Grampians
Bushfire Management Strategy 2020

Fuel management
Bushfire Risk Engagement Areas

VICTORIA
State Government

SAFER
TOGETHER

Acknowledgements

We acknowledge and respect Victoria's Traditional Owners as the original custodians of the state's land and waters, their unique ability to care for Country and deep spiritual connection to it. We honour Elders past and present, whose knowledge and wisdom has ensured the continuation of culture and traditional practices.

We are committed to genuinely partner and meaningfully engage with Victoria's Traditional Owners and Aboriginal communities to support the protection of Country, the maintenance of spiritual and cultural practices and their broader aspirations in the 21st century and beyond.

We would like to acknowledge the numerous people within DELWP, Parks Victoria, the CFA and local governments who contributed to the discussions and decision-making processes that resulted in this strategy. We would also like to acknowledge stakeholder groups and community members for their interest and input into this planning process.

Aboriginal people should be aware that this publication may contain images or names of deceased persons in photographs or printed material.

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Contents

Abbreviations and Definitions

Abbreviation	Term
APZ	Asset Protection Zone an area around properties and infrastructure where we intensively manage fuel to provide localised protection to reduce radiant heat and ember attack on life and property in the event of a bushfire
BMZ	Bushfire Moderation Zone an area around properties and infrastructure where we manage fuel to reduce the speed and intensity of bushfires and to protect nearby assets, particularly from ember attack in the event of a bushfire
BREA	Bushfire Risk Engagement Area parts of the landscape where managing bushfire fuels is most effective in reducing risk
CAR	Comprehensive, Adequate and Representative reserve system
CBBM	Community Based Bushfire Management
CFA	Country Fire Authority
DELWP	Department of Environment, Land, Water and Planning
EMV	Emergency Management Victoria
FFMVic	Forest Fire Management Victoria comprised of staff from DELWP, PV, Melbourne Water and VicForests when working in bushfire management on public land
FMZ	Fire Management Zone for fuel management purposes, public land in Victoria is classified into four fire management zones: asset protection zone, bushfire moderation zone, landscape management zone, and planned burning exclusion zone
GMA	Geometric Mean Abundance an index of the relative abundance of species within a community. As the relative abundance of species changes, so too does the GMA, and this can be used as a measure of resilience
Ha	Hectares
JFMP	Joint Fuel Management Program
LDNP	Little Desert National Park

Abbreviation	Term
LMZ	Landscape Management Zone an area where we manage fuel to minimise the impact of major bushfires, to improve ecosystem resilience and for other purposes (such as to regenerate forests and protect water catchments)
MER	Monitoring, Evaluation and Reporting
MISS	Minimum Impact Suppression Strategy
NCR	Nature Conservation Reserve
PBEZ	Planned Burning Exclusion Zone an area where we try to avoid planned burning, mainly because ecological assets in this zone are primarily intolerant to fire
PV	Parks Victoria
RAP	Registered Aboriginal Party
Residual risk	the amount of risk that remains after bushfires and fuel management activities reduce fuel. Residual risk is used by DELWP as a performance measure
RSFMPC	Regional Strategic Fire Management Planning Committee
SDM	Structured Decision Making
TFI	Tolerable Fire Interval a term which expresses the minimum or maximum recommended time intervals between successive fire disturbance events at a site or defined area for a particular vegetation community. The time interval is derived from the vital attributes of plant species that occupy the vegetation community. The TFIs guide how frequent fires should be in the future to allow the persistence of all species at the site or defined area
VFRR-B	Victorian Fire Risk Register – Bushfire
WCAP	Wimmera Conservation Action Plan

Introduction

Victoria is one of the most bushfire-prone areas in the world. Victorians are accustomed to living with bushfire risk, which is the likelihood and consequence of bushfires. It includes the likelihood of a fire starting and spreading across the landscape, and the consequences of it impacting the things we value: people, communities, houses and farms, infrastructure, our economy and the natural environment.

Bushfires are driven by three key factors – fuel, weather and topography – which together make up the 'fire behaviour triangle'. These three factors combine to affect how a bushfire behaves: how fast it travels, where it spreads, and how intensely it burns. Fuel management is important, because it is the only element of the fire behaviour triangle that we can influence.

Bushfire fuels are the leaves, bark, twigs and shrubs that are burnt by fire. The fuel type, dryness, size, moisture content and arrangement can all affect the speed, size and intensity of a bushfire. Fuel management includes planned burning — lighting and managing planned fires in the landscape — and mechanical treatment — mowing, slashing, mulching and using herbicides. Fuel management activities reduce the amount of fuel across our landscape, decreasing the fire behaviour of bushfires, helping limit their spread and intensity when they occur, and making it easier for our firefighters to control them and lessen their impacts.

Bushfire risk is influenced not only by how a bushfire behaves, but also by how fire impacts the different things that we value. For example, population growth in and near forested areas increases the bushfire risk, as more people enter areas where major bushfires are more likely to impact. The Victorian community is changing in other ways, with an aging population and decreases in volunteering in some areas, leading to an increase in vulnerability to bushfire. For plants and animals, drought, invasive species incursion, as well as habitat loss and fragmentation increase the susceptibility to negative bushfire impacts.

Our changing climate – bringing rising average temperatures, more hot days and less rainfall – means bushfire risk is constantly increasing as fuels dry out and extreme fire weather events increase. Bushfires with the worst consequences typically occur during extreme weather conditions (such as during very hot, dry and windy periods). The disastrous 2019–20 bushfire season, followed periods where parts of Eastern Australia – extending from Tasmania through Victoria, New South Wales and into Queensland – had experienced their driest conditions on record. Over 1.5 million hectares (ha) in Victoria were burnt and large areas of eastern Australia impacted.

Photo credit: Josh Bushell

In Victoria, climate change is forecast to:

- extend the bushfire season
- make bushfires larger, more severe, and more frequent
- make days with an elevated fire danger rating more frequent
- extend the area that experiences extreme weather conditions, increasing the frequency of these for communities that may have never or have only infrequently experienced such conditions
- start the bushfire season earlier, with more bushfires starting in spring (which may also change fire weather conditions that are experienced, such as wind speed and direction)
- further strain available resources and capacity as the bushfire season increasingly overlaps with suitable weather periods for planned burning.

The impacts of climate change on fire-sensitive habitats and refugia for plants and animals will become increasingly important to manage.

With climate change making many extreme weather events more frequent and more extreme, the impacts on communities are also likely to increase. Of 15,700 disasters between 1980 to 2015, 91% were weather related, and 51% of fatalities and 79% of economic losses were caused by weather related extremes.[1]

Our shared responsibility to mitigate bushfire risk

While bushfires will always be a threat, Victorians have demonstrated their ability to work together to plan and deliver activities on public and private land to mitigate bushfire risk. As with all areas of emergency management, supporting communities to be safer and more resilient is the shared responsibility of all Victorians, not just of government agencies. To best manage bushfires, it is important that communities and government organisations come together to understand bushfire risk, agree on strategies, and then work both individually and collaboratively to fulfil their individual and shared responsibilities.

Actions that agencies are responsible for include issuing fire danger warnings and advice, reducing fuel through planned burning and mechanical treatments, commissioning bushfire science research, and recruiting and training firefighters. Actions that community members are responsible for include developing and practising a bushfire plan, fully extinguishing campfires, preparing their property, and participating in community bushfire preparedness activities and events. Actions we do together include building an understanding of risk in our area, sharing information through community and social channels, developing, practicing and implementing plans to protect what is valued most by the local community.

Resilient communities prepare better for bushfires. They provide the volunteer workforce essential in the response phase, and they are better able to face the acute shocks and stresses of a bushfire and to recover after it.

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1   Department of Home Affairs, 2018

Victoria's 'shared responsibility' approach recognises that communities:

- are best-placed to understand and mitigate their risks and drive preparedness and recovery, including through their fundamentally important volunteer contribution

- have knowledge, expertise, capability and diverse perspectives to work with agencies to mitigate bushfire risk

- have networks and relationships that help agencies identify and protect the things communities value, improve their capacity and create meaningful, sustainable solutions.

The shared responsibility approach seeks to ensure:

- the interests, values and expectations of stakeholders in, or members of, communities are understood and considered in the planning process

- ownership of the planning process and responsibility for implementing strategies are broadly shared.

Shared responsibility does not mean equal responsibility: there are some areas where land and fire management agencies are better-placed and have more resources and information to make decisions and act on them. Equally, while agencies develop plans and implement programs for mitigation, planning, preparedness, response and recovery, governments or agencies cannot guarantee that bushfires will be consequence-free for the community. Communities and individuals have the responsibility to prepare their own plans, properties and assets to reduce the impact of bushfires. During major bushfires with far-reaching consequences, land and fire agencies may not always be able to coordinate and deliver the support the community may expect.

Recognising the role of Victoria's Traditional Owners

The Grampians region recognises the ***Victorian Traditional Owner Cultural Fire Strategy***, which aims to re-establish cultural fire with Traditional Owner led practices across Victoria, so Traditional Owners can heal Country and fulfil their rights and obligations to care for Country. The *Victorian Traditional Owner Cultural Fire Strategy* provides a set of principles and strategic priorities to facilitate greater self-determination for Traditional Owners and a framework for effective Traditional Owner-led cultural fire management in Victoria. The strategy has an important role in informing the Joint Fuel Management Program (JFMP) in consultation with individual Traditional Owner groups. Traditional Owners emphasise that cultural fire is applied to achieve culturally meaningful objectives, but that risk reduction is often a complementary outcome.

Photo credit: DELWP

Bushfire management planning

Strategic planning

Considers **long-term timeframes (10-40+ years)**

Large geographic scales

Focuses activity like **planned burning** and **mechanical works** in the most effective places to reduce bushfire risk

Output = **Bushfire Management Strategy**

Operational planning

Medium term time frames

Determines **how the strategy will be implemented** to contribute to the strategic objectives

The Joint Fuel Management Program **identifies many fuel management activities** – planned burning and mechanical works – within the strategy area

Output = **Programs of planned burns, mechanical works and engagement** over one to three years

Tactical planning

Short timeframes across small land units

Describes **how an individual burn or fuel management activity will be implemented** to meet objectives eg. lighting patterns, ignition time, fuel moisture parameters

Output = **detailed output about how a burn or activity will be conducted** to meet objectives.

Figure 1. Bushfire management strategic, operational and tactical planning for fuel management

Bushfire management planning occurs at different levels, with varying time frames, focuses and outputs. **Figure 1** shows fuel management planning at strategic, operational and tactical levels.

Strategic planning

The strategic planning process identifies where important values and assets are located across the landscape. It considers the current extent and quality of these values and where possible considers future trends including population, industry and environmental change. Strategic planning identifies objectives for the important values and assets, and develops an approach to manage the risks posed to them. The resulting bushfire management strategies describe landscape zones that focus fuel management activities to deliver bushfire risk reduction and ecological outcomes.

Strategic bushfire management planning takes place within a legislative and policy context which includes:

- the *Emergency Management Act 2013*, which requires from 1 December 2020 the Emergency Management Commissioner to prepare a state emergency management plan and to approve eight regional emergency management plans. In combination with the municipal emergency management plans, these provide for an integrated, coordinated and comprehensive approach to emergency management. The Act also requires emergency management plans to contain provisions providing for the mitigation of, response to and recovery from emergencies and to specify the emergency management roles and responsibilities of agencies

- the *Conservation Forests and Lands Act 1987*, which requires the Department of Environment, Land, Water and Planning (DELWP), through the *Code of Practice for Bushfire Management on Public Land* (2012), to develop a risk-based approach to bushfire management on public land. This document meets the requirements set out in the Code of Practice to prepare a strategic bushfire management plan.

- ***Safer Together: A new approach to reducing the risk of bushfire in Victoria*** (2015), a Victorian Government policy, focuses on how effective our actions are in reducing risk and not just the amount of activity we undertake.

Photo credit: Steffen Schultz

Operational and tactical planning

This bushfire management strategy informs the development of operational plans, primarily the Joint Fuel Management Program (JFMP). The JFMP is the three-year rolling statewide program of fuel management works on public and private lands carried out by Forest Fire Management Victoria (FFMVic) and Country Fire Authority (CFA) to reduce bushfire risk and to maintain the health of native plants and animals that rely on fire to survive. Works include planned burning, slashing, mowing and clearing works, creating and maintaining fuel breaks, and carrying out maintenance on fire infrastructure (like fire dams and lookout towers).

This strategy does not directly address tactical (burn) planning, which is done for individual burns. Tactical planning can include individual burn objectives, community engagement plans and how the burn will be delivered safely.

Other bushfire management actions

This bushfire management strategy outlines our risk-based approach to fuel and ecological fire management. However, fuel management is not the only bushfire management action that reduces bushfire risk and is not always the most effective action to reduce that risk. Fuel management needs to be supported with other actions for a number of reasons:

- Some parts of the landscape have inherently high levels of bushfire risk which requires more actions to reduce that risk
- The ability to reduce risk through fuel management may be limited in some landscapes and there will always be fuel re-accumulation
- The effectiveness of fuel management may be reduced under extreme weather conditions
- Fuel management reduces fire behaviour, it does not eliminate bushfire. Suppression activities are always required to control bushfires

Table 1 lists some key actions that agencies and communities undertake together to manage bushfire risk and complement our fuel management approach.

As with fuel management, these actions are guided by bushfire risk analysis combined with other information to ensure they are most effective. Strategies and plans for these actions are developed through emergency management planning processes by agencies at the state, regional and municipal levels.

Table 1.   Bushfire management approaches beyond fuel management

Approach	Key actions
Reduce bushfire ignitions through prevention activities	• Education and advertising campaigns (e.g. campfire safety, reporting ignitions) • Coordinated, risk-based patrolling • Deterrence for deliberate or negligent ignition – laws/prosecution • Monitoring arsonists • Restrictions – fire danger period and total fire ban triggers, duration and restrictions (including legislative change) • Reducing ignitions from powerlines
Increase the effectiveness of fire suppression	• Fire detection (towers, aerial surveillance) • Resourcing, capacity and capability of fire-fighting resources (fire crews, contractors, incident management teams) • Aircraft fleet management: type, distribution, availability and pre-determined dispatch • Road infrastructure including maintenance of the strategic fire access road network and network of fuel reduced areas. • Other fire response infrastructure maintenance including remote water access and helipads • Fire readiness including rostered and pre-formed Incident Management Teams and fire crews
Reduce bushfire spread and severity	• Planned burning based on tenure-blind risk • Strategic breaks and burn unit boundary standards • Flexible delivery of burning (e.g. managed bushfire, unbounded burns) • Other forms of fuel management (e.g. slashing, spraying, mulching) particularly in high-risk areas where planned burning is not suitable • Identify and effectively manage fuel hazard reduction on private bush
Reduce the physical effects of bushfires in inhabited areas	• Domestic property preparedness in towns, including fire prevention notices, penalties and cost recovery • Vegetation management on public and private land within or immediately bordering towns including implementation of fire prevention notices • Identification, prioritisation and treatment of risk to critical infrastructure • Access and egress (roadside vegetation/tree maintenance) pre- and post-fire • Asset protection (on-ground)
Reduce the social effects of bushfires on communities	• Bushfire education programs targeting vulnerable communities including those with identified at-risk or changing demographics, and/or where bushfire risk cannot be effectively reduced through planned burning. • Recovery planning and relationship building pre-bushfire (e.g. via community groups, scenario events and activities) • Municipal bushfire plans • Warnings and advice messaging • Personal and neighbourhood bushfire plans
Reduce impacts from fire management actions	• Community engagement about fire management and smoke impacts • Planning to minimise impacts on biodiversity, cultural heritage and other values • Connections between planning and delivery (e.g. on-ground staff aware of biodiversity/cultural sites and mitigation actions) • Cross-tenure planning and consultation • Monitoring effectiveness of mitigations (and subsequent improvement)

About this bushfire management strategy

Victorian landscapes, environments and communities are diverse and multifaceted, and Victorian communities have diverse values, preferences and priorities. This regional bushfire management strategy reflects our region's unique environments and communities. To develop this strategy, we undertook a regional planning process that was guided by the knowledge and priorities of experts, stakeholders and community members from Grampians region.

Between November 2017 and September 2019, representatives of CFA, DELWP, Parks Victoria, Emergency Management Victoria and local governments engaged in a strategic bushfire risk management planning process. The process was guided by the Grampians Regional Strategic Fire Management Planning Committee (RSFMPC), through the regional Safer Together Coordinating Committee and Working Group. They offered opportunities to stakeholders and the broader regional community to be involved in the planning process through both in-person and online mechanisms.

Our bushfire management strategy focuses on:

- reducing the risk of bushfires threatening lives, homes, the environment and other important values and assets across the landscape
- maintaining or improving the resilience of ecosystems
- establishing a shared understanding of bushfire risk across the sector, based on the latest science and the extensive knowledge of agency personnel
- using a 40-year horizon, so long-term ecological changes and fuel accumulation rates can be considered in annual operational planning processes.

The strategic planning process resulted in two strategies to reduce bushfire risk and maintain ecosystem health: together, they comprise this strategy — the *Grampians Bushfire Management Strategy 2020*.

The individual strategies are:

- our fuel management strategy, which focuses on reducing bushfire fuels through planned burning and mechanical works (mowing and slashing) on public land

- our Bushfire Risk Engagement Areas (BREAs), which focus on targeted community engagement to complement, inform and drive fuel management and other risk mitigation activities on public and private land.

