

Date: 4 December 2020

Our ref: 20PER-16887

Parcel Property
Level 3, 14 Walters Dr,
Osborne Park,
WA, 6017

Bushfire Attack Level (BAL) Assessment Report for Brightwood Estate, Baldivis

Site Details

Address: Brightwood Estate, Baldivis

Stage 6 – Lots 512, 513, 514, 515, 533, 534, 535

Suburb: Baldivis **State:** Western Australia

Local Government Area: City of Rockingham

Description of building works: Residential Development

Report details

Report/Job number:	16887	Report version:	v1
Assessment date:	5 August 2020	Report date:	4 December 2020
Author:	James Leonard and Daniel Panickar	Review:	Daniel Panickar (BPAD Level 3 – 37802)



SITE ASSESSMENT AND SITE PLAN

The assessment of the seven subject lots was undertaken on 5 August 2020 for the purpose of determining the Bushfire Attack Level (BAL) in accordance with *Australian Standard AS 3959-2018 Construction of Buildings in Bushfire Prone Areas (SA 2018) Detailed Method (Method 2)*. An overview of the site is presented in Figure 1.

The software tool 'NBC Bushfire Attack Assessor v4.1' (Couch n.d.) was used to undertake the Method 2 assessment and calculate the appropriate BAL rating for each of the subject lots. The process undertaken for this Method 2 assessment is detailed below.

RELEVANT FIRE DANGER INDEX

Step 1 of the Method 2 assessment process requires a determination of the Fire Danger Index (FDI) for the site.

A blanket rating of FDI 80 is adopted for Western Australia, as outlined in Australian Standard (AS) 3959–2018 and endorsed by Australasian Fire and Emergency Service Authorities Council (AFAC).

VEGETATION CLASSIFICATION AND EFFECTIVE SLOPE UNDER CLASSIFIED VEGETATION


Steps 2 and 3 of the Method 2 assessment (classification of vegetation and assessment of slope under classified vegetation) have been combined for ease of display below.

All vegetation within 100 m of the seven subject lots was classified in accordance with Clause 2.2.3 of AS 3959-2018. Each distinguishable vegetation class with the potential to determine the BAL is identified below and presented in Table 1 and Figure 1.

Slope under classified vegetation within the 100 m assessment area was assessed in accordance with Clause 2.2.5 of AS 3959-2018. The effective slope under vegetation associated with each vegetation plot is presented in Table 1 and Figure 1.

Note: It is currently assumed that areas of landscaped vegetation within the site and assessment area will be managed and maintained by Parcel Property (the developer) until replaced by residential dwellings and associated infrastructure or handed over to the City of Rockingham in the future.

Table 1: Vegetation class and effective slope

Plot	Classification or Exclusion Clause	Class B woodland
1	<p>Photo Point 1</p> <p>Classified vegetation within this plot is comprised of trees between 10 to 30 m tall with approximately 20 to 30% foliage cover. There is limited surface litter. Some grass and shrubs are present at the base of the trees.</p> <p>Slope under the vegetation has been assessed as upslope/ flat land.</p>	

Plot 2 Classification or Exclusion Clause Class B woodland

Photo Point 2

Classified vegetation within this plot is comprised of trees between 10 to 30 m tall with approximately 20 to 30% foliage cover. There is limited surface litter. Some grass and shrubs are present at the base of the trees. Slope under the vegetation has been assessed as 6° downslope.



Plot 3 Classification or Exclusion Clause Class G grassland

Photo Point 3

Classified vegetation within this plot is predominantly grassland with foliage cover from the over storey less than 10%. Slope under the vegetation has been assessed as 3° downslope.



Plot 4 Classification or Exclusion Clause Excluded under clause 2.2.3.2 (e) and (f)

Photo Point 4

This plot has been excluded under Clause 2.2.3.2 (e) & (f) of AS 3959-2018. This area has been cleared for construction within Brightwood Estate.



SLOPE BETWEEN SITE AND CLASSIFIED VEGETATION

Step 4 of the Method 2 assessment process requires the slope between the site and classified vegetation to be determined.

The slope between the site and all vegetation plots as assessed as flat.

DISTANCE BETWEEN SITE AND CLASSIFIED VEGETATION

Step 5 of the Method 2 assessment process requires the distance between the site and classified vegetation to be determined. In the case of this assessment, BAL contours have been generated and overlain on site plans to determine separation distances as displayed in Table 2 and Table 3 respectively.

FLAME LENGTH

Step 6 of the Method 2 assessment process requires the flame length associated with each vegetation plot to be determined. These results are provided in Appendix B.

FLAME WIDTH

Step 7 of the Method 2 assessment process allows modification of the standard 100 m flame width used in the determination of BAL ratings based on relative orientation of vegetation.

Flame width was not modified for this assessment.

ELEVATION OF RECEIVER

Step 8 of the Method 2 assessment process allows modification of the elevation of receiver value used in the determination of BAL ratings. The elevation of receiver is the height (level) of the site that will receive the radiant heat flux exposure from the adjoining hazard. The default value selects the elevation where the maximum radiant heat exposure is received.

Default elevation of receiver values were used for this assessment. Note: due to a script error in 'NBC Bushfire Attack Assessor v4.1', the elevation of receiver was set at 3 m for Grassland vegetation in order for the 'BAL thresholds' script to run. This override has been recommended by the software developer and does not affect the accuracy of the results.

RADIANT HEAT FLUX AND DETERMINED BUSHFIRE ATTACK LEVEL

Steps 9 and 10 of the Method 2 assessment (determination of radiant heat flux and resultant BAL rating) have been combined for ease of display below.

The inputs detailed in preceding sections of this report were input into the software tool 'NBC Bushfire Attack Assessor v4.1' to calculate BAL contour distances associated with each vegetation plot. Results from the assessment are provided in Table 2 and Figure 2.

Table 2: BAL Analysis AS 3959-2018 (BAL contours)

Plot	Vegetation Classification	Effective Slope	Separation distances required				
			BAL-FZ	BAL-40	BAL-29	BAL-19	BAL-12.5
1	Class B woodland	Upslope/ flat land	<11	11-<14	14-<21	21-<29	29-<100
2	Class B woodland	6° Downslope	<15	15-<19	19-<27	27-<38	38-<100
3	Class G grassland	3° Downslope	<7	7-<9	9-<13	13-<18	18-<50
4	Excluded under Clause 2.2.3.2 (e) & (f)	N/A	No separation distances required – BAL-LOW				

The determined Bushfire Attack Level (highest BAL) for the seven subject lots is provided in Table 3. Advisory notes related to each BAL rating are provided in 0.

Detailed calculations from the assessment are provided in Appendix B.

