BUILDING BUSHFIRE RESILIENCE IN THE GREAT SOUTHERN

Shire of Denmark, City of Albany, Shire of Plantagenet

Building bushfire resilience in communities – National strategy for disaster resilience

- "State governments and municipal councils to adopt increased or improved protective management, emergency management and advisory roles."
- Strive to recognize and understand the risks disasters pose to their own and their communities interests.
- Leaders drive development of partnerships and networks to build resilience at government, business, neighborhood and community levels.

What is the "Building Resilience In the Great Southern" [BRIGS] Project?

- The Western Australian and Commonwealth governments have a National Partnership Agreement for Natural Disaster Resilience that delivers the National Disaster Resilience Program (NDRP).
- Application was submitted to the NDRP to fund the three local governments to enhance the evacuation planning and bushfire risk mitigation strategies over 8 precincts.
- Aimed to implement sustained resilience or disaster mitigation strategies that directly benefit the WA community.
- This project reduces identified risks and closes capability gaps, in an effort to reduce future post-disaster funding needs.
- This project aided in the development of a rigorous physical risk mitigation program where possible and develops a greater understanding of bushfire risk in the community.

What is the "Building Resilience In the Great Southern" [BRIGS] Project?

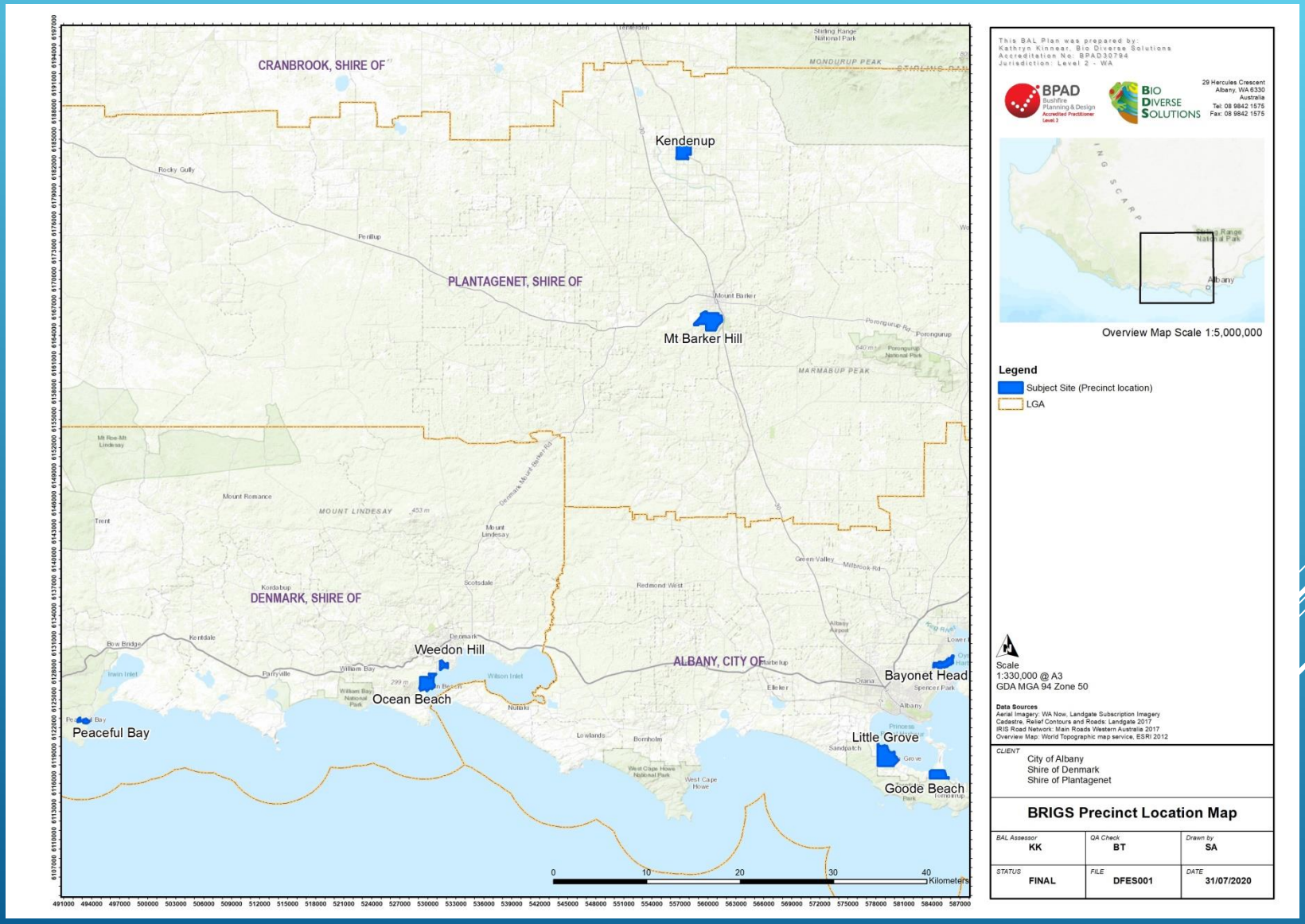
8 precincts in 3 LGA's

- Goode Beach (CoA);
- Little Grove and Big Grove(CoA);
- Bayonet Head(CoA);
- Peaceful Bay (SoD);
- Ocean Beach (SoD);
- Weedon Hill (SoD);
- Kendenup (SoP); and
- Mount Barker Hill (SoP).

The 8 precincts identified for the project were based on the following parameters:

- High fuel loads and extreme bushfire risks;
- Limited access and egress for the communities to evacuate (one-way access);
- High population density in summer (extreme risk) period
- Legacy planning issues. Communities not consistent with the current SPP 3.7

8 precincts "Building Resilience In the Great Southern" [BRIGS] Project?



What is the "Building Resilience In the Great Southern" [BRIGS] Project?

Key processes

- Applying a AS3959 BAL contouring methodological (method 1) approach (WAPC endorsed methodology) to define and map bushfire risks to our Extreme-risk communities.
- CSIRO Spark modelling to determine Burn Perimeter analysis, Bushfire rate of spread, Locality risk and building risk.
- Identification of vulnerable communities where evacuation may be compromised and recommendations to improve opportunities for evacuation or if evacuation not probable /possible under certain circumstances.
- Identifying areas for possible community refuge. Off site and on site precinct refuge options determined from modelling. Method 2 BAL assessments.
- Develop Works Programs and treatment schedules with priorities developed.
- Review of gazetted fire notice in each LGA.
- Stakeholder engagement – DBCA, WCWA, DFES, LGA, DoEd,
- Public consultation – during project (in precinct, public sessions and post project through implementation).
- Treatment schedule will be implemented to the degree that is allowed within budget/time constraints.

What is the Fire Management Notice?

Designated under Section 33 of Bushfires Act

Sets maintenance requirements for land owners on their property

Duty of care of land owners to implement, can be fined if found not compliant.

Duty of care of Local Government to enforce:

- *Safety of residents in community*
- *Legal implications if not enforced*
- *Consider cost – cost to the community after a bushfire and cost to LGA*

Where its referred to..triggers reminders to the land owner their obligations in an approved BMP report.

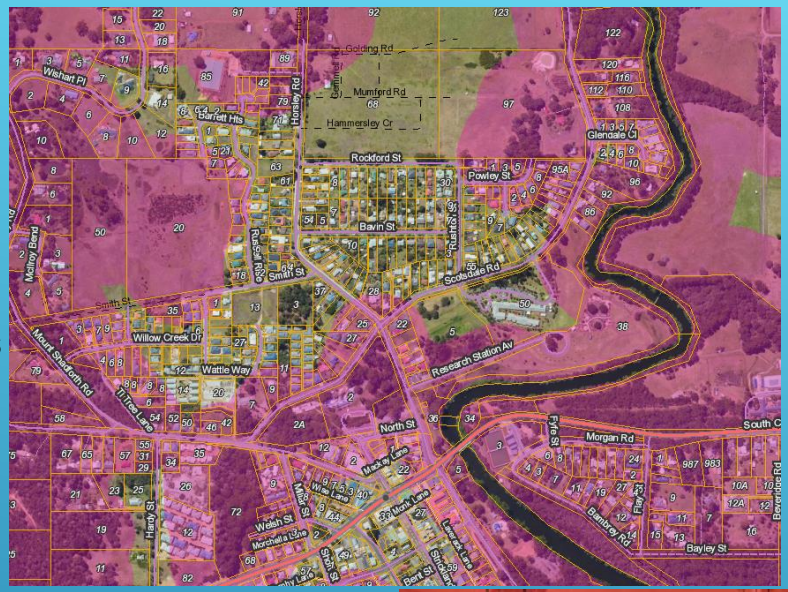
An approved BMP report specifically is:

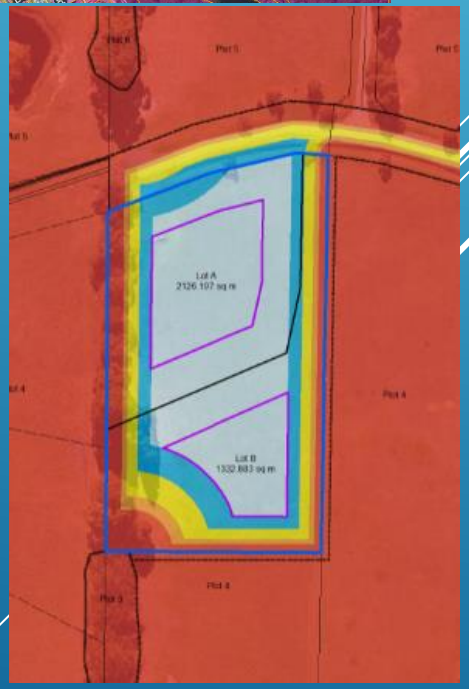
- *A site specific report.*
- *Outlines BAL requirements, APZ dimensions, access requirements and water.*
- *A variation to the FMN.*

The FMN ensures during the bushfire season there are mitigation measures in place on private property.

AS3959 and the planning system

- A bushfire response is required anytime you do something in the “pink”.
- WA state based mapping developed by the Office of Bushfire Risk Management (OBRM).
- Designated through the Fire and Emergency Services (Bush Fire Prone Areas) Order 2015
- If you enter the planning system or building system, it requires the site to be assessed for bushfire risk – AS3959 is used as a measure of risk and/or for building application.
- BAL Assessments should be undertaken by a FPA Accredited (BPAD) person.
- We cannot assume the LGA will clear all vegetation adjacent to a BAL rated dwelling.





Bushfire Attack Level (BAL) Certificate

Determined in accordance with AS 3959-2018

This Certificate has been issued by a person accredited by Fire Protection Association Australia under the Bushfire Planning and Design (BPAD) Accreditation Scheme. The certificate details the conclusions of the full Bushfire Attack Level Assessment Report (full report) prepared by the Accredited Practitioner.

Property Details and Description of Works

Address Details	Unit no	Street no	Lot no	Street name / Plan Reference	
	Suburb			State: WA	Postcode
Local government area					

AS3959-2018 Measures Bushfire Fuels

- AS3959 provides a measure of radiant heat flux (impact) on a building.
- AS3959 is also used as a planning tool to measure bushfire risk.
- Uses a classification system according to vegetation structure.

TABLE 2.3
CLASSIFICATION OF VEGETATION

Vegetation classification	Vegetation type	Figure No. in Figures 2.4(A) to 2.4(H)	Description
A Forest	Tall open forest Tall woodland	01 02	Trees over 30 m high; 30%–70% foliage cover (may include understorey ranging from rainforest species and tree ferns to low trees and tall shrubs). Found in areas of high reliable rainfall. Typically dominated by eucalypts with a sub-dominant tree layer.
	Open forest Low open forest	03 04	Trees 30 m high; 30%–70% foliage cover (may include understorey of sclerophyllous low trees or shrubs). Typically dominated by eucalypts, melaleuca or callistemon (may include riverine and wetland environments) and callitris. Includes eucalypt plantations.
	Pine plantation	Not shown	Trees 30 m in height at maturity, generally comprising Pinus species or other softwood species, planted as a single species for the production of timber.
B Woodland	Woodland Low woodland	05 07	Trees 10 m–30 m high; 10%–30% foliage cover dominated by eucalypts and/or callistris with a prominent grassy understorey. May contain isolated shrubs.
C Shrubland	Closed (low) heath Open heath	10 11	Found in wet areas and/or areas affected by poor soil fertility or shallow soils. Shrubs 1 m–2 m high. Wet heaths occur in sands adjoining dunes of the littoral (shore) zone. Montane heaths occur on shallow or water-logged soils.
	Low shrubland	12	Shrubs <2 m high; greater than 30% foliage cover. Understoreys may contain grasses. Acacia and Casuarina often dominant in the arid and semi-arid zones.
D Scrub	Closed scrub (Tall heaths)	13	Found in wet areas and/or areas affected by poor soil fertility or shallow soils; >30% foliage cover. Dry heaths occur in rocky or sandy areas. Shrubs >2 m high. Typical of coastal areas and tall heaths up to 6 metres in height. May be dominated by Banksia, Melaleuca or Leptospermum with heights of up to 6 metres.
	Open scrub	14	Shrubs greater than 2 m high; 10%–30% foliage cover with a mixed species composition.
E Mallee/Mulga	Tall shrubland	15	Vegetation dominated by low trees or tall shrubs (especially eucalypts and acacias) some with a multi-stemmed habit (mallee); usually greater than 2 m in height; <30% foliage cover. Understorey of widespread dense low shrubs or sparse grasses and generally found in the arid and semi-arid zones, but not within the rangelands.
F Rainforest	Tall closed forest Closed forest Low closed forest	16 17 18	Trees >90% foliage cover; understorey may contain a large number of species with a variety of heights. Not dominated by eucalypt species.

(continued)

Plot	9 & 10	Classification or Exclusion Clause	Grassland Type G

Location: To the north, south, east and west external to the subject site in agricultural lands, small unmanaged lots central to the site. small areas central to the subject site.

Description: Grazed paddocks of mixed pasture and unmanaged lots with introduced species such as Kikuyu, Hibbertia, Conyza etc.

Average vegetation height: 200-300mm.

Vegetation Coverage: <10% trees.

Available fuel loading: <4.5t/ha.

Effective slope:

Plot 9: Flat/upslope.

Plot 10: Downslope >0 to 5 degrees.

Photo Id 43: View to the west of Grassland Type G located to the west of the subject site along Chauvel Road.

Plot	7 & 8	Classification or Exclusion Clause	Forest Type A

Location: Located throughout the subject site.

Dominant species & description: Mixed Jarrah, Wandoo, Casuarina and Marri Low open forest, Planted Eucalypts (introduced) and bluegum/pine plantations. Overstorey consists of interconnected canopy of eucalyptus with mid storey species of juvenile trees, Banksia, Acacia, Kunzea, Hibbertia, Melaleuca and Leucopogon. Understorey of Kangaroo paws, native sedges and herbs. Multi-layered.