The strategy is a supplement to the **Grampians Regional Strategic Fire Management Plan**, developed by the Grampians RSFMPC, and applies to the same Grampians emergency management region footprint. The plan's agreed vision, strong leadership and greater cooperation between agencies promotes greater community resilience through effective engagement and best-practice integrated fire management planning.

Regional emergency management plans and municipal emergency management plans are being prepared in line with the new amendments to the Emergency Management Act 2013. This strategy will help inform the bushfire components of these plans, now and into the future.

For the purpose of the C*ode of Practice for Bushfire Management on Public Land (2012)*, the FFMVic Chief Fire Officer has approved the public land components of this strategy: specifically, where the strategy relates to state forests, parks administered under the National *Parks Act 1975* and protected public land. These components of the strategy will directly guide FFMVic's fuel management operations. This strategy replaces the former Strategic Bushfire Management Plans for public land, published by DELWP and PV in 2014 and 2015, which used bushfire risk landscape footprints.

Photo credit: DELWP

Method overview

This document presents the outcomes of the strategic bushfire management planning process.

The planning process involved considerable community engagement — with individuals, private land managers, businesses, community organisations and other stakeholders — to tap into their knowledge, understand their priorities, discuss and evaluate options with them and prepare to involve them in implementing the strategy.

In the planning process, we:

- identified the values and assets that are most important to the residents of and visitors to the region: we grouped these into human life, economy – industries and agriculture, infrastructure, nature and heritage
- developed regional objectives: the things we want to achieve by implementing the strategy
- combined local knowledge, bushfire behaviour modelling, historical data and the best-available science to understand how bushfires behave in our region and to forecast bushfire and fuel management strategy impacts on our most important and at-risk values and assets
- developed and evaluated many potential strategies to select two — our fuel management strategy and the Bushfire Risk Engagement Areas (BREAs) — that will enable agencies and communities to best mitigate bushfire risk to the region's most important and at-risk values and assets.

The planning process was underpinned by the International Standard for Risk Management ISO 31000. The standard acknowledges that risk can never be completely eliminated. Bushfires will still occur, and we must all be prepared and ready to respond. However, bushfire risk can be reduced with a high-quality risk management approach.

The planning process followed the principles of structured decision making (SDM). SDM is a framework that helps people unpack complex decisions, navigate trade-offs and make logical and transparent choices. It provides a means of bringing together both scientific information and human values to make decisions, through analysis and inclusive deliberation. The principles of SDM are particularly useful in decision-making contexts characterised by uncertainty, multiple stakeholders and competing objectives. Broadly, the SDM steps involved included understanding the landscape context, setting objectives, identifying possible management strategies, and estimating and analysing the consequences and inherent trade-offs of these strategy options. We then selected the strategy that gives the greatest benefit to the things we care about, while balancing the impacts of fuel management actions on those same values.

Identifying and assessing risk to values and assets

The planning process identified values and assets across the region and modelled the impact bushfires and fuel management would have on them. Values are the ultimate durable reasons we care about managing bushfires, and assets are the physical sites that represent these values. For example, we value native species, and the locations of their populations and habitat are the assets we protect to ensure their continued existence.

To identify the region's most important values and assets, we consulted with our partners, stakeholders and communities, and we drew on specialised data sets including the Victorian Fire Risk Register – Bushfire (VFRR-B) and Victorian Biodiversity Atlas.

We used Phoenix RapidFire, which is world-leading bushfire simulation software developed in Victoria, to model the spread of a bushfire from an ignition point under the specified weather conditions. This enables us to understand the impact bushfires could have on people, homes and other important values and assets in our landscape. We modelled ignitions and bushfire spread patterns at thousands of places throughout the region:

- using ignition likelihood models based on historical ignition characteristics and patterns
- using the bushfire characteristics information in the 'Bushfire history and patterns' section
- under a range of bushfire weather conditions, including Code Red conditions: a Forest Fire Danger Index (FFDI) rating of 130 or above. These were the conditions in many parts of the state on Black Saturday 2009, and conditions were similar at times during the 2019–20 fire season. Code Red conditions are also forecast to become more frequent and more extreme with climate change.

We also used a new 20-year historical weather dataset for Victoria to identify recent changes to the state's climate and so we could better model the average frequency with which various weather scenarios occur. This provided some indication of the likelihood of these scenarios occurring in future. We also partnered with climate scientists to forecast various climate conditions relevant to bushfires which will inform future strategic bushfire risk management planning and preparedness decisions.

Core measures we used in our planning process to predict ecological responses to fire included potential changes to the tolerable fire interval (TFI) and geometric mean abundance (GMA) of species in a community. We also considered high value ecological areas as part of developing, evaluating and selecting bushfire management strategies.

Vegetation recovery after fire.
Photo credit: Glenn Rudolph

Our landscape context

The Grampians region is the second-largest region in Victoria, covering an area of approximately 20 per cent (4.6 million ha) of the state (**Figure 2**). The region is bounded by the South Australian border to the west, the Loddon Mallee region to the north-east, the Metropolitan region to the east and the Barwon South West region to the south. The region is home to 4% of Victoria's population, and it encompasses the local government areas of Ararat, Moorabool, Ballarat, Northern Grampians, Golden Plains, Pyrenees, Hepburn, West Wimmera, Hindmarsh, Yarriambiack and Horsham. The public land estate comprises 21.6% of the regional footprint. The major industries are health care and social assistance, agriculture, education and training and retail trade (including tourism).

Photo credit: DELWP
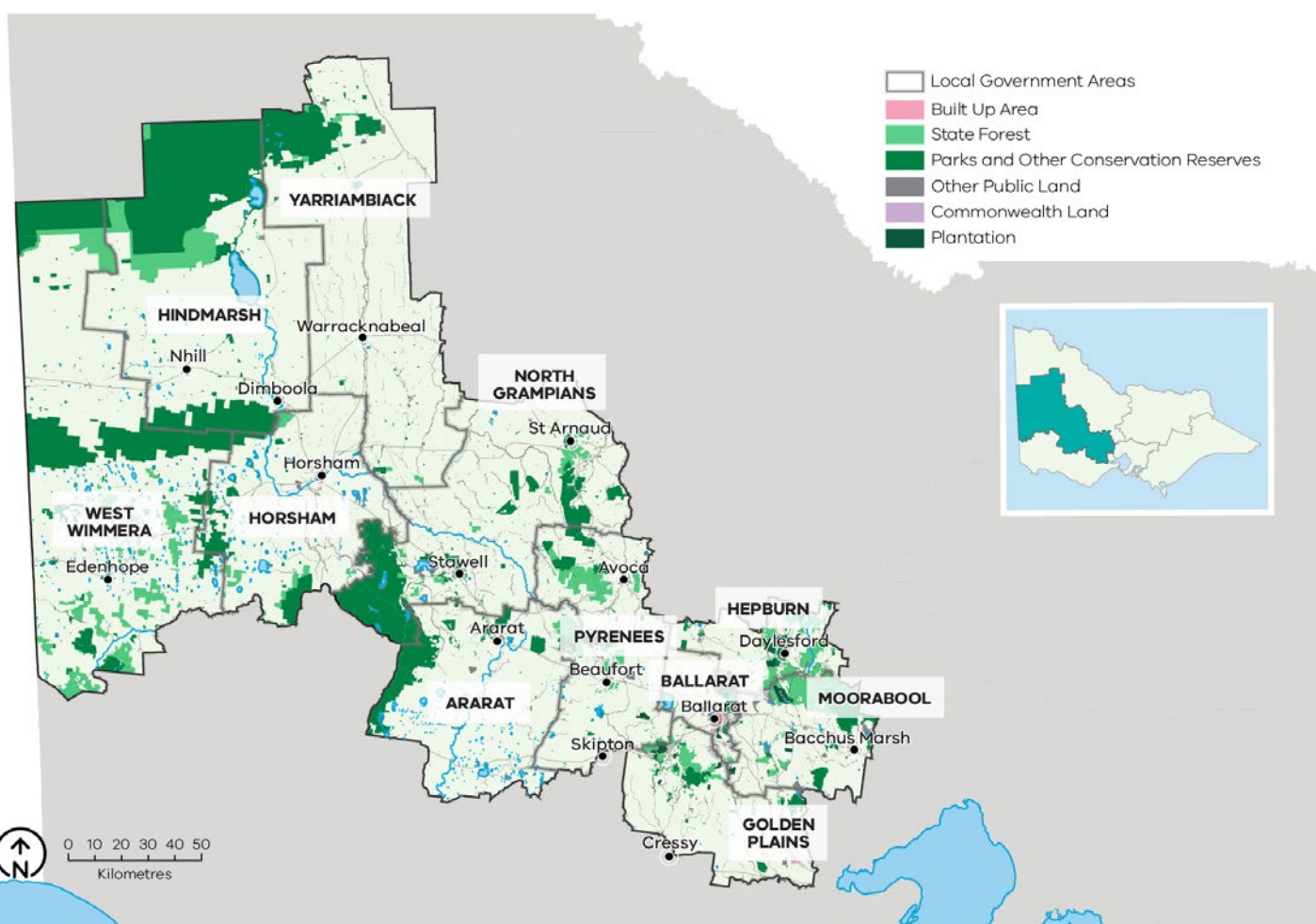
Figure 2.   The Grampians region with local government boundaries and public land tenure

Local government profiles

Ararat Rural City (population 11,795)

Ararat is located in the northern area of the municipality, which also includes the settlements of Pomonol, Elmhurst, Moyston, Warrak, Buangor, Maroona, Mininera, Wickliffe, Lake Bolac, Westmere and Streathem. The hills extending north and west of Ararat have retained areas of remnant vegetation identified as being of high and very high conservation significance including the Ararat Hills Park and other state parks. The north-eastern area of the municipality contains the Langi Ghiran, Mount Cole and Mount Buangor State Parks and scattered rural settlements. The Grampians National Park extends across the north-western corner of the municipality.

City of Ballarat (population 107,325)

Ballarat is one of Australia's largest inland cities and the third largest city in Victoria. The City of Ballarat municipality covers an area of 740 square kilometres and includes the outlying townships of Buninyong, Miners Rest, Learmonth and Cardigan Village. Due to being located centrally in Western Victoria, Ballarat services a large regional population. The municipality includes several parks, reserves and forests including; Woowookarung Regional Park, Mount Buninyong State Reserve, Glen Park State Forest, Nerrina Heritage Area and a section of Creswick State Forest.

Golden Plains Shire (population 23,120)

The shire is predominantly rural, with several small settlements servicing local communities between Ballarat and Geelong. The shire covers an area of 2,703 km², and includes the settlements of Bannockburn, Dereel, Gheringhap, Lethbridge, Linton, Berringa, Teesdale, Rokewood and Meredith. The shire is the fifth-fastest-growing municipality in regional Victoria, and many residents work in Ballarat or Geelong. The shire's economic base is provided through agriculture, retailing, construction and manufacturing. Agriculture is responsible for $144 million worth of output annually, and it employs 25.6% of the shire's workforce. The main industries are agriculture (wool and grain growing, intensive poultry and pig farming), construction and wine-making.

Hepburn Shire (population 15,330)

Approximately 45% of the shire's population is scattered through numerous small townships, hamlets and rural localities, which are often in forested or semi-forested environments. Many low-density residential developments have resulted in significant areas of privately-owned forest. The shire has many areas of high-quality soils, which provide the base for important horticultural and cropping activities. Areas of poorer-quality soils have not been cleared for agriculture and much remains as Crown land. The forests are used for firewood and minor forest produce, beekeeping, water-catchment protection, outdoor recreation activities and flora and fauna conservation. The shire is renowned for its mineral springs, with over 72 known in the region. The population of the Daylesford–Hepburn corridor increases greatly during weekends and holiday periods, as it is a very popular tourist destination.

Hindmarsh Shire (population 5,741)

The four largest settlements in the shire are Nhill, Jeparit, Dimboola and Rainbow. The shire's major industry is agriculture. Many of the businesses in these settlements are highly connected to the agricultural sector. Jeparit and Nhill experience an increase in population from spring through to autumn. The shire contains large portions of two national parks — Big Desert National Park and Wyperfeld National Park — as well as other reserves scattered across the shire. Lakes Hindmarsh and Albacutya and the shire's other wetlands and rivers are home to a range of birdlife. Lake Hindmarsh also provides many recreational opportunities, and when the lake contains water it is a key spot for locals and visitors to camp.

Horsham Rural City Council (population 19,642)

Horsham has a population of about 14,543 people, with the remainder of the population scattered across the municipality in smaller localities. This municipality provides a connection between the northern section of the Grampians National Park, the end of the Great Dividing Range and the Little Desert National Park, which abuts the northern boundary. Mt Arapiles-Tooan State Park, Jilpanger Nature Conservation Reserve, Black Range State Park and Rocklands Reservoir are also located within the municipality. There are numerous smaller state forests and nature conservation reserves scattered throughout and many private bushland blocks

and vegetated roadsides and corridors. The heritage-listed Wimmera River is the dominant feature of the municipality, with several smaller rivers and creeks joining it before or close to Horsham. Yarriambiack Creek is sourced from the Wimmera River upstream of Horsham. Connected to this intricate system of waterways are a number of recreational lakes. Some are part of the water management system serving towns and farms in the region. Others are naturally filled lakes and swamps that are seasonal. These sites provide a range of opportunities (such as camping, skiing, hunting and fishing) for people. The main season for many of these activities is spring and summer, when the seasonal population increases in the area.

Moorabool Shire (population 32,311)

Moorabool Shire is a semi-rural municipality nestled between Melbourne, Geelong and Ballarat. The shire includes the towns of Bacchus Marsh, Blackwood, Ballan and Gordon. Surrounded by State parks and forests the shire is rich with hiking trails, heritage sites, luscious food and wine, parks and gardens. Seventy-four percent of this shire is water catchment, state forest and national park including Lerderderg State Park, Wombat State Forest, Brisbane Ranges National Park and Werribee Gorge State Park. The shire is environmentally diverse, and its topography is characterised by great ranges, plains and rugged river gorges. Some of the many reservoirs in the shire are the Lal Lal, Bostock, Pykes Creek, Moorabool and Korweinguboora reservoirs. The shire also includes three major rivers: the Werribee, Lerderderg and Moorabool rivers.

Northern Grampians Shire (population 11,845)

The shire lies on the north-east side of the Grampians National Park and is situated between the rural cities of Ballarat, Bendigo and Horsham. The main population centres include; Stawell, St Arnaud, Great Western and Halls Gap. During peak tourism periods and major events, the visitor population often exceeds the permanent population. The Grampians National Park, in particular, experiences a large number of both domestic and international visitors over the summer period. The Grampians National Park (Gariwerd) is also one of the richest Aboriginal rock-art sites in south-eastern Australia. The municipality covers some 590,000 ha of a wide range of land types, from steep, mountainous, forested country to flat grazing and cropping lands. The settlement of Halls Gap contains large areas of privately owned remnant vegetation. The municipality contains several endemic flora species, including the Pomonal Leek Orchid. The main watercourse is the Wimmera River, and there are a number of water storages including Lake Wartook, Lake Fyans, Lake Bellfield, Lake Lonsdale and Teddington Reservoir.

Pyrenees Shire (population 7, 353)

The shire includes the towns of Avoca, Beaufort, Lexton and Trawalla, and boasts several significant flora and fauna species including Mt Cole and Ben Major Grevillea, Legless lizard, 200 species of protected grasses, White gums and Platypus. The municipality has many state parks, forests and reserves. These include Pyrenees Range State Forest, Landsborough Nature Conservation Reserve, Mt Cole State Forest, Langi Ghiran and more. There are over 50 wind turbines within the shire's boundaries, with almost another 200 planned for construction in the shire. Agriculture is the shire's main industry, with 81% of land use in the region devoted to agricultural production.

West Wimmera Shire (population 3,903)

Rural land use comprises over 80% of total land use in the shire, with less than 3% used for business, industrial or residential purposes. The main settlements are Edenhope, Kaniva, Harrow, Goroke and Apsley, and smaller settlements include Serviceton, Chetwynd, Dergholm, Lillimur and Miram. The major waterway is the Glenelg River, which is located in the south of the shire. The major land use across the shire is agriculture. The shire is divided in two by the Little Desert National Park, which separates the Red Gum grazing plains from the sandy Mallee vegetation. There are a number of other public land forests and reserves scattered throughout the shire, mainly consisting of brown stringybark vegetation associated with the poorer soils. A large number of naturally filled wetlands are scattered across the southern section of the shire, providing a range of recreational opportunities and significant environmental assets.

Yarriambiack Shire (population 6,674)

Rural land use comprises over 90% of the shire, and less than 3% is used for non-agricultural business, industrial or residential purposes. The main population centres of the municipality are Warracknabeal, Murtoa, Hopetoun, Minyip, Rupanyup, Woomelang and Beulah. There are a number of small farming communities located throughout the shire, which produces one quarter of Victoria's total grain production (predominantly wheat and barley) and is also noted for its production of lamb and wool. In recent years, the shire has also become rich in oilseed and legume crops. Areas of poorer-quality soils have not been cleared for agriculture, and much remains as public land. Floristically rich, these localities are prized habitats for native fauna. The forests are used for beekeeping, water-catchment protection, outdoor recreation activities and flora and fauna conservation.

