Asset Management Plan

Vegetation Asset Management Plan

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Tasmanian Networks Pty Ltd (ABN 24 167 357 299)

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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 Leader with any queries or suggestions.

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

Minimum Requirements

The requirements set out in TasNetworks' documents are minimum requirements that must be complied with by all TasNetworks team members, contractors, and other consultants.

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

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Various	Minor updates

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1 Purpose

The purpose of this document is to describe to both internal and external stakeholders:

- TasNetworks' approach to vegetation management, as reflected through its legislative and regulatory obligations and strategic plans;
- the key strategies, programs and projects directed to minimising a range of safety and reliability impacts that can arise from the interaction of vegetation with TasNetworks overhead supply network;
- forecast vegetation management capital expenditure (CAPEX) and operational expenditure (OPEX), including the basis upon which these forecasts are derived, and
- standards and practices that are adopted to manage vegetation near powerlines and ground based fuel loading.

2 Scope

This document covers vegetation management within the vicinity of all TasNetworks owned distribution and transmission powerlines and communications assets where TasNetworks has a responsibility and operational requirements to maintain vegetation clearances.

2.1.1 Limitations

While TasNetworks implements a very substantial annual program to manage vegetation in easements and maintain clearance from the distribution, transmission and communications network, it is important to acknowledge that it is not possible to eliminate all risk arising from vegetation.

Firstly, for the very large tree population that TasNetworks has responsibility to manage, a range of environmental laws and regulations limits the extent to which TasNetworks can cut or remove vegetation. Secondly, live, apparently healthy vegetation outside regulated clearance distance can and does fail, mostly in high wind conditions, and fall on to TasNetworks overhead supply network. Further, the extent to which TasNetworks may remove or cut vegetation is constrained by funding for vegetation management programs (reflecting what the public is willing to pay) as well as aesthetic and other social amenity value considerations which communities attribute to trees.

Accordingly, TasNetworks vegetation management program aims to reduce vegetation hazards to network safety and reliability, within the range of applicable legal, financial, environmental and social constraints.

3 Legislative framework

Key legislation that requires TasNetworks to implement programs relating to vegetation management includes:

- Electricity Supply Industry Act 1995 (ESI Act);
- Electricity Industry Safety and Administration (ESI&A Act) (1997); and
- The Tasmanian Electricity Code (TEC).

Additionally there is a significant range of legislation and regulations that must be complied with in works undertaken to implement TasNetworks Vegetation Asset Management Plan (VAMP). These include, among others, State and/or Commonwealth legislation applying to vegetation clearing, environment protection and occupational health and safety.

3.1 Electricity Supply Industry Act 1995 (ESI Act)

The ESI Act exists to:

- 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 ESI Act covers safety aspects at a high level and is implicit regarding vegetation management risks.

3.2 Electricity Industry Safety and Administration Act 1997 (ESI&A Act)

The ESI&A Act exists to establish safety standards for electrical apparatus, to provide for the investigation of accidents in the electricity industry and for related purposes.

The ESI&A Act covers:

- powers of entry and inspection;
- powers to order rectification;
- powers to order disconnection; and
- emergency powers relevant to TasNetworks' vegetation management activities.

3.3 The Tasmanian Electricity Code (TEC)

The TEC provides, among other things, 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 TEC 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 powerlines. This framework is explicit regarding works requirements and practices in various fire risk areas[1].

TasNetworks has the regulatory responsibility to manage trees growing near powerlines and mitigate risks associated with trees coming into contact with powerlines. The minimum standard to which TasNetworks must achieve is compliance with Chapter 8A of the TEC.

4 Distribution Code Requirements (TEC Chapter 8A)

Due to the legislative requirements to comply with Chapter 8A, and the high level of detail contained within it, this section has been developed specifically to provide clarity on how TasNetworks complies with the TEC.

[1] The TEC 8A refers to three fire risk areas within Tasmania, being Low Bushfire Risk (LBRAs), High Bushfire Risk Areas (HBRAs), and High Bushfire Loss Consequent Areas (HBCAs). Although TEC 8A relates to distribution networks only, TasNetworks has applied these fire risk areas to its entire network (i.e.: Transmission and Distribution networks).

Compliance is achieved through the ongoing implementation of initiatives and programs across the business, as documented within TasNetworks' strategic, tactical and operations plans and procedures throughout the organisation.

Table 1 serves as a summary as to where key components of Chapter 8A are addressed throughout TasNetworks' suite of documents in order to achieve compliance.

Table 1 TasNetworks documentation for the achievement of compliance with TEC 8A

Clause	Title	Requirement	Reference
8A.3	Distribution Powerline Clearance Standards	Compliance with fire risk categories	Bushfire Mitigation Management Plan
8A.5.1 (a)	Maintenance of the Clearance Space	Implement a management plan that specifies an inspection cycle and/or pruning and clearing cycle which is designed to achieve, under normal growth conditions, the relevant clearance space prescribed in clause 8A.3.4. The management plan must include the Distribution Network Service Provider's risk assessment approach	Vegetation Asset Management Plan Vegetation Operational Management Plan Service Provider Contract Technical Specification
8A.5.1 (b)	Maintenance of the Clearance Space	Decide which method to adopt to ensure that the clearance space remains free of vegetation taking account the potential risk to the public, conservation and other values, and avoided costs associated with the alternatives	Vegetation Asset Management Plan Vegetation Operational Management Plan Service Provider Contract Technical Specification
8A.5.1 (c)	Maintenance of the Clearance Space	If the method adopted is pruning or clearing, determine the regrowth space, hazard space and the pruning and clearing cycle	Vegetation Operational Management Plan
8A.5.1 (d)	Maintenance of the Clearance Space	Ensure that the pruning or clearing is done responsibly	Vegetation Operational Management Plan
8A.5.1 (e)	Maintenance of the Clearance Space	Give special attention to how the clearance space is maintained at important locations and the sites of important vegetation	Vegetation Operational Management Plan
8A.5.2	Assistance to the Public with Vegetation Matters	Assist and inform the public on vegetation related matters and so that pruning or clearing activities near distribution powerlines can be undertaken safely	Vegetation Operational Management Plan Service Provider Contract Technical Specification

8A.5.3	Notification, Consultation and Negotiation	Notify the occupiers of land, giving reasonable notice and consult with land owners	Vegetation Operational Management Plan Service Provider Contract Technical Specification
8A.5.6	Training	A Distribution Network Service Provider should ensure that any of its employees undertaking vegetation management in the vicinity of its powerlines, and any contractors it engages to carry out vegetation management, are appropriately trained and competent for that task	Vegetation Operational Management Plan Service Provider Contract Technical Specification

5 Transmission Code Requirements

Following consultation with the Office of the Tasmanian Electricity Regulator (**OTTER**), it was determined that there was not a requirement to codify transmission vegetation line clearing standards. In lieu of legislations, OTTER and TasNetworks jointly developed a standard for transmission vegetation line clearing which is detailed within **Appendix B** of this asset management plan.

Clearance specifications within the standard include requirements for vertical and horizontal clearances from conductors and towers, as well as clearance requirements for management of ground based fuel loading and provision of emergency access and working areas.

6 Vegetation asset management framework

This asset management plan has been developed to align with both TasNetworks' Asset Management Policy and Strategic Objectives.

It is part of a suite of documentation that supports the achievement of TasNetworks' strategic performance objectives. The asset management plans identify the issues and strategies pertaining to network system assets and details either the strategic approach, or the appropriate activities that need to be undertaken to address the identified issues.

The ISO 55000 series of standards are the internationally accepted standard for asset management (**AM**). The ISO 55000 series comprises three separate standards:

- ISO 55000:2014, which provides an overview of AM;
- ISO 55001:2014, which specifies the requirements for the establishment, implementation, monitoring and improvement of an AM system; and
- ISO 55002:2014, which provides guidance for the application of the AM system.

TasNetworks' AM system is being developed in alignment with the ISO 55000 series of standards, and the TasNetworks AM framework, as shown in Figure 1, uses the ISO 55000 AM system framework[2] as its template.

TasNetworks' vegetation management framework has been overlaid onto the TasNetworks AM framework to show the direct relationship between the two.

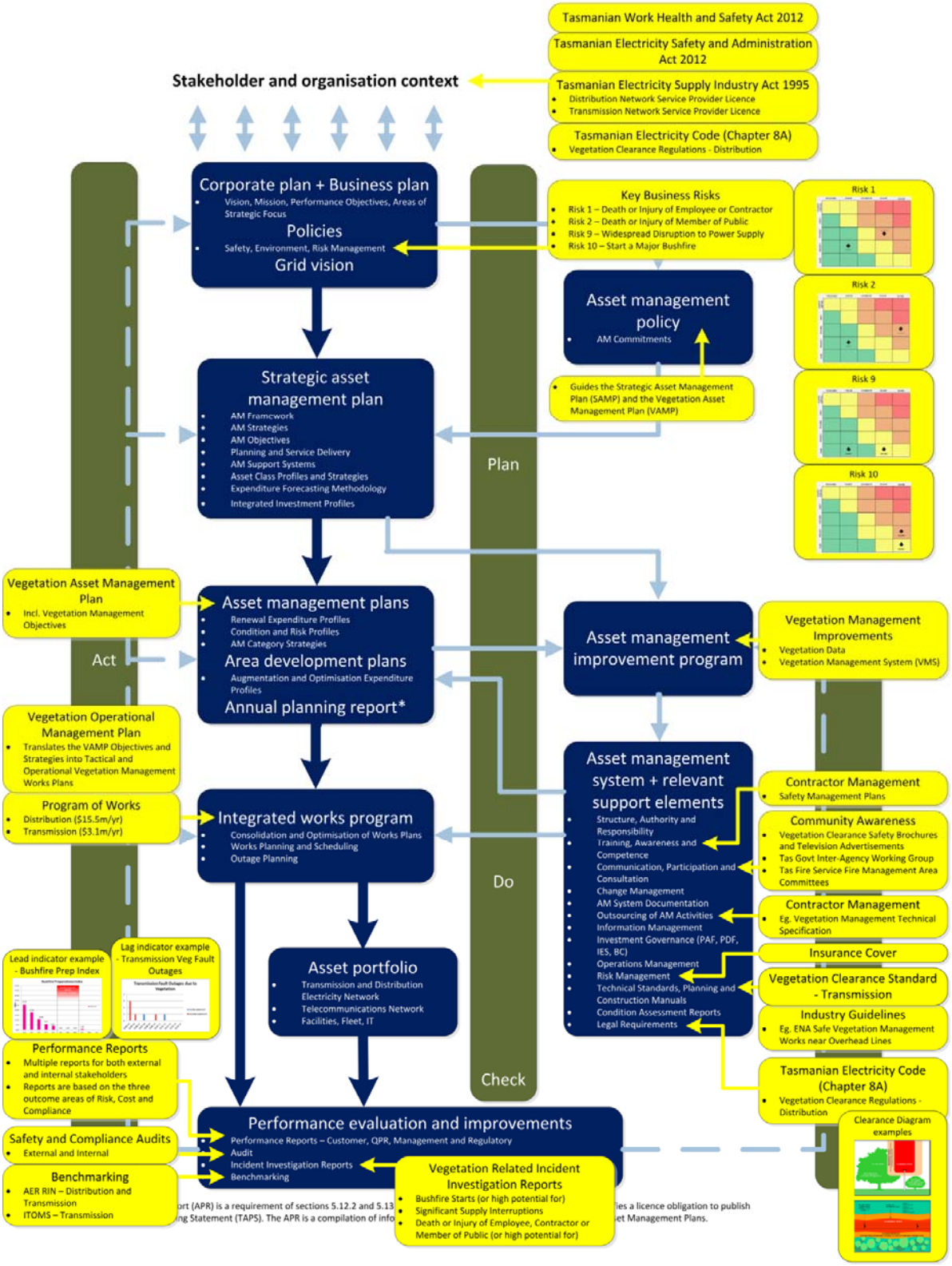
Key points regarding the vegetation management framework are:

[2] Referred to in ISO 55000 as the 'Relationship between key elements of an ISO 55000 AM system'.

