Bushfire Risk Mitigation Plan

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Responsibilities

This document is the responsibility of the Asset Strategy Team, Tasmanian Networks Pty Ltd, ABN 24 167 357 299 (hereafter referred to as "TasNetworks").

Please contact the Asset Strategy Team Leader with any queries or suggestions.

- Implementation All TasNetworks staff and contractors.
- Compliance All group managers.

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The end user is expected to implement any practices which may not be stated but which can be reasonably regarded as good practices relevant to the objective of this document.

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Record of revisions

Section number	Details
Varied	Minor updates and removal of expenditure
Various	Various sections updated following completion of quantified risk assessment for 2019 Regulatory submission.

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1 Purpose

The purpose of this risk mitigation plan is to describe:

- TasNetworks' approach to preventing the ignition of bushfires and mitigating the impacts of bushfire that are caused by the electricity supply network, meeting legislative and regulatory obligations and strategic plans;
- the key capital and operational projects and programs underpinning network asset-related bushfire risk mitigation activities;
- forecast expenditure for the mitigation of bushfire risk, including the basis upon which these forecasts are derived; and
- TasNetworks' inherent and residual risk exposure resulting from the implementation of bushfire risk mitigation activities.

2 Scope

This mitigation plan covers bushfire ignition risk mitigation activities for both distribution and transmission network assets owned or inspected by TasNetworks. This plan applies to all assets that could cause fire ignition in all areas of TasNetworks' transmission and distribution network.

This mitigation plan makes reference to other plans, manuals, standards, policies, procedures and work instructions which, together with this plan, describe all of TasNetworks' activities that contribute to the reduction of bushfire risk.

Other key documents are shown in Section 23 – References.

3 Bushfire mitigation objectives

TasNetworks has identified the risk of bushfires started by TasNetworks' assets or operations as one of the highest risks to the business. The risk of *"Major bushfire start is attributed to TasNetworks assets and/or work practices, leading to fatality or permanent impairment of a member of the public."* is included within TasNetworks' Key Risk Profile as 'Risk 10'.

The key strategic objectives of the Bushfire Risk Mitigation Plan are:

- Safety - manage the risks posed by the potential for live electricity supply assets to start bushfires, which have the potential to impact human safety and property – these risks arise principally from:
  - vegetation coming into contact with live electricity supply assets;
  - faults occurring on network assets which have failure modes that can cause bushfire ignition;
  - poor work practice or errors made by TasNetworks staff when constructing, operating or maintaining the electricity supply network; and
  - third party actions, deliberate or accidental, which result in faults which cause bushfire ignition.
- Compliance - achieve compliance with all relevant legislative and statutory requirements;
- Performance - mitigate the risk of supply interruptions as a result of bushfires started by live electricity supply assets;

- **TasNetworks' business risk -** manage bushfire risks in a manner consistent with TasNetworks' risk appetite, and to the target levels specified in the related key business risks.

TasNetworks aims to meet these objectives in a safe, cost effective and environmentally responsible manner.

4 Strategic alignment

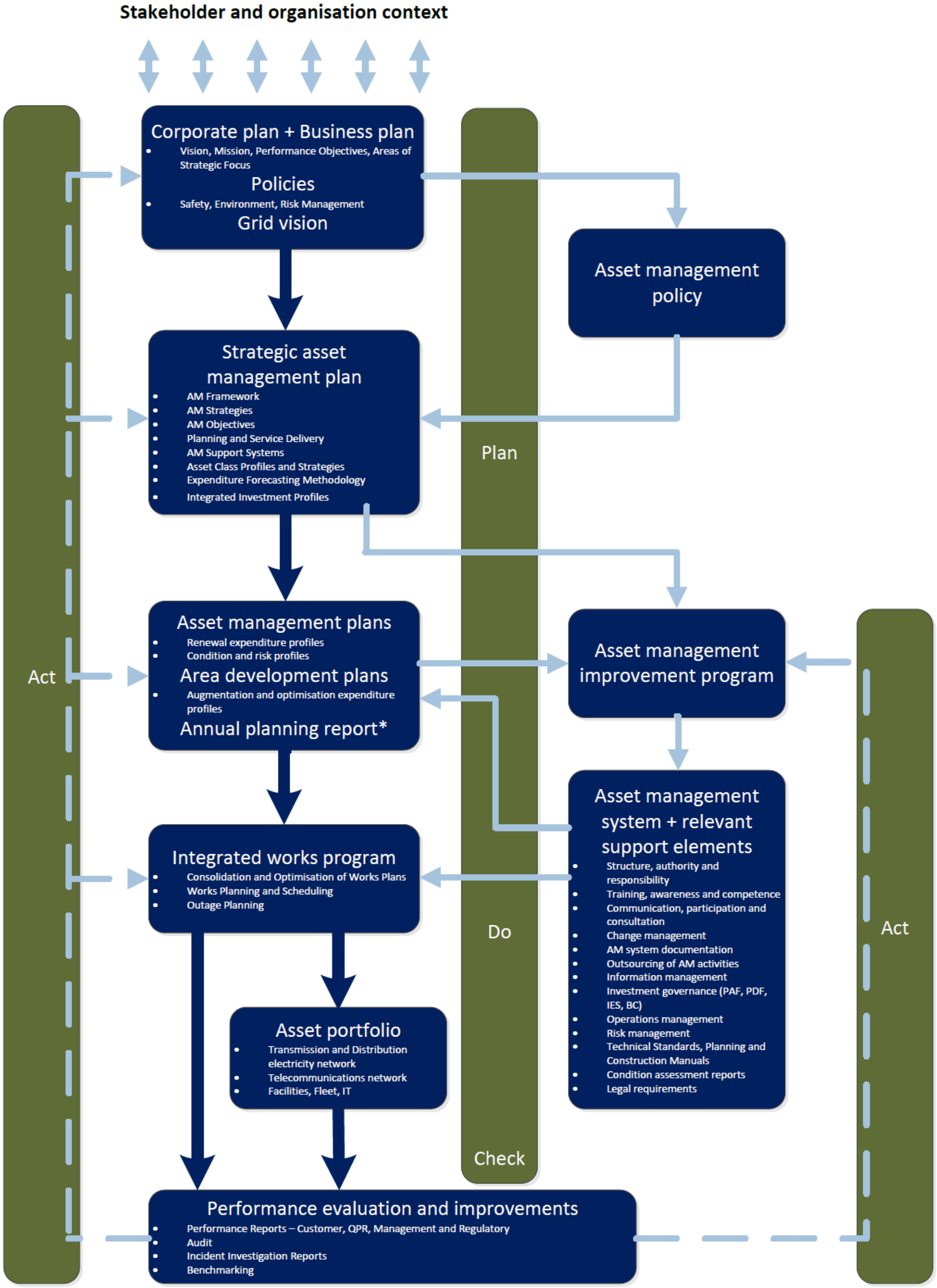
This risk mitigation plan has been developed to align with both TasNetworks' Asset Management Policy and Asset Management Objectives.

It is part of a suite of documentation that supports the achievement of TasNetworks' strategic performance objectives and its vision. TasNetworks' management plans identify the issues and strategies relating to network assets and operations, and detail the specific activities that need to be undertaken to address the identified issues.

Figure 1 represents TasNetworks' asset management framework that support the asset management system. The figure also outlines how the documents relate to each other. The diagram highlights the existence of, and interdependence between, the Plan, Do, Check, Act components of good asset management practice. The Bushfire Risk Mitigation Plan provides guidance to other stakeholders in the preparation of asset management plans, ensuring effective bushfire risk mitigation outcomes are achieved, while also summarising some key bushfire risk mitigation outcomes and commitments made within those asset management plans.

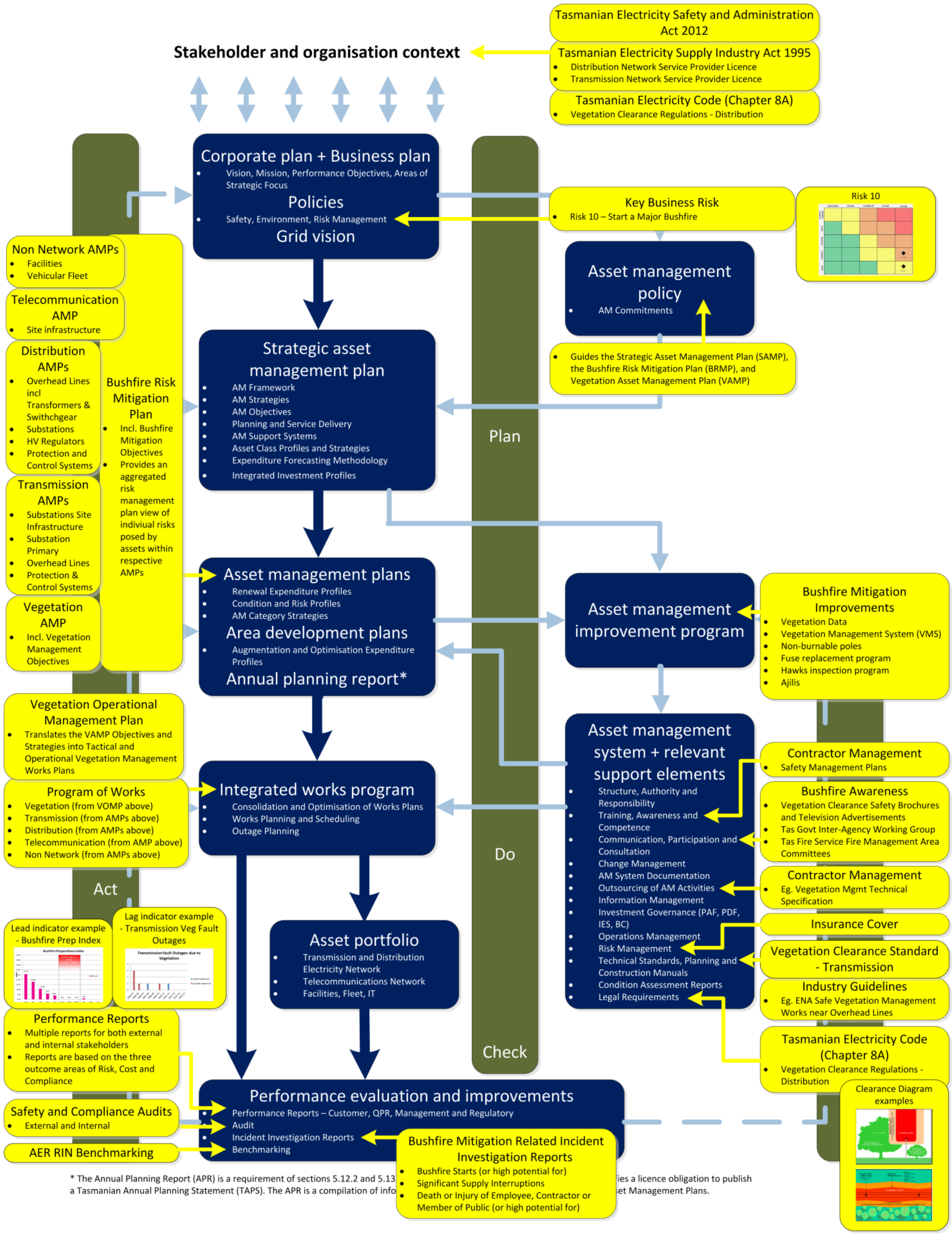
TasNetworks' bushfire mitigation framework has been overlaid onto the TasNetworks asset management framework to show the direct relationship between the two, and is shown in Figure 2.

Figure 1 TasNetworks Asset Management Framework



* The Annual Planning Report (APR) is a requirement of sections 5.12.2 and 5.13.2 of the National Electricity Rules (NER) and also satisfies a licence obligation to publish a Tasmanian Annual Planning Statement (TAPS). The APR is a compilation of information from the Area Development Plans and the Asset Management Plans.

Figure 2 TasNetworks Asset Management Framework with Bushfire Mitigation Framework Overlay



5 Strategic approach

TasNetworks' Risk Management Framework[1] (**the framework**) provides the essential supporting structure for risk management across the organisation. The framework is based on the international standard for risk management AS/NZS ISO31000 Risk Management – Principles and Guidelines.

Risks are assessed considering the potential impacts on:

- people and safety.
- environment and community; and
- customer outcomes;
- regulatory and legal obligations;
- business continuity;
- corporate reputation; and
- financial performance.

In the context of Risk 10[2] *"Major bushfire start is attributed to TasNetworks assets and/or work practices, leading to a fatality or permanent impairment of a member of the public."*, the inherent risk is rated as Extreme (Likelihood = Almost Certain, Severity = Severe).

TasNetworks' risk appetite is to see the overall risk reduced to Medium by reducing the Likelihood of the risk to Rare (Likelihood = Rare, Severity = Severe).

The most recent risk review sees the risk ranked as High (Likelihood = Unlikely, Severity = Severe).

It is acknowledged that while TasNetworks has many risk controls in place, the majority of the controls are aimed at reducing Likelihood, as TasNetworks' ability to reduce the Severity of bushfires is limited.

Continued program improvements, strategic initiatives and actions are aimed at reducing the risk to as close as possible to the target risk appetite.

TasNetworks also works with other agencies and the community to foster a shared responsibility approach to bushfire risk management. Whilst fire and other emergency services agencies run programs aimed at reducing the consequences of bushfires (eg: community protection plans, community education programs about fire risk, preparedness and survival), and individuals have responsibilities to plan and take appropriate levels of preparedness and survival actions, TasNetworks' bushfire mitigation (**BFM**) activities are focussed principally on reducing the likelihood of fires starting from our assets or activities.

TasNetworks' Risk Management Framework gives the risk management matrix to be used for the assessment of risk and provides guidance for determining the likelihood and severity of risk (Reference 1).

6 Compliance with regulatory and legal responsibilities

TasNetworks is obligated to comply with a number of statutory and regulatory responsibilities. The key obligations are outlined in the following section.

6.1 Electricity Supply Industry Act 1995

The Electricity Supply Industry (ESI) Act exists to:

[1] TasNetworks Risk Management Framework (V1.0 March 2015)
[2] See TasNetworks' Key Risk Profile (Reference 3)

- promote efficiency and competition in the electricity supply industry;
- establish and maintain a safe and efficient system of electricity generation, transmission, distribution and supply;
- establish and enforce proper standards of safety, security, reliability and quality in the electricity supply industry; and
- protect the interests of consumers of electricity.

The Act covers high level safety obligations and is implicit regarding bushfire risks.

6.2 Electricity Industry Safety and Administration Act 1997

The Electricity Industry Safety and Administration (EIS&A) Act exists to establish safety standards for electrical articles, to provide for the investigation of accidents in the electricity industry and for related purposes.

The EIS&A Act covers:

- powers of entry and inspection;
- powers to order rectification;
- powers to order disconnection; and
- emergency powers.

6.3 The Tasmanian Electricity Code (TEC)

The TEC provides, inter alia, a statement of the relevant technical standards of the electricity supply industry, an access regime to facilitate new entry, guidance on price setting methodologies, a means of resolving disputes that may arise and establishes advisory committees to assist the Regulator. There has been on-going development and refinement of the Code to ensure that it best meets the needs of the Tasmanian electricity supply industry and customers.

Specifically, Chapter 8A of the TEC includes a framework for the management of vegetation around distribution power lines; an activity that has been identified as posing a risk of bushfire risk and over which TasNetworks has some influence. This framework is explicit regarding works requirements and practices in various fire hazard categories.

6.4 Occupational Licensing Act 2005

The Occupational Licensing (Standards of Electrical Work) Code of Practice 2013 set the minimum standards for electrical work in Tasmania.

Incorporated into this Code of Practice are:

- AS 5577;
- AS 2067;
- AS/NZS 3000;
- AS/NZS 7000; and
- Any additional obligations imposed by AS 2067, AS/NZS 3000 and AS/NZS 7000 referring to further Australian Standards or documents, including any amendments or revisions of those Australian Standards or documents from time to time.