Bushfire history and patterns

The largest 2% of fires that have been recorded within the Grampians region are shown in **Figure 3**. Larger fires have occurred routinely at two locations in the Grampians region: the Big Desert and the Grampians National Park. This is likely due to these landscapes being remote, challenging for firefighting and having high amounts of continuous vegetation.

Historically, south-western Victoria has suffered huge losses of property in bushfire events (such as the 1942 fires in the Western District that destroyed over 500 houses), and bushfires have also had a huge impact on the local pastoral industry. In recent years, there have been significant house losses from bushfires in the northern Grampians and the Enfield area.

Within the region, there are significant contrasts between the bushfire history of different areas. For example, there are no major fires on record in Yarriambiack Shire, whereas Hepburn Shire has a record of building losses to bushfire. In the last 10–15 years, there have been many major fires in the Grampians and Little Desert National Parks, which are particularly prone to lightning ignitions. One example is the Mt Lubra fire which ignited by lightning in the Grampians National Park on the 20th of January 2006. The fire resulted in the loss of 3 lives and hundreds of buildings. Over a two-week period, the Mt Lubra fire had burnt over 127,000 hectares and approximately 47% of the Grampians National Park. Since 2006, Grampians National Park has experienced another 2 large scale fires, both caused by lightning. These 3 fires have impacted roughly 85% of the Grampians National Park and have had significant impact on communities, tourism and agriculture in the region.

The eastern half of the Grampians region is where the greatest bushfire risk sits, particularly for settlements in and around the Wombat State Forest and Lerderderg State Park, such as Daylesford, Trentham and Gisborne. In 1983, on Ash Wednesday, a fire claimed seven people's lives in the Macedon, East Trentham area. The fire reached a final size of 29,500 hectares, destroying 157 homes and 628 other buildings. Whilst fires of this size have not occurred since, the potential consequence of large fires in this area remains high.

The area south of Ballarat is also high risk, driven by the Enfield State Park and surrounding state forest. This is due to the larger population that resides in these localities, as well as the number of settlements located near forests.

In the western half of the Grampians region, a larger number of property losses are likely to occur within settlements, due to the density of the population. The highest loss within this area is modelled to occur in Halls Gap, due to the density of population and its location within the Grampians National Park.
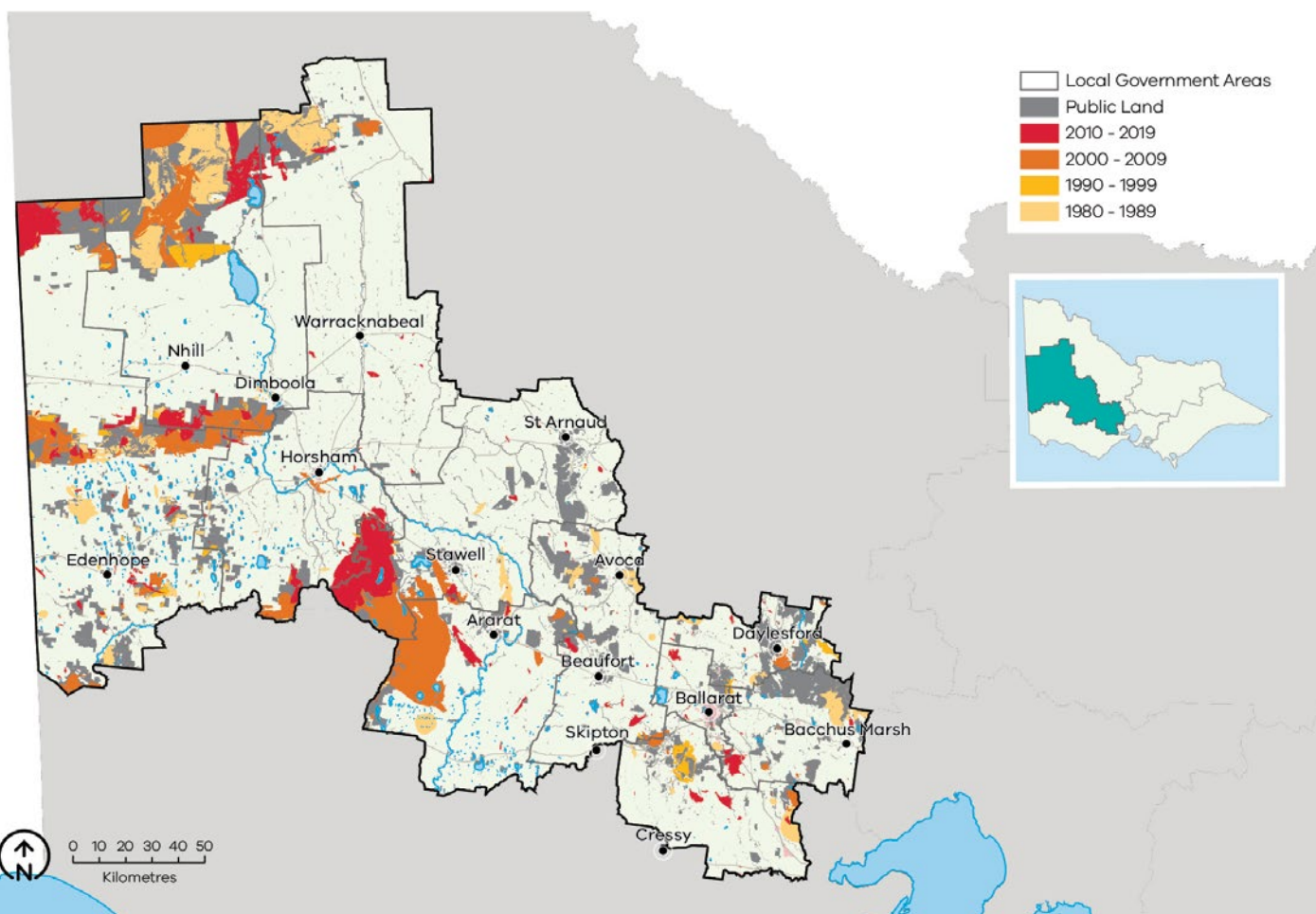
Figure 3.   Bushfire history for the Grampians region, 1980–2019

The Mt Lubra bushfire burnt 47% of the Grampians National Park in 2006 and resulted in the loss of 3 lives.
Photo credit: Glenn Rudolph

Values and assets

Here we describe the most important features of our landscape that informed our strategy.

Human landscape

Life and property

The population of the Grampians region is about 214,600 people. The major population centres are Ballarat, Horsham, Bacchus Marsh, Ararat, Stawell, Daylesford, Hepburn and Beaufort. Parts of the region experience a significant influx of tourists over weekends and holiday periods, particularly Daylesford, Hepburn Springs, Halls Gap and the Grampians National Park.

Critical infrastructure values

The Grampians region includes several critical infrastructure values that have a higher risk of impact from bushfire. They include Ballarat University and Technology Park, the State Library Storage Facility and several communications towers (such as those on Mount Cole and Mount William) (**Figure 4**).

Figure 4.   Critical infrastructure, assets, systems and networks in the Grampians region

Economic values

The Grampians has different economic characteristics across the region including mineral resources, dryland farming, service industries and manufacturing. Agriculture is a major land use in the region, and over half of Victoria's grain is grown in Yarriambick Shire. The Daylesford – Macedon corridor and Halls Gap are major tourism centres on weekends and during holiday periods. Horticulture and viticulture are important industries, especially in Hepburn Shire (**Figure 5**).
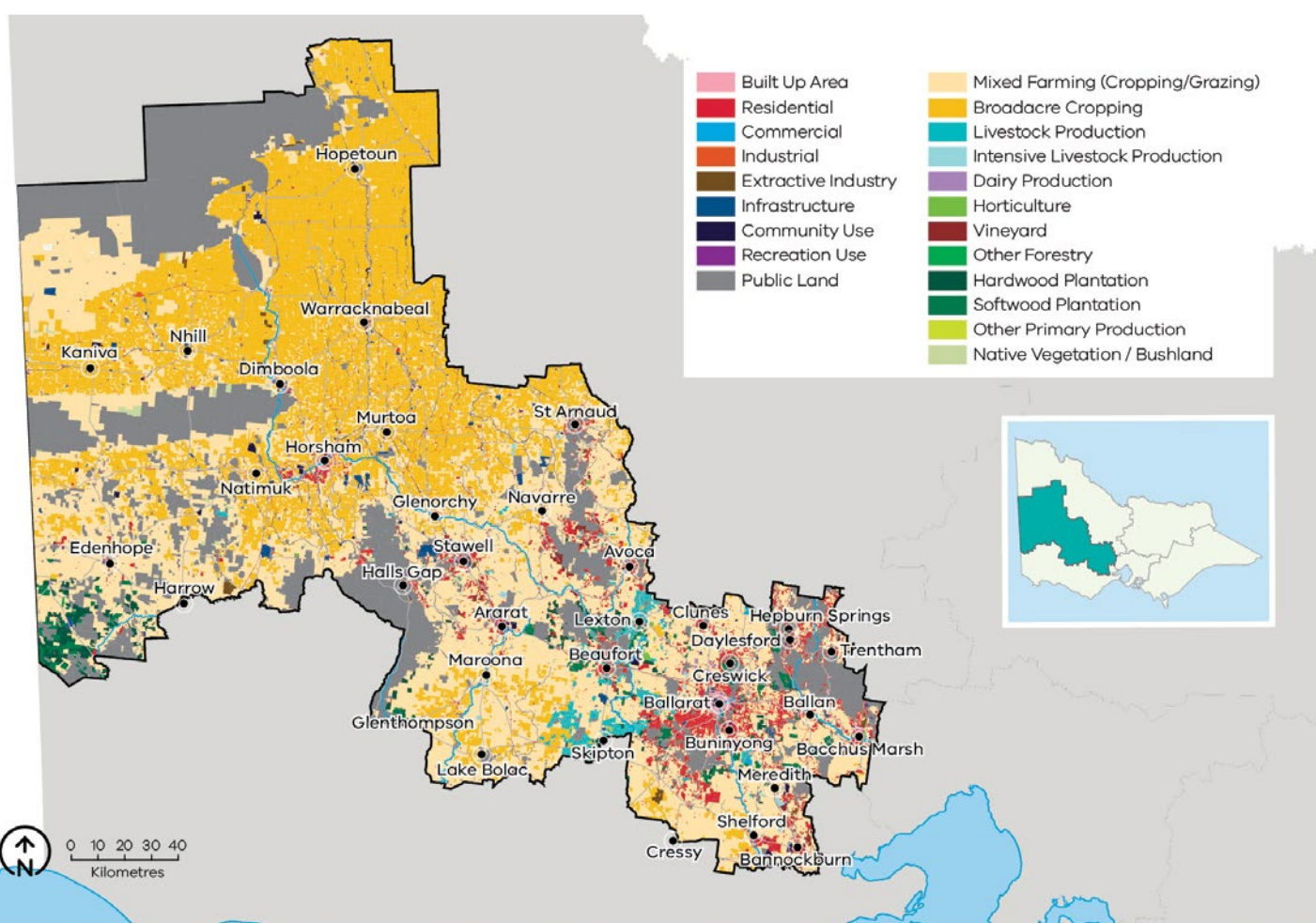
Figure 5.   Generalised land use in the Grampians region

Aboriginal cultural heritage

The Registered Aboriginal Parties in our region (**Figure 6**) are:

- Barengi Gadjin Land Council Aboriginal Corporation
- Gunditj Mirring Traditional Owners Aboriginal Corporation
- Eastern Maar Aboriginal Corporation
- Dja Dja Wurrung Clans Aboriginal Corporation
- Wathaurung Aboriginal Corporation
- Wurundjeri Woi Wurrung Cultural Heritage Aboriginal Corporation.

Well-known Aboriginal sites in the region include Langi Ghiran; Lal Lal Falls, believed to be the earthly home of Bunjil, the Creator to most Victorian Aboriginal groups; and Taylors Rock in the Mt Arapiles-Tooan State Park. The Grampians National Park (Gariwerd) is one of the richest Aboriginal rock-art sites in south-eastern Australia. In addition, the region has many Aboriginal cultural heritage sites including ceremonial gathering places, burial sites, scar trees and artefact scatters.

A Wimmera Co-operative Management Agreement was formalised in 2005. This agreement is between the State and the Wotjobaluk, Jaadwa, Jadawadjali, Wergaia and Jupagalk Traditional Owners, with Barengi Gadjin Land Council Aboriginal Corporation as the representative body. The agreement established the Winyula Council to advise the State on the management of those lands. The relationship is now maintained directly between Barengi Gadjin Land Council Aboriginal Corporation and PV. Co-managed lands under this agreement include: Lake Albacutya Park, Lake Hindmarsh Lake Reserve, Little Desert National Park, Mount Arapiles-Tooan State Park, Wimmera River Heritage Area Park and Wyperfeld National Park.

In the Grampians Region, Kara Kara National Park and Hepburn Regional Park are jointly managed with Dja Dja Wurrung under a Recognition and Settlement Agreement. The agreement also covers joint management of other parks extending into the Loddon Mallee region. Joint management is overseen by the Dhelkunya Dja Land Management Board. Hepburn Regional Park encompasses Mt Franklin, one of the most significant cultural heritage places in Victoria.
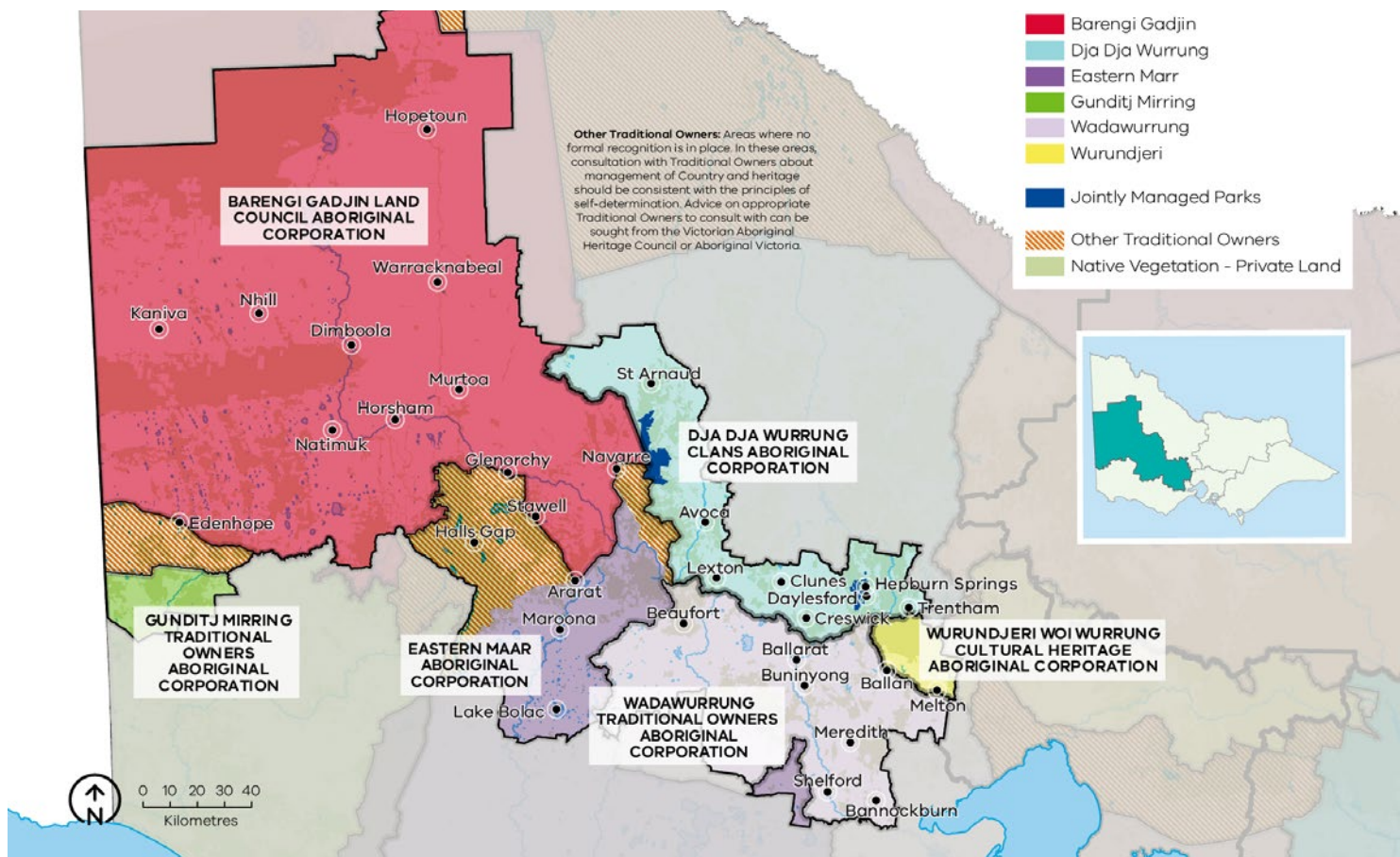
Figure 6.   Traditional Owner groups in the Grampians region

Lal Lal Falls, believed to be the earthly home of Bunjil, the Creator to most Victorian Aboriginal groups.

