

Strategic fire management plan

Otway District 2017 - 2020

Shires of Corangamite, Colac Otway and Surf Coast



Otway District Bushfire
Planning Collaboration



Department of
Environment, Land,
Water & Planning



Version Control Table

Version	Release Date	Author	Changes
1.0	4 November 2016	Cheryl Nagel & Peter Ashton	First complete working draft of plan for review of Steering Group
1.1	9 November 2016	Cheryl Nagel and Peter Ashton	Draft refined throughout and provided to Project Control Group for review
1.2	10 November	Cheryl Nagel and Peter Ashton	Draft updated to include Project Control Group direction and provided to members of all three MFMPs for review and endorsement, specifically: <ul style="list-style-type: none"> • Moved aim and objectives to front • Reduced section on vulnerable people • Created new section of strategic direction headlines from action table • Minor text refinement
1.3	11 November	Cheryl Nagel and Peter Ashton	Actions removed from document with strategic directions headlines retained, under direction of project control group. Other minor updates.
1.4	15 November	Cheryl Nagel and Peter Ashton	Minor adjustments following further direction of the project control group. Submitted to each MFMP and MEMPC for endorsement.
1.5	21 November 2016	Cheryl Nagel and Peter Ashton	Minor adjustments to incorporate MFMP and MEMPC review, minor editing and formatting improvements. Submitted to the Barwon South West Regional Fire Management Planning Committee for review
2			
3			

Front cover photograph – Fire approaching Wye River on Christmas day 2015; Andrew Hack

Context statement

This is the first version of a strategic fire management plan across the three Otway Shires. It replaces and supersedes the Municipal Fire Management Plans of Corangamite Shire, Colac Otway Shire and Surf Coast Shire which all have an expiry date of March 2017.

Comments on this Plan are welcome and should be sent to:

Otways Bushfire Planning Collaboration
c/- Surf Coast Shire
PO Box 350 Torquay Vic, 3228

Or otwaybushfireplanning@surfcoast.vic.gov.au

Foreword

This Strategic Fire Management Plan for the Otway District fire risk landscape advances integrated fire management across the footprint of the Corangamite, Colac Otway and Surf Coast Shires. It describes how Councils, fire agencies, relevant authorities, groups and communities will share the responsibilities, and work together to reduce fire - risk, impacts, consequences and increase resilience. Taking a risk-based approach, the Objectives and Strategic Directions of this plan assist in treating current fire risks and also mandate the future development of subsidiary plans that get to the real detail of risk management and mitigation at township scale.

This plan is quite different to the three municipal fire management plans that it replaces. The plan is aspirational, describing what we would ideally like to achieve with fire management over the long term, while understanding that it will take some time to achieve. The plan has a defined term of three years; however the vision for this plan stretches well beyond. This approach will ensure a continuum, short and long term, of the many varied risk treatments required to meet the challenges faced by a fire risk landscape with a history of numerous, and sometimes destructive fires in bushland, grasslands, peri-urban and structural environments.

The plan focusses on enhanced collaboration between agencies, and with communities; it embeds ways for community aspirations to influence fire management and at the same time build greater community resilience. Many objectives and actions of the plan can only be achieved through agencies and communities working more closely together regardless of land tenure and traditional agency delineations.

A robust landscape risk analysis is employed by this plan which underpins its content. The plan seeks to ensure finite agency and community resources are allocated to best effect – to address the highest risks and achieve the best possible results for all of our communities. The plan seeks to foster cooperative learning and development and to then effectively apply learnings to achieve greater risk reduction and more resilient communities.

The responsibility for Fire Management Planning, including implementation at Municipal level is legislatively vested in Municipal Fire Management Planning Committees. These committees recognise the need for shared planning, shared learning and shared responsibility in order to get meaningful results for our communities in this fire prone landscape.

In commending this plan to the attention of all agencies and communities affected by it, I acknowledge the substantial works and efforts already undertaken in the furtherance of fire risk management in the Otway region and look forward to working cooperatively toward giving effect to this plan to reach even greater and safer outcomes for us all.

Mark Gunning

Chair, Steering Group - Otway District Strategic Fire Management Plan

Authorisations and endorsements

In authorising this plan, each Council adopts elements of the plan that pertain to that Council only.

This plan was adopted by each Council in partnership with the committees described in below:

Plan adopted by:

..... Corangamite Shire Council Colac Otway Shire Council Surf Coast Shire Council
Date

Plan endorsed by each Municipal Fire Management Planning Committee:

..... Corangamite Shire, date Colac Otway Shire, date Surf Coast Shire, date
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Plan endorsed by each Municipal Emergency Management Planning Committee:

..... Corangamite Shire, date Colac Otway Shire, date Surf Coast Shire, date
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Plan reviewed and endorsed by the Barwon South West Regional Fire Management Planning Committee

..... Chairperson Date
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Introduction

Overview

This Strategic Fire Management Plan for the Otway District (the Plan) extends across the footprint of the three Shires – Corangamite, Colac Otway and Surf Coast. It describes how agencies and councils will work together and with communities to reduce fire risk, impacts and consequences and to build community resilience.

The Otway District is recognised as being one of the highest bushfire risk areas in Australia and the world (Bradstock 2010). The factors that make up that risk include: extensive and highly flammable vegetation, rugged terrain and occasional extreme weather, combined with the proximity of houses to the bush, the nature of house construction and limited road access. Traversing the three Shires, the Otway ranges are a key bushfire risk and a regional priority for risk management (Barwon South West Regional Fire Sub Committee 2016)

Fire has long been a part of the Otway District landscape. As history shows, there is considerable potential for devastating bushfires¹, and effective management of that risk is needed to minimise bushfire impacts.

Figure 2 Victoria's Black Thursday 1851; Oil on canvas by William Strutt 1864



Within the three-shire footprint, this plan describes how agencies involved in fire management will work together, and with communities to achieve more effective fire risk reduction and help communities become safer and more resilient.

In the context of a thorough understanding of landscape risk and the benefits of integrated risk mitigation, this plan predominantly focusses on reducing fire risk for private and municipal land and assets within towns and on the wildfire interface. It also addresses risk to critical infrastructure and community values. Taking a risk based approach, this plan promotes shared responsibility for planning and action. While bushfire is the major risk addressed in this plan, structural and chemical fire risk are considered to a lesser extent.

¹ The term bushfire is used throughout this plan to describe wildfire in grasslands, heathlands, woodlands and forest.

Plan purpose and aim

The *purpose of this plan* is to enhance integration, coordination and effectiveness of fire risk reduction and community fire safety activities across the three shires and across all fire management agencies, groups and communities.

Through this enhancement, the aim and objectives of this plan will be more effectively achieved.

The *aim of this plan* is to reduce the risk to life and community values from the threat of fire, and facilitate the development of resilient and fire adapted communities which have an increased capacity to recover from fire.

About this plan

Planning for the three Shires together acknowledges that while each Shire has unique attributes, there are some commonalities in landscape and fire risk. It recognises that bushfires and grassfires in this district can and do cross municipal boundaries. Planning for the district will enhance the integration, coordination and effectiveness of bushfire risk reduction activities across the landscape and across emergency management agencies; that it is achievable is an acknowledgment of the maturity of the partnerships developed between the councils and agencies.

It is intended that this Plan recognise and provide guidance to the extensive work already undertaken in fire management and planning across the three shires, but not duplicate it. Its role is to enhance integration, coordination and effectiveness of fire management and planning.

Key parts of this Strategic Fire Management Plan define its [purpose](#), [aim and objectives](#), and describe the [strategic directions](#) to outline how agencies will work together and with communities to deliver the plan.

Fire management prescriptions are provided at three scales:

- landscape
- township
- household/ property.

Four themes are used to group objectives, directions and actions:

- safer communities,
- enhanced protection of assets,
- better sharing of knowledge, responsibilities and resources
- impacted communities recover and thrive.

This plan has been built on a detailed examination of the bushfire risk across the District, and a much less developed understanding of what communities' value and want to protect. Delivery of this plan will help fill that knowledge gap so that the future development of subsidiary plans and reviews of this plan can be better informed and targeted to meet community needs.

This Plan is part of a tiered approach to fire management planning; one strategic plan across the three Shires provides higher-order objectives and directions, and this is coupled with a suite of future subsidiary plans – to be developed with communities - that get to the detail of township risk, risk mitigation and community bushfire resilience.

Authority and term

This Strategic Fire Management Plan meets all of the requirements for a Municipal Fire Management Plan (MFMP) and fulfils the requirements for a Fire Prevention Plan for each Shire. It replaces the

former Municipal Fire Management Plans of each. This plan constitutes a landscape bushfire strategy as described in the State Bushfire Plan 2014, and is a sub-plan of each Shire's Municipal Emergency Management Plan.

The plan has been prepared under the provisions of the *Emergency Management Act 1986* (Section 20)² and *Country Fire Authority Act 1958*³. The Emergency Management Manual Victoria (EMMV), which applies the provisions of the Emergency Management Act 1986, provides for an Emergency Management Planning Committee to appoint a Fire Management Planning Committee. The Fire Management Planning Committee then takes responsibility for the preparation of the Municipal Fire Management Plan, and for monitoring, review and reporting on the delivery of that plan. Fire Management Planning Committees have been appointed for all three Otway District shires.

This Strategic Fire Management Plan – Otway District has been prepared and endorsed in accordance with the guidelines provided in the EMMV, which includes guidance on municipal fire management planning committees, suggested terms of reference, and the planning process, along with content of the plan, endorsement and audit procedures. This Plan constitutes a sub plan of each Council's Municipal Emergency Management Plan.

This plan will extend for three years from the date it is adopted by each Council.

Plan development

The responsibility for preparing Fire Management Plans rests with Municipal Fire Management Planning Committees (MFMPs), which consist of representatives from fire and land management agencies including DELWP, Parks Victoria, CFA, Local Government, Victoria Police, VicRoads, water authorities and DHHS. Taking an innovative approach, the MFMPs of each of the three Otway District Shires agreed on a new model for municipal fire management planning, resulting in one strategic fire management plan being produced for the three shires (Figure 3). This new model for planning was supported by relevant emergency management agencies and committees.

The three MFMPs established one Steering Group to oversee the development of the plan, with membership drawn primarily from the Committees. Data for the risk analysis was sourced primarily from DELWP, the Councils and the ABS. Risk analysis for the plan was undertaken by Council and DELWP staff, and drafting of the plan was undertaken by Council staff funded through the State Government Municipal Emergency Resource Program.

Development of the purpose, aim and objectives and directions/actions

Development of the purpose, aim and objectives and directions/actions for this Strategic Fire Management Plan was guided by the Project Steering Group⁴ and informed by a program logic exercise undertaken by that Group. The aim, objectives and directions/actions of this plan have been developed to reduce the risk, impacts and consequences of fire on important community values and assets. As our understanding of priorities for protection increases and the detailed understanding of the nature of the risk

² The Emergency Management Act 1986, prescribes that Councils must appoint an Emergency Management Planning Committee and must have a Municipal Emergency Management Plan. Under the Emergency Management Manual Victoria (EMMV) - which applies the provisions of the Emergency Management Act 1986 - specific hazard plans can be developed as sub plans to the Municipal Emergency Management Plan where the hazard is deemed a priority risk.

³ Under the Country Fire Authority Act 1958, Councils must have a fire prevention plan, and for councils within the Country Area of Victoria, a fire management plan prepared in accordance with the EMMV is deemed to satisfy the requirements for a municipal fire prevention plan.

⁴ The Project Steering Group consists of members nominated from the Municipal Fire Management Planning Committees of each of the three shires and includes the project team.

to values grows, the plan objectives and actions will be refined. Often this refinement will be described in subsidiary plans, such as township bushfire safety/resilience plans.

Relationship with other planning

This plan does not operate in isolation – it is nested within a planning framework which guides fire management at the State, Regional, Landscape and Municipal level. It accords with the direction set through related plans and policies listed below and indicated in figure 3, applying and adapting relevant elements at a District scale. It will contribute towards achieving the broader aims and objectives of these related documents. Key guidance or support applied to this plan includes:

- **Safer Together** – (Department of Environment Land Water and Planning 2016). This Victorian Government Policy seeks to ensure that fire and land management agencies partner with locals to find the most effective mix of actions to reduce bushfire risks and impacts for communities across private and public land in the highest risk areas.
- **Barwon South West Regional Strategic Fire Management Plan 2016** (Barwon South West Regional Fire Sub Committee 2016) states that its primary aim is to protect human life from the risk of fire (p3), and identifies a further aim to continue to develop greater community led planning and community resilience.
- **Barwon Otway Strategic Bushfire Management Plan 2015** (Department of Environment and Primary Industries 2014) explains the risk-based, public land fuel management strategy DELWP will use to minimise the impact of major bushfires on people, property, infrastructure and economic activity, while maintaining and improving the resilience of natural ecosystems. Working with communities and stakeholders to understand what they want to protect is a feature of this plan.
- **State Bushfire Plan 2014** (Emergency Management Victoria 2014) states that the objective of all bushfire management activities in Victoria is to reduce the impact and consequences of bushfire on human life, communities, essential and community infrastructure, the economy and the environment.
- **Victorian Emergency Management Reform White Paper 2012** (State Government of Victoria 2012) gives priority to building community resilience and community safety.
- **Emergency Management Manual Victoria** guides the preparation of municipal fire management plans.
- **Municipal Emergency Management Plans** of the three Shires.
- Former **Municipal Fire Management Plans** of the three Shires have been reviewed and valuable actions which are either incomplete or ongoing in nature have been carried over to the new plan.

The planning model takes a tiered approach; the strategic plan provides higher order objectives and strategic directions, and this is coupled with a suite of subsidiary plans that get to the detail of township risk, risk mitigation and community bushfire resilience.

Subsidiary plans

This strategic plan gives direction for the future development of subsidiary plans, such as township bushfire safety/resilience plans for high risk communities which are a critical component of the overall planning framework. These local plans seek to foster greater community involvement and ownership, acknowledging that the building of trust and partnerships through the process of developing a plan can be more valuable than the produced plan. Community based bushfire planning at the township and settlement scale involves agencies and specialists work in partnership with communities to identify *what*

is important to protect and *how* community values will be protected. This approach takes fire management planning to a new level. It emphasises the need to both plan and work together, and empowers communities to make informed decisions on bushfire risk. It is community based planning at the township and settlement scale that can achieve the greatest bushfire risk reduction and community benefit.

Figure 3 outlines the planning model and its relationship with other plans – current and future.

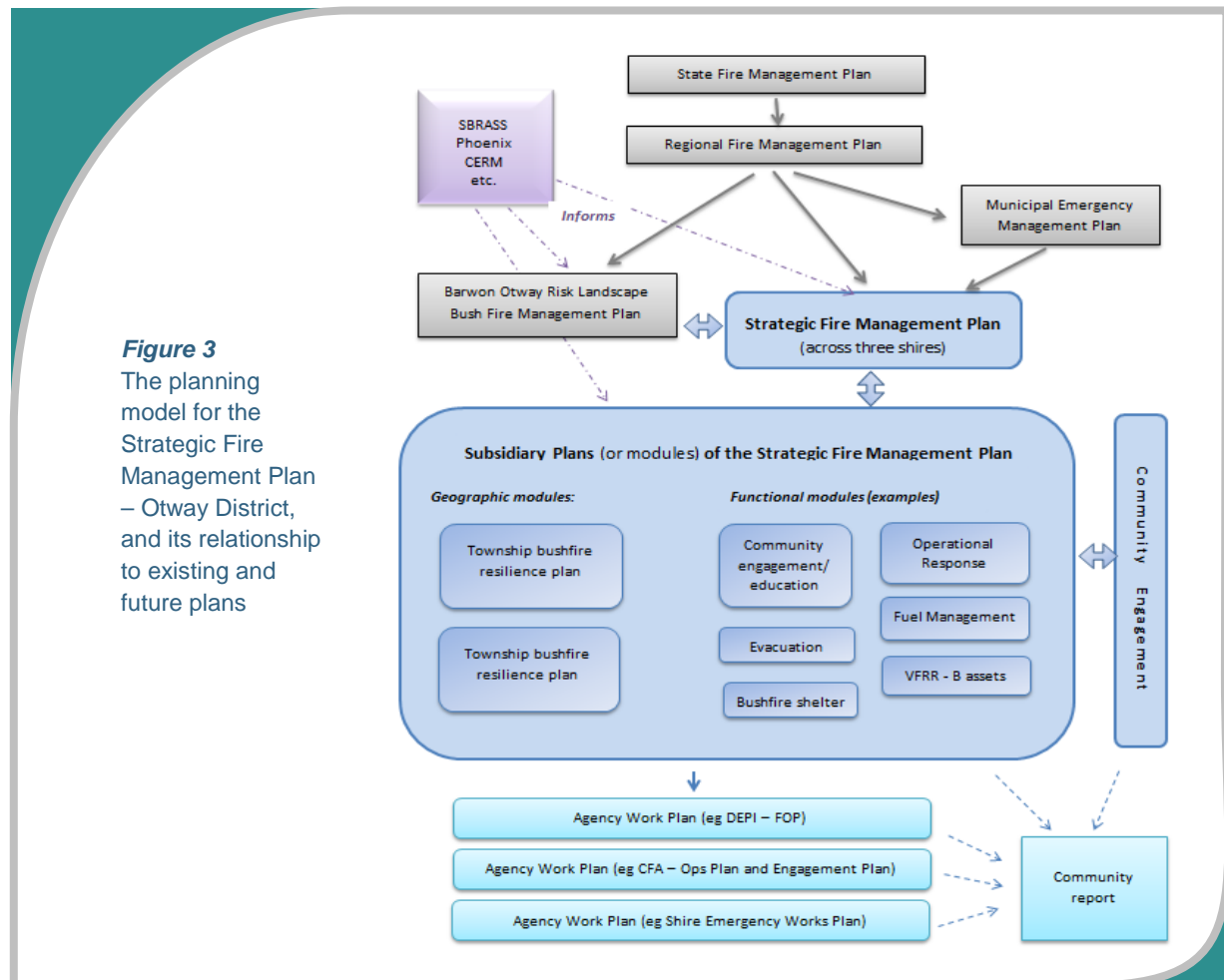


Figure 3
The planning model for the Strategic Fire Management Plan – Otway District, and its relationship to existing and future plans

Special relationship with the Barwon Otway Strategic bushfire management plan

In 2014, the Department of Environment and Primary Industries (now the Department of Environment, Land, Water and Planning (DELWP)) released the Barwon Otway bushfire risk landscape Strategic bushfire management plan which primarily outlines the fuel management strategy DELWP delivers on public land to minimise the impact of major bushfires on people, then environment, property and economic activity (Department of Environment and Primary Industries 2014). In that plan, the DELWP has assessed that fuel management undertaken on public land has brought the overall bushfire risk to Otway towns down from a notional 100% to about 65% - this remaining risk is termed the residual risk.

The Otway District Strategic Fire Management Plan is a sister plan to the Barwon Otway plan, but with a smaller footprint⁵ It primarily focuses on reducing the residual risk through targeting works in townships and at the wildfire interface, protecting critical assets and working with communities.

⁵ DELWPs Barwon Otway strategic bushfire management plan includes the local government areas of the City of Greater Geelong and the Borough of Queenscliffe

Working with communities, this Plan considers risk reduction on private and municipal land, in the context of that done on public land. In this way it can be considered a mirror image of DELWP's plan. Ultimately, it is envisaged that future revisions of each plan could combine them into one.

Risk analysis within both plans draws heavily on the intensive bushfire modelling work undertaken by DELWP across the Barwon-Otway risk landscape. Using Phoenix⁶ Rapidfire bushfire simulation software, some 10,000 simulated fires were modelled across the landscape and the data analysed to inform the township risk rating within this plan. More detail on the risk analysis is provided in the section on the [risk based planning approach](#).

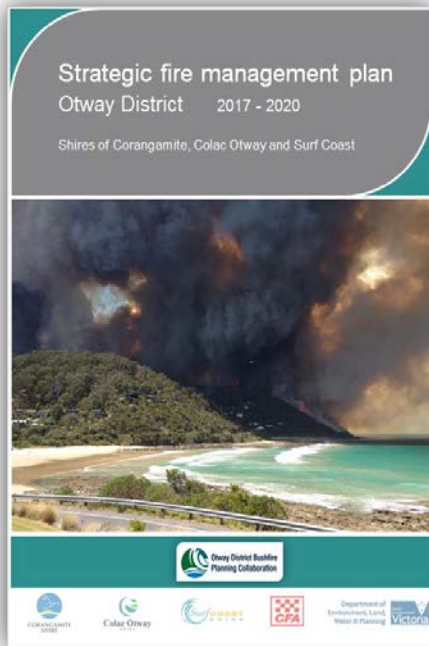
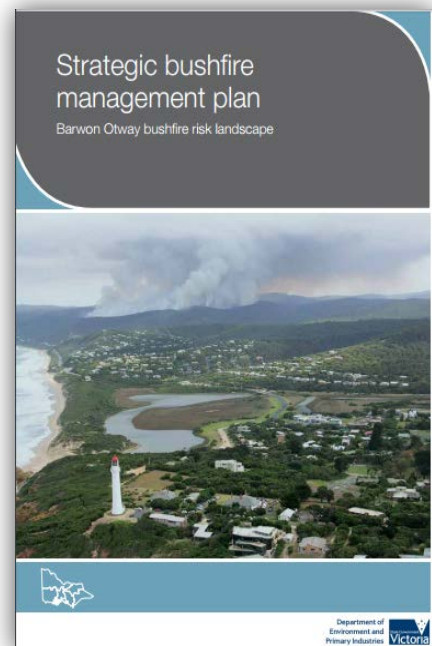


Figure 4
Strategic fire management plan for the three Otway Shires is a sister document to the DELWP's strategic bushfire management plan – they operate hand-in-hand.