Table 3: BAL assessment summary

Lot number	Vegetation classification most affecting BAL	Effective slope	Site slope	Separation (m)	BAL rating
512	Plot 2 Class B woodland	6° Downslope	Flat	39	BAL-12.5
513	Plot 2 Class B woodland	6° Downslope	Flat	39	BAL-12.5
514	Plot 2 Class B woodland	6° Downslope	Flat	39	BAL-12.5
515	Plot 2 Class B woodland	6° Downslope	Flat	39	BAL-12.5
533	Plot 1 Class B woodland		Flat	39	BAL-12.5
534	Plot 2 Class B woodland	6° Downslope	Flat	39	BAL-12.5
535	Plot 2 Class B woodland	6° Downslope	Flat	39	BAL-12.5

Figure 1: Vegetation classification

Legend

- Lots
- 100m Assessment Area
- Photo location
- Contours 5m Intervals

Vegetation classification

- Class B woodland
- Class G grassland
- Excluded under clause 2.2.3.2 (e) and (f)

N

Datum/Projection:
GDA 1994 MGA Zone 50 www.ecoaus.com.au

0 12.5 25 50
Metres

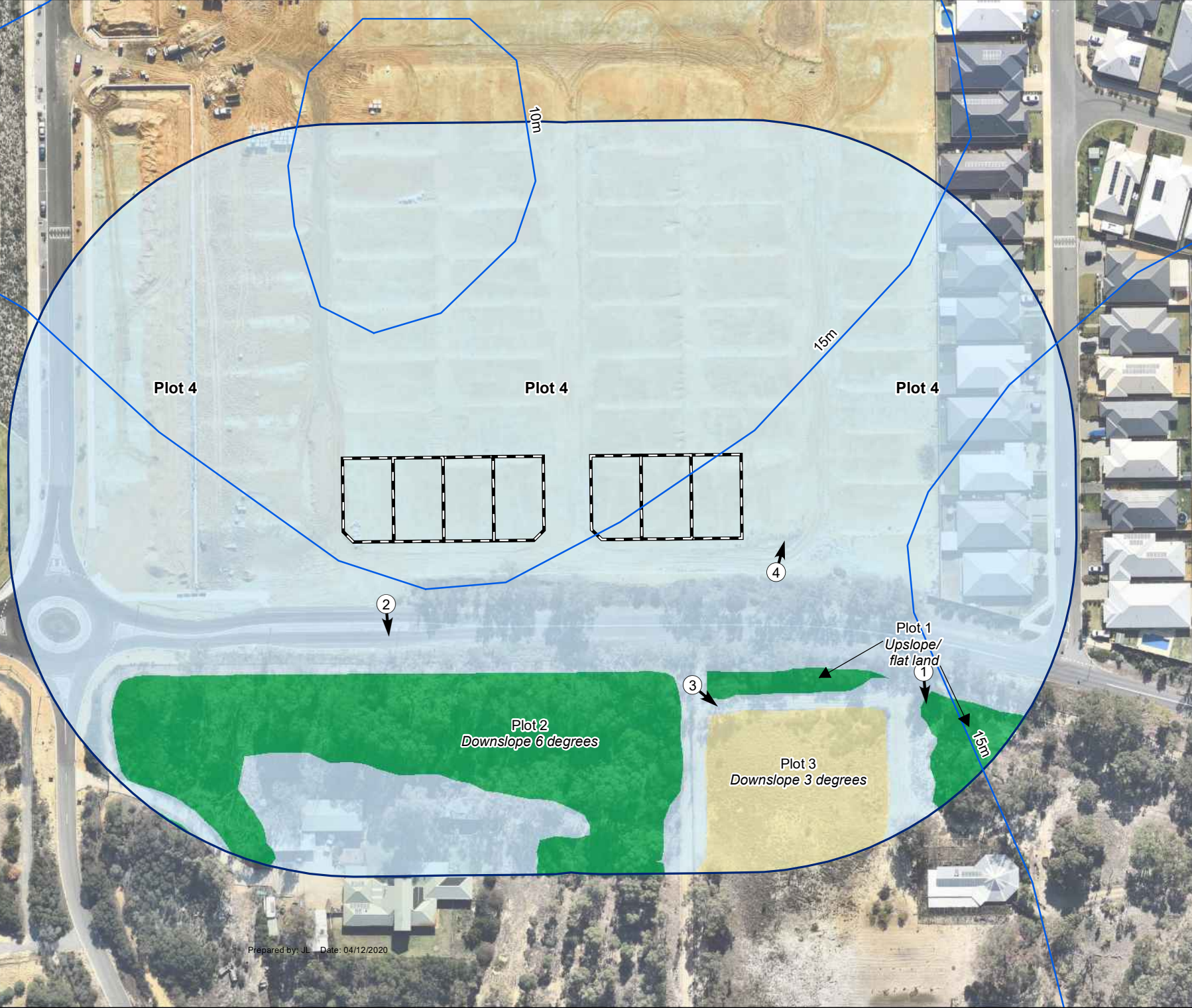


Figure 2: Bushfire Attack Level (BAL) Contour assessment

Legend

- Lots
- 100m Assessment Area
- Bushfire Hazard interface

Bushfire Attack Level (BAL) Contours

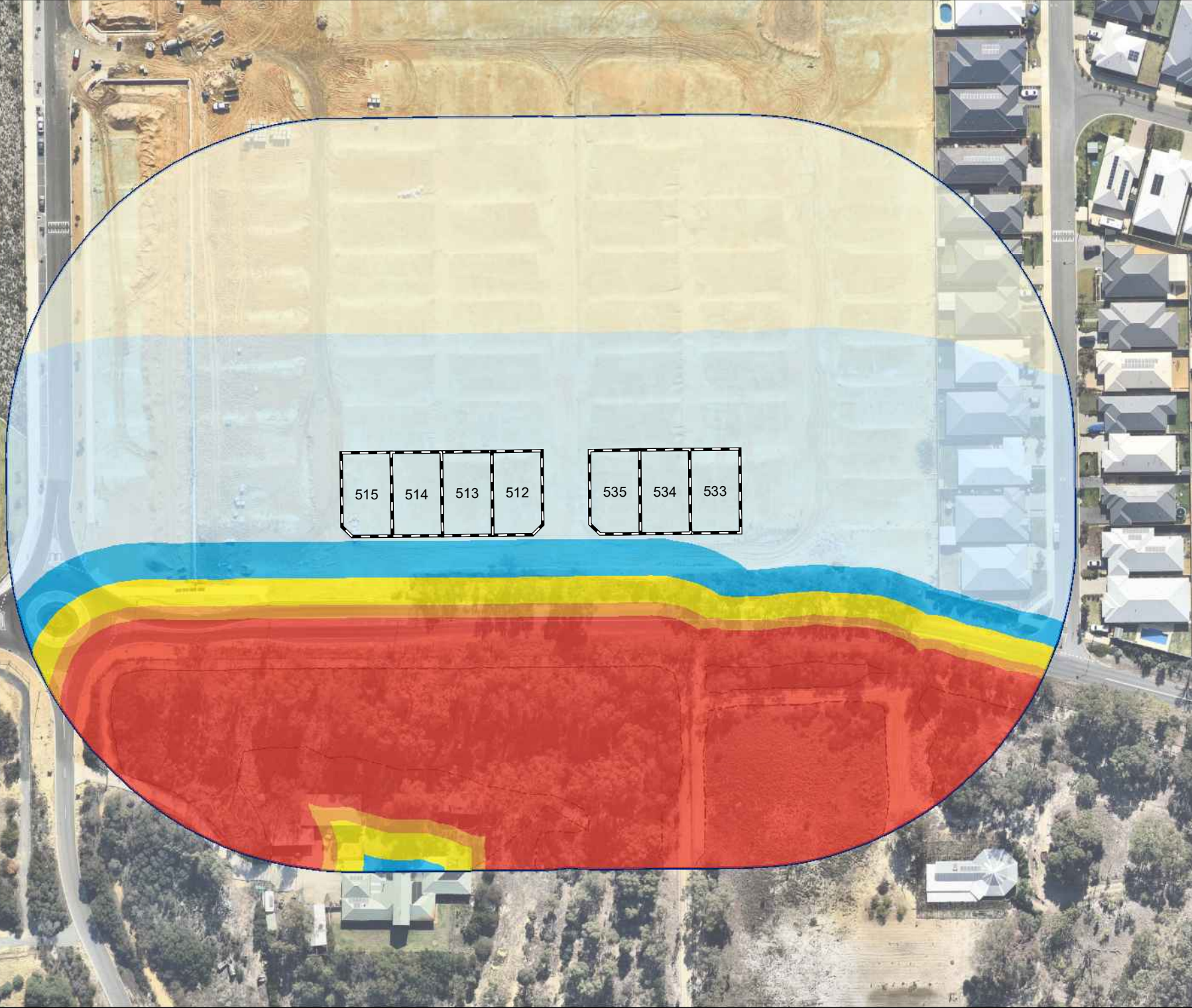
- BAL-FZ
- BAL-40
- BAL-29
- BAL-19
- BAL-12.5
- BAL-LOW