Photo credit: Josh Bushell

Natural landscape

The region's 1.052 million ha public land estate is comprised of a network of parks, reserves and state forest, which is built upon the national criteria for a comprehensive, adequate and representative (CAR) reserve system of Australia's forests (**Figure 7**). The forests and parks in the region are diverse and include heath desert in the west, rocky outcrops in the Grampians National Park, fragmented forests south of Ballarat and wetter forests near Macedon. Parks and reserves are primarily managed for nature conservation, ecosystem services and recreation. State forest is managed for a greater diversity of purposes including biodiversity conservation, water catchment services, timber harvesting, firewood production, minor produce and apiary use. Recreation and tourism are also an important and increasingly popular use of state forest, with many active and passive pursuits commonplace across the Grampians region.

Native vegetation in the eastern side of the region has been highly disturbed and fragmented in many areas, particularly during the Gold Rush from 1851 to the late 1860s as well as from grazing, cropping, timber harvesting and urban development. During the Gold Rush, many forests right across the goldfields underwent intensive digging and clearing, accompanied by extensive timber cutting for infrastructure and firewood.

Photo credit: Steffen Schultz
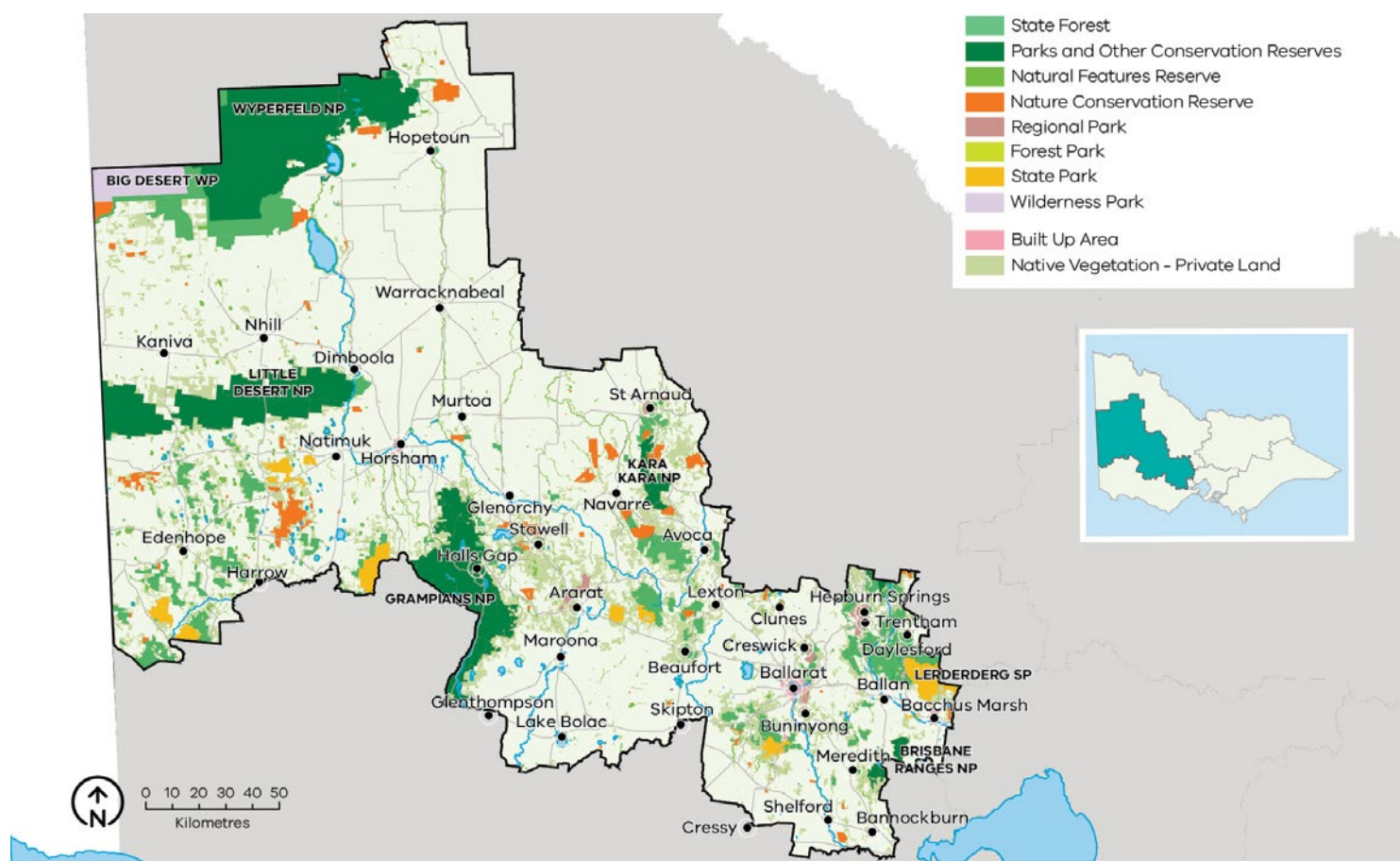
Figure 7. Native vegetation by land tenure in the Grampians region

Photo credit: Steffen Schultz

South-eastern Red-tailed Black-Cockatoo

The South-eastern Red-tailed Black-Cockatoo is a rare, large, nomadic cockatoo found only in south-west Victoria and south-east South Australia. The Victorian and Commonwealth governments recognise it as threatened, and it is one of Victoria's most fire-sensitive fauna species. A national recovery team, formed in 1997, coordinates the management and recovery of the cockatoo. DELWP has actively participated in this team since its inception.

The cockatoo is mainly restricted to stringybark woodlands where it relies on the seeds of Brown stringybark and Desert stringybark for food. The extent of buloke clearing in the past is an important aspect of this reliance on stringybark seed for feed, as buloke is also an important food source. Fire is important for the health of the highly flammable stringybark woodlands: bushfires are common and the vegetation's reproductive cycle depends on fire. However, fire damage to the tree canopy (or crown) also reduces (for about 10 years) the amount of seeds stringybark trees produce, reducing the cockatoo's food source. This is particularly important during breeding season, when the species' food requirements are highest. This balance of limiting crown scorch in stringybark forests from planned burning operations whilst reducing the risk to other assets and maintaining an appropriate amount of fire for the forest's ecological health difficult, and one that will be addressed as part of the planning process.

Image 1.   The South-eastern Red-tailed Black-Cockatoo is an endangered species found in south-west Victoria, and it is of cultural significance to Traditional Owners

Photo credit: Michael Sverns

Greater Glider

The arboreal Greater Glider is found in the wetter forest within the Wombat State Park. Although once considered common, Greater Gliders have undergone substantial recent declines and are now listed as threatened under the *Flora & Fauna Guarantee Act 1988 (Vic)* and Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999 (C'th)*.

Adverse effects on Greater Glider populations subjected to fire can occur due to direct, short-term mortality effects and loss of the canopy food source, as well as longer-term effects on habitat structure and ecosystem function. Both planned and unplanned fires of relatively low intensity can lead to accelerated collapse of hollow-bearing trees, which are a key habitat resource for Greater Gliders. The incorporation of pre-, during, and post-burn measures to reduce the risk of these impacts can assist the species resilience in this forest.

Image 3.   The Greater Glider is a threatened species found in the Wombat State Park.

Photo credit: Adam Whitchurch

Our objectives

What matters most in the Grampians region is discussed in the landscape context section and is summarised into the following fundamental values:

- Human life
- Economy
- Infrastructure
- Nature
- Heritage.

These values are the ultimate, durable reasons why we care about managing bushfires, and they are what we want to protect and manage through bushfire management in the Grampians region.

The following regional objectives are derived from our values and articulate what we are aiming to achieve in the Grampians region (**Table 2**). These objectives contribute to the overall objectives for fire management articulated in the **Grampians Regional Strategic Fire Management Plan**.

Photo credit: Glenn Rudolph

Table 2. Grampians region's values and objectives and how they align with the statewide vision, policy context and strategic objectives

Vision
Safer and more resilient communities

Policy context

The Victorian Preparedness Goal is *A safer and more resilient community that has the capabilities to withstand, plan for, respond to and recover from emergencies that pose the greatest risk.*

The Safer Together policy's four priorities for reducing the risk of bushfires in Victoria are Community first, Land and fire agencies *working together, Measuring success and Better knowledge = better decisions.*

Strategic objectives (Code of Practice for Bushfire Management on Public Land)

- To minimise the impact of major bushfires on human life, communities, essential and community infrastructure, industries, the economy and the environment. Human life will be afforded priority over all other considerations
- To maintain or improve the resilience of natural ecosystems and their ability to deliver services such as biodiversity, water, carbon storage and forest products.

Grampians region values				
Human life	**Economy**	**Infrastructure**	**Nature**	**Heritage**
Grampians region objectives				
Minimise loss of life and property	Reduce the risk of economic drivers being impacted by bushfire	Minimise loss of community infrastructure	Maximise persistence of ecological communities and species	Maximise cultural heritage values

Our risk management approach

In hot, dry and windy conditions, a bushfire can travel quickly across a large area of our landscape. To effectively understand bushfire risk, we simulate many bushfires across the entire landscape to determine where bushfires are likely to start, spread and cause damage to values and assets, with a particular focus on people and communities. We can then reduce fuel hazard, through our fuel management program, across the spread paths of these simulated bushfires with the intention of reducing the spread and intensity of these fires and ultimately limiting their impacts.

Risk in Grampians region

Figure 8 shows the risk of house loss in the Grampians region. It compares where houses could be destroyed by bushfire across the region.

Different shades represent different levels of risk. As the shades progress from yellow through red to purple, more and more houses are potentially destroyed. The purple areas represent the top 5% of risk in Grampians region. More houses could potentially be destroyed in these areas than any other.

While bushfire risk exists across the entire landscape and house loss can and will occur in other areas, this map shows where the greatest 70% of house loss risk sits within our region.

Bushfire simulations generated by Phoenix RapidFire illustrate risk by showing where significant impacts on houses may occur. Simulations are undertaken using a range of different weather conditions, likelihood of an ignition, maximum fuel loads and limited bushfire suppression.

This helps us plan where, how often and how much fuel management we do to reduce risks to communities over years, or even decades.

This map does not reflect any recent bushfires or activities that could change the risk in the region. Importantly, this map shows where there is potential to destroy more houses compared to other parts of the region. It does not show risk to individual houses.

Higher risk areas in Grampians region

Daylesford is an example of a high-risk town within the Grampians region. This is due to the large amount of forest located to north, west and south of the town, as well as its population. The township also experiences a large influx of tourist over the fire danger period. The forest around Daylesford could allow fires to become large and intense before impacting the town. Prediction modelling tells us that many fires can reach Daylesford and cause house loss.

Photo credit: Donna Thomas

## Lower risk areas in Grampians region

In contrast, Lethbridge is located away from forest and surrounded by mostly grass. While grass fuels burn quickly, house loss from grass fires is less likely than in forest fires. This is because grass fires are not as hot and cause less embers. Fire history and prediction modelling tells us Lethbridge would experience less house losses.

Photo credit: DELWP
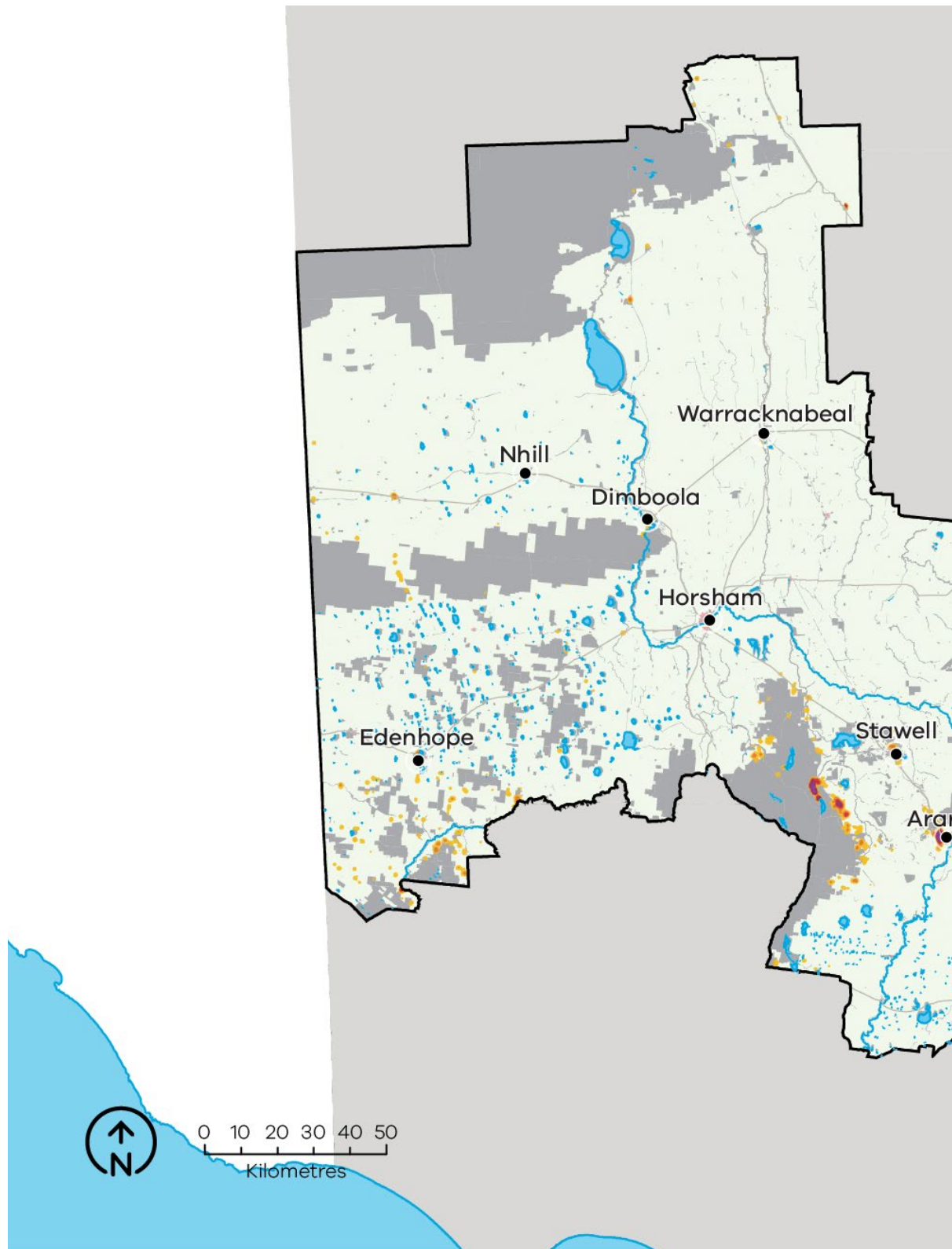
Figure 8.   Bushfire risk within the Grampians region. This map only considers modelled house loss within the Grampians region, and so risk shown on this map can only be compared within this region.

Legend:
- Built Up Area
- Public Land

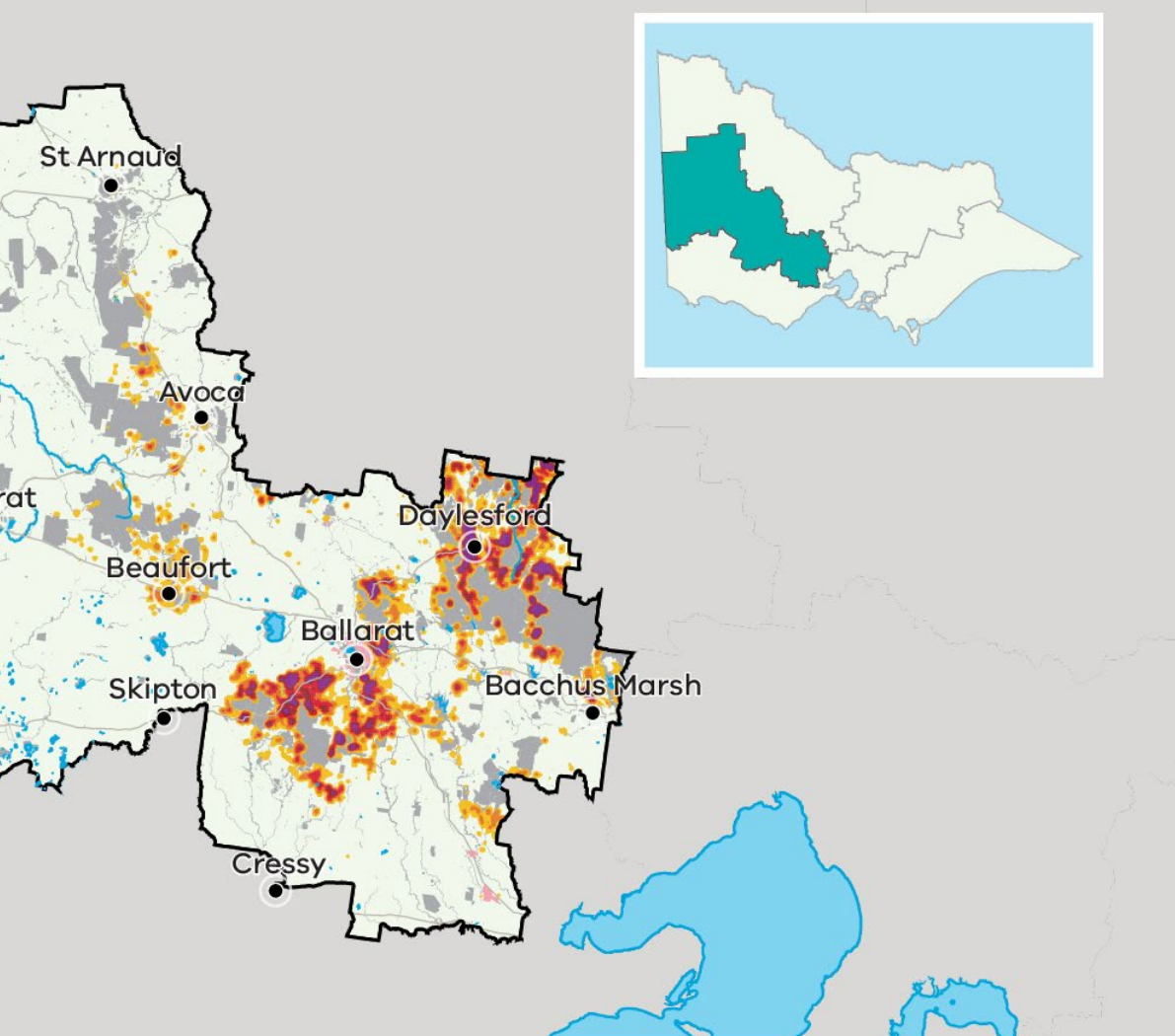**House Loss Bushfire Risk (Comparative in Region)**
- Highest risk – Top 5% of risk
- Higher risk – Top 10% of risk
- High risk – Top 20% of risk
- Intermediate risk – Top 40% of risk
- Low-Intermediate risk – Top 70% of risk

Why model house loss?