6.5 Work Health and Safety ACT 2011

The term 'so far as is reasonably practicable' is widely used in risk management, and is a standard adopted by, and defined in the Commonwealth Work Health and Safety (WHS) Act 2011 (in Section 18).

In practical terms it means that firstly, consideration must be given to what can be done - that is, what is possible in the circumstances for ensuring health and safety. Having considered what can be done it is then necessary to consider whether it is reasonable, in the circumstances to do all that is possible. This means that what can be done should be done unless it is reasonable in the circumstances to do something less.

The Work Health and Safety Act 2011 (Section 17 – Management of risks) states that there is:

A duty imposed on a person to ensure health and safety requires the person:

a) to eliminate risks to health and safety, so far as is reasonably practicable; and

b) if it is not reasonably practicable to eliminate risks to health and safety, to minimise those risks so far as is reasonably practicable.

In considering what is reasonably practicable, Section 18 (What is reasonably practicable in ensuring health and safety) identifies the relevant matters to be taken into account are:

a) the likelihood of the hazard or the risk concerned occurring; and

b) the degree of harm that might result from the hazard or the risk; and

c) what the person concerned knows, or ought reasonably to know, about

   I. the hazard or the risk; and

   II. ways of eliminating or minimising the risk; and

d) the availability and suitability of ways to eliminate or minimise the risk; and

e) after assessing the extent of the risk and the available ways of eliminating or minimising the risk, the cost associated with available ways of eliminating or minimising the risk, including whether the cost is grossly disproportionate to the risk.

7 Operating environment

TasNetworks manages a transmission and distribution network of more than 22,000 km of overhead powerlines, upon which Tasmanians have a very high dependency for contemporary living, wellbeing and business. Over 90% of the network consists of bare overhead conductor, which cross a variety of terrains varying from built up urban areas through to cultivated farm land and bush.

TasNetworks' network supplies electricity to over 277,000 customer installations throughout Tasmania. Customers include major commercial and industrial customers directly connected to the transmission network, as well as smaller businesses and residential customers connected to the distribution network.

There are also approximately 70,000 privately-owned poles connected to the network. Inspections and maintenance of private poles is currently undertaken by TasNetworks by Ministerial direction. This arrangement will continue into the future unless otherwise agreed.

7.1 Bushfire history in Tasmania

Like all overhead electricity distribution networks in fire prone environments, TasNetworks' network assets have varying degrees of vulnerability to bushfires.

In Tasmania, bushfires usually occur during the warmer months from November to March, with a peak in January and February. They are unusual during the winter months, however major fires have occurred as early as October and as late as April.

As Tasmania has relatively mild summer weather conditions, generally the fires burn slowly and are controlled by firefighting crews.

There have been a few notable exceptions to this including:

- the 'Black Tuesday' fires around Hobart on 7 February 1967, which killed 62 people, injured 900, and rendered 7,000 people homeless;
    - the 1966-67 summer was preceded by an unusually wet spring (September and October 1966 rainfall was more than twice the long-term average for that period) resulting in prolific grass growth. Conditions then turned very dry, with November 1966 to February 1967 rainfall being little more than a third of the long-term average rainfall for that period. Grasslands cured and forest fuels dried out significantly.
    - the occurrence of extreme fire weather on 7 February 1967 resulted in numerous fires moving into dry, heavy forest fuels, subsequently merging and forming an extreme forest fire event. This event is a case of a short-term drought contribution to a severe fire event.
- the 2006-07 East Coast Fire Season where 18 homes were lost at Scamander and around 200 TasNetworks poles were lost;
    - in northern and eastern Tasmania, 2006 was a very dry year. In Hobart, 2006 rainfall had been little more than half of the long-term annual average. This longer-term drought situation resulted in very dry forest fuels, including during the spring period. In October 2006, severe fires burnt through areas of Hobart's eastern shore, and in December 2006 large intense forest fires burnt in north-eastern Tasmania, impacting Scamander among other places; and
- the 'Dunalley Fires' on the Tasman Peninsula on 4 January 2013, which destroyed around 100 homes;
    - the 2013 Dunalley Fires also occurred during an unusually warm and windy summer, where a total of ten total fire ban days were declared (the average being three in a summer).

Whilst high impact fire events are more common on the mainland, this history illustrates that high consequence fires can occur in Tasmania. When drought and severe fire weather combine, and fires start in areas with extensive eucalypt forest cover, fires with fire behaviour at the upper levels of possible severity can occur.

There is no history of powerlines starting catastrophic bushfires in Tasmania. However, the experience in mainland Australia is that powerlines can start bushfires. Whilst the average number of bushfires started by electrical assets across Australia is relatively low (1-4 per cent of all bushfires) (reference 2), inquiries into catastrophic bushfires in Victoria have found that a disproportionately high number have been started by electrical assets.

As a result, the risk of TasNetworks' assets and/or operations starting a bushfire is rated as one of the highest risks to the business (reference 3).

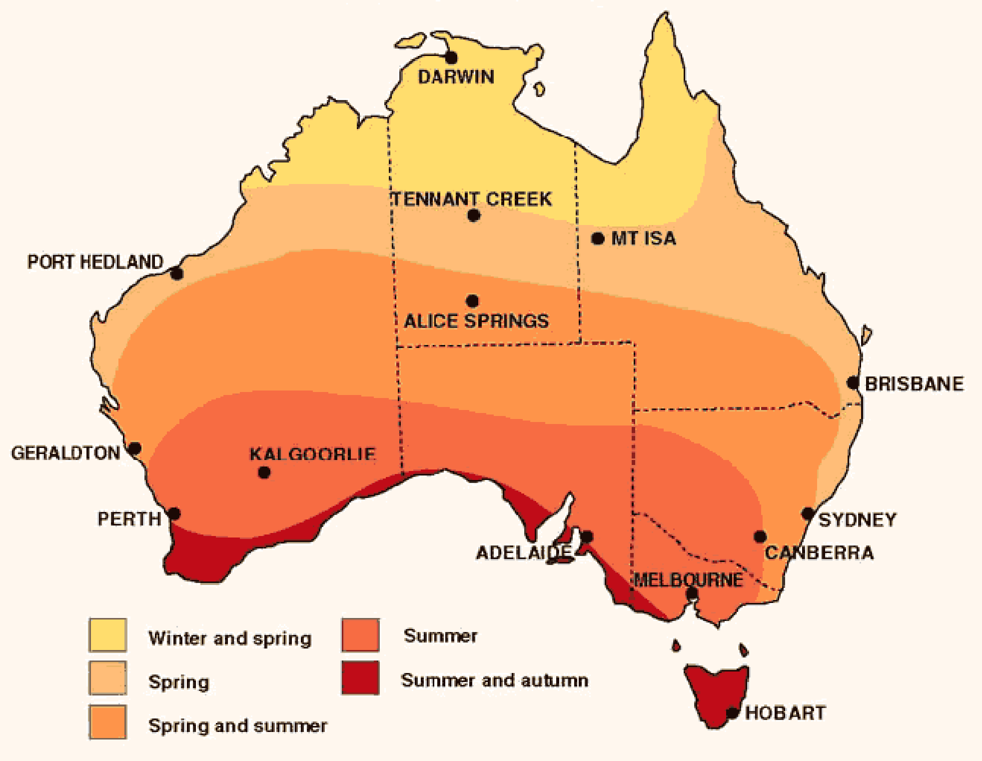
TasNetworks also recognises that there is the potential to lose a significant number of its assets during a bushfire due to the spread of the assets across the state, as occurred during the Dunalley fires when approximately 600 timber poles were destroyed and power was cut off to over 2000 homes for approximately 15 days.

Events of this kind severely impact TasNetworks' ability to provide continuous electricity supply, which has serious consequences for TasNetworks and for the fire management capability of the emergency services and the safety of the public.

7.2 Expert finding into Tasmanian bushfire weather and climate change

South-eastern Australia has the reputation of being one of the three most fire-prone areas in the world, along with southern California and southern France[3].

Figure 1: Seasonal pattern of fire danger. **http://www.bom.gov.au/climate/c20thc/ffire.shtml**

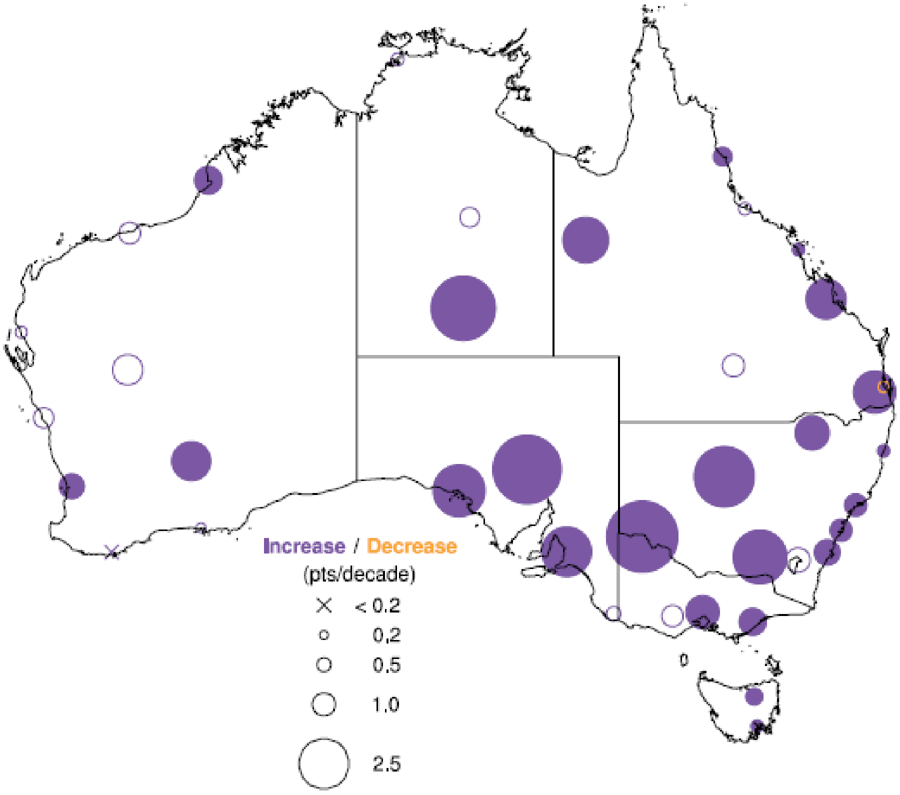


Fire danger has increased in recent decades[4]. Observed fire weather in Australia from 1973–2010 is analysed for trends using the McArthur Forest Fire Danger Index (FFDI). Annual cumulative FFDI, which integrates daily fire weather across the year, increased significantly at 16 of 38 stations. Annual 90th percentile FFDI increased significantly at 24 stations over the same period. None of the stations examined recorded a significant decrease in FFDI.

The largest increases in seasonal FFDI occurred during spring and autumn, although with different spatial patterns, while summer recorded the fewest significant trends. These trends suggest increased fire weather conditions at many locations across Australia, due to both increased magnitude of FFDI and a lengthened fire season.

[3] K. Hennessy, C. Lucas, N. Nicholls, J. Bathols, R. Suppiah and J. Ricketts. Climate change impacts on fire-weather in south-east Australia. CSIRO Marine and Atmospheric Research, Bushfire CRC and Australian Bureau of Meteorology. 2005.
[4] Clarke H, Lucas C, Smith P. Changes in Australian fire weather between 1973 and 2010. International Journal of Climatology. 2013.

Figure 2: Map of trend in annual 90th percentile FFDI. Marker size is proportional to the magnitude of trend. Reference sizes are shown in the legend. Filled markers represent trends that are statistically significant.



Fire danger is projected to increase further with greenhouse warming[5]. *The impact of climate change on the risk of forest and grassland fires in Australia* concludes that Australia will be significantly more exposed to forest and grassland fire risk in the future.

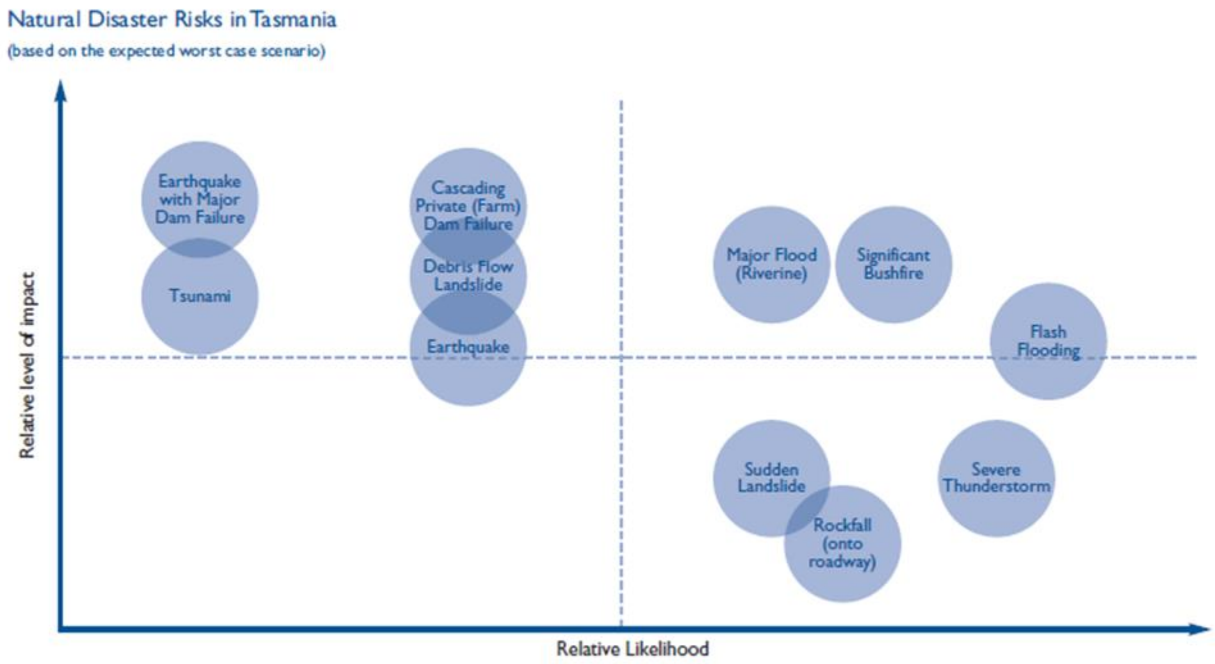
Bushfires already cause extensive damage and concern, and any increase in fire danger or shifts in the frequency, intensity or timing of fires, will have widespread consequences for human communities and natural systems[6]. Multi-model mean fire dangers indicate an accelerated increase if fire danger later this century via:

- a continuation of the trend of increasing springtime fire danger, a gradual increase in summer fire danger, but little change in autumn;
- an overall broadening of the fire season;
- an increase in the number of days at the highest range of fire danger at several representative locations around Tasmania, associated with synoptic patterns conducive to dangerous fire weather

[5] Pitman A, Narisma G, McAneney J. The impact of climate change on the risk of forest and grassland fires in Australia. 2007.
[6] Paul Fox-Hughes, Rebecca Harris, Greg Lee, Michael Grose and Nathan Bindoff. Future fire danger climatology for Tasmania, Australia, using a dynamically downscaled regional climate model.2015.

The 2012 Tasmanian State Natural Disaster Risk Assessment (**TSNDRA**)[7] highlighted fire driven by changing weather and climate as one of the natural hazards most likely to cause significant damage and cost to Tasmania.

Figure 3: Relative impact and likelihood of natural disasters in Tasmania



Relative Impact and Likelihood of Natural Disasters in Tasmania

The TSNDRA identifies that Bushfire and Flood remain Tasmania's most significant hazard risk types. The assessment found that Bushfires are generally more severe in the southeast part of the State.