- it aligns with the AM framework, which aligns completely with the ISO 55000 series of standards;
- vegetation management aligns to four key business risks which are all presently assessed as having 'partially effective' control effectiveness, with three being rated as 'medium' risk and one being rated as 'high' risk;
- the VAMP is complemented by a Vegetation Operational Management Plan (VOMP) which helps translate the VAMP objectives and strategies into tactical and operational vegetation management works plans. This documentation arrangement is currently unique to this asset category within the TasNetworks asset portfolio and supports TasNetworks' adoption of an *empowered service provider* business model; and
- the ISO 55000 framework is recommended by the Energy Network Association (ENA[3]), as a useful guiding framework for vegetation management.

[3] Energy Networks Association, Vegetation Management Practice Report, October 2015

Figure 1 TasNetworks asset management framework with vegetation management overlay



The VAMP is a strategic plan. It establishes vegetation management program business and operating context and directs what needs to be done (objectives; strategies; programs) with regard to managing vegetation. It also establishes a framework for measuring program effectiveness and performance. The VAMP:

- establishes the business and operating context for TasNetworks' vegetation management program;
- establishes TasNetworks' approach and objectives to mitigate risk to acceptable levels;
- outlines the strategies and associated suite of programs, support systems, and strategic initiatives (projects) to be planned and implemented to achieve the objectives;
- establishes the performance indicators, measures, and monitoring system to enable tracking of the extent to which asset management objectives and performance targets are being achieved; and
- establishes the auditing and reporting strategy.

The VOMP is a tactical and operational plan. It outlines the method (how, when and with what) by which the vegetation management strategies and programs established in the VAMP are to be implemented so the VAMP objectives can be achieved. The VOMP:

- outlines the tactical decisions taken to prudently and efficiently implement the vegetation management strategies and programs established in the VAMP;
- provides detail on multi-year and annual vegetation management programs;
- details what work is to be done within the program period;
- outlines the resource commitments (including responsibilities);
- specifies the compliance standards (quality) for work to be done;
- stipulates timeframes for work to be done;
- outlines the budget and other financial management processes;
- outlines the auditing and reporting regime; and
- outlines the method for evaluating and reviewing the tactical and operational planning and implementation effectiveness and performance.

Vegetation management operational documentation is further defined within the VOMP and includes documents that aid in the delivery of the works, such as:

- standards;
- guidelines;
- contract technical specifications; and
- procedures.

7 Vegetation management objectives

TasNetworks' vegetation management objectives reflect the vision for a resilient network that delivers low cost, sustainable energy to an engaged and knowledgeable customer base to ensure TasNetworks will be "*trusted by our customers to deliver today and create a better tomorrow*".

The Business Strategies outlined in TasNetworks' Corporate Plan are designed to achieve the Business Strategic Objectives. Explicit in these strategies are the business imperatives of maintaining safety, reliability and sustainability.

In accordance with this, TasNetworks has developed the following key objectives for vegetation management:

(i) **Safety** - mitigate the risk of public and worker safety incidents caused by vegetation interacting with live electricity assets;

(ii) **Bushfire Risk** - mitigate the risk of bushfires caused by vegetation interacting with live electricity assets;

(iii) **Compliance** - Comply with all relevant legislative and statutory requirements;

(iv) **Performance** - mitigate the risk of supply interruptions as a result of vegetation coming into contact with live electricity assets;

(v) **Network Damage** - mitigate the risk of vegetation-caused damage to TasNetworks electricity assets;

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

8 Key performance indicators and measures

TasNetworks measures program performance against vegetation management objectives through a series of key performance indicators (**KPIs**).

KPIs are designed such that they can be arranged in a variety of views that cover all key aspects of program objectives.

8.1 Lead Indicators

Table 2 TasNetworks vegetation management performance lead indicators

Indicator description	Use of the indicator	Target
PT1[4] find rate - Vegetation contact/proximity defects requiring highest-priority rectification.	Annual occurrence rates and inter-annual occurrence trends reveal the extent to which the inspection and cutting regime is preventing the occurrence of vegetation conditions for which fault occurrence is imminent.	Distribution: all immediate risk PT1, vegetation defects will be removed in the HBCA. Removal of all PT1 vegetation defects state-wide (i.e.: HBCA and non HBCA regions) by the end of the 2017-18 financial year. Transmission: Nil
PT30 find rate - Vegetation which has already grown inside clearance.	Annual occurrence rates and inter-annual occurrence trends reveal the extent to which urgent vegetation clearance non-compliance is occurring.	Distribution: all immediate risk PT30 vegetation defects will be removed in the HBCA prior to the 2016-17 bushfire season and for all future bushfire seasons. Removal of all PT30 vegetation defects state-wide (i.e.: HBCA and non HBCA regions) by the end of the 2017-18 financial year. Transmission: Nil

[4] Conservatively translated from the TEC:
PT 1 – Vegetation within the clearance space touching or likely to touch;
PT 30 – Vegetation within the clearance space; and
PT 180 – Vegetation within, but near the outer boundary of the clearance space.
PT 365 – Vegetation inside the regrowth space, which is the space beyond the clearance space that should be cleared to allow for anticipated vegetation regrowth for the period of the pruning and clearing cycle. The vegetation is considered likely to grow within the clearance space within 12 months; and
PT 720 – Vegetation inside the regrowth space but likely to be within the clearance space within 24 months.

Indicator description	Use of the indicator	Target
PT180 find rate - Vegetation currently inside clearance (but toward the outer margins of the clearance zone) but which could be expected to become a PT1 if not cleared before the next bushfire season.	Annual occurrence rates and inter-annual occurrence trends reveal the extent to which the annual volume of non-deferrable vegetation clearance works is increasing or decreasing.	Distribution: all immediate risk PT180 vegetation defects will be removed in the HBCA prior to the 2016-17 bushfire season and for all future bushfire seasons Removal of all PT180 vegetation defects state-wide (i.e.: HBCA and non HBCA regions) by the end of the 2017-18 financial year. Transmission: Nil
PT365 find rate – Vegetation within the "regrowth zone" and is likely to grow inside clearance before the next inspection.	Annual occurrence rates and inter-annual occurrence trends reveal the extent to which the annual volume of current treatment cycle vegetation is increasing or decreasing.	Distribution: Annual volume reduction post 2017-18 financial year. Transmission: Nil
PT720 find rate – Vegetation within the "regrowth zone" and is likely to grow inside clearance after the next inspection (more than 12 but less than 24 months' time).	Annual occurrence rates and inter-annual occurrence trends reveal the extent to which the forward vegetation works volume beyond the current treatment cycle vegetation is increasing or decreasing.	Distribution: Annual volume reduction post 2017-18 financial year. Transmission: Annual volume reduction post 2017-18 financial year.
NVS – Non Vegetated Span – has no vegetation or vegetation unlikely to grow inside clearance within the next 5 years.	Annual occurrence rates and inter-annual occurrence trends reveal the extent to which the proportion of the network not requiring recurrent vegetation works is increasing or decreasing.	Distribution: Annual volume increase post 2017-18 financial year. Transmission: Annual volume increase.
Hazard Trees find rate – Trees in or outside the clearance space that have obvious stem or overhanging branch structural defects (observable during routine clearance inspections) which if they failed during foreseeable weather conditions would fall on to conductors.	Annual occurrence rates and inter-annual occurrence trends reveal the extent to which the proportion of the network exposure to hazard trees not requiring recurrent vegetation works is increasing or decreasing.	Distribution: Annual volume reduction post 2017-18 financial year. Transmission: Nil

Indicator description	Use of the indicator	Target
Vegetation clearance audit compliance results.	Ensuring that the quality of service delivered by its vegetation scoping and cutting contractors is within defined parameters.	Distribution: Audit[5] HBCA for a confidence level of 99% and margin of error of 0.5%; and Audit spans outside the HBLCA for a confidence level of 95% and a margin of error of 0.5%. Transmission: Audit for a confidence level of 99% and margin of error of 0.5%.
Reporting	Ensure ongoing monitoring, evaluation and reporting on the performance of the strategic, tactical and operational work programs in achieving vegetation management program delivery, and objectives	Distribution: Monthly reporting and evaluation at scheduled monthly meetings Transmission: Monthly reporting and evaluation at scheduled monthly meetings
Development and implementation of an integrated (transmission and distribution) vegetation management system	Ensure improvement of ability to monitor, evaluate and report on the performance of the strategic, tactical and operational work programs in achieving vegetation management program delivery, and objectives	Implementation of a vegetation management system (VMS) in 2017-18 financial year.

8.2 Lag Indicators

Table 3 TasNetworks vegetation management performance lag indicators

Indicator description	Use of the indicator	Target
Vegetation inside clearance – Vegetation caused faults from vegetation inside clearance space	Annual occurrence rates/inter-annual trends for system faults caused by vegetation that has grown into the clearance space (representing shortcomings of the inspection and cutting program) Sub-categories: Differentiate between transmission and distribution Differentiate between occurrences within and outside the HBCA Differentiate between occurrences within and outside the Bushfire Season	Distribution: Nil caused by vegetation inside clearance in HBCA. Annual volume reduction of vegetation inside clearance for all fire risk areas post 2017-18 financial year. Transmission: Nil

[5] See Section 14.5 for further explanation of audit requirements.

Indicator description	Use of the indicator	Target
Vegetation outside clearance – Vegetation caused faults from vegetation outside clearance space	Annual occurrence rates/inter-annual trends for system faults caused by trees or branches that fail and fall on to conductors Sub-categories: Differentiate between transmission and distribution Differentiate between occurrences within and outside the HBCA Differentiate between occurrences within and outside the Bushfire Season	Distribution: Nil caused by vegetation outside clearance in HBCA Annual volume reduction of vegetation outside clearance for all fire risk areas post 2017-18 financial year Transmission: Nil
Electrical safety incidents involving vegetation	Annual occurrence rates/inter-annual trends for electric shock incidents involving vegetation. Sub-categories: Differentiate between transmission and distribution Differentiate TasNetworks workers (employees and contractors) and the general public Differentiate between 'tree-down' incidents and others	Distribution: Nil Transmission: Nil
Ground fires from 'grow-ins'	Annual occurrence rates of ground fires resulting from live vegetation which has grown into the clearance space Sub-categories: Differentiate between transmission and distribution Differentiate between occurrences within and outside the HBCA Differentiate between occurrences within and outside the Bushfire Season	Distribution: Nil Transmission: Nil

Indicator description	Use of the indicator	Target
Ground fires from 'fall-ins'	Annual occurrence rates of ground fires resulting from trees and/or branches which fall on to conductors Sub-categories: Differentiate between transmission and distribution Differentiate between occurrences within and outside the HBCA Differentiate between occurrences within and outside the Bushfire Season Differentiate whether or not previously reported as a Hazard Tree	Distribution: Nil in HBCA Annual volume reduction of vegetation outside clearance for all fire risk areas post 2017-18 financial year Transmission: Nil
Costs for unplanned network maintenance / repair due to 'trees down' incidents	Annual costs and inter-annual cost trends revealing the extent to which trees are resulting in network damage annually. Differentiate between occurrences within and outside clearance space	Distribution: Annual cost reduction for all fire risk areas post 2017-18 financial year Transmission: Nil
Annual vegetation works delivery program costs	Annual costs and inter-annual cost trends revealing the degree of variability in vegetation clearance works delivery. Sub-categories: Differentiate between transmission and distribution Inspection Vegetation cutting/clearance contract works Hazard tree program treatment works Vegetation audit program works Internal switching (including deferred outages) Data management	Distribution: Planned works program completed within annual budget targets Transmission: Planned works program completed within annual budget targets

Additional performance indicators are measured at a tactical/operational program delivery level to ensure additional elements (such as contractor management, outage, and stakeholder management, and annual works program delivery progress) issues are monitored. These KPIs are detailed within the VOMP.

9 Risk management

TasNetworks' Integrated Risk Management Model provides the essential supporting structure for risk management in TasNetworks. The Risk Management Model is based on the Australian/New Zealand 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;
- customer outcomes;
- regulatory and legal obligations;
- business continuity;
- financial performance; and
- corporate reputation.