Human lives are given priority over all other considerations, however we cannot know where exactly people will be in the event of a bushfire. Simulations of house loss help to identify areas across our landscape where bushfires could have the greatest potential impacts on lives, as well as on other things we value such as our homes themselves, livelihoods and communities. This also reflects the importance of homes as a primary place of shelter and residence. The simulated house loss shown in **Figure 8** indicates where these areas are and the possible scale of bushfire impacts relative to other parts of our region. We consider these impacts when developing fuel management strategies for the values and objectives in our region. We can model how our strategies improve the outcomes by reducing bushfire risk to people's homes, and the social values connected with them. House loss informs one of our key metrics — 'residual risk'— by which we assess the effectiveness of our fuel management strategies. The residual risk metric is explained in more detail below.

How do we model house loss?

We compare the characteristics of bushfires that are simulated in Phoenix RapidFire with those that led to actual house loss in historic bushfires. Our model assumes houses (based on address points) are destroyed by a simulated bushfire if the modelled fire intensity exceeds 10,000 kilowatts per metre (generally a crown fire) or if ember density exceeds 2.5 embers per square metre. Research indicates that bushfire embers account for the majority of houses lost, with most occurring within 1 km of the edge of forested areas and native vegetation (although house loss still occurs beyond this distance). This is consistent with our modelling which shows similar patterns of house loss. Other fire behaviour factors can have a strong influence on house loss (such as convective strength of the fire), and they are being further researched to understand this risk.

We estimate the magnitude of property impacts by analysing how many houses are modelled as destroyed under all of our simulated bushfires. We can compare between communities to understand which are more likely to suffer large numbers of houses lost.

It is important to note that the modelled property impact is only a coarse estimate and should not be applied at the individual house level. The vulnerability of a house also depends on other factors: its building materials, design and maintenance, how close it is to combustible elements, the presence of human intervention (before, during and after a fire) and the environment in which a bushfire occurs. These factors cannot all be modelled in landscape scale simulations. However, over time they can be included in statistical models, to improve estimates of potential house loss.

Photo credit: Glenn Rudolph

Our fuel management strategy

Our fuel management strategy describes our approach to balance the threats posed by bushfire to our most important values and assets, with managing fire to enhance the health and resilience of ecosystems. It responds to Grampians region's unique bushfire risk profile, determined through our risk assessment process.

Fire Management Zones

The fuel management strategy is presented as an arrangement of different Fire Management Zones (FMZ) on public land, as described in the Code of Practice for Bushfire Management on Public Land (2012). There are four zones – Asset Protection Zone (APZ), Bushfire Moderation Zone (BMZ), Landscape Management Zone (LMZ) and Planned Burning Exclusion Zone (PBEZ). Although the name of the zone indicates the primary purpose of that zone, it is recognised that multiple goals can be achieved when undertaking activities in each zone. For example, a burn undertaken primarily for land management purposes may also have asset protection outcomes.

Bushfire risk mitigation outcomes are the primary purpose of Asset Protection Zones. Ecological outcomes are still considered, but the protection of life and property is the priority for these zones. This emphasis gradually shifts through the Bushfire Moderation Zone and the Landscape Management Zone, such that the Planned Burning Exclusion Zone's primary focus is ecological outcomes. It is important to note that although the Bushfire Moderation Zone has a stronger bushfire risk mitigation focus than the Landscape Management Zone, there is still a focus on risk mitigation in the Landscape Management Zone.

Fuel management is often scheduled in the Landscape Management Zone to complement that which has been undertaken in the Bushfire Moderation Zone and the Asset Protection Zone and enhance the risk reduction that can be achieved across the whole landscape. Fuel management in the Landscape Management Zone will be undertaken less frequently with burns often undertaken over a broader area with lower coverage, to reduce the ecological impacts.

In some areas, communities may see fuel management works occurring in nearby forest most years. This may be because we are delivering a multi-year planned burn, where some fuel types or areas of the burn are targeted in one year, and a different fuel type or area targeted the next year. It may be because we are burning in adjacent blocks to those previously treated, to ensure the highest level of protection to the town. If we undertake mechanical treatments such as slashing in an area, fuels often re-accumulate quickly and treatments need to be repeated.

The aims of each zone, how they have been placed and how they will be implemented in Grampians region is described further in **Table 3**.

The FMZ configuration for public land in the Grampians region is shown in **Figure 9**.

Photo credit: Lauren Todman

Photo credit: Josh Bushell
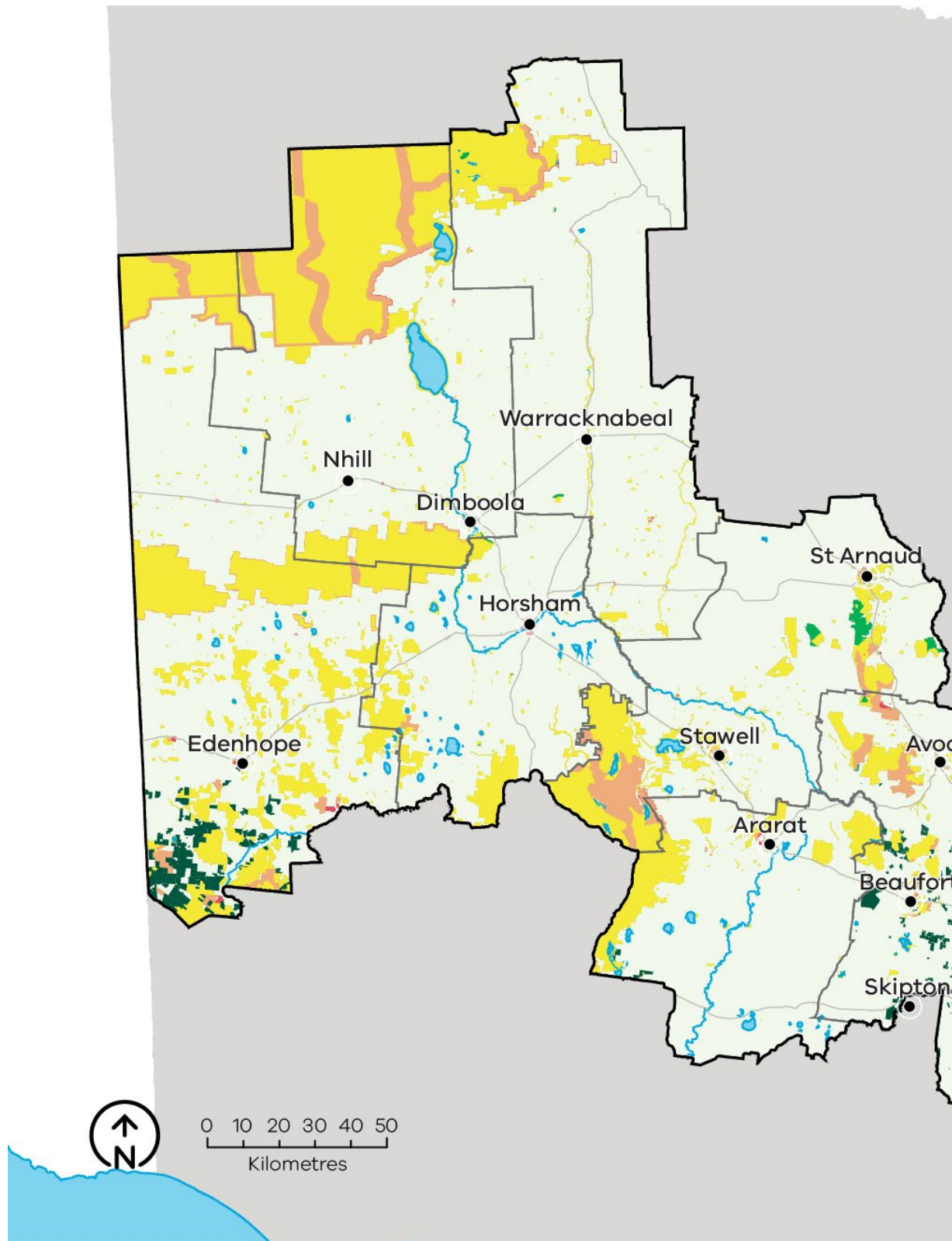
Figure 9.   Fire Management Zones for public land in the Grampians region. This zoning configuration was developed through risk assessment processes and in consultation with key delivery partners.

Local Government Areas

Built Up Area

Plantation

Fire Management Zones

Asset Protection Zone (APZ)

Bushfire Moderation Zone (BMZ)

Landscape Management Zone (LMZ)

Planned Burn Exclusion Zone (PBEZ)

Daylesford

Ballarat

Bacchus Marsh

Cressy

Table 3.   Description of the aims, placement, planned fire intervals and typical outcomes of fire management zones for public land in the Grampians region. This is a description of typical featur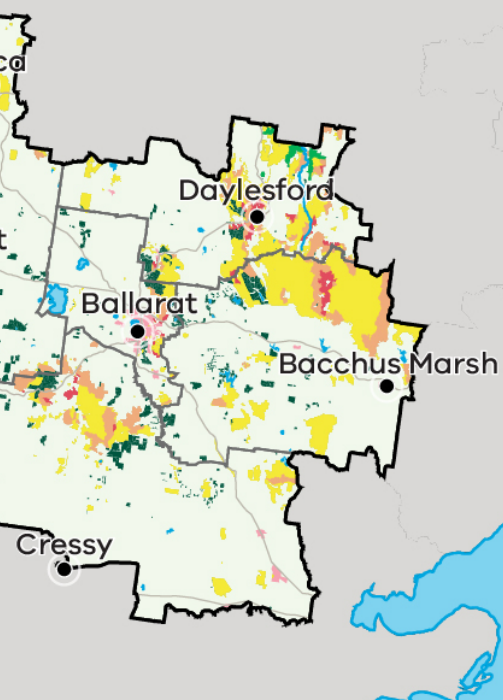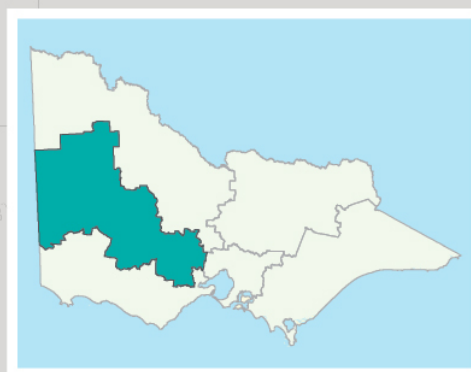es of these four zones, consistent with the aims of the zones in the *Code of Practice for Bushfire Management on Public Land* (2012).

	Asset Protection Zone (APZ)	Bushfire Moderation Zone (BMZ)	Landscape Management Zone (LMZ)	Planned Burning Exclusion Zone (PBEZ)
Aim	Provide localised protection to human life, property and key assets.	Reduce the speed and intensity of bushfires. Achieve ecologically-desirable outcomes where possible.	Reduce overall bushfire hazard at the landscape-scale; support ecological resilience and land-management objectives.	Exclusion of planned burning from areas primarily intolerant to fire.
Typical placement	Where most effective to reduce overall bushfire risk; typically, smaller burn units on the public/private interface.	Near public/private interface or key assets, or strategic placement to inhibit spread of large fires.	Rest of landscape not covered by APZ, BMZ or PBEZ.	Burn units wholly or largely covered by vegetation communities less tolerant of fire.
Typical planned fire interval	5 to 8 years.	8 to 15 years.	Varies depending on land-management and fire-management objectives.	Not applicable.
	These intervals are indicative only to help provide an understanding of time between planned fire in each zone. Planned fire intervals for each zone are determined by fuel hazard (type, size, arrangement and quantity) triggers to achieve fuel treatment outcomes in each zone. Actual planned fire intervals may be more or less frequent depending on previous fire severity and coverage, vegetation type, climatic and seasonal conditions and actual rate of fuel re-accumulation. It is also important to note that some burns are conducted in multiple stages and sequenced with other burns in the landscape to form a landscape mosaic, meaning that planned burning operations can occur in the same area over successive years. Some areas, especially in APZ, are treated with mechanical treatments which may occur more frequently.			
Fuel treatment goal	Reduce radiant heat and ember attack.	Complement APZ goals and reduce bushfire spotting.	Reduce treatable fuels and achieve ecologically beneficial fire intervals.	Not applicable.
Typical fuel treatment outcomes	Intensive treatment; 80-100% burn cover, with reduction of bark fuel hazard a priority. In some cases, mechanical treatment as alternative or complementary.	Moderately intense treatment, seeking significant reduction of fuel hazard over a majority of treatable fuels within the burn unit. Coverage targets typically 50–70%.	Varies depending on land-management and fire-management objectives. Generally involves burning at low intensity, with less than 50% burn cover.	No planned fire.

Ecosystem resilience

An ecosystem's resilience is its capacity to withstand and recover from a range of disturbances, including fire. We cannot measure ecosystem resilience by looking at a single species or fire event: we must look at the whole landscape, and at multiple fires with various frequencies, intensities, scales and seasons of burning. Tolerable fire intervals (TFIs) are the minimum and maximum recommended times between fire events for a particular ecological fire group. Burning regularly outside these intervals increases the risk that there will be fundamental changes in the abundance and composition of species, and the type of vegetation. Growth stage structures (GSS) describe the mix of habitats available across a particular landscape or vegetation type.

In our fuel management strategy, TFI has been used as a tool to guide where burning can occur that has the least amount of impact on a vegetation community. The strategy aims to minimise the total area burnt below minimum TFI because fire can affect overall ecosystem resilience if it occurs too frequently. However, planned burning may be conducted in some areas below minimum TFI to reduce bushfire risk to life, property and important ecosystems.

Larger and more intensive bushfires have a significant impact on ecosystem resilience. Planned burning may also be conducted below minimum TFI to reduce the size, severity and frequency of large bushfires. There will be instances in the footprints of past large bushfires where fuels re-accumulate and become flammable before ecological maturity is reached. Fire is also reintroduced in these areas below minimum TFI to prevent large bushfires reoccurring, which can be more likely due to fuels loads being the same across a broad scale area. Burning below minimum TFI will have shorter term or localised impacts on vegetation communities, however we also need to compare this with how they would be impacted should a major bushfire occur.

We recognise that TFI is a broad measure of ecosystem resilience and there are finer-scale vegetation responses to differing severity of planned burning and bushfires, however it can help us with regional-scale planning.

We are continuing to improve our understanding of TFIs by monitoring the responses of different species of vegetation to differing fire severity, and by investing in research that improves our ability to predict these responses. We are also improving the TFI mapping by using species distribution models for key flora species on which minimum TFIs are based. This enables TFIs to be mapped more accurately.

About our fuel management strategy

The Grampians region fuel management strategy achieves a high level of risk reduction for communities whilst balancing other values. Asset Protection Zone (APZ) and Bushfire Moderation Zone (BMZ) are the priority areas for treatment to reduce risk to life and property in all sub-landscapes. These areas have been identified as locations where fuel management can directly assist the protection of nearby communities.

The prevention of large-scale, high-intensity bushfires is another priority of strategic bushfire management. This strategy aims to prevent homogenisation of age class across the landscape, and minimise areas burnt below minimum TFI. In order to manage parks (such as the Little Desert National Park), the internal break strategy shown in **Figure 9** is to be implemented and, where appropriate, minimum impact suppression is to be applied.

Future development of Landscape Management Zone (LMZ) plans will aim to reduce the occurrence of large-scale fires and provide more opportunities for ecological burning in the region to achieve long-term ecological benefits. This will include practices such as conducting cooler late-season burns within Greater Glider habitat in order to regenerate the native shrub layer without burning the gliders' canopy food source and surrounding habitat trees.