Average vegetation height: 12-16m.

Vegetation Coverage: >30-70% foliage cover.

Available fuel loading: 25-35 t/ha.

Effective slopes:

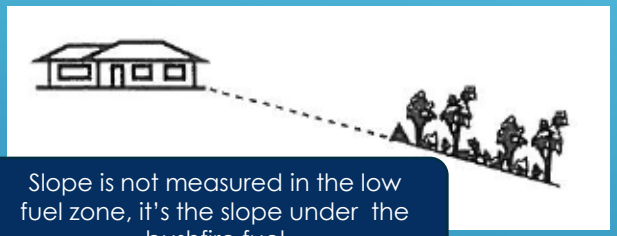
Plot 7: Flat/upslope.

Plot 8: D/S > 0 to 5 degrees.

Photo Id 28: View of Plot 7 Blue gums located in the south east of the subject site.

AS3959-2018 Measures Bushfire Fuels

- Once vegetation structure and slope is classified uses a matrix to determine the impact of bushfire onto a building or subject site.
- Fire Danger Index (FDI) of 80.



Slope is not measured in the low fuel zone, it's the slope under the bushfire fuel

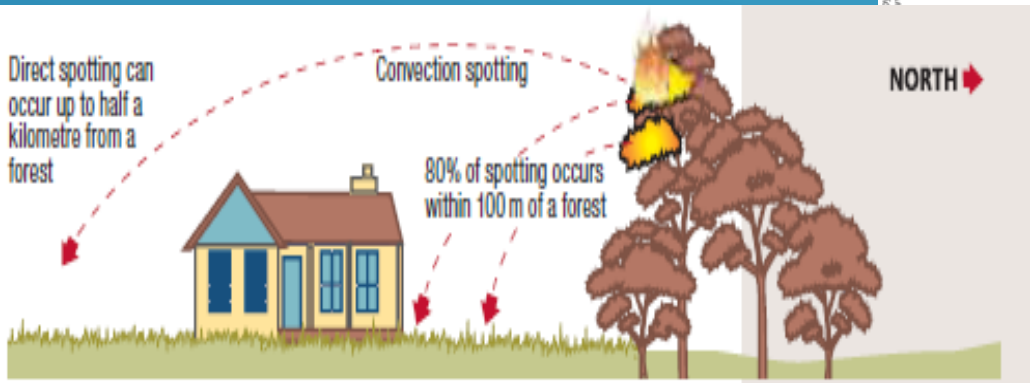
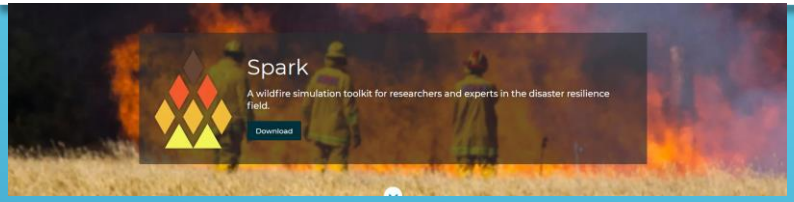


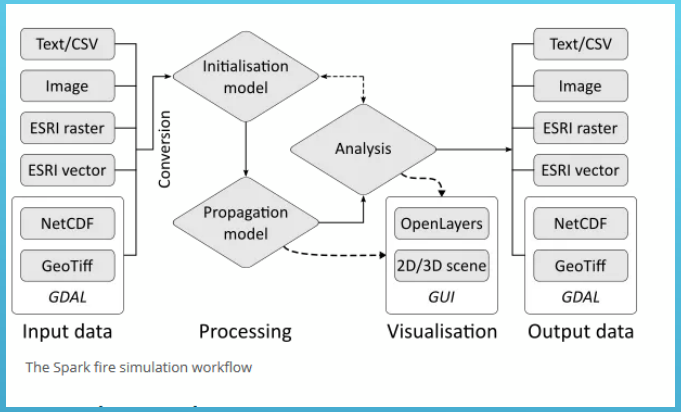
TABLE 2.5

DETERMINATION OF BUSHFIRE ATTACK LEVEL (BAL)—FDI 80 (1090 K)

Vegetation classification	BALs				
	BAL—FZ	BAL—40	BAL—29	BAL—19	BAL—12.5
	Distance (m) of the site from the predominant vegetation class				
	All upslopes and flat land (0 degrees)				
A. Forest	<16	16–<21	21–<31	31–<42	42–<100
B. Woodland	<10	10–<14	14–<20	20–<29	29–<100
C. Shrubland	<7	7–<9	9–<13	13–<19	19–<100
D. Scrub	<10	10–<13	13–<19	19–<27	27–<100
E. Mallee/Mulga	<6	6–<8	8–<12	12–<17	17–<100
F. Rainforest	<6	6–<9	9–<13	13–<19	19–<100
G. Grassland	<6	6–<8	8–<12	12–<17	17–<50
	Downslope >0 to 5 degrees				
A. Forest	<20	20–<27	27–<37	37–<50	50–<100
B. Woodland	<13	13–<17	17–<25	25–<35	35–<100
C. Shrubland	<7	7–<10	10–<15	15–<22	22–<100
D. Scrub	<11	11–<15	15–<22	22–<31	31–<100
E. Mallee/Mulga	<7	7–<9	9–<13	13–<20	20–<100
F. Rainforest	<8	8–<11	11–<17	17–<24	24–<100
G. Grassland	<7	7–<9	9–<14	14–<20	20–<50
	Downslope >5 to 10 degrees				
A. Forest	<26	26–<33	33–<46	46–<61	61–<100
dland	<16	16–<22	22–<31	31–<43	43–<100
bland	<8	8–<11	11–<17	17–<25	25–<100
b	<12	12–<17	17–<24	24–<35	35–<100
ee/Mulga	<7	7–<10	10–<15	15–<23	23–<100
forest	<11	11–<15	15–<22	22–<31	31–<100
sland	<8	8–<10	10–<16	16–<23	23–<50
	Downslope >10 to 15 degrees				
st	<33	33–<42	42–<56	56–<73	73–<100
dland	<21	21–<28	28–<39	39–<53	53–<100
bland	<9	9–<13	13–<19	19–<28	28–<100
b	<14	14–<19	19–<28	28–<39	39–<100
ee/Mulga	<8	8–<11	11–<18	18–<26	26–<100
forest	<14	14–<19	19–<28	28–<39	39–<100
sland	<9	9–<12	12–<18	18–<26	26–<50
	Downslope >15 to 20 degrees				
st	<42	42–<52	52–<68	68–<87	87–<100
dland	<27	27–<35	35–<48	48–<64	64–<100
bland	<10	10–<15	15–<22	22–<31	31–<100
D. Scrub	<15	15–<21	21–<31	31–<43	43–<100
E. Mallee/Mulga	<9	9–<13	13–<20	20–<29	29–<100
F. Rainforest	<18	18–<25	25–<36	36–<48	48–<100
G. Grassland	<10	10–<14	14–<21	21–<30	30–<50

CSIRO SPARK Modelling

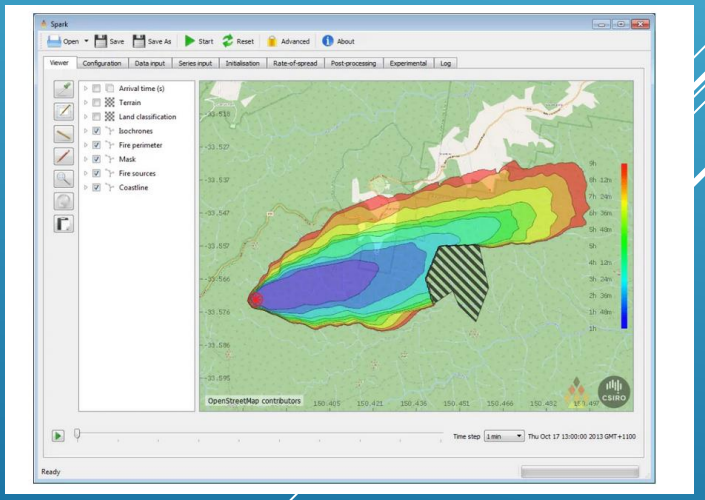




The Spark fire simulation workflow

SPARK is s system developed by CSIRO that enables the simulation of hours of fire spread at a landscape scale.

- System based on a level set propagation model allowing simulation of any number of distinct fire fronts.
- BRIGS used SPARK to assess the likelihood and consequence of bushfire attack on life and property.
- Undertaken on each precinct for
  - Landscape risk – how large is the bushfire catchment of the precinct;
  - Locality risk – quantity and degree of the bushfire hazard;
  - Building risk – AS3959 to assess amount of buildings at risk; and
  - Analysis of evacuation and refuge options – safer place options within the precinct based on a radiant heat flux of ≤.10kW/m^2.



How do we get people out

"Bushfire fatality data from 260 fire events from 1901 to 2011 analysed by CSIRO, shows that whilst late evacuation represents the primary activity taken at the time of death, there is a rising trend of fatalities occurring within structures (sheltering in place)"

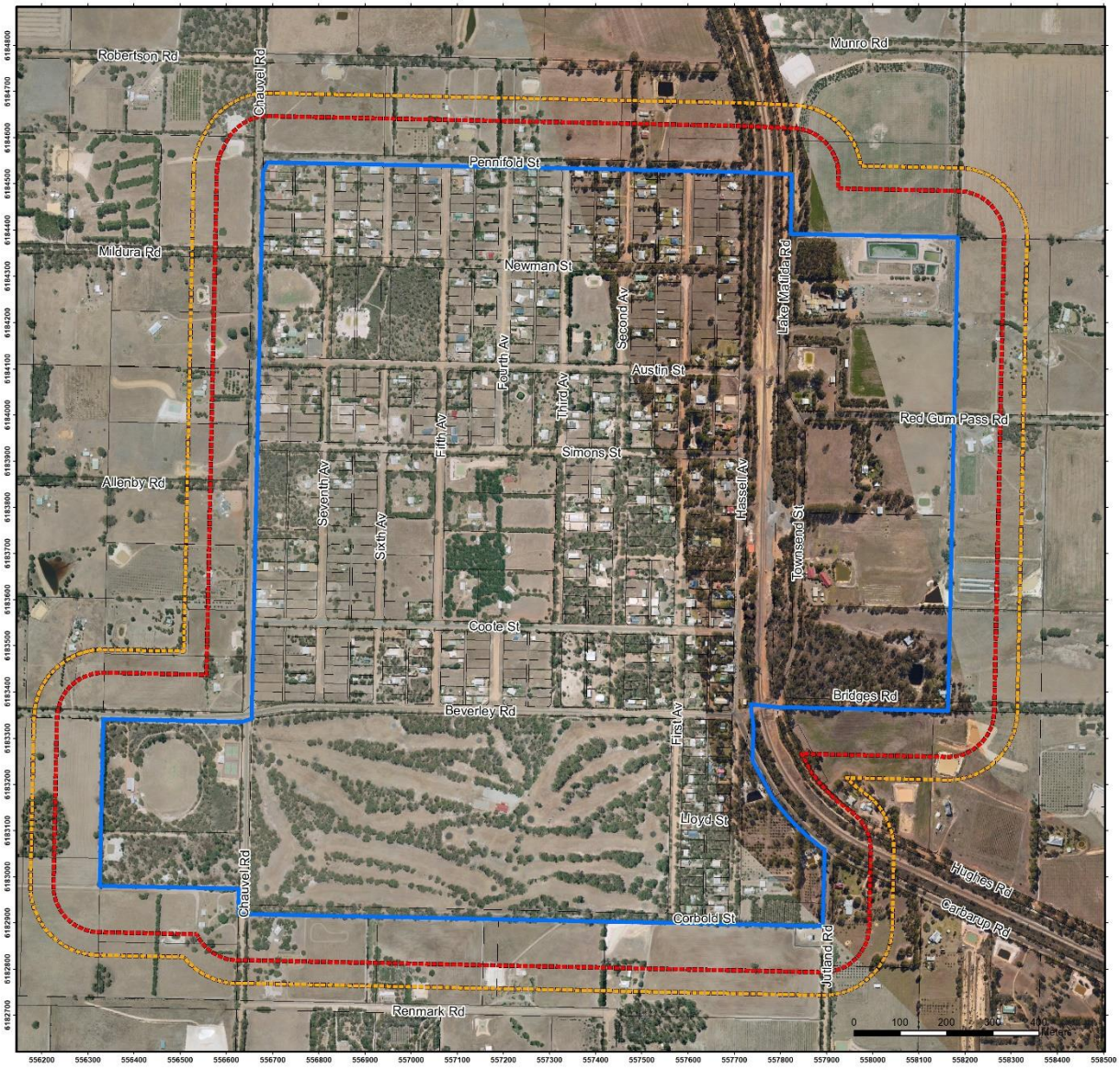
Need to:

- Examine evacuation travel times and routes. Bring together studies already done and build on what we don't know.
- If route justified do we have community refuge?
- Is our community prepared?
- Summer visitors prepared? Absentee land owners?