The highest risk associated with vegetation management has been assessed as the risk of a bushfire starting as a result of vegetation coming into contact with TasNetworks assets.

From a corporate risk framework perspective, this risk is incorporated within Key Business Risk 10 – Bushfire Start.

9.1 Risk of bushfire caused by vegetation contact

In the context of a vegetation related fault starting a bushfire, the inherent risk is rated as Very High (Likelihood = Almost Certain, Severity = Severe).

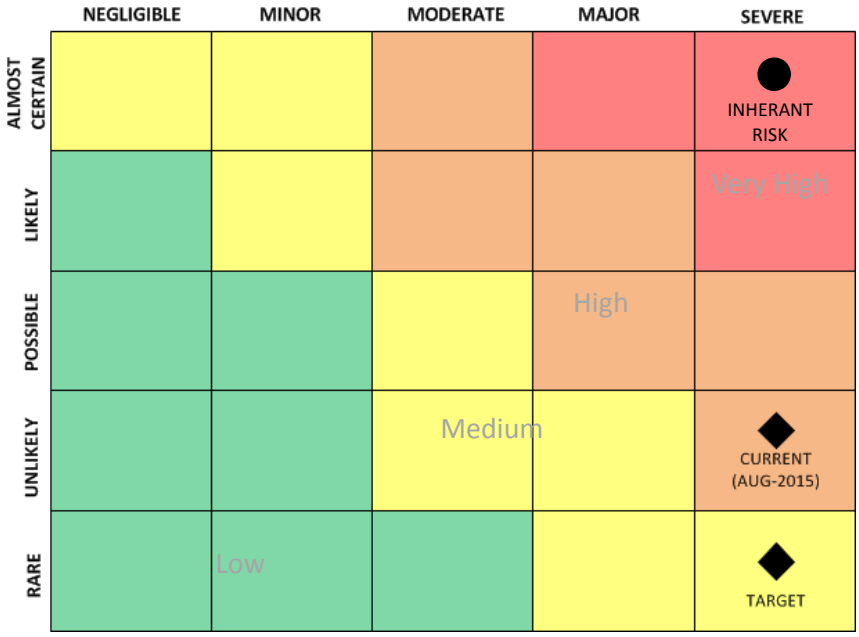
TasNetworks' risk appetite is to see the overall risk reduced to Medium by reducing the Likelihood of the risk to Rare (Likelihood = Rare, Severity = Severe).

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

It is acknowledged that in the context of bushfire mitigation, whilst TasNetworks has many risk controls in place, the majority of the controls are aimed at reducing likelihood of a bushfire occurring, 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 a level that is as low as is reasonably practicable.

Figure 2 shows the inherent, assessed, and target risk of Key Business Risk 10.

Figure 2 Risk matrix for Key Business Risk 10 (Major bushfire start is attributed to TasNetworks assets and/or work practices)



TasNetworks acknowledges that there are vegetation-associated risk dimensions other than bushfire. However, bushfire is considered the highest order risk due to the potential consequence severity for which it is possible that for a fire starting in severe bushfire weather conditions, in a location where it can spread and develop into a large uncontrollable bushfire, has the potential to result in multiple fatalities/injuries and

large scale property damage. Action taken to address this highest-order vegetation-related risk will serve to also reduce all other vegetation-related risk dimensions to tolerable levels.

10 Vegetation profile

TasNetworks' electrical network extends across the state of Tasmania. The electrical infrastructure crosses land with multiple tenures and uses, however native vegetation is predominant across the state in areas such as state forest reserves, national parks and local government areas.

10.1 General distribution of vegetation across the network

By overlaying an overhead network asset and vegetation classification spatial data layers using TasNetworks geographic information system (GIS), it is possible to gain insight into the types and patterns of vegetation and resultant exposure of TasNetworks' infrastructure throughout the State.

Table 4 Percentage of TasNetworks' overhead assets within various vegetation classifications

Vegetation classification	Percentage of TasNetworks' overhead assets within classification
Post European Cleared	56.2%
Woodland Dry	18.9%
Urban (Cleared)	13.7%
Woodland Wet	6.8%
Moorland/Heathland	3.2%
Grassland	0.6%
Scrub	0.3%
Rainforest	0.3%
Lake	0.2%
Wetland	0.01%

10.2 Network exposure to vegetation

TasNetworks' overhead network contains a total of 7,842 transmission spans (with a total route length of 2,342 km) and a total of 227,339 distribution spans (with a total route length of 17,542km). In terms of relevance to vegetation management, the network is further sub-classified/segmented on the basis of voltage, and bushfire risk areas (LBRA, HBRA and HBCA).

10.2.1 Factors that affect vegetation fire risk

Table 5 Network breakdown by voltage

Voltage	# Spans	% in HBCA	Factors that affect fire risk
Transmission 110–220 kV	7,842	Approx. 10%	• Mostly in managed corridors (particularly the higher voltages), with widest tree clearances

			• Maintenance corridor tree clearance program • No branch overhangs allowed • Higher conductor suspension heights (vertical clearance from vegetation) than the distribution network • Remotely controllable protection system • Very high fault energy (grow-ins, should they occur, can cause fires)
Distribution 240V– 44kV	227,339	Approx. 13%	• Mostly no cleared corridor, high exposure to trees. • Not all trees TasNetworks responsibility to maintain • Relatively high exposure to HCBA (approx. 30,000 spans) • Grow-in-caused fires uncommon • Fall-ins causing clashing or conductor failure are the largest cause of ground fires • Requirement to risk-assess branch overhangs • 11-44kV protection system barrier more effective than low voltage protection systems

10.2.2 Factors that affect vegetation/asset performance

The four key factors that affect vegetation management clearance programs are:

- targeting, timeliness and quality of vegetation treatment implementation (failures or sub-optimal performance in any of these three dimensions can have significant consequences for subsequent treatment cycles);
- seasonal weather patterns that affect vegetation growth dynamics and bushfire risk;
- the ability to effectively manage contractor delivery of the vegetation management program; and
- ensuring adequate data management systems are in place to monitor, evaluate and report on the performance of the strategic, tactical and operational work programs.

10.3 Vegetation dynamics in Tasmania

Vegetation clearance zone integrity and ensuring adequate access to powerlines is subject to the highly dynamic and persistent influence of woody vegetation (tall shrubs and trees). The large tree population to which TasNetworks' network is extensively exposed is live, growing annually, and attempting to occupy cleared areas through dispersing seed or through vegetative means such as via lateral root suckers. Varying proportions of tree populations in different areas are senescent, some dying, afflicted by health issues, and/or subject to damage vectors (such as storms, fires, drought, dieback, fungal decay, insect attack and human activity) which weaken limbs and/or stems increasing their susceptibility to damage from natural events.

Further, some vegetation species are highly resilient to control efforts. For example, most Tasmanian eucalypt species have adapted over millennia to frequent disturbance by grazing and fire, and have evolved means (such as lignotubers and epicormic buds on stems and branches) to survive disturbances which kill or remove above ground parts. Such species readily resprout after pruning or cutting down to ground level, and have the ability to quickly regrow with the benefit of an established and intact, fully functional lignotuber and/or root system.

Repeated treatment is typically required through the life of a tree to prevent interaction with assets, and multiple treatment techniques (integrated vegetation management) typically involving combinations of cutting/slashing and herbicide application are required to prevent re-occupation of cleared areas. Weather events favourable to seedling recruitment and establishment can result in pulse regeneration events in

cleared areas. Similarly, changes to vegetation management regimes (intended or unintended; temporary or sustained) can also give rise to a vegetation response leading to step changes in vegetation condition.

Tasmania has highly favourable conditions for vegetation growth, and is home to some of the fastest growing hardwood tree species in the world (the native Tasmanian Blue Gum and hybrids thereof are a preferred timber plantation species across southern Australia and many countries around the world). Tasmania is Australia's wettest State, and while Tasmania does experience droughts, annual rainfall is more reliable than in many mainland areas. In the agricultural areas and major populations centres where the bulk of Tasmania's population resides and thus containing a high proportion of TasNetworks assets, soils are also mostly favourable for vegetation growth. These factors serve to make Tasmania one of the most challenging environments in Australia for vegetation management.

Accordingly, the dynamic nature of vegetation demands that well-designed, integrated and persistent vegetation management programs are required to effectively control vegetation risks.

11 Vegetation and powerlines

Contact between vegetation and powerlines on transmission and distribution networks can:

- 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;
- 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;
- interrupt power supply as a result of the faults caused by phase/phase or phase/earth contacts; and
- cause damage to the powerline through falling vegetation.

On the Low Voltage (LV)[6] distribution network the issues typically experienced as a result of vegetation contact are:

- clashing conductors causing phase to phase faults; and
- broken conductors causing phase to earth faults or phase to phase faults.

On the High Voltage (HV)[7] and Extra High Voltage (EHV)[8] networks, direct contact by vegetation to energised lines may not be required to receive a fatal electric shock or start a fire, as simply being in close proximity can be a danger.

The issues typically experienced on HV and EHV networks as a result of vegetation contact include:

- clashing conductors causing phase to phase faults;
- branches bridging across two or more lines causing phase to phase faults;
- vegetation contacting (or coming near to) a single conductor causing phase to earth faults; and
- broken conductors causing phase to earth faults or phase to phase faults.

Examples of these issues are presented in Photos 1 to 4 below.

[6] LV includes any assets energised at <11kV, and associated support infrastructure
[7] HV includes any assets energised at, or between, 11kV and 44kV, and associated support infrastructure
[8] EHV includes any transmission assets energised at or greater than 110kV, and associated support infrastructure

Photo 1: Conductor clash

Photo 2: Phase-to-phase fault

Photo 3: Phase-to-earth fault

Photo 4: Multiple broken conductors

Injuries can result to anyone climbing the vegetation in proximity to powerlines as it may allow them to come within the danger zone and receive an electric shock.

If the damage to the powerline causes the conductor to break, this may result in:

- live wires falling to the ground or on to fences which may:
  - (a) cause electric shock to the public; or
  - (b) start a fire.
- live wires falling on to other conductors below them causing power surges which may:
  - (a) damage equipment; and
  - (b) cause electric shock to people touching the equipment.

As wind, temperature, the weight of the conductor and the distance between support structures 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.

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 (EHV) and distribution (HV and LV) conductors.

12 Vegetation impact

Vegetation management is undertaken to pursue zero harm safety objectives and to ensure quality and reliability of supply is maximised. Despite comprehensive vegetation management programs in place on both of the transmission and distribution networks, interruptions on the network are still experienced as a result of vegetation coming into contact with powerlines (although less common on transmission lines). The vast

majority of interruptions are caused by vegetation blowing or falling onto powerlines from outside prescribed clearance spaces. In certain circumstances and conditions this vegetation contact has the potential to start fires.

12.1 Vegetation impact data capture and analysis

TasNetworks captures data relevant to vegetation impacts, including:

- vegetation fault data via TasNetworks' outage management system and recorded on a monthly basis;
- safety incident data via TasNetworks safety management system and recorded on a monthly basis;
- fire start data via TasNetworks enterprise asset management system and recorded on a monthly basis, and
- outage analysis data via TasNetworks outage system and recorded monthly.

The Asset Strategy and Performance team analyse this data on a monthly basis and review outcomes annually. The Vegetation Management team (within Works and Service Delivery) also monitor outages within and outside the clearance space on a monthly basis and carry out field checks where vegetation inside clearance space incursions occur.