Little Desert National Park sub-landscape[2]

LMZ in the Little Desert National Park (LDNP) is managed to reduce the potential for large fires to develop. This reduces the risk of areas of long-unburnt vegetation, which are important for Mallee Fowl, being burnt by bushfire and then having a large proportion of the LDNP being one young age class. This is achieved in the LDNP by having a series of thin strips burnt to BMZ standards and burnt in rotation — each strip every 12 years — to minimise the amount of vegetation burnt under minimum TFI. The strips are backed up for another burn every 3–5 years. This creates a series of fuel breaks in the park to reduce the risk of large fires developing. An example of these breaks is shown in **Image 2**. Similarly, a network of LMZ internal breaks have been created to reduce the potential for large bushfires to dominate the park and impact on the ecology of the area.
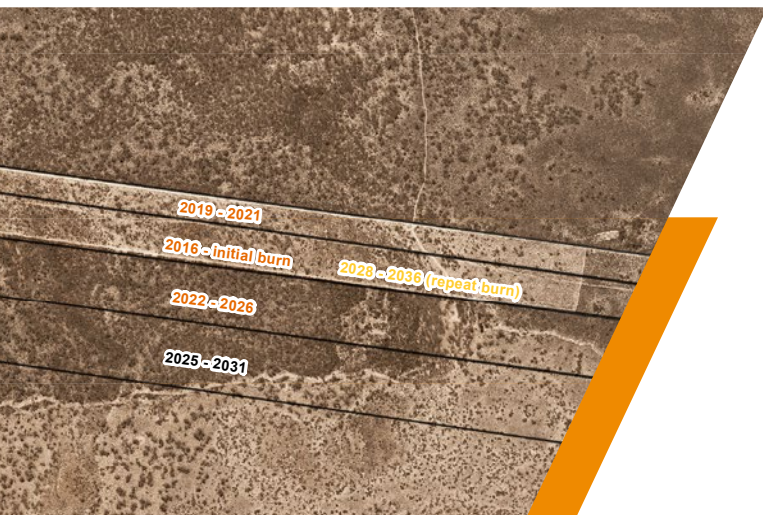
Image 2.   Schematic representation of how fuel-reduced strips may be created and scheduled in Little Desert National Park showing how they are backed up and repeated.

The placement of these breaks is shown on the strategy maps in **Figure 9**.

A strategy for the applying fire in the broader LDNP landscape will developed as part of a suite of LMZ Strategies within the Grampians Region. The plan will aim to facilitate burns in the LMZ to both reduce large fires and develop a diversity in the age of vegetation, which contributes to providing important habitat for native animal such as Malleefowl and Silky Mouse. In the interim, the Fire Ecology Strategy and Conservation Action Plan for the park should be considered the guide for planned burning in these areas.

Grampians National Park sub-landscape

In the Grampians National Park the area on the western side of the Serra Range along with forest around Halls Gap has been zoned Bushfire Moderation Zone. Regular treatment of these areas will reduce the likelihood of embers impacting Halls Gap, Pomonal and the Mount William Range. The BMZ around the edge of Halls Gap aims to further protect nearby by assets by reducing radiant heat.

Further planning is underway for how prescribed fire should be used in areas of LMZ. Within these areas, the approved Grampians National Park Fire Ecology Strategy and Conservation Action Plan will be applied over a 40-year period to estimate landscape-scale ecological impacts and responses. These ecological needs will be balanced with the need to reduce the risk of large fires developing, and objectives discussed in this document will guide the placement and extent of planned burning in LMZ.
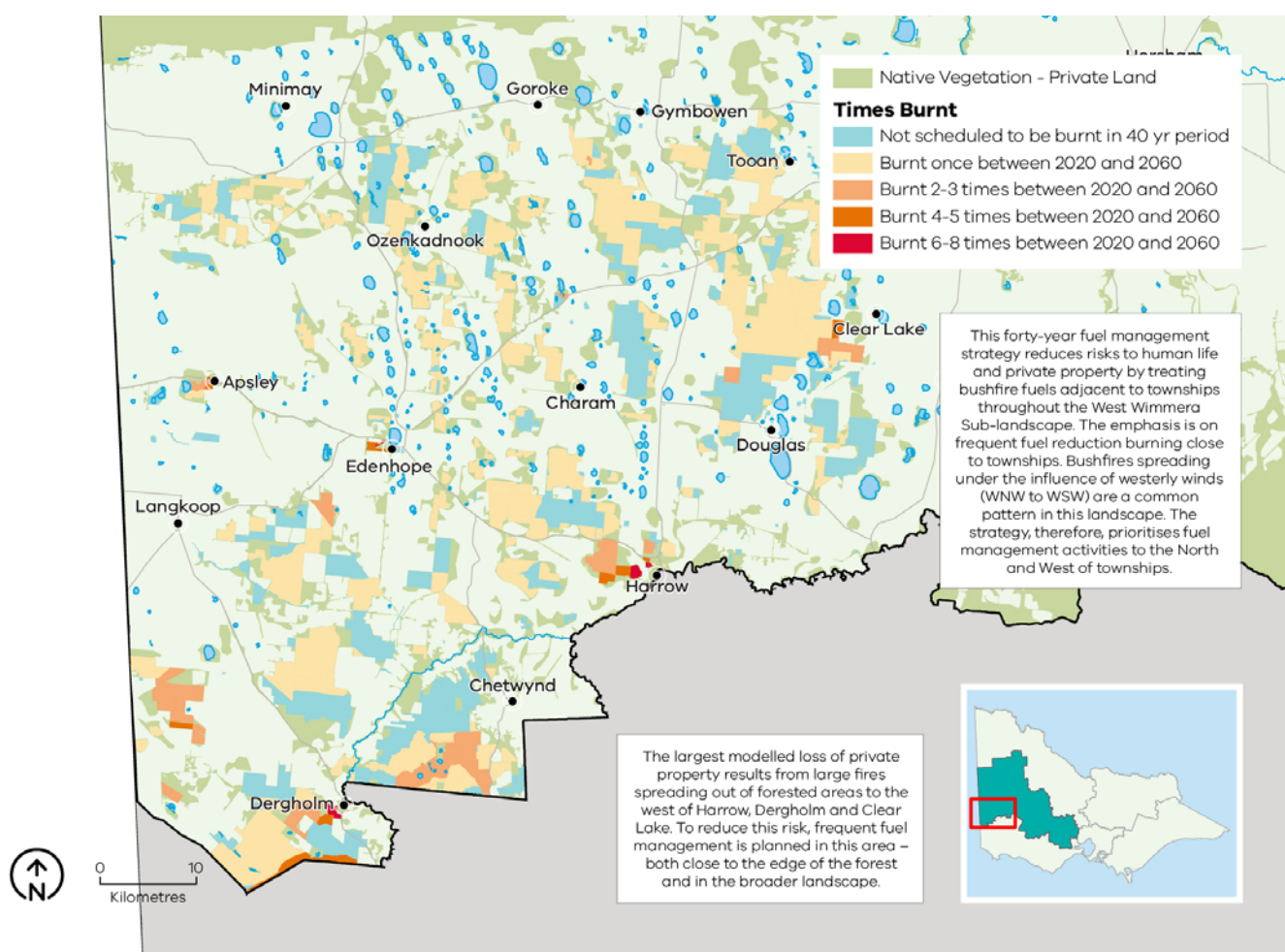
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2   Sub-landscapes are also locally referred to as landscape management units (LMUs).

West Wimmera sub-landscape

The strategy for the West Wimmera sub-landscape was developed by the Barwon South West region to enable consistent planning across the full range of habitat for the South-eastern Red-tailed Black Cockatoo. The Barwon South West Region Bushfire Management Strategy 2020 explains the process used in planning for this area.

In the West Wimmera, a landscape mosaic approach has been adopted, which includes burning many areas once over the 40-year period. This is complemented by burning targeted areas in BMZ 2–3 times over the 40-year period. This design proved most effective in reducing bushfire impacts to human life, human settlements and industries, and it best balanced the needs of fauna and flora species. The design provides the flexibility in delivery to account for periods when the cockatoo's rolling canopy scorch target would be exceeded. We forecast that the scorch target is likely to be exceeded for between 6 and 12 years during the next 40-year period. The strategy for this area is shown as the number of times burnt within a 40-year period and is shown in a map in **Figure 10**.

Legend:
- Native Vegetation - Private Land
- **Times Burnt**
  - Not scheduled to be burnt in 40 yr period
  - Burnt once between 2020 and 2060
  - Burnt 2-3 times between 2020 and 2060
  - Burnt 4-5 times between 2020 and 2060
  - Burnt 6-8 times between 2020 and 2060

This forty-year fuel management strategy reduces risks to human life and private property by treating bushfire fuels adjacent to townships throughout the West Wimmera Sub-landscape. The emphasis is on frequent fuel reduction burning close to townships. Bushfires spreading under the influence of westerly winds (WNW to WSW) are a common pattern in this landscape. The strategy, therefore, prioritises fuel management activities to the North and West of townships.

The largest modelled loss of private property results from large fires spreading out of forested areas to the west of Harrow, Dergholm and Clear Lake. To reduce this risk, frequent fuel management is planned in this area – both close to the edge of the forest and in the broader landscape.

The broad patterns displayed in this sub-landscape map provides an indication as to where and how much fire is required to meet the forecast outcomes of the strategy. In many instances, particularly in areas burnt only once or twice in the 40-year period, there is flexibility around which areas are selected to be burnt. This is especially the case in the FarSouthWest and West Wimmera, with the strategy designed to achieve a whole of landscape mosaic outcome over the 40-year period.

This "whole of landscape mosaic" strategy is designed to create a pattern of burning, that optimises the risk reduction benefits to communities, as well as the plantation and agricultural sectors. This also balances the needs of native plants and animals that have different fire needs.

Selected areas are scheduled to be burnt 2-3 times over the next 40 years across the landscape. These burns are conducted in locations that reduce the risk from bushfires to plantations and/or the South-eastern Red-tailed Black Cockatoo (SeRtBC). The SeRtBC is an endangered species that is only found in this area. Risk reduction in this landscape is supported by other nearby areas being burnt once over the 40 year period. This strategy helps maximise the food available to the SeRtBC, whilst reducing overall risk to communities and the regional economy.

Figure 10.   West Wimmera number of times burnt over 40 years

Wombat sub-landscape

The Wombat sub-landscape includes the highest risk communities in the Grampians Region. APZ has been placed in forest areas located at the edge of communities. By treating fine fuels in these areas routinely, the risk of impacts directly from flame, radiant heat and embers is reduced.

BMZ is located slightly further away from communities. During high fire danger days, bushfires are most likely to approach communities from the north, west and south. This informs the placement the BMZ to best protect townships from fire. Regularly treating these areas reduces risk to nearby communities by reducing radiant heat as well as threat from embers.

Within the LMZ in the Wombat sub-landscape, some areas could be treated more frequently to reduce risk to communities or based on community input. These may be appropriate to be treated more regularly, at an approximate frequency of 18 years.

Targeted planned burning in LMZ may also be undertaken to reduce the risk to priority infrastructure and to support current risk reduction measures for key egress routes.

Planned burning will be avoided where possible in riparian areas and the Sedgy Riparian Woodland ecological vegetation class for the management of Greater Glider habitat. This will be achieved through operational and tactical planning measures. Planned burning will be excluded from reference areas in the Wombat Sub-landscape.

Mt Cole; Enfield; Brisbane Ranges; Ballarat; Ararat – Stawell sub-landscape

To reduce risk to life and property, the forest directly surrounding many communities is zoned as Asset Protection Zone. In these areas fine fuels are reduced through regularly planned burning or mechanical treatments order to protect nearby assets.

BMZ forest blocks often adjoin areas zoned as APZ. These areas will be targeted for planned burning roughly 3 times over the 40 year period. The treatment of these areas will reduce the risk to nearby towns by reducing the impacts of radiant heat and the occurrence of embers. APZ and BMZ work together to assist in reducing the fire intensity around at-risk communities and reduce the likelihood of assets being impacted by fire.

The remaining forested areas are zoned as LMZ. Planned burning is conducted in these areas to reduce the potential spread of large fires and to protect environmental values. LMZ plans to further guide planned burning will be developed for these sub-landscapes. Existing considerations for fuel management in LMZ across the region include:

- Planned burning is important to maintain ecological resilience and this strategy aims to implement an appropriate amount of planned burning in the landscape
- If additional burning is required for reduction of bushfire risk to communities or based on community input, then this should be focused within the Bushfire Risk Engagement Areas (BREAs)
- Burning may be required to reduce the risk to prioritised infrastructure or support current risk reduction measures for key egress routes (localised fuel reduction activities) to increase ecological resilience, ecological planned burns should consider patchiness and provide opportunities for multiple year treatment
- Ecological planned burns should consider follow-up treatment required (that is, pest plant and animal management) and broader land management objectives.

Big Desert / Wyperfeld sub-landscape

Victorian landscapes and environments are diverse and complex. There is no one-size-fits-all approach to fuel management strategy design and the reduction of bushfire risk. The large Mallee parks — Big Desert and Wyperfeld — are no exception.

The risk profile of many small settlements in the north-west of our region is influenced by fires that may exit the large Mallee parks. The edges of these parks are treated to reduce the likelihood of exit fires that may impact residential property or agricultural assets. Similarly, a network of internal breaks has been defined to reduce the potential for large bushfires to dominate the system and create homogeneity of age class. These breaks are zoned as BMZ, as they have bushfire moderation objectives, but are treated in line with the strategy detailed in this case study. This strategy remains largely unchanged from that identified in DELWP's and Parks Victoria's 2015 Mallee and Murray Goulburn Strategic Bushfire Management Plan and represents an evolution of a fuel management strategy that has existed since 2005. Fire management in Big Desert / Wyperfeld is managed through Loddon Mallee region.

Boundary breaks

In key towns on the edge of the large Mallee parks, bushfire risk can be effectively reduced by treating the edge of the park to prevent destructive exit fires from impacting priority assets. The analysis identified priority areas where boundary breaks are a fundamental part of the fuel management strategy. **Table 4** on the right outlines the risk reduction potential to each priority settlement.

Table 4.   Settlements and the residual risk when only exit fires are managed

Settlement	Approximate residual risk (exit fire risk managed only)
Jeparit	30%
Brim, Beulah & Hopetoun	59%
Yaapeet	18%
Walpeup	74%
Rainbow	62%

While spotting is likely 1–2 km from the main head fire, having a recently burnt break (6–10 years) will reduce the spotting potential significantly. For the private property interface, any spotting into paddocks is generally suppressed more easily than it is within the parks. A total break width of 1500 m, with three, 500 m sections is proposed for the highest-risk catchments. Each section will be backed up after 5–10 years to ensure the spotting potential is minimal from within the 1500 m break. After as little as three years, fire may carry through the breaks, and for this reason a 100 m mechanically treated edge is proposed to significantly reduce the spread of the head fire.

The treatment strategy will consist of:

- one 100 m mechanical treatment on private interface (in the most high-risk catchments only)
- three 500 m burns completed as fuel loads dictate (indicative return time of every 5–7 years) (**Figure 11**).

Figure 11. Fire break design of edge breaks on the boundary between private and public lands. Orange line = highly intensive treatment (such as chaining 100 m wide strip of vegetation). Yellow = strips of burning conducted one every 5–7 years.

In lower-risk catchments, the same boundary principle is applied, however mechanical treatments are not required, and there will be three burns of 250–300 m. This will provide a 750 m – 1000 m strip, aimed at reducing the potential for fire spread and intensity.