Bushfire Risk Management System

- BAL Contour plans complimentary to the BRMS Process
- Data integration
- Works program more detailed in urban areas
- Does not identify evacuation requirements

Kendenup Precinct



This BAL Plan was prepared by:
Kathryn Kinnear, Bio Diverse Solutions
Accreditation No: BPAD30784
Jurisdiction: Level 2 - WA

BPAD Bushfire Planning & Design Accredited Practitioner Level 2

BIO DIVERSE SOLUTIONS
29 Hercules Crescent
Albany, WA 6330
Australia
Tel: 08 9842 1575
Fax: 08 9842 1575

Overview Map Scale 1:100,000

Legend

- Subject Site
- 100m Assessment Boundary
- 150m Assessment Boundary
- Cadastre

Scale
1:8,000 @ 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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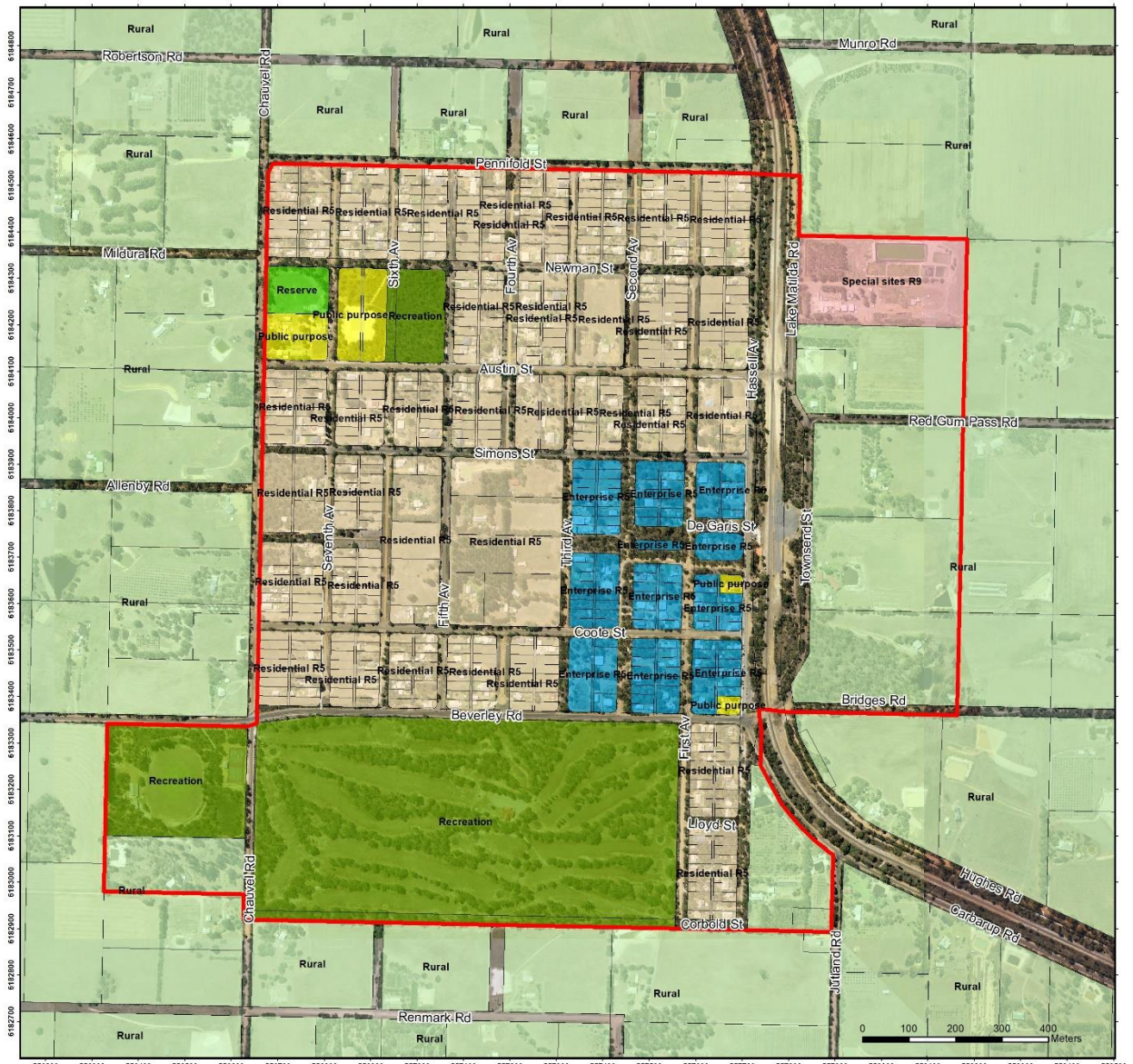
Kendenup
Mount Barker, WA 6324

Figure 1. Kendenup Townsite

BAL Assessor	QA Check	Drawn by
KK	BT	SA
STATUS	FILE	DATE
FINAL	DFES001	24/07/2020

Kendenup Precinct and land tenure



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Accreditation No: BPAD30794
Jurisdiction: Level 2 - WA

BPAD Bushfire Planning & Design Accredited Practitioner Level 2

BIO DIVERSE SOLUTIONS

29 Hercules Crescent
Albany, WA 6330
Australia
Tel: 08 9842 1575
Fax: 08 9842 1575

Overview Map Scale 1:100,000

Legend

- Subject Site
- Cadastre

LPS Zoning

- Residential R5 (483 Lots)
- Enterprise R5 (97 Lots)
- Public purpose
- Recreation
- Reserve
- Rural
- Special sites R9

Scale
1:8,000 @ 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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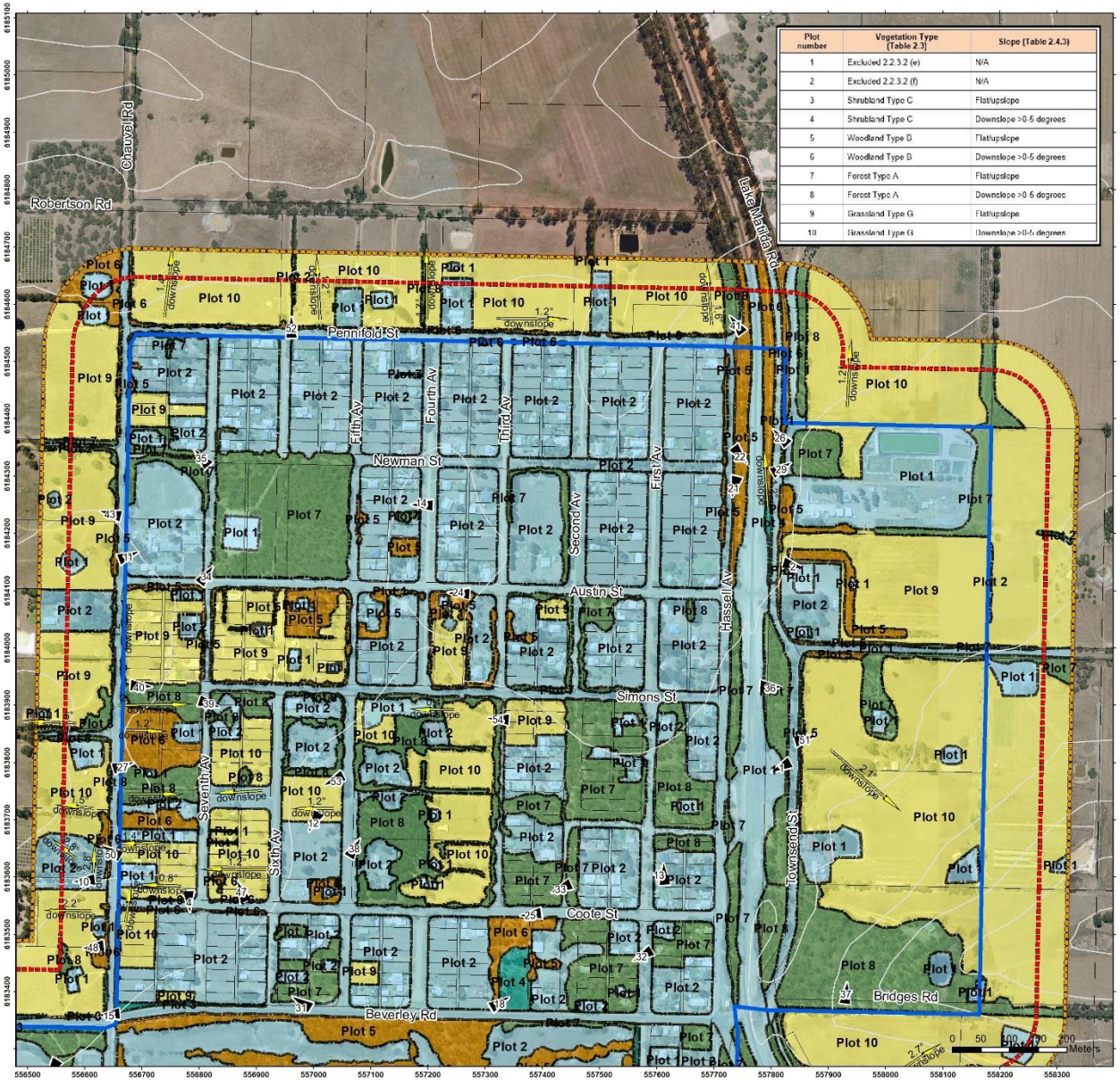
Figure 2. Land Tenure & Zoning

BAL Assessor	QA Check	Drawn by
-	KK	SA
STATUS	FILE	DATE
FINAL	DFES001	24/07/2020

Vegetation Mapping Kendenup Precinct to AS3959



Plot number	Vegetation Type (Table 2.3)	Slope (Table 2.4.3)
1	Excluded 2.2.3.2 (e)	N/A
2	Excluded 2.2.3.2 (f)	N/A
3	Shrubland Type C	Flat/upslope
4	Shrubland Type C	Downslope >0-5 degrees
5	Woodland Type B	Flat/upslope
6	Woodland Type B	Downslope >0-5 degrees
7	Forest Type A	Flat/upslope
8	Forest Type A	Downslope >0-5 degrees
9	Grassland Type G	Flat/upslope
10	Grassland Type G	Downslope >0-5 degrees

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29 Hercules Crescent
Albany, WA 6330
Australia
Tel: 08 9842 1575
Fax: 08 9842 1575

Overview Map Scale 1:100,000

Legend

- Subject Site
- 100m Assessment Boundary
- 150m Assessment Boundary
- Cadastre
- 5m Contours
- Slopes Degrees
- Photo Point

Vegetation

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

Scale
1:6,500 @ 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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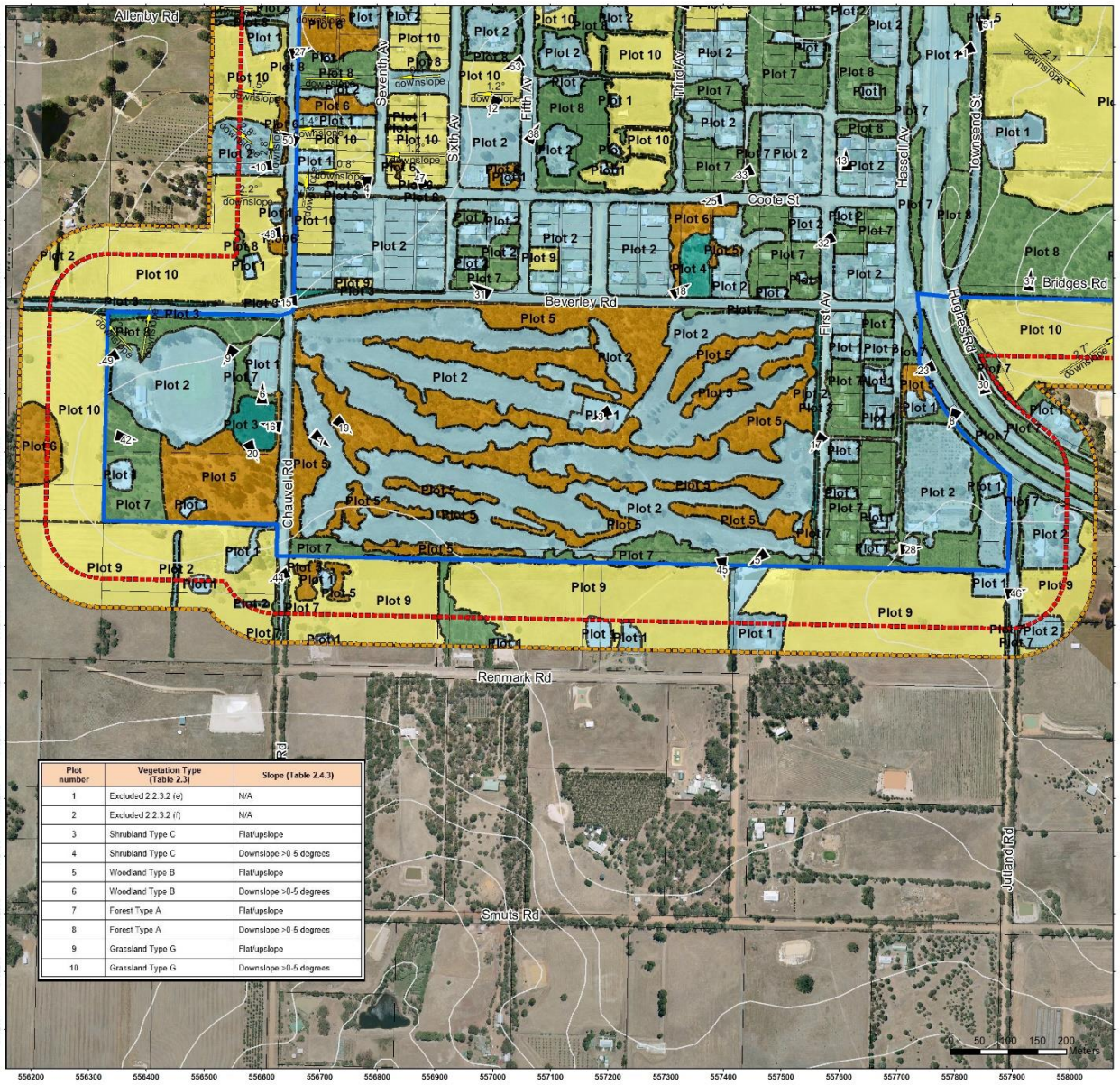
Figure 3 - Vegetation Classes (North)

BAL Assessor	QA Check	Drawn by
KK	BT	SA
STATUS	**FILE**	**DATE**
FINAL	DFES001	18/12/2019

Vegetation Mapping Kendenup Precinct to AS3959



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1	Excluded 2.2.3.2 (e)	N/A
2	Excluded 2.2.3.2 (f)	N/A
3	Shrubland Type C	Flat/upslope
4	Shrubland Type C	Downslope >0-5 degrees
5	Woodland Type B	Flat/upslope
6	Woodland Type B	Downslope >0-5 degrees
7	Forest Type A	Flat/upslope
8	Forest Type A	Downslope >0-5 degrees
9	Grassland Type G	Flat/upslope
10	Grassland Type G	Downslope >0-5 degrees

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Jurisdiction: Level 2 - WA

BPAD Bushfire Planning & Design Accredited Practitioner Level 2

Bio Diverse Solutions
29 Hercules Crescent
Albany, WA 6330
Australia
Tel: 08 9842 1575
Fax: 08 9842 1575

Overview Map Scale 1:100,000

Legend

- Subject Site
- 100m Assessment Boundary
- 150m Assessment Boundary
- Cadastre
- 5m Contours
- Slopes Degrees
- Photo Point