While DELWP's plan targets risk reduction on public land, this plan seeks to further reduce bushfire risk by focussing on communities, townships and critical infrastructure.



Relationship with statutory planning - planning overlays that consider fire

Councils have mapped Bushfire Prone areas throughout each Shire and have updated the Planning Schemes to include Bushfire Management Overlays. These maps can be found at <http://services.land.vic.gov.au/landchannel/jsp/map/PlanningMapsIntro.jsp>

Other planning overlays apply to various parts of the State that may influence fire management. The overlays and their conditions apply to all authorities and organisations and it is advisable that fire suppression agencies assist their members to become familiar with those that influence fire suppression management in the Otway District. For the information of Incident Controllers or Incident Management teams these overlays and the conditions that they may apply can be found on the Department of Environment Land, Water and Planning website at:

<http://planningschemes.dpcd.vic.gov.au/schemes/corangamite>

<http://planningschemes.dpcd.vic.gov.au/schemes/colacotway>

<http://planningschemes.dpcd.vic.gov.au/schemes/surfcoast>

⁶ Phoenix RapidFire is a sophisticated bushfire simulation tool developed by Melbourne University, DELWP and the Bushfire CRC and used to model bushfire risk in Victoria. Phoenix uses information about weather, topography, vegetation and fire history to simulate (and predict) the spread and impact of bushfires. It helps us to understand bushfire behaviour – including flame height, ember density, spotting distance, convection column strength and intensity. - See more at: <http://www.delwp.vic.gov.au/safer-together/science-and-technology#sthash.7YiRlilR.dpuf>

Governance and approval process

The MFMP Committees of Corangamite, Colac Otway and Surf Coast Shires established one multi-agency and multi-shire Steering Group to guide the development of the Plan, and the Steering Group reported back to the MFMP Committees. The project governance and approval model for this plan is shown in Figure 5.

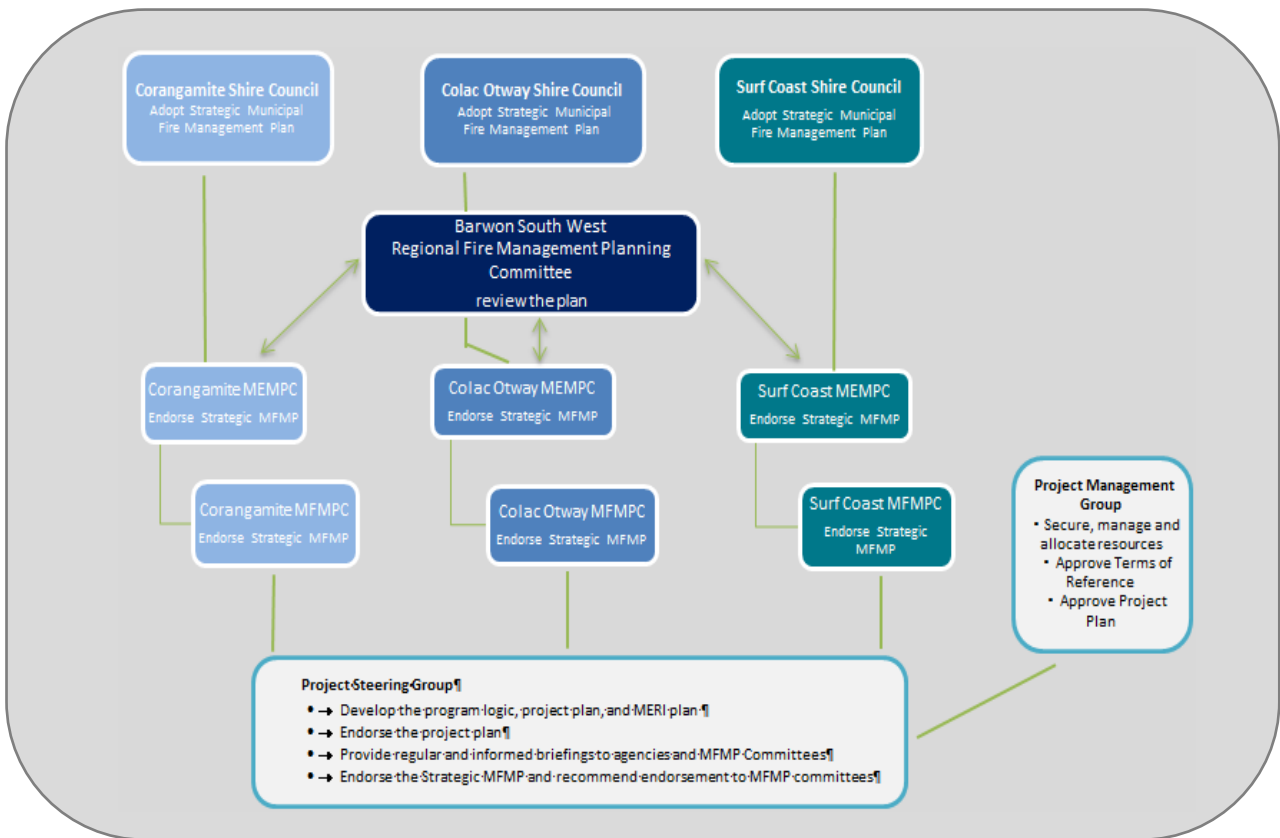


Figure 5 Governance and approval model for the development of the Strategic Fire Management Plan

Approvals

The Plan has been endorsed by the plan Steering Group, the three multiagency Municipal Fire Management Planning Committees and the Municipal Emergency Management Planning Committees of each of the three Shires. The plan has also been reviewed by the Barwon-South West Regional Fire Management Committee and has been adopted by each of the three Councils.

Engagement process

Engagement for the development of this plan has been undertaken primarily through the Project Steering Group, and the Municipal Fire Management Planning Committees of the Surf Coast Shire, Colac Otway Shire and Corangamite Shire. The Steering group is comprised of representatives of the following organisations:

- Department of Environment, Land, Water and Planning
- Country Fire Authority – Districts 6 and 7

- Victoria Police
- VicRoads
- Department of Health and Human Services
- Parks Victoria
- Corangamite Shire
- Colac Otway Shire
- Surf Coast Shire

The Municipal Fire Management Committees for each Shire are responsible for the development and implementation of this plan, and have been engaged throughout the process from the model concept, the project plan preparation and approval, and the drafting and development of this plan.

Extensive community engagement at the township level will be undertaken in the preparation of the township bushfire safety/resilience plans, which are subsidiary plans to this. Township plans will adopt the principles of community based planning and as such will maximise community empowerment in determining what communities want to protect and how community values will be protected.

The engagement associated with this plan has been focused on agencies participating in the MFMPC. Community engagement will more meaningful at the township level and a comprehensive engagement program will occur in the future preparation of township plans.

A draft of this plan is available for comment on the website of each Council:

- Corangamite Shire - <http://www.corangamite.vic.gov.au/index.php/emergency>
- Colac Otway Shire - <http://www.colacotway.vic.gov.au/My-property/Fire-and-emergencies>
- Surf Coast Shire - http://www.surfcoast.vic.gov.au/My_Community/Emergencies_and_Safety

Objectives of this plan

The aim and objectives of this plan must be read in conjunction with the plan purpose and aim.

Plan Purpose: enhance the integration, coordination and effectiveness of fire risk reduction and community fire safety activities across the three shires and across all fire management agencies, groups and communities.

Plan Aim: reduce the risk to life and community values from the threat of fire, and facilitate the development of resilient and fire adapted communities which have an increased capacity to recover from fire.

As with all plan development work, some plan objectives can be partly achieved through the process of developing the plan (particularly those which focus on collaboration), but many objectives can only be achieved through plan implementation. In the case of this strategic plan, some objectives can only be fully met through the development and implementation of the identified subsidiary plans as described in the plan [strategic directions](#).

The objectives of this plan seek to protect that which is recognised as important in the context of fire risk. Successful delivery of the strategic directions and actions of this plan will achieve these objectives.

The 11 objectives of this plan are grouped under four themes, acknowledging that many objectives relate to more than one theme:

- safer communities,
- enhanced protection of assets,
- better sharing of knowledge, responsibilities and resources
- impacted communities recover and thrive.

In delivering these objectives this plan recognises that it is starting from a well-developed base; agencies and communities have already progressed many of these objectives, and this plan is about supporting, continuing and enhancing that work as well providing some new directions.

Safer communities

1. Reduce the residual risk to life and communities from the threat of fire in the Otway district landscape through a focus on risk in townships and settlements, at the wildfire interface, and for important community assets, road corridors, critical infrastructure and the regional economy. In undertaking this task:
 - a. priority will be given to identified high bushfire risk communities and vulnerable people in each Shire,
 - b. communities will help identify the values and assets which are important to protect,
 - c. informed community appetite for risk and risk mitigation measures will drive the approach,
 - d. a shared responsibility model will be applied.

2. Assist communities to better understand their bushfire risk, including the nature of that risk and available mitigation options, so they can make informed decisions about their response.
3. Facilitate the development of bushfire resilient communities and fire adapted townships – which are both less impacted by fire and have better capacity to recover.

Enhanced protection of assets

4. Ensure priority is given to the protection of designated critical assets and assets and values identified by communities as important to protect.
5. Contribute to reducing impacts of bushfire on the regional economy, including regional tourism and the Great Ocean Road, and agricultural and manufacturing enterprises and assets.
6. In undertaking bushfire works including planning, fire preparedness, response and recovery activities, be cognisant of and avoid or minimise impacts on cultural values, high value environmental assets and ecosystem resilience and functioning.

Better sharing of knowledge, responsibilities and resources

7. Strengthen and build the partnership approach between agencies and with communities so that agencies and communities are working together and are better connected.
8. Build community and agency capacity to reduce risk, increase resilience and recover from impacts.
9. Learn from each fire event, increase our fire knowledge and improve pathways for that knowledge to inform community and agency decisions and actions for fire management (reduce the gap in knowledge and its application).
10. Ensure resources are targeted to the range of actions that deliver the most effective results in reducing risk and facilitating the development of resilient and bushfire adapted communities (or simply, in achieving the aim and objectives of this plan).

Impacted communities recover and thrive

11. Support and enhance existing recovery planning and processes and strengthen linkages between fire management and fire recovery.

About the planning area

Overview

For the purposes of this plan, the combined area of the Shires of Corangamite, Colac – Otway and Surf Coast shires is known as the Otway District. Located in the south west of Victoria, the District occupies a footprint of over 9,400 square kilometres, with Corangamite Shire accounting for 4,400, Colac–Otway Shire 3,400 and Surf Coast Shire 1,560, and this constitutes the footprint of this plan. Together, the three shires have a population of some 62,541 people.

Figure 6
The Otway District planning footprint



Table 1 Land area and population of each Shire in 2016

Shire	land area	population
Corangamite	4,407 sq km	15,671
Colac Otway	3,433 sq km	21,000
Surf Coast	1,569 sq km	25,870

Landscape

The Otway District encompasses a rich tapestry of natural and cultural values which are the backbone of a vibrant regional lifestyle and economy. From the extensive fertile grasslands of the volcanic plains and the unique Stony Rises, to the forests, woodlands and heathlands of the Otway ranges and the iconic coastline, there is outstanding natural diversity and wealth. For thousands of generations Aboriginal people have occupied the area creating this cultural landscape, often shaping the landscape through the use of fire.

Significant features of the District include:

- The iconic coastline from Torquay to Peterborough with its sandy beaches, rocky headlands, estuaries and bays, and the internationally renowned cliffs and stacks of the 12 Apostles.
- Internationally and locally significant Indigenous cultural values; including landscapes, places, artefacts and songlines, extending back some 60,000 years and through to the present day.
- The tourism icon of the Great Ocean Road and the coastal holiday towns from Torquay to Port Campbell including Aireys Inlet, Lorne, Wye River, Apollo Bay and Cape Otway
- Productive agricultural land supporting forestry, cropping, grazing, dairy and niche agriculture.
- National Parks including the Great Otway National Park and Port Campbell National Park, protecting landscapes, cultural values and important native species and communities of plants and animals, while providing visitors and locals with valuable nature based recreation experiences.
- Waterways and estuaries, including internationally significant wetlands and valuable rivers and streams.
- The nationally significant Victorian Volcanic Plains – expansive volcanic plains, scoria cones and ephemeral wetlands supporting important and threatened grassland communities, and providing productive agricultural land.
- Lake Corangamite – the largest natural lake in Victoria.
- The impressive Otway Range – with its rivers, gorges and waterfalls and extensive remnant forests, interspersed with picturesque townships and settlements.



Figure 7
Cliffs and sea stacks of
the Port Campbell
coastline

(photo:
<http://visit12apostles.com.au>

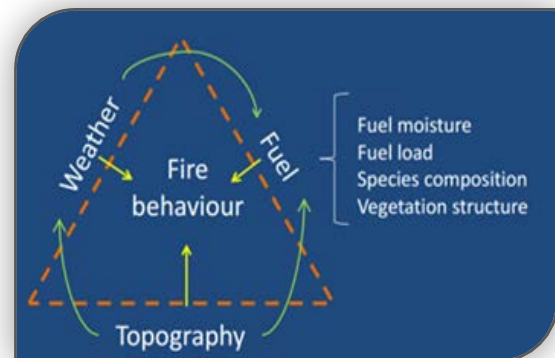
Environment

Environmental factors have a substantial influence on bushfire behaviour, which, in turn influences the bushfire risk; these are:

- **Vegetation** (fire fuel) – amount, type and availability to burn – including fuel flammability (ignitability, combustibility and sustainability), moisture content, structure, arrangement, height and connectivity,
- **Topography** – elevation, aspect, slope, terrain ruggedness and influences on aridity,
- **Climate and weather** - including temperature, relative humidity, wind speed and direction and atmospheric instability, along with underlying conditions (such as long term dryness) and the timing of weather events such as wind changes.

The nature of these factors and how they interact place a significant proportion of the Otway District in an extreme risk category for bushfire.

Figure 8
The bushfire behaviour triangle



Vegetation

The District is home to spectacular and high value native forests, woodlands, heathlands and grasslands. Large areas of the District support agricultural and horticultural enterprises including grazing, cropping and forestry.

Forested vegetation extends across some 25 percent of the District, commonly in large tracts on and around the Otway ranges and foothills, extending from Bellbrae in the east to Port Campbell in the west. Heathlands are scattered through foothills of the ranges and in patches along the coast, and notably in the dryer environment around Anglesea and the wetter area around Carlisle River.



Figure 9
Wet forests of the Otway Ranges
(photo: Parks Victoria)

Dry eucalypt forests and woodlands are generally found at the foothills of the range and interspersed between heathland areas. The District also contains numerous plantations, consisting mainly of introduced pine and blue gum, which are generally located in wetter environments. Wet eucalypt forests, through to rainforests are generally found along the central part of the main ridge through the Otways, and in associated gullies and south facing slopes. Patches of forested areas also occur away from the main association and some of these will have a bearing on fire risk for some settlements.

Extensive grasslands and cropping land dominate in the north and west, and the south west is home to one of the State’s most productive dairying areas – the Heytesbury, established through clearing of forest under a former soldier settlement scheme. Grasslands including native, grazing and cropping lands make up about 70% of the district and for the majority of its range is located north of the forested lands.

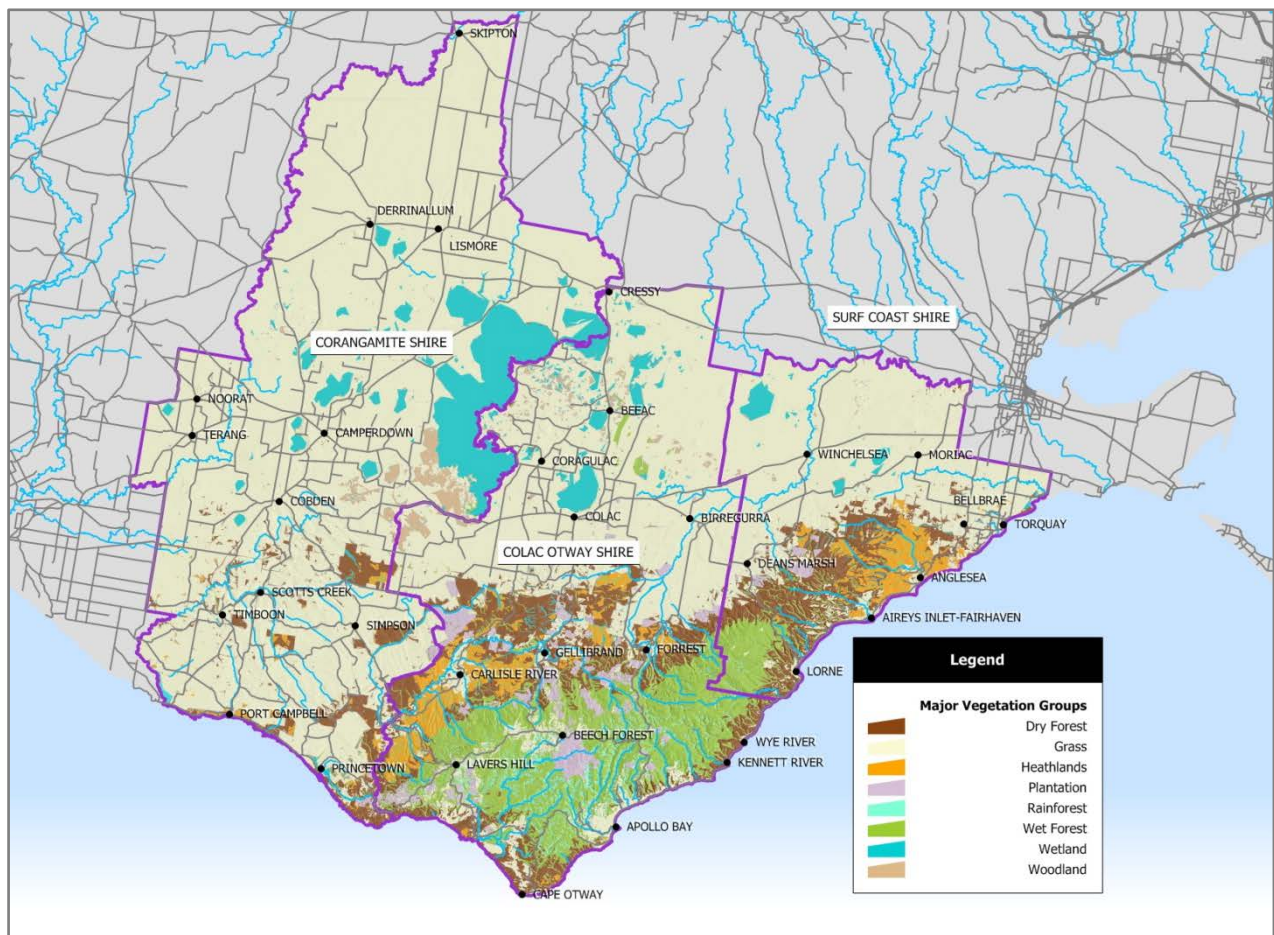


Figure 10 Major vegetation groups of the Otway District

Distinctive bushfire risk profiles are associated with the different vegetation types across the District. From the dry heathlands in the east, to the woodlands and wet forests of the central and western Otway ranges, and to the extensive grasslands beyond - the three Shires share a number of similar environmental features. This in turn, presents corresponding similarities in the bushfire risk profiles. Notably, this part of Victoria is considered amongst the highest bushfire risk areas in Australia and internationally (Bradstock 2010).

Topography

The ranges, rising to a height of near 600 metres at Mount Sabine, predominantly have distinct north and south facing aspects, which are dissected by numerous ridges and gullies. The main ridge of the range becomes less distinct in its northwest and westerly extent where the land is characterised by undulating country, where the landform is characterised by broad areas of basalt plains that are occasionally dissected by low valleys and interspersed with extinct volcanoes. These fertile volcanic plains support high value native grasslands, and large areas have been modified and developed into productive grazing and cropping land.

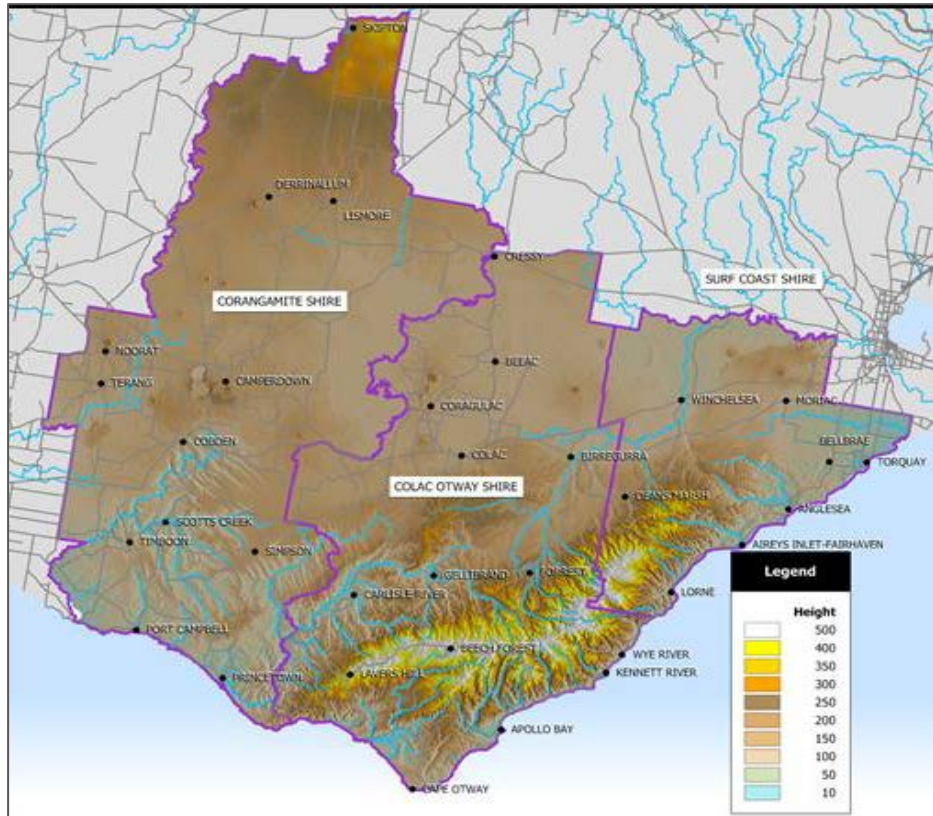


Figure 11
Elevation within the Otway District – height (m) above sea level

District elevation highlighting the distinctive Otway Range and foothills, and showing the volcanic plains.