Internal strategic corridors

Large internal strategic corridors are the key to limiting the spread of large fires. The strategic corridors have been placed such that natural fires do not exceed 20,000 ha in a single-day run, and risk homogenisation of the fire age class within the public land system. Implementation of the internal strategic corridors follows the process below:

1. Maintain internal fuel-reduced corridors 3 x 1000 m wide (width variable on EVC).
2. Maintain internal strategic corridor system by 'revolving' strip burns (1000 m wide).
3. Once fuels have reached a point where the first strip will almost carry fire, back-up with a second strip to the west.
4. Once fuels have reached a point where the back-up strip will almost carry fire, burn a third and terminal strategic strip to the west.
5. Once fuels in the terminal strip have reached a point where they will almost carry fire, re-burn the first (eastern) strip again.
6. Once all three strips have been treated a second time, the entire strategic corridor must be relocated.
7. Prior to the final strip treatment, review the whole strategy of strategic corridors and redesign a new network of corridors (**Figure 12**).
8. An indicative timeframe for treatment of the next strip is 5–7 years in the Big Desert–Wyperfeld National Park.
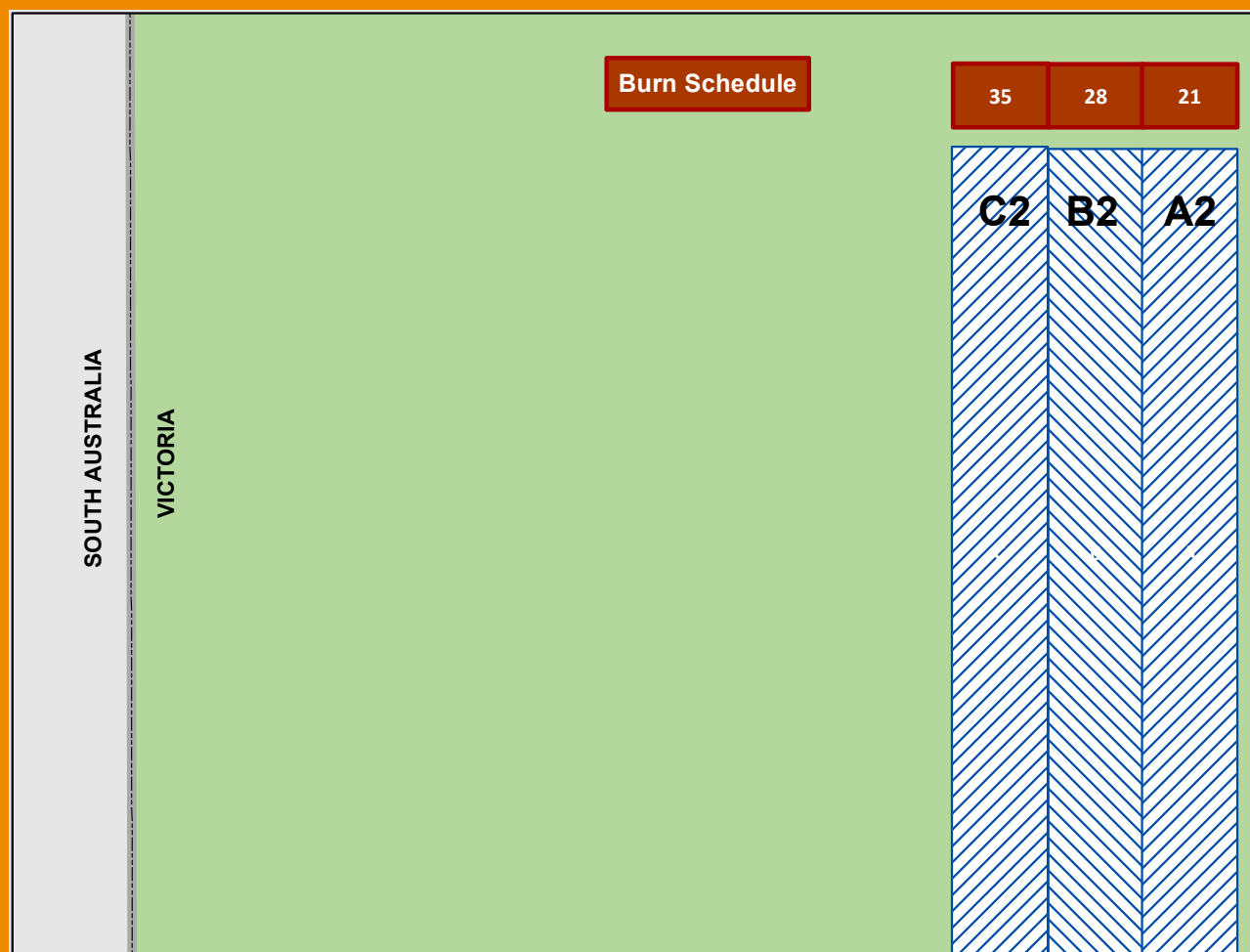
Figure 12. Schematic of the second stage of implementing the internal break strategy for the large Mallee parks

Minimum Impact Suppression Strategy (Big Desert- Wyperfeld)

A strategy that has been trialled in previous years is the use of Minimum Impact Suppression Strategy (MISS). This strategy can be used in conjunction with priority suppression zones (as defined in the Loddon Mallee Region Bushfire Management Strategy 2020) and the local knowledge of incident management teams in the Big Desert-Wyperfeld Complex. The successful implementation of strategic breaks through the fuel management strategy greatly reduces the likelihood of large fires and enables the use of MISS.

Incident Controllers are required to consider the possible long-term environmental and cultural impacts of suppression tactics used. This method of containment is cost-effective, often environmentally preferred due to the absence of mechanical disturbance, culturally less damaging, and significantly less resource-intensive. This suppression method is also much safer for firefighters. Use of MISS must be endorsed by the incident controller and will be defined by the location of the bushfire, proximity to priority assets and fuel-reduced corridors, as well as the underlying fuel and weather conditions. Effective implementation of MISS depends on the successful

implementation of the fuel management strategy, and it will follow the process below:

1. Define high-risk zones where active suppression is preferred.
2. Define containment zones where MISS will be effective:
   a. allow medium-potential-sized fires to run within their containment zones:
      i. natural bushfires will be allowed to burn out to strategic breaks
      ii. fires will be marked 'contained'
      iii. as fires are already contained, mechanical edges may not be necessary
      iv. maintain watching brief on bushfire behaviour
      v. allow to self-extinguish
      vi. then be declared safe
   b. declare areas of high risk where larger potential fires will be controlled to limit size.
3. Natural fires inform strategic break treatment over time:
   a. where deemed appropriate back these up over time.

Victoria's residual risk

We measure the impact of the fuel management on reducing bushfire risk. This measure is called 'residual risk'. Residual risk is calculated as the percentage of bushfire risk 'left over' after fuel in forests has been reduced, either through fuel management activities or bushfires.

Our statewide fuel management target is to keep residual risk at or below 70% of Victoria's potential maximum bushfire risk. Maximum bushfire risk refers to maximum fuel conditions and extreme bushfire conditions (Forest Fire Danger Index of 130). In practice however, the residual risk is different in different parts of the landscape, due to differences in vegetation, topography and where houses are located. Our fuel management strategy, together with the strategies of all the other regions in Victoria, contributes to achieving the statewide target.

To measure residual risk, we first use the Phoenix RapidFire bushfire simulation software to simulate thousands of bushfires across Victoria under conditions of highest fuel in the landscape and worst-case bushfire weather conditions. We calculate the impacts on houses, based on these simulations, and this is the maximum residual risk. We then simulate a second set of bushfires where we have changed the fuels in the landscape, to

allow us to compare the two scenarios and estimate the reduced impact. When measuring current or past residual risk, we include bushfires and planned burns that have occurred to reduce the fuels in the landscape. When we are testing strategies, we model different arrangements of planned burning that might occur by implementing our strategy, for 40 years into the future.

Using Phoenix, we have forecast the performance of our preferred fuel management strategy together with other regions in Victoria. **Figure 13** shows changes in residual risk from 1980 to 2060, with projected residual risk values beyond 2020.

Our fuel management program takes us some of the way to managing bushfire risk, however we also manage bushfire risk through other prevention, preparedness and response activities. As yet, we are unable to model the impacts of our other bushfire management actions beyond planned burning in our residual risk metric, including mechanical treatments. We are working to be able to include these and other improvements to the metric in the future.

Photo credit: Glenn Rudolph
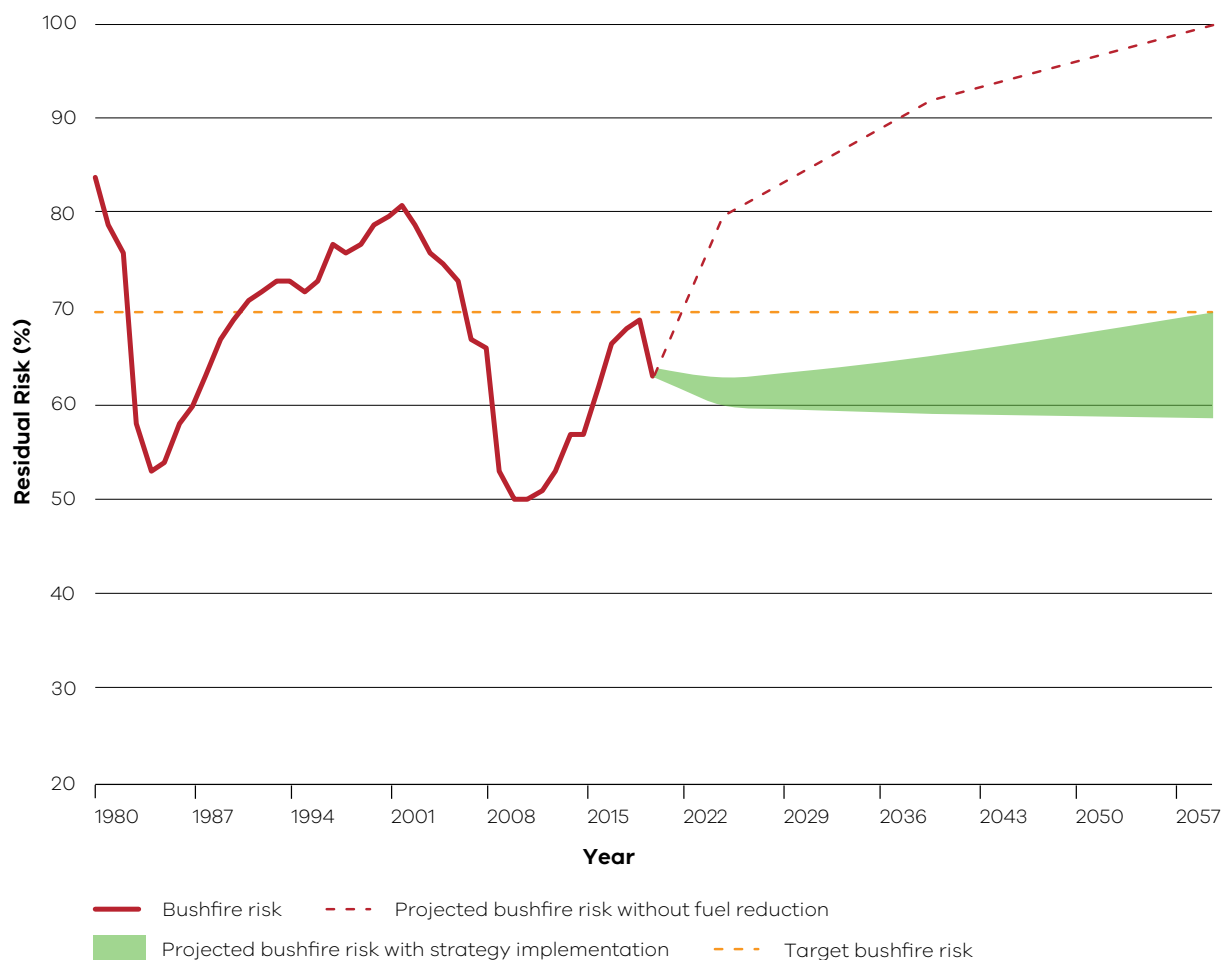
Figure 13.   Statewide residual risk

Historic and projected future bushfire risk for Victoria. The orange dotted line is the statewide bushfire risk target (70%). The red line represents historical bushfire risk due to past bushfires and planned burning. The green shaded area is the projected bushfire risk for the fuel management strategies of all Victorian regions collectively, measured from 2021 to 2060. This represents that there is a range of possible future residual risk values which is dependent on the amount of fuel reduction achieved each year in our region and across Victoria. The red dotted line represents projected increase in bushfire risk without fuel reduction.

Monitoring, conservation goal setting and Traditional Owner management in the West Wimmera

The strategy in the West Wimmera highlights a need for continued burning in this area to maintain ecological resilience through managing the competing needs of all species. The Wimmera Conservation Action Plan (WCAP) (Parks Victoria, 2018) highlights suites of species of concern for the Wimmera heathland and woodland areas and includes the woodland bird community, Victorian Mallee bird community, small ground-dwelling mammals and medium-large reptile species (such as goannas, snakes and lizards). Species response curves and optimal growth stages were developed from the Victorian Biodiversity Atlas and several fauna studies in the West Wimmera region. This data indicates that a range of growth stages is optimal for species identified in the WCAP. This analysis reinforces the need for continued planned burning, an outcome of the selected strategy.

Traditional Owners aspire to apply cultural fire within the Jilpanger-Tooan Park complex to rebuild connection and capacity to manage their lands. The intent is to reintroduce cool burning to a designated area within the park complex to maintain a strategy of regular, low-scorch burns. It is acknowledged that this is a medium-term goal as the current high fuel loads across much of the park complex is likely to result in some scorch in the short-term. It is believed that more frequent burning in low fuel environments will better manage for culturally important species (such as the South-eastern Red-tailed Black-Cockatoo) by keeping fire out of the canopy. As discussed in the program logic table (**Appendix 1: Program logic**), a Traditional Owner fire committee led by Barengi Gadjin Land Council will be established to bring more Traditional Owners into this discussion and other fire management decisions.

Fox and cat baiting is important to reduce predation pressure on small mammals, reptiles and woodland and Mallee birds, particularly in areas burnt by large bushfires where mobility of foxes and cats can increase. In addition, where known priority weeds occur, weed control should be undertaken post-fire to maintain habitat quality. This strategy advocates for pest plant and animal control to be integrated into fuel management activities.

Implementing this strategy will include:

- using planned burning to create diverse age classes throughout the West Wimmera in line with the broad strategy
- continuation of monitoring efforts in the Jilpanger-Tooan complex to verify that the modelled range of growth stages is optimal to improve or maintain faunal groups outlined in the WCAP
- selection of small areas in Jilpanger-Tooan complex to trial more frequent burning with the aim of changing the upside-down forest (too much understorey fuel) structure to one that is considered more healthy, as determined by Traditional Owners
- implementation of a monitoring strategy to determine the influence of cool burning on cultural values, canopy health, forest structure and flora species.

Photo credit: DELWP

Bushfire Risk Engagement Areas

As part of the 2017-2019 strategic bushfire management planning process, land and fire management agencies have undertaken an analysis to define Bushfire Risk Engagement Areas (BREAs)[3]. BREAs identify parts of the landscape where managing bushfire fuels is most effective in reducing risk. This helps to indicate the priority areas in our region where we can work with communities to reduce bushfire fuels.

BREAs also help land and fire management agencies, local government and stakeholders to focus conversations about the range of treatment options available to reduce bushfire risk. This may include other actions where reducing fuels may not be possible. Over time, on-ground discussions and assessments between agencies and the community will determine the treatments that best suit a particular place.

Managing fuels on private and public land begins with a conversation about the benefits, limitations and viability of fuel reduction in a BREA. Complementary or alternative treatments will arise from these discussions. We will work with the community to explore risk treatment options for private land and, where suitable, apply them to complement public land fuel management described in our fuel management strategy. By working together in this way, we will maximise the impact of our collective risk-reduction effort.

It is important to note that BREAs are not legislated planning zones and do not obligate landowners or land and fire agencies to take any action. They cover large areas of public and private land, their boundaries do not align to administrative or cadastral boundaries, and are not linked to individual parcels of freehold land.

The Grampians region's BREAs are shown in **Figure 14**.