Vegetation

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

Scale
1:6,500 @ 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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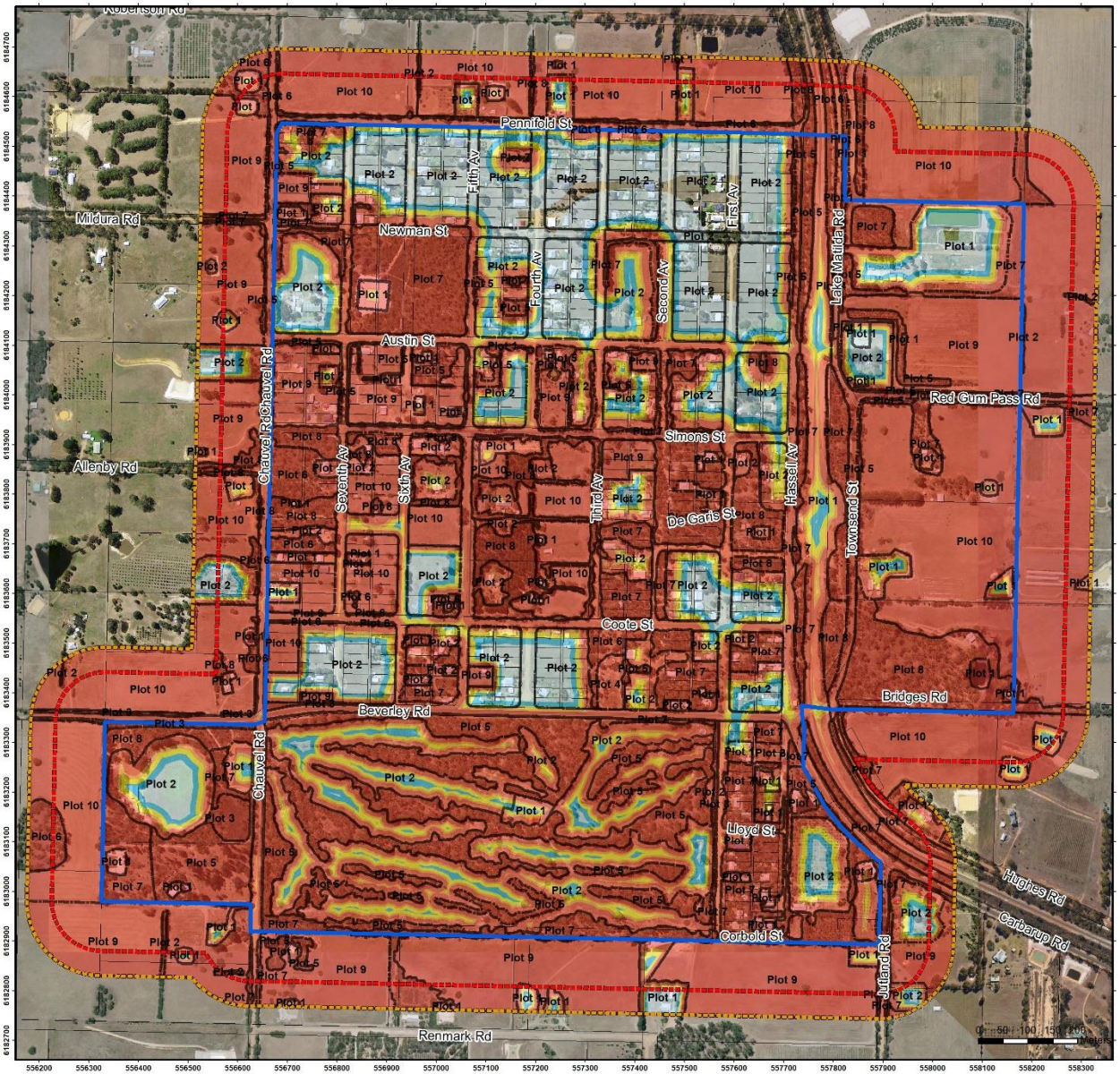
Figure 4 - Vegetation Classes (South)

BAL Assessor	QA Check	Drawn by
KK	BT	SA
STATUS	**FILE**	**DATE**
FINAL	DFES001	18/12/2019

BAL Contour Plan – Kendenup Precinct



This BAL Plan was prepared by:
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Accreditation No: BPAD30794
Jurisdiction: Level 2 - WA

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BIO DIVERSE SOLUTIONS

29 Hercules Crescent
Albany, WA 6330
Australia
Tel: 08 9842 1575
Fax: 08 9842 1575

Overview Map Scale 1:100,000

Legend

- Subject Site
- 100m Assessment Boundary
- 150m Assessment Boundary
- Cadastre

BAL Contours

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

Scale
1:7,500 @ 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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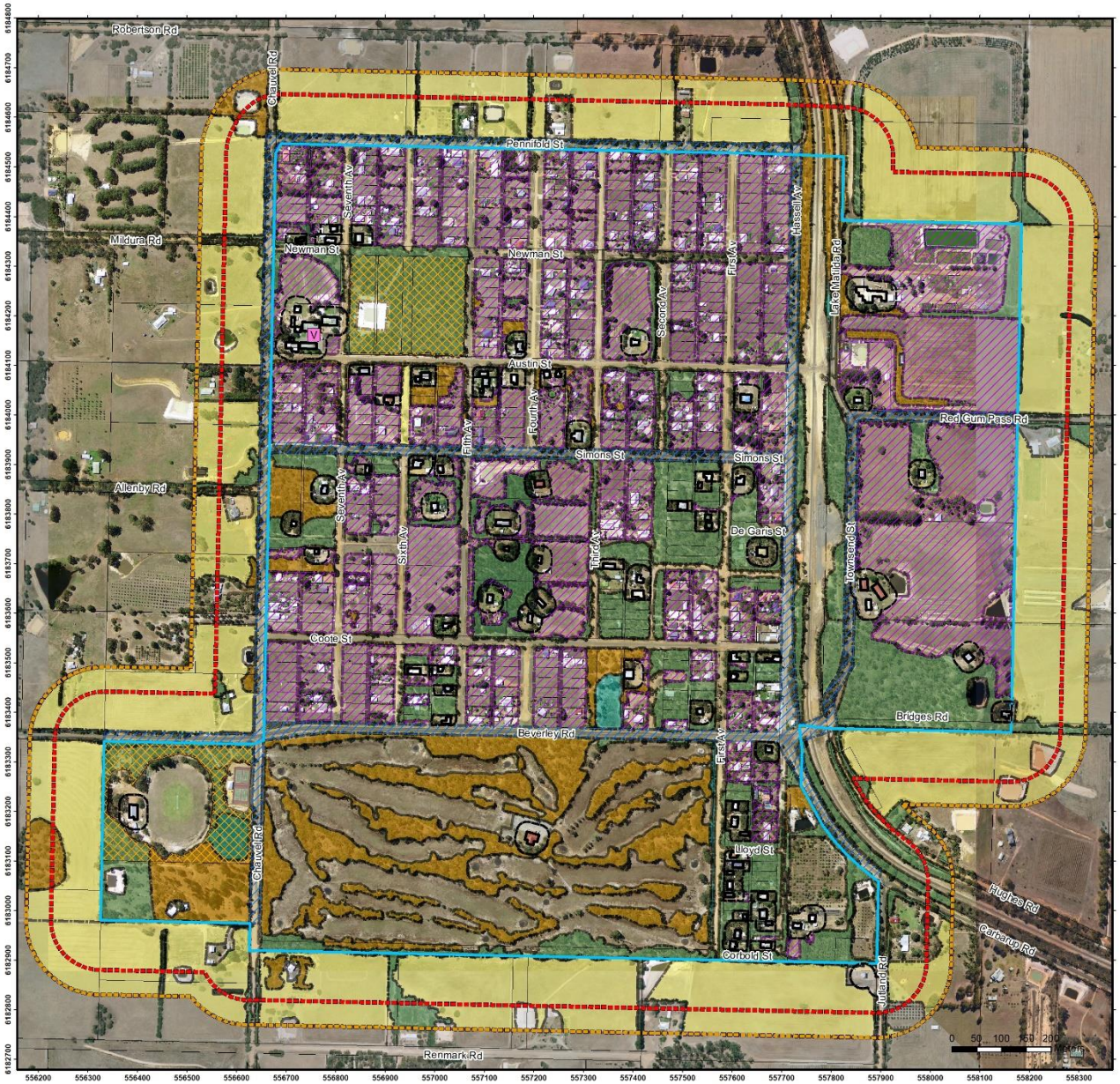
Mount Barker, WA 6323

Figure 5 - BAL Contour

BAL Assessor	QA Check	Drawn by
KK	BT	SA
STATUS	FILE	DATE
FINAL	DFES001	10/01/2020

Works Program Mapping



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BPAD Bushfire Planning & Design Accredited Practitioner Level 2
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29 Hercules Crescent
Albany, WA 6330
Australia
Tel: 08 9842 1575
Fax: 08 9842 1575

Overview Map Scale 1:100,000

Legend

- Subject Site
- 100m Assessment Boundary
- 150m Assessment Boundary
- Cadastre
- Vulnerable Land Use
- Existing Dwelling
- BPZ as per BFMN
- Prescribed Burn
- Fuel Reduce Crown Land
- Fuel Reduce Grassland <20Ha as per BFMN

Vegetation

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

Scale
1:7,500 @ A3
GDA MGA 94 Zone 50

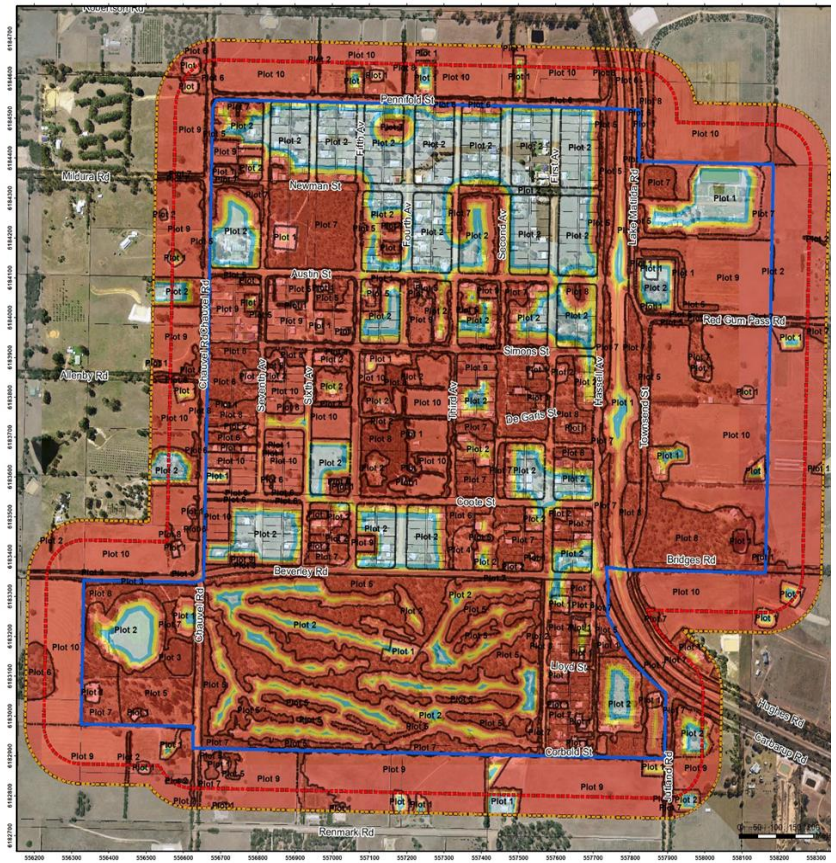
Data Sources
Aerial Imagery: WA Now, Landgate Subscription Imagery
Cadastre, Relief Contours and Roads: Landgate 2017
IRIS Road Network: Main Roads Western Australia 2017
Overview Map: World Topographic map service, ESRI 2012

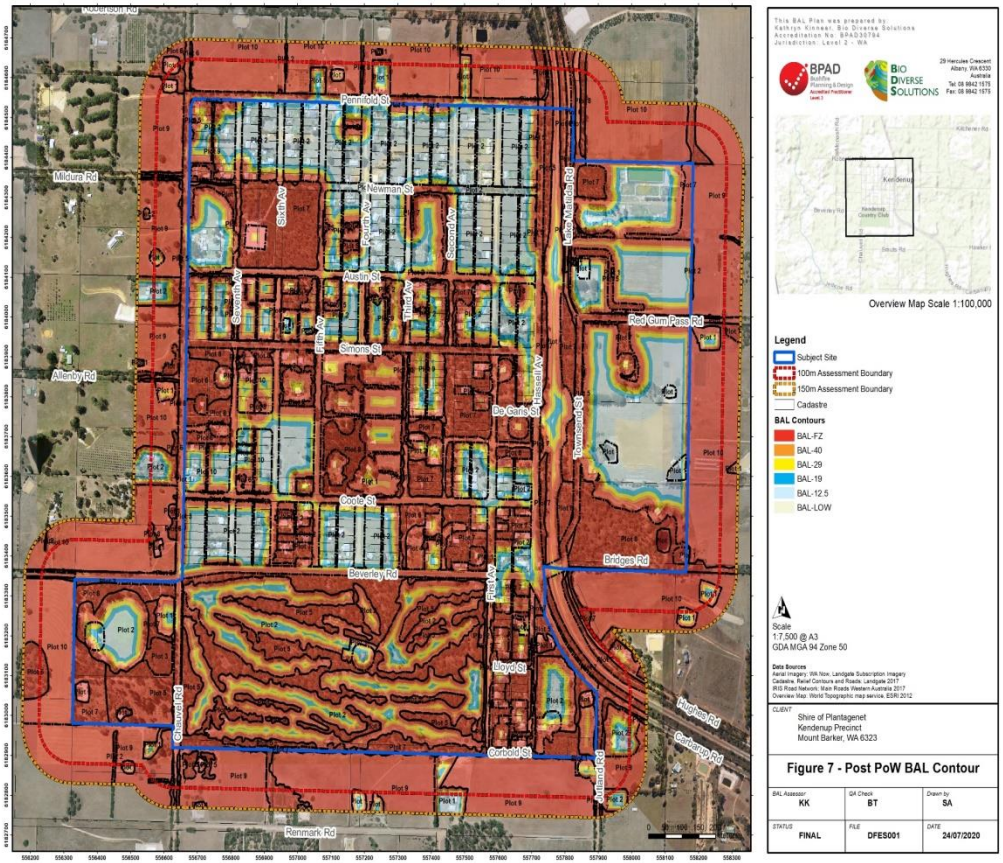
CLIENT
Shire of Plantagenet
Kendenup Precinct
Mount Barker, WA 6323

Figure 6. Program of Works

BAL Assessor	QA Check	Drawn by
KK	BT	SA
STATUS	FILE	DATE
FINAL	DFES001	23/07/2020

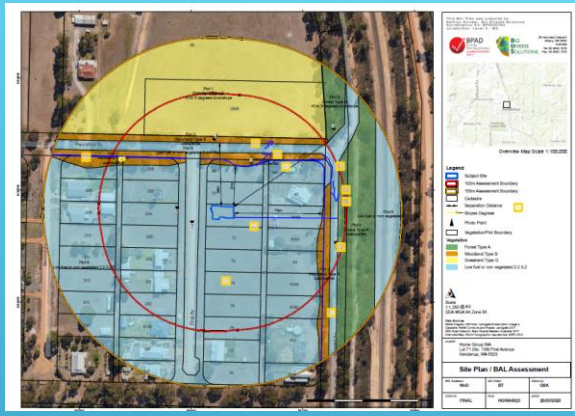
BAL Contour Plan Post Program of Works





Program of Works

- Applying the SoP Bush Fire Mitigation Notice to Kendenup on private property – consider low fuel to whole of lots, specifically low fuel on lots <2500m2
- Undertake review and update to the BFMN to reflect current terminology and legal application.
- Apply BAL assessments for APZs on larger (>2500m^2) Special Residential lots to achieve an APZ compliant to BAL 29 or less
- Retrofitting buildings within the precinct to BAL and AS3959.
- Mechanical fuel reduction in road reserves with Beverley Road as a priority to assist in safe evacuation and egress into and exiting the precinct.
- Government agencies and private land owners (larger special residential lots) to consider small, cool burns to assist reduction of fuel loads on private property/reserves and managing of fuels adjacent to other residents and the primary school in the north west.
- A minimum of 20m APZ to surround the Kendenup Primary School (Vulnerable land use) and a standalone emergency evacuation plan to eb developed for the school in line with WAPC guidelines and SPP3.7.
- Linking future public roads, assigning Emergency Access Routes, Emergency Access Ways and Fire Service Access Routes for assisting in rapid flow of traffic in a bushfire emergency.
- Upgrading signage exiting the precinct for orderly evacuation of the precinct.
- Upgrading and/or maintaining access to a minimum of trafficable standards and ensuring turnaround areas are provided to WAPC guidelines technical standards.