Key finding of the TSNDRA includes the necessity to maintain focus on prevention in awareness and education programs:

> *This was a common issue expressed across hazard – that work was needed to further embed prevention and mitigation into hazard and risk education and communication programs. It was felt that there remained a focus on 'what to do in the event of a disaster' in current programs, when it was likely that **community resilience could be improved better by focusing on preventative actions.***

Climate Futures for Tasmania modelling[8] projections indicate the following changes by the end of the century:

• The type of strong weather system that brings the majority of the worst fire weather days to south–east Tasmania is projected to become more frequent.

[7] Department of Police and Emergency Management. 2012 Tasmanian State Natural Disaster Risk Assessment. 2012.
[8] Fox–Hughes P, Harris RMB, Lee G, Jabour J, Grose MR, Remenyi TA & Bindoff NL. Climate futures for Tasmania – Future fire danger. 2015.

• The total number of days per year categorised as 'Very High Fire Danger' is projected to increase by at least 120%. In the future, this is about a 10% per decade increase to 2100.

• Projected changes show strong regional and seasonal variations. Regions currently with the greatest risk of fire are projected to get worse most rapidly.

• The area of Tasmania under 'Total Fire Ban' conditions during summer due to fire weather is projected to increase by at least 75%. This is a 6% increase per decade.

• The average area of Tasmania in spring categorised as 'Very High Fire Danger' is projected to increase by at least 250%. This is a 20% increase per decade.

• There is no major change to the fire danger risk in autumn.

• The analysis suggests that all projections could be conservative estimates of future changes.

The Climate Futures for Tasmania study provides supporting evidence for stakeholders to prioritise and develop future bushfire strategies.

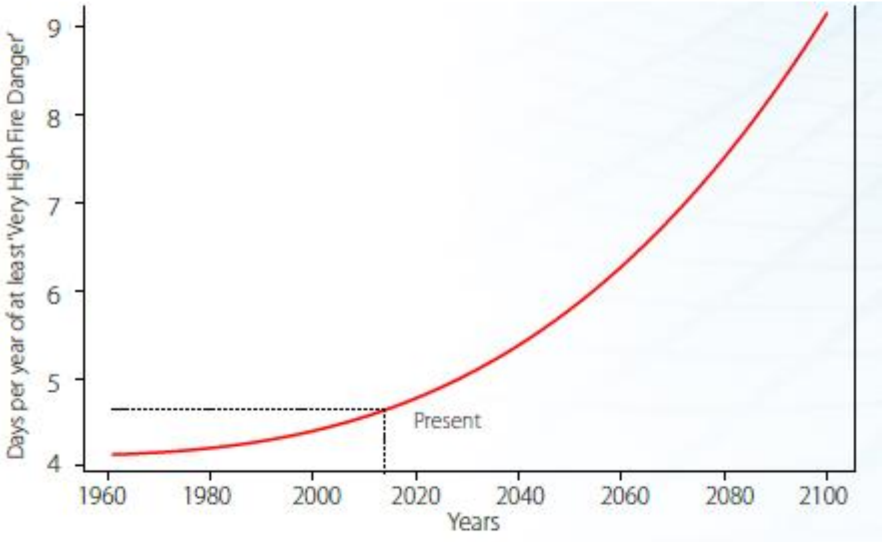
There is an increase in both average and extreme (99th percentile) Forest Fire Danger Index projected through the century. The rates of change vary across Tasmania and are different in each season. Most notably there is an increase in high fire danger days projected to occur in spring. There is also a projected increase in the frequency of the weather systems associated with many

of the most severe fire weather events, and increases to other large–scale drivers of fire risk, as well as projected increases in soil dryness.

Taken together, all these factors provide a consistent story of increasing fire weather risks through the 21st century. This increase in risk factors will underlie the ongoing year–to–year and decade–to–decade variability of fire weather events in Tasmania.

Given the expected shorter return periods of bushfire events, emergency services may need to plan for more rapid repair of vital infrastructure and recovery of personnel to meet these increased risks.

Figure 4: Projected frequency of 'Very High Fire Danger' days from 1961 to 2100



Smoothed projection of the number of days per year categorised as at least 'Very High Fire Danger' from 1961 to 2100. Forest Fire Danger Index values will increase into the future, with the majority of the increase after 2050.

7.3 Reports and recommendations following catastrophic mainland bushfires

Following catastrophic fires in Victoria during 1977, 1983 and 2009, the Victorian State Government devoted considerable resources to examining systemic factors associated with the reliability and safety of Victoria's electricity distribution networks. Recommendations from the reports resulted in mandatory changes to policy and procedures within Victoria. These recommendations were also applicable to the Tasmanian distribution and transmission networks, with the vast majority of issues related to distribution networks.

Within Tasmania, TasNetworks compared the composition of the network and asset management practices to those of the distribution and transmission network service providers associated with the bushfires in Victoria. Comparisons to key outcomes and recommendations within the various Victorian reports were also completed. The reports commissioned by the Victorian State Government included:

- 1977 Board of Enquiry (**Barber report**);
- 1992 Electricite de France (**EDF**) report (addressing outcomes from the fires that occurred in 1983);
- 2009 Victorian Bushfire Royal Commission (**VBRC**); and
- 2011 Powerline Bushfire Safety Taskforce (**PBST**) report.

Whilst there is clear evidence that some initiatives within the Barber report and EDF report were adopted within Tasmania, it is unclear as to how much emphasis and rigour was applied at the time to adopt key recommendations.

TasNetworks has reviewed its asset management practices, with consideration given to the outcomes of the Barber and EDF reports, and also within the context of bushfire risk in the Tasmanian environment, to determine (and incorporate where necessary) the recommendations that are relevant to TasNetworks.

TasNetworks has, where practicable, aligned its asset management practices with outcomes of the VBRC and PBST. A presentation on TasNetworks' compliance to the VBRC was made to the Tasmanian Government Victorian Bushfire Royal Commission Forum in November 2010 (Reference 4).

7.4 Tasmanian Fire Danger Ratings

The expected fire behaviour on a given day will vary depending on factors such as temperature, relative humidity, wind speed, vegetation and drought factors.

The Bureau for Meteorology issues a Fire Danger Index (**FDI**), which is a combination of air temperature, relative humidity, wind speed and drought.

An FDI of 1 means that fire will not burn, or will burn so slowly that it will be easily controlled, whereas an FDI in excess of 100 means that fire will burn so fast and so hot that it is uncontrollable.

In Tasmania, when the FDI is expected to reach or exceed a value of 38 either on any particular day or the next day, the Bureau of Meteorology will issue a Fire Weather Warning, which may result in the Tasmania Fire Service (**TFS**) declaring a day of Total Fire Ban (**TFB**) in all or part of the state. Usually, a Total Fire Ban lasts for 24 hours from midnight to midnight.

The FDI is used to determine the Fire Danger Rating (**FDR**), which provides a classification of the expected fire behaviour on a given day. The relationship between FDI and FDR is given in Table 1 along with a summarised description of the conditions to be expected on each type of day.

Table 1 Relationship between Fire Danger Index (FDI) and Fire Danger Rating (FDR)

FDI	FDR	Description
100+	Catastrophic	• Most fires breaking out a 'catastrophic' day will spread rapidly and be uncontrollable. • There is a high likelihood that people in the path of a fire will be killed or seriously injured. • Many homes are very likely to be destroyed. • Even the best-prepared homes will not be safe.
75-99	Extreme	• Some fires breaking out today will spread rapidly and be uncontrollable. • People in the path of a fire may be killed or seriously injured. • Many homes are very likely to be destroyed.
50-74	Severe	• Some fires breaking out today will spread rapidly and be uncontrollable. • People in the path of a fire may be killed or seriously injured. • Some homes are likely to be destroyed.
25-49	Very High	• Some fires breaking out today will spread rapidly and be difficult to control. • There is a possibility that people in the path of a fire will be killed or seriously injured. • Some homes may be destroyed.
12-24	High	• Fires breaking out today can be controlled. • People in the path of a fire are unlikely to be killed or seriously injured if they take shelter.
0-11	Low-Moderate	• Fires breaking out today can be controlled easily. • There is little risk to people and property.

On average, Tasmania experiences three TFB days (FDI greater than 38) per annum. FDIs greater than 75 have only occurred in Tasmania six times in the last ninety years (approximately once every 15 years).

Error! Reference source not found. is an extract of the historical analysis performed by Hennessy et al (reference 5) in 2005 of the occurrence of fire danger days at different locations across Australia between 1974 and 2003.

Table 2 Historical Analysis of Fire Danger Occurrence (1974-2003)

Location		Number of Days with FDI 25-49 per year	Number of Days with FDI >50 per year
Tasmania	Hobart	3.4	0.3
	Launceston	1.5	0.0
Victoria	Melbourne	9	0.6
	Bendigo	17.8	1.6
	Mildura	79.5	10.4

This indicates that extreme fire weather events are far less common in Tasmania than on the mainland; however they are still possible.

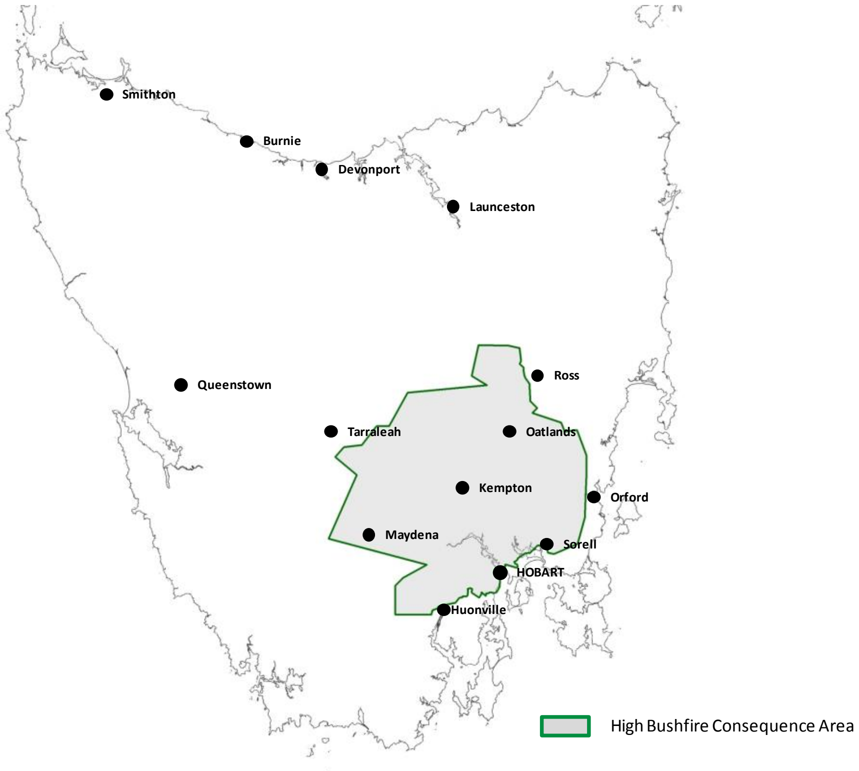
7.5 High Bushfire Loss Consequence Area (HBLCA) Model

In 2011-12, TasNetworks (then Aurora Energy) undertook a review of its bushfire mitigation strategy in view of the outcomes of the 2009 VBRC and reports presented by the PBST released in 2011. One of the key strategic initiatives identified and endorsed by the Board was the development of new bushfire consequence areas associated with the distribution network.

Recent works undertaken by Dr Kevin Tolhurst in bushfire risk management and fire behaviour prediction through the University of Melbourne (initiated through the Victorian Bushfire Royal Commission, and with the Bushfire Cooperative Research Centre) has been acknowledged throughout the industry as leading edge technology in this field[9].

TasNetworks engaged Dr Kevin Tolhurst as a consultant to work with TFS and Parks and Wildlife Service (PWS) and determine appropriate bushfire consequence areas throughout Tasmania, specifically for TasNetworks to target its bushfire mitigation programs. The high bushfire loss consequence area (HBLCA) defined through this work is shown in Figure 3.

Figure 3 TasNetworks' High Bushfire Loss Consequence Area (80% Model)



The fundamental difference between the previous bushfire risk areas, and that delivered by Dr Tolhurst, is the basis of what they are indicating. The pre-1995 bushfire risk areas were derived from typical vegetation types and seasonal climatic conditions across the state, and was an indication of the likelihood of a fire being sustained. The new model specifically looks at the potential loss (consequence) caused by a fire starting at a known point near the network, on an extreme day of localised climatic predictions (TFB day).

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9 Section 3.3, Page 44 of PBST states..."*The Taskforce has identified Phoenix as the best available tool to assess fire loss consequence at this time...*"

Having defined HBLCAs allows more effective application of asset and vegetation management strategies and supports TasNetworks' strategic objective of ensuring prudent risk management programs.

TasNetworks has adopted the VBRC approach of including the highest 80 per cent of the state's fire loss consequence into our defined High Bushfire Loss Consequence model.

The highest 80 per cent of the state's fire loss consequence is associated with fire risk from approximately 3,300 kilometres of powerlines (around 15 per cent of total rural powerline length).

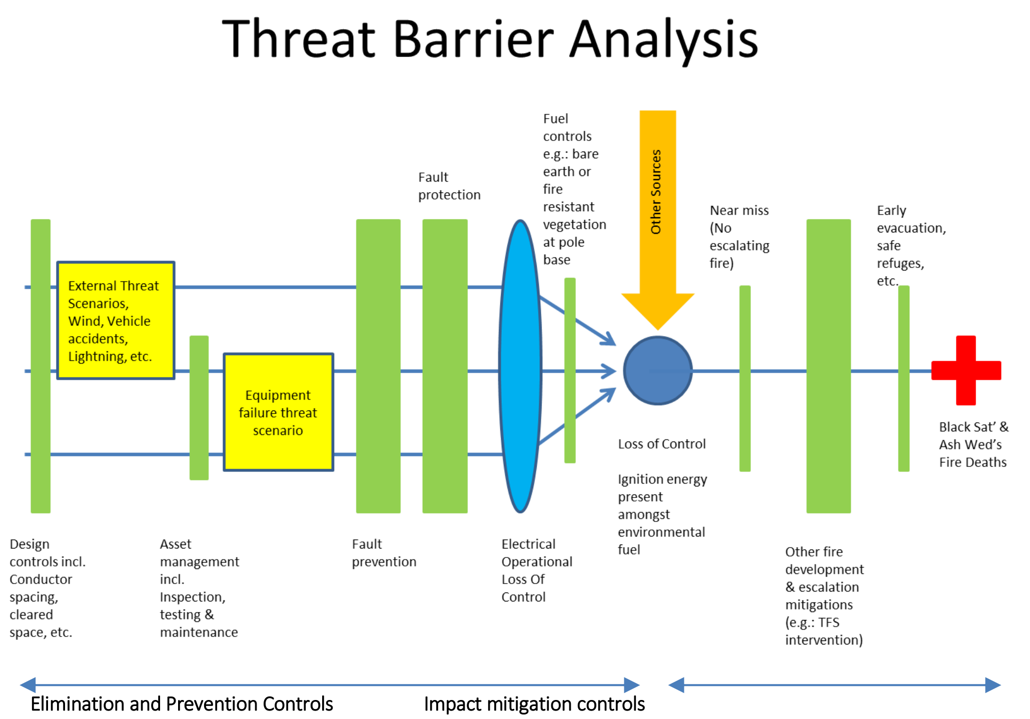
Whilst the defined HBLCA can be applied to transmission lines, at the time modelling was undertaken only distribution lines had been included in the project.

A review of the HBLCA is currently underway (which will include transmission line modelling), with outcomes expected to be implemented prior to June 2018.