eco logical
AUSTRALIA

Datum/Projection:
www.ecoaus.com.au GDA 1994 MGA Zone 50

0 12.5 25 50
Metres

N



515 514 513 512

535 534 533

REFERENCES

Couch, P. n.d. *Bushfire Attack Calculator Training v4.1*. Developed by Newcastle Bushfire Consulting.

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

Appendix A – Additional Information / Advisory Notes

This assessment was undertaken as per AS 3959-2018. It is important that the current version of AS 3959, is consulted for construction purposes.

This BAL rating is based on the information current at the date of this letter and is valid for 12 months from the date of this letter.

Bushfire Attack Level (BAL) as set out in the Australian Standard 3959 Construction of Buildings in Bushfire-Prone Areas (AS 3959), as referenced in the Building Code of Australia.

Bushfire Attack Level (BAL)	Classified vegetation within 100 m of the site and radiant heat flux exposure thresholds	Description of predicted bush fire attack and levels of exposure	Construction Section as per AS 3959
BAL-LOW		There is insufficient risk to warrant specific construction requirements.	4
BAL-12.5	≤12.5 kW/m ²	Ember attack	3 and 5
BAL-19	>12.5 kW/m ² ≤19 kW/m ²	Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing radiant heat flux.	3 and 6
BAL-29	>19 kW/m ² ≤29 kW/m ²	Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing radiant heat flux	3 and 7
BAL-40	>29 kW/m ² ≤40 kW/m ²	Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing radiant heat flux with the increased likelihood of exposure to flames.	3 and 8
BAL-FZ	>40 kW/m ²	Direct exposure to flames from fire front in addition to radiant heat flux and ember attack	3 and 9

Source: “AS 3959 - 2018 Construction of buildings in bushfire-prone areas” published by Standards Australia, Sydney

Appendix B – Calculations



NBC Bushfire Attack Assessment Report V4.1

AS3959 (2018) Appendix B - Detailed Method 2

Print Date: 4/12/2020

Assessment Date: 3/12/2020

Site Street Address: Brightwood Method 2, Baldivis

Assessor: Daniel Panickar; Eco Logical Australia

Local Government Area: WA

Alpine Area: No

Equations Used

Transmissivity: Fuss and Hammins, 2002

Flame Length: RFS PBP, 2001/Vesta/Catchpole

Rate of Fire Spread: Noble et al., 1980

Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005

Peak Elevation of Receiver: Tan et al., 2005

Peak Flame Angle: Tan et al., 2005

Run Description: Plot 1 - Woodland

Vegetation Information

Vegetation Type: Woodland

Vegetation Group: Forest and Woodland

Vegetation Slope: 0 Degrees

Vegetation Slope Type: Level

Surface Fuel Load(t/ha): 15

Overall Fuel Load(t/ha): 25

Vegetation Height(m): 2

Only Applicable to Shrub/Scrub and Vesta

Site Information

Site Slope: 0 Degrees

Site Slope Type: Level

Elevation of Receiver(m) Default

APZ/Separation(m): 29

Fire Inputs

Veg./Flame Width(m): 100

Flame Temp(K): 1090

Calculation Parameters

Flame Emissivity: 95

Relative Humidity(%): 25

Heat of Combustion(kJ/kg) 18600

Ambient Temp(K): 308

Moisture Factor: 5

FDI: 80

Program Outputs

Level of Construction: BAL 12.5

Peak Elevation of Receiver(m): 6

Radiant Heat(kW/m²): 12.45

Flame Angle (degrees): 76

Flame Length(m): 12.36

Maximum View Factor: 0.202

Rate Of Spread (km/h): 1.44

Inner Protection Area(m): 22

Transmissivity: 0.811

Outer Protection Area(m): 7

Fire Intensity(kW/m): 18600

BAL Thresholds

BAL-40: BAL-29: BAL-19: BAL-12.5: 10 kw/m²: Elevation of Receiver:

Asset Protection Zone(m): 11 14 21 29 47 6

Run Description: Plot 2 - Woodland

Vegetation Information

Vegetation Type: Woodland
Vegetation Group: Forest and Woodland
Vegetation Slope: 6 Degrees
Vegetation Slope Type: Downslope
Surface Fuel Load(t/ha): 15
Overall Fuel Load(t/ha): 25
Vegetation Height(m): 2
Only Applicable to Shrub/Scrub and Vesta

Site Information

Site Slope: 0 Degrees
Site Slope Type: Level
Elevation of Receiver(m) Default
APZ/Separation(m): 38

Fire Inputs

Veg./Flame Width(m): 100
Flame Temp(K): 1090

Calculation Parameters

Flame Emissivity: 95
Relative Humidity(%): 25
Heat of Combustion(kJ/kg) 18600
Ambient Temp(K): 308
Moisture Factor: 5
FDI: 80

Program Outputs

Level of Construction: BAL 12.5
Peak Elevation of Receiver(m): 8.25
Radiant Heat(kW/m2): 12.3
Flame Angle (degrees): 74
Flame Length(m): 17.16
Maximum View Factor: 0.204
Rate Of Spread (km/h): 2.18
Inner Protection Area(m): 29
Transmissivity: 0.793
Outer Protection Area(m): 9
Fire Intensity(kW/m): 28139

BAL Thresholds

BAL-40: BAL-29: BAL-19: BAL-12.5: 10 kw/m2: Elevation of Receiver:
Asset Protection Zone(m): 15 19 27 38 58 6

Run Description: Plot 3 - Grassland

Vegetation Information

Vegetation Type: Grassland

Vegetation Group: Grassland

Vegetation Slope: 3 Degrees

Vegetation Slope Type: Downslope

Surface Fuel Load(t/ha): 4.5

Overall Fuel Load(t/ha): 4.5

Vegetation Height(m): 0

Only Applicable to Shrub/Scrub and Vesta

Site Information

Site Slope: 0 Degrees

Site Slope Type: Level

Elevation of Receiver(m) 6

APZ/Separation(m): 19

Fire Inputs

Veg./Flame Width(m): 100

Flame Temp(K): 1090

Calculation Parameters

Flame Emissivity: 95

Relative Humidity(%): 25

Heat of Combustion(kJ/kg) 18600

Ambient Temp(K): 308

Moisture Factor: 5

FDI: 110

Program Outputs

Level of Construction: BAL 12.5

Peak Elevation of Receiver(m): 3.73

Radiant Heat(kW/m2): 12.26

Flame Angle (degrees): 79

Flame Length(m): 7.62

Maximum View Factor: 0.193

Rate Of Spread (km/h): 17.59

Inner Protection Area(m): 19

Transmissivity: 0.836

Outer Protection Area(m): 0

BAL Thresholds

BAL-40: BAL-29: BAL-19: BAL-12.5: 10 kw/m2: Elevation of Receiver:
Asset Protection Zone(m): 7 9 13 18 33 3

