers and visitors are provided with at least two vehicular access routes at all times as outlined in Section 3.2
- water supply
 - * implementation of reticulated water supply as outlined in Section 3.3.

5. References

- Bureau of Meteorology (BoM) 2017, *Climate statistics for Australian locations: Monthly climate statistics for Bunbury*, [Online], Commonwealth of Australia, available from:
http://www.bom.gov.au/climate/averages/tables/cw_009965.shtml, [02/05/2017].
- Commonwealth Science and Industrial Research Organisation (CSIRO) 1999, *Fire Danger and Fire Spread Calculator*, Commonwealth Science and Industrial Research Organisation, Perth.
- Department of Fire and Emergency Services (DFES) 2017, *Map of Bush Fire Prone Areas*, [Online], Government of Western Australia, available from:
<http://www.dfes.wa.gov.au/regulationandcompliance/bushfireproneareas/Pages/default.aspx>, [02/05/2017].
- Department of Planning (DoP) 2016, *Visual guide for bushfire risk assessment in Western Australia*, Department of Planning, Perth, WA.
- Environmental Protection Authority (EPA) 2008, *Advice on areas of conservation significance in the Preston Industrial Park*, Advice of the Environmental Protection Authority to the Minister for the Environment under Section 16(e) of the Environmental Protection Act 1986, EPA, Perth.
- GHD Pty Ltd (GHD) 2015, *Waterloo Urban and Industrial Expansion Flora and Fauna Survey*, GHD.
- McCaw L and Hanstrum B 2003, 'Fire environment of Mediterranean south-west Western Australia', in *Fire in Ecosystems of South-West Western Australia: Impacts and Management*, eds I Abbott & ND Burrows, Backhuys Publishers, Leiden, Netherlands, pp. 171–188.
- Standards Australia (SA) 2009, *Australian Standard AS 3959–2009 Construction of Buildings in Bushfire-prone Areas*, Standards Australia, Sydney.
- Western Australian Planning Commission (WAPC) 2015, *State Planning Policy 3.7 Planning in Bushfire-Prone Areas*, Western Australian Planning Commission, Perth.
- Western Australian Planning Commission (WAPC) 2017, *Guidelines for Planning in Bushfire-Prone Areas*, Western Australian Planning Commission, Perth