7.6 Threat barrier analysis

TasNetworks has undertaken a Threat Barrier Analysis in relation to fires originating from electrical infrastructure to identify the range of risk controls, before and after a 'loss of control' event.

Figure 4 Threat barrier analysis



Threat barrier analysis models can assist to understand how powerlines start fires (threats) and how they can be prevented (barriers).

Threat-barrier analysis is a well-developed analysis technique used in many industries to demonstrate the utility of precautionary effort in a transparent manner.

The model employed by TasNetworks was developed through the Black Saturday PBST.

The loss of control point is important legally. It is always better to prevent the problem, either by eliminating the threat or enhancing prevention than by attempting to mitigate the impacts of an event after control is lost. This is consistent with the hierarchy of controls described in occupational health and safety legislation and risk management literature generally.

TasNetworks has adopted a precautionary approach to risk. This means that all practical precautions are considered and the task is to determine what cannot be justified on the balance of the significance of the risk as compared to the effort required to reduce it. That is, practical precautions are identified by criticality (consequence), and the desirability of implementing a precaution is assessed by weighing the risk against the costs (broadly defined) of implementation.

Using threat-barrier modelling, TasNetworks has investigated available options to reduce the risk of vegetation contacting powerlines and starting bushfires, particularly on extreme fire risk days and concludes that there is no single solution to mitigate the risk. It is noted that the precautionary options implemented throughout the various asset management plans generally reduce the likelihood of electrically initiated fire starts and will have minimal impact (if any) on consequences.

8 Risk management process

An integral aspect of TasNetworks' bushfire mitigation programs is the overarching concept of risk management.

TasNetworks' Risk Management Model provides the essential supporting structure for risk management in TasNetworks. The Risk Management Model is based on the international standard for risk management AS/NZS ISO 31000 Risk Management – Principles and Guidelines.

TasNetworks Risk Management Framework provides an overview of the TasNetworks approach to risk management.

The framework contains two primary components – the strategic framework elements and the risk management process (or model).

8.1 Risk identification

Following the most recent reviews of bushfire risks (April 2014), TasNetworks identified the following risks:

- network asset starts fire (inappropriate asset design);
- network asset starts fire (inadequate asset replacement and/or maintenance strategies);
- network asset starts fire (inadequate quality/workmanship/delivery of programs);
- vegetation contact with network asset starts fire;
- work practice starts fire;
- fire started by third party;
- business potentially implicated in fire start, and
- bushfire recovery work exacerbates the impact of a bushfire.

The above risk review included both transmission and distribution lines.

Appendix A gives an over view of the risk review process used for assessment of risk.

The next detailed review of network bushfire risks is scheduled for June 2018. A review may occur earlier if circumstances change such that it is required.

8.2 Risk analysis

Following the risk identification process, risk records are developed for each risk which includes risk narrative regarding inherent risk, potential causes and consequence, current controls and current control effectiveness.

8.3 Risk evaluation

The risk evaluation process includes key stakeholder input in determining whether it is believed that the current controls in place are adequate in reducing inherent risks to a point whereby residual risk meets the business' risk appetite. This typically includes representatives from the following teams:

- Engineering and Design;
- Asset Area Management;
- Asset Strategies; and
- Asset Performance.

8.4 Risk treatment

Where residual risks rank above the business appetite (particularly those ranking as 'High' or 'Extreme'), risk treatment plans are created to ensure additional risk treatment controls are developed and implemented within appropriate time frames in order to reduce the risk to a point that is acceptable.

Risk treatment controls can take many different formats including development or changes to process, procedures, projects, or works programs.

Refer to TasNetworks' Risk Management Framework for further detail regarding risk management.

Appendix B presents a summary of outcomes of the 2014 risk review process.

9 Bushfire mitigation performance

The following sections provide an assessment of TasNetworks' historical bushfire mitigation performance, typically consisting of an analysis of fire starts.

9.1 Fire start historical occurrence – transmission

Fires started by the transmission system will usually be the result of a fault outage. Except in the case of some minor transient faults (not resulting in outages), all fault investigations incorporate findings from post-fault patrols or during subsequent asset inspections.

TasNetworks' incident investigation and outage databases show that since 2004 TasNetworks transmission network has not initiated any fires. This does not mean that the transmission network cannot start fires. Anecdotal evidence indicates that there may have been fires associated with transmission system faults, although these are very rare occurrences and occurred prior to 2004.

The very rare occurrence rate is largely a function of high reliability asset design and maintenance, and wider clearance of vegetation from transmission network assets through the creation and maintenance of easements, in combination with effective vegetation management.

9.2 Fire start historical occurrence – distribution

Distribution network characteristics differ from the transmission network in some key ways. Unlike transmission lines, distribution lines:

- are located on narrow easements and have substantially closer proximity to vegetation, including the presence of overhanging vegetation, particularly on low voltage lines;
- are suspended at lower heights above the ground and therefore are closer to vegetation, and therefore a wider range of vegetation species that can grow to the height of lines;

- network route length is much longer than the transmission network (approximately tripled) therefore posing greater exposure; and
- are designed to a lower level of design reliability. The transmission network has a higher criticality in terms of supply reliability than the distribution network, and therefore attracts more rigorous maintenance and fault investigation management regimes driven by high reliability management imperatives.

For distribution assets, an analysis of records from TasNetworks' outage management system and incident reporting system was conducted between July 2012 and June 2017 to quantify the number and cause of ground fires initiated by TasNetworks' assets (Reference 6).

Due to improvements in analysis, data from July 2012 onwards is considered to be more reliable than earlier extracts and is the most comprehensive analysis done to date. Whilst data post 2012 shows an increase in fire starts, this is an outcome of improved data rather than a real increase of fire start incidents due to increased focus and training of field staff involved within the reporting process. Pre-2012 data is considered unreliable and therefore is not included within any ongoing statistical or modelling analysis.

With the introduction of mobile computing and field closeout of jobs, further improvements in data integrity and analysis are expected.

Figure 5 and Table 3 presents a summary of causes of overhead distribution network initiated ground fires[10].

Figure 5 Causes of fires initiated by distribution network assets

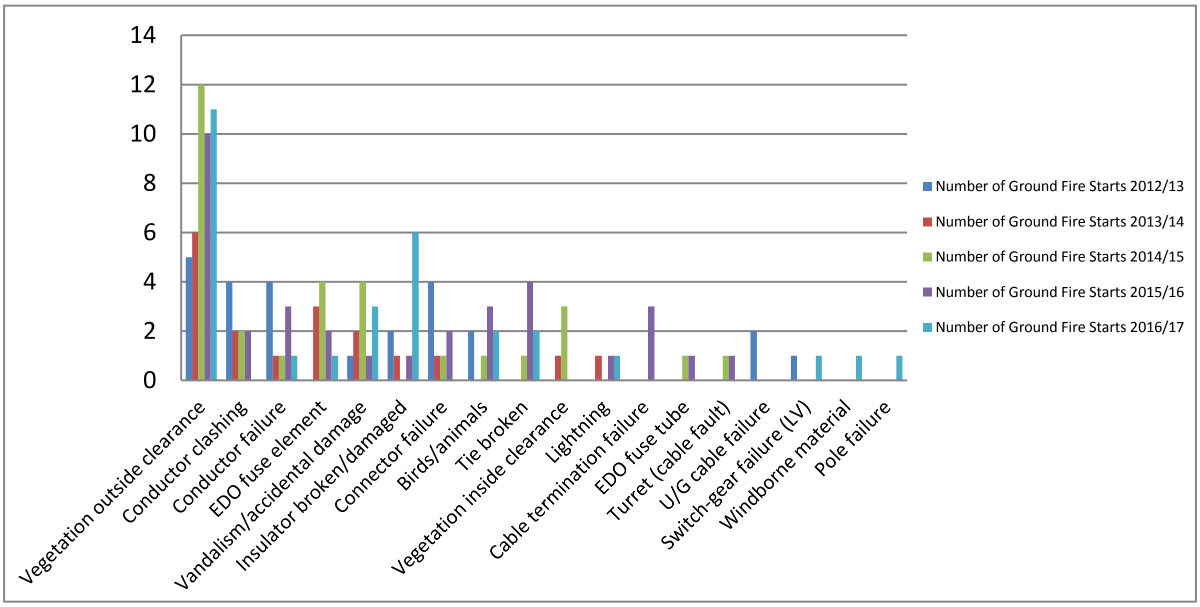


Table 3 Causes of fires initiated by distribution network assets

Fire Cause	Number of Ground Fire Starts						% of Total
	2012/13	2013/14	2014/15	2015/16	2016/17	TOTAL	
Vegetation outside clearance	5	6	12	10	11	**44**	31.9
Conductor clashing	4	2	2	2	0	**10**	7.2
Conductor failure	4	1	1	3	1	**10**	7.2
EDO fuse element	0	3	4	2	1	**10**	7.2
Vandalism/accidental damage	1	2	4	1	3	**11**	8.0

[10] Ground fires are fires that occur at ground level (in grass or vegetation). Pole fires are fires that are contained to the top of the pole and are not generally included within ground fire statistics due to specific conditions resulting in lower risk rankings. In the event that pole fires do cause ground fires, occurances are recorded as ground fires.

Insulator broken/damaged	2	1	0	1	6	**10**	7.2
Connector failure	4	1	1	2	0	**8**	5.8
Birds/animals	2	0	1	3	2	**8**	5.8
Tie broken	0	0	1	4	2	**7**	5.1
Vegetation inside clearance	0	1	3	0	0	**4**	2.9
Lightning	0	1	0	1	1	**3**	2.2
Cable termination failure	0	0	0	3	0	**3**	2.2
EDO fuse tube	0	0	1	1	0	**2**	1.4
Turret (cable fault)	0	0	1	1	0	**2**	1.4
U/G cable failure	2	0	0	0	0	**2**	1.4
Switch-gear failure (LV)	1	0	0	0	1	**2**	1.4
Windborne material	0	0	0	0	1	**1**	0.7
Pole failure	0	0	0	0	1	**1**	0.7
TOTALS	**25**	**18**	**31**	**34**	**30**	**138**	**100**

9.2.1 Distribution fire start summary

Analysis of Figure 5 indicates the following:

- The major cause of fires on the distribution network is vegetation outside clearance (44 fires in 5 years). Vegetation contact outside the clearance space starts approximately 4 times as many fires as the next worst category (conductor clashing).
- Conductor clashing and conductor failure are the next highest fire start category (10 in 5 years).Both these causes had higher occurrences in 2012/13, which was a notably dry summer.
- Significant external causes of fires include vandalism/accidental (11 fires in 5 years) and birds/animals (8 fires in 5 years).

9.3 Fire causation analysis

In this section the key factors involved in each of the major fire cause classes are summarised.

9.3.1 Vegetation

Contact between vegetation and energised transmission or distribution network assets can:

(i) cause an electric shock:

(a) if the vegetation is damp and a person touches it, or

(b) if the contact causes the conductors fall to the ground.

(ii) start a fire:

(a) through clashing conductors causing sparking, or

(b) conductors in contact with dry vegetation, either in the air or on the ground, igniting the vegetation.

(iii) interrupt power supply as a result of the faults caused by phase/phase or phase/earth contacts, and

(iv) cause damage to the powerline through falling branches.

On low voltage distribution networks the issues typically experienced as a result of vegetation contact are:

(i) vegetation contact causing conductors to clash resulting in phase to phase faults, and

(ii) vegetation falling on to conductors and breaking them or dislodging them from insulators resulting in phase to earth faults or phase to phase faults.

On transmission and distribution networks direct contact may not be required to receive a fatal electric shock or start a fire, simply being too close can be a danger.

The issues typically experienced on transmission and distribution networks as a result of vegetation contact are:

(i) clashing conductors causing phase to phase faults;

(ii) branches bridging across two or more conductors causing phase to phase faults;

(iii) vegetation contacting (or coming near to) a single conductor causing phase to earth faults, and

(iv) broken conductors causing phase to earth faults or phase to phase faults.

As wind, temperature, the weight of the conductor and the distance between the poles can cause overhead conductors to swing and sag, the clearance zone between vegetation and conductors needs to take into consideration the dynamic nature of the conductors and the vegetation.

As the fault level (the current expected to flow in a fault scenario) and the danger zone around a conductor vary with the voltage of a powerline, different vegetation management practices are required when managing the risks associated with vegetation around transmission and distribution conductors.

On average, TasNetworks records approximately 500 instances of vegetation related outages on the distribution networks every year with an average of 9 fire starts per year resulting from vegetation. The transmission network has recorded seven vegetation related outages occurring within the last 10 years resulting in zero fire starts.

Vegetation fire causes come in three main categories:

- vegetation which has grown inside the Clearance Zone comes into electrical contact with live conductors (commonly called 'grow-ins');
- vegetation outside the Clearance Zone, in which branches or whole trees fail and fall onto electricity assets (commonly called 'fall-ins'), and
- parts of vegetation outside the Clearance Zone, which detach from the vegetation and are blown by the wind landing on conductors (commonly referred to as 'blow-ins').

Given TasNetworks distribution network's very high exposure to vegetation (227,339 spans with approximately 1 million trees needing to be trimmed per year) the number of grow-in fires is small (four in 4 years).

As noted above, 30% of TasNetworks vegetation-caused fires are from vegetation outside the Clearance Zone. TasNetworks investigates each vegetation fire cause to determine more detailed causal factors (such as blow-in or fall-in, and cause of fall-in). A significant proportion of 'outside clearance' vegetation caused fires are caused from blow-ins (typically at least half) and the prevention of blow-in vegetation is beyond the reasonable ability of Network Service Providers.

The remaining fall-in vegetation is comprised of a mix of live, apparently healthy trees and branches which fail, and other trees and branches which have structural defects (some externally visible, some not). Limited research into fall-in causation has indicated that approximately 75% of fall-ins is from trees with no apparent defect (SP AusNet, 2009). Accordingly, there are significant limits to which the fall-in tree risk can be controlled.

TasNetworks implements a substantial annual vegetation management program aimed at preventing grow-ins and minimising the networks exposure to hazard trees by removing dead and obviously defective trees found during vegetation inspections. The vegetation programs are outlined in Section 10, and strategic planning detail including vegetation program objectives and performance metrics is provided in the Vegetation Asset Management Plan.

9.3.2 Conductor clashing

During high winds or due to moving objects coming into contact with bare overhead conductors, conductors can clash resulting in phase-to-phase faults. These can liberate sparks/molten metal which in some circumstances may still have sufficient heat energy when they fall to ground to start fires in dry vegetation.

Key risk controls include routine asset inspection and maintenance programs to identify and rectify conductors no longer complying with design specifications. Additionally, implementation of a low voltage (**LV**) spreader program is directed to reducing the potential for clashing on the LV network. Conductor clashing prevention programs are outlined in section 10 and strategic planning detail for the LV spreader program is contained in the Conductors and Hardware – Distribution Asset Management Plan (Reference 10).

9.3.3 Conductor failure

In some circumstances, conductors can fail through vibration-caused fatigue, particularly on long spans. Some conductor types including ageing copper and galvanised steel conductor types can be more failure prone than other types. Conductors which fail and fall to ground can generate phase-to-ground faults which can start fires in dry vegetation. They can also cause phase-to-phase faults where the broken conductor comes into contact with another conductor.

Routine asset inspection and maintenance programs to identify and replace ageing conductors and failure prone conductor types are a key risk control. Additionally, installations of vibration dampers on spans prone to vibration induced conductor fatigue are implemented in accordance with the Conductors and Hardware – Distribution Asset Management Plan (Reference 10). Conductor failure prevention programs are outlined in section 10 and strategic planning detail for the vibration damper retrofitting program is also contained the Conductors and Hardware – Distribution Asset Management Plan (Reference 10).