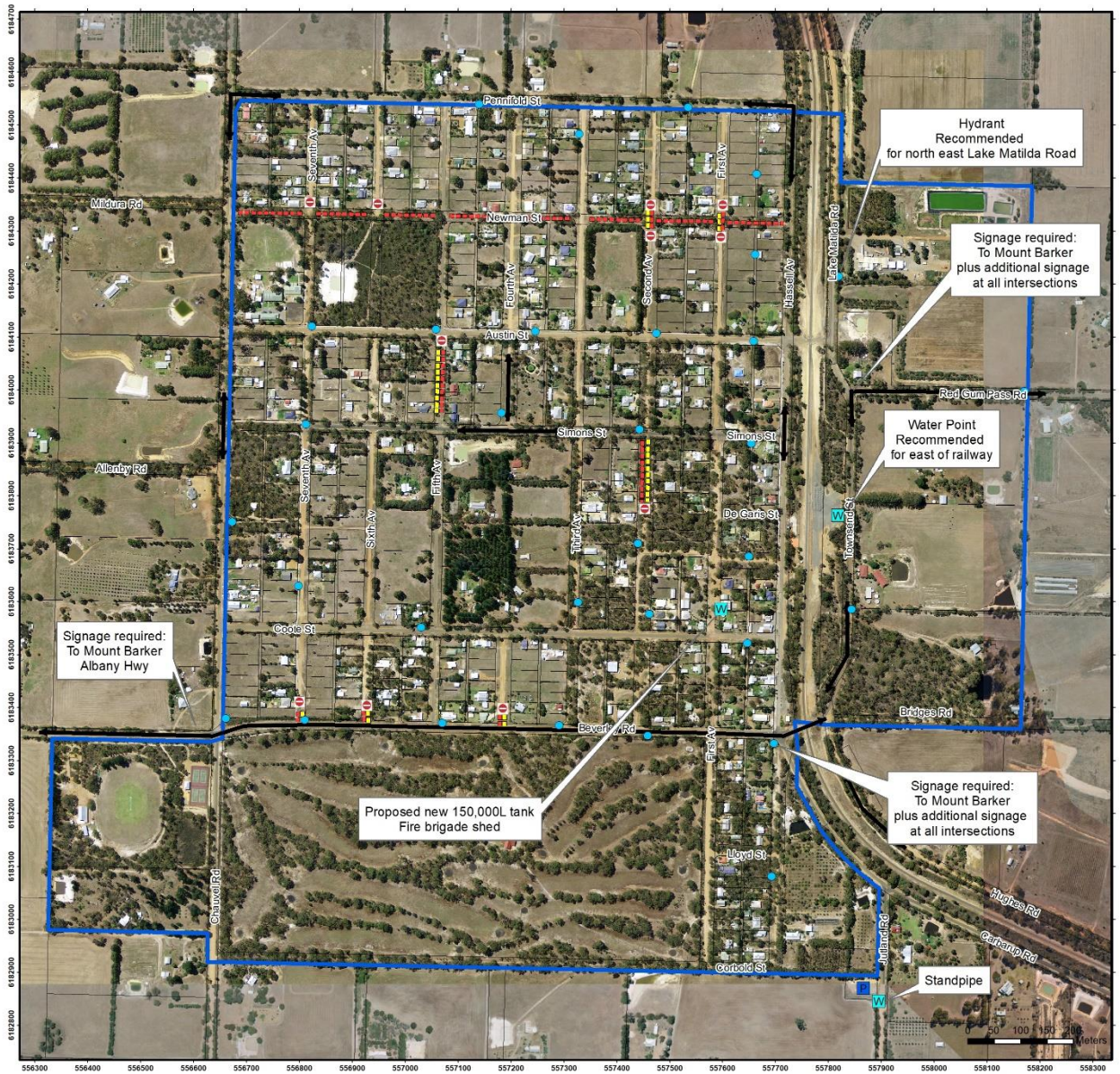
Project BAL Build

Building a BAL-rated house, like this BAL 19 home, is not as expensive as often thought. Credit: Lee Griffith.

How much does it really cost to build homes that will survive bushfire?

A new West Australian study by Kathryn Kinnear (Bio Diverse Solutions) and Julie de Jong (H + H Architects), Project BAL Build, has sought to address the misinformation and confusion about the cost of building bushfire-resistant houses.

Access and Water



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

BPAD Bushfire Planning & Design Accredited Practitioner Level 2
BIO DIVERSE SOLUTIONS
29 Hercules Crescent
Albany, WA 6330
Australia
Tel: 08 9842 1575
Fax: 08 9842 1575

Overview Map Scale 1:100,000

Legend

- Subject Site
- Cadastre
- Water Point
- Public Drinking Water Supply (PDWS)
- Dead_End_Road
- Emergency Access Routes (EAR)
- Fire Services Access (FSA)
- Emergency Access Way (EAW)

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

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Shire of Plantagenet
Kendenup Precinct
Mount Barker, WA 6323

Figure 8. Access and Water

BAL Assessor	QA Check	Drawn by
KK	BT	SA
STATUS	**FILE**	**DATE**
FINAL	DFES001	23/07/2020

Water.. Do we have it when we need it?

Precinct	Water infrastructure	Capacity	Location	Comments
Kendenup	Elevated Tank	200m3	Jutland Rd	Hydrant pressure Residential Supply - Supplied from Albany.

- Supply for fire Water sources into Kendenup are via a pipe and gravitated tank network into the reticulated scheme pipe and hydrant network.
- Suppression is through the standpipe located at Jutland Road.
- A model for water supply for bushfire preparedness is outlined in the proposed PACE model is shown below.

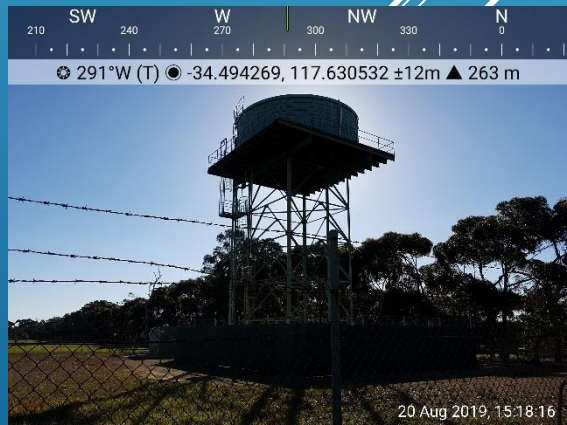
PACE

Primary: Jutland Road Stand pipe, Roadside Hydrants.

Alternative: Kendenup Brigade Shed proposed new 150,000L via roof top capture. Mount Barker Shire Depot and additional Hydrant on Lake Matilda Road.

Contingency: Water tanks east of the railway. Residents rainwater tanks, recommend an isolated supply on all residential lots.

Emergency: Dams adjacent to the townsite if available,



CSIRO – SPARK burn perimeter analysis

Figure 4: Burn perimeter analysis (ESE)

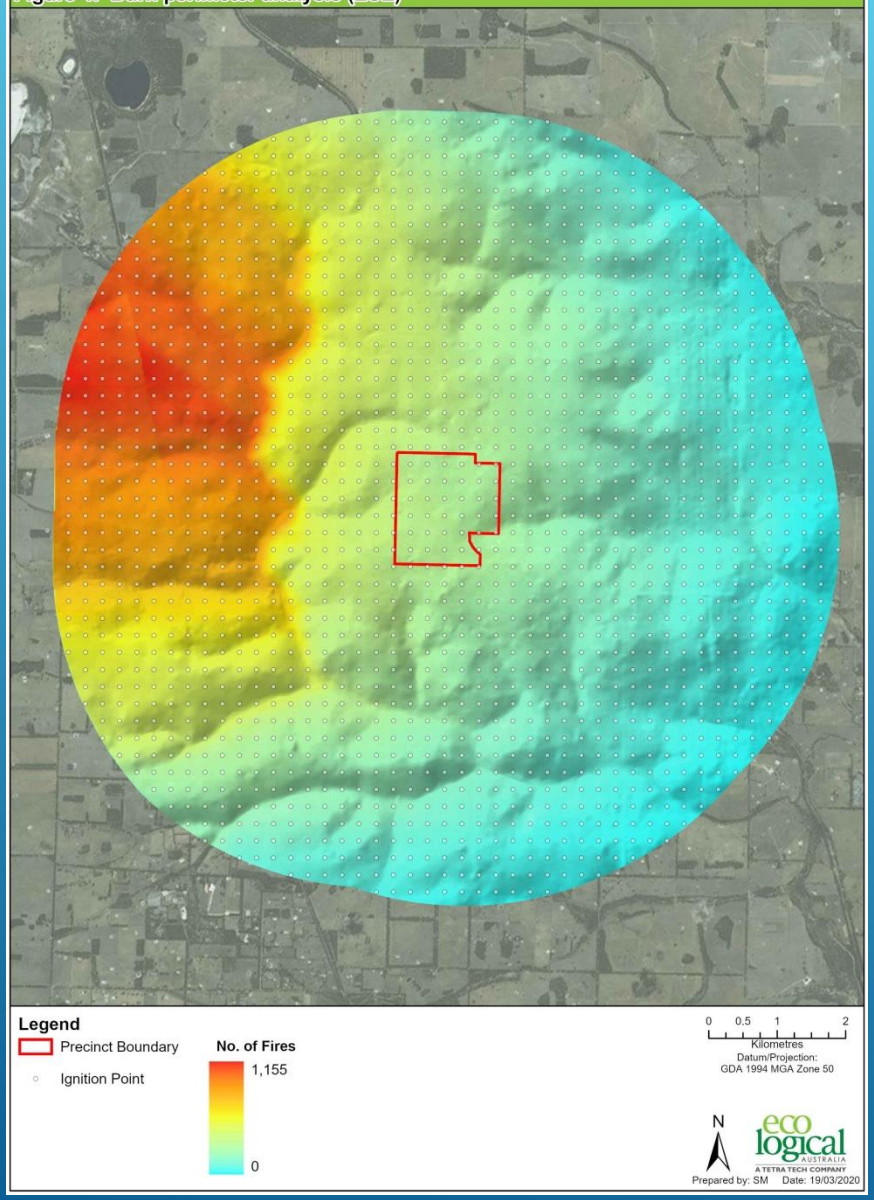
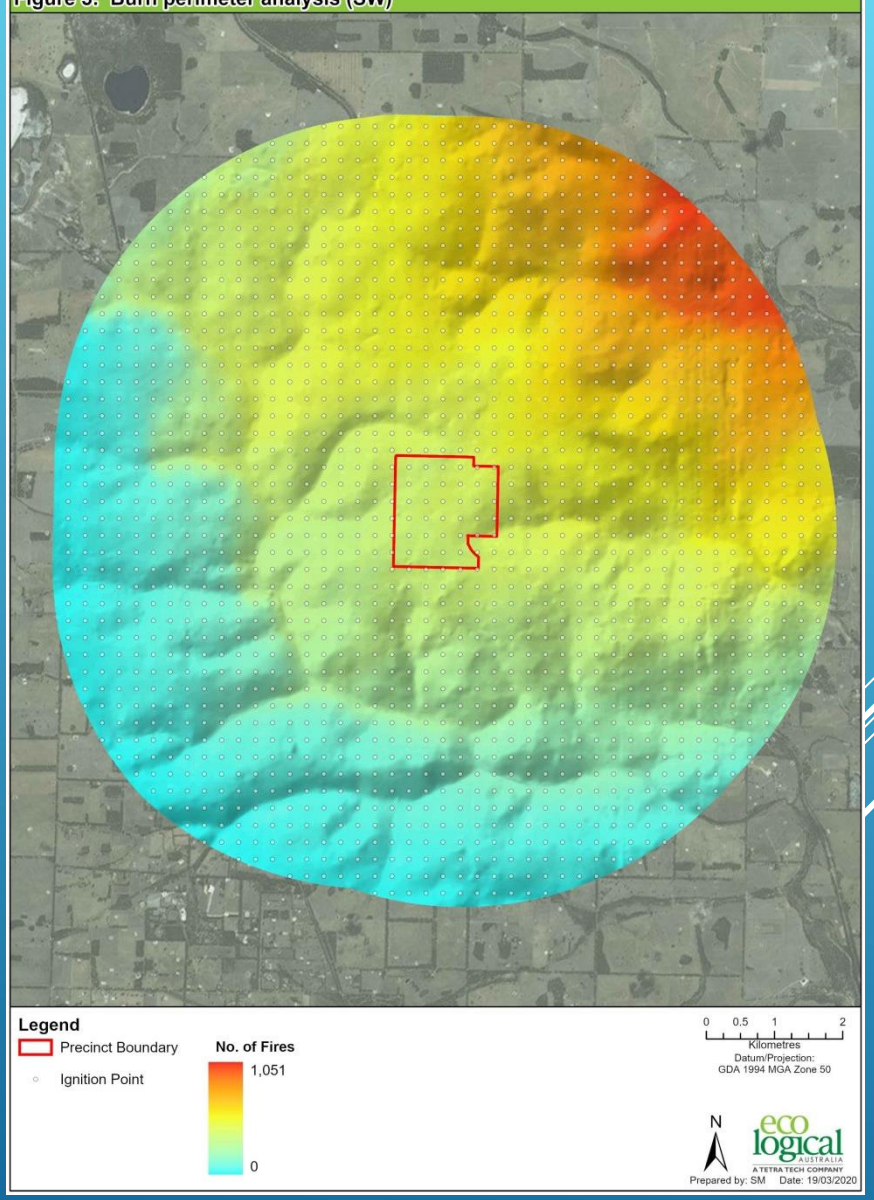
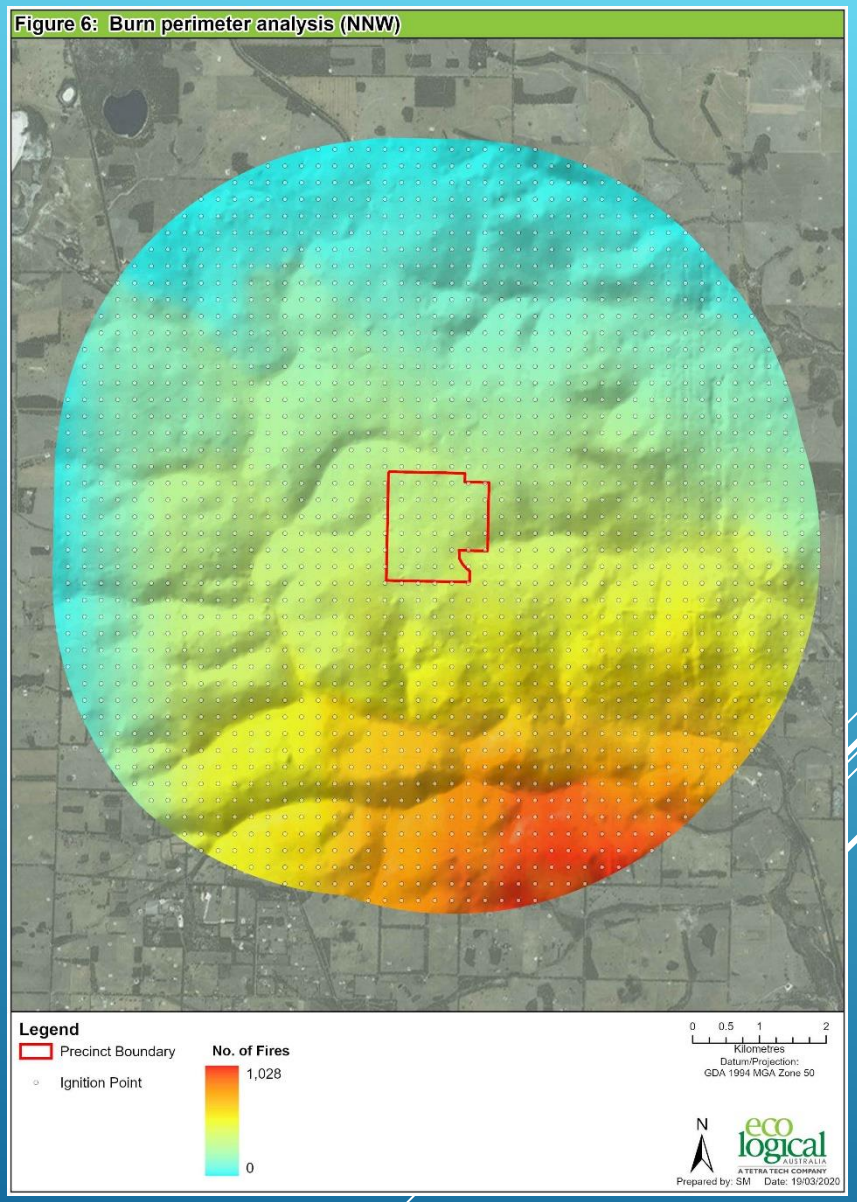