Appendix 1
Site photographs

WANJU



Photo 1: Class A forest to the southeast



Photo 2: Class A forest to the southeast



Photo 3: Class A forest to the southeast



Photo 4: Class A forest to the southeast

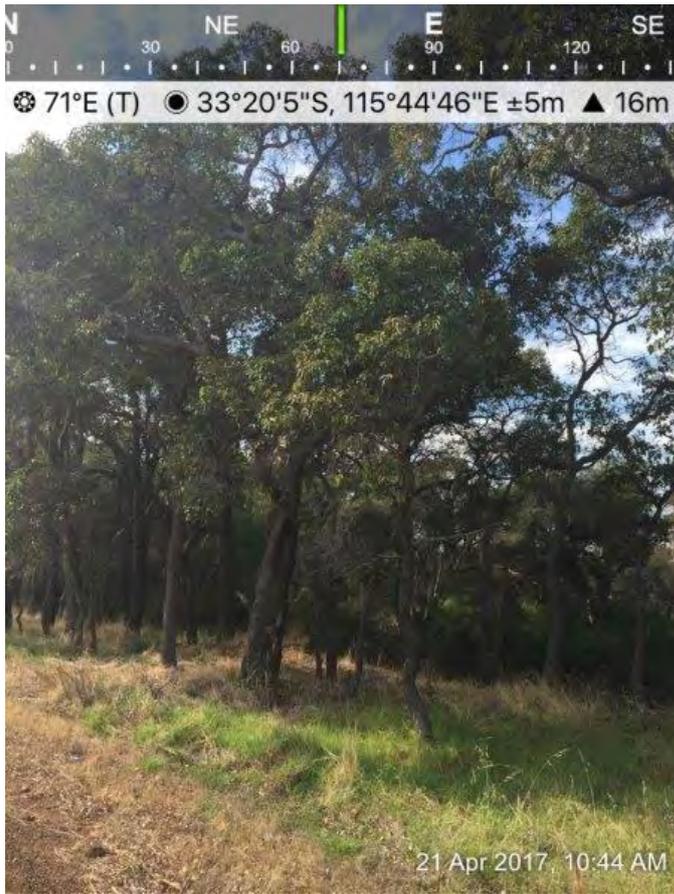


Photo 5: Class A forest to the south



Photo 6: Class A forest to the west



Photo 7: Class A forest to the west



Photo 8: Class A forest (in background) to the west



Photo 9: Class B woodland to the west



Photo 10: Class B woodland to the west



Photo 11: Class B woodland to the west



Photo 12: Class B woodland



Photo 13: Class B woodland to the west



Photo 14: Class B woodland to the west



Photo 15: Class B woodland to the north



Photo 16: Class B woodland to the north



Photo 17: Class D scrub to the west

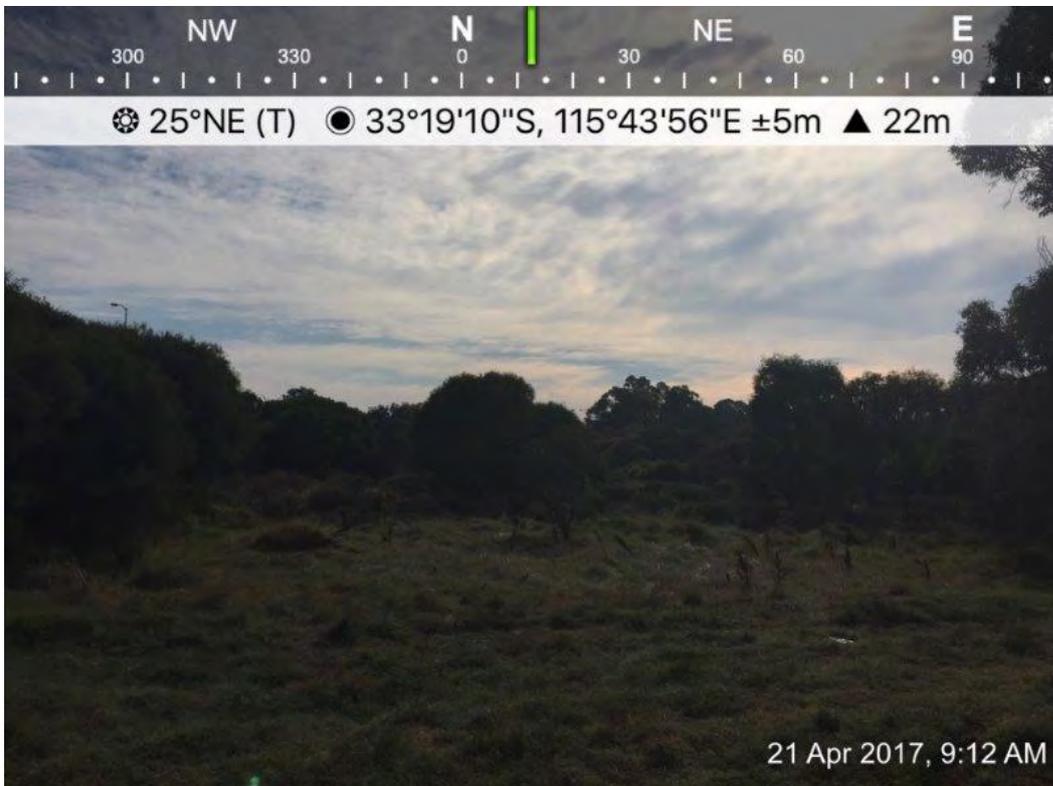


Photo 18: Class D scrub to the west

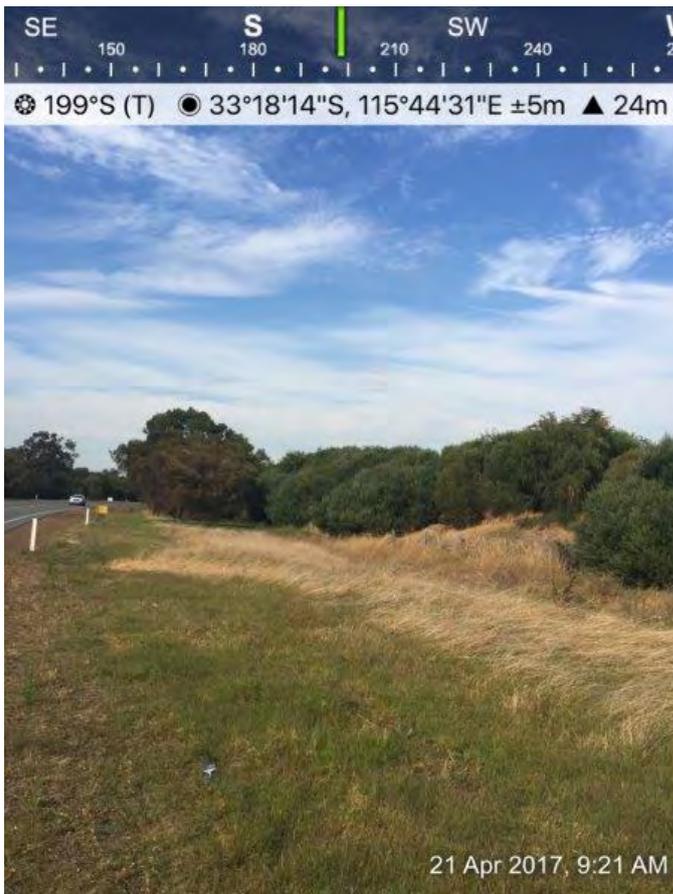


Photo 19: Class D scrub to the northwest



Photo 20: Class G grassland



Photo 21: Class G grassland



Photo 22: Class G grassland



Photo 23: Grazed and managed rural areas (Excluded Clause 2.2.3.2 f)



Photo 24: Grazed and managed rural areas (Excluded Clause 2.2.3.2 f)



Photo 25: Grazed and managed rural areas (Excluded Clause 2.2.3.2 f)