9.3.4 High voltage fuses

Some high voltage (**HV**) fuse designs are prone to initiating fires when they activate in conditions where dry fire-prone vegetation is present around pole bases where HV fuses are present. On TasNetworks distribution network, this risk principally arises from expulsion drop out (**EDO**) fuses.

To address this inherent fuse design risk, TasNetworks is implementing a program to replace EDO fuses with either dropout reclosers or Boric Acid fuses which are not prone to starting fires. EDO fuse replacement programs are outlined in section 10, and program detail is contained in the Overhead Switchgear – Distribution Asset Management Plan (Reference 11).

9.3.5 High voltage loops and links

Electrical joint defects, including those which result in excessive heating in HV loops and links can cause fires if not detected and rectified.

In addition to routine visual inspection processes to identify defects, thermal imaging inspection increases the likelihood that hot loops and links are found for remediation prior to failure. Thermal inspection programs are outlined in section 10, and program detail is contained in the Conductors and Hardware – Distribution Asset Management Plan (Reference 10).

9.3.6 Other asset classes with the potential to cause fire

As outlined during TasNetworks most recent fire cause risk assessment workshop (2014) there is a range of other asset classes which have failure modes which can cause fires under certain circumstances. These asset classes represent a relatively low residual risk of fire causation, and can be effectively managed through routine inspection and maintenance programs. The asset types with failure modes that can cause fires, that are managed through condition centred maintenance programs include:

- HV insulators;
- conductor ties;
- cross arms;
- poles;
- LV switchgear, and
- LV junction boxes.

9.3.7 External fire cause sources

Apart from accidental causes involving members of the public causing asset failures or faults, two other key potential sources of fire are experienced by TasNetworks:

- Birds and animals – Possums and large water birds/birds of prey interact with TasNetworks overhead network, and from time-to-time these interactions can cause fires. While possum guards on poles prevent many animal interactions with overhead conductors, they can only prevent a proportion of such events, it being reasonably common for possums to access the overhead network via service lines connecting to houses. Bird 'diverters' are installed mid span on conductors where instances of mid span contact has been identified on multiple occasions. Mid span contact from swans is typically associated with lines in close proximity to major waterbodies and throughout irrigated areas.
- Vandalism/accidental – The majority of this cause is associated with accidental damage to assets (such as vehicle accidents) whereby the damage has resulted in the failure of assets leading to fires. In the case of vehicle accidents, resultant damage varies widely from broken poles to broken/clashing conductors.

TasNetworks analyses fire start data annually, however the collection of this data is still largely a manual process and, due to relatively small number of fires per annum, the conclusions drawn from it can be subjective. Through its InService upgrade project (ORM) and SAP implementation (Ajilis), TasNetworks is implementing improvements to its processes and systems to improve the quality of this data.

9.4 Summary table of fire causes, risk and mitigation measures

Table 4 below describes mitigation measures in place for each of the major distribution asset categories relating to potential fire starts. Vegetation related outages have been removed from the equation calculating fire start percentages to solely reflect asset failures.

It can be seen the six main causes of potential asset failures equates to 80% of all potential asset related fires, and in turn, relates to 65% of actual ground fires. Risk mitigation programs have been developed to ensure all high and very high risks are addressed through the various measures mentioned within the table.

Table 4 Summary of causes and fire risk (distribution assets)

Percentage of potential ground fires causing sparks, burns, flame, etc. (July 2012 to June 2016)	Percentage of actual ground fires (July 2012 to June 2016	Fire Cause	Fire Risk	Mitigation Measures
Electrical Joints 31%	11%	HV Loops and Links	Very High	Identified through routine inspection and thermal imaging programs
		HV Fittings	Very High	through routine inspection and thermal imaging programs

Conductor Clashing 16%	14%	HV Clashing Conductors	Very High	Addressed through a range of programs including cross arm replacement, asset repair and replace/relocate HV programs
		LV Clashing Conductors	Very High	LV spreader programs addressed through retrofit program
Conductor Failure 16%	11%	Conductor Failure	Very High	Address conductor failure through vibration by retrofitting vibration dampers
		Conductor Failure	Very High	Addressed indirectly through a number of non-bushfire specific programs (refer relevant AMPs) as well as general asset repair. Most failure prone conductors have been targeted under the copper conductor, and galvanised steel conductor replacement programs (the primary driver for these is safety rather than specifically fire mitigation).
		Conductor Tie Failure	Very High	Defects detected through routine inspection program and aerial inspection program
EDO Fuses 16%	13%	HV Fuses	Very High	Program developed to install Boric Acid fuses or dropout reclosers in place of EDO fuses
HV Insulators 10%	6%	HV Insulators	High	Defects detected through routine inspection program
Birds/Animals 9%	9%	Bird and Animals	High	Addressed through installation of bird flappers, retrofit insulating covers and indirectly through Wildlife Endangered Species Protection program (i.e. installation of bird perches)
Total ~ 80%	Total ~ 65%			

For further detail relating to each of the distribution asset categories, please refer to Section 23 for the appropriate asset management plans.

Table 5 Summary of causes and fire risk (transmission assets)

Fire Cause	Fire Risk	Mitigation Measures
Pole Failure	Low	Wood pole renewal programs
Conductor/ Fittings Failure	Low	Conductor Assemblies Replacement Program
Insulator/ Fittings Failure	Low	Insulator Assemblies Replacement Program
Conductor/ Fittings Failure	Low	Defects detected through routine inspection program and aerial inspection program
Insulator/ Fittings Failure	Low	Defects detected through routine inspection program and aerial inspection program

For further detail relating to each of the transmission asset categories, please refer to Section 23 for the appropriate asset management plans.

9.5 Outage to ground fire conversion rates

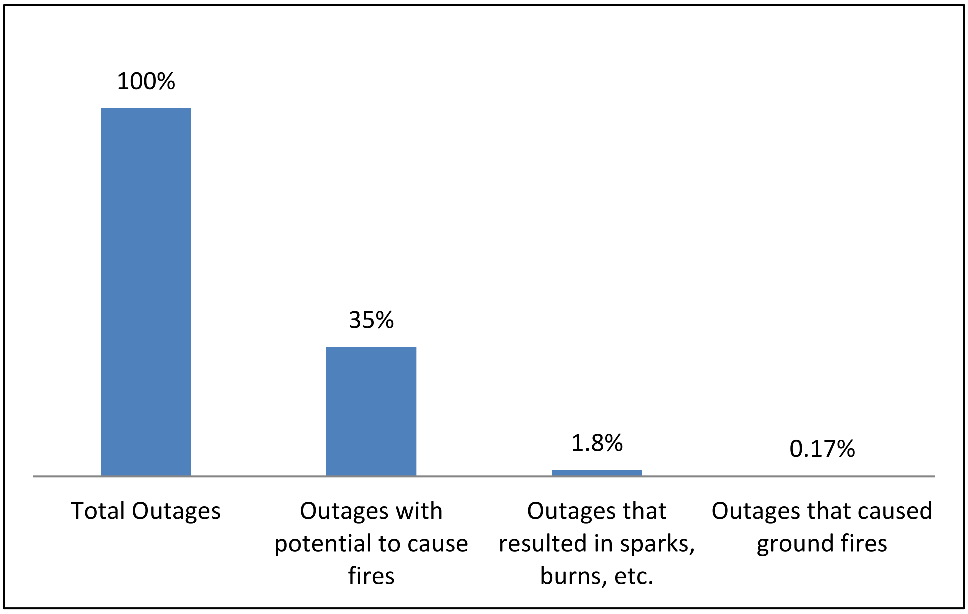
Further analysis of outage data compared to fire start data (from July 2012 to June 2015[11]) demonstrates the small numbers of fire starts compared to total number of faults experienced on the networks.

This data is shown within Table 6 and Figure 6 below.

Table 6 Number of outages versus number of fires (July 2012 to June 2015)

Sum of Total Outages	Sum of Outages - Some Fire Potential	Sum of Actual Potential Fires	Sum of Actual Ground Fires
40,960	14,399	724	68

Figure 6 Percentage of outages versus percentage of fires (July 2012 to June 2015)



[11] Most recent analysis completed at the time of writing this document.

9.6 Bushfire mitigation program effectiveness evaluation

Whilst the causes of asset related fires (Figure 4 and Table 3) is instructive in determining associated network risks, reliance on the number of fires caused per annum as a benchmark or indicator of program effectiveness can be misleading given the relatively small number of fires experienced per annum. Seasonal variation can have a significant effect on the number of fires experienced/reported each year. In rainfall deficit years when particularly dry summer conditions are in place, it can reasonably be expected that a higher conversion rate of potentially fire-causing faults to actual fires may occur, simply because environmental conditions are more conducive to fire ignition. As highlighted by the Victorian Bushfires Royal Commission (2009), days on which the fire danger index reaches Total Fire Ban levels, and particularly the worst days at or near the 'Catastrophic' fire danger rating, can result in substantially increased electricity-caused fire occurrence (relative to annualised averages rates of fire occurrence). Very strong winds associated with these worst-case days, in conjunction with dry, highly fire conducive conditions are the main contributing factors to this. Accordingly, inter-annual trends need to be interpreted in the context of the seasonal conditions.

9.6.1 Bushfire mitigation performance metrics

In 2018, TasNetworks is undertaking a review of performance metrics for bushfire mitigation. In addition to lagging indicators already routinely collected, improved leading BM indicators are currently being developed.

TasNetworks has already established a system of leading and lagging indicators for its vegetation management program, which are detailed in the Vegetation Asset Management Plan (Reference 7).

The design of the new bushfire mitigation performance metrics system is to enable visibility not only of the 'after-the-event' program impacts (numbers of fires), but also the leading indicators which relate to exposure levels. The intention is to maintain visibility of trends in asset types/conditions that historically have been TasNetworks more significant causes of fires. For example, the following indicators are under consideration:

Table 7 System of bushfire mitigation leading indicators under consideration

Fire cause	Leading indicator type	What it indicates
Vegetation inside clearance	P1, P30 and P180 annual occurrence	Find rates in the vegetation condition codes most likely to lead to contact. If inter-annual trends are decreasing, risk exposure is decreasing
Vegetation outside clearance	Hazard trees – Urgent Hazard trees – Standard	After an initial peak find period upon program commencement, there should be a subsequent decline in find rates which indicates declining risk exposure
Conductor clashing	Cumulative number of LV spreaders installed Number of LV spans in HBLCA remaining without spreaders	Increasing installation total, and decreasing number of outstanding spans indicates decreasing risk exposure

Fire cause	Leading indicator type	What it indicates
Conductor failure	Number of high vibration risk spans without retrofitted vibration dampers Number of most failure prone conductor types still in service	Declining numbers remaining indicate declining risk exposure.
EDO fuses	Number of EDO fuses still in service	Declining numbers indicate declining risk exposure.
HV loops and links	Hot HV loops and links detection made during inspections	Declining numbers indicating problem loops/links being remedied and exposure reduced.

The bushfire mitigation performance indicators will be evaluated and reported on annually, with inter-annual trends identified, and commentary provided on what the observed data and trends are indicating.

From July 2017 TasNetworks has begun to include measures (ideally, seeing a reduction) of '*outages with the potential to cause fires'* as an indicator of program effectiveness for individual program of work sub categories.

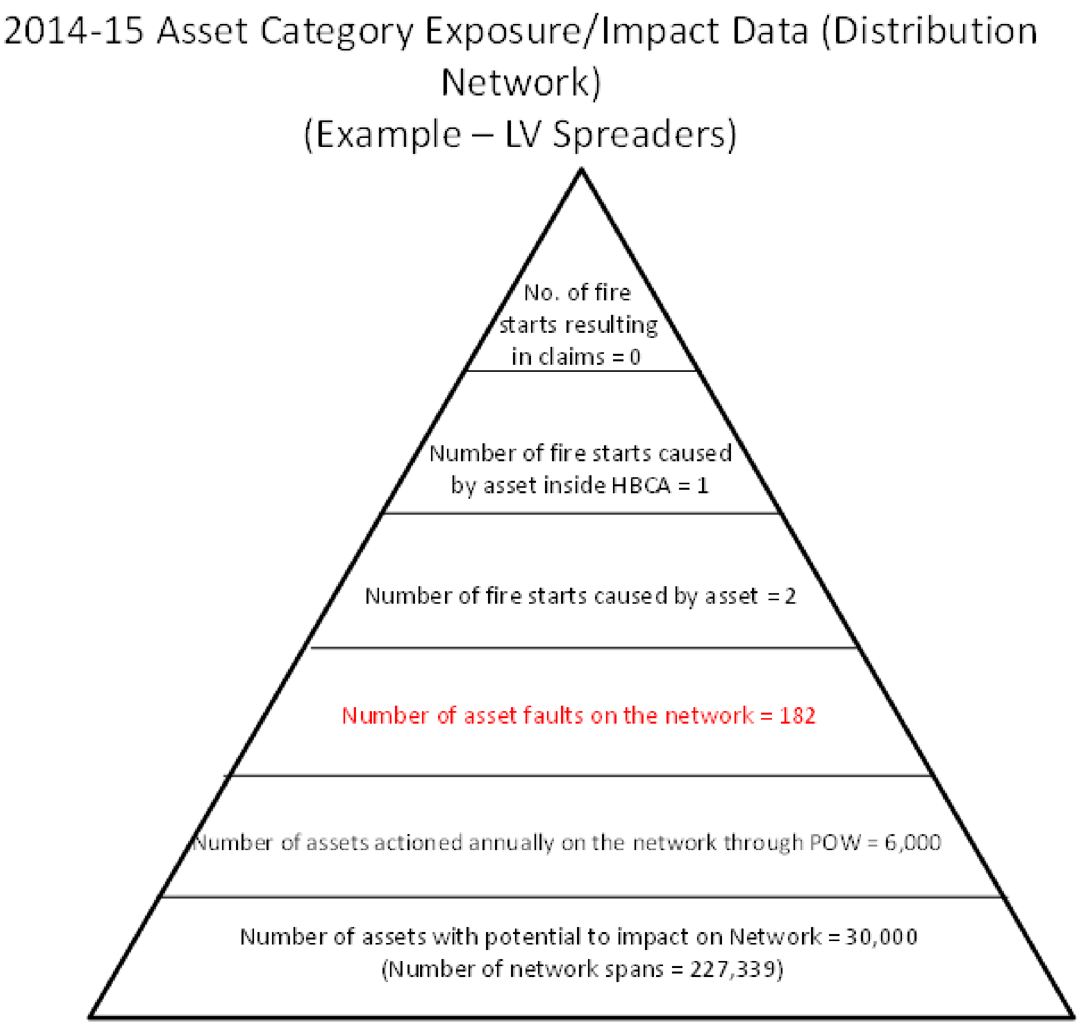
For example, the effectiveness of the program of work created to install LV spreaders can be measured by volume variance of cause codes relating to LV conductor clashing (as shown in Figure 7 below). That is to say a reduction in outages caused by clashing LV conductor over time would be an indicator of positive program effectiveness.

It is feasible that once programs of work have been fully quantified and set, outage targets may also be set for each relevant program of work. Such targets have not been determined to date, but outcomes will be monitored for future benchmarking purposes.

The following example of an exposure-impact pyramid analysis demonstrates that the network is exposed to a relatively large number of assets with the potential to impact on the network and that some related faults have resulted in fire starts. Subsequent outcomes of risk reviews have heighted the requirement to develop a risk management plan to specifically address this risk. Risk management plans typically result in the development of prioritised programs of work to mitigate the risks (in this instance, the program of work focusses on the installation of LV spreaders).

Similar exposure-impact pyramids have been established for all programs of work aimed at bushfire mitigation for both transmission and distribution projects.