Bushfire Attack Level (BAL) Certificate

Determined in accordance with AS 3959-2018

Site Details

Address:	Lot 512, Brightwood Estate		
Suburb:	Baldivis	State:	WA
Local Government Area:	City of Rockingham		
Use of building	Residential Dwelling	Main BCA class:	Class 1a
Report / Job Number:	20PER-16887	Report Date:	04/12/2020

Determination of Highest Bushfire Attack Level

AS 3959 Assessment Procedure	Vegetation Classification	Effective Slope	Separation Distance	BAL
Method 2	Class B woodland	Downslope 6 degrees	39 m	BAL - 12.5

Practitioner Details

I hereby certify that I have undertaken the assessment of the above site and determined the Bushfire Attack Level stated above in accordance with the requirements of AS 3959-2018.

Name Daniel Panickar
Eco Logical Australia

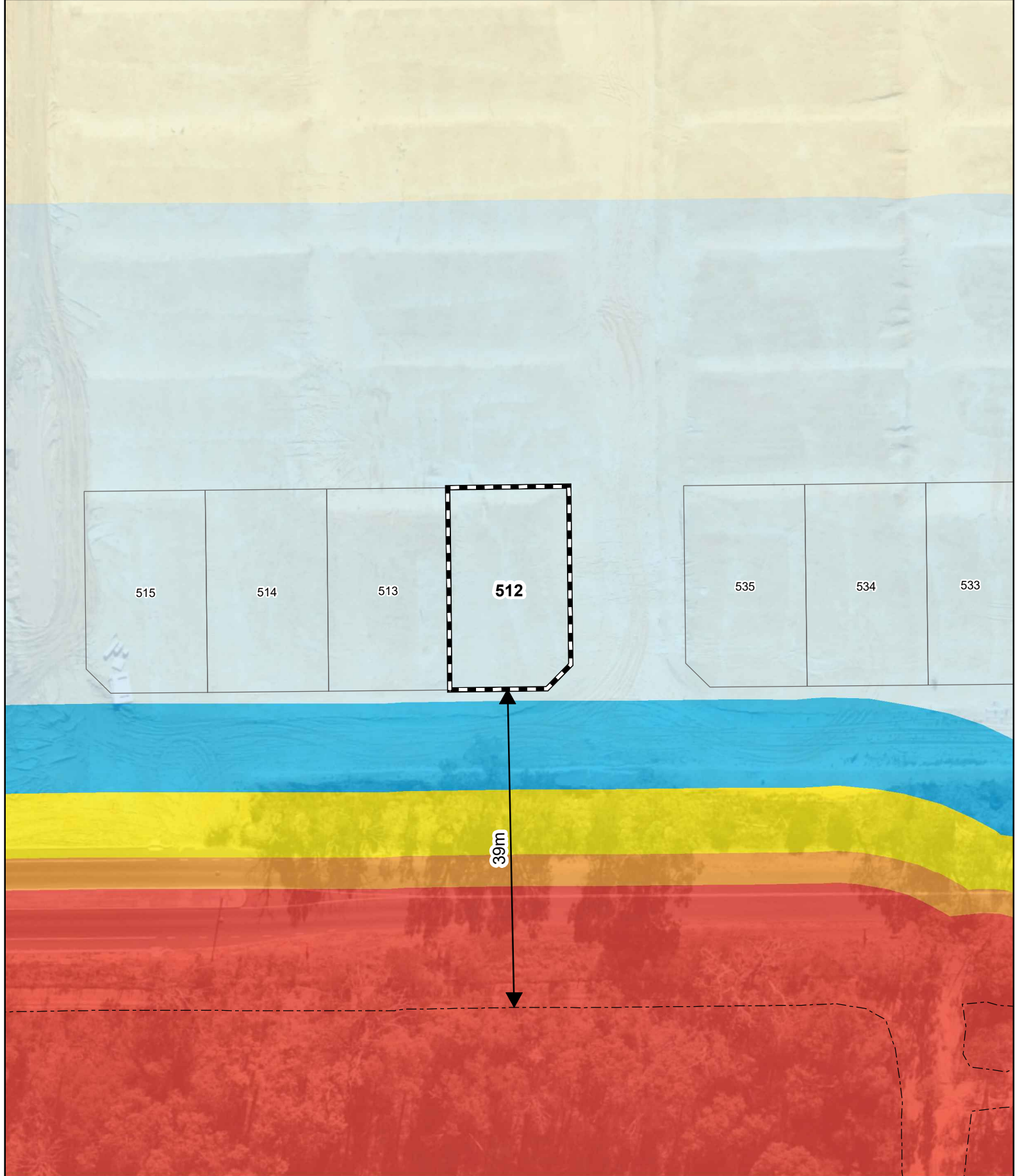
Signature: 

Certificate Date: 04/12/2020



Accreditation No: BPAD 37802
Expiry: December 2021

Bushfire Attack Level (BAL) Contours - Lot 512 (BAL - 12.5)



- Legend**
- Lot location
 - 100m site assessment
 - Bushfire Hazard Interface
 - Distance to bushfire hazard interface

- Bushfire Attack Level (BAL)**
- BAL-FZ
 - BAL-29
 - BAL-40
 - BAL-19
 - BAL-12.5
 - BAL-LOW



0 5 10 20
Metres
Datum/Projection:
GDA 1994 MGA Zone 50

Bushfire Attack Level (BAL) Certificate

Determined in accordance with AS 3959-2018

Site Details

Address:	Lot 513, Brightwood Estate		
Suburb:	Baldivis	State:	WA
Local Government Area:	City of Rockingham		
Use of building	Residential Dwelling	Main BCA class:	Class 1a
Report / Job Number:	20PER-16887	Report Date:	04/12/2020

Determination of Highest Bushfire Attack Level

AS 3959 Assessment Procedure	Vegetation Classification	Effective Slope	Separation Distance	BAL
Method 2	Class B woodland	Downslope 6 degrees	39 m	BAL - 12.5