Terrain has a significant influence on bushfire behaviour and risk. Not only does it influence the type of vegetation occurring and its moisture content, terrain ruggedness can provide extra energy for a bushfire, and long uphill fire runs can be associated with increased fire spread and intensity, along with the potential for unusual fire behaviour and ember storms.

Figure 12
Stony Rises



Rainfall

Rainfall of the district shows similar variation to the topography. The area of highest rainfall receives approximately 2,000mm annually, and this occurs in the highest parts of the range near Lavers Hill. The annual average rainfall then drops away to the north and east of the ranges and reduces to below 500mm in some areas. As you move west from the main part of the range into the undulating country the rainfall remains relatively high in the 800 – 1000 mm range.

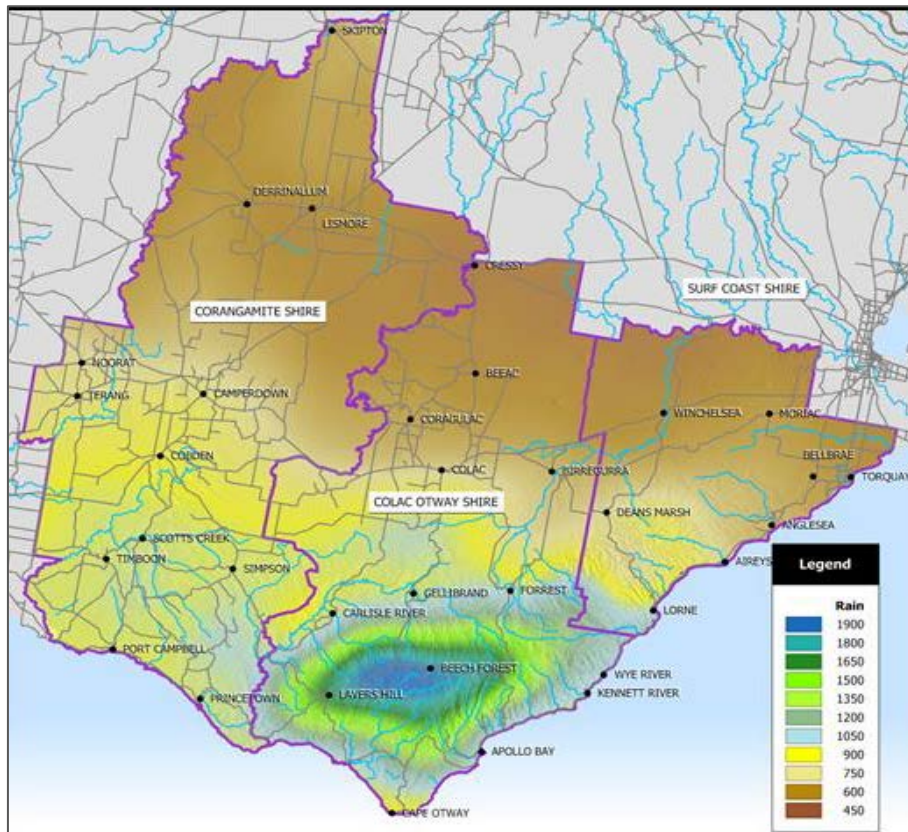


Figure 13
Annual rainfall
(mm)

Environmental influences on fire behaviour and risk

It is this complex make up of vegetation, terrain and weather that plays a major part in defining the fire risk in the Otway District. An understanding of these factors contributes to defining the risk environment across the landscape and for each settlement or towns and also plays an important role in determining which management strategies will be most valuable.

Figure 14 Wye River- Jamieson Track fire suppression

photo
Andrew Hack



People and demographics

In understanding fire risk and determining the best range of actions to reduce that risk, it is important to understand relevant aspects of the people of the District. There are a number of human factors that can both increase and decrease fire risk. In this section, we look at those elements that have a bearing on bushfire risk.

Population

The population of the region is forecast to grow from around 65,000 in 2015 to 84,000 in 2036; nearly 20,000 more permanent residents.

Table 2 Population across the District in 2016 and forecast to 2036

Population						
	Population Density (persons per hectare)	Census 2011 Population	Population 2015 *	2026	2036	Total change
Surf Coast Shire	0.17	25,874	28,941	36,381	43,763	+17,088
Colac Otway Shire	0.06	20,343	20,255	22,280	23,725	+2,918
Corangamite Shire	0.04	16,370	15,671	16,485	16,594	+68
3 Shires		62,587	64,867	75,146	84,082	
Victoria						

Source: .id Consulting Profile, based on ABS Census 2011 * Australian Bureau of Statistics Cat.3128

Dwellings and households

Around one third of all dwellings in the region are not permanently occupied; in Surf Coast shire this is 42%. Additional bushfire risk is associated with this pattern of residency. Part time residents of the District may find it difficult to access to the education and engagement programs offered by agencies and councils to help people understand reduce their risk. Further, the work required to maintain properties at an optimal bush risk standard can be more challenging if people visit infrequently.

Table 3 Comparison of the number of dwellings and households across the three shires, where households are those with permanent residents.

Dwellings and households					
	Dwellings	Households	Average household size	Unoccupied dwellings	
				No.	% of all dwellings
Surf Coast Shire	16,671	9,632	2.6	7,000	42.0
Colac Otway Shire	11,320	8,179	2.4	3,092	27.3
Corangamite Shire	7,674	6,401	2.4	1,224	16.0
3 Shires	35,665	24,212		11,316	31.7
Victoria			2.6		10.8

Source: .id Consulting Profile, based on ABS Census 2011

Visitation and part time populations

Part time populations are significant in the district including holiday home residents, seasonal visitors, event populations and day trippers. During peak visitation periods, the overnight population of Surf Coast Shire is estimated to increase to over 85,000 and Colac Otway Shire to around 48,600. This does not include day trippers to the area. Some coastal towns experience an 8 fold increase or more in numbers over the holiday season, which also coincides with the fire danger period – for example, Aireys Inlet and Wye River.

This large seasonal population increase can result in significant challenges for emergency management. Township facilities, including roads, can be over-capacity, and in the event of a fire, any evacuation is likely to involve very larger numbers of people on a very limited road network, which could easily become blocked. While some regular visitors to the district may have a good understanding of bushfire risk with effective plans in place to reduce that risk, most will not.

Table 4 Peak overnight population for Surf Coast, Colac Otway and Corangamite Shires, 2013/14

Area	Permanent Population 2013	Population Holiday Homes	Population Caravan Parks, Cabins & Camping Sites	Population Hotels, Motels, Apartments, Units & B&Bs	Peak Overnight Population	Permanent to peak multiplier
Total Surf Coast Shire	27,920	39,989	14,065	3,435	85,409	3.1
Total Colac Otway Shire	20,452	17,420	8,730	1,960	48,562	2.4
Corangamite Shire	15,971	13,061	4,543	10,789	44,365	2.7

Source: Economic Indicators Bulletin, City of Greater Geelong, 2013 prepared for G21 Councils (Surf Coast and Colac Otway shires), and Corangamite Shire

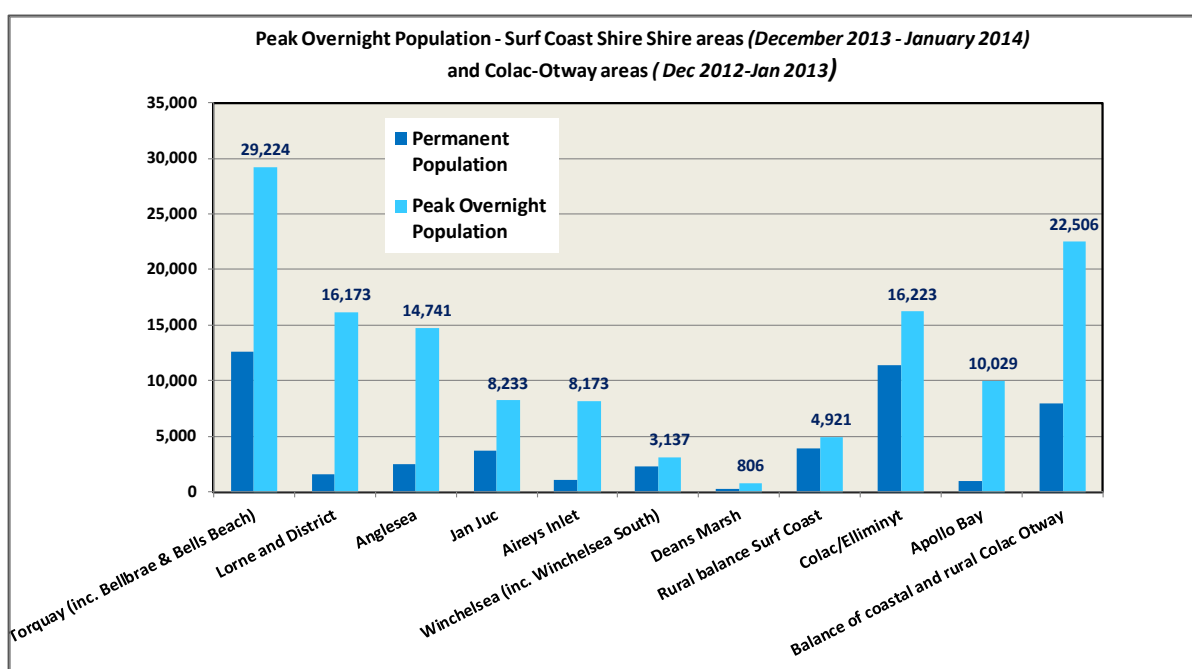


Figure 15 Peak overnight population for selected towns in the Surf Coast and Colac Otway Shires

Demographics of fire risk of susceptible populations

It is well recognised that dealing with an emergency such as a bushfire is very demanding, and when people in this situation, need to provide support to others, the success of dealing with the emergency can be significantly compromised. Young people, some older people and people with disabilities require extra support during an emergency. Disadvantaged people may also be at greater risk.

here are around 11,000 people aged 65 years and over living in the region currently and this number will nearly double by 2036. There are also more the 3,000 households with children under 15 years of age.

Table 5 Summary of age characteristics for the three shires

Age characteristics									
	Median Age	Population 65 years and over, 2011		Population 65 years and over, 2036		Children under 15 years		Households with young children (under 15 years)	
		No.	%	No.	%	No.	%	No.	%
Surf Coast Shire	40	3,760	14	10,049	23	5,535	21.4	1,970	20.5
Colac Otway Shire	42	3,853	19	5,776	24	3,855	19.0	1,160	14.2
Corangamite Shire	43	3,147	19	4,752	29	3,409	20.8	990	15.5
3 Shires		10,760		20,577		12,799		3,130	
Victoria	37		14				18.7		16.8

Source: .id Consulting Profile, based on ABS Census 2011

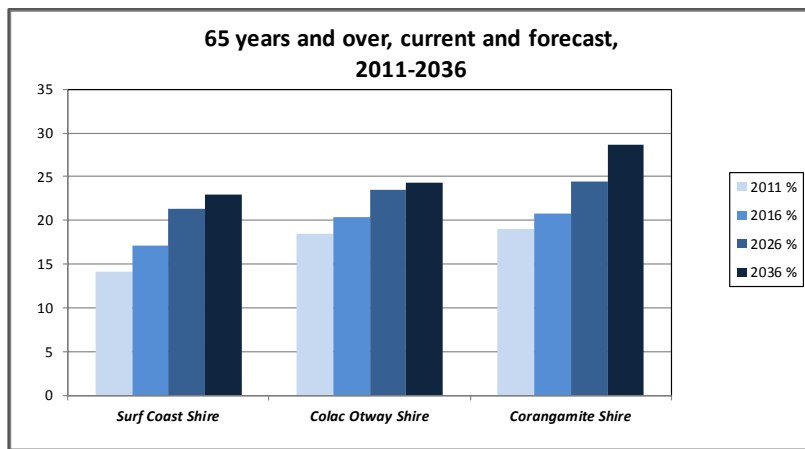


Figure 16 The increase in the number of people over 65 years forecast to 2036

Current and forecast age structure for the Otway District shires, 2011-2036

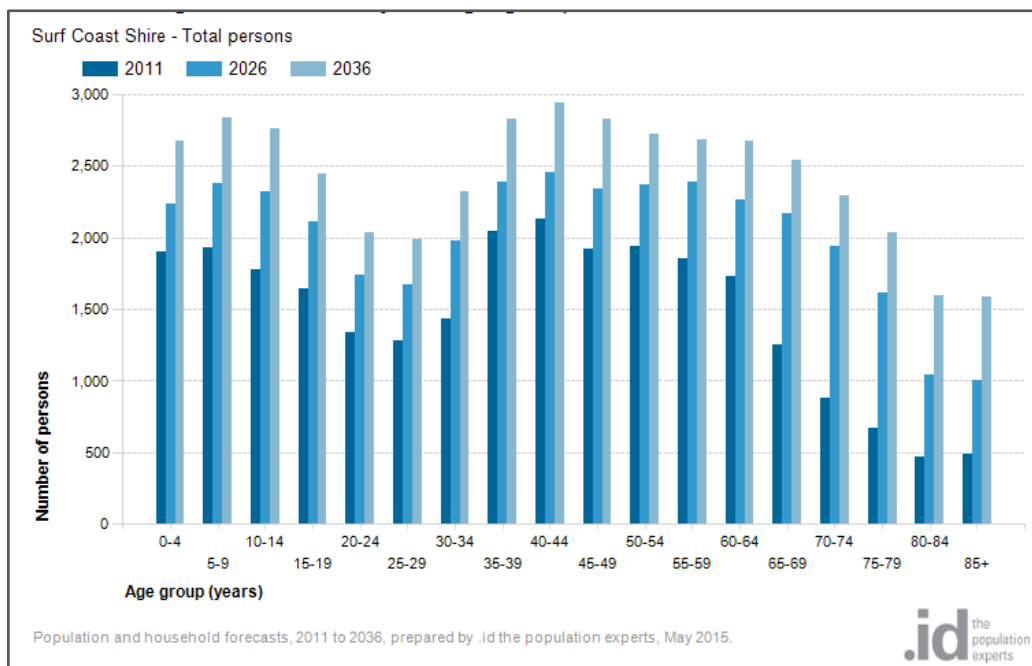


Figure 17 Surf Coast Shire forecast age structure – 5 year age groups

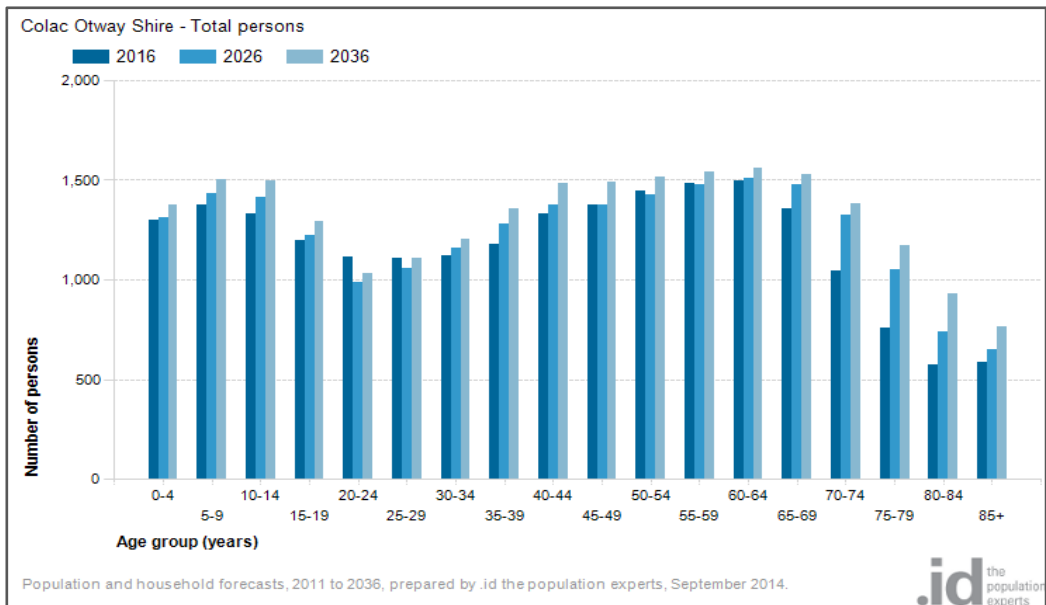


Figure 18 Colac Otway Shire forecast age structure - 5 year groups

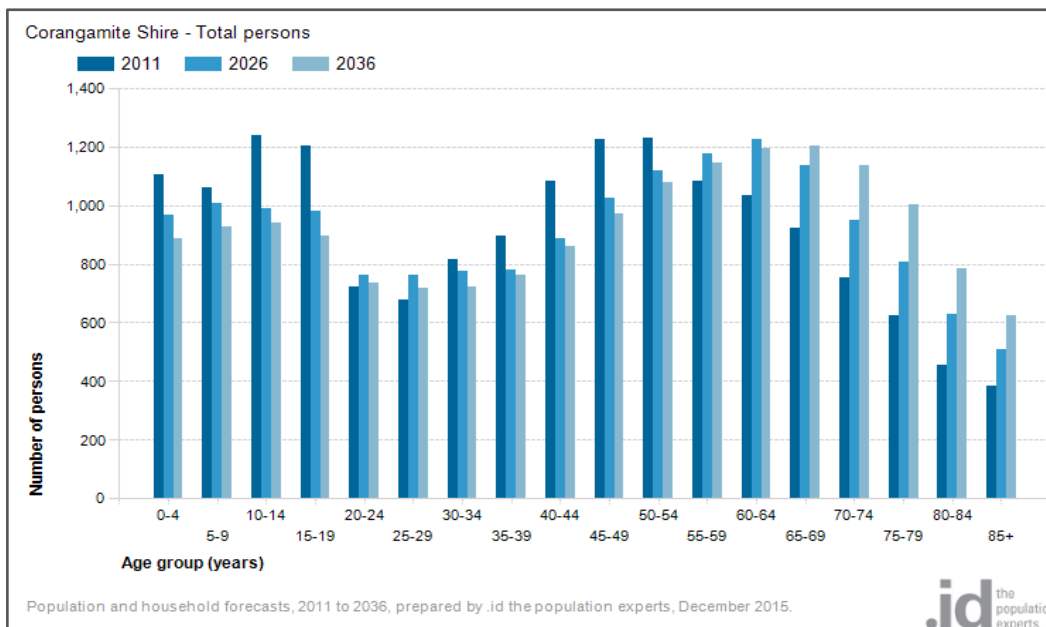


Figure 19 Corangamite Shire forecast age structure – 5 year age groups

Table 6 Disadvantage and need for assistance characteristics across the three shires

Key characteristics									
	Need for assistance		SEIFA index of disadvantage	Households with no internet connection		Households with no car		No qualification	
	No.	%		No.	% of all hd	No.	%	No.	%
Surf Coast Shire	869	3.4	1067	1,419	14.7	296	3.1	7,430	36.5
Colac Otway Shire	1225	6.0	965	2,382	29.1	525	6.4	8,494	51.5
Corangamite Shire	900	5.5	986	1,923	30.0	319	5.0	7,035	54.2
3 Shires	2994			5,724		1140	4.7	22,959	46.1
Victoria			1010		19.1		8.3		43.9

Source: .id Consulting Profile, based on ABS Census 2011

Vulnerable people

The Department of Health and Human Services (DHHS) is the designated lead agency to improve the safety of vulnerable people in emergencies by supporting emergency planning and preparedness (State of Victoria 2015). The DHHS Vulnerable people in emergencies policy (State of Victoria 2015) encourages personal and community emergency planning for vulnerable people because they are likely to require more time or assistance to respond safely to emergencies. The policy defines a vulnerable person as “someone living in the community who is frail, and/or physically or cognitively impaired; and unable to comprehend warnings and directions and/or respond in an emergency situation” (State of Victoria 2015).

The policy prescribes that where there is recognised bushfire risk, specific bushfire planning should be undertaken in addition to basic personal emergency planning, and that funded agencies have a responsibility to support vulnerable people to undertake this planning. Other agencies and groups also support vulnerable people. For example the Red Cross has developed a range of resources to assist emergency preparation, including materials targeting seniors and people with a disability - <http://www.redcross.org.au/emergency-resources.aspx>.

Councils have a further role to maintain a register of vulnerable people and to maintain a list of local facilities where vulnerable people are likely to be situated, (State of Victoria 2015). The Municipal Emergency Management Plan of each Council contains further information on support to vulnerable people in each shire.

Susceptible people

In addition to people who are recognised as vulnerable and possibly included on the vulnerable people register, this District also has a large number of people who are more susceptible to bushfire risk. These include tourists and visitors, older and younger people, people from non English-speaking backgrounds and those that are disadvantaged. The scale of susceptible people is described in the earlier sections on demographics, and it is considerable. The risk analysis undertaken for this plan incorporates an assessment of susceptibility for each locality. The objectives, directions and actions acknowledge this challenge and provide specific approaches to reduce risk for susceptible people and for facilities that support susceptible people.

Figure 20 Lorne Beach
December 2015
– view of the convection
column of the Wye River-
Jamison Creek bushfire

Of note, many beach-goers
do not appear to be
responding to the
approaching fire threat.