Figure 7 Exposure/impact of asset related outages



9.7 Fire start investigation

TasNetworks' risk management system is the primary system used for recording incidents occurring on, or associated with the network. The risk management system ranks risks associated with all incidents and accidents and risk rankings will determine the level of investigation required for each incident. Notwithstanding the risk ranking outcome, TasNetworks undertakes investigation of all ground fire events that occur in relation to both transmission and distribution networks. The level of investigation for incidents that have the potential to cause fires will be determined by the incident's risk ranking.

9.8 Benchmarking

TasNetworks is continually improving the tools and processes by which it collects fire start data. The data collected then allows TasNetworks to benchmark results with other local and interstate counterparts or agencies where data is compatible.

It is important that performance and outcomes of bushfire mitigation strategies and plans are monitored and measured to ensure compliance and enable continuous improvement opportunities.

TasNetworks' suite of bushfire mitigation performance measures are aligned with the bushfire mitigation objectives.

The indicators have been developed to enable TasNetworks to measure:

- preparation leading into each bushfire season;
- performance throughout the bushfire season; and
- long term trends within Tasmania.

The indicators are developed through three main sources, being:

- the Bushfire Mitigation reporting dashboard;
- TasNetworks' asset register (which incorporates fault data); and
- Australian Incident Reporting System (AIRS) data, via the Tasmanian Fire Service.

9.8.1 Bushfire mitigation reporting dashboard

The bushfire mitigation reporting dashboard is a summary of progress of key inspection and maintenance activities undertaken.

The dashboard shows a summary of bushfire-related OPEX and CAPEX programs and includes:

- volumes planned;
- volumes achieved; and
- budget status.

Additional levels of reporting detail are available to enable stakeholders to 'drill down' into each reporting category to view additional information for individual items of interest.

An example of the bushfire mitigation reporting dashboard is shown in Figure 8.

Figure 8 Bushfire mitigation reporting dashboard

CAPEX Programs

Decrciption	Network	Measure	Volume Health Indicator	Cost Health Indicator	
Copper (CU) Conductor Replacement Program	Distribution	Spans	Green	Green	–
Galvanised Iron (GI) Conductor Replacement Program	Distribution	Spans	Green	Amber	↓
Install Vibration Damper Program	Distribution	Spans	Green	Amber	↓
Air Break Switch Replacement Program	Distribution	Sites	Green	Green	–
Install LV Fuse Links Program	Distribution	Sites	Amber	Amber	↓
Conductor Clashing (LV spreader retrofit) Program	Distribution	Spans	Green	Amber	↓
Conductor Clashing (LV cross arms) Program	Distribution	Spans	Amber	Red	↑
Live Line Clamp Program	Distribution	Sites	Amber	Amber	↓
Bird/Animal Mitigation Program	Distribution	Sites	Amber	Amber	↓
Conductor Assemblies Replacement Program	Transmission	Sites	Green	Green	–
Insulator Assemblies Replacement Program	Transmission	Sites	Green	Green	–
Conductor Fittings Program	Transmission	Sites	Amber	Amber	↓
Insulator Fittings Program	Transmission	Sites	Amber	Amber	↓

OPEX Programs

Decrciption	Network	Area	Volume Health Indicator	Cost Health Indicator	
Asset Inspections - Structures	Distribution	HBCA	Green	Green	–
Asset Inspections - Attachments	Distribution	HBCA	Green	Green	–
Vegetation Inspections	Distribution	HBCA	Green	Green	–
Asset Inspections - Structures	Transmission	All	Green	Green	–
Asset Inspections - Attachments	Transmission	All	Green	Green	–
Vegetation Inspections	Transmission	All	Green	Green	–
Asset Maintenance - Structures	Distribution	HBCA	Green	Green	–
Asset Maintenance - Attachments	Distribution	HBCA	Green	Green	–
Vegetation Maintenance	Distribution	HBCA	Green	Amber	↓
Asset Maintenance - Structures	Transmission	All	Green	Green	–
Asset Maintenance - Attachments	Transmission	All	Green	Green	–
Vegetation Maintenance	Transmission	All	Green	Green	–

Commentary:

CAPEX -LV Corss arm replacement project volumes 10% down and cost 30% above budget - Review of current works program underway. Resolution due prior to end of October 2016.

OPEX - NA

LEGEND

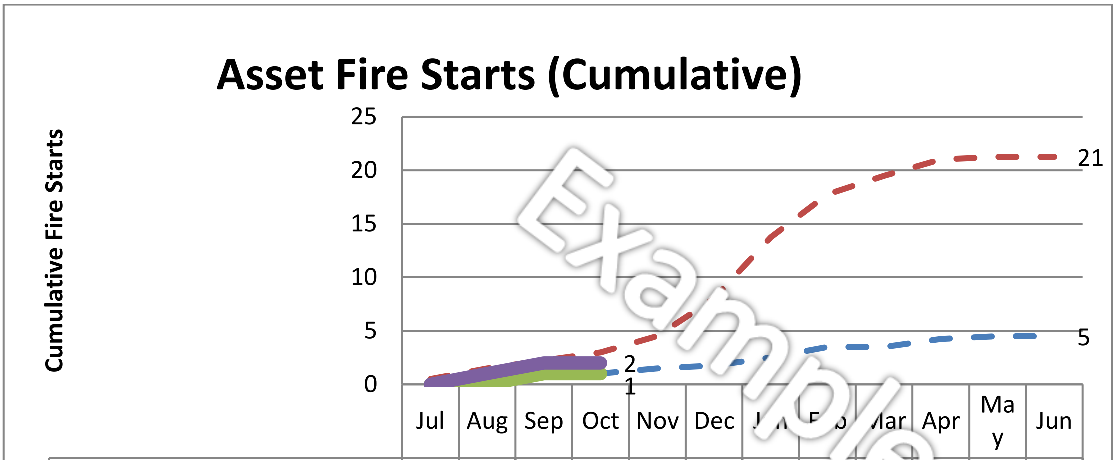
Green	On Target (>95%)
Amber	Expected to be favourable at project end (>80% - <95%)
Red	At risk to be unfavorable at project end (<80%)

9.8.2 Annual count of fires caused by electrical assets compared to longer term annual average

TasNetworks also benchmarks performance of the number of ground fires experienced per year against historical annual averages.

Records are separated for fires that occur inside and outside the high bushfire consequence area.

Figure 9 Asset fire starts compared to longer term annual average

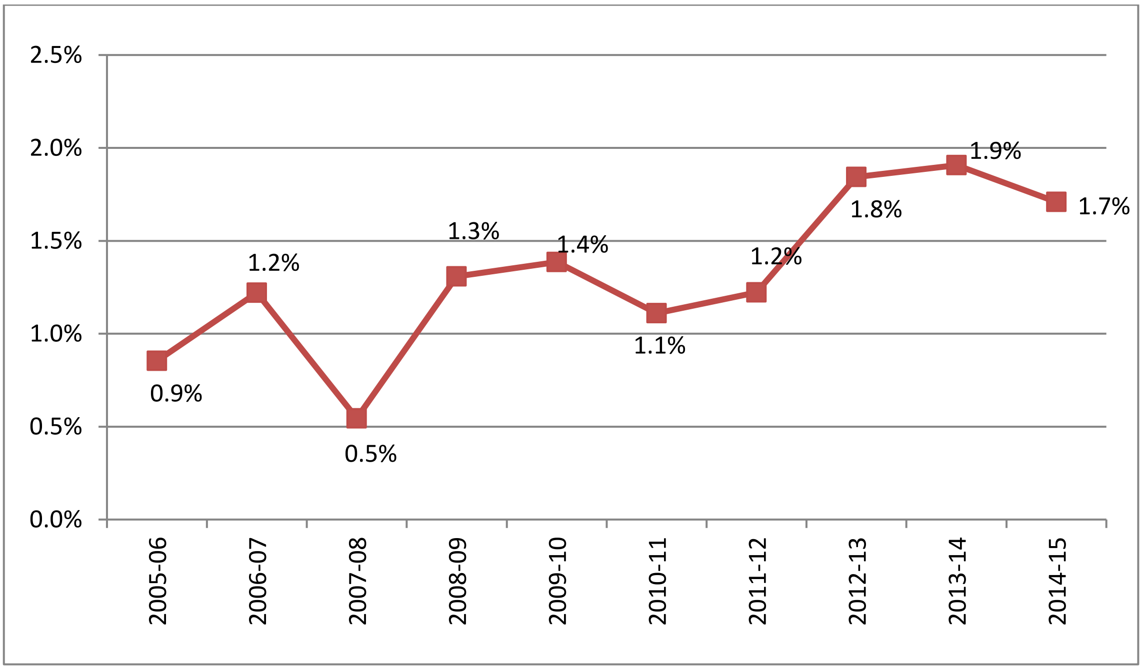


	Jul	Aug	Sep	Oct	Nov	Dec	[illegible]	[illegible]	[illegible]	Apr	May	Jun
Past Four Years Average Inside HBCA	0	1	1	1	2	2	3	4	[illegible]	4	5	5
Past Four Years Average Outside HBCA	1	2	2	3	5	8	14	18	20	21	21	21
2016-17 Inside HBCA	0	0	1	1								
2016-17 Outside HBCA	0	1	2	2								

9.8.3 Fires caused by electrical assets as % of total vegetation fires attended by TFS

The AIRs data provided by TFS shows all fires started by TasNetworks' assets (as recorded by TFS) as well as TFS bushfire attendances (distribution asset fire data is also cross referenced with TasNetworks outage data). This data enables TasNetworks to measure the ratio of bushfires started by distribution assets in Tasmania as a percentage of all bushfires started within Tasmania. Figure 10 shows the percentage of vegetation fires attended by TFS that were caused by distribution electrical infrastructure.

Figure 10 Fires caused by electrical assets as % of total vegetation fires attended by TFS



As this indicator compares against the total number of bushfires attended by TFS annually, it also includes the usual seasonal variations seen from year-to-year whereby extended periods of drought or wetter than usual years will have a positive or negative impact upon the total number of bushfires experienced across the State.

Monthly, annual, and long term (10 year) averages allows TasNetworks to analyse bushfire starts by asset within the Tasmanian context.

The national average for number of vegetation fires started by distribution power lines is quoted as between 1% to 4% of all vegetation fires, (reference from VBRC). Using the data provided by the TFS, TasNetworks has averaged 1.3% over the last ten years, which is favourable when compared to the national average.

9.9 Bushfire mitigation work program progress reporting

The monthly bushfire mitigation report enables managers to maintain a consolidated overview of critical activities that are carried out as part of the annual program of works.

Bushfire mitigation progress reports are included within TasNetworks Monthly Performance Reports from October through until March each bushfire season.

Two key Board papers form part of the rolling Board agenda; a pre-summer preparedness report is presented in October, and a post bushfire season report is presented in May. Additional Board reports relating to bushfire mitigation activities are not uncommon (particularly during unseasonably dry or high risk years) and are developed and presented at Board meetings as required.

10 Bushfire mitigation programs of work

There are various mitigation programs that TasNetworks implements on its Networks to mitigate the risk of bushfire or more specifically fire ignition. These programs are outlined in this section.

Greater detail relating to the programs can be found within each relevant Asset Management Plan.

10.1 Vegetation management strategy – outline

Due to the types of asset failures that it causes, vegetation related fire starts are considered an extreme fire risk to TasNetworks. Accordingly, a specific vegetation management program has been developed and operated by a dedicated team within TasNetworks.

TasNetworks conducts a vegetation clearing program that is aimed to achieve code compliance as required by Chapter 8A of the TEC and as defined within the Transmission Vegetation Clearance Standard (Appendix B of the Vegetation Asset Management Plan (VAMP)).

In addition to the clearing program, on an annual basis between 1 September and 31 December, 3,300km of rural distribution feeders within the HBLCA are patrolled and cleared of vegetation that has grown too close to powerlines.

The annual pre-summer inspection process is designed to ensure unseasonal re-growth events that may occur between cycles are identified and cleared prior to the onset of the bushfire season. The pre-summer program also acts as an additional check of programmed works that occurred within the HBLCA throughout the year.

The key programs and core activities which collectively comprise TasNetworks' vegetation management strategy as outlined in the VAMP are:

(i) Vegetation inventory - Acquire and maintain a quantitative and qualitative understanding of the network's exposure to vegetation and factors affecting network vegetation exposure.

(ii) **Asset creation/reconfiguration** - When creating new network assets or considering reconfiguration of existing assets, assess and consider vegetation management costs, as part of whole-of-life cost assessment in selecting investment strategy.

(iii) **Vegetation inspection** - Inspect network assets to find vegetation requiring action – inspect on a cycle appropriate to vegetation growth dynamics and risk, and in step with associated vegetation cutting/treatment works program requirements.

(iv) **Vegetation works prioritisation** - Prioritise vegetation identified as requiring action on the basis of risk, and develop efficient work schedules for actioning vegetation.

(v) **External notification -** Notify responsible parties/owners of vegetation that is not TasNetworks responsibility to clear, of their obligations to clear vegetation in accordance with relevant standards.

(vi) **Action vegetation clearance works** - Action vegetation using effective treatment methods, to maintain vegetation clearance compliance, and maintain stable or reducing forward work cycle volumes.

(vii) **Works program data capture** - Collect and manage vegetation action works data in a form that supports assessment and forecasting of future work volumes and budget forecasting.

(viii) **Audit works compliance and effectiveness** - Implement an audit program to provide inspection and clearance works quality assurance and influence appropriate contractor behaviour/performance.

(ix) **Monitor, evaluate and report** - on the performance of the tactical and operational work programs in achieving vegetation management program delivery, and objectives.

A high level overview for each of the program/core activities (above) is provided at section 13 of the VAMP. More detailed information pertaining to vegetation management program design and implementation (for the above key program and core activities) is contained in the Vegetation Operational Management Plan (**VOMP**).

10.2 Distribution network vegetation management imperatives

The vegetation management strategy developed for vegetation in proximity to the distribution network is to achieve an ongoing sustainable vegetation clearing regime. The regime will initially reduce, and then maintain risk to an acceptable level within the power line easement. The implementation of the strategy has been prioritised to:

- initially reduce risk through the sufficient removal rates of vegetation to ensure the vegetation management objectives are met as soon as practicable, with decreasing workloads (and therefore costs) into the future;
- achieve an annual workload that is predictable, consistent and sustainably manageable whilst meeting all legislative and regulatory obligations, at the lowest sustainable cost;
- maintain vegetation clearance compliance with TEC Chapter 8A; and
- formalise a structured program of reducing the hazard tree population to which the network is exposed.

Vegetation management objectives and performance indicators for the distribution network are set out in the VAMP. Achieving the longer term objectives in relation to reducing the future volume of recurrent vegetation management woks is heavily influenced by the amount of vegetation that can be removed from within power line easements over a series of visits, such that the removal rate of at-risk vegetation is greater than the rate at which it can regenerate over the same time period.

10.3 Transmission network vegetation management imperatives

The vegetation management strategy developed for vegetation in proximity to the transmission network is to continue to implement an ongoing sustainable vegetation clearing regime.

The regime will continue to maintain risk at an acceptable level within the power line easement.

The implementation of the strategy has been prioritised such that:

- there will be a consistent, state-wide approach to vegetation management;
- historical vegetation clearances in existing easements will be maintained, to continue to maintain the successful degree of risk management achieved in the past,
- vegetation defects are removed in timeframes according to their respective priorities;
- an accurate register of vegetation defects is maintained;
- risks will continue to be managed through the annual pre-bushfire vegetation management program; and
- continuation of the effective auditing and review regime and established key performance indicators, focused on ensuring the vegetation management objectives are achieved on a sustained basis, and that works are undertaken safely.

Further detail regarding TasNetworks' vegetation management program can be found within the VAMP and the VOMP (References 7 and 8).

10.4 Overhead supply network asset management

There is a fundamental requirement for TasNetworks to periodically inspect its assets to appropriately and effectively target preventative maintenance programs and to ensure the physical state and condition of the asset does not represent a hazard to the public.