Figure 5: Burn perimeter analysis (SW)



CSIRO – SPARK burn perimeter analysis

- Fires spreading under a SW wind resulting in the largest impact to the precinct.
- The location of the precinct in an agricultural area, largely surrounded by semi-managed to unmanaged grasslands in all directions means that there are large fire catchments in virtually every direction.
- Given the nature of the bushfire fuels surrounding the precinct (i.e. primarily grassland with only limited pockets of wooded vegetation), while able to facilitate fast-moving fires, they are easier to mitigate through regular slashing and installation/maintenance of firebreaks.



CSIRO – SPARK bushfire rate of spread analysis

Figure 7: Bushfire rate of spread analysis (ESE)

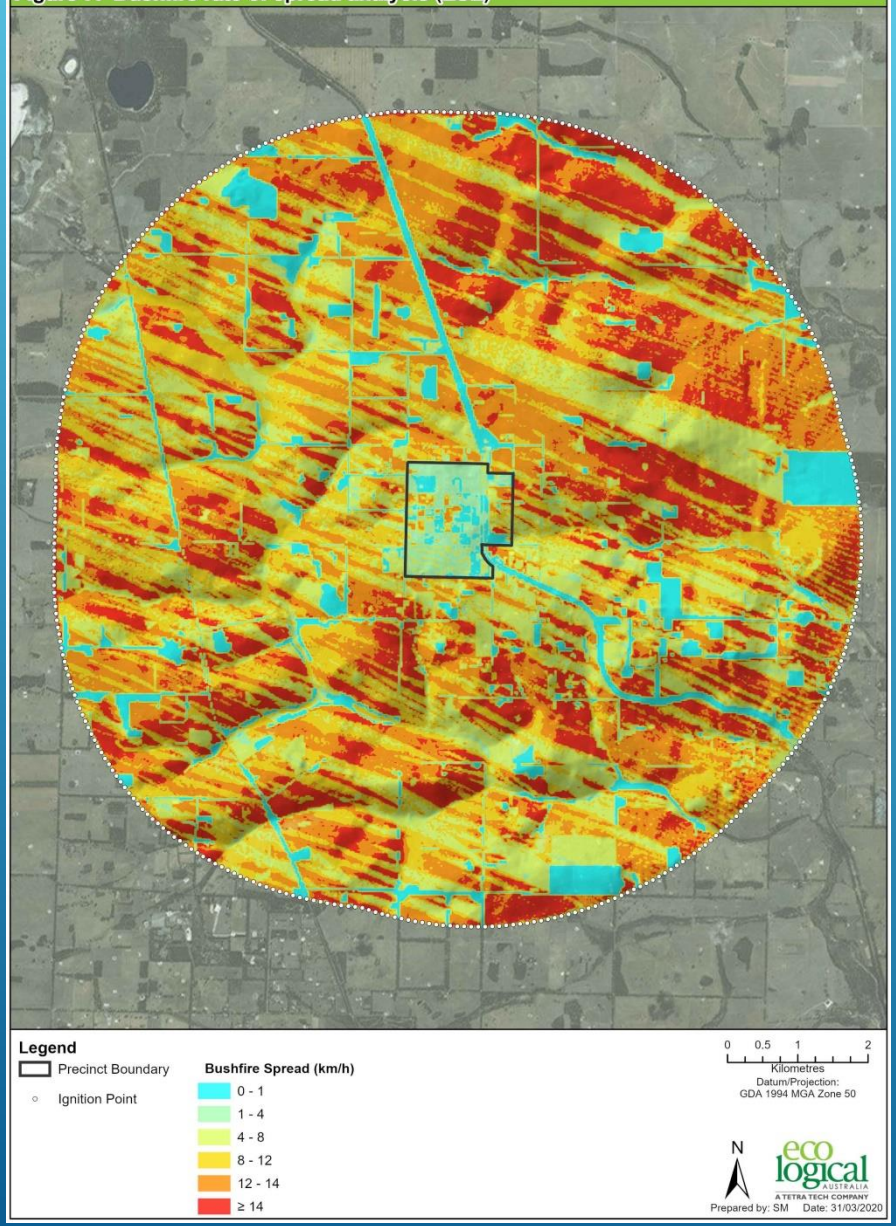
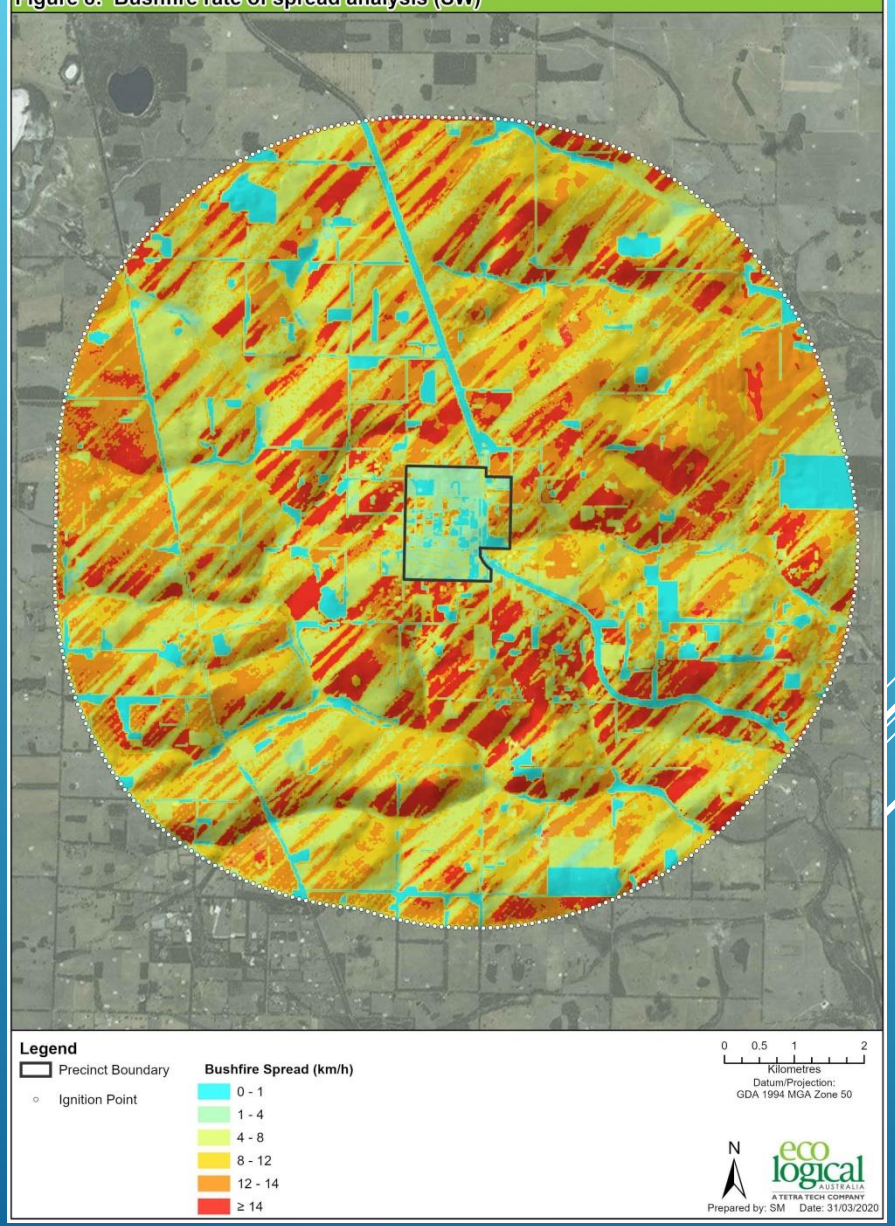
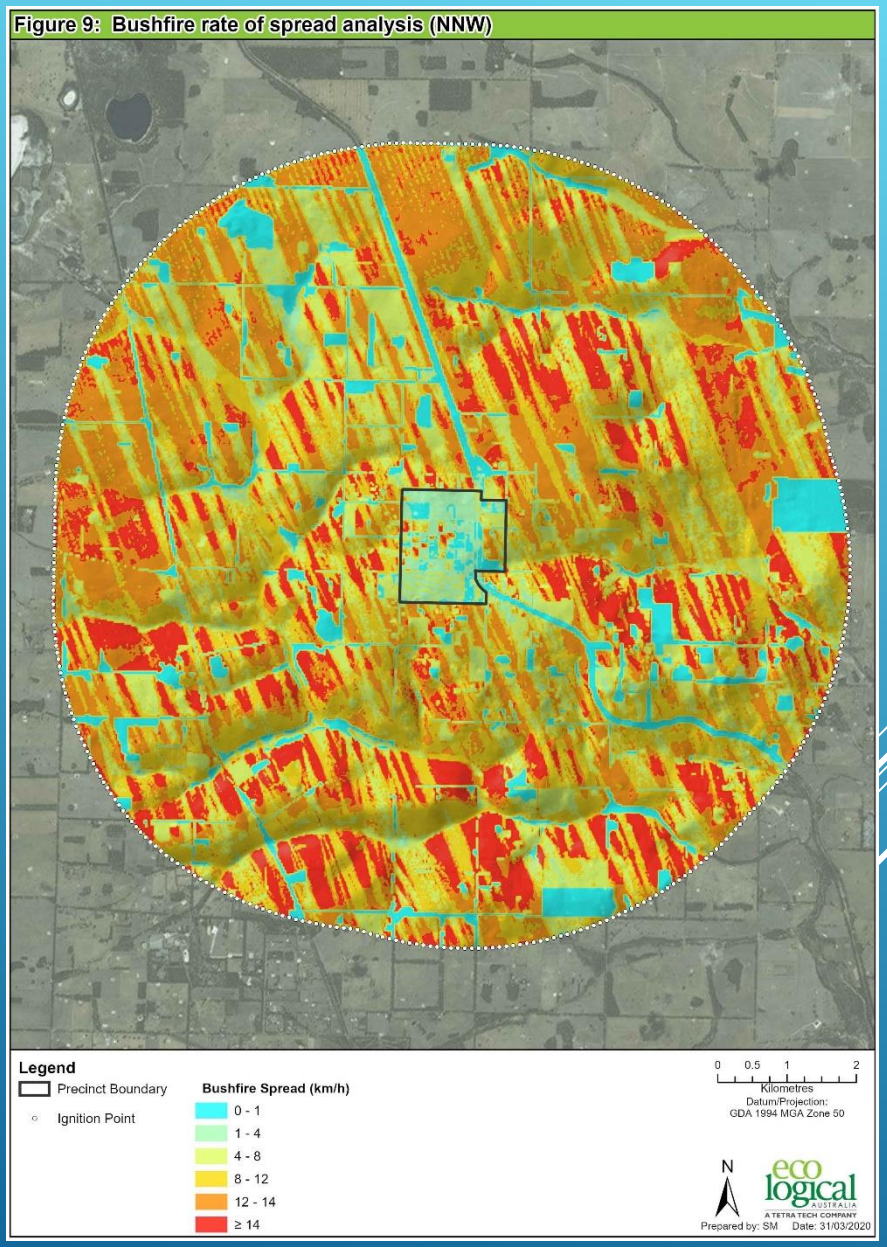


Figure 8: Bushfire rate of spread analysis (SW)



CSIRO – SPARK bushfire rate of spread analysis

- Bushfire rate of spread analysis undertaken in this project assess the potential bushfire spread and speed from different bushfire attack scenarios.
- Provides insights into the potential time to impact of assets within the precinct as well as the road network providing access.
- That fast rates of spread are observed across the landscape with orientation of the fast ‘bands’ related to the wind direction,
- The nature of the vegetation surrounding the precinct (i.e. predominantly grass fuels) allow for very fast fire spread.
- Historical fire spread and wind directions suggest that SW and NNW winds pose a higher risk to the precinct.
- The potentially very fast-moving grass fires modelled have the potential to cut off roads very quickly, thereby highlighting that offsite evacuation may not be appropriate for the precinct under all conditions.