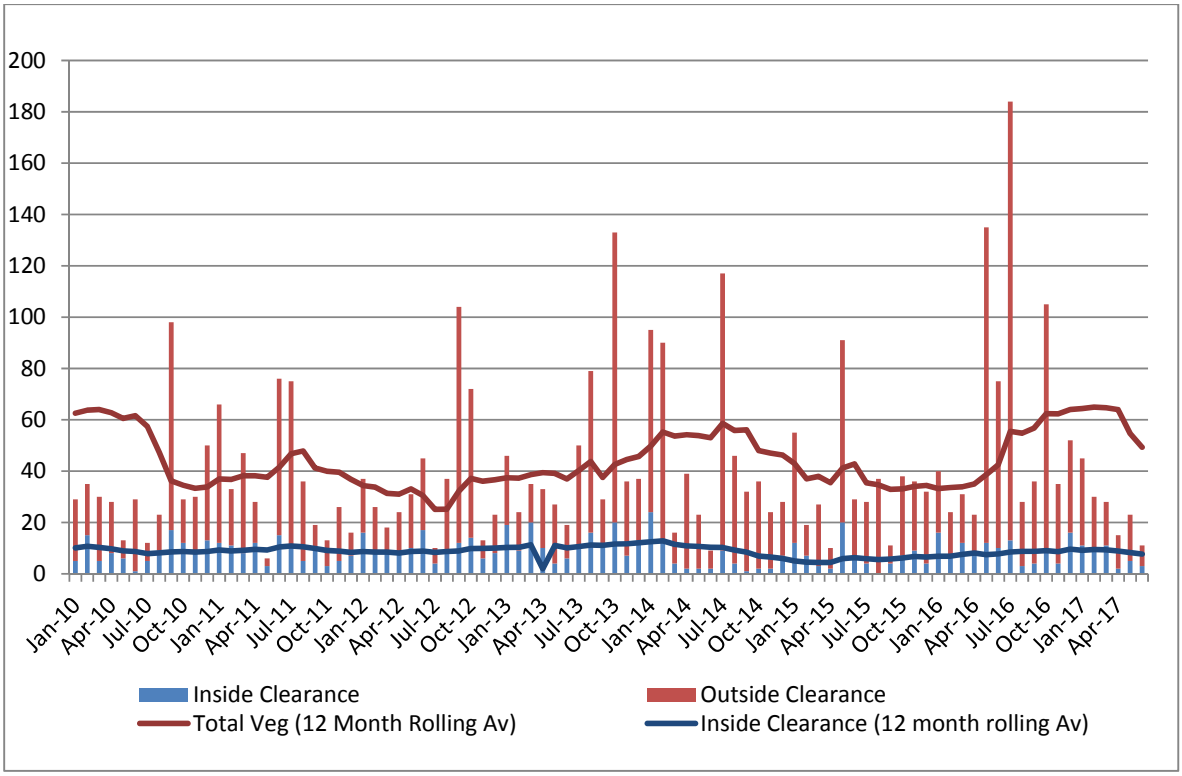
12.2 Faults/Outages caused by vegetation

Vegetation-caused faults are recorded and analysed separately on both transmission and distribution networks.

12.2.1 Distribution network faults

TasNetworks experiences approximately 500 vegetation related outages per annum (from a total of approximately 14,000 faults per annum). Vegetation related outages are recorded as either being 'Inside' or 'Outside' the regulated Clearance Space (as prescribed within Chapter 8A of the TEC). The interruptions relating to vegetation inside or outside the clearance zone are shown in Figure 3 below.

Figure 3 Distribution fault outages due to vegetation Jan 2010 – Jul 2017



TasNetworks measures the impact of system outages in terms of duration and frequency. Both duration and frequency are expressed as a calculated index. The two performance indices are referred to as:

- system average interruption duration index (SAIDI), or the average number of minutes a customer will be without electrical supply per year; and
- system average interruption frequency index (SAIFI), or the average number of interruptions to electrical supply a customer will experience per year.

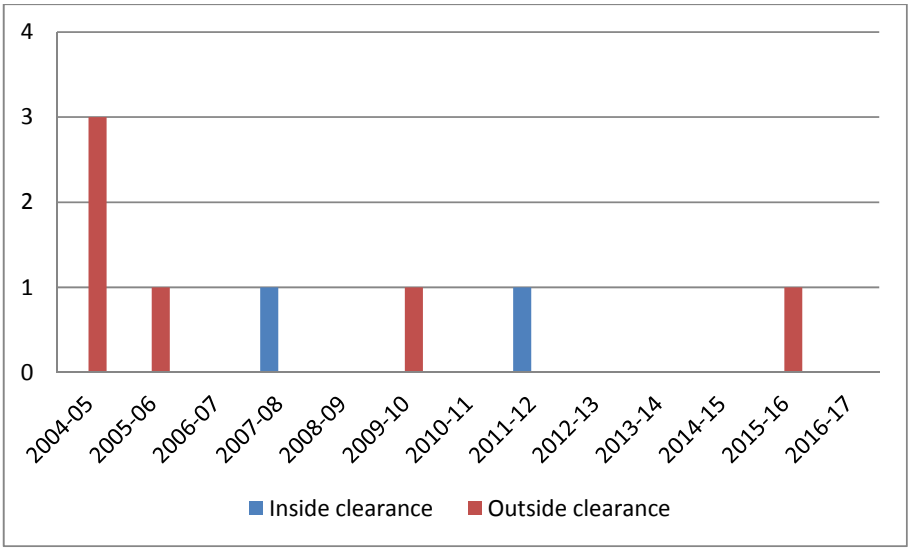
SAIDI and SAIFI are recorded to monitor trends and to be used as a performance indicator of program effectiveness.

12.2.2 Transmission network vegetation caused faults

TasNetworks measures the service performance of its transmission network vegetation management by the number of fault outages caused by vegetation.

The figure below summarises the fault outage performance due to vegetation over time, and whether the outage has resulted from vegetation within clearance space or from trees falling from outside clearance space.

Figure 4 Transmission fault outages due to vegetation 2004-05 to 2016-17



Since the transition from ground-based to aerial vegetation inspections in 2000, TasNetworks has experienced very good vegetation performance on the transmission network. The conclusions that can be drawn from this include:

- TasNetworks' management regime has been sufficient to virtually eliminate vegetation impacts from inside clearance as a cause of fault outages; and
- vegetation issues from outside clearance are uncommon. As TasNetworks does not have direct control over the management of vegetation outside its EHV easements, the improvement in this aspect of easement performance is difficult to achieve and requires close communication and consultation with landowners.

12.2.3 Timing and distribution of faults caused by vegetation

The likelihood that a vegetation caused fault will result in a high impact event depends significantly on the location and timing of the fault. In relation to fires, the following location and timing factors are relevant:

- fires occurring within the HBCA have a higher likelihood of resulting in adverse consequences because they are in areas where fires can develop and spread to areas where the resulting fire impact can be severe.
- fires occurring during the bushfire season have a higher likelihood of resulting in adverse consequences because summer and early autumn conditions are much more conducive to fire spread and intensity than at other times of the year; and
- fires occurring on Total Fire Ban Days and Very High or worse fire danger days have a substantially greater likelihood of resulting in adverse consequences because fires are more likely to ignite in such conditions, can very quickly become uncontrollable, and achieve fire spread rates and intensity at or near the upper bounds possible.

Accordingly, vegetation caused faults during the fire season, in the HBCA, and particularly on days of Total Fire Ban are the greatest priorities to avoid.

Due to the potential for increased loss associated with causing a bushfire, greater clearances between vegetation and powerlines are required in areas designated as having the highest potential consequence in order to minimise this risk. Further, vegetation clearance timing in the highest potential consequence areas is timed for completion prior to the start of the bushfire season. Additionally, on the worst fire weather days (Total Fire Ban days) additional bushfire risk control measures are applied through adjusting protection

system settings to minimise the potential for bushfire ignition, should a fault occur (Reference 9 – Total Fire Ban Procedure).

Major storm events throughout winter and spring (when bushfire risk is typically low) can cause significant occurrences of trees falling from outside the clearance space resulting in widespread damage to the distribution network and unplanned outages. Vegetation-caused faults arising from these winter and spring storm events account for a substantial proportion of (but not all) TasNetworks vegetation impacts.

12.3 Safety incidents caused by vegetation

Incidents of electric shock as a result of vegetation contacting live overhead powerlines are very rare. One incident has been recorded over the last ten years.

12.4 Fire caused by vegetation

12.4.1 Transmission network fires caused by vegetation

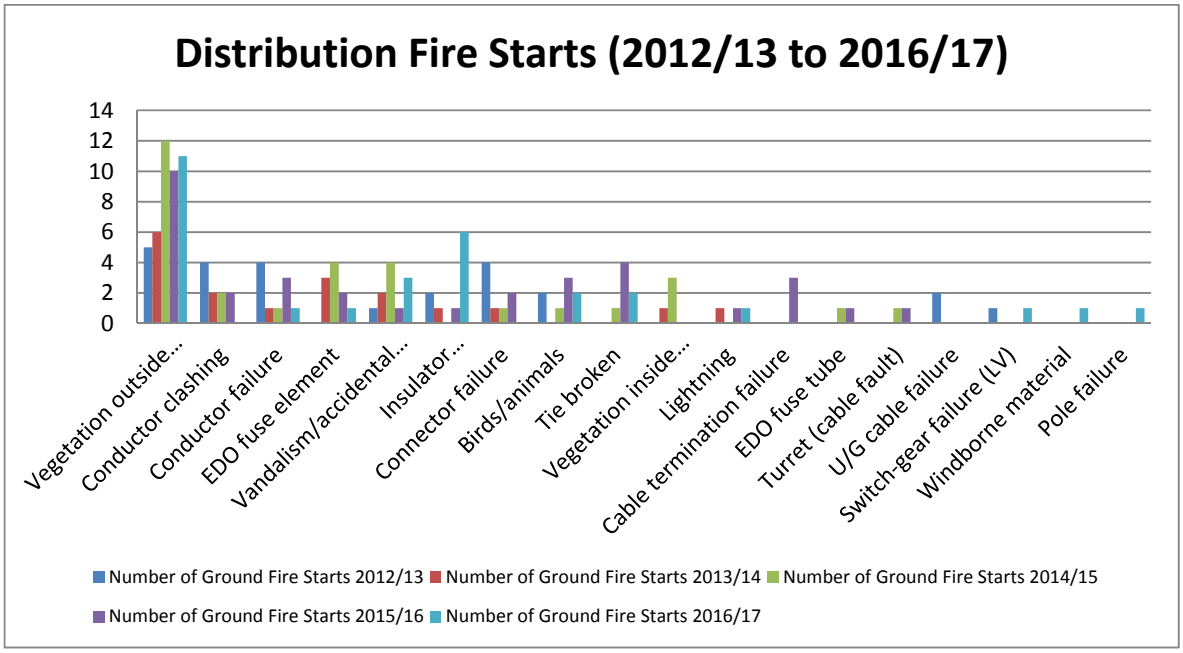
There are no recorded instances of vegetation causing fires in relation to transmission lines over the last 10 years. This is in significant part due to effective vegetation management. However, it is possible fire TasNetworks transmission network could start fires – this has previously happened although more than ten years ago, and has also happened on mainland transmission networks.

12.4.2 Distribution network fires caused by vegetation

Vegetation coming into contact with overhead powerlines attributed as the cause of approximately 35% of network-initiated bushfires and remains the single largest cause of powerline related fires. Figure 5 below shows that during 2012-13 to 2016-17, 48 fires were started as a result of vegetation contacting powerlines (out of a total of 138 fires).

The data shown in Figure 5 is collected from TasNetworks enterprise asset management system on a monthly basis and routinely reported to management (including annual reporting to Board).