Other than visiting the assets, there is no other economic solution to satisfy this requirement as online condition monitoring techniques are not economically feasible for overhead system assets.

Land based inspection is the only practical way to monitor transmission tower footings and decay rates in poles, but various monitoring techniques can be utilised for other overhead system assets. Aerial and land based surveys of conductors, fixtures and switchgear are both possible.

Corrective maintenance on poles (i.e. replacing a pole after it has failed) incurs a considerably higher cost than preventative maintenance (i.e. replacing or staking a pole prior to failure) and can impact consumer service levels significantly. Given that weather conditions exceed design standards from time to time, a portion of corrective maintenance is always expected. The key trade-off TasNetworks monitors is the cost incurred inspecting poles versus the premium incurred from corrective maintenance, and more importantly the level of impact on consumer service levels.

For some assets such as surge arrestors and overhead LV aerial bundled cables (ABC), deterioration of components are very difficult to identify and/or provide preventative maintenance strategies. In these situations corrective maintenance and/or programmed asset replacement is a viable alternative (subject to assessing fire and other risk factors).

10.4.1 Equipment and design standards

While routine and non-routine maintenance activities can significantly reduce the likelihood of fire ignition for existing assets, a significant strategy in the mitigation of bushfire risk is to ensure that the network is initially built to a standard that will minimise the risk of TasNetworks' assets initiating fires.

To drive operational efficiencies, selection of the best available assets and standardisation across the network is a key element to driving down TasNetworks' operating costs. In addition to achieving purchasing savings through economies of scale, if a structured approach is taken spares management, maintenance practices and operating procedures can all be simplified.

TasNetworks maintains a set of technical specifications to control the nature and type of assets being purchased for deployment into the network. These specifications include 'fire-safe' alternatives to be used in fire danger areas.

TasNetworks' design and construction standards and planning manuals provide details on how this equipment is to be deployed in the network.

10.4.2 Routine maintenance (distribution)

There are several routine inspection programs relevant to bushfire mitigation which all aim to detect defects before they develop into major faults. These preventive maintenance strategies have been created within the asset management system. This system generates time based work orders for inspection and maintenance planning. A summary of routine distribution maintenance programs can be found within the Overhead Line Structures – Distribution Asset Management Plan (Reference 9).

All programs are supported by the Network Procedure (NP R AM 03) Identification and Management of Overhead Line Defects (Reference 13) which describes defect management procedures for asset component defects.

NP R AM 03 covers:

- identification;
- recording;
- assigning of priorities; and
- timeframes for repair.

It also lists those defects that present a fire risk, which are then assessed against predetermined criteria to determine their risk and prioritised for remedial action.

10.4.3 Non-routine maintenance (distribution)

TasNetworks' general asset repair program covers the repair of minor defects that have been identified and have the potential to cause asset failure in the future or shorten the expected life of the asset. Public risk and reliability are the main drivers.

The majority of these defects are reported through the routine line inspection program and include minor work involving asset repair such as re-fixing loose material, replacing possum guards, removing operating platforms, as well as repairs of defects linked to high fire risks.

In addition TasNetworks' Fault/Call Centre receives ad hoc asset and vegetation defect reports from employees and the public that are managed as per the defect priority in NP R AM 03.

More details of these programs can be found within the Overhead Line Structures – Distribution Asset Management Plan (Reference 9).

10.4.4 Proposed CAPEX plan (distribution)

Table 12 Overhead system CAPEX unit volumes

Bushfire mitigation works programs	Unit measure	2017-18 Units	2018-19 Units	2019-20 Units	2020-21 Units	2021-22 Units	2022-23 Units	2023-24 Units
Live Line Clamp Program	pole	150	150	150	150	150	150	150
Install single phase reclosers for SWER	site	4	4	4	4	4	4	4
Replace/relocate open wire HV with insulated alternative	span	5	5	227	227	227	227	227
Replace HV connectors within 2km of zone substations	site	0	0	18.3	18.3	18.3	-	-
Conductor Clashing (LV spreader retrofit) Program	span	1,000	1,000	400	400	400	400	400
Conductor Clashing (LV cross arms) Program	crossarm	305	305	83	83	83	83	83
Install Vibration Damper Program	pole	500	500	75	75	75	75	75
Copper (CU) Conductor Replacement Program	km	20	20	20	20	20	20	20
Galvanised Iron (GI) Conductor Replacement Program	km	11	11	36	36	36	14	14
Aluminium (Al) Conductor Replacement Program	km	9	9	12	12	12	5	5
Replace HV ABC	span	-	-	Na*	Na*	Na*	Na*	Na*
HV fuse replacement program	sites	500	500	500	500	500	500	500
Bird/Animal Mitigation Program	span	125	125	Na*	Na*	Na*	Na*	Na*
Install LV Fuse Links Program	pole	163	50	50	50	50	50	50

- Bushfire mitigation program will be completed as part of the general overhead program of work post 2018-19.

10.5 Asset management (transmission)

Transmission assets are designed and constructed to higher levels of security and reliability than distribution assets. For this reason vegetation inspections and subsequent clearing or removal (Section 10.3) of vegetation from around transmission assets is the primary form of bushfire risk mitigation employed by TasNetworks.

However, several transmission asset management programs are in place that ensure safety and supply reliability, while also providing some level of mitigation against bushfire ignition.

There are no operational or capital programs of work applied to the transmission network specifically for the purposes of bushfire risk mitigation.

Programs that assist in risk mitigation include:

- wood pole replacements with steel poles;
- K-pole replacements;
- renewal of conductor assemblies;
- renewal of insulator assemblies;
- renewal of support assemblies;
- tower foundation refurbishment and renewal, and
- routine asset inspections.

11 Bushfire mitigation work programs responsibilities

11.1 End-to-end (E2E) works program management process

The rolling works program lists the schedule of proposed and committed works over a minimum rolling seven year period. Projects within the works program are executed through the utilisation of a staged, whole-of-lifecycle process – the end to end works program management (E2E) process. The objective of the E2E process is to provide an efficient process that complies with the governance of the gated investment process.

This process applies to the management of all works through the project lifecycle.

11.2 Empowered services

The organisational structure of TasNetworks was established to support an empowered services operating model. The end to end works management process has been developed to align with this model and to allow respective groups within TasNetworks to focus on their core accountabilities. Marchment Hill defined the empowered services operating model as:

“Works Management is combined with Works Delivery which is subsequently empowered to decide how the program is actually delivered. Asset Management has a relatively narrow functional remit, focussing its efforts entirely on developing strategic asset management related priorities and the definition of what work needs to be undertaken, and by when.”

TasNetworks has interpreted the empowered services operating model through a business structure with the following key themes.

- Strategic Asset Management (SAM)

  - Focus is on needs assessments and strategy development
  - Determines what works/programs should be delivered, and by when
  - Prioritisation of works program
  - Not 'distracted' by delivery of works
- Works and Service Delivery (W&SD)
  - Acts as Asset Steward for TasNetworks
  - Implements the programs and strategies set by SAM
  - Interpret, deliver and resource works that have been identified by SAM

11.3 Process roles

The Programming and Planning group within W&SD has overall responsibility for the rolling works program. This responsibility includes visibility of the works across the entire process:

- both capital and operational works.
- all network works – both transmission and distribution.

There are two specific works roles that are assigned through the process:

- Works Initiators (SAM) - responsible for entering works into the rolling works program in line with developed strategies, and
- Works Owners (W&SD) - responsible for developing and implementing works adhering to the strategies and functional specifications.

11.4 Works initiator (SAM)

The works initiator is a subject matter expert and is expected to understand the drivers for a particular portion of the program. In the process, the works initiator is responsible for undertaking the options analysis and developing works into an approved strategic program for inclusion in the forward rolling works program. The works initiator is the business point of contact for works until they achieve investment approval and are entered into the rolling works program.

The works initiator is responsible for:

- utilising the consultation matrix to assist with understanding the stakeholder group for the works and appropriately consulting the stakeholder group;
- providing the inputs for the works to enter the strategic prioritisation;
- obtaining the necessary strategic investment approval of the works;
- providing the works definitions and justifications for submissions to the Australian Energy Regulator, and
- submitting the functional specification for the works.

As a subject matter expert, the works initiator may have identified the needs and developed the initial strategies also.

11.5 Works owner (W&SD)

A works owner is assigned for each of the items in the rolling works program. This person is responsible for seeing the works progressed through the development and funding stages to delivery. The works owner is the business point of contact for the works once it has entered the development phase through to completion. In particular the works owner is responsible for:

- confirming the stakeholder group and ensuring the appropriate consultation is maintained;
- developing the technical specifications for how work will be progressed, detailing how the requirements of the functional specification will be met;
- development of the delivery strategy;
- management of the works delivery team;
- gaining customer agreement/approval – for internal driven works, the customer agreement is referred to SAM;
- gaining funding approval for the works;
- progressing the works through to completion, and
- completing the works review and the works close-out.

11.6 Governance and Risk Assessment Team

The purpose of the Governance and Risk Assessment Team (GRAT) is to assist the W&SD General Manager in providing the appropriate corporate governance and oversight responsibilities in relation to the delivery of the network works programs.

The function of the GRAT is to take responsibility for the business issues associated with the delivery strategies for both capital and operational works programs. The GRAT is responsible for approving delivery strategies, defining delivery benefits, and monitoring the health of program delivery risks, quality and timeliness. The team is made up of the following representatives:

- Project Delivery and Contracts Group Leader;
- Engineering and Design Group Leader;
- Program Coordinating and Reporting Team Leader;
- Asset Engineering Leader (Primary);
- Asset Engineering Leader (Secondary);
- Major Works Delivery Team Leader;
- Contract Performance and Delivery Team Leader (if applicable);
- Minor Works Delivery Team Leader (if applicable); and

Further detail regarding the E2E process can be found within End to End Works Management Process (Reference 17).

12 Management of private powerlines

Private power lines and poles extend from the:

(i) Network Service Provider's (**NSP)** (TasNetworks’) point of supply, to the point of attachment on the owner's building, pump shed or pole mounted meter and the like. Please note, the point of supply is usually at the first pole (on private land) off the NSPs low voltage feeder, and

(ii) Owner's building to out buildings, pumps and the like.

The owner will be aware that due to the effects of exposure, weather and ground conditions, powerlines and poles degrade, rot and they can fail. If they fail, there are the extreme risks of damage to life and/or property, from:

- fire and bush fires
- electric shock
- electrocution and
- being struck by falling objects.

To manage the safety aspects and above responsibilities associated with all private overhead powerlines and poles, they need to be inspected, tested and certified as 'safe and fit for purpose' on a routine basis. Currently, TasNetworks is inspecting private overhead line and poles up to the customer's metering position, at the same we inspect our own overhead powerlines and poles in the area, and this is performed every;

- 3½ years for natural wooden poles and
- 5 years for all other poles.

The inspection and testing of the overhead powerline and poles etc. may identify maintenance or rectification work to be undertaken. This may include the replacement of the pole, cross-arms, insulators, conductors, or associated fittings and this electrical work must also be performed by a licensed and suitable competent electrical contractor. The inspection may also identify the need for vegetation in the vicinity of the overhead powerlines lines and poles to be trimmed or removed, to maintain a safe clearance from the overhead assets.

If the overhead powerline and poles are not 'safe and fit for purpose', TasNetworks is entitled to disconnect the power supply in the interests of safety to their employee, members of the public and property owners.

The arrangement whereby TasNetworks inspects private powerlines is currently under review and it is expected that a final decision to either cease or continue this practice indefinitely will be made in the foreseeable future. These inspections are presently unfunded by the Regulator or the customer and are therefore internally funded. The 2015-16 cost associated with inspection of private powerlines was approximately $600,000.

Defects identified by TasNetworks on private powerlines are forwarded to the Electrical Safety and Standards (ESS) group within the Justice Department.

ESS is responsible for the issuing of all defect notices and management of corrective actions.

13 New technologies/initiatives

13.1 External

TasNetworks has been actively involved with the Energy Networks Association (ENA) bushfire workshops and various other industry groups that have exposed TasNetworks to new and emerging technology and management processes throughout the industry.

Some technologies have already been trialled and implemented within TasNetworks (such as PHOENIX bushfire modelling, Fault Tamers and ‘Fuse Saver’ protection systems).

Other emerging technology and management processes currently implemented or under trial by interstate DNSPs include:

- Light Detection And Ranging (LiDAR) technology;
- new insulated conductors (Hendrix cable);
- new insulation for retrofit onto existing bare conductor;

- alternative distribution poles;
- intumescent paint of CCA treated natural wood poles;
- faster acting protection systems;
- trials of single phase reclosers for SWER systems;
- improved asset inspection techniques;
- benchmarking initiatives, and
- improved management processes on TFB days.

TasNetworks will continue to monitor the progress of these developments and continue trials in areas where it is thought such technology could benefit TasNetworks' circumstances.

13.2 Internal

A process of continuous improvement within TasNetworks has identified a number of aspects of its bushfire mitigation strategy that requires review and potential improvement. These include:

- review HBLCA boundaries and underlying modelling, considering high soil dryness experienced on the central east coast in recent years;
- verify appropriateness of FDI triggers to ensure that the approach adopted interstate on total fire ban days is still relevant to the Tasmanian environment;
- review whether there is a need for additional bushfire risk mitigation activities for vegetation/assets in the vicinity of transmission lines in the HBLCA;
- review the BPI reporting framework to ensure bushfire preparedness continues to be reported in the most effective manner, and
- explore alternative pole types (other than timber) for improved performance during bushfires.

14 Liaison with other organisations

Several meetings between TasNetworks and other key agencies (including TFS, SES, DEIR and BoM) highlighted the requirement for formal pre-bushfire season meetings to:

- discuss relevant developments within each agency;
- to ensure each agency understands the high level strategies that will be applied during the bushfire season, and
- to confirm communication methods and processes to be utilised during the bushfire season.

Meetings have been occurring annually in September and are scheduled into TasNetworks' Bushfire Mitigation Calendar of Events (Appendix C).

15 Operational and system activities triggered by declaration of a Total Fire Ban (TFB) day

The Control Room *Total Fire Ban Procedure* (DOP-002) details the actions to be taken on the distribution network by the Control Room in the event of the declaration of a Day of Total Fire Ban.

The procedure includes detail regarding:

- pre bushfire season SCADA testing for communication devices;

- process for disabling distribution auto reclosers;
- busbar switching at Scottsdale substation on TFB days to lower fault current and resultant induced conductor galloping[12] and EDO melt sparking;
- communications with TFS;
- internal notification and advice;
- TFB day initiation/cancellation of activities;
- flow chart of activities, and
- responsibilities.

No other specific actions are taken in relation to the transmission network unless individual lines are likely to be threatened by bushfires (or similar adverse weather conditions), in which case the Australian Energy Market Operator (AEMO) may need to be notified of vulnerable circuits and contingencies put in place. Further information relating to Transmission lines may be found within document TNO-107 '*Operation of Transmission Lines During Extreme Summer Conditions'*.

16 Incident Control System (ICS) process and bushfire preparedness

TasNetworks has a well-defined ICS process in place to manage incidents in real time, such as a major bushfire in the vicinity of powerlines. For example, the ICS process will not currently be implemented within TasNetworks on a TFB day unless a fire ignites and threatens TasNetworks' infrastructure.

This process has been reviewed and now integrates the existing ICS process into days of increased bushfire risk through the introduction of a 'pre-ICS phase' on days of TFB.

17 Proactive disconnection of powerlines

Section 4.5 of the Powerline Bushfire Safety Taskforce (PBST) report discusses the concept of deliberately turning of powerlines on a temporary basis and concluded that, "under most circumstances, the potential impact on the community that may result from the deliberate turning off of powerlines on a temporary basis outweighs the risk of leaving them in service". The PBST also acknowledged that "There will only be limited circumstances where deliberate turning off of powerlines on a temporary basis is warranted on a lowest overall risk basis. However, this precaution may be reasonable and practicable in those limited circumstances".