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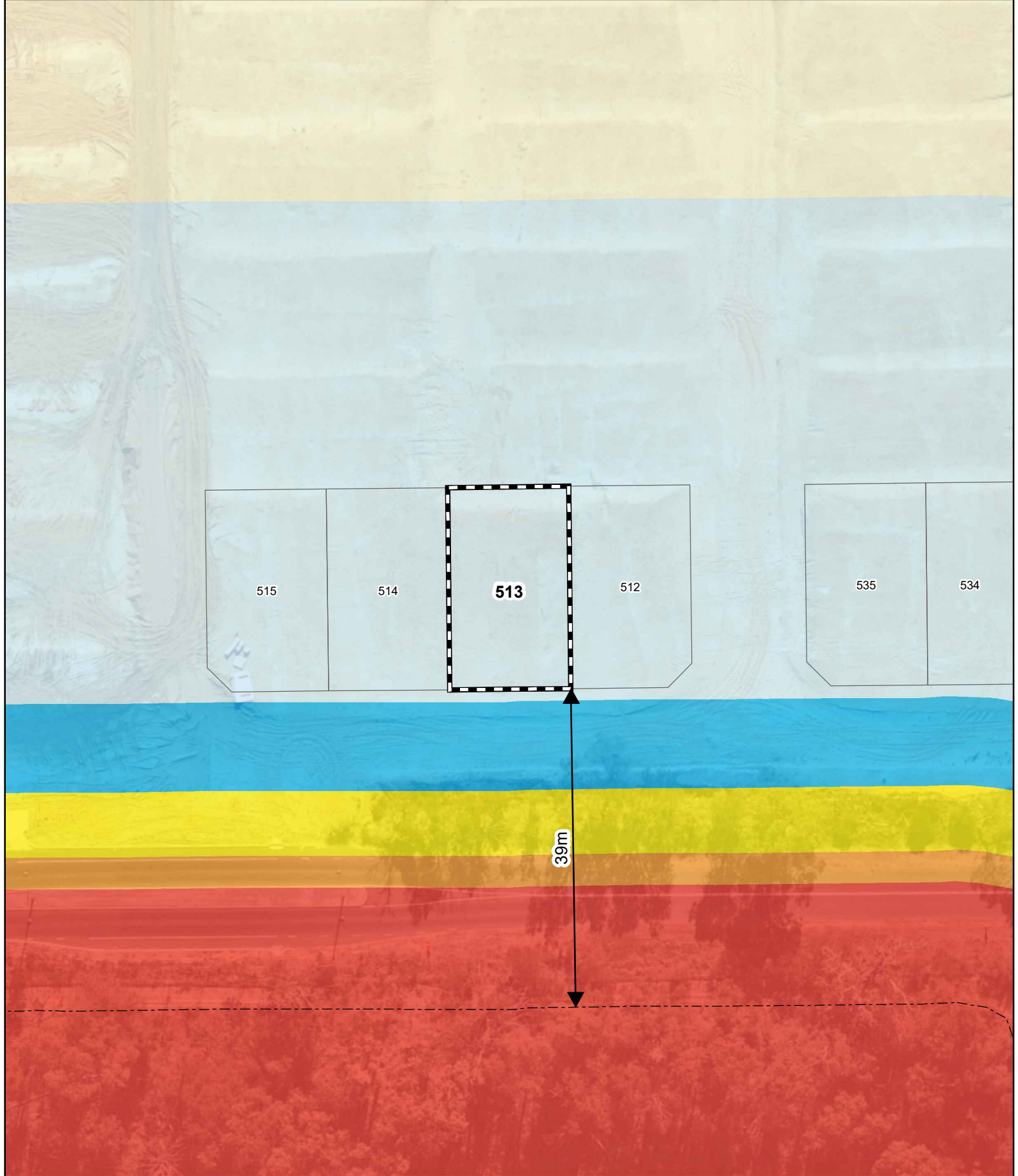
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Certificate Date: 04/12/2020



Accreditation No: BPAD 37802
Expiry: December 2021

Bushfire Attack Level (BAL) Contours - Lot 513 (BAL - 12.5)



- Legend**
- Lot location
 - 100m site assessment
 - Bushfire Hazard Interface
 - Distance to bushfire hazard interface

- Bushfire Attack Level (BAL)**
- BAL-FZ
 - BAL-29
 - BAL-40
 - BAL-19
 - BAL-12.5
 - BAL-LOW



0 5 10 20
Metres
Datum/Projection:
GDA 1994 MGA Zone 50

Bushfire Attack Level (BAL) Certificate

Determined in accordance with AS 3959-2018

Site Details

Address:	Lot 514, Brightwood Estate		
Suburb:	Baldivis	State:	WA
Local Government Area:	City of Rockingham		
Use of building	Residential Dwelling	Main BCA class:	Class 1a
Report / Job Number:	20PER-16887	Report Date:	04/12/2020

Determination of Highest Bushfire Attack Level

AS 3959 Assessment Procedure	Vegetation Classification	Effective Slope	Separation Distance	BAL
Method 2	Class B woodland	Downslope 6 degrees	39 m	BAL - 12.5

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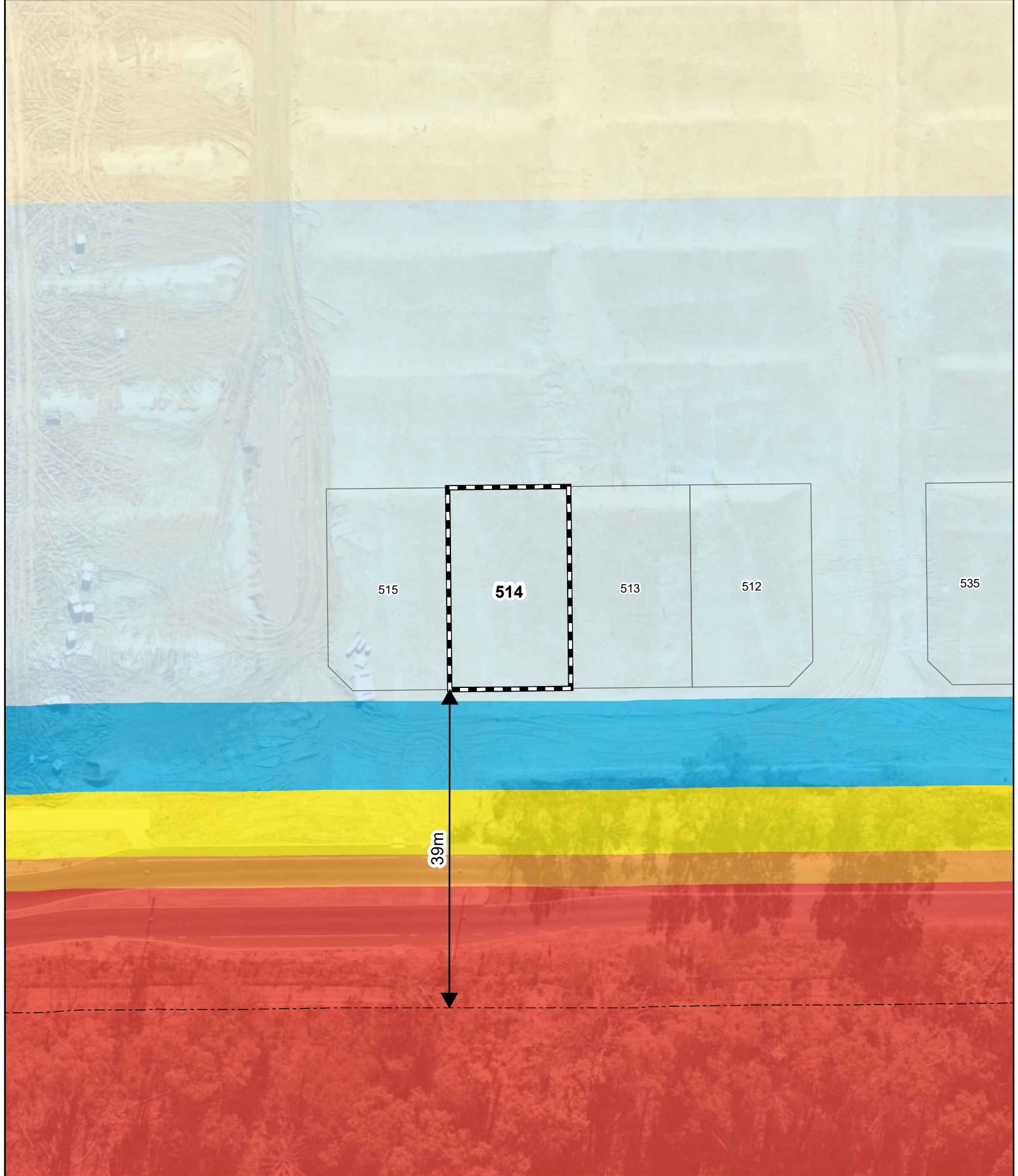
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Certificate Date: 04/12/2020