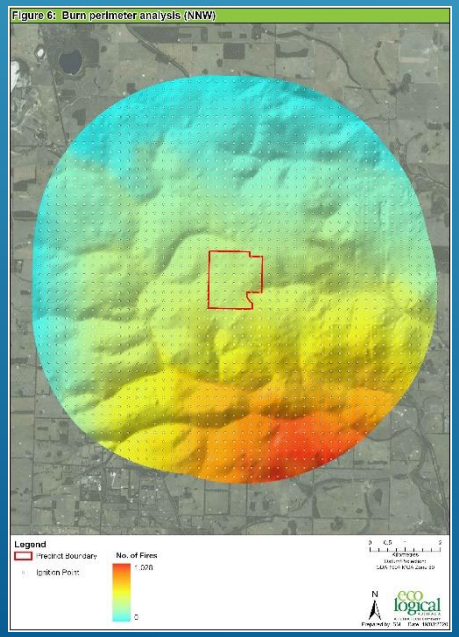


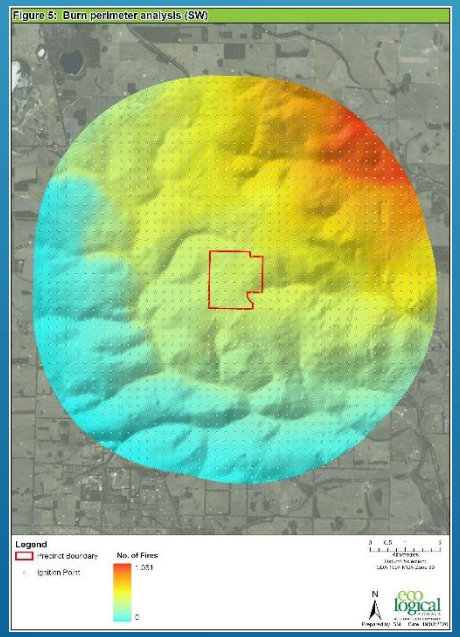
Combined burn perimeter and time to arrival analyses in Precinct

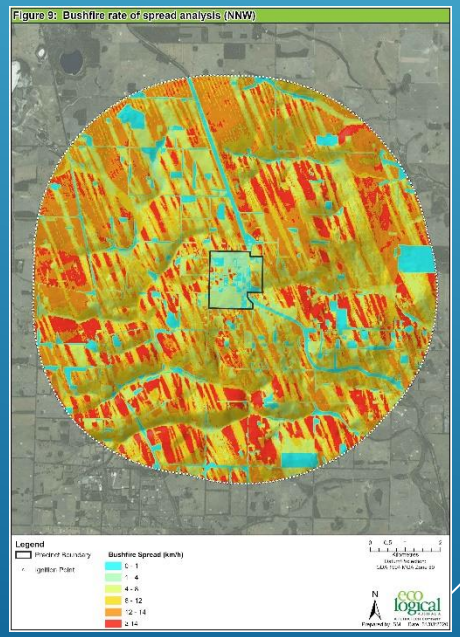
A summary of the interpretation of the results from both the burn perimeter and time to arrival analyses is provided below:

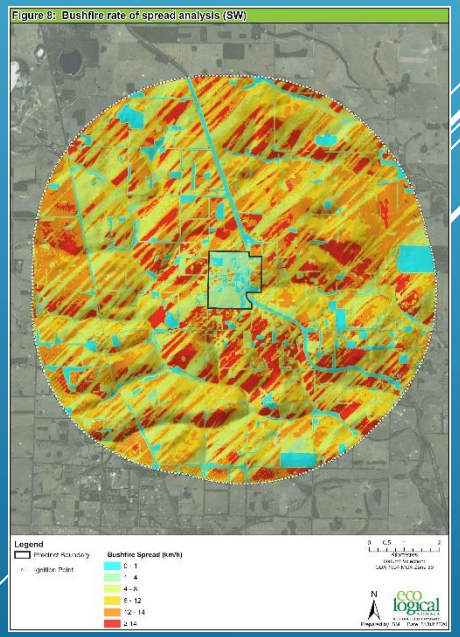
- The precinct is most at risk from fires spreading under a SW or NNW wind;
- Fires in the landscape are likely to be very fast moving when burning through grass fuels; and
- The modelled fast-moving grass fires have the potential to cut off roads very quickly, thereby highlighting that offsite evacuation may not be appropriate for the precinct under all conditions.

The results of the landscape risk assessment demonstrate the high level of bushfire risk the precinct is exposed to.









Locality risk for the Precinct

Figure 10: Bushfire intensity analysis (ESE)

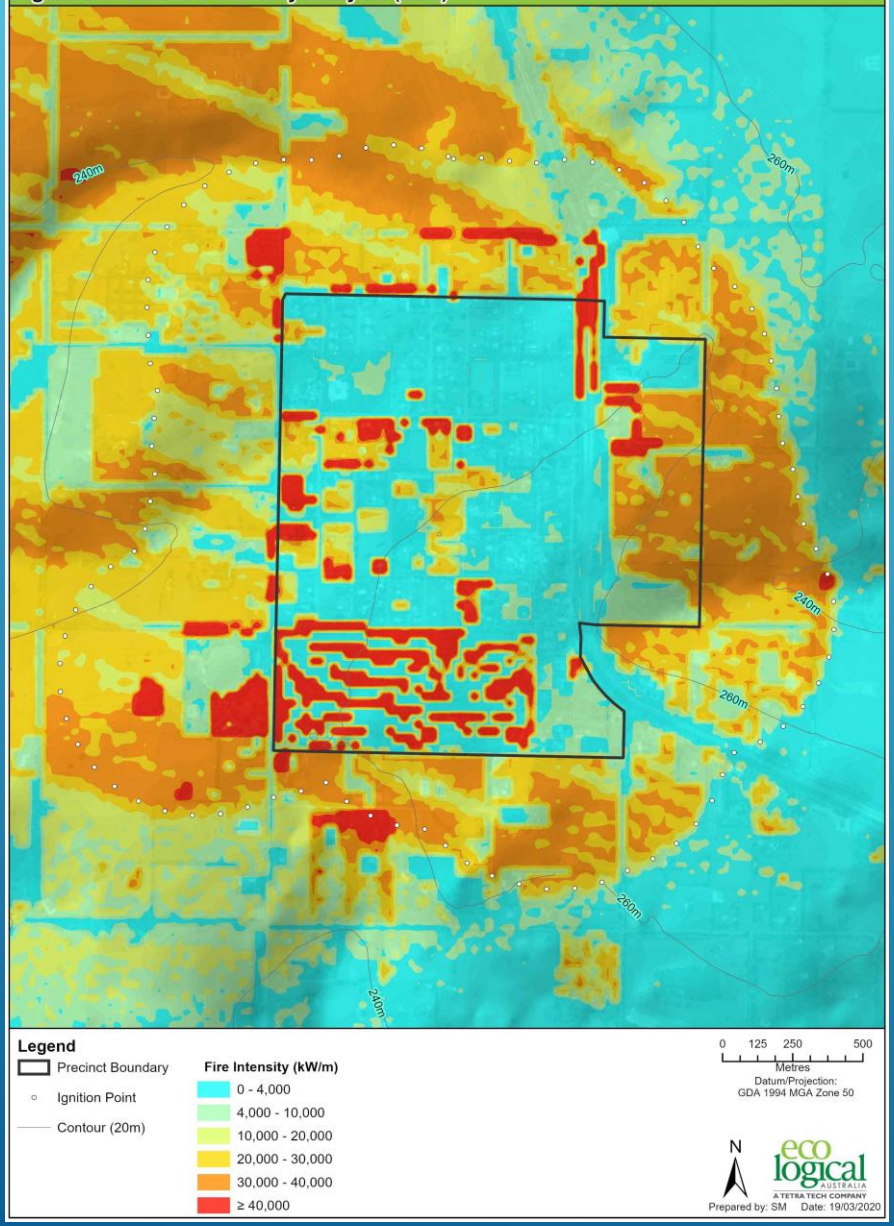
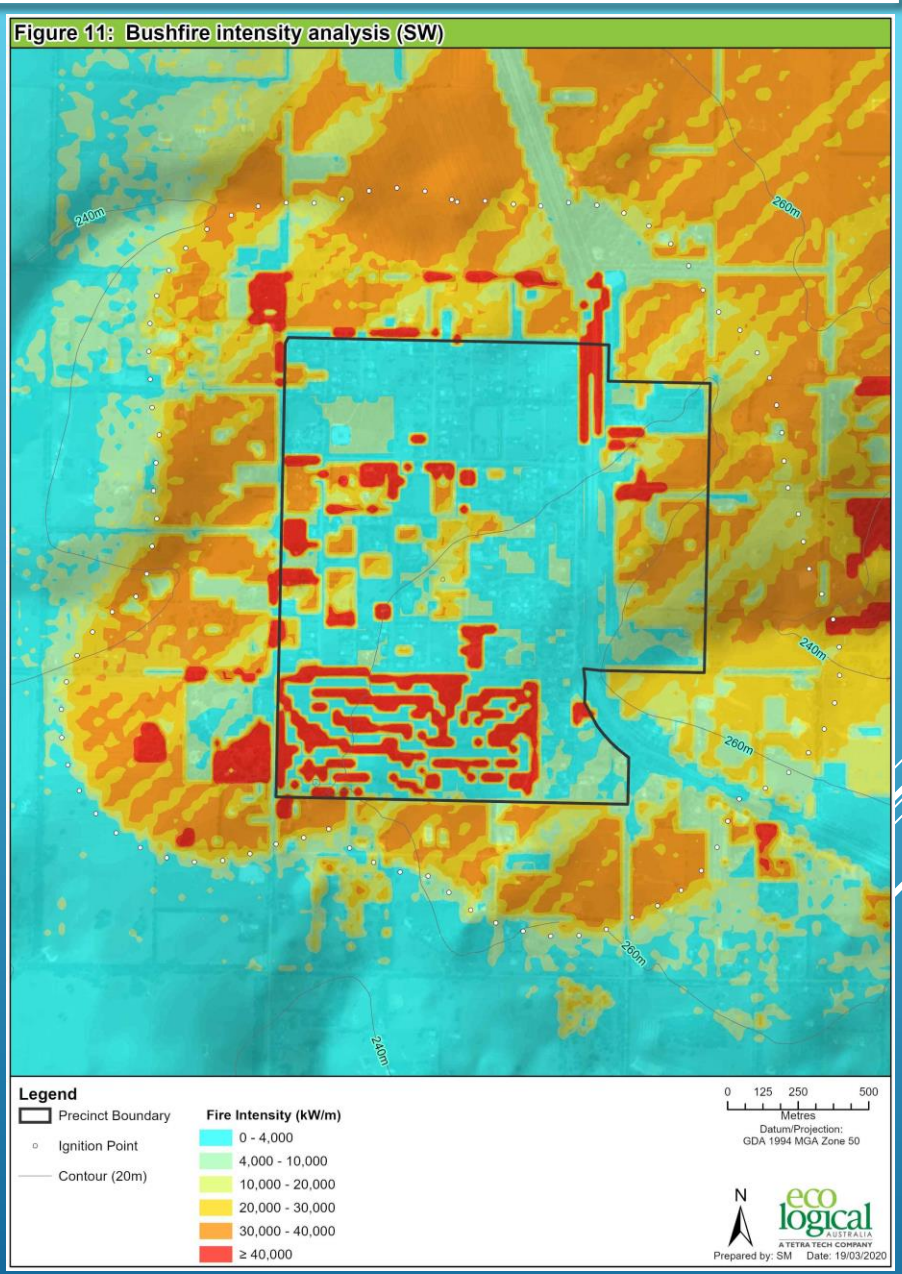
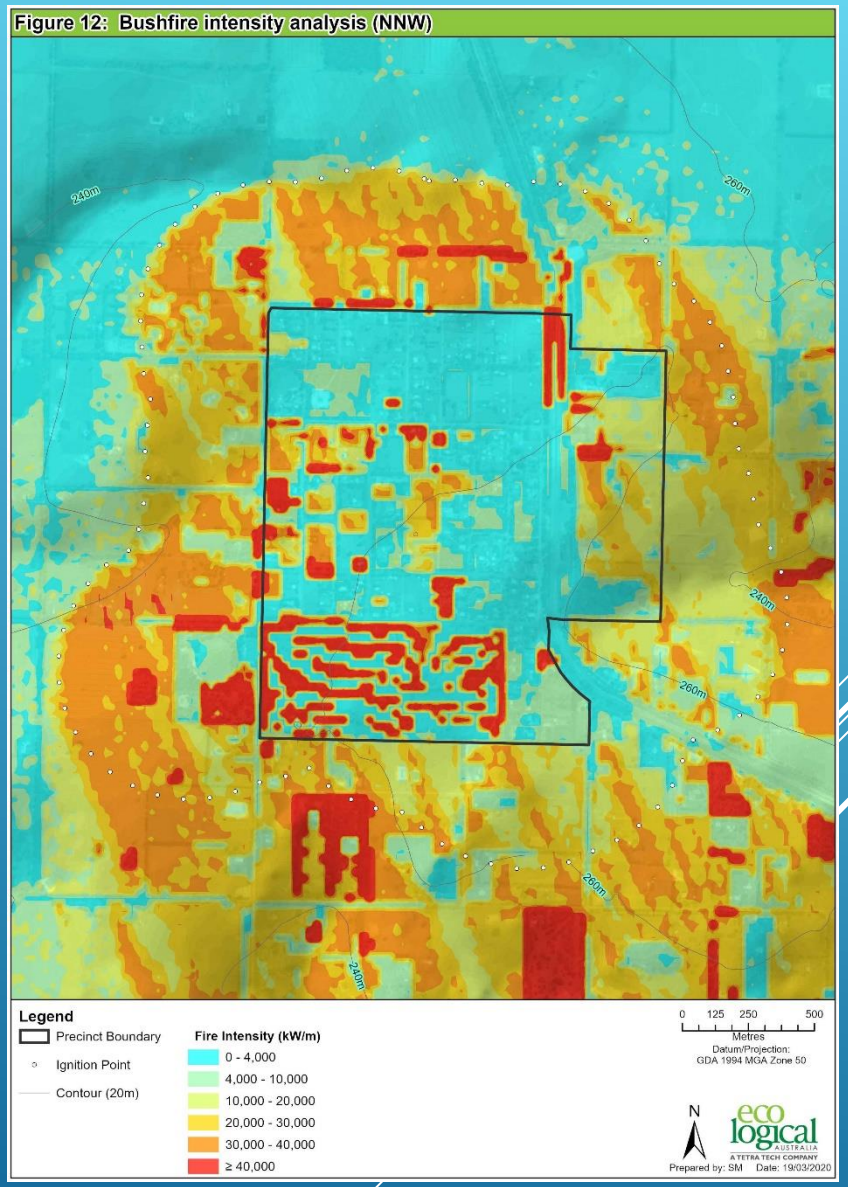


Figure 11: Bushfire intensity analysis (SW)



Locality risk for the Precinct

- The results show the potential for high bushfire intensity at the precinct interface under all three wind directions.
- Vegetation Connections adjacent to the precinct boundaries and to vegetation within the precinct results in the potential for high bushfire intensities being experienced deep within the precinct itself.
- These high intensities are related to large areas containing grass fuels as well as wooded vegetation in the areas in and surrounding the precinct, which would facilitate very fast-moving, intense bushfires driven by the direction of prevailing winds.
- The results indicate that intense bushfire is possible at all interfaces of the precinct (as well as within). Consequently, the maintenance of existing, and installation of new, fuel breaks (e.g. perimeter roads) would be beneficial to reducing this aspect of bushfire risk.