Image by Sal Buchanan,
Permission pending



Case Study – Fairhaven; changing demographics, changing bushfire risk

This case study examines the implications of township and demographic changes on bushfire risk

We often look to the past to give us an understanding of what may happen in the future, and this approach has been used to explore some aspects of bushfire risk for coastal communities of the surf coast.

In 1983, the Ash Wednesday bushfires destroyed some 700 houses between Lorne and Anglesea. While it is possible that a similar fire could again impact these coastal towns, it is useful to understand that the towns have changed since 1983 and there is potential for bushfire impact to be considerably greater.

In this case study we look at the settlement of Fairhaven and how changed demographics and town planning have altered the risk profile. While Fairhaven has been selected in this instance, several towns along the surf coast have experienced similar changes and parallels can be drawn.

Key bushfire risk factors explored in this example include:

- number and density of houses,
- distance of houses to the bush, and
- proximity of houses to each other.

Overall increase in the number of houses

At the time of the Ash Wednesday fires, there were some 200 houses in Fairhaven, and by 2016 this number increased to over 500. Figure 21 shows this increase in the number and density of houses in Fairhaven.

The extra risk associated with having more houses, a higher population, and the potential for increased house loss is self-evident. However two other factors play an important role in bushfire and house loss in this town.



Figure 21 Dwellings in Fairhaven following Ash Wednesday fire

Red dots indicate houses that were burnt during the Ash Wednesday fire of 1983 and yellow dots indicate houses that remained intact. Blue dots represent houses that have been built since 1983, which are in addition to the houses re-built on the red-dot sites.

Distance between houses and the bush

The distance from a house to the bush is a key bushfire risk factor. Using the house loss ratios experienced in Fairhaven from the 1983 fire as they relate to the distance of a house to the bush, a theoretical house loss potential was developed for current house locations. This helps us consider the bushfire risk implications of an increased number of houses in close proximity to the bush.

Figure 21 and figure 22 (over page) show the change since 1983 in the number of houses in Fairhaven located in close proximity to the bush. Figure 2 compares the number of houses lost in Ash Wednesday to the potential for house loss today under a similar fire situation, assuming all other risk factors are equal with conditions that existed in the Ash Wednesday fire.

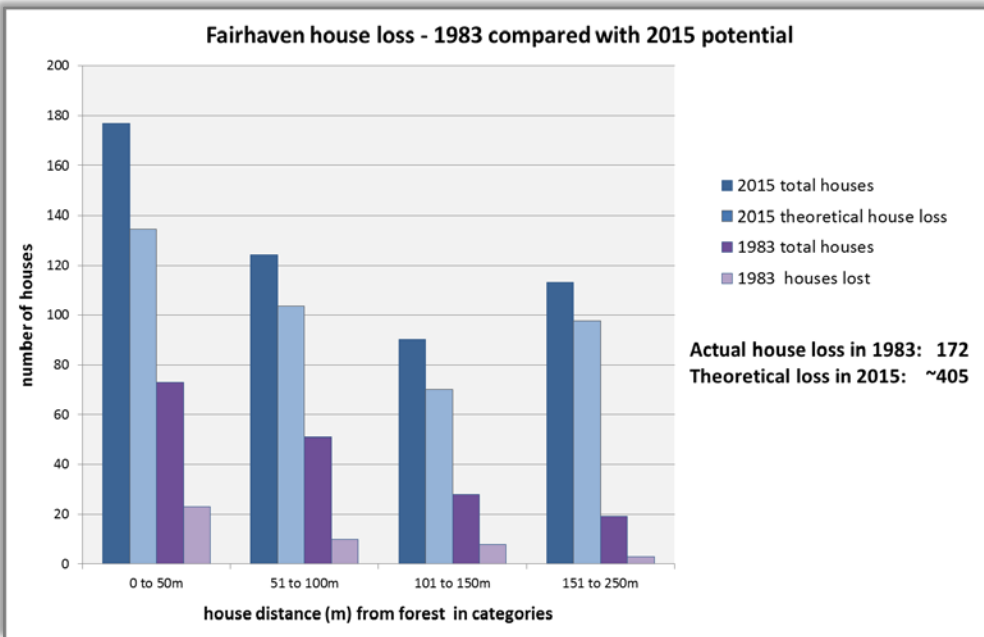


Figure 22 Fairhaven house loss in 1983 compared with 2105 potential

This compares houses lost in the Ash Wednesday fires against the potential in 2015 under a similar fire scenario, due to changes in the proximity of houses to the bush (only).

In the Ash Wednesday fire, 172 houses were lost at Fairhaven. As at 2015, it is estimated that 405 houses in Fairhaven are close enough to the bush to be destroyed by a fire similar to that of Ash Wednesday.

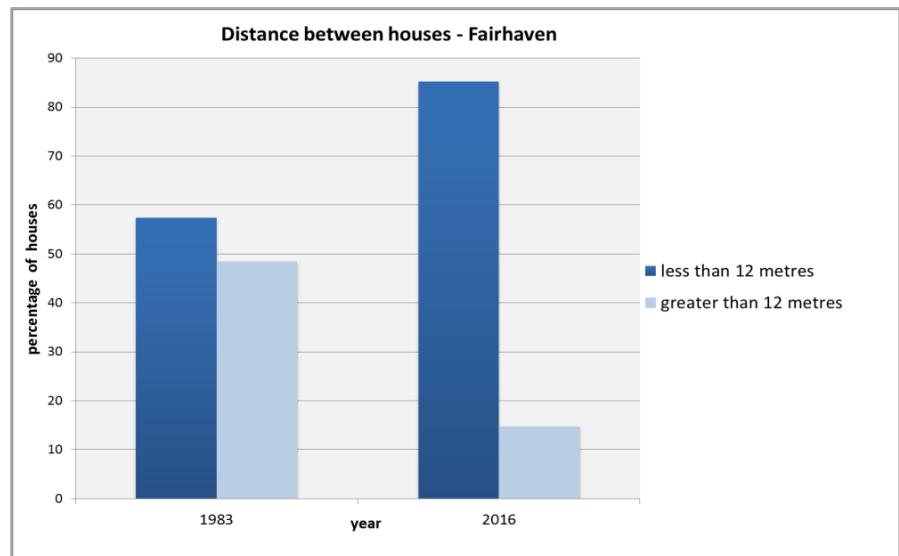
House to house ignition

Another key bushfire risk factor has changed considerably since 1983, and this could further increase house loss for towns like Fairhaven. House to house ignitions can occur when houses are located relatively close together. As experienced in the Wye River/ Separation Creek fire on Christmas day 2015, this can be a significant house loss factor.

Learnings from the Wye River/Separation Creek fire show that much of the house loss in these towns was

due to house to house ignitions – where one house became involved in the fire and the heat or flames from that house fire ignited a neighbouring house. Houses located closer than 12 metres have an increased chance of ignition from a neighbouring house (Leonard et al. 2016). Figure 3 compares the approximate distance between houses in Fairhaven in 1983 and in 2015, and we can see that many more houses are within 12 metres of each other – 57% in 1983 increasing to 85% in 2015.

Figure 23 Changes in the distance between houses (approximate) in Fairhaven, between 1983 and 2015



Implications

The pattern of increasing house numbers and density, along with locating houses close to the bush and to each other needs to be understood as a bushfire risk factor across towns of the Otway coast, as it has the potential to result in significantly greater house loss.

This is critical, as evidence collected about bushfire impacts in Australia over time show a strong correlation between house loss and life loss - generally for every 17 houses lost, one life is lost (Blanchi et al. 2012).

Bushfires in the Otway district

Bushfire history

Fire has had a long association with the Otway ranges and the surrounding plains, so much so that the majority of plant species now present have developed adaptations to survive fire, and in many cases rely on its occurrence for their ongoing survival. We know from the diary extracts of early sailors that smoke and fire in the area was commonly reported. "In March 1802, the French explorer Nicolas Baudin, sailing westwards along the Victorian coast from Wilson's Promontory, passing Cape Otway saw smoke in the distant inland and later saw fire burning on top of a rise on the shore" (Blainey 2013).

Figure 24
'Aborigines using fire to hunt kangaroos', Joseph Lycett, c1820. National Library of Australia



The role that Aboriginal people played in shaping the vegetation through the use of fire and the evolution of fire adapted plants takes this fire history back many thousands of years. What is difficult to define is, if or how, the type of fire has changed since indigenous people managed the landscape. Some speculate that although there was much fire in the landscape for thousands of years, the intensity of those fires may have been less than what we commonly see today. In part, this is likely to be due improved response efforts - as a community we have become very good at suppressing all but the large and intense fires, and as a result this is the type of fire we now commonly associate with the term bushfire. Another consideration is that a change in fire regime and intensity could have led to a change in vegetation structure and fuel availability, providing a positive feedback loop for the development of large uncontrollable fires.

It is likely that large uncontrollable fires were also a feature of the landscape before the European settlers arrived. The presence of Mountain Ash in the higher regions of the Otway ranges may tell a story. This species occurs in areas that are generally wetter and dry out less often than the surrounding foothills and plains, however, the species has developed a regeneration strategy that requires at least one episode of reasonably intense fire during a three to four hundred year time period; suggesting that that intense fires did extend into the less fire prone areas.

It is difficult to fully understand fire regimes and intensity of the past and how it may have changed over the millennia, however, it is worth considering when we consider the part fire will play in our communities in the future.

Whilst the recent fire history has at times been devastating to our modern way of life, there has been a distinct change in how fire is viewed and used in the last 200 years. Interestingly, indigenous people often view fire as a life-giver; an essential tool for their survival in this landscape. Conversely, later arrivals to this land tend to view fire through a lens of devastation and loss.

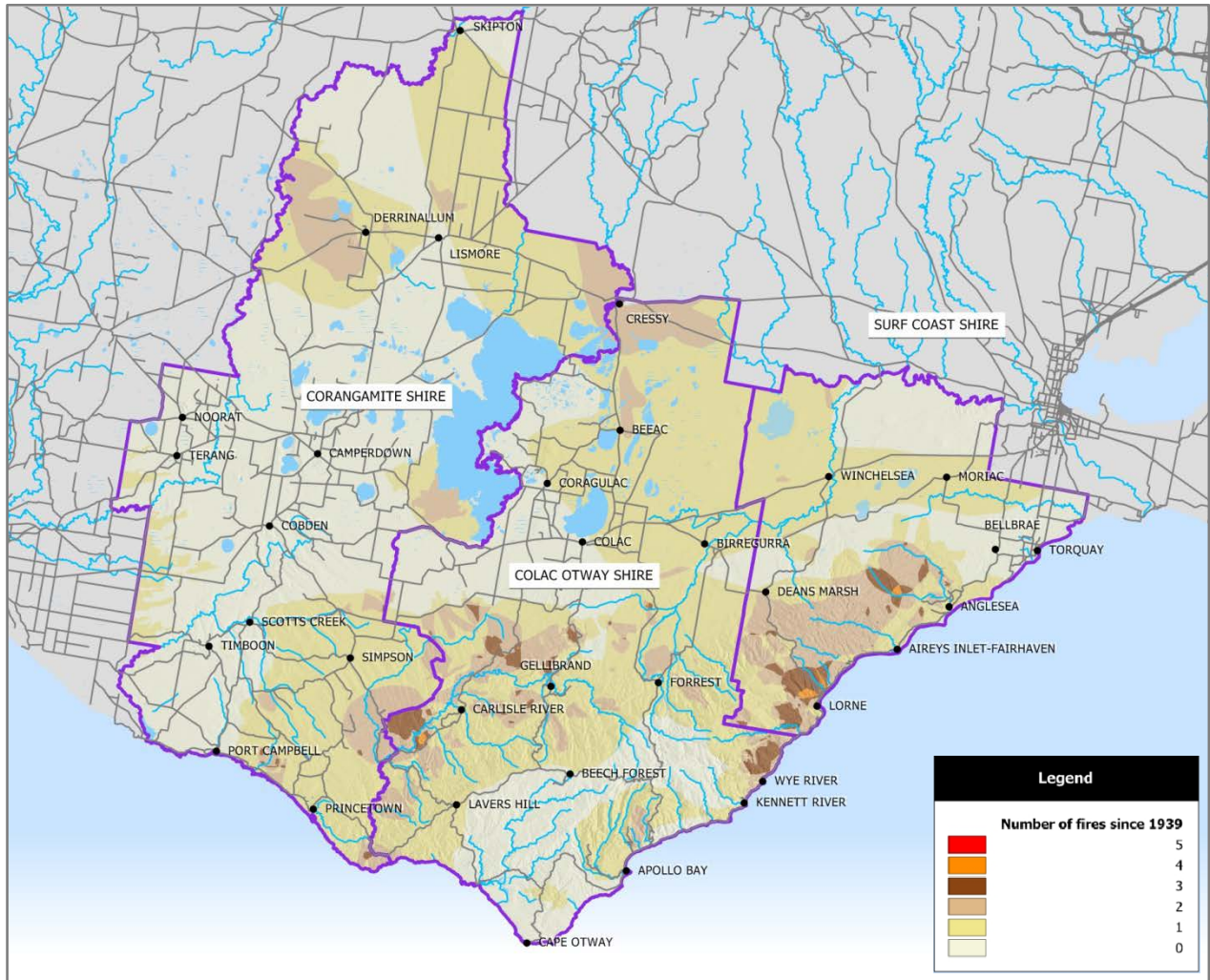


Figure 25 Wildfire history of the Otway District since 1939

The map indicates that approximately half of the area of the District has experienced at least one wildfire in the past 77 years, and some areas have been impacted by five wildfires (note that our capacity to systematically map wildfire has evolved over time, becoming more thorough around 1990). As may be expected, the Otway ranges have generally experienced a higher frequency of wildfire, with the areas inland of Anglesea, Aireys Inlet and Lorne, and near Carlisle River having the highest wildfire frequency. Significant wildfires have also occurred in areas of grassland to the north of the ranges. This map does not include planned burns.

A full list of significant wildfires in the District since records began is included in Appendix B. The list shows us that over the past 166 years large fires have been reasonably common across the landscape. These fires have been in response to different bushfire drivers and in the section below we will investigate these drivers and explore how they may have changed over time. We will consider implications for the future, acknowledging that what we can learn from the past may only tell us part of the story about what is likely to occur in the future.

How fires behave

Understanding how bushfires behave and how that influences the risk profiles for localities within the District is an integral part of understanding risk, and more importantly for building and communicating effective risk mitigation measures. The factors described in this section are based on a model put forward in; *A biogeographic model of fire regimes in Australia: current and future implications* (Bradstock 2010), where the key hierarchical bushfire drivers are identified as fuel biomass, fuel moisture/dryness, fire weather and ignitions. These are described below for our biogeographic area, including how each plays a part in the underlying risk.

These components – *fuel biomass (amount), fuel dryness, fire weather, and ignition* - can be thought of as dials (or switches); as soon as the dial is above 0 for all components at the same time, a bushfire can occur. As each of the dials are turned up, the greater the contribution that component plays in the behaviour of the fire. If any one of the dials is turned off, a bushfire will not occur.



Fuel Biomass

To have any fire you need fuel, and for a bushfire, vegetation is commonly the fuel. This is the reason that fuel is at the head of the hierarchy. As discussed in the landscape section, there is a range of fuel types within the District, however at its most basic form the main fuel components are the grassland fuels which make up the majority of the planning area, and forest-type fuels covering about 25% of the District. Each community or asset is located in proximity to one or both of these broad fuel types, and the fuel type will underpin nature of the bushfire risk.

The greater the fuel load, and the more flammable the species, and the more favourable the structure of the fuel to burn - the further this fuel biomass dial is turned up and the greater its contribution to fire behaviour.

Factors associated with fuel biomass have some commonalities across the planning area; including:

- the majority of the fuel burns readily when available and
- the district has very large connected areas of both grassland and forest fuels, with the only major disruptions to this being the lake systems and the larger towns.
- many people in our communities live in close proximity to connected fuel and this is a major driver of the risk profile for each locality.

The grassland and forest fuel types also have attributes unique to each:

- different responses to climate result in different amounts of fuel present at any given time.
- fire intensity, rate of spread, and production of embers are all related to the fuel type.

The combination of these factors and the fuel load are important aspects in understanding risk and mitigation. The conclusion of this brief examination of fuel biomass is that this District has sufficient connected fuel to carry large, fast and intense fires across most of the District.

Fuel moisture

The next component to consider is the fuel moisture or dryness. Each fuel type (vegetation) has a different cycle of drying in response to the rainfall (long and short term), terrain and the structure of the vegetation. Drying cycles can be viewed at two levels and different fuels are susceptible in varying degrees to these influences. The first is the short term cycle based on the rainfall over recent periods, as this influences growing cycles and the moisture content of live vegetation and dead ground fuels. We have however, seen a number of devastating fires occur when not only short term drying of fuel occurs, but long term moisture deficits (consecutive dry years) are also in play leading to a drying of heavier forest fuels which then become more available to burn with the fire front. As the vegetation dries out the further this dial is turned up. Understanding when these drying cycles occur allows us to understand when fuel dryness/moisture component raises the potential bushfire risk.

Fire weather

When the elements of fuel biomass and fuel moisture together allow for conditions which could support a large scale damaging fire (ie are both above 0 on the dial), we then need to examine the next factor – fire weather. Bushfires can only exist in the presence of a weather stream that promotes intense fire and reduces our ability for suppression. In general terms, the aspects of weather that promote devastating fire include the temperature, humidity, wind strength and the atmospheric stability. The combination of these factors will define the potential of a fire. The [Fire Danger Rating](#) system, drawn from the Forest Fire Danger Index is a very useful way of understanding how weather influences fire risk.

Ignition

Finally, to have any fire there must be an ignition source. Analysis of ignitions in the district shows that they are widespread and generally are not a limiting factor to the development of devastating fire. That said, they are also an element for which fire mitigation strategies can be very important. Ignition control strategies currently employed by emergency services can be effective in reducing ignition probability.

Figure 26 below shows a relative probability of ignition model developed by DELWP and the Otway District Bushfire Planning Collaboration for the Otway District for the purpose of refining bushfire modelling. This approach was adopted following examination of previous work which found that anthropogenic ignitions (caused by humans) were correlated with population density (Gill and Williams 1996), and on the understanding that human ignitions account for some 95% of all ignitions in the District.

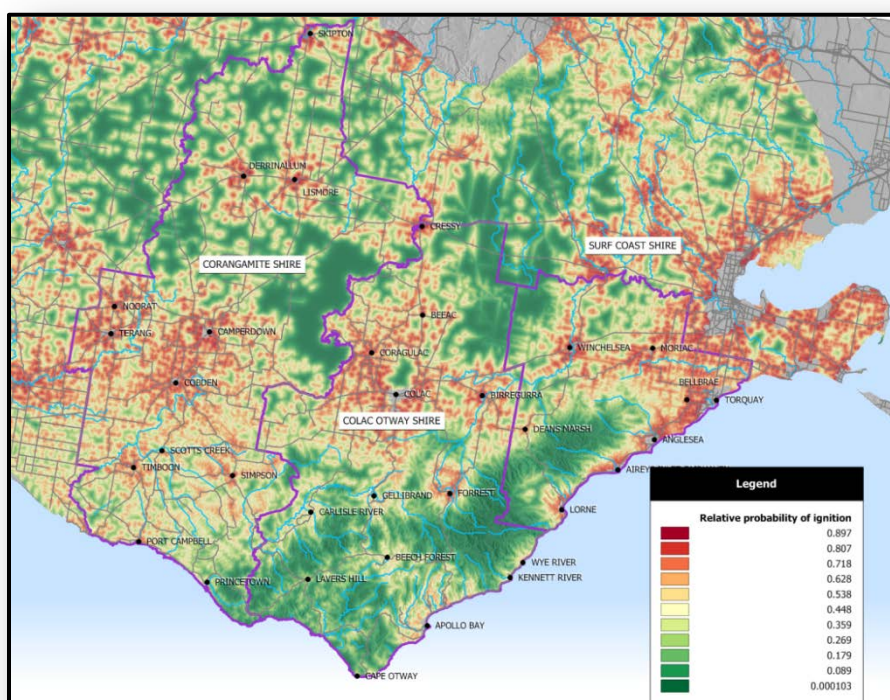


Figure 26 Relative probability of ignition

The model used a logistic regression function to spatially express ignition probability in association with population centres and different road classes. Historic ignitions selected for the modelling were based on ignitions that had the potential to become bushfires, independent of season.

The location of an ignition has an important role in the potential spread of a fire and its impact, and therefore the effect on communities. This is demonstrated through the use of modelled house loss emanating from different ignition points as shown in Figure 27 below.

Figure 27 maps the location of ignitions which result in fires that cause house loss. Red indicates areas of fire ignition which generate the greatest modelled house loss, through to white, which indicate the areas of lowest house loss. It is based on analysis of the 10,000 modelled Phoenix Rapidfire simulations using a fire weather steam similar to Black Saturday.