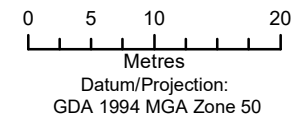
Accreditation No: BPAD 37802
Expiry: December 2021

Bushfire Attack Level (BAL) Contours - Lot 514 (BAL - 12.5)



- Legend**
- Lot location
 - 100m site assessment
 - Bushfire Hazard Interface
 - Distance to bushfire hazard interface

- Bushfire Attack Level (BAL)**
- BAL-FZ
 - BAL-29
 - BAL-40
 - BAL-19
 - BAL-12.5
 - BAL-LOW



Bushfire Attack Level (BAL) Certificate

Determined in accordance with AS 3959-2018

Site Details

Address:	Lot 515, Brightwood Estate		
Suburb:	Baldivis	State:	WA
Local Government Area:	City of Rockingham		
Use of building	Residential Dwelling	Main BCA class:	Class 1a
Report / Job Number:	20PER-16887	Report Date:	04/12/2020

Determination of Highest Bushfire Attack Level

AS 3959 Assessment Procedure	Vegetation Classification	Effective Slope	Separation Distance	BAL
Method 2	Class B woodland	Downslope 6 degrees	39 m	BAL - 12.5

Practitioner Details

I hereby certify that I have undertaken the assessment of the above site and determined the Bushfire Attack Level stated above in accordance with the requirements of AS 3959-2018.

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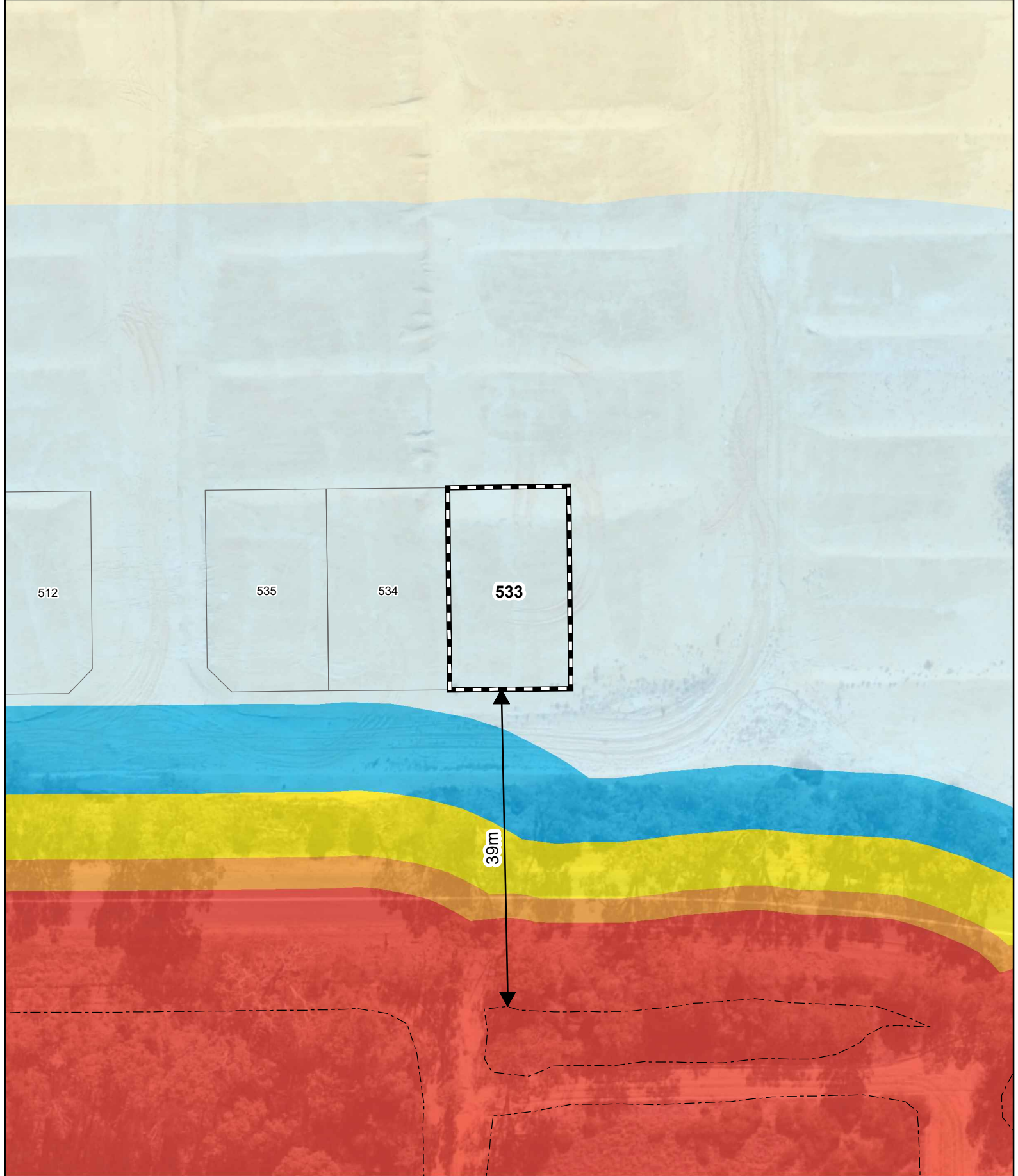
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Certificate Date: 04/12/2020



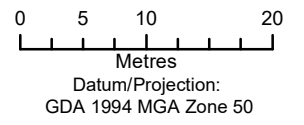
Accreditation No: BPAD 37802
Expiry: December 2021

Bushfire Attack Level (BAL) Contours - Lot 533 (BAL - 12.5)



- Legend**
- Lot location
 - 100m site assessment
 - Bushfire Hazard Interface
 - Distance to bushfire hazard interface

- Bushfire Attack Level (BAL)**
- BAL-FZ
 - BAL-29
 - BAL-40
 - BAL-19
 - BAL-12.5
 - BAL-LOW



Bushfire Attack Level (BAL) Certificate

Determined in accordance with AS 3959-2018

Site Details

Address:	Lot 533, Brightwood Estate		
Suburb:	Baldivis	State:	WA
Local Government Area:	City of Rockingham		
Use of building	Residential Dwelling	Main BCA class:	Class 1a
Report / Job Number:	20PER-16887	Report Date:	04/12/2020

Determination of Highest Bushfire Attack Level

AS 3959 Assessment Procedure	Vegetation Classification	Effective Slope	Separation Distance	BAL
Method 2	Class B woodland	Upslope / Flat Land	39 m	BAL - 12.5