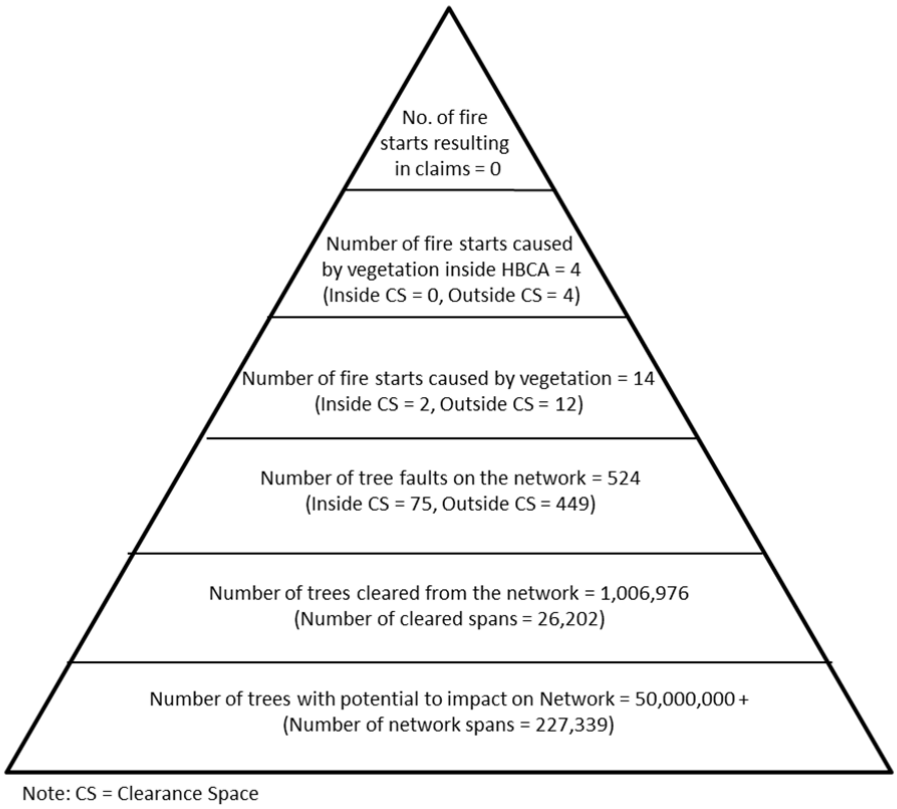
Figure 5 Fire caused by TasNetworks' distribution network 2012-13 to 2016-17



12.5 Vegetation exposure/fire impact pyramid analysis

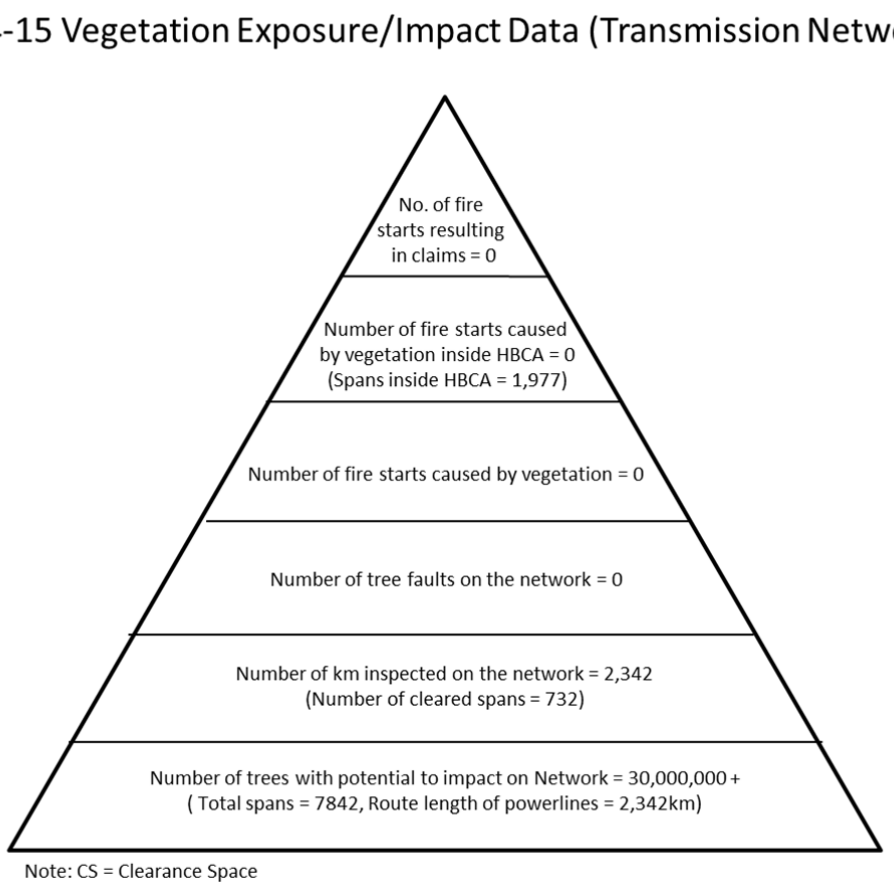
Figures 6 and 7 below illustrates TasNetworks' network exposure to vegetation and the impact the vegetation management program has had in reducing the risk of fire ignition as a result of vegetation coming into contact with overhead powerlines.

Figure 6 Vegetation exposure/impact on distribution network



Note: CS = Clearance Space

Figure 7 Vegetation exposure/impact on transmission network



The data within Figures 6 and 7 show that both TasNetworks' distribution and transmission networks have a very high exposure to vegetation with the potential to impact the network. Whilst the total volume of trees with the potential to impact the network has not yet been quantifiably identified, the figure is thought to be a conservative estimate.

The pyramids demonstrate the effectiveness of TasNetworks' vegetation management strategy and programs in reducing the risks associated with such a high level of vegetation exposure to zero major fires within the HBCA.

However, as shown within Figure 6, despite approximately one million trees being cleared (either removed or trimmed) from the distribution network during 2014-15, faults from vegetation contacting distribution powerlines from either inside or outside the defined clearance space can still occur. Such occurrences from trees inside the clearance space result from trees exceeding their estimated growth rates prior to the programmed return period, whereas faults occurring outside the clearance space are generally a result of seemingly healthy trees or limbs (not identified as Hazard Trees[9] at the time of inspection) failing or blowing into contact with powerlines from within the Hazard Space during extreme weather conditions.

Approximately three percent of all faults from vegetation contacting distribution powerlines result in a fire occurring. As can be seen within Figures 5 and 6, the vast majority of these resultant fires are caused by trees or limbs failing from outside the clearance space.

[9] See Appendix A for further explanation of Hazard Space and Hazard Trees.

Generally, the only vegetation related fires occurring inside the HBCA are as a result of trees or limbs failing from outside the clearance space. It is rare for fires to occur inside the HBCA as a result of trees or limbs failing within the clearance space[10].

TasNetworks has not recorded any significant fires occurring as a result of vegetation contacting powerlines inside the HBCA (on transmission or distribution networks) within the last 10 years.

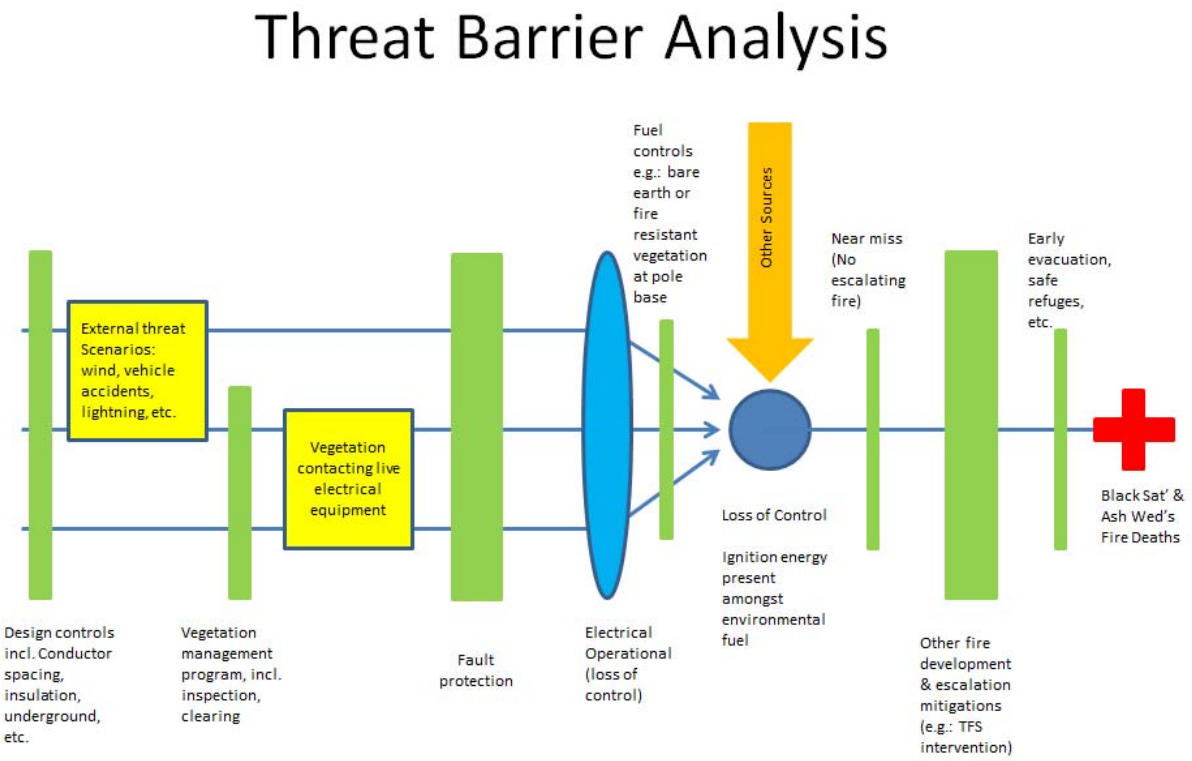
13 Vegetation management strategy

In general, vegetation management strategies can be considered to follow a similar approach to other asset management strategies, even though vegetation is highly dynamic and requires sustained, frequent maintenance. The key process and elements of TasNetworks' vegetation management strategy can be presented in a Threat Barrier Analysis form.

13.1 Threat barrier analysis

TasNetworks has undertaken a vegetation-specific Threat Barrier Analysis to identify the range of risk controls, before and after a 'loss of control' event.

Figure 8 Threat barrier analysis



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

[10] Additional vegetation management risk mitigation measures applied inside the HBCA ensures a reduced likelihood of at risk trees failing from within the clearance space. See Section 14 for further detail.

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 shown above was developed through the Black Saturday Powerline Bushfire Safety Taskforce (PBST) report published in 2011.

The loss of control point is important legally. It is always better to prevent the problem, either by eliminating the threat or enhancing precautions than by trying to recover the situation after control is lost. This is entirely 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 concurs with the PBST in that there is no 'silver bullet' option on the table. It is noted that the precautionary options implemented throughout the VAMP predominantly reduce the likelihood of electrically initiated fire starts. Impact on consequence can be affected through prioritisation of work inside the HBCA prior to the onset of the high bushfire risk season.

13.2 Vegetation management strategy overview

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; and

(ix) Monitor, evaluate and report on the performance of the strategic, 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 14 of this VAMP. More detailed information pertaining to vegetation management program design and implementation (for the above key program and core activities) is contained in the VOMP.

13.3 Transition from previous to current and future strategies

TasNetworks' vegetation management strategy is in a transition phase from the separate approaches and fixed-cycle systems existing prior to the amalgamation of transmission and distribution businesses, to a strategic system based on vegetation condition/risk assessments and forecasts.

Future vegetation management programs will include integration of both distribution and transmission programs. Integration is expected to occur post to December 2017.

13.3.1 Overview of previous strategy

Prior to creation of TasNetworks, the approach to vegetation management can be characterised as:

Distribution

- no operational vegetation management database in place, therefore inadequate evidence base for vegetation exposure and work volumes across the network, lack of understanding of find rates, and inability to forecast future vegetation management work volumes or budgets;
- planned 2 year rolling cut cycles, cutting to a 3 metre 2 year regrowth specification – the cycle was not being achieved (actual cycle length was 4 to 6 years);
- 12% of distribution spans inspected annually with cutting limited to those inspected;
- significant additional annual inspection and cut program required in HBCA to achieve annual clearance compliance due to routine cutting cycles not being achieved;
- no internal database to capture and track spans or tree volumes cut (data held externally by contractor);
- substantial majority of vegetation fires due to trees/branches falling on to conductors from trees outside the clearance space, but no tree overhang risk assessment, and no formal hazard tree program;
- contract management effort focussed on monitoring and driving contractor performance (performance-based hourly rates contract);
- weak quality/compliance audit effort with paper-based audit systems; and
- program performance monitoring restricted to pre-summer program delivery progress – no clear system of outcomes-based indicators.