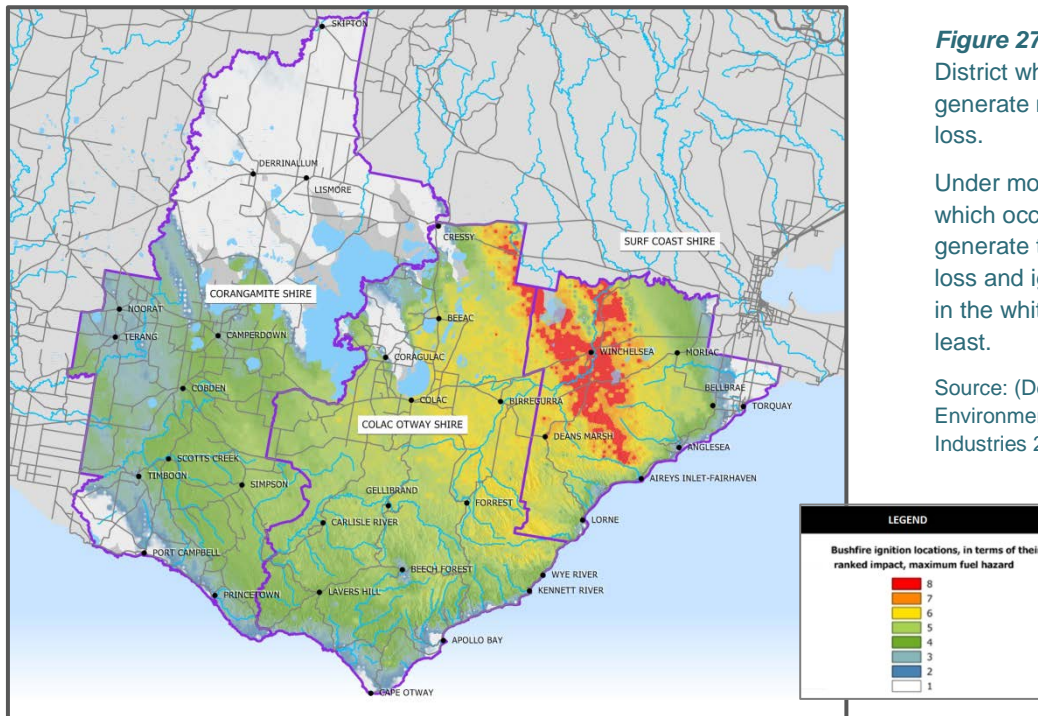


Figure 27 Locations in the District where fire ignitions generate modelled house loss.

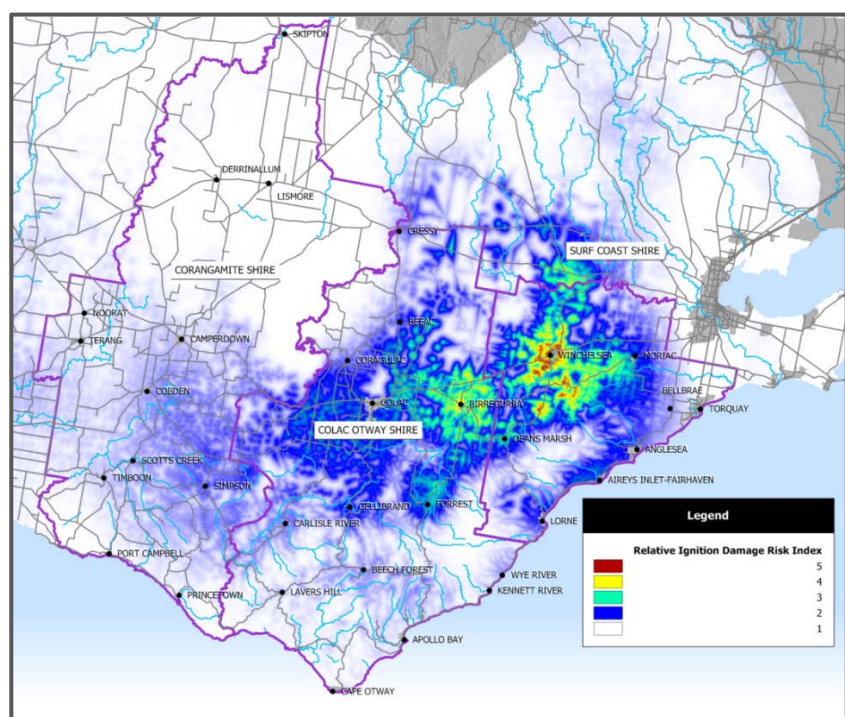
Under modelling, Ignitions which occur in the red areas generate the greatest house loss and ignitions occurring in the white generate the least.

Source: (Department of Environment and Primary Industries 2014)

Figure 28 below is a simple combination of the relative ignition probability (figure 27) and the potential damage (house loss) from an ignition location (figure 27). It serves to highlight areas in the District where both ignition probability is highest and potential house loss is highest showing us the higher risk areas for ignition.

Figure 28 Relative ignition damage risk index (house loss)

Note – the production of maps in this section is limited by the information available as inputs to modelling and by the modelling tool itself. They are based on the best info available at the time, acknowledging that accuracy will improve over time.



Case Study – Wye River and Separation Creek house loss learnings

This case study examines some aspects of house loss in Wye River and Separation Creek resulting from the 2015 Christmas day fire; it explores the importance of township and domestic fuels in the bushfire risk equation, and provides insights into how impacts from the recurrence of a similar fire could be reduced.

Understanding a township's individual characteristics and how they influence its bushfire risk profile is critical; it allows us all to determine the most effective ways of tackling risk to transition towns to being more fire adapted and resilient and in the face of future emergencies. The 2015 Christmas day bushfire that impacted the communities of Wye River and Separation Creek, as devastating as it was, allow us to examine the factors which contributed to the higher than expected house loss which occurred.

This case study, drawn from the house loss surveys and the report describing the house loss findings (Leonard 2016), looks at three of the key factors:

- township ground fuel,
- town steepness and,
- storage of household items.

Township ground fuel

Generally, we might expect a fire front to travel through bush and reach a town to cause damage by direct flame contact, radiant heat and ember attack. However in the case of the 2015 Separation Creek and Wye River fire this did not occur. Instead, embers generated from the main fire started a relatively small number of spot fires within the town which then developed and spread through the fine ground fuels of the town (mainly leaves, twigs and low vegetation).

These ground fires generally travelled against the prevailing wind, back towards the main fire under the influence of the slope and the pull of winds generated by the convection column of the main fire. Often only about 40cm high, the ground fires were then able to ignite susceptible heavier fuels such as houses and structures, and in turn, they were able to ignite close neighbouring houses and structures.

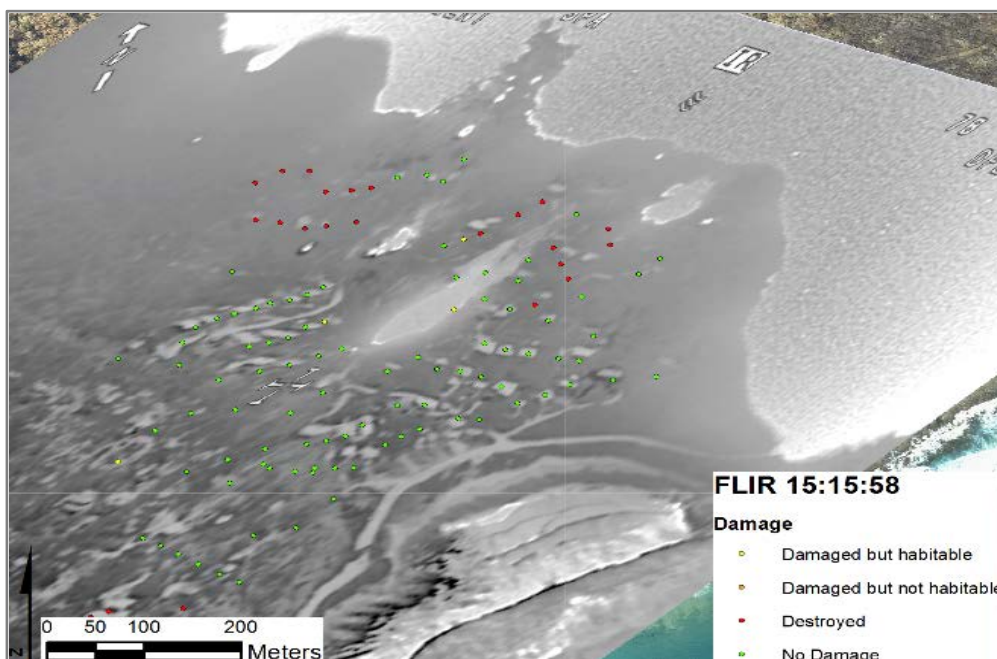


Figure 29 FLIR (forward looking infrared) image showing spot fires in Separation Creek (source: cited in (Leonard 2016))

We can see from figure 29 – an infrared image of the fire at 3:16 pm on Christmas day - a number of ember generated fires had developed within Separation Creek (light areas indicate fire), and were travelling back toward the main fire front. This highlights the first of the characteristics that contributed to the loss;

the townships consisted of a largely connected fine fuel layer that allowed fire spread throughout the town and ultimately right up to the structures. The towns essentially burnt from within experiencing limited impact from the fire front itself (Leonard 2016).

Terrain steepness – retaining walls and under-house storage

There are a number of compounding features associated with the steepness of the towns' terrain which increase their vulnerability, and here we will look at two.

- Retaining walls for slope stabilisation, by necessity are a feature of both towns. Commonly, these are built of timber – some of pine and some of hardwood figure 30 - and by their nature are in contact with the ground and associated fine fuels.
- The slope of the towns dictate that many of the houses are largely elevated, which allows for storage of heavy fuel items under the building as can be seen in figure 31.



Figure 30 Remains of a retaining wall near a house



Figure 31 Heavy fuel stored under a house

These two features enabled the surface fire to easily transition from burning fine ground fuels to ignition of heavier fuel – the retaining walls, items stored under or near buildings, and directly to the buildings; all contributing to house loss.

In addition, many houses did not have ember-proof under-floor areas, and this allowed access for embers which ignited fuel under the house, generating enough heat and flame contact to ignite the house above.

Learning

While there are other elements that contributed to house loss, the three factors briefly discussed in this case study are distinctive features of Wye River and Separation Creek - they serve to remind us that individual towns need individual solutions.

The learning from this is multifaceted: it teaches us not only about future risk mitigation in these towns, but more importantly, how understanding the hazard is critically important and how developing bespoke solutions for each township **with their communities** is the future of fire management and a focus of the strategic directions and actions of this fire plan.

Risk-based planning approach

This plan takes a risk based approach so that collectively, we can determine how to best direct our efforts and resources to minimise the impacts and consequences of fire on the things we all value. To achieve this we need a detailed understanding of the risk. In this section we focus on bushfire risk – which is the likelihood of bush fire causing damage.

Risk analysis across the District was undertaken in the lead up to the preparation of the plan. From this work several key risk criteria were selected as important measures of risk and were used to rank bushfire risk across all localities in the District:

- Bushfire simulation modelling – using Phoenix Rapidfire⁷ modelling, data generated by DELWP from 10,000 simulated fires were assessed to determine for each town a broad range of fire-township interactions. From the analysis we selected the following elements to represent bushfire risk:
 - the frequency that modelled fires reached the town.
 - the potential scale of impact - we examined for each locality: average number of houses lost, total number of houses lost and number of times the fire impacted more than 20% of the town.
- The influence of landscape topography and vegetation on the potential for unusual fire behaviour and intense ember drops on each town (termed drop-zone).
- Access and proximity of each town to a large, open and permanently low-fuel space for last resort bushfire shelter – often a wide accessible beach.
- The relative need each town has for assistance due to age (younger or older) and disability.
- The relative degree to which tourism is a feature of each town, understanding that tourists are likely to be more vulnerable and large visitor numbers can pose additional risk – eg traffic issues.

This analysis is the basis of the risk profiles presented in tables 7 to 10 below, and a more detailed description of each risk element is provided below. A table showing the modelled risk of all localities within the District, along with a more detailed description of risk elements is included as appendix C.

Identifying bushfire risk in the Otway District

A number of complementary approaches to identifying risk need to be considered in making determinations on priorities and treatments. They include bushfire modelling analysis and fire history examination, along with specialist and local knowledge.

The Victorian Bushfire Risk Profiles Report (Department of Environment and Primary Industries 2013) released by DELWP's predecessor in 2013, presented a method of using Phoenix Rapidfire modelling to

⁷ Phoenix RapidFire is a sophisticated bushfire simulation tool developed by Melbourne University, DELWP and the Bushfire CRC and used to model bushfire risk in Victoria. Phoenix uses information about weather, topography, vegetation and fire history to simulate (and predict) the spread and impact of bushfires. It helps us to understand bushfire behaviour – including flame height, ember density, spotting distance, convection column strength and intensity. - See more at: <http://www.delwp.vic.gov.au/safer-together/science-and-technology#sthash.7YiRliIR.dpuf>

test a number of different landscape fuel (vegetation) management scenarios – or planned burning - against a scenario in which there was no fuel management. Modelled house loss was used as a measure of bushfire risk. Not only could the different fuel management scenarios be compared against each other, a risk reduction value could now be estimated; that is, the amount of risk reduced by each planned burn scenario could now be assessed and compared.

This risk reduction value helped us understand the benefit of proposed DELWP and CFA fuel reduction (broad scale planned burn) programs, and just as importantly it gave us an understanding of how much bushfire risk remains to be tackled using other risk reduction strategies. This component of the risk remaining after planned burning is known as the *residual risk*.

Bushfire risk profiles for District localities

Having a robust understanding of the nature of risk is the critical foundation for determining the best strategies and actions to reduce that risk. It is the basis from which agencies and communities can direct their efforts and resources to the most effective solutions.

The following series of tables show the relative bushfire risk of localities within the District, determined through application of the methodology summarised above, and detailed below. The first table takes a district wide approach, and subsequent tables are shire by shire. All risk ratings are ranked scores from 1 to 10 (except bushfire shelter which is 1 to 5), and those emanating from Phoenix are the risk of house loss, determined spatially. Importantly, evidence over time demonstrates that there is a strong correlation between house loss and life loss resulting from bushfire impacts (Blanchi R 2012).

It is important to note, that the bushfire risk analysis presented in these tables is undertaken through modelling, and while we have used the best tool and the best data available at the time of writing this plan, it is still modelling and must be treated as such. Other factors, such as fire history and local knowledge also need to be considered. For example, Pomborneit is an example of a locality which has experienced a number of fires which due to access are difficult to suppress.

Understanding the tables

The tables present a number of ways of looking at relative bushfire risk between localities in the District, and can be used to inform various lines of enquiry – depending on what you are most interested in. For example, you may want to know how often a modelled fire reaches the locality, but this will not indicate the degree of impact. Likewise, impact can be explored in a number of ways; from the average number of houses lost over the 10,000 modelled fires, to the relative number of times house loss in a locality exceeds 20% of the houses – which is likely to have a substantial impact on community as well as the individual house-holders.

It is difficult, and not particularly useful, to provide an overall risk ranking between localities as there are many ways of defining the risk. However, generally the higher the locality is on this table, the greater the overall risk. Values in the table are heat mapped to provide a quick visual reference – green is lower risk while red is higher. A worthwhile way to use these tables is to examine the full risk profile of each town in which you have an interest.

Working through the tabulated township risk profile, the first 5 columns represent information extracted from the work undertaken by DELWPs Barwon Otway Risk Landscape team to present different aspects of exposure and consequence. Outputs as derived during that process and have been given a relative ranking based on a number between 1 and 10, with 10 being the highest risk or consequence. Further information on the method can be sourced in the Victorian Bushfire Risk Profiles Report (Department of Environment and Primary Industries 2013).

Table 7 Bushfire risk profiles – relative and ranked risk for localities across the District – 60 localities

Locality	LG	No. of houses in locality	Ranked likelihood of fire reaching the town	Ranked average number of houses lost	Ranked total house loss / number of houses in town	Ranked likelihood of township experiencing substantial impact (>20% house loss)	Ranked Drop zone potential	Ranked access to large low fuel area (1 good, 3 poor, 5 none)	Ranked need for assistance Age/ Disability (total no. of people)	Ranked tourism factor
LORNE	sc	2744	9	10	6	5	9	1	5	10
WYE RIVER	co	396	6	4	9	6	7	3	3	10
BENWERRIN	sc	57	8	1	8	10	8	5	2	5
LAVERS HILL	co	208	7	2	7	7	10	5	2	6
FERGUSON	co	32	7	1	7	7	8	5	5	6
FORREST	co	345	7	2	7	7	7	5	1	7
KENNETT RIVER	co	199	6	2	8	5	6	3	3	10
BARRAMUNGA	co	171	8	1	4	9	8	5	2	3
WEEAPROINAH	co	29	6	1	9	8	9	5	1	1
AIREYS INLET	sc	1309	3	7	3	2	6	3	6	8
BELLS BEACH	sc	95	5	2	10	5	5	3	4	7
SEPARATION CREEK	co	147	4	2	8	5	7	3	2	9
ANGLESEA	sc	3484	6	5	2	2	8	1	8	8
BEECH FOREST	co	353	10	1	5	6	9	5	3	3
WYELANGTA	co	193	8	1	4	8	10	5	2	1
CHAPPLE VALE	co	124	7	1	4	7	10	5	4	1
GELLIBRAND	co	360	9	1	4	5	8	5	5	5
MOUNT SABINE	co	10	6	1	4	8	10	5	1	2
CARLISLE RIVER	co	396	10	1	4	8	7	5	1	2
TANYBRYN	co	73	6	1	5	8	7	5	1	2
GREY RIVER	co	14	3	1	7	4	7	3	3	9
JAN JUC	sc	2124	5	8	3	2	4	1	3	7
KAWARREN	co	202	7	1	6	5	6	5	3	4
BELLBRAE	sc	509	6	2	4	5	3	5	6	4
JOHANNA	co	153	5	1	5	4	6	3	4	8
BIG HILL	sc	44	4	1	6	4	8	3	2	7
SKENES CREEK NORTH	co	32	4	1	9	5	6	5	1	2
EASTERN VIEW	sc	81	5	1	5	4	7	3	1	8
YUULONG	co	122	5	1	5	5	9	5	2	1
KENNEDYS CREEK	c	78	6	1	2	6	6	5	4	2
TIMBOON	c	825	8	2	2	3	4	5	7	4
APOLLO BAY	co	2532	6	3	1	1	7	1	6	9
BARWON DOWNS	co	276	7	1	3	5	5	5	4	1
PORT CAMPBELL	c	620	7	1	2	2	6	1	5	10
GELLIBRAND LOWER	c	83	4	1	2	4	6	5	4	4
BARONGAROOK	co	260	5	1	4	4	5	5	5	1
GLENAIRE	co	151	5	1	2	3	7	5	5	3
JANCOURT	c	19	3	1	3	4	3	5	8	2
WONGARRA	co	81	5	1	6	5	6	3	1	2
FAIRHAVEN	sc	608	2	3	2	2	6	3	2	8
MOGGS CREEK	sc	203	2	2	3	2	6	3	3	8
PENNYROYAL	sc	99	4	1	4	3	5	5	3	5
GHERANG	sc	179	5	1	5	4	5	5	3	1
SKENES CREEK	co	406	3	2	3	2	6	3	4	6
WENSLEYDALE	sc	97	5	1	4	3	7	5	3	2
IRREWILLIPE EAST	co	74	6	1	4	6	0	5	4	1
CAPE OTWAY	co	52	3	1	1	1	8	5	1	10
BOONAH	sc	27	4	1	4	4	7	5	1	1
HORDERN VALE	co	62	2	1	2	2	9	5	2	4
IRREWILLIPE	co	146	8	1	4	4	0	5	5	1
SCOTTS CREEK	c	168	7	1	2	3	3	5	5	2
CARPENDAIT	c	97	6	1	4	5	0	5	3	1
JANCOURT EAST	c&co	131	8	1	3	4	3	5	2	1
PRINCETOWN	c	260	7	1	2	3	0	3	4	7
TORQUAY	sc	8395	4	2	1	0	2	1	10	7
WAARRE	c	13	4	1	3	4	4	5	1	1
GLENFYNE	c	85	5	1	2	3	4	5	3	1
MARENGO	co	379	3	1	1	1	5	1	4	9
MURROON	co	92	3	1	2	2	7	5	3	1
PARAPARAP	sc	106	5	1	3	4	0	5	4	1
WINCHELSEA SOUTH	sc	111	3	1	3	3	4	5	3	1
DEANS MARSH	sc	265	4	1	2	2	6	5	2	2
SIMPSON	c	377	10	1	2	1	0	5	5	4

A complete list of the ranked assessment of all localities within the District is included as Appendix B.

Table 8 Corangamite Shire – bushfire risk profiles - relative and ranked risk assessed for localities

Locality	LG	No. of houses in locality	Ranked likelihood of fire reaching the town	Ranked average number of houses lost	Ranked total house loss / number of houses in town	Ranked likelihood of township experiencing substantial impact (>20% house loss)	Ranked Drop zone potential	Ranked access to large low fuel area (1 good, 3 poor, 5 none)	Ranked need for assistance Age/ Disability (total no. of people)	Ranked tourism factor
KENNEDYS CREEK	c	78	6	1	2	6	6	5	4	2
TIMBOON	c	825	8	2	2	3	4	5	7	4
PORT CAMPBELL	c	620	7	1	2	2	6	1	5	10
GELLIBRAND LOWER	c	83	4	1	2	4	6	5	4	4
JANCOURT	c	19	3	1	3	4	3	5	8	2
SCOTTS CREEK	c	168	7	1	2	3	3	5	5	2
CARPENDEIT	c	97	6	1	4	5	0	5	3	1
JANCOURT EAST	c&co	131	8	1	3	4	3	5	2	1
PRINCETOWN	c	260	7	1	2	3	0	3	4	7
WAARRE	c	13	4	1	3	4	4	5	1	1
GLENFYNE	c	85	5	1	2	3	4	5	3	1
SIMPSON	c	377	10	1	2	1	0	5	5	4
COBRICO	c	72	4	1	1	2	0	5	7	1
COWLEYS CREEK	c	26	4	1	2	2	3	5	3	1
COORIEMUNGLE	c	227	9	1	2	1	0	5	4	2
CAMPERDOWN	c	2149	2	1	1	0	0	5	9	3
CURDIEVALE	c	112	5	1	1	3	0	5	2	2
TERANG	c	1410	5	1	1	0	0	5	8	2
CURDIES RIVER	c	23	4	1	2	3	0	3	2	3
SKIPTON	c	459	2	1	1	1	0	5	6	3
NEWFIELD	c	52	5	1	2	3	0	3	2	2
PETERBOROUGH *	c	497	3	1	1	2	0	1	2	8
GLENORMISTON NORTH	c	68	2	1	1	2	0	5	4	2
TIMBOON WEST	c	34	4	1	1	3	0	5	2	1
BOORCAN	c	93	3	1	1	2	0	5	4	1
ELINGAMITE NORTH	c	58	5	1	1	2	0	5	3	1
LARRALEA	c	22	2	1	1	2	0	5	4	1
BRUCKNELL	c	74	5	1	1	0	3	5	3	1
DIXIE	c	75	3	1	1	1	0	5	5	1
ELINGAMITE	c	35	3	1	1	0	3	5	4	1
HEYTESBURY LOWER	c	34	3	1	1	3	0	5	1	1
NAROGHID	c	58	3	1	1	2	0	5	3	1
BOSTOCKS CREEK	c	62	2	1	1	2	0	5	3	1
BOOKAAR	c	121	3	1	1	1	0	5	4	1
GARVOC	c	251	3	1	1	2	0	5	2	1
NOORAT	c	196	3	1	1	0	0	5	5	2
DERRINALLUM	c	366	4	1	1	0	0	5	4	2
ECKLIN SOUTH	c	138	6	1	1	1	0	5	2	1
GNOTUK	c	55	2	1	1	1	0	5	4	1
KOLORA	c	139	2	1	1	2	0	5	2	1
COBDEN	c	1083	5	1	1	0	0	5	3	2
LISMORE	c	470	3	1	1	0	0	5	3	3
MANNERIM	c	77	1	1	1	0	0	5	6	1
NOORAT EAST	c	13	1	1	1	2	0	5	2	1
PAARATTE	c	20	5	1	2	1	0	5	1	1

* Peterborough as a locality contains only 60 properties within Corangamite Shire, the remainder are in Moyné Shire.