Practitioner Details

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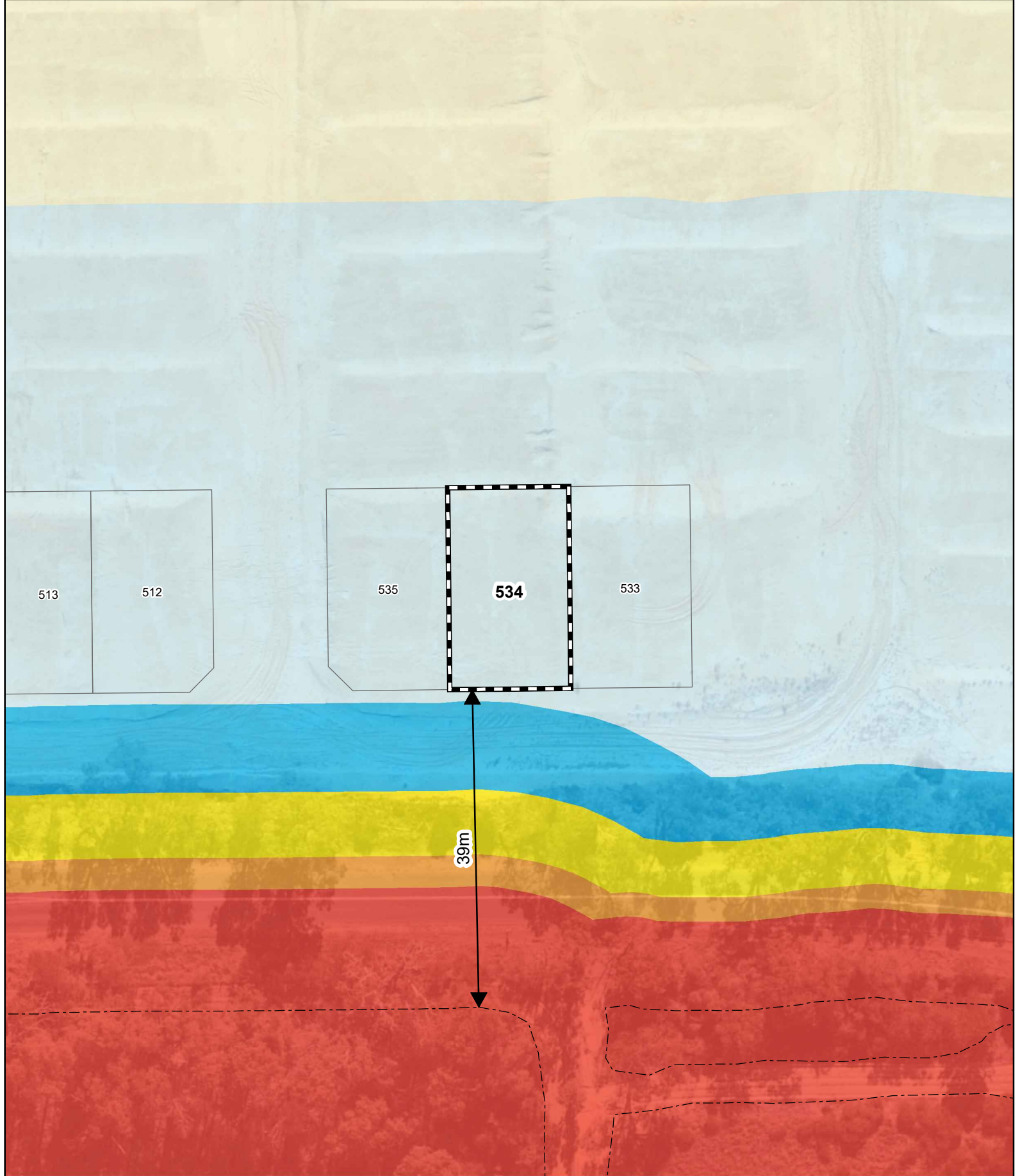
Signature: 

Certificate Date: 04/12/2020



Accreditation No: BPAD 37802
Expiry: December 2021

Bushfire Attack Level (BAL) Contours - Lot 534 (BAL - 12.5)



- Legend**
- Lot location
 - 100m site assessment
 - Bushfire Hazard Interface
 - Distance to bushfire hazard interface

- Bushfire Attack Level (BAL)**
- BAL-FZ
 - BAL-29
 - BAL-40
 - BAL-19
 - BAL-12.5
 - BAL-LOW



0 5 10 20
Metres
Datum/Projection:
GDA 1994 MGA Zone 50

Bushfire Attack Level (BAL) Certificate

Determined in accordance with AS 3959-2018

Site Details

Address:	Lot 534, Brightwood Estate		
Suburb:	Baldivis	State:	WA
Local Government Area:	City of Rockingham		
Use of building	Residential Dwelling	Main BCA class:	Class 1a
Report / Job Number:	20PER-16887	Report Date:	04/12/2020

Determination of Highest Bushfire Attack Level

AS 3959 Assessment Procedure	Vegetation Classification	Effective Slope	Separation Distance	BAL
Method 2	Class B woodland	Downslope 6 degrees	39 m	BAL - 12.5

Practitioner Details

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Eco Logical Australia

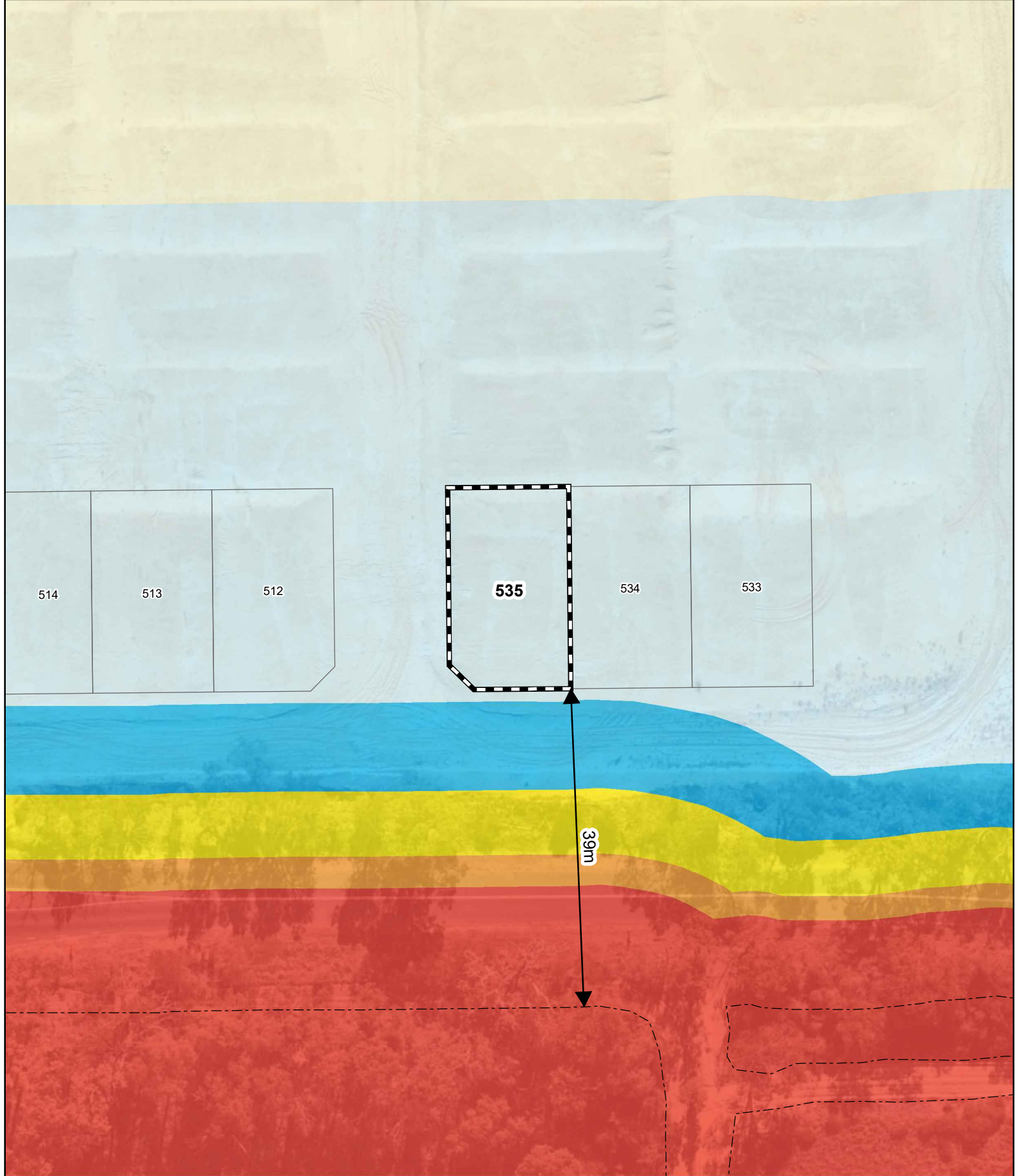
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Certificate Date: 04/12/2020