Transmission

- annual aerial and ground based inspection program;
- Span clearance works scheduled in response to inspection results, according to assigned priority;
- accurate register of inspection results and vegetation defects;
- relatively stable and consistent works program with stable and predictable costs;
- effective auditing and review regime and with established system of key performance indicators.

The previous vegetation management system issues were identified during a detailed internal vegetation management audit conducted in October 2014. Arising from audit data analysis during 2016, a transitional program of vegetation management reforms has been developed which is intended to prioritise and address residual risks from the previous approaches and establish a sustainable vegetation maintenance situation in the short/medium term, whilst putting in place an evidence and risk-based vegetation management system for future works forecasting and budgeting, with an improved system of performance monitoring and reporting.

13.3.2 Overview of current transitional strategy

Based on the October 2014 internal audit outcomes, options analysis was undertaken to determine the best transitional approach to achieve the vegetation management objectives as soon as practicable.

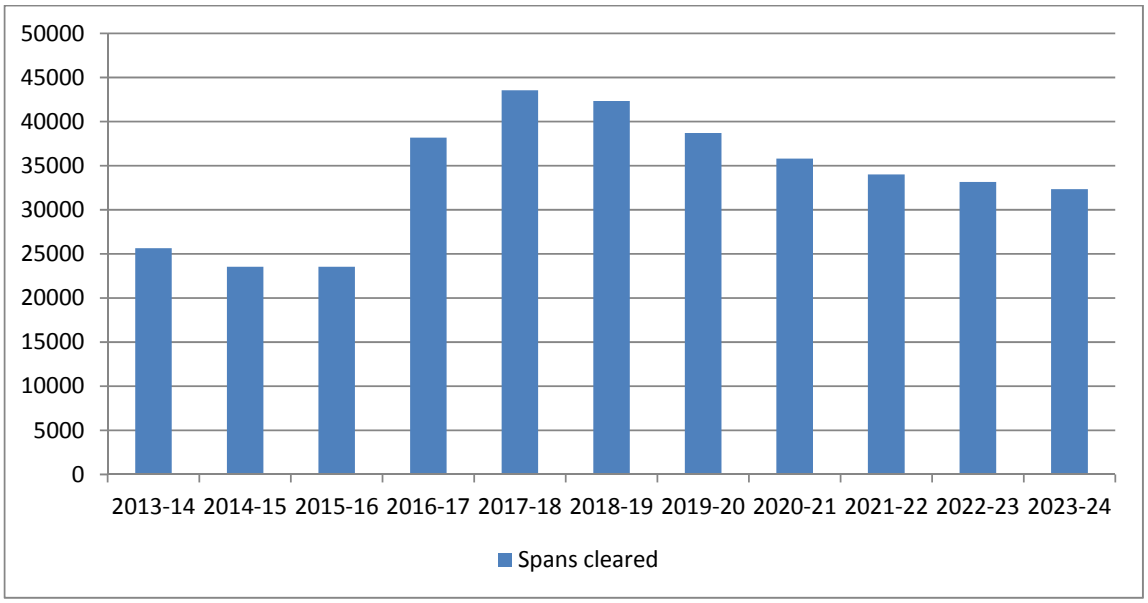
A revised approach (summarised below and shown within Figure 9) was developed to ensure that the immediate risks within the HBCA are prioritised for removal, whilst progressing with the removal of other priority defects.

Distribution

The transitional approach will ensure that vegetation management objectives are met within two years. This approach requires an increase in spans cleared over the next two financial years. Specifically, an increase from an average of 23,500 spans in 2015-16 to approximately 38,000 spans in 2016-17. Further increases are planned to occur during 2017-18 and 2018-19, with 43,500 and 42,300 respectively planned to be cleared.

The number of spans planned to be cleared between 2019-24 are expected to decrease further from approximately 38,700 in 2019-20 to 32,300 in 2023-24, at which time the number of spans required to be cleared will plateau as the result of achieving a steady maintenance state.

Figure 9 Distribution vegetation spans cleared



Based upon the data gathered to date, the increased number of spans actioned and subsequent increase in investment will result in the achievement of the vegetation management objectives earlier than would be the case if the current expenditure profile was maintained. The transitional approach will result in an improved risk position, improved awareness of actual vegetation defects, enabling tactical management and deployment of resources as we work towards achieving the vegetation management objectives.

The transitional approach will also result in a hazard tree management plan developed, implemented and maintained state-wide, rather than solely within the HBCA as is currently the case. The hazard tree management plan will aim at ensuring hazard tree locations are identified and reduced at a sustainable level. The reduction in volume of hazard trees near the network is expected to be in the vicinity of three percent per annum. This target will be reviewed upon completion of data capture.

TasNetworks also expects that the transitional strategy will significantly increase the number of vegetation management resources deployed in the state compared to the previous arrangement. TasNetworks estimates that the resource capacity state-wide will increase by approximately 40 per cent.

With the deployment of multiple vegetation service providers, incorporating increased contract resources and a higher cut-rate, TasNetworks will also be increasing current auditing and monitoring programs to

ensure effective management of the potential risk an escalation in the program and multiple contractors across the state could create.

Under the transitional approach the following will be achieved:

- all immediate risk PT1, PT30 and PT180 vegetation defects will be removed in the HBCA prior to the 2016-17 bushfire season and for all future bush fire seasons;
- removal of all PT1, PT30 and PT180 vegetation defects state-wide (i.e.: HBCA and non-HBCA regions) by the end of the 2017-18 financial year, at which time the vegetation management objectives will be met;
- an increased level of auditing undertaken on compliance with the vegetation management objectives and vegetation management works and to provide assurance that the clearance spaces are being maintained, while maintaining a safe work environment;
- further establishment and maintenance of state-wide vegetation data collection; and
- development and implementation of a state-wide hazard tree management program.

The transitional approach will reduce risk to a level better aligned with TasNetworks' risk appetite, and ensure TasNetworks continues to work towards meeting the vegetation management objectives as soon as practicable. As stated previously, TasNetworks will continue to work to achieve the targets outlined, at which point a maintenance state for vegetation will be achieved. At that same time in July 2018 a renewed state-wide vegetation management contract(s) is forecast to commence.

The transitional strategy will facilitate the continuity of vegetation management and enable the utilisation of accurate and complete vegetation data to more accurately forecast the future workload. It is anticipated that this will result in a better cost outcome in the future. Other forecast benefits of stable vegetation service providers include reduced safety risks, embedding increased maturity of the tactical management of service providers, and greater cost efficiency.

In addition to the transitional strategy, TasNetworks will continue to maintain tracks and easements to a level and condition such that safe all-weather access to TasNetworks assets and easements is possible for the purposes of routine maintenance and emergency fault repairs.

Historically, track and easement maintenance volumes and costs have remained relatively steady since 2012-13. Approximately 275 kilometres of track and easement mainteanace is undertaken per annum.

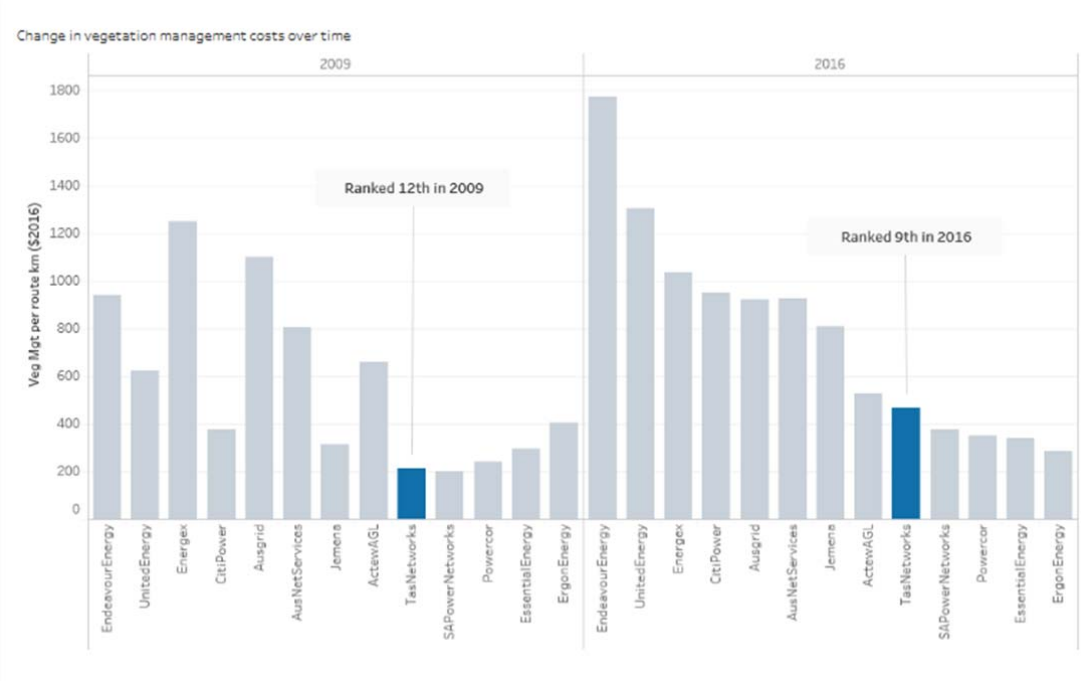
No significant increases are forecast in the near future.No significant changes are foreseen for the track and easement maintenance programs from previous year.

Distribution Benchmarking

2015 benchmarking of TasNetworks' historical vegetation management operational expenditure [11] against that of its peers has found that TasNetworks 'OPEX per overhead km' was below that of its peers, and below the industry average when normalised against both customer density and the weighted average trimming cycle.

2016 RIN benchmarking[12] (shown in Figure 10) highlights that whilst TasNetworks' vegetation costs per overhead km has increased since 2009, current costs per km are well below that of peer utilities.

Figure 10 Change in vegetation management costs over time



Transmission

The current vegetation management approach for vegetation in proximity to transmission lines is mature, and is currently achieving the vegetation management objectives through the implementation of annual pre-bushfire season aerial inspections and subsequent vegetation defect rectification. On average, approximately 940 spans are maintained per annum. Considering these successful outcomes TasNetworks does not propose making any changes to its current program at this point in time.

Transmission Benchmarking

TasNetworks' transmission networks are benchmarked biannually for asset management practices against international and national transmission companies.

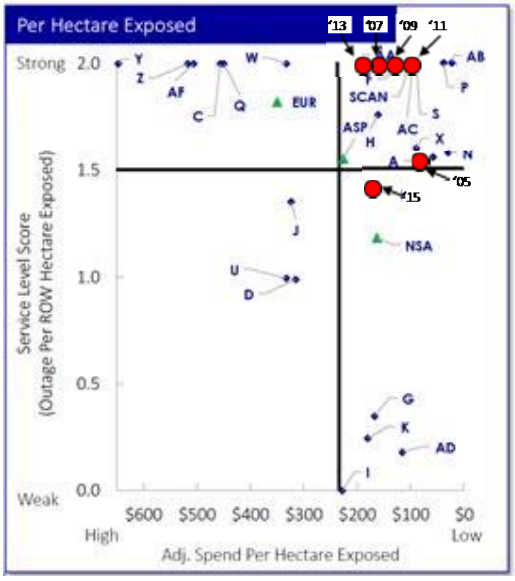
The International Transmission Operations & Maintenance Study (ITOMS) provides a means to benchmark performance (maintenance cost & service levels) between related utilities from around the world. The benchmarking exercise combines all forced and fault outages caused by vegetation into one distinct category, while also measuring the cost to provide 'right of way' (ROW) maintenance. Further details relating

[11] TasNetworks Opex Benchmarking, Huegin - 17 June 2015
[12] 2016 RIN benchmarking was carried out by Sankofa Consulting

to the ITOMS studies are provided in ITOMS reports which are held by TasNetworks' Strategic Asset Management Group.

Figure 10 illustrates TasNetworks' benchmarked ROW performance against all other ITOMS participants for the last six reporting periods.