Table 9 Colac Otway Shire bushfire risk profiles - relative and ranked risk assessed for localities

Locality	LG	No. of houses in locality	Ranked likelihood of fire reaching the town	Ranked average number of houses lost	Ranked total house loss / number of houses in town	Ranked likelihood of township experiencing substantial impact (>20% house loss)	Ranked Drop zone potential	Ranked access to large low fuel area (1 good, 3 poor, 5 none)	Ranked need for assistance Age/ Disability (total no. of people)	Ranked tourism factor
WYE RIVER	co	396	6	4	9	6	7	3	3	10
LAVERS HILL	co	208	7	2	7	7	10	5	2	6
FERGUSON	co	32	7	1	7	7	8	5	5	6
FORREST	co	345	7	2	7	7	7	5	1	7
KENNETT RIVER	co	199	6	2	8	5	6	3	3	10
BARRAMUNGA	co	171	8	1	4	9	8	5	2	3
WEEAPROINAH	co	29	6	1	9	8	9	5	1	1
SEPARATION CREEK	co	147	4	2	8	5	7	3	2	9
BEECH FOREST	co	353	10	1	5	6	9	5	3	3
WYELANGTA	co	193	8	1	4	8	10	5	2	1
CHAPPLE VALE	co	124	7	1	4	7	10	5	4	1
GELLIBRAND	co	360	9	1	4	5	8	5	5	5
MOUNT SABINE	co	10	6	1	4	8	10	5	1	2
CARLISLE RIVER	co	396	10	1	4	8	7	5	1	2
TANYBRYN	co	73	6	1	5	8	7	5	1	2
GREY RIVER	co	14	3	1	7	4	7	3	3	9
KAWARREN	co	202	7	1	6	5	6	5	3	4
JOHANNA	co	153	5	1	5	4	6	3	4	8
SKENES CREEK NORTH	co	32	4	1	9	5	6	5	1	2
YUULONG	co	122	5	1	5	5	9	5	2	1
APOLLO BAY	co	2532	6	3	1	1	7	1	6	9
BARWON DOWNS	co	276	7	1	3	5	5	5	4	1
BARONGAROOK	co	260	5	1	4	4	5	5	5	1
GLENAIRE	co	151	5	1	2	3	7	5	5	3
WONGARRA	co	81	5	1	6	5	6	3	1	2
SKENES CREEK	co	406	3	2	3	2	6	3	4	6
IRREWILLIPE EAST	co	74	6	1	4	6	0	5	4	1
CAPE OTWAY	co	52	3	1	1	1	8	5	1	10
HORDERN VALE	co	62	2	1	2	2	9	5	2	4
IRREWILLIPE	co	146	8	1	4	4	0	5	5	1
JANCOURT EAST	c&co	131	8	1	3	4	3	5	2	1
MARENGO	co	379	3	1	1	1	5	1	4	9
MURROON	co	92	3	1	2	2	7	5	3	1
GERANGAMETE	co	122	6	1	3	4	0	5	2	1
PETTICOAT CREEK	co	10	2	1	3	2	6	3	1	4
WATTLE HILL	co	16	2	1	2	3	6	5	1	1
BARONGAROOK WEST	co	164	6	1	2	1	4	5	4	1
SUGARLOAF	co	17	2	1	3	2	6	5	1	1
SOUTH PURRUMBETE	co	83	4	1	1	2	0	5	4	4
BUNGADOR	co	53	5	1	3	3	0	5	2	1
YEODENE	co	92	4	1	3	3	0	5	2	1
COLAC EAST	co	248	1	1	1	0	0	5	10	2
BIRREGURRA	co	665	3	1	1	0	0	5	6	4
SWAN MARSH	co	129	5	1	2	1	0	5	3	2
YEO	co	80	2	1	1	0	4	5	4	1
EURACK	co	55	1	1	1	0	0	5	8	1
PIRRON YALLOCK	co	124	1	1	1	0	3	5	4	2
BEEAC	co	348	1	1	1	0	2	5	5	1

Table 10 Surf Coast Shire bushfire risk profiles - relative and ranked risk assessed for localities

Locality	LG	No. of houses in locality	Ranked likelihood of fire reaching the town	Ranked average number of houses lost	Ranked total house loss / number of houses in town	Ranked likelihood of township experiencing substantial impact (>20% house loss)	Ranked Drop zone potential	Ranked access to large low fuel area (1 good, 3 poor, 5 none)	Ranked need for assistance Age/ Disability (total no. of people)	Ranked tourism factor
LORNE	sc	2744	9	10	6	5	9	1	5	10
BENWERRIN	sc	57	8	1	8	10	8	5	2	5
AIREYS INLET	sc	1309	3	7	3	2	6	3	6	8
BELLS BEACH	sc	95	5	2	10	5	5	3	4	7
ANGLESEA	sc	3484	6	5	2	2	8	1	8	8
JAN JUC	sc	2124	5	8	3	2	4	1	3	7
BELLBRAE	sc	509	6	2	4	5	3	5	6	4
BIG HILL	sc	44	4	1	6	4	8	3	2	7
EASTERN VIEW	sc	81	5	1	5	4	7	3	1	8
FAIRHAVEN	sc	608	2	3	2	2	6	3	2	8
MOGGS CREEK	sc	203	2	2	3	2	6	3	3	8
PENNYROYAL	sc	99	4	1	4	3	5	5	3	5
GHERANG	sc	179	5	1	5	4	5	5	3	1
WENSLEYDALE	sc	97	5	1	4	3	7	5	3	2
BOONAH	sc	27	4	1	4	4	7	5	1	1
TORQUAY	sc	8395	4	2	1	0	2	1	10	7
PARAPARAP	sc	106	5	1	3	4	0	5	4	1
WINCHELSEA SOUTH	sc	111	3	1	3	3	4	5	3	1
DEANS MARSH	sc	265	4	1	2	2	6	5	2	2
BAMBRA	sc	126	3	1	2	2	4	5	3	2
BARRABOOL	sc	108	3	1	2	1	4	5	4	1
GNARWARRE	sc	131	2	1	1	0	4	5	4	1
WINCHELSEA	sc	1353	4	1	1	0	0	5	7	1
BUCKLEY	sc	125	3	1	1	1	0	5	4	1
WURDIBOLUC	sc	62	3	1	1	0	3	5	3	1
MORIAC	sc	317	2	1	1	0	0	5	6	1
MOUNT MORIAC	sc	154	2	1	1	1	0	5	4	1
FRESHWATER CREEK	sc	227	3	1	1	1	0	5	2	2
MOUNT DUNEED	sc	665	2	1	1	0	0	5	5	1
INVERLEIGH	sc	818	3	1	1	0	0	5	2	3
MODEWARRE	sc	159	3	1	1	0	0	5	4	1
BREAMLEA	sc&g	134	1	1	1	0	0	3	1	6
OMBERSLEY	sc	79	3	1	1	0	0	5	3	1
CONNEWARRE	sc	543	1	1	1	0	0	5	3	1

Future refinement

This work to better understand and define bushfire risk will be continually refined, primarily through the Barwon Otway Risk Landscape team working in partnership with research institutions, Councils, CFA and others. Where feasible and beneficial, elements of this risk profile will be made spatial and this will add value to operations and community engagement activities.

One example of this is the risk analysis work to stratify risk zones in townships based on house loss probabilities generated from Phoenix Rapidfire and other modelling tools, along with relevant current research. Importantly, this will provide the basis for a whole new way of approaching risk management in towns – it will identify the safer and less safe areas within a town, driving a range of decisions and risk treatments for agencies and townspeople. Risk stratification is a key feature of future [township bushfire safety planning](#).

This is a feature of This work will also support the VFRR-B (Victorian Fire Risk Register – Bushfire) and help improve the information, both in terms of understanding the risk and development of mitigation strategies for each of the listed assets.

Victorian Fire Risk Register - Bushfire

The Victorian Fire Risk Register – Bushfire, is a database of important assets requiring risk reduction action, compiled by Municipal Fire Management Planning Committees and managed by the CFA. The VFRR – B includes an extensive list of assets, their risk rating and a list of mitigation works. .

This list is largely based on a group assessment of the asset and gives a good basis on which to make decisions. As future work into risk is developed and strategic directions from this and other plans provides a finer understanding of risk at specific sites, the VFRR should be reviewed to ensure the more detailed risk understanding is recorded and to maintain consistency.

This is particularly important in determining risk mitigation strategies. It is envisioned that as more detailed assessment of settlements and townships occurs that a more detailed assessment of VFRR assets will follow, and this information will be used to update the database be available information during suppression activities to aid planners and operations officers.

An example of a more detailed asset listing this is provided in the case study on Wannon Water's pumping station which illustrates the need for finer detailed analysis for some assets and for more specific mitigation measures.

Structural and chemical fire risk assessment

This Plan recognises that at the time of writing, a risk assessment for structural fire and hazardous material risk assessment in the built environment is being developed by the MFB, as project leaders, and consequently this Plan is predominately focused on bushfire risk.

The fire and hazardous material Project will include key asset identification, and other available site and incident statistical information. Once this guidance is finalised, this Plan will be updated to accommodate it. The fire and hazardous material risk assessment will give consideration to likelihood factors, such as structural and chemical fire history (number and type) across the municipalities and across the relevant industry, and the potential consequences of those occurrences (death, injury, economic and property loss).

Consideration will be given to high risk premises and assets, for example (for life risk) nursing homes, aged care facilities and institutional care facilities, (and for property loss risk) commercial and industrial premises. In terms of chemical fires, consideration will be given to high risk premises such as chemical manufacturers, or high chemical use industries, chemical transport industries, fuel suppliers and any other industry identified following a comprehensive risk assessment process.

This risk assessment will ultimately form part of the township fire safety/resilience plans; a key deliverable of this Strategic Fire Plan.

Critical assets within each Shire are listed in the Victorian Fire Risk Register – Bushfire.

Reducing Bushfire Risk

The strategy

The strategy to reduce bushfire risk in the Otway District has a number of key elements:

- A robust and detailed understanding of the risk and its nature as the basis for all planning and action.
- Understanding what is important to protect, and this includes what communities and individuals value along with what critical services and assets need to be protected for community safety and resilience – for example, telecommunications, electricity, roads, and business districts.
- Fire and land management agencies working in effective partnership and with communities, including embedding avenues for communities to shape decisions on risk appetite and mitigation.
- Growing our knowledge of fire risk and risk reduction effectiveness and sharing information across agencies, research institutions and communities.
- Targeting of resources and efforts to activities and actions that can deliver the most effective risk reduction outcomes, and for agencies, this is regardless of historical delineations.
- Increasing the capacity of agencies and communities to prepare, respond and recover.
- Building community resilience and supporting the transition to fire adapted townships.

Importantly, this work will be based on and articulate a better understanding the nature and detail of bushfire risk to life and community values - across the landscape, and specifically within the high risk towns and settlements, as this is the foundation for any successful risk reduction work.

How we will collectively go about achieving this strategy is described in the section on [strategic directions](#).

Three scales of planning and action

This plan recognises that to reduce the overall bushfire risk to things that we value, it is important to address risk at all three scales of:

- landscape
- township or settlement, and
- property or household

Having a gap at any one level creates a weak link in the chain. For example, the best planned burn program possible cannot prevent embers from a fire landing on a flammable garden near a house and burning that house down.

This Otway District Strategic Fire Management Plan is a plan to tackle the *residual risk* – that remaining after planned burning programs are delivered. This residual risk is primarily associated with townships or settlements and at the property level.

Reducing residual risk is the focus of this document and guides its strategic directions and actions. It is important to note however, that bushfire risk in this District can never be fully removed. The actions and strategic directions of this plan, seek to predominantly tackle risk at the township and property, in the context of landscape scale risk reduction

Landscape scale risk reduction

DELWP's Barwon Otway Strategic Bushfire Management Plan (Department of Environment and Primary Industries 2014) is a plan to address risk at the landscape scale, predominantly through selecting a planned burning program that maximises the reduction of risk while minimising impacts on other values. Other actions to reduce risk at the landscape scale include fire behaviour research and modelling, risk analysis, bushfire suppression and preparedness, and patrols. CFA and Parks Victoria are also involved in landscape scale risk reduction through many of these activities.

DELWP have assessed that landscape scale actions undertaken in the Otway District have reduced the overall bushfire risk from a notional 100% (no risk treatments) to approximately 65%. Further risk reduction – tackling the residual risk - can be achieved at the township and property scales.

Township or settlement scale risk reduction

In developing this Strategic Plan an exploration was undertaken into how fire management planning could be improved to deliver better community safety outcomes. This exploration highlighted opportunities for improvement in risk analysis and risk mitigation at the township or settlement scale. It further identified that a community based planning approach for high risk townships could increase community input, ownership and action. While this strategic plan is required to deliver legislative requirements, and give a mandate for higher level directions and actions, it is township scale planning that could deliver real benefits in community safety and resilience.

Activities to reduce risk at the township or settlement scale include:

- building a detailed understanding of risk within towns and at the wildfire interface
- fuel reduction on private and public land and at the wildfire interface
- bushfire and township fire suppression
- access, egress and evacuation
- public bushfire shelter options
- community engagement and education
- building community resilience and township fire adaptation
- asset protection
- research into bushfire and township/community interactions
- township level bushfire safety planning

Groups and organisations primarily involved in tackling risk at this scale include: Councils, CFA, Victoria, EMV, Police, VicRoads and local communities – groups and individuals. DELWP and Parks Victoria are involved at the wildfire interface.

The development of community based township/settlement plans is a key deliverable of this strategic plan.

Property or household scale risk reduction

Management of individual properties and assets is a critical part of reducing fire risk. Landscape and township scale risk works cannot be effective unless they are joined by that undertaken at the property level.

Activities to reduce risk at the property scale include:

- having a solid understanding bushfire risk associated with the property
- design and management of houses to avoid ember incursion and flame contact
- design and management of gardens
- having an effective and practiced household bushfire survival plan.

Identifying what's important to protect

Key to this plan is empowering communities to help identify what is important to protect and how these values or assets should be protected. To achieve this, the plan provides objectives and actions which develop and embed this approach, and it will be a feature of township scale planning.

The plan also needs to protect assets, services and values which are important for community functioning, including at a broader scale, and some of these have national or international value – all of which must be considered.

The VFRR-B asset list is the current home for recording assets requiring protection and these assets are grouped in themes of: social, built, economic, natural and cultural.

Projections for future fire risk

Climate influences

Climate change is forecast to increase the number of extreme bushfire weather events and to extend the bushfire season - both starting earlier and continuing later into the season (Clarke 2011). This effect is expected to be strongest in the forested areas of the southern states, particularly near the coast (Bradstock 2014). The projections for risk in the grassland systems across this district are likely to be less well understood as a major driving factor will be fuel biomass and its association with rainfall. Whilst predictions for increasing days of FFDI above 40 for 2100 are forecast, declining rainfall predictions may counteract this to a certain extent (Clarke 2011).

Demographic influences

Whilst it is predicted the climate factors will increase bushfire risk, the changes in communities are likely to present the greatest change to the risk profile for many of communities across the planning district. The changes in the climate risk profile are relatively slow in comparison to the changes associated with a changing community profile. This profile has changed quickly over the last 20 years and this trend is predicted to continue. It will need to be a focus of mitigation going forward.

Three major areas of change that are of particular importance are: 1) the population uniformly across the planning district are getting older, with the percentage and amount of people moving into the over 65 age bracket increasing. This will mean more people will become more vulnerable in the face of a fire threat, as the statistics have shown in the Black Saturday studies. 2) A number of communities in the district have experienced general population growth and a percentage of these have been into areas of high fire risk. 3) The projected and the current increasing use of the area by visitors may also have a significant bearing, as generally these groups have limited knowledge and understanding of bushfire and by virtue of this will also be vulnerable in the face of a major incident.

Preparedness, response and recovery influences

It can be assumed that our future response systems and hardware will continue to improve as has been seen in the past. However as our climate and population change it will be increasingly important to continue to improve both preparedness and recovery.

If we do improve our capacity in preparedness, response and recovery and continue to build resilience in our communities, it is possible that we can not only maintain current risk levels in the face of increasing environmental and social challenges, but that we can in fact reduce it.

Case Study - Wannon Water's enhanced protection of a critical asset

This case study examines how Wannon Water took a deeper look at what's needed to ensure a critical piece of infrastructure – the Gellibrand main pumping station - could continue to provide essential water services to communities if it is impacted by fire.

The Gellibrand Pumping Station provides the primary water supply to the extensive North Otway urban water system. Water pumped from the Gellibrand River via the pump station is transferred to more than 50,000 people, including the major regional centre of Warrnambool and several significant exporting dairy manufacturers and food processors. If the facility were to be taken off-line due to bushfire impact, the water stored in the system could only maintain this important supply for less than three weeks.

The Gellibrand pumping station is a critical asset and is recognised as being of State and National significance in the Victorian Fire Risk Register.

This case study looks at how Wannon Water systematically worked through a detailed understanding of the risk to their asset; including the potential likelihood and consequences of bushfire impact, and how the risk could be effectively mitigated.

Identifying the risk and potential impact

Wannon Water initially identified the bushfire risk to the pumping station through the Victoria Fire Risk Register process, and determined that the nature of the risk and the potential consequences required a more detailed examination. Wannon water set about fully understanding how this asset was placed in the bushfire risk landscape and how susceptible to fire it may be.

A risk assessment to test mitigation options was undertaken by DELWP using Phoenix Rapidfire modelling. This was considered along with an earlier report by Terramatrix and evidence from the Black Saturday fires in 2009, where similar facilities were impacted. Together this information built a picture of the vulnerability of the pumping station, should it face a similar bushfire situation, and the most effective mitigations options.



Figure 32 and Figure 33 Damage to a water pumping plant which occurred during the 2009 Black Saturday fires

Identifying the potential consequences

While understanding the risk posed from bushfire was the first part of the analysis, developing a detailed understanding of the potential consequence should the asset be impacted took this risk analysis to a whole new level. Factors such as the demographic and economic reliance on the facility and how the asset contributes to community function were examined.

With the importance of the asset fully understood, attention turned to an assessment of options to have the station operable following bushfire impact. Investigations included opportunities for temporary replacement, and timeframes for replacement or repair at varying levels of damage.

Developing effective tailor-made solutions

Wannon Water, armed with a comprehensive picture of the risk and consequence environment, was then able to identify and develop effective, tailor-made risk mitigation strategies and measures to provide water security for the communities they serve.

These included:

- Ember proofing vents and windows, and other bushfire attack level improvements,
- Cross tenure fuel management, including planned burning.
- Onsite fuel Management
- Wannon Water has commissioned a replica electric switchboard; multiple switchboards built within a shipping container. The shipping container can be moved and then used at a number of high risk sites.



Figure 34 and Figure 35

Examples of Gellibrand pumping station risk mitigation works:

- Ember proofing vents and windows

Learnings

This fire plan seeks to enhance the protection of assets which are valued by communities along with those that provide important community services. This work led by Wannon Water illustrates a process that could be replicated - at varying levels of detail - for many of the high value assets within the District. It would provide a much better understanding of the risk to important assets and of the potential consequences should fire impact. This would provide a sound basis from which to develop more effective, bespoke risk reduction measures.

Understanding the key limiting factors and the exposure to the ongoing use of the facility

This type of detailed analysis could be fed back into the Victorian Fire Risk Register where it is readily available to Incident Controllers for decision-making in the management of a wildfire incident, and where it can be used to inform agency fire risk mitigation works programs.

Fire management strategic directions

The strategic directions of this plan explain how fire management agencies, working together and with communities, intend to achieve the plan [aim and objectives](#). Implementation of the strategic directions in as well as the actions of the associated Strategic Action Plan will constitute delivery of this plan in accordance with its [purpose](#).

Plan Purpose: enhance the integration, coordination and effectiveness of fire risk reduction and community fire safety activities across the three shires and across all fire management agencies, groups and communities.

Plan Aim: reduce the risk to life and community values from the threat of fire, and facilitate the development of resilient and fire adapted communities which have an increased capacity to recover from fire.