Proactive disconnection of powerlines may occur in circumstances where safety is a major concern or in the event where urgent maintenance (that could result in a bushfire) exists on a day forecast to see elevated Fire Danger Ratings.

TasNetworks' Bushfire Mitigation Preparedness Index is designed to ensure planned maintenance activities are monitored and completed prior to the summer period and therefore avoid this situation; however it is possible that such a maintenance item could be identified throughout the bushfire season.

There is no previous history of TasNetworks proactively disconnecting a powerline on a day of TFB due to outstanding maintenance posing significant bushfire risks.

[12] Galloping can result in conductor clashing.

18 Controls for field-based employees responding to bushfire threats

TasNetworks has developed workplace health and safety work practice for field crews acting in response to bushfires, including the requirements for risk assessments to be completed prior to entry into high bushfire risk areas. (Work Practice IMS-OPR-00-04 - Total Fire Ban Response Plan - Reference 16).

The work practice also details work restrictions put in place on days of total fore ban to ensure risks of starting fires through activities carried out by field employees are minimised. Work restrictions include:

- hot work (welding, grinding, gas torch, use of petrol driven chain saws);
- driving off road or cleared tracks - exhausts can ignite dry grass;
- operating overhead switchgear;
- installing poles through live conductors;
- driving through road blocks into the vicinity of active fires to perform any type of work, and
- no smoking on site.

19 Customer impact of Total Fire Ban day protection settings

Auto reclosers exist in the distribution system as part of a protection system designed to achieve a balance between protection reliability and protection security.

Protection reliability and protection security are opposing drivers in the design of power system protection.

Bushfire mitigation objectives can also be in opposition to reliability.

Whilst an initial asset related fault may cause ignition of vegetation in close proximity to the faulted asset, the continued attempts at reclosing onto the HV system due to operation of on auto-recloser will increase the risk (likelihood) of ignition.

For this reason, the auto-reclose facilities on all protection devices supplying areas within the total fire ban area defined by TFS are disabled on days of TFB.

A recent review of the effect of this strategy over the previous three years has found that the maximum potential contribution to system SAIDI and SAIFI of this disabling of auto-reclose functionality is approximately 0.5 per cent. Actual contribution to system SAIDI and SAIFI would be somewhat less than the maximum potential, as it is reasonable to assume that some of these outages would have occurred regardless of the auto-reclose facility being disabled.

Table 15 Potential contribution to system SAIDI and SAIFI as a result of disabling auto-reclose functionality on TFB days

Potential contribution to system SAIDI & SAIFI as a result of disabling auto reclosers on TFB Days					
Year	TFB Days	Sum of system SAIDI	Sum of system SAIFI	% of total annual SAIDI	% of total annual SAIFI
2011/12	3	0.79	0.01	0.3%	0.5%

2012/13	11	2.24	0.02	0.5%	0.7%
2013/14	8	1.37	0.01	0.4%	0.4%
3 year Average	7	1.47	0.01	0.4%	0.5%

It is determined that the positive impact of this policy decision (reducing the likelihood of causing bushfires) outweighs the relatively minor negative impacts on customer reliability (0.5% increase to SAIDI & SAIFI).

20 Community awareness

TasNetworks implements an annual media campaign aimed at ensuring public awareness of potential bushfire risks associated with powerlines. The current awareness campaign is targeted at increasing the community awareness of growing trees too close to powerlines and highlights risks associated with private powerlines.

Figure 11 Media campaigns

The campaign generally runs from October to January and includes various types of mediums including:

- television and radio interviews;
- pamphlets;
- website advertisements; and
- social media (e.g. Facebook and Twitter)

TasNetworks also maintains explanatory information on its website differentiating between private and TasNetworks' obligations (for both asset and vegetation maintenance) in relation to private powerlines and service lines.

Additional commentary and interviews are conducted as required and coincides with other scheduled events that occur (such as 'bushfire awareness week').

21 Program of audits

TasNetworks applies an audit regime that has been documented within the Health Safety Environment and Quality (**HSEQ**) Audit Plan and Schedule. The audit plans are to be reviewed and updated annually.

Audits are designed to ensure acceptable levels of compliance and quality are achieved. Audits are carried out via resource from program managers as well as from TasNetworks' HSEQ Quality Assurance & Risk Management Team.

Audit results are reviewed by the HESQ/QARM Audit Review Committee for effectiveness and any recommendations for improvements.

The audit plan may be adjusted depending upon the results of audits and additional audits may be carried out to ensure identified risks are adequately addressed.

Additional to routine audits, TasNetworks carries out independent audits of management plans and strategy for compliance and control effectiveness. Internal Audit engaged GHD to carry out an independent third party to audit the bushfire mitigation asset management plan during the last quarter of 2015.

22 Risk mitigation plan responsibilities

Maintenance and implementation of this risk mitigation plan is the responsibility of the Asset Strategy Team Leader.

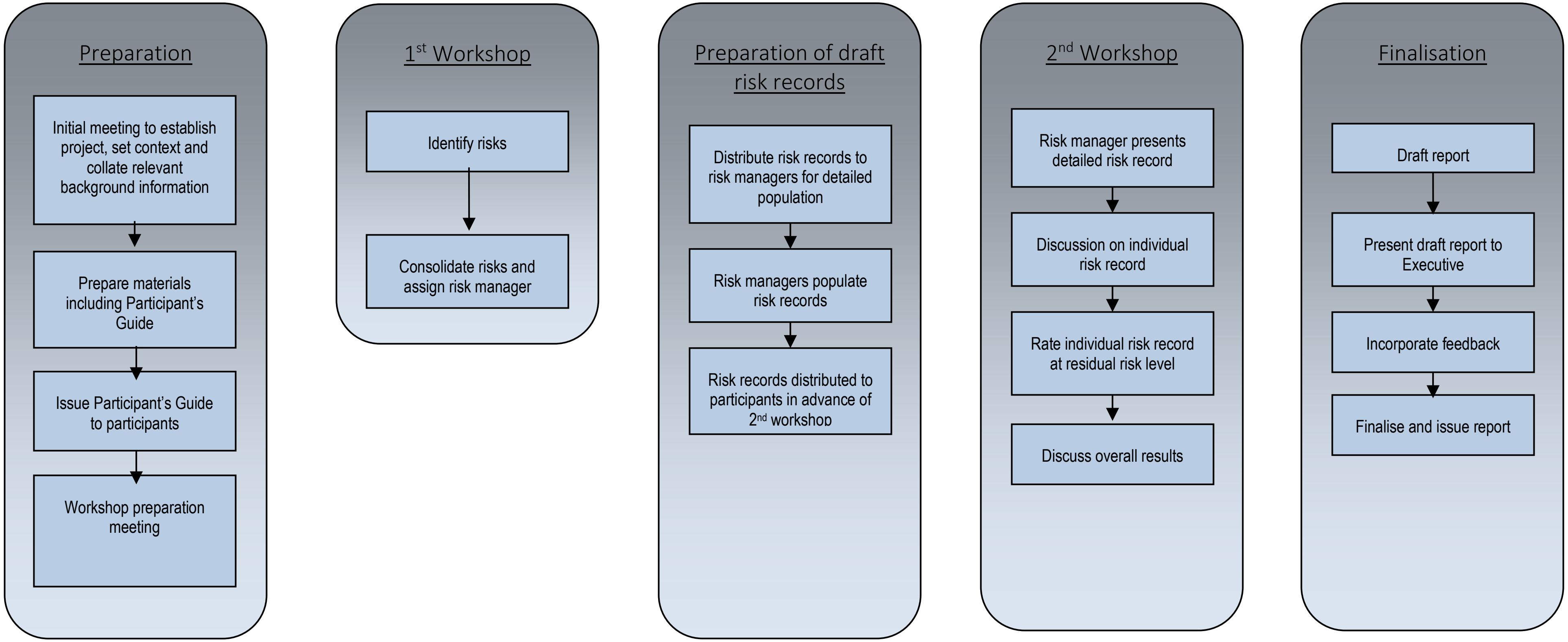
Approval of this risk mitigation plan is the responsibility of the Leader Asset Strategy and Performance Team.

23 References

1. TasNetworks Risk Management Frameworks
2. Powerline Bushfire Safety Taskforce – Final Report 30 September 2011 http://www.esv.vic.gov.au/Portals/0/About%20ESV/Files/RoyalCommission/PBST%20final%20report%20.pdf
3. TasNetworks' Key Risk Profile
4. Tasmanian Government Victorian Bushfire Royal Commission Forum presentation (NW# 30152341)
5. CSIRO – Climate Change Impacts on Fire-Weather in South Eastern Australia - Hennessy et al 2005 http://laptop.deh.gov.au/soe/2006/publications/drs/pubs/334/lnd/ld_24_climate_change_impacts_on_fire_weather.pdf
6. Fire Starts 2012 2013 Onwards (181820)
7. Vegetation Asset Management Plan (VAMP) (168300)
8. Vegetation Operational Management Plan (VOMP)
9. Overhead Line Structures – Distribution Asset Management Plan (R260425)
10. Conductors and Hardware – Distribution Asset Management Plan (R260427)
11. Overhead Switchgear – Distribution Asset Management Plan (R181933)
12. Pole Mounted Transformers – Distribution Asset Management Plan (R260428)
13. NP R AM 03 - Identification and Management of Overhead Line Defects
14. Transmission Line Easements Asset Management Plan (R32687)
15. Distribution Overhead Line Design and Construction Standard (R207584)
16. Work Practice IMS-OPR-00-04 - Total Fire Ban Response Plan
17. End to end works management process (R356224)
18. Transmission Line Conductor Assemblies Asset Management Plan (R32677)
19. Transmission Line Insulator Assemblies Asset Management Plan (R32678)

20. Transmission Line Support Structure Asset Management Plan (R32681)
21. Transmission Line Easements Asset Management Plan (R32687)
22. Total Fire Ban Procedure (DOP-002)

Appendix A – Risk review process



Appendix B – Risk review summary (2014)

Description	Inherent Risk	Target Risk	Current Controls	Residual Risk	Additional Risk Treatment Controls	Status
Network asset starts fire (Inappropriate asset design)	Extreme	Medium	• Specifications based on standards, guidelines and good industry practice • Assets built to design standards based on good industry practice • Fire start reporting and analysis for continual improvement • Involvement in ENA and other industry bodies • Insurance	High	• Conduct review of fault data, causes and controls • Develop operational plan • Develop longer term tactical and strategic plan • Conduct gap analysis between transmission and distribution bushfire documentation	• Complete
Network asset starts fire (Inadequate asset replacement and/or maintenance strategies)	Extreme	Medium	• Reliability Centred Maintenance (RCM) assessment conducted for overhead assets • Asset replacement and maintenance strategies based on good industry practice • Fire start reporting and analysis for continual improvement • Involvement in ENA and other industry bodies • Insurance	High	• Conduct additional review of fault data, causes and controls • Develop longer term tactical and strategic plan • Conduct gap analysis between transmission and distribution bushfire documentation • (NOTE: Controls for this risk, and the previous risk, will be developed concurrently)	• Complete
Network asset starts fire (Inadequate quality/ workmanship/delivery of programs)	Extreme	Medium	• Audits of work practices and quality of work • Monitoring of compliance to asset management strategies • Fire start reporting and analysis for continual improvement • Total Fire Ban Response Plan, GE-WP-014	High	• A process review to be undertaken with relevant groups regarding end to end work flow process • Inter-group discussion to develop/assess the requirement for additional control actions	• Complete

Description	Inherent Risk	Target Risk	Current Controls	Residual Risk	Additional Risk Treatment Controls	Status
Vegetation contact with distribution network asset starts fire	Extreme	Medium	• Vegetation management strategy and plans developed • Vegetation management program based on good industry practice • Audits of work practices and quality of work • Monitoring of compliance to management strategies • Involvement in ENA and other industry bodies	High	• Development of a vegetation management information technology system • Review of KPIs • Vegetation Management Plan finalised	• Complete
Work practice starts fire	Extreme	Medium	• Restricted work practices and Adverse Weather procedure on Total Fire Ban Days • Practices aligned with good industry practice • SMS alerting workers to Total Fire Ban Days • Fire Extinguishers on Operational Vehicles • Fire Season promotion ahead of time each year • Total Fire Ban Response Plan, GE-WP-014	High	• A summary of emergency safety advice added to GE-WP-014 Total Fire Ban Response Plan. • Reiterate field staff other key aspects of GE-WP-014 Total Fire Ban Response Plan	• Complete
Fire started by third party	Extreme	High	• Community awareness / media campaigns • Alterations to operation of network on days of Total Fire Ban (TFB) • Networking with other utilities and fire authorities	High	• Review of business processes and procedures to ensure currency	• Complete

Description	Inherent Risk	Target Risk	Current Controls	Residual Risk	Additional Risk Treatment Controls	Status
Business potentially implicated in fire start	Extreme	Medium	• Inter-agency liaison (TFS, ESS, Etc.) • Process for notification of defects to responsible authority/person • Community awareness / media campaigns • Networking with other utilities	High	• Undertake fault data cleanse (check alignment to cause codes) • Undertake fault data analysis into cause/mode/material/area & equipment	• Complete
Bushfire recovery work exacerbates the impact of a bushfire	High	Medium	• Feeder patrols prior to re-energising • Control Room Procedure for Days of Total Fire Ban	High	• Reinforce the message to operators for crews to ensure faults found are most likely the cause of outages, if unsure, ensure further line patrols are carried out • Complete and test the new fire-ban script in new SCADA system • Discuss with Asset Team the possibility of engaging sensitive earth fault protection on reclosers before attempted feeder livening on fire-ban days	• Complete

Appendix C – Bushfire mitigation calendar of events

Key Milestones	Milestone Dates
Report to Board regarding bushfire mitigation activity status	Monthly
Review the bushfire mitigation calendar of events	Early June
Review and update (if necessary) the bushfire mitigation reporting dashboard.	Early August
Review bushfire risk mitigation plan.	Early August
Confirm target dates to complete specific fire prevention programs if changes are required from the target dates below: • Pre-summer inspection completion - 31 November annually; • Completion of all maintenance items outside policy in HBLCA - 30 November annually; • Aerial inspection of transmission lines - 30 November annually; and, • Completion of all vegetation pruning in HBLCA - 30 November to 31 December annually. At this time contingency plans are to be developed to ensure the resources are available to complete potential outstanding works.	Assessed from August and then monthly thereafter
Arrange fire risk prevention media and brochures.	End August
Arrange TFS seasonal outlooks, liaise closely with TFS officials on expected bushfire season and adjust programs as required.	Mid-September
Attend inter-agency briefing on expected bushfire season	End September
Begin communication of fire risk prevention media and brochures.	End September
Review Emergency Management Plan	End October
Ensure applications have been made for total fire ban day permits from TFS.	Early November
Complete briefing of senior Leaders.	Mid-December
Complete, or have reassessed, outstanding maintenance within the HBLCA.	End November
Provide opportunity to TasNetworks' Senior Leadership team and/or Board members to view outcomes of bushfire risk mitigation activities in the field.	End December
Complete pre-summer pruning program, or reassess priorities, within the HBLCA.	End November to 31 December

Produce summer auditing schedules for the HBLCA summer audit program.	End December
Begin auditing via the HBLCA summer audit program.	Early January
Review effectiveness of fire prevention systems including: • assessing the implementation of the Bushfire Risk Mitigation Plan (BFM); • identifying any deficiencies in the BFM or the plan's implementation through a risk review process; • improving the BFM and the plan's implementation if any deficiencies are identified.	After end of fire season
Conduct inter-agency bushfire post-season review	Mid-May