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3   During the consultation phases of this strategic planning process, these areas were called 'Priority Fuel Management Areas' (PFMAs). They have since been renamed to provide greater clarity as to their intended use. Feedback and comments received during the planning process from stakeholders and community members relating to PFMAs have been incorporated into designing the BREA strategy.
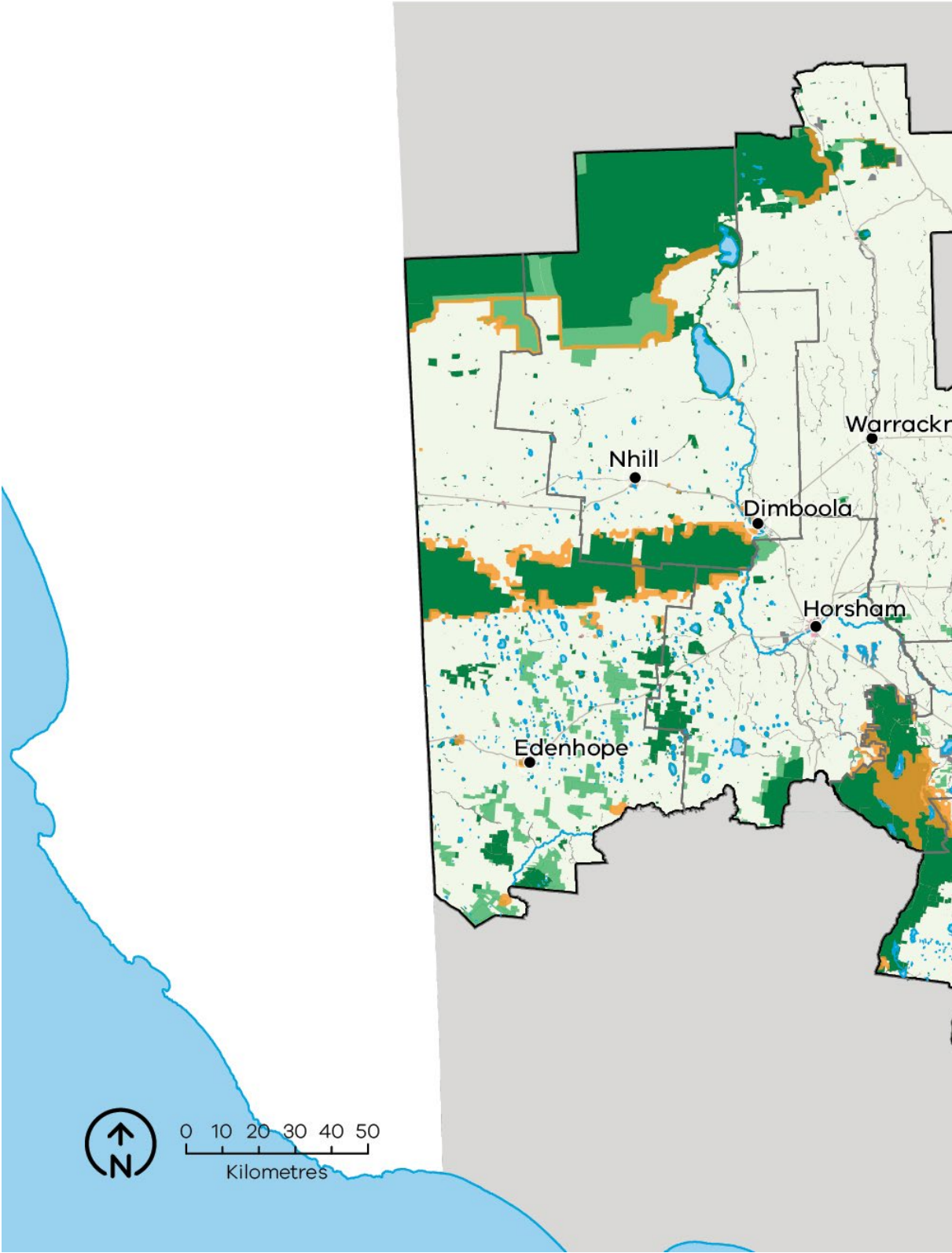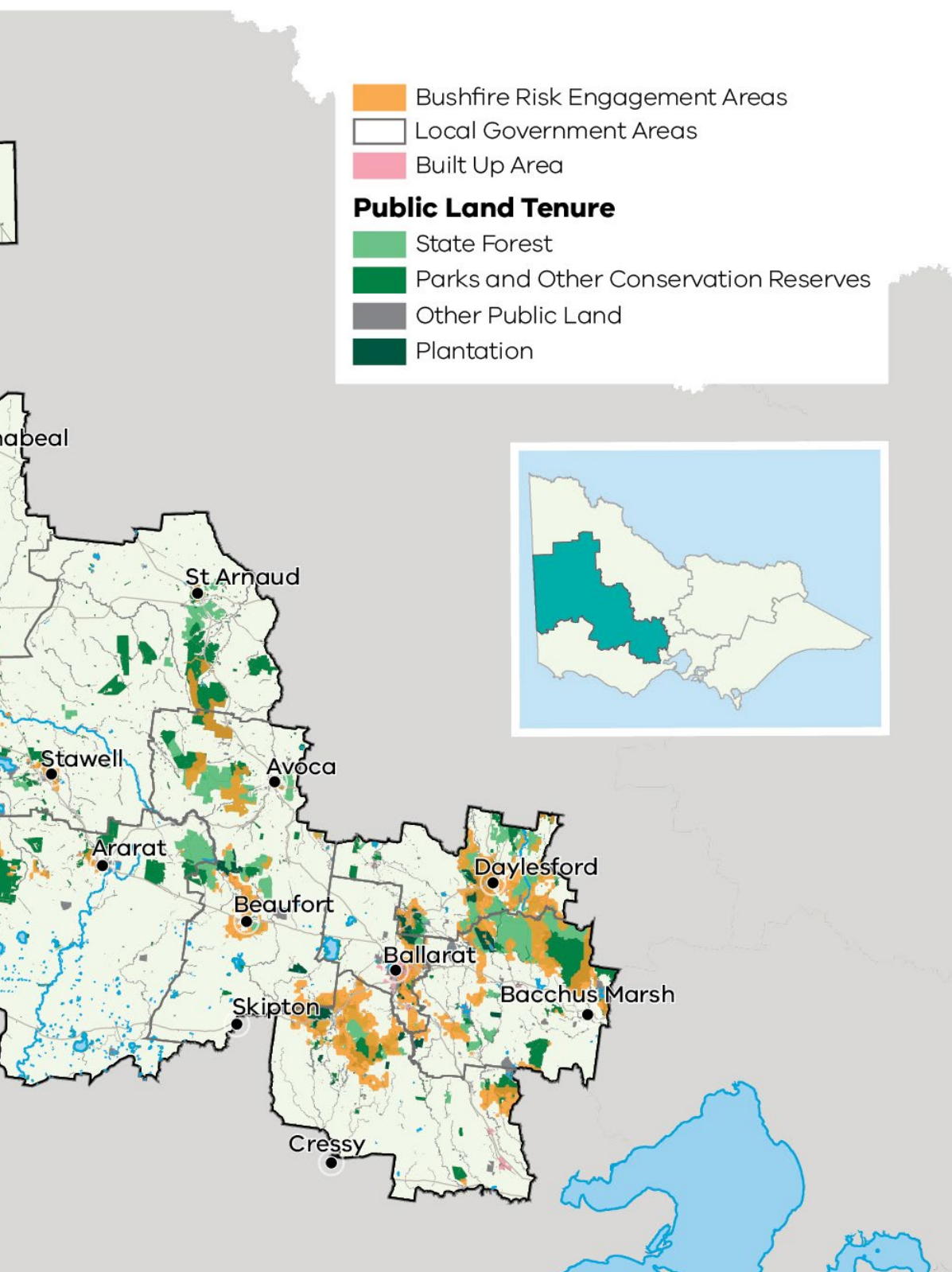
Photo credit: DELWP

Photo credit: Glenn Rudolph

Figure 14.   Bushfire Risk Engagement Areas in the Grampians region

Bushfire Risk Engagement Areas
Local Government Areas
Built Up Area

Public Land Tenure
State Forest
Parks and Other Conservation Reserves
Other Public Land
Plantation

Implementation

Implementation of this bushfire management strategy will occur through the Joint Fuel Management Program (JFMP) prepared by FFMVic and CFA, as well as a range of agency-specific operational plans.

The fuel management strategy described here directly informs the development of the JFMP, and it is through the implementation of this program that bushfire risk in the Grampians region will be maintained in line with the state residual risk target, in a manner which balances outcomes for multiple values.

Fuel management on private land, where appropriate and with landholder permission, will form part of the overall JFMP and will reduce bushfire risk in the Grampians region even further.

The JFMP prepared by FFMVic and CFA is also informed by the Victorian Traditional Owner Cultural Fire Strategy.

Our bushfire management strategy can also help inform actions in municipal fire management plans.

The implementation of Bushfire Risk Engagement Areas will be undertaken by all agencies working together with the community. BREAs assist agencies to plan where to engage with communities about fuel management where it is most effective to reduce bushfire risk or explore alternative options to reduce that risk.

Photo credit: Josh Bushell
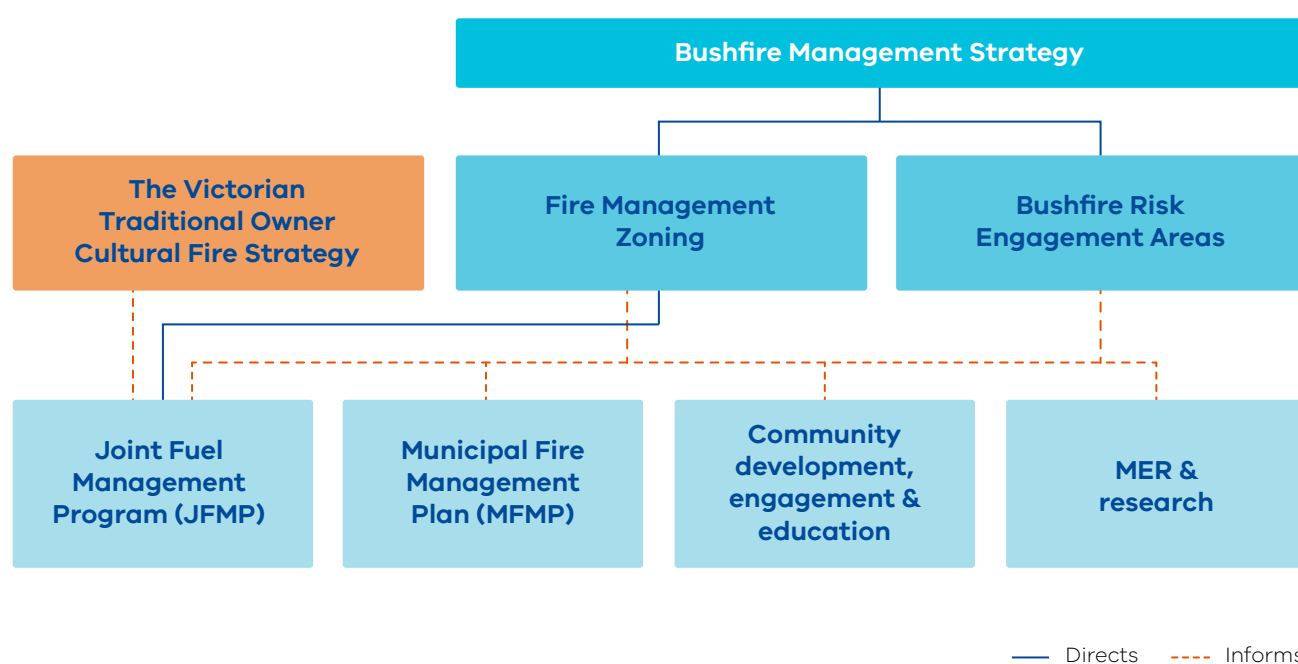
Figure 15. Schematic representation of the strategy's influence on implementation programs and plans

Monitoring, evaluation and reporting

Regional monitoring, evaluation and reporting (MER) enables us to measure how our strategies and actions are performing against the regional objectives set out in this bushfire management strategy. This is achieved by developing key evaluation questions that we will use to measure success against our objectives and enable reporting and improvements. The MER process ensures transparency and supports adaptation of management practices to achieve improved outcome from bushfire management to our important values. Key evaluation questions and the process for addressing them will be developed in MER plans by individual agencies.

A MER plan can also identify key knowledge gaps and prioritise research and monitoring activities to address them. MER plans ultimately improve risk-based planning and decision-making, helping to guide future resource and funding allocation.

Individual agencies will be responsible for the MER of their own work programs and the activities that they deliver. The spirit of collaboration will continue between agencies, such as identifying and addressing knowledge gaps that cross tenure boundaries.

FFMVic's MER program is guided by the Monitoring, Evaluation and Reporting Framework for Bushfire Management on Public Land (MER Framework), which aims to assess how well management activities across Victoria are achieving the two objectives of the Code of Practice. Information on FFMVic's annual fuel management monitoring and reporting can be found in Managing Victoria's Bushfire Risk: Fuel Management Report.

Photo credit: Josh Bushell

Photo credit: Steffen Schultz

Appendix 1: Program logic

Table 5.   Grampians Bushfire Management Strategy 2020 program logic

Vision	**Safer and more resilient communities**	
Policy context	The Victorian Preparedness Goal is A safer and more resilient community that has the capabilities to withstand, plan for, respond to and recover from emergencies that pose the greatest risk.	
Strategic objectives	• To minimise the impact of major bushfires on human life, communities, essential and community infrastructure, industries, the economy and the environment. Human life will be afforded priority over all other considerations.	
Grampians region values	**Human life**	**Economy – industries and agriculture**
Grampians region objectives	• Minimise loss of life and property	• Reduce the risk of economic drivers being impacted by bushfire
Long-term outcomes	• Reduced residual risk to houses and other areas of congregation • Enhanced resilience of key egress routes enabling safer egress • Increased community awareness of bushfire risk (residents / visitors) and capacity to manage their own bushfire risk (residents only)	• Reduced risk to town-based industries • Reduced risk to the agriculture, forestry and viticulture industries • Reduced risk to key tourism areas

The Safer Together policy's four priorities for reducing the risk of bushfires in Victoria are Community first; Land and fire agencies working together; Measuring success; and Better knowledge = better decisions.

- To maintain or improve the resilience of natural ecosystems and their ability to deliver services such as biodiversity, water, carbon storage and forest products.

Nature	Infrastructure	Heritage
• Maximize persistence of ecological communities and species	• Minimise loss of infrastructure	• Maximise cultural heritage values
• Persistence of threatened, rare and endemic species • Minimised impacts on 'high value ecological areas' – long unburnt, refuge areas etc. • Reduced deviation from 'target' growth stage structure. • Increased landscape ability to recover post-bushfire • Size of severe bushfires within native vegetation areas is minimised	• Reduced risk to critical infrastructure outside of built-up areas • Reduced risk to water quality being impacted by bushfire	• Reduced number of Aboriginal cultural heritage and European historic sites impacted by fire • Increased involvement of Traditional Owner groups and Registered Aboriginal Parties in fire planning • Increased number of burns with Traditional Owner groups' and Registered Aboriginal Parties' involvement

Grampians region values	Human life	Economy – industries and agriculture
Medium-term Outcomes	• Residual risk maintained at or below 70% within the Midlands FFMVic District. • Maintain residual risk within the Wimmera FFMVic District at or below 70% • Risk modelling products are available to municipal planning teams to assist any review process of egress routes • Utilisation of established method for assessing the influence of roadside burning / weed management on risk. Incorporate with DELWP-led project assessing biodiversity values on roadsides • Bushfire risk assessment of events is incorporated into overall risk assessment process in partnership with municipalities • Flammable weed issues are identified in high-risk areas and prioritised for funding • Decision- makers are educated to ensure the links between this strategy and land use planning are understood and implemented as appropriate	• Risk to priority assets are managed • Residual risk for Daylesford and Halls Gap (as key tourism areas) maintained at appropriate levels within their respective sub-landscape risk target
Short-term Outcomes	• Key Egress routes across the region are identified • Opportunities to improve resilience of key egress routes investigated to supplement fuel reduction works undertaken • Roadside risk management project implemented by Barwon South West is assessed, and its applicability to roadside and weed fuel management reviewed. • Completion of a detailed assessment of visitation trends and the movement of people on high-fire-risk days (including campgrounds and events) and implications for risk management; develop strategies for high-risk areas • Assessment into the feasibility of mechanical fuel treatment in high-risk areas • Alignment of community awareness engagement activities (e.g. FireScape, CBBM) with priority fuel management areas and priority towns • Fuel management activities reviewed in plantations close to priority towns • Inoperable APZ and BMZ areas that contribute the greatest risk to life and property are identify. • Inoperable APZ and BMZ areas which can be made operable or be treated through other methods are identified.	

Nature	Infrastructure	Heritage
• Prioritisation and development of LMZ strategic plans for all sub-landscapes that balance ecological objectives and fire size. • In partnership with Barwon South West Region, crown scorch within SE Red-tailed Black Cockatoo habitat is limited	• Landscape risk to priority assets is managed through the fuel management strategy	Wadawurrung • Develop a Traditional-Owner-led strategic fire management plan Barengi Gadjin Land Council • Work with the established fire committee (see short-term outcomes) to determine and implement the desired level of input from Traditional Owners into burn planning at all levels
• LMZ strategic plan developed for Grampians sub-landscape • Within the LMUs described previously, only undertake burning in LMZ when an objective is consistent with that in the strategy outlined in this document and future LMZ planning. • Impact of planned burning on threatened species continues to be accessed in line with the JFMP with appropriate mitigation measures implemented • Development of process to ensures pest plant and animal control is implemented as required for all ecological burns		Wadawurrung • Work together to enable an increased level of Traditional Owner participation in planned burning and bushfire response by increasing training opportunities and equipment • Work together to determine areas where traditional burning could occur • Work together to evaluate contemporary fire science and how this aligns with traditional knowledge Barengi Gadjin Land Council • With support from DELWP, establish a fire committee (focus on the next generation) that seeks to involve more Traditional Owners in fire management decisions (including undertaking more traditional burns) • Working with the fire committee, implement traditional burning in the Jilpanger NCR to create a healthier environment, manage for indicator species and reduce crown scorch levels long-term

Grampians region values	Human life	Economy – industries and agriculture
Assumptions	• Measuring house loss is an appropriate surrogate for loss of life • Phoenix categorises house loss accurately in all areas • All modelling input data is correct (fuel, address points, weather) • Transient populations are accounted for in residual risk measurement • Phoenix captures treated areas as 100% treated yet burning objectives and outcomes will vary in percentage coverage. • Treatment proposed through other planning processes is effective. • Egress during the event is not safe. • Egress planning reduces risk to life. • Current education programs are adequate	• Reducing risk to towns will reduce the risk to those industries based within townships • The economic influence of industries outside of the township area on those town-based industries is addressed through the agriculture- and tourism-specific objectives • Maximising people's enjoyment of nature will be achieved through meeting this objective

Nature	Infrastructure	Heritage
• Modelled data used in calculations is accurate (this data requires research and validation as it is not likely to be accurate for all species) • Long unburnt / no-fire-history areas are actually long-unburnt and hold the ecological values associated with long-unburnt forest • Refuge areas maintain their value through drought periods, landscape change and after wildfire impact. Species distribution models are accurate • Target growth stage structure derived from GMA calculations. Modelled data used in calculations is accurate (this data requires research and validation as it is not likely to be accurate for all species) • Fire is the most important variable driving diversity • Growth stages accurately represent habitat attribute change with time-since-disturbance. The growth stages were developed to represent developmental stages in vegetation, not habitat attributes for fauna • The older growth stage is actually long unburnt and healthy • TFIs at regional scale and finer scale are accurate (these need to be tested)	• Risk to infrastructure within built-up areas will be managed through the life and property objective • All critical infrastructure captured through VFRR-B • Slope / vegetation (as indicators of debris flow risk) are the key indicators for the risk to water quality from bushfire • Significant rainfall post-bushfire is likely to occur, resulting in a debris flow and hence an impact on water quality	

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