Objectives and strategic directions of this plan are listed under four themes, however many relate to multiple themes. The themes are:

- safer communities,
- enhanced protection of assets,
- better sharing of knowledge, responsibilities, and resources
- impacted communities recover and thrive.

It is acknowledged that in the Otway District, we are starting from a well-developed base; agencies and communities have been working together for some time. This plan is about continuing to support and enhance existing work as well as identifying new objectives and directions.

Plan delivery

This plan outlines the purpose, aim, objectives and strategic directions. The recommended detailed actions associated with the strategic directions are listed in a separate document called the Work Programming Guide. This guide details steps that should be considered in the work plan phase. The work plan development phase will be a separate function for each of the three MFMPCs. A yearly work plan will be formulated by each committee, who will determine the priorities for the financial year based on the priorities and actions in the Work Programming Guide, available resources of the partner agencies, policy direction and community need. It is critical that the work program should also be informed by risk assessments in this document and those held by the agencies. The work programming guide should also be updated on an as needs basis, but should be review annually to maintain currency.

Strategic directions

The Strategic Actions headline the full list of actions detailed in the Work Programing Guide

Table 11 Strategic directions

The strategic directions

1. **Develop and implement community based Township/settlement bushfire safety plans for targeted high risk towns or settlements**

A robust risk analysis will identify higher and lower risk areas within towns and settlements and is the critical foundation for all other planning. The principles of community based planning will be applied, and planners will work with communities to identify what is important to protect and to understand their risk appetite and develop a tailor made approach for each area. Township plans will embed increased protection for vulnerable and susceptible people. Development of Township or Settlement Bushfire Safety plans will be ongoing and extend over many years, and priority will be given to higher risk towns/settlements. These plans will clearly link to local CFA response plans and may also consider other hazards if relevant. Township transition plans may be incorporated – these describe how towns move from being vulnerable to fire, to being more resilient and fire adapted, and the steps required to make that shift.

2. **Enhance the provision and management of public bushfire shelters**

Township risk assessments combined with community based planning principles will reveal and refine the bushfire shelter needs for each town and settlement. A bushfire shelter plan will be developed to prioritise shelter needs across the landscape and within each shire. It will include a comprehensive assessment of formal and informal public shelter options, identify significant gaps and issues, and determine actions to reduce risk. Local CFA brigades and communities will be involved in this work, some of which will be undertaken as part of township/settlement bushfire safety planning.

The establishment, provision and annual assessment of Neighbourhood Safer Places-Bushfire Places of Last Resort (NSP-BPLR) is prescribed in the NSP-BPLR plans of each Council, including locations. The bushfire shelter plan will inform these plans.

3. **Develop and implement a community engagement and education plan**

This plan will integrate and coordinate the planning, design and delivery of engagement activities between all agencies (including local governments, CFA, Vic Pol, EMV, PV and DELWP) and across the footprint of the three shires. The plan will be locally relevant, based on a sound understanding of fire risks for each town. The package of engagement activities identified through this plan will be most relevant to local communities – including susceptible and vulnerable people, and holistically deliver community needs in a logical sequence. Agencies will together and with communities and local brigades to deliver the plan.

4. **Tourist, visitor and other vulnerable groups bushfire risk reduction**

Continue to identify and deliver high priority actions which reduce bushfire risk for tourists, visitors and other vulnerable or susceptible groups. Particular attention will be given to tourist events and attractions, and holiday accommodation.

The strategic directions

5. Continue to investigate and contribute to the development of evacuation planning for the Great Ocean Road Region

This direction supports work that has recently commenced through a multiagency approach to develop robust evacuation planning for the Great Ocean Road region through provision of specialist and local knowledge and to ensure linkages with other relevant work are maintained. The development of modelling is critical to this work and will be supported.

6. Continue to identify and review priorities for the protection of assets and values, and determine and review treatments

This work relies on developing a more in-depth understanding of risk and risk mitigation options for critical assets, including the application of appropriate modelling. It involves working with communities to identify assets and values which are important to protect and exploring treatment options. Importantly, asset protection work must ensure high value natural resources are protected and that ecosystem resilience and functioning is not compromised.

Planning for asset protection also includes reviewing and updating VFRR-B data.

7. Investigate the value of bringing together existing operational response planning to improve integration between agencies and across the plan landscape

Agencies will look at ways of working in collaboration and to realise opportunities to improve the current fire response arrangements. This may include coordination of patrol activities, of pre-positioning fire response resources. In addition, avenues will be provided to involve community leaders in agencies discussions and decision-making on response matters. The wide range of fire response infrastructure will be maintained and improved as required.

8. Collate, prepare and review fuel management plans and programs to ensure landscape fuel management is integrated with township and wildfire interface fuel management, and takes a tenure-complementary approach

A number of agencies, communities and landholders are involved in fuel management activities across the landscape. An opportunity exists to better understand and align this work, so that risk work is targeted and integrated, and risk reduction is maximised. This may result in a fuel management plan being developed for each shire footprint to address fuel management not already addressed through DELWP's Fire Operations Plans.

9. Construction, renewal and refurbishment of public facilities – explore and implement avenues for public buildings to model best practice in bushfire safety and fire adaptation

Opportunities exist for the construction, renewal or refurbishment of public buildings to meet best practice protocols for bushfire safety, including vegetation management, building location, design and materials, and building use. This work will examine those opportunities and make recommendations for improvements for bushfire safety.

The strategic directions

10. **Statutory planning and Council strategic planning - align council planning objectives and directions with those required to meet bushfire safety requirements**

Councils undertake a number of statutory and strategic planning functions, and opportunities exist for these functions to achieve improved outcomes for bushfire risk reduction, for example, Township Character Plans. There are also opportunities for planning schemes to deliver improved bushfire safety outcomes, and aspects such as settlement boundaries, housing density, vegetation requirements, and asset protection zones could be explored. Planning overlays may also need to be adjusted following fire in the landscape – for example, to address landslip matters.

11. **Maximise opportunities to learn from bushfire events**

Emergency events of a significant scale are relatively rare, yet they are what we all cooperatively plan and prepare for. The ability to maximise learnings from events, such as a bushfire, is critical to improving our collective ability to reduce the risk to life and community values, and to build community resilience and fire adaptability. Often, the experience of a bushfire provides the drive and capacity for better outcomes.

Achieving this direction requires an expansion of opportunities for cross agency collaboration, before, during and after a bushfire. We need to ensure that our collective bushfire science knowledge is advanced through learnings captured from each event so we can increase the capacity and capability of agencies, communities and individuals. Importantly we must ensure the learnings from bushfire events are broadly shared and used to update and inform plans and responses, and to improve engagement products and approaches.

12. **Continue to identify, develop and apply best practice approaches to understand and reduce fire risk**

Developing and applying best practice approaches relies on the development and maintenance of effective partnerships between agencies and councils and with research institutions. Such an approach facilitates opportunities for research to inform and improve practical fire management and vice versa. This direction supports the growth of partnerships.

A key aspect of this work is to continue to develop, refine and apply bushfire modelling to improve accuracy of assessment of bushfire risk. For example improved modelling can help us better understand how grassland risk can be more accurately considered as part of the bushfire risk profile. This direction supports the development and application of new modelling approaches, and the interpretation and sharing of outcomes.

13. **Enhance the sharing of resources across agencies; before, during and after a bushfire event**

Improve information flow across agencies and between agencies and communities before, during and after an event or threat. Explore opportunities to increase capacity and expertise within and between agencies, including the sharing of information, education and training.

The strategic directions

14. Identify opportunities to more effectively target fire management resources to the highest priority activities which yield the best outcomes

Taking a risk-based approach, this direction aims to focus the allocation of resources to interventions (or works) which can most effectively reduce the highest risks. For maximum effectiveness, this needs to occur both within and across agencies taking a tenure-blind and agency-blind approach. This work will also explore and apply avenues to encourage and assist communities and individuals to target their efforts to best effect.

This direction also explores opportunities to share works across private and public lands – for example, to encourage agencies and communities to work together to establish asset protection zones across public and private land on wildfire interfaces, where deemed effective.

15. Responsibilities for each agency will be clearly articulated and reported against.

To deliver this strategic direction, the Work Programming Guide will be refined – this is a separate document which provides further guidance, prioritised actions and accountabilities. Each MFMP will develop an annual work plan, guided by the Work Programming Guide, to deliver the Strategic Directions.

Each MFMP will also prepare a [monitoring, evaluating and reporting](#) plan (MERI plan) within 6 months of adoption of this plan. The three MERI plans will measure and report on the effectiveness of the delivery of this Strategic Plan.

16. Improve recovery processes

Capture and share the learnings from bushfire events, collaborate with communities, understand their experiences and respond appropriately. Use learnings from each fire event to improve relevant plans and process for use for future events.

Monitoring, evaluation and reporting

Plan outcomes and indicators of success

Once this plan and its subsidiary plans are implemented, the following outcomes are expected:

- Reduction in residual bushfire risk across the District, and particularly that for high risk areas and critical assets (residual risk is that which remains after landscape scale work – for example planned burning on public land - is undertaken).
- Increased and enhanced partnerships between agencies, research institutions, councils and communities driving more integrated and effective fire management.
- Improved capacity (skills, knowledge, capabilities) of agencies and communities to understand and reduce bushfire risk.
- More effectively targeted resources across and between agencies, councils and communities towards fire management interventions which have the greatest likelihood of reducing the highest risks (which are most likely to be successful in reducing residual risk).
- Enhanced community resilience - communities are better prepared to respond and recover from bushfire
- High risk towns and communities are more fire adapted

Monitoring, evaluation and reporting (MER) are important elements of this Plan and its implementation. Development of an MERI (Monitoring, evaluation, reporting and improvement) plan is a key action of this plan.

An effective MER framework that is an integral part of the Plan will:

- ensure programs and investment achieve the plan aim and objectives
- evaluate the effectiveness of plan objectives along with the directions and actions undertaken so they can be improved in future reviews, as required.

Monitoring and evaluating the Plan

Each Municipal Fire Management Planning Committees will develop a MER plan within six months of the plan being adopted by the three Councils.

The MER plan will be structured around the plan aim and objectives and the themes. The MER plan will include:

- further refinement and development of the Plan indicators of success and clarity on how these will be measured and monitored,
- evaluation questions which relate to the impact, appropriateness, effectiveness, and legacy of the Plan,
- documentation of its assumptions and clarity on the relationship between plan objectives and directions/actions (program logic).

The evaluation component of the MER plan will pose questions such as:

- to what extent were the plan objectives progressed,
- to what extent were strategic directions of this plan and actions of MFMPCC plans delivered,
- how effective were the implemented directions and actions,
- what reduction in residual risk occurred as result of plan implementation, and
- what increase in community resilience and township fire adaptation occurred as a result of plan implementation?

The monitoring and measurement components of the plan will provide opportunities to report the progress being made. Some of the monitoring will be relatively straight forward, for example, reporting on delivery of plan actions. Other measurements of change will be more challenging.

To enable effective monitoring and evaluation, implementation of the MER plan will require its own set of actions. Coordinated by the Otway Bushfire Planning Collaboration, the MFMPCCs of each shire will collaborate to:

- define key monitoring needs to evaluate the effectiveness of fire risk management activities and the building of resilient and fire adapted communities,
- collect, collate and share data to report on the effectiveness of the Plan.

Reporting

The MER plan will report on changes to residual bushfire risk along with changes to community resilience and township fire adaptability. Reporting will take the form of:

- annual progress reports,
- periodic review to review or adjust directions, actions, accountabilities and priorities, as required,
- a full evaluation of progress and achievements by December 2021.

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Appendices

Appendix A Definitions and abbreviations used in this plan

Abbreviations

CFA	Country Fire Authority
COS	Colac Otway Shire
CS	Corangamite Shire
DEDJTR	Department of Economic Development, Jobs, Transport and Resources
DELWP	Department of Environment, Land Water and Planning
DHHS	Department of Health and Human Services
FDR	Fire danger rating
FFDI	Forest fire danger index
FLIR	Forward looking infrared
MEMP	Municipal Emergency Management Plan
MEMPC	Municipal Emergency Management Planning Committee
MERI	Monitoring, evaluation, reporting and improvement
MFMP	Municipal Fire Management Plan
MFMPCC	Municipal Fire Management Planning Committee
MFPP	Municipal Fire Prevention Plan
NSP	Neighbourhood Safer Place – Bushfire Place of Last Resort
PPRR	Prevention, Preparedness, Response and Recovery
PRPR	Primary Responsible Person Representative
RSFMP	Regional Strategic Fire Management Plan
SCS	Surf Coast Shire
RSFMPCC	Regional Strategic Fire Management Planning Committee
SES	State Emergency Services
VBRC	Victoria Bushfire Royal Commission
VFRR	Victoria Fire Risk Register
WMO	Wildfire Management Overlay

Definitions

Bushfire	Unplanned fire occurring in grassland, heathland, woodland or forest
Drop Zone	An area that has the potential to experience extensive ember attack during a bushfire, due to landscape factors.
Fire Danger Rating	The Fire Danger Rating predicts how dangerous a bushfire would be if one occurred. It is strongly influenced by the Forest Fire Danger Index and the Grassland Fire Danger Index
Forest Fire Danger Index	A numeric site measure of predicted or actual environmental factors describing the degree of danger of fire in Australian forests.
Landscape	In the context of this plan it refers to the land and all it contains within the Otway Planning District, including the shires of Corangamite, Surf Coast and Colac-Otway
Residual risk	That bushfire risk remaining after broad scale planned burning is completed

Appendix B List of recorded significant fires in the District since 1851

The fires that have been included in the list below because they have been of a large size or have caused notable damage or human life loss, and had detailed information recorded as part of a historical document. Some smaller more recent fires have been included where there was potential for that fire to have caused significant damage had conditions been different; this seeks to highlight the ongoing risk.

Table 12 List of significant recorded fires in the Otway District since 1851

Date	Description of significant fires	Surf Coast	Colac - Otway	Corang -amite
1851 February 6	Black Thursday. The "Fires covered a quarter of what is now Victoria" including "The Pyrenees, the Loddon country, the Wimmera, Colac, the "far west", the Portland country, Mount Gambier, the country between Geelong and Ballarat. Not one house in ten survived in the Barrabool Hills"	✓	✓	
1881 March	Bushfires 'raged' between Colac and Gerangamete and near Birregurra and the Otway Ranges.	✓	✓	
1886 January 4-5	Otway & Heytesbury regions, including Colac		✓	✓
1889 January	Bushfires around Lorne for several days. The coach from Birregurra to Lorne 'passed through fires nearly all the way from Deans Marsh to Erskine House'.	✓		
1890 January	forest between Deans Marsh and Lorne 'ablaze for two to three days'. The fire was reported as about half a mile in width.	✓		
1891 February 14	Black Saturday' fires 'raged all over the colony', including Mount Duneed and Coast districts, and Birregurra and Winchelsea districts. The fires skirted the coast line between Jan Juc and Lorne. Jan Juc was just saved by a wind change.	✓		
1893 February 28	Bushfires 'raged with great fierceness' between Winchelsea and the Coast. Fire approached the Anglesea River and encroached on township allotments on the west side of the river	✓		
1898 February	Bushfires from Cape Otway forest extended to Anglesea, which was at one stage 'threatened with complete extinction' by the fires. The Anglesea Hotel was 'swept out of existence by the fiery fiend'. The same fire got within 'dangerous proximity to Torquay'. Lorne was also threatened.	✓	✓	
1901 February	Extensive fires reported at Birregurra and in the Geelong region. Several people lost their lives in the Birregurra fire. Jan Juc was also threatened by fire.	✓	✓	
1905 January	Extensive fires occurred throughout the Geelong area and between Jan Juc and Anglesea. Record temperatures of 107.8 – 110.5 in the shade.	✓	✓	
1908 January	Bushfires across the State, including around Jan Juc, Modewarre and Anglesea. The fire caused 'wholesale destruction' at Anglesea, with seven houses destroyed.	✓		
1912 January	Extensive fire at Aireys Inlet. Two cottages destroyed.	✓		
1914	Otway Ranges' Beech Forest and 'forest south of Colac'		✓	
1919 1 February to 1 March	"Three people died when bushfires consumed Otway forests. Bushfires were widespread for six weeks and many with 100 homesteads burnt and about 500 people left homeless." Bushfire at Anglesea, with five houses destroyed. The Lorne saw mill was destroyed.		✓	
1919 24 Nov	120,000 ha Otway Ranges and Grampians		✓	
1920	Bushfires around Anglesea (for several days), between Mount Moriac and Aireys Inlet, between Lorne and Anglesea, at Wensleydale and between Jan Juc and		✓	

Date	Description of significant fires	Surf Coast	Colac - Otway	Corang -amite
February	Anglesea.			
1926 February	Bushfires at Lorne, Eastern View, Aireys Inlet, near Jan Juc, around Wensleydale, Sections of the Great Ocean Road and in other areas throughout the State. At least 29 people died across Victoria.	✓		
1926 March	Bushfire between the Otway Coal Mine and Bamba. Fires in the Otway Ranges endangered pine plantations at Anglesea.	✓		
1931 February	Bushfire commenced near the pine plantation at Anglesea and swept through the bush between Anglesea, Bellbrae and Torquay. Extensive fire between Wensleydale and Bamba.	✓		
1932 January-February	Widespread fires. Reports of fires include: Beech Forest and Cape Otway near Lorne, Aireys Inlet & Benwerrin.	✓	✓	
1936 April	Fires in Geelong and neighbouring districts. A fire with a seven mile fire front threatened the township of Anglesea, with neighbouring pine plantations damaged. Also fires in the Otways and other parts of the State.	✓	✓	
1937 November	Bushfire threatened settlement at Eastern View and swept towards Fairhaven.	✓	✓	
1938 December	Fire burning for several days around Eastern View threatened several cottages and the golf course.	✓		
1938 February	Bushfire along the west side of Anglesea river threatened the township of Anglesea. Also fires towards Aireys Inlet, at Big Hill, Benwerrin and Pennyroyal.	✓	✓	
1939 13 January	Towards the end of a long drought, numerous fires burning separately in various parts of the state joined and peaked in severity on - "Black Friday". The fires affected almost every section of Victoria, including the Otways. "The findings of the Royal Commission that was held following the fires were highly significant in increasing fire awareness and prevention throughout Australia." Lorne was threatened and sixteen houses were destroyed. Hundreds of people sought the safety of the beach. Also fires between Aireys Inlet and Anglesea and extensive grass fire at Moggs Creek.	✓	✓	✓
1940 March	Fires in southern parts of the State, including Torquay where one life was lost, 86 houses and various buildings destroyed and heavy loss of stock and grass.	✓	✓	✓
1944 14 January – 14 February	Major fires across Western District destroyed more than 500 houses with 15-20 fatalities. Geelong was ringed by fires in Moriac, Modewarre, Bellbrae and Mount Duneed to the edge of Torquay. The townships of Derrinallum, Berrybank, Cressy as well as the areas of Vite Vite, Mingay and Duverney were severely affected by a large fire as it burnt to the south. Grass fires near Hamilton, Dunkeld, Skipton and Lake Bolac burned about 440,000 hectares in eight hours	✓	✓	✓
1947 January	Wide spread fires at Anglesea. Fire leapt the Anglesea River and threatened to destroy the township. The fire raced through the centre of town and destroyed two homes, several buildings and a number of boats. Anglesea Fire Brigade building was set on fire three times. The main street was 'strewn with fallen power and telephone lines'.	✓		
1957 5 September	Fires at Anglesea and Aireys Inlet with 2,428 hectares burnt.	✓		
1961	500 acres and 300 sheep were lost at Modewarre in a deliberately lit fire.	✓		
1962 16 January	Otways (2,024 ha)		✓	
1965 21 February	Otways (12,000 ha).		✓	

Date	Description of significant fires	Surf Coast	Colac - Otway	Corang - amite
1965 March	Over 8,000 acres burnt and one house and several buildings destroyed at Big Hill – Eastern View.	✓		
1965	A large fire in the stony rises area from Convict Track on the Emu Creek to Crawford's Road at the Lismore - Skipton Road burnt about 500 Ha.			✓
1966 November	Otways - Modewarre, Wurdale, Anglesea (15,000 ha).	✓	✓	
1966 March	Bushfire destroyed 14 houses at Anglesea, with property damage of \$100,000.	✓	✓	
1968 11 January	Colac Gellibrand road, 10 miles south of Colac, Barangarook threatened (810 ha) (11 Jan) also a fire on north side of Lorne (1215 ha) (6 Feb).		✓	
6 February	large fire in the Lorne area occupied 27 brigades for four days. Over 5,000 acres burnt and several buildings destroyed.	✓		
1969 January	Fires burnt over 2,000 hectares at both Bellbrae and Gnarwarre. Multiple fires in southern and central Victoria.	✓		
1976	A fire of about 7000 ha burnt on the east side and up to Lake Corangamite, and is believed to have caused damage at the Stoneyford Wreckers			✓
1977 12 February	<p>“Widespread fires occurred across the Western District of Victoria, mostly in grasslands This included the Cressy (Wallinduc or Werneth) fire: 42,000 ha.in which 3 people lost their lives. In Cressy 10 houses were destroyed along with 2 halls, a garage and fuel depot. The State school and tennis centre at Werneth were destroyed and a large number of outbuildings.</p> <p>Large fire in the Lorne area occupied 27 brigades for four days. Over 5,000 acres burnt and several buildings destroyed.</p> <p>Pura Pura – Derrinallum area, fire burned 18700Ha of pasture, 42,200 sheep, 1291 cattle, 13 houses, 159 other buildings and 910 km of fencing. Mingay - Lismore fire burned 1800 Ha of pasture, 2000 sheep, 7 buildings and 68 km of fencing. The town of Lismore was saved by a last minute wind change. All of these fires originated from power lines.</p>	✓	✓	✓
1980 March	Fire within two kilometres of Anglesea township, with about 400 hectares burnt. Source of fire was smouldering peat moss from fire several weeks earlier.	✓		
1981 October	Fairhaven evacuated due to fire. Three houses were lost and others damaged. The fire was started by a controlled burn.	✓		
1982 January	There was a fire at the Anglesea camping ground. Twenty caravans, 13 tents, two prefabs and two annexes were destroyed.	✓		
1983 16 February	“Ash Wednesday”. Over 100 fires in Victoria, with the Otway ranges severely affected. The Otway fire originated at Deans Marsh (in what is now Surf Coast Shire) and resulted in 3 deaths and around 41000 ha burnt (mainly forested country) and 729 houses lost	✓		✓
1994 November	A fuel reduction burn adjacent to Moggs escaped which resulted in 200 hectares of bush being burned, with one house destroyed and 25 damaged.	✓		
1998 March	Yeodene peat fire – repeated outbreaks over a number of years were contained close to the site, however in 1998 an outbreak escaped the site and burnt over 300 hectares, being stopped on the Barwon River flats.			✓
2001 February 2	“Wingeel Plains Fires” (2000 ha).		✓	
2002 September	Chapple Vale (786 ha).		✓	