Figure 11 Right of way ITOMS trend



The 'Right of Way Maintenance' metric demonstrates that over the past reporting period, TasNetworks has improved its cost performance whilst maintaining costs below the international average as well as the Australia/South Pacific (ASP) average. The 2015 service performance result declined from the previous four perfect results due to the occurrence of a single vegetation related incident. The single event in the 2015 service performance result mirrors that of the 2005 service performance result which is indicating a non-target service outcome on a ten year cycle which is considered acceptable, particularly given the below benchmark average input costs. The cost improvements can be attributed to TasNetworks' flexible and targeted vegetation clearing program and a shift towards the utilisation of herbicides in vegetation management. This also demonstrates the effectiveness of TasNetworks' transmission vegetation management strategies and provides confidence that TasNetworks is proactively reviewing its vegetation management strategies to maintain its cost and service performance.

13.3.3 Desired future maintenance strategy (for distribution from 2018/19)

The vegetation management strategy developed for vegetation in proximity to the distribution network is intended to achieve an ongoing sustainable vegetation clearing regime. The regime will initially reduce, and then maintain risk to an acceptable level. 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; and
- achieve an annual workload that is predictable, consistent and sustainably manageable whilst meeting all legislative and regulatory obligations, at the lowest sustainable cost.

The timeframe for achieving the vegetation management objectives is heavily influenced by the amount of vegetation that can be removed 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. In practice, the following will be realised when the objectives are sustainably achieved:

- there will be a consistent, state-wide approach to vegetation management;
- there will be no PT1, PT30, or PT180 vegetation defects identified during annual inspections;
- vegetation defects will be proactively managed, with removal of defects identified as PT365 and PT720;
- a hazard tree management program will be implemented and maintained state-wide, as committed to in the Bushfire Mitigation System Audit at the April 2016 Board meeting;
- vegetation defects are removed in timeframes according to their respective priorities;
- an accurate register of vegetation defects will be maintained;
- a pre-bushfire season vegetation management program will not be required because risks will be managed and actioned through the annual vegetation management program; and
- there will be an 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.

It is also important to note that over the coming years some fundamental improvements are anticipated to the environment in which the vegetation management program is implemented, with a positive impact on the program. These key environmental aspects include:

- the appointment of new service provider(s) and establishment of associated vegetation management contract(s);
- the collection of additional vegetation data through scoping activities in 2018;
- the implementation of a Vegetation Management System (VMS) in 2017-18; and
- a hazard tree management plan developed, implemented and maintained state-wide, rather than solely within the HBCA as is currently the case.

These advances will impact positively on the forecast outcomes and when they will be achieved.

Appendix C outlines previous, current, and future vegetation management approaches.

14 Programs of work and strategic projects

TasNetworks has in place a range of vegetation work programs aligned to delivering the Vegetation Management Strategy. All works programs are managed and delivered by TasNetworks Works and Service Delivery Group.

14.1 Vegetation inventory acquisition (project)

Vegetation data is acquired by external contractors, aligned to the vegetation management priority coding system. It is anticipated a network-wide vegetation inventory will occur every two years to ensure data currency. Further details of the vegetation inventory acquisition are contained in the VOMP.

Inventory data will be maintained through importing vegetation inspection and treatment data collected by contractors (to TasNetworks data specifications). The vegetation inventory data will reside within TasNetworks VMS.

Any changes to scope for this program can impact on decisions at both strategic and tactical levels and therefore require consultation between the Strategic Asset Management Group and Works and Service Delivery Group, with referral to the governance and risk assessment team (GRAT) for endorsement.

14.2 Create new assets and replace/relocate overhead assets (Distribution - REHVE)

A program is planned and executed for the replacement or relocation of overhead assets due to high vegetation risks. The work category code assigned to this program is REHVE.

This category of work relates to distribution powerlines where there are economic benefits to replacing or relocating powerlines (i.e.: capital costs) rather than clearing the vegetation in proximity to them (i.e.: operational costs). Such instances are extremely uncommon for transmission lines due to the related asset replacement/relocation costs usually proving uneconomical.

The majority of works within this category relates to works that are predominantly associated with the management of hazard trees.

A forecasted increase in work volumes within this work category (from recent historical works programs) over the 2019-24 revenue determination period reflects the strategic approach to reduce hazard tree exposure to the networks by approximately three percent per annum of recorded locations.

Recently captured data sets (2016-17) show that the risk reduction target of three percent will equate to approximately 136 spans per annum being converted from open wire construction to a covered alternative.This reduction target will be reviewed upon results of further data capture expected to be undertaken during 2018-19 on completion of the VMS.

When creating new network assets, or considering reconfiguration of existing assets, vegetation management costs will be assessed and considered as part of whole-of-life cost assessment, and factored in to investment strategy selection.

In areas identified to have unacceptable vegetation outage performance, clearance requirements for vegetation growing within heavily vegetated/high growth areas may not be achievable through the contemporary tree clearing regimes due to legislative requirements, environmental impacts or community expectations and require alternative methods to achieve regulatory compliance. In instances such as these, line re-design options may be the only viable alternative to meet TEC requirements. Line re-design can take the form of relocating or undergrounding assets, or replacing bare overhead conductors with an insulated alternative.

In many instances required clearance distances between vegetation and electrical assets cannot be achieved via tree clearing techniques due to issues such as:

- The aesthetic impact of removal of large volumes of trees required to achieve required clearances;
- areas of significance (e.g. World heritage areas, National Parks, Wet lands, etc.);
- trees of historical significance;
- street tree amenity issues;
- threatened and endangered species;
- organic farming; and
- avenues of Honour, etc.

In these situations, options for TEC compliance may be limited to items such as:

- overhead line re-design (relocate open wire route);
- overhead line re-design (convert open wire to covered conductor);
- overhead line re-design (convert overhead line to underground); and
- overhead line re-design (convert to hybrid underground/covered overhead options).

The actual costs for each re-design option will vary from site to site, depending upon a variety of factors. Construction costs range from approximately $15,000 per span for conversion from HV open wire overhead conductor to HV aerial bundled conductor (ABC), to approximately $50,000 per span for conversion from HV open wire overhead conductor to HV underground conductor.

Priorities for allocation for funding within this program will be directed by Strategic Asset Management (Works Initiator) for implementation by Works and Service Delivery.

14.3 Routine vegetation maintenance

As described in Section 13, the strategy for the distribution network is undergoing a transition in order to improve management capabilities and outcomes.

The VEGEM work category code is assigned to the distribution network routine maintenance program (OPEX) whereby works will be inspected, planned and executed throughout the delivery of the vegetation management strategy.

The objective of the distribution vegetation management program is to achieve an ongoing clearing regime that initially reducess, and then maintain risk at an acceptable level.

Transmission vegetation management program is captured separately within transmission OPEX expenditure reporting under the work category code of NTLVE. As described in Section 13, TasNetworks does not propose making any changes to its current approach at this point in time.

The vegetation clearance maintenance component of TasNetworks' vegetation management strategy is comprised of four key components:

14.3.1 Vegetation inspection

Network assets are to be inspected to find vegetation requiring clearance action, and to remove emergent vegetation that may impact on overhead lines to prevent it requiring recurrent trimming action. To achieve satisfactory inspection outcomes it will be necessary to inspect on a cycle appropriate to vegetation growth dynamics and risk, and in step with associated vegetation cutting/treatment works program requirements. TasNetworks has selected an annual inspection cycle across both the distribution and transmission network. On the distribution network, inspections are undertaken visually from the ground by appropriately qualified and skilled vegetation inspection contractors. On the transmission network, inspections are undertaken using aerial and ground patrols to identify any vegetation and easement access issues within and adjacent to the transmission line corridor, primarily between October and December, prior to the commencement of the bushfire season.

Within this program, decisions relating to the inspection cycle and the implementation method (E.G.: in-house or contract resource separated or combined with cutting) can impact on decisions at both strategic and tactical levels and therefore require consultation between the Strategic Asset Management Group and Works and Service Delivery Group, with referral to the GRAT for endorsement.

Further operational details about the operational scope, specifications, delivery method and timing for vegetation inspection programs are contained in the VOMP.

14.3.1 Vegetation works prioritisation

TasNetworks prioritises vegetation identified as requiring action on the basis of risk, and develops efficient work schedules for clearing vegetation. The prioritisation system applied by TasNetworks reflects the expected timeframe within which assessed vegetation is likely to grow into clearance/safety zones with the overhead conductors, and is therefore a proxy risk assessment. The prioritisation codes used also serve as priority timelines for clearing the vegetation.

Identified defects are compiled into vegetation work schedules/packages for issue to clearance contractors.

Any changes to scope for this program can impact on decisions at both strategic and tactical levels and therefore require consultation between the Strategic Asset Management Group and Works and Service Delivery Group, with referral to the GRAT for endorsement.

Further operational details about the operational scope, specifications, delivery methods and timing for vegetation work prioritisation and works program packaging/scheduling and issue are contained in the VOMP (covering both distribution and transmission).

14.3.1 External notification to clear vegetation

With regards to distribution powerlines, not all vegetation within clearance zones is TasNetworks' responsibility to action, particularly with respect to vegetation on private property near service lines and vegetation in proximity to private lines.

TasNetworks' obligations to inspect vegetation clearance includes private lines, and hence further obligations arise to notify responsible parties/owners of their obligations to clear vegetation in accordance with relevant standards. Additionally, any notifications made are also required to be notified to the Tasmanian safety regulator (within the Department of Justice).

TasNetworks has responsibility to clear in the vicinity of all transmission powerlines.

Further operational details about the operational scope, specifications, delivery methods, inclusions and timing for management of external notification processes are contained in the VOMP.

14.3.1 Action vegetation clearance works

Due to the large exposure of the overhead network to vegetation and the favourable growth conditions in Tasmania, there is a substantial volume of vegetation clearance work required annually to maintain compliance with regulated distribution clearance distances and transmission clearance standards (>1 million trees trimmed/cleared in 2014/15). Accordingly, TasNetworks needs to action vegetation using effective treatment methods, to maintain vegetation clearance compliance, and maintain stable or reducing forward work cycle volumes.

The operational delivery of the vegetation clearance program is developed and managed by Works and Services Delivery. Further operational details about the operational scope, specifications, delivery methods, and timing for management of external notification processes are contained in the VOMP (covering both distribution and transmission).

The overall approach to the vegetation clearance maintenance programs will be evaluated and reviewed annually.

Within this program, decisions relating to the contracting model and specification can impact on decisions at both strategic and tactical levels and therefore require consultation between the Strategic Asset Management Group and Works and Service Delivery Group, with referral to GRAT for endorsement.

14.4 Works program data capture (VMS – strategic project; ongoing data capture – program)

TasNetworks needs to collect and manage vegetation action works data in a form that supports assessment and forecasting of future work volumes and budget forecasting.

TasNetworks is in the process of commissioning development and delivery of an in-house VMS, which will be used to import, manage and analyse a range of vegetation management data including works data imported from mobile devices used in the field during vegetation works delivery. The VMS will apply to both distribution and transmission vegetation management programs.

The development and delivery of the VMS is being managed by Network Information Systems. Further operational details about the system scope, specifications, delivery methods, and timing for management of external notification processes are contained in the VOMP (covering both distribution and transmission).

Any changes to scope for this program can impact on decisions at both strategic and tactical levels and therefore require consultation between the Strategic Asset Management Group and Works and Service Delivery Group, with referral to the GRAT for endorsement.

14.5 Audit works compliance and effectiveness (program)

The substantial vegetation inspection and clearance works undertaken by contractors require a program of safety and quality assurance audit for monitoring contractor performance and assessing clearance compliance and achievement of other vegetation management program objectives.

Accordingly, TasNetworks will implement an audit program to provide inspection and clearance works quality assurance and influence appropriate contractor behaviour/performance.