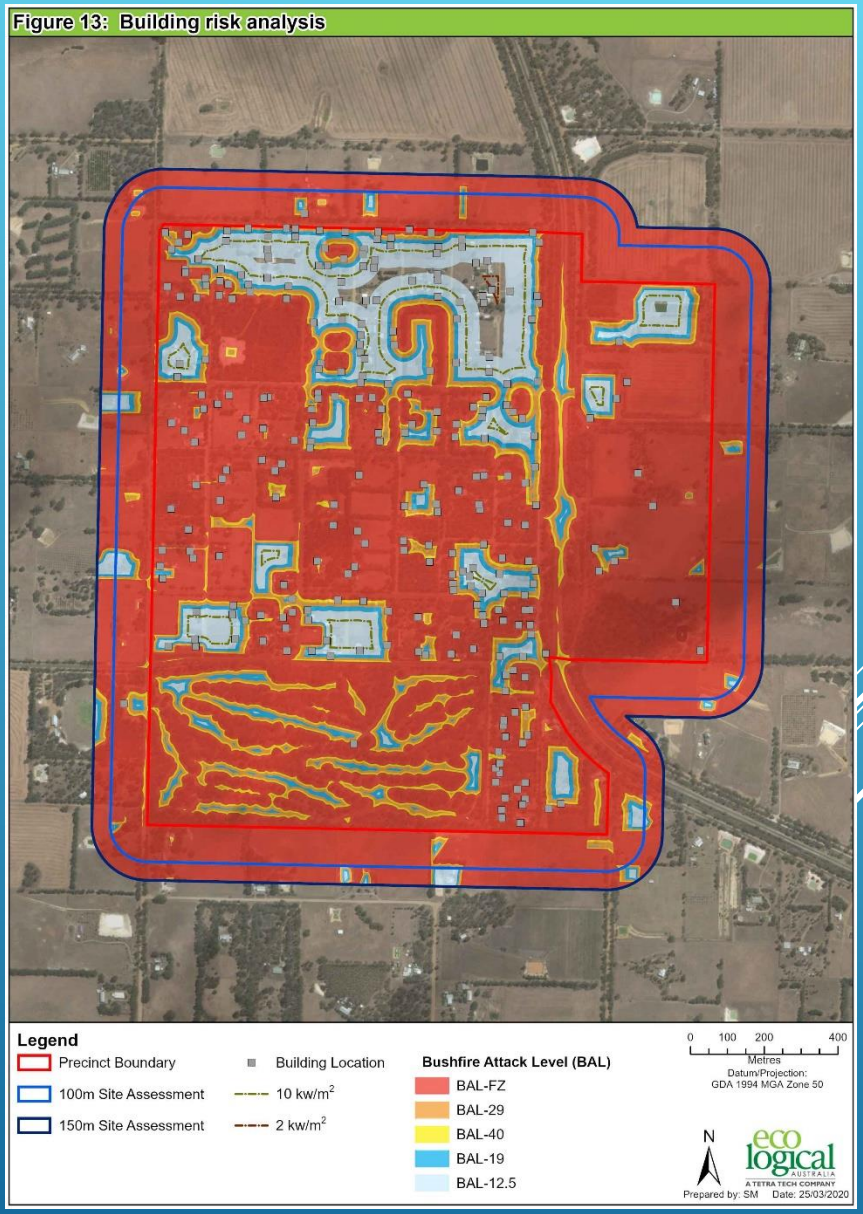
Building risk assessment

- The majority of buildings within the precinct (approx. 54%) occur within areas potentially subject to BAL-FZ (i.e. flame zone) and no buildings were greater than 300 m from bushfire hazards. Caused by a mixture of unmanaged to semi-managed grasslands and forest vegetation within the precinct.

- Regular maintenance of vegetation on private properties as per requirements of all private property owners under the Shire of Plantagenet 2019/2020 Annual Bush Fire Mitigation Notice (SoP 2019) would likely lead to a major reduction in building risk.

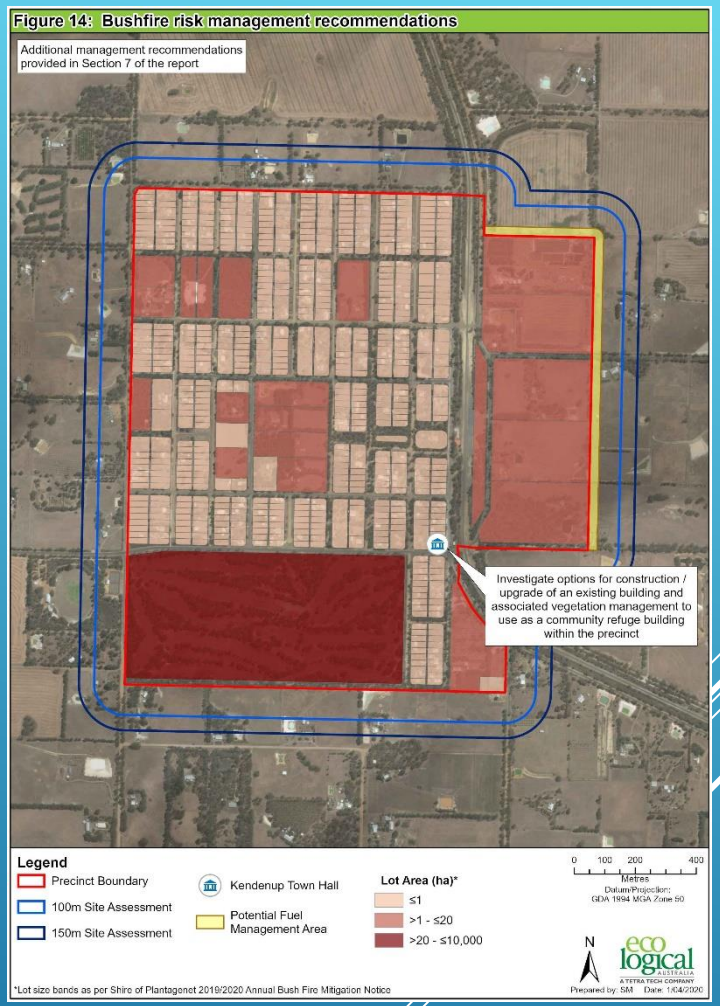
BAL Rating	Number of buildings	% of Buildings
BAL-FZ	153	53.7%
BAL-40	18	6.3%
BAL-29	28	9.8%
BAL-19	33	11.6%
BAL-12.5	48	16.8
BAL-LOW	5	1.8
BAL-LOW (100-300 m from hazard)	0	0
Grand Total	**285**	**100%**

Figure 13: Building risk analysis



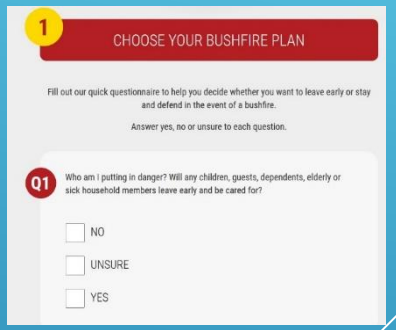
Analysis of evacuation and refuge options

- Early evacuation to the Mount Barker townsite is likely to be the safest offsite option currently available to residents and visitors.
- Very fast-moving grass fires could impact on the precinct and roads to the town centre before evacuation can commence or be completed safely
- The most efficient route to Mount Barker is approximately 22 km long travelling west on Beverley Road and then south on Albany Highway, through predominantly grassy areas that could facilitate a fast-moving grass fire that could overrun the roads Alternate evacuation routes using Carbarup Road pose similar issues.
- off-precinct evacuation should only be undertaken at the direction of emergency services.
- Every fire is different. if off-precinct evacuation is to occur, early evacuation, well in advance of a bushfire is recommended.
- Both Albany Highway and Carbarup Road provide access in two directions (north and south), off-precinct evacuation can take into consideration the direction of bushfire attack and likely path to ensure evacuees are not cut off by fire before arrival. These multiple access routes improve the bushfire evacuation options for the precinct; however, this is counteracted by the potential for very rapid-fire spread.
- Off-precinct evacuation may not be a suitable primary recommendation for the precinct .
- Consider advising residents and visitors to pre-emptively relocate from the precinct if there is an out of control bushfire within 20 km on Extreme or Catastrophic Fire Danger Rating (FDR) days.



On-precinct evacuation

- The analysis of safer place refuge options identified a number of areas of a suitable size within the precinct that could currently be used to locate a refuge building based on the radiant heat flux thresholds (Figure 19) identified in ELA report
- The Kendenup Town Hall location currently does not meet the radiant heat flux thresholds for a building refuge, management of nearby vegetation and retrofitting of the building to incorporate ember and radiant heat protection could be investigated to provide residents and visitors with a prominent location in town that may be used as an on-precinct refuge.
- Houses not built to AS3959 are not considered a safe option for shelter
- Management of grassy fuels on private properties and sheltering on-site in a well-prepared and defendable property may enhance safety
- The precinct is surrounded by and contains grassy fuels that could facilitate rapid bushfire spread, evacuating people to an on-precinct refuge before the onset of a fast-moving fire may not be able to be achieved. In these situations, on-site sheltering may need to be relied upon.
- Homeowners need awareness of the bushfire risk they are exposed to and comply with the Shire of Plantagenet 2019/2020 Annual Bush Fire Mitigation Notice (SoP 2019).
- Residents should be encouraged to prepare their own bushfire survival plan.
- Maintaining their property with regard to the DFES Homeowner's Bushfire Survival Manual (DFES 2014).



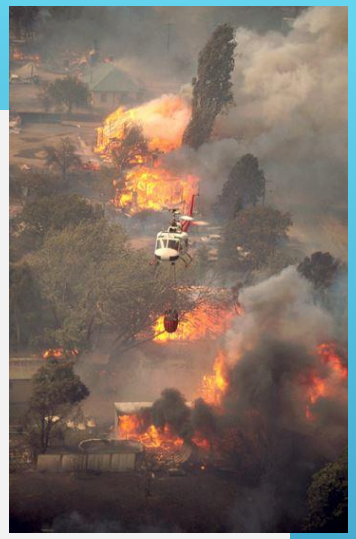
Cost

- Community cost post fire: Trauma, Re-establishment costs and time to rebuild.

  "Canberra suffered not just economic loss but significant social devastation. The first person to suffer from the smoke was a 61-year old man in Duffy. He died of asphyxiation fighting the fire in his backyard. Tragically there were also three more to follow, among them an 83-year-old woman and a 37-year-old woman. Many people were affected by depression, particularly those who had lost their homes in the fires. The community began to question the lack of preparation for the fires and the total confusion at the time."

- *LGA recovery cost: rebuilding, cost to government.*
- *Personal cost: trauma and rebuilding.*

The red indicates the families and homes destroyed in Duffy



Stakeholder assistance..

Priority and ranking No	Implementation Action	Agency
1	Assist with funding options to private landowners to retrofitting dwellings to BAL and AS3959.	DFES/SEMC & DoHA (fed)
2	Assist with funding options/mechanism through provision of advice to the LGA and private landowners to undertake individual BAL assessments on dwellings to install a compliant APZ associated with BAL-29 or less (where able to achieve) and AS3959 setbacks/APZ area.	DFES/SEMC & DoHA
3	Investigate options for construction of community on precinct refuge area within the precinct and associated vegetation management. Federal assistance may be required.	DFES/SEMC & DoHA (fed)
4	Assist with provision of guiding policy to the LGA on "space open refuge areas" and "community refuge buildings" to assist in development of these areas within the precinct by the LGA/LEMC.	DFES/LEMC
5	A standalone emergency evacuation plan to be developed for the school in line with WAPC guidelines and SPP3	DoE
6	Consideration to updating the DFES Homeowner's Bushfire Survival Manual (DFES 2014) or similar public available information to assist with current public available information and dissemination from the LGA.	DFES
7	Asist the LGA through provision of advice on the legal wording in regards to the Fire Management Notice.	DFES
8	LEMC to assist with Investigation of options for the construction or designation of an off-precinct community refuge (or safer place) building and associated vegetation management.	LEMC
9	Continue to undertake vegetation management to 20m APZ (low fuel) around all water infrastructure within the precinct as shown on Figure 8. Seek adjacent neighbour compliance to meet 20m protection zone where applicable.	WCWA
10	WCWA assist the LGA by providing baseline mapping of water supply to the precinct/greater town to assist with planning, mitigation and suppression activities.	WCWA
11	DPLH assist through provisions of advice to the LGA with planning strategies and schemes to ensure that SPP3.7 is applied consistently throughout the precinct.	DPLH

Where to from here..lets talk about it its your community..

- Questions
- Suggestions
- Funding options
- Stakeholders not considered?
- Next steps from Shire of Plantagenet
- Next fire season 2020/21 preparations
- Feedback on the project

Shire of Plantagenet

BIO DIVERSE SOLUTIONS

eco logical AUSTRALIA
A TETRA TECH COMPANY

SEMC STATE EMERGENCY MANAGEMENT COMMITTEE

Australian Government Department of Home Affairs

DFES Department of Fire & Emergency Services

CITY OF Albany

Shire of Plantagenet

SHIRE OF DENMARK

BIO DIVERSE SOLUTIONS

Shire of Denmark, City of Albany, Shire of Plantagenet

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