Date	Description of significant fires	Surf Coast	Colac - Otway	Corang -amite
2005 11 January	The "Carranballac" fire destroyed large areas of crops, some stock, hay and pasture but there was no loss of human life or buildings.			✓
2006	Stony Rises fire destroyed over 3,000 ha of pasture and hay reserves during a drought season which impacted heavily on land owners' recovery from the fire (Moores road fire)			✓
2008 December	A tanker overturned and caught on fire on the Great Ocean Road, Big Hill killing the driver causing road closure and major traffic diversions.	✓		
2009 9 February	The 2009 Black Saturday Weerite-Pomborneit fire destroyed 1500 ha of pasture, crops, fodder reserves and some infrastructure. The Geelong-Warrnambool rail line was damaged and power supplies to local residents cut.			✓
2014 February	Schoulers road fire (400ha) burnt over a number of weeks, with containment very difficult due to the stony rises terrain.			✓
2015 25 December	The townships of Wye River and Separation Creek lost 106 houses. The fire was started by lightning in inaccessible country a week prior. The total fire burnt over a number of weeks and when finally extinguished the fire had burnt 2260 hectares.		✓	

Appendix C District bushfire risk profiles

Table 13 Risk profiles for all localities within the District

Locality	LG	No. of houses in locality	Ranked likelihood of fire reaching the town	Ranked average number of houses lost	Ranked total house loss / number of houses in town	Ranked likelihood of township experiencing substantial impact (>20% house loss)	Ranked Drop zone potential	Ranked access to large low fuel area (1 good, 3 poor, 5 none)	Ranked need for assistance Age/ Disability (total no. of people)	Ranked tourism factor
LORNE	SC	2744	9	10	6	5	9	1	5	10
WYE RIVER	CO	396	6	4	9	6	7	3	3	10
BENWERRIN	SC	57	8	1	8	10	8	5	2	5
LAVERS HILL	CO	208	7	2	7	7	10	5	2	6
FERGUSON	CO	32	7	1	7	7	8	5	5	6
FORREST	CO	345	7	2	7	7	7	5	1	7
KENNETT RIVER	CO	199	6	2	8	5	6	3	3	10
BARRAMUNGA	CO	171	8	1	4	9	8	5	2	3
WEEAPROINAH	CO	29	6	1	9	8	9	5	1	1
AIREYS INLET	SC	1309	3	7	3	2	6	3	6	8
BELLS BEACH	SC	95	5	2	10	5	5	3	4	7
SEPARATION CREEK	CO	147	4	2	8	5	7	3	2	9
ANGLESEA	SC	3484	6	5	2	2	8	1	8	8
BEECH FOREST	CO	353	10	1	5	6	9	5	3	3
WYELANGTA	CO	193	8	1	4	8	10	5	2	1
CHAPPLE VALE	CO	124	7	1	4	7	10	5	4	1
GELLIBRAND	CO	360	9	1	4	5	8	5	5	5
MOUNT SABINE	CO	10	6	1	4	8	10	5	1	2
CARLISLE RIVER	CO	396	10	1	4	8	7	5	1	2
TANYBRYN	CO	73	6	1	5	8	7	5	1	2
GREY RIVER	CO	14	3	1	7	4	7	3	3	9
JAN JUC	SC	2124	5	8	3	2	4	1	3	7
KAWARREN	CO	202	7	1	6	5	6	5	3	4
BELLBRAE	SC	509	6	2	4	5	3	5	6	4
JOHANNA	CO	153	5	1	5	4	6	3	4	8
BIG HILL	SC	44	4	1	6	4	8	3	2	7
SKENES CREEK NORTH	CO	32	4	1	9	5	6	5	1	2
EASTERN VIEW	SC	81	5	1	5	4	7	3	1	8
YUULONG	CO	122	5	1	5	5	9	5	2	1
KENNEDYS CREEK	C	78	6	1	2	6	6	5	4	2
TIMBOON	C	825	8	2	2	3	4	5	7	4
APOLLO BAY	CO	2532	6	3	1	1	7	1	6	9
BARWON DOWNS	CO	276	7	1	3	5	5	5	4	1
PORT CAMPBELL	C	620	7	1	2	2	6	1	5	10
GELLIBRAND LOWER	C	83	4	1	2	4	6	5	4	4
BARONGAROOK	CO	260	5	1	4	4	5	5	5	1
GLENAIRE	CO	151	5	1	2	3	7	5	5	3
JANCOURT	C	19	3	1	3	4	3	5	8	2
WONGARRA	CO	81	5	1	6	5	6	3	1	2
FAIRHAVEN	SC	608	2	3	2	2	6	3	2	8

Locality	LG	No. of houses in locality	Ranked likelihood of fire reaching the town	Ranked average number of houses lost	Ranked total house loss / number of houses in town	Ranked likelihood of township experiencing substantial impact (>20% house loss)	Ranked Drop zone potential	Ranked access to large low fuel area (1 good, 3 poor, 5 none)	Ranked need for assistance Age/ Disability (total no. of people)	Ranked tourism factor
MOGGS CREEK	sc	203	2	2	3	2	6	3	3	8
PENNYROYAL	sc	99	4	1	4	3	5	5	3	5
GHERANG	sc	179	5	1	5	4	5	5	3	1
SKENES CREEK	co	406	3	2	3	2	6	3	4	6
WENSLEYDALE	sc	97	5	1	4	3	7	5	3	2
IRREWILLIPE EAST	co	74	6	1	4	6	0	5	4	1
CAPE OTWAY	co	52	3	1	1	1	8	5	1	10
BOONAH	sc	27	4	1	4	4	7	5	1	1
HORDERN VALE	co	62	2	1	2	2	9	5	2	4
IRREWILLIPE	co	146	8	1	4	4	0	5	5	1
SCOTTS CREEK	c	168	7	1	2	3	3	5	5	2
CARPENDAIT	c	97	6	1	4	5	0	5	3	1
JANCOURT EAST	c&co	131	8	1	3	4	3	5	2	1
PRINCETOWN	c	260	7	1	2	3	0	3	4	7
TORQUAY	sc	8395	4	2	1	0	2	1	10	7
WAARRE	c	13	4	1	3	4	4	5	1	1
GLENFYNE	c	85	5	1	2	3	4	5	3	1
MARENGO	co	379	3	1	1	1	5	1	4	9
MURROON	co	92	3	1	2	2	7	5	3	1
PARAPARAP	sc	106	5	1	3	4	0	5	4	1
WINCHELSEA SOUTH	sc	111	3	1	3	3	4	5	3	1
DEANS MARSH	sc	265	4	1	2	2	6	5	2	2
SIMPSON	c	377	10	1	2	1	0	5	5	4
GERANGAMETE	co	122	6	1	3	4	0	5	2	1
PETTICOAT CREEK	co	10	2	1	3	2	6	3	1	4
WATTLE HILL	co	16	2	1	2	3	6	5	1	1
BAMBRA	sc	126	3	1	2	2	4	5	3	2
BARONGAROOK WEST	co	164	6	1	2	1	4	5	4	1
SUGARLOAF	co	17	2	1	3	2	6	5	1	1
COBRICO	c	72	4	1	1	2	0	5	7	1
COWLEYS CREEK	c	26	4	1	2	2	3	5	3	1
SOUTH PURRUMBETE	co	83	4	1	1	2	0	5	4	4
BARRABOOL	sc	108	3	1	2	1	4	5	4	1
BUNGADOR	co	53	5	1	3	3	0	5	2	1
COORIEMUNGLE	c	227	9	1	2	1	0	5	4	2
CAMPERDOWN	c	2149	2	1	1	0	0	5	9	3
YEODENE	co	92	4	1	3	3	0	5	2	1
COLAC EAST	co	248	1	1	1	0	0	5	10	2
CURDIEVALE	c	112	5	1	1	3	0	5	2	2
TERANG	c	1410	5	1	1	0	0	5	8	2
CURDIES RIVER	c	23	4	1	2	3	0	3	2	3
SKIPTON	c	459	2	1	1	1	0	5	6	3
BIRREGURRA	co	665	3	1	1	0	0	5	6	4
NEWFIELD	c	52	5	1	2	3	0	3	2	2
PETERBOROUGH *	c	497	3	1	1	2	0	1	2	8

Locality	LG	No. of houses in locality	Ranked likelihood of fire reaching the town	Ranked average number of houses lost	Ranked total house loss / number of houses in town	Ranked likelihood of township experiencing substantial impact (>20% house loss)	Ranked Drop zone potential	Ranked access to large low fuel area (1 good, 3 poor, 5 none)	Ranked need for assistance Age/ Disability (total no. of people)	Ranked tourism factor
GLENORMISTON NORTH	c	68	2	1	1	2	0	5	4	2
TIMBOON WEST	c	34	4	1	1	3	0	5	2	1
BOORCAN	c	93	3	1	1	2	0	5	4	1
ELINGAMITE NORTH	c	58	5	1	1	2	0	5	3	1
SWAN MARSH	co	129	5	1	2	1	0	5	3	2
GNARWARRE	sc	131	2	1	1	0	4	5	4	1
LARRALEA	c	22	2	1	1	2	0	5	4	1
WINCHELSEA	sc	1353	4	1	1	0	0	5	7	1
YEO	co	80	2	1	1	0	4	5	4	1
BRUCKNELL	c	74	5	1	1	0	3	5	3	1
DIXIE	c	75	3	1	1	1	0	5	5	1
ELINGAMITE	c	35	3	1	1	0	3	5	4	1
EURACK	co	55	1	1	1	0	0	5	8	1
HEYTESBURY LOWER	c	34	3	1	1	3	0	5	1	1
NAROGHID	c	58	3	1	1	2	0	5	3	1
PIRRON YALLOCK	co	124	1	1	1	0	3	5	4	2
BOSTOCKS CREEK	c	62	2	1	1	2	0	5	3	1
BEEAC	co	348	1	1	1	0	2	5	5	1
BOOKAAR	c	121	3	1	1	1	0	5	4	1
BUCKLEY	sc	125	3	1	1	1	0	5	4	1
GARVOC	c	251	3	1	1	2	0	5	2	1
NOORAT	c	196	3	1	1	0	0	5	5	2
WURDIBOLUC	sc	62	3	1	1	0	3	5	3	1
DERRINALLUM	c	366	4	1	1	0	0	5	4	2
ECKLIN SOUTH	c	138	6	1	1	1	0	5	2	1
GNOTUK	c	55	2	1	1	1	0	5	4	1
KOLORA	c	139	2	1	1	2	0	5	2	1
MORIAC	sc	317	2	1	1	0	0	5	6	1
MOUNT MORIAC	sc	154	2	1	1	1	0	5	4	1
WARNCOORT	co	102	2	1	1	1	0	5	3	2
COBDEN	c	1083	5	1	1	0	0	5	3	2
COLAC WEST	co	114	1	1	1	0	0	5	5	2
FRESHWATER CREEK	sc	227	3	1	1	1	0	5	2	2
LISMORE	c	470	3	1	1	0	0	5	3	3
MANNERIM	c	77	1	1	1	0	0	5	6	1
NOORAT EAST	c	13	1	1	1	2	0	5	2	1
PAARATTE	c	20	5	1	2	1	0	5	1	1
BERRYBANK	c	64	2	1	1	1	1	5	2	1
BULLAHARRE	c	13	2	1	1	2	0	5	1	1
MOUNT DUNEED	sc	665	2	1	1	0	0	5	5	1
SKIBO	C	48	2	1	1	1	0	5	3	1
TESBURY	c	49	2	1	1	1	0	5	3	1
WINGEEL	co	26	2	1	1	2	0	5	1	1
CORAGULAC	co	106	1	1	1	0	0	5	5	1
CORUNNUN	co	81	1	1	1	0	0	5	5	1

Locality	LG	No. of houses in locality	Ranked likelihood of fire reaching the town	Ranked average number of houses lost	Ranked total house loss / number of houses in town	Ranked likelihood of township experiencing substantial impact (>20% house loss)	Ranked Drop zone potential	Ranked access to large low fuel area (1 good, 3 poor, 5 none)	Ranked need for assistance Age/ Disability (total no. of people)	Ranked tourism factor
INVERLEIGH	sc	818	3	1	1	0	0	5	2	3
MODEWARRE	sc	159	3	1	1	0	0	5	4	1
DARLINGTON	c	106	2	1	1	0	0	5	4	1
FOXHOW	c	47	2	1	1	0	0	5	4	1
GLENORMISTON SOUTH	c	76	2	1	1	0	0	5	4	1
MINGAY	c	31	2	1	1	1	0	5	2	1
VITE VITE	c	45	2	1	1	1	0	5	2	1
BREAMLEA	sc&g	134	1	1	1	0	0	3	1	6
COLAC	co	5402	1	1	1	0	0	5	3	2
KARIAH	c	48	3	1	1	0	0	5	3	1
LARPENT	co	139	1	1	1	0	0	5	4	1
LESLIE MANOR	c	59	3	1	1	0	0	5	3	1
OMBERSLEY	sc	79	3	1	1	0	0	5	3	1
POMBORNEIT NORTH	c	57	1	1	1	0	0	5	3	2
TANDAROOK	c	23	1	1	1	1	0	5	2	1
WARRION	co	155	1	1	1	0	0	5	4	1
WHOOREL	co	26	1	1	1	1	0	5	2	1
BRADVALE	c	58	2	1	1	0	0	5	3	1
MOUNT BUTE	c	54	2	1	1	0	0	5	3	1
STONYFORD	c&co	73	2	1	1	0	0	5	3	1
ALVIE	co	91	1	1	1	0	0	5	3	1
BALINTORE	co	55	1	1	1	0	0	5	3	1
CONNEWARRE	sc	543	1	1	1	0	0	5	3	1
COROROOKE	co	178	1	1	1	0	0	5	3	1
DREEITE	co	104	1	1	1	0	0	5	3	1
ELLIMINYT	co	1377	1	1	1	0	0	5	3	1
IRREWARRA	co	247	1	1	1	0	0	5	3	1
ONDIT	co	101	1	1	1	0	0	5	3	1
PITTONG	c	40	1	1	1	1	0	5	1	1
POMBORNEIT	c	63	1	1	1	0	0	5	2	2
WEERITE	c	75	1	1	1	0	0	5	3	1
DUVERNEY	c	28	2	1	1	0	0	5	2	1
VITE VITE NORTH	c	37	2	1	1	0	0	5	2	1
WEERING	co	61	2	1	1	0	0	5	2	1
CHOCOLYN	c	48	1	1	1	0	0	5	2	1
CRESSY	c&co	253	1	1	1	0	0	5	2	1
KOALLAH	c	26	1	1	1	0	0	5	2	1
NALANGIL	co	52	1	1	1	0	0	5	2	1
POMBORNEIT EAST	c	31	1	1	1	0	0	5	2	1
WOOL WOOL	co	38	1	1	1	0	0	5	2	1
WERNETH	c	108	1	1	1	0	0	5	1	1

* Peterborough as a locality contains only 60 properties within Corangamite Shire, the remainder are in Moyne Shire.

Table 14 Detailed explanation of risk profile table column headers

Table heading descriptor	Score Definition - all scores are mathematically ranked 1 to 10 from raw data, with the exception of access to large low-fuel area which is ranked from 1 to 5
LG	Local Government area (sc – Surf Coast Shire, cos – Colac-Otway Shire, c – Corangamite Shire)
No. Houses per town	The number of houses within the footprint of the locality.
Av number of houses lost (ranked)	An average number of houses lost, drawn from the 10,000 simulated fires run across the landscape and how many houses burnt in the total simulation.
Total house loss / number of house In town (ranked) -	This column is based on the number of houses lost as a percentage of the total number of houses in the town. This column gives us an understanding of the vulnerability of the town/ settlement. It also gives a basic understanding on how survivable the town would be to seek shelter in.
Likelihood of fire to cause substantial impact to town	This figure is a ranking based on the number of fires that impacted a township or settlement that caused more than 20% of the house to be lost. This figure gives an understanding of which places are impacted at the greatest frequency by highly damaging fires.
Ranked Drop zone potential	This analysis helps us to understand the factors that could contribute to a major ember drop zone and the potential for damaging winds associated with terrain, vegetation, and fire weather. This work is still in development, but it is worth showing the ranked scale to help inform aspects of the risk profile. Understanding the potential here may have an important role to play, as the damaging nature of these effects were evident during Black Saturday.
Ranked access to a beach or large space of low fuel -	This element was included as a beach whilst not an ideal shelter in a major bushfire does provide an option for a number of towns that in effect could reduce the life loss potential compared to a township with no access.
Ranked need for assistance Age/ Disability (total number of people) -	This column is a simple representation of the number of people in a township or settlement that have either a disability, are less than 14 years old or more than 65 years old. This represents a component of susceptible people and research from Black Saturday found that not only these people, but the carers are at great risk from a major bushfire.(Blanchi R 2012)
Ranked Tourism factor	The degree to which the usual population of the town expands during the summer months, which also coincides with higher fire danger ratings - ranked As another major component of susceptible people, in some areas tourists form a substantial proportion of the population and this leads to those areas having a higher risk.

Appendix D Drop zone analysis

Drop zone analysis is important in understanding the bushfire risk and the potential for fire storm impact on each town. It is a new way of considering the factors that have seen the phenomenon of mass ember attack on townships during a bushfire.

Following the 2009 Victorian Black Saturday fires, Dr Kevin Tolhurst (and others) examined factors that led to the catastrophic outcomes at Marysville. The influence of terrain ruggedness and its interaction with convection on the development of potential fire storms at particular locations was investigated. Dr Tolhurst found that the catastrophic outcome at some locations on Black Saturday was strongly influenced by terrain factors - relatively long runs of steep uphill slopes supporting ember-generating vegetation within about 6kms of those locations from the direction of fire. This effect has been termed *drop zone*. Dr Tolhurst is preparing a report on the drop zone concept to the CFA. At the time of undertaking the risk analysis for this plan and writing the plan this report was not available.

Using the principles and methodology of this work and in discussion with Dr Tolhurst, the Otway Bushfire Planning Collaboration undertook a finer scaled analysis drop zone risk assessment across all localities of the Otway District, using the Marysville investigation as a benchmark (Ashton and Nagel 2015). The report prepared on this work describes the process of identifying drop zone potential for Otways towns as a component of township bushfire risk assessment. Drop zone work contributes to the risk analysis of each town and is used in addition to Phoenix RapidFire modelling and other risk analysis.

Factors examined in the Otway drop zone analysis were:

- the fire direction - a north west fire run potential and a south west fire run potential were analysed separately.
- from each of these fire aspects the amount of potential uphill run was calculated, this component considered the individual length and steepness of the uphill runs (as well as combined totals).
- These factors were overlayed where they intersected forested vegetation. The main premise of these characteristics is the potential for the generation of extensive convection columns, that have the potential to carry a vast ember loads. As these columns are susceptible to breaking down as the fuel or the slope alters significantly creating a mass launch zone, that potentially becomes susceptible to other winds that can take the embers to ground as an ember storm.
- The analysis was tabulated and ranked for each town, and is presented as part of the township risk assessment spreadsheet in the risk tables in the strategic fire plan

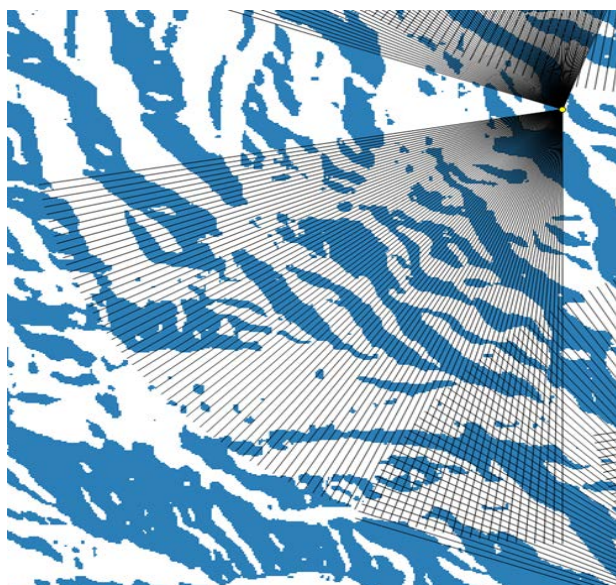


Figure 36 Illustration of landscape assessment for drop zone potential

This was achieved through data transfer from the selected input criteria, to a series of array lines emanating from a central point in the township or settlement.

This analysis is likely to be refined in future with the further input of Dr Tolhurst and the release of his report. It was determined that this initial work undertaken in the Otways was a valuable contribution to the analysis of the risk profile of this planning area and hence is briefly described here. Further detail is available in the report (Ashton and Nagel 2015).