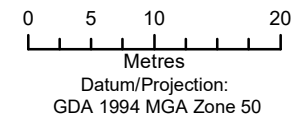
Accreditation No: BPAD 37802
Expiry: December 2021

Bushfire Attack Level (BAL) Contours - Lot 535 (BAL - 12.5)



- Legend**
- Lot location
 - 100m site assessment
 - Bushfire Hazard Interface
 - Distance to bushfire hazard interface

- Bushfire Attack Level (BAL)**
- BAL-FZ
 - BAL-29
 - BAL-40
 - BAL-19
 - BAL-12.5
 - BAL-LOW



Bushfire Attack Level (BAL) Certificate

Determined in accordance with AS 3959-2018

Site Details

Address:	Lot 535, Brightwood Estate		
Suburb:	Baldivis	State:	WA
Local Government Area:	City of Rockingham		
Use of building	Residential Dwelling	Main BCA class:	Class 1a
Report / Job Number:	20PER-16887	Report Date:	04/12/2020

Determination of Highest Bushfire Attack Level

AS 3959 Assessment Procedure	Vegetation Classification	Effective Slope	Separation Distance	BAL
Method 2	Class B woodland	Downslope 6 degrees	39 m	BAL - 12.5

Practitioner Details

I hereby certify that I have undertaken the assessment of the above site and determined the Bushfire Attack Level stated above in accordance with the requirements of AS 3959-2018.

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Eco Logical Australia

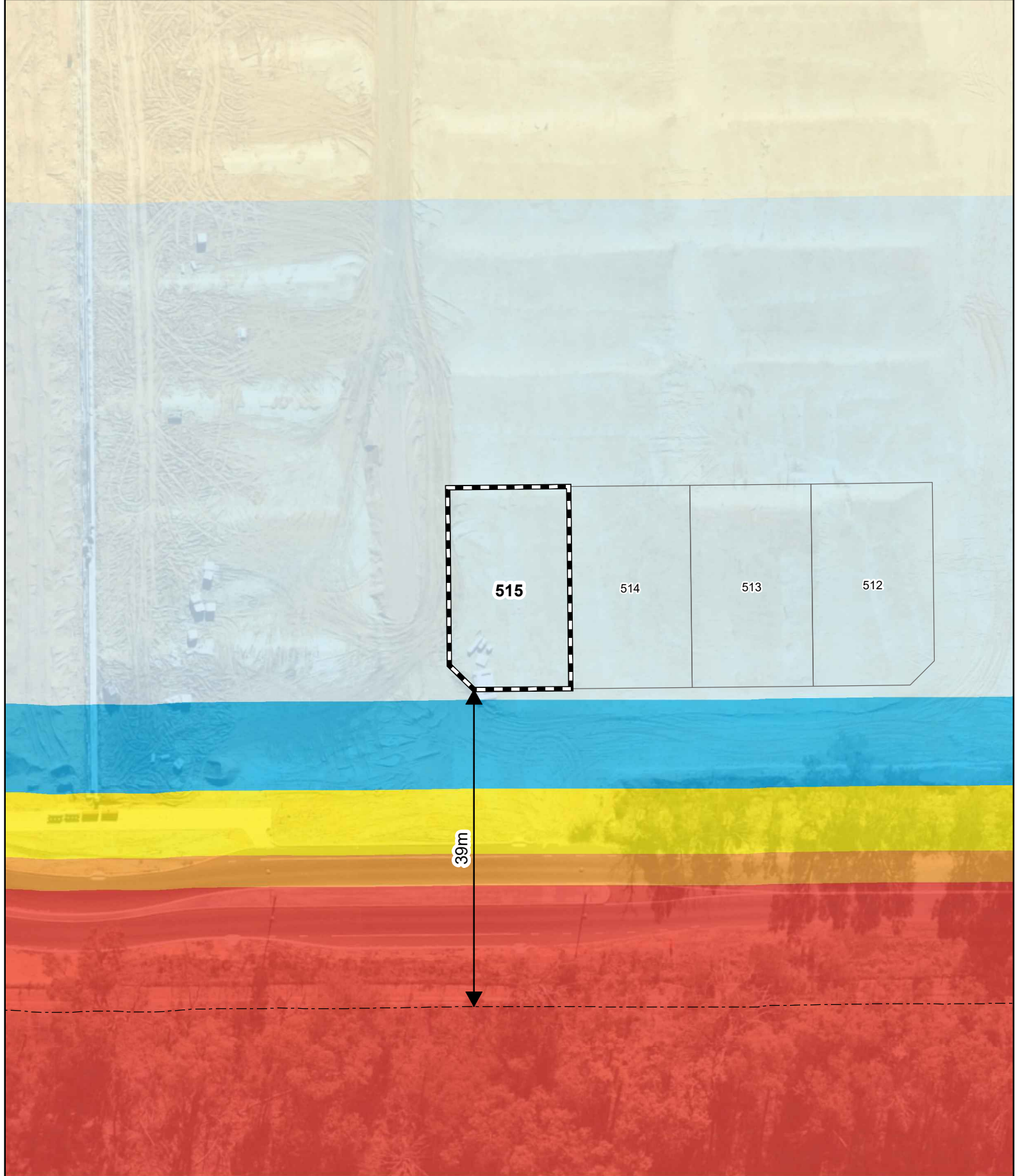
Signature: 

Certificate Date: 04/12/2020



Accreditation No: BPAD 37802
Expiry: December 2021

Bushfire Attack Level (BAL) Contours - Lot 515 (BAL - 12.5)



- Legend**
- Lot location
 - 100m site assessment
 - Bushfire Hazard Interface
 - Distance to bushfire hazard interface

- Bushfire Attack Level (BAL)**
- BAL-FZ
 - BAL-29
 - BAL-40
 - BAL-19
 - BAL-12.5
 - BAL-LOW



0 5 10 20
Metres
Datum/Projection:
GDA 1994 MGA Zone 50

N

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AUSTRALIA
www.ecoaus.com.au
Prepared by: SM Date: 4/12/2020