Photo 26: Grazed and managed rural areas (Excluded Clause 2.2.3.2 f)



Photo 27: Grazed and managed rural areas (Excluded Clause 2.2.3.2 f)



Photo 28: Grazed and managed rural areas (Excluded Clause 2.2.3.2 f)

WATERLOO



Photo 29: Class A forest to the southwest



Photo 30: Class A forest to the southwest



Photo 31: Class B woodland to the north



Photo 32: Class B woodland (in background) to the south



Photo 33: Class B woodland to the west



Photo 34: Class B woodland to the west



Photo 35: Class D scrub (in background) and Glass G grassland (in foreground) to the north



Photo 36: Class G grassland



Photo 37: Class G grassland



Photo 38: Grazed and managed rural areas (Excluded Clause 2.2.3.2 f)



Photo 39: Grazed and managed rural areas (Excluded Clause 2.2.3.2 f)



Photo 40: Grazed and managed rural areas (Excluded Clause 2.2.3.2 f)



Photo 41: Grazed and managed rural areas (Excluded Clause 2.2.3.2 f)



Photo 42: Grazed and managed rural areas (Excluded Clause 2.2.3.2 f)



Photo 43: Grazed and managed rural areas (Excluded Clause 2.2.3.2 f)

PICTON SOUTH



Photo 44: Class A forest to the southeast



Photo 45: Class A forest

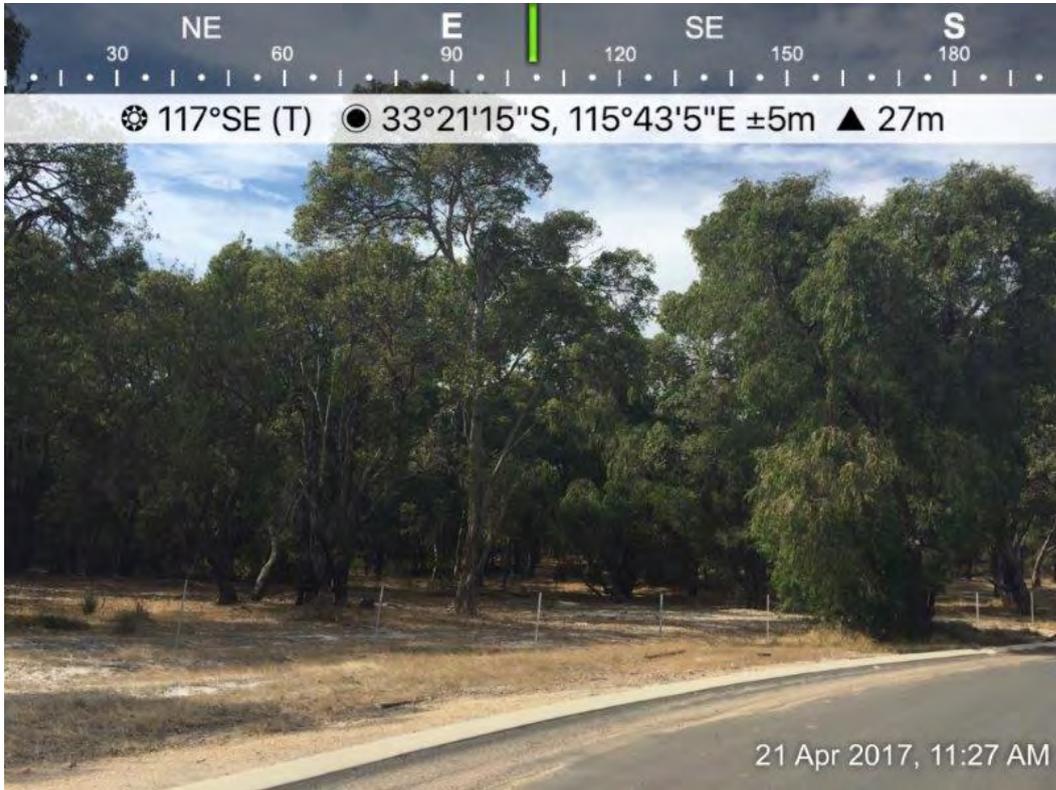


Photo 46: Class A forest



Photo 47: Class A forest to the west



Photo 48: Class A forest to the west



Photo 49: Class A forest to the west



Photo 50: Class A forest to the south



Photo 51: Class A forest to the south



Photo 52: Class A forest to the south



Photo 53: Class B woodland within existing POS



Photo 54: Class B woodland to the south



Photo 55: Class B woodland to the east



Photo 56: Class B woodland to the east



Photo 57: Class B woodland to the east



Photo 58: Class B woodland to the northeast



Photo 59: Class B woodland to the northeast



Photo 60: Class B woodland to the south



Photo 61: Class B woodland north of South Western Highway



Photo 62: Class B woodland (in background) to the west



Photo 63: Class B woodland north of South Western Highway



Photo 64: Class B woodland south of South Western Highway



Photo 65: Cleared areas (Excluded Clause 2.2.3.2 e and f)



Photo 66: Grazed and managed rural areas (Excluded Clause 2.2.3.2 f)