To ensure that the quality of service provided by TasNetworks' vegetation contractors meets acceptable levels, TasNetworks will undertake routine audits of vegetation scoping and cutting. In accordance with standard methodology for determining the appropriate sample size, TasNetworks will undertake the following annual audits to meet the specified confidence levels and margins of error:

- audit of 9585 distribution spans in the HBCA, for a confidence level of 99% and margin of error of 0.5%;
- audit of 7015 distribution spans outside the HBCA, for a confidence level of 95% and a margin of error of 0.5%; and
- audit of all transmission spans state-wide for a confidence level of 99% and margin of error of 0.5%.

Where the defect rates of the vegetation contractor exceed the values specified above by more than the allowable margin of error (0.5%), TasNetworks will take action to reach an appropriate resolution with the contractor.

An annual audit plan is to be developed to deliver the vegetation management audit strategy. The audit plan is to incorporate auditing of:

- safety;
- both clearance compliance and vegetation removal work specification compliance;
- vegetation inspection results validation;
- vegetation works data capture validation.

The annual audit plan is developed and delivered by Works and Services Delivery, and incorporated in the VOMP.

14.6 Monitor, evaluate and report (program)

To facilitate continuous improvement processes, it is necessary to monitor, evaluate and report on the performance of the tactical and operational work programs in achieving vegetation management program delivery, and objectives (covering both distribution and transmission).

TasNetworks will assess delivery performance issues and develop improvement recommendations in relation to each of the work programs (above). TasNetworks will also evaluate performance against the leading and lagging indicators (as detailed within Section 8).

The performance evaluation and program delivery reports will be jointly developed by the Strategic Asset Management and Works and Service Delivery groups.

Performance reports will be compiled monthly and delivered to the Strategic Asset Management and Works and Service Delivery groups.

15 Support systems

Recent Regulatory Information Notice (RIN) data collection activities and resulting benchmarking outcomes, and a review of information systems and the associated processes used by TasNetworks in managing the risk, cost and performance associated with vegetation has revealed that there are a number of improvement opportunities in this area.

During 2017-18, TasNetworks will develop and implement an improved VMS that will enable improved capture and quantification of workloads and forecasting data for both distribution and transmission network. This information will be used to more accurately match funding and resourcing strategies to workloads, meeting TasNetworks' goal of achieving a sustainable maintenance cycle.

An investment in such a specialised asset management system (ultimately with integration into TasNetworks enterprise resource planning system) will achieve best practice by bringing TasNetworks into alignment with other Australian network service providers (NSPs), and will also significantly improve TasNetworks' ability to continue to leverage the value provided by the RIN benchmarking process.

16 Financial summary

All programs of work have undertaken an investment evaluation (as part of relevant pricing determinations) to ensure risks are mitigated by employing the most efficient and effective solutions. Further detail may be found within the investment evaluation summary (IES) for each program of work.

17 Responsibilities

17.1 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. The empowered services operating model has been defined 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)	Works and Service Delivery (W&SD)
• Focus is on needs assessment and strategy development • Determines what works/programs should be delivered, and by when • Prioritisation of works program • Not 'distracted' by delivery of works	• 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

17.2 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 life-cycle.

17.3 Process roles

The Programming and Planning group within Works and Service Delivery 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; and
- 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.

17.4 Works initiator

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.

17.5 Works owner

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.

17.6 Governance and risk assessment team (GRAT)

The purpose of the 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); and
- Minor Works Delivery Team Leader (if applicable).

Further detail regarding the E2E process can be found within end to end works management process (R356224).

17.7 Asset management plan maintenance

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

Approval of this management plan is the responsibility of the Leader Asset Strategy and Performance.

18 Related standards and documentation

The following documents have been used to either in the development of this management plan, or provide supporting information to it:

1. Electricity Supply Industry Act 1995
2. Electricity Industry Safety and Administration Act 1997
3. Tasmanian Electricity Code (Chapter 8A)
4. TasNetworks Risk Management Framework (R209871)
5. Bushfire Mitigation Asset Management Plan (R303735)
6. Transmission Lines Easements Asset Management Plan (R32687)
7. Distribution Vegetation Operational Management Plan (R293200)
8. Hazard Tree Management Plan (R403835)
9. Total Fire Ban Procedure (DOP-002)
10. Operation of Transmission Lines During Extreme Summer Conditions (TNO – 107)
11. Energy Networks Association, Vegetation Management Practice Report, October 2015
12. Energy Networks Association Doc. 023-2009, Guidelines for Safe Vegetation Management Works near Overhead Lines

Appendix A – Distribution Hazard Space and Hazard Tree explanation

Hazard Space:

The space outside the clearance space and regrowth space in which trees or limbs due to their unsafe condition are a potential hazard to the safety of a distribution powerline under the range of weather conditions that can reasonably be expected to prevail.

The hazard space will vary with the species of vegetation and the extent of exposure to adverse weather conditions. The hazard space should be determined with reference to these factors and assessed with the support of vegetation management and arboriculture expertise.

Not all trees inside the hazard space are hazard trees.

Hazard Trees:

All trees, including healthy, structurally sound trees, present a risk of failure if they are subject to stronger winds than they can withstand, or other sources of physical impact that cause tree failure. Tree failure modes can include uprooting/blow down (particularly when the ground in which they are rooted is affected by waterlogging or disturbance), or stems and/or branches can fail when subject to wind loading beyond levels they can withstand. However, it is mostly not a viable option (socially, economically or environmentally) to clear all vegetation within falling distance of overhead network assets.

Accordingly, the term 'hazard trees' is typically used to define the component of the tree population to which overhead networks are exposed which constitutes a 'high risk' of failure in the direction of the assets. There is no national standard or definition that delineates when a tree is deemed a 'hazard tree' or not. Therefore, TasNetworks needs to establish its own definition. In doing so, the definition needs to be in practical terms, suitable for application by vegetation management staff and contractors. It also needs to be reasonable such that it does not extend to incorporating trees that have little risk of failure during the current or next inspection/cutting cycle.

Having reviewed various definitions in use by other Australian NSPs (and noting that they are all different), TasNetworks has adopted the following Hazard Tree definition:

> *Dead or dying trees, and trees with obvious externally visible defects that indicate poor structural integrity, which based on the inspector's experience are at high risk of failure in foreseeable weather conditions, and upon failure would be likely to come into contact with overhead power lines.*
>
> *Note: Hazard trees includes trees with defective limbs of sufficient size which, based on the inspector's experience, if the limb failed it would be likely to fall on to the overhead power line and with sufficient force to cause conductor clashing or failure.*
>
> *This definition applies regardless of whether the hazard tree is inside or outside the clearance space.*

For the purposes of practical application by inspectors, noting that inspection for hazard trees is undertaken as part of normal vegetation clearance inspections, structural defects and/or visible indicators of poor structural integrity would need to be sufficiently large and obvious to be visible to inspectors during their normal clearance inspection practice. To be clear, the requirement for inspectors to be observant for, and record hazard trees, does not require them to depart from their normal vegetation clearance inspection practice or location.

To differentiate overhanging vegetation from hazard trees, TasNetworks has adopted the following definition for Overhanging Vegetation:

> *Vegetation which is not deemed a 'hazard tree' but which has branches inside the clearance space and are overhanging overhead power lines, not including low voltage.*

Hazard trees are generally not easily trimmed due to their stature or their height/extension above roadways, and due to their hazardous nature (limbs and stem section at imminent risk of failure), and often positioning of equipment is limited to working over the top of live High Voltage powerlines.

Hazard Tree Management Process:

Further detail regarding the processes used to manage hazard trees are documented within the VOMP (Reference 7).

Appendix B – Transmission Vegetation Clearance Standard

Figure 10 Safety clearance dimensions from transmission line conductors

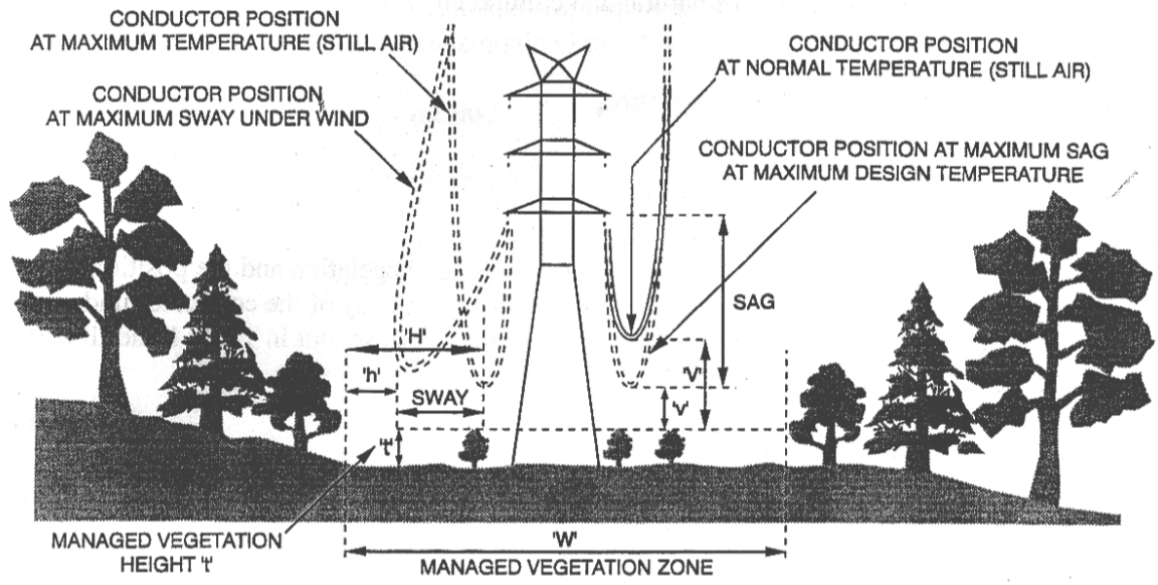


Table 6 Safety clearances to vegetation required from transmission line conductors

		Safety Clearances Before Allowance for Sag and Sway		Safety Clearances Including Allowance for Sag and Sway (Span Length up to 400m)	
Nominal Voltage (kV)	Nominal Managed Vegetation Zone Width 'W' (m)	Dimension 'v' (m)	Dimension 'h' (m)	Dimension 'V' (m)	Dimension 'H' (m)
110	34	2.5	3.5	7.0	12.0
220	40	3.5	4.5	8.0	13.0
220	40	3.5	4.5	8.0	13.0

Notes regarding Figure 14 and Table 6:

(a) Columns 3 and 4 of the table give the safety clearances necessary between vegetation and conductors at the design limits of sag and sway. Design standards for the managed vegetation zone width 'W' and the managed vegetation height 't' provide for the safety clearances together with the additional allowances necessary for sag and sway. Working distances 'V' and 'H' will be greater for spans longer than 400m.

(b) Dimension 'W' – nominal width of the managed vegetation zone for span lengths up to 400m. Actual width may vary for differing span lengths and tower dimensions, and will generally coincide with easement dimensions. Width will be greater for spans longer than 400m.

(c) Dimension 't' – limit of mature vegetation height within the managed vegetation zone. Design standards allow for trees up to 3m (88 & 110kV) and 3.2m (220kV) without infringing the safety clearance to the lowest conductor.

(d) Dimensions 'W' and 't' are based on mature vegetation. Additional allowance must be made for future regrowth or regrowth in assessing need for clearing/pruning.

(e) Dimension 'v' – clearance measured vertically from the lowest conductor when at maximum sag.

(f) Dimension 'h' – clearance measured horizontally from the outermost conductor when at maximum sway.

(g) Columns 5 and 6 of the table give safety distances between vegetation and conductors which include allowance for sag and sway for span lengths up to 400m. These are working distances assessed from the normally observed position of the conductor and are applied at any point along the span.

(h) Dimension 'V' – clearance measured vertically from the lowest conductor in its normal operating position and includes allowance for maximum sag.

(i) Dimension 'H' – clearance measured horizontally from the outermost conductor in its normal operating position (no wind) and includes allowance for maximum sway. This clearance applies to the centre 2/3 of span and can be reduced appropriately within end 1/6 of span (at either end) as shown in Figure 14.

Figure 11 Vegetation grading for the hazard space adjacent to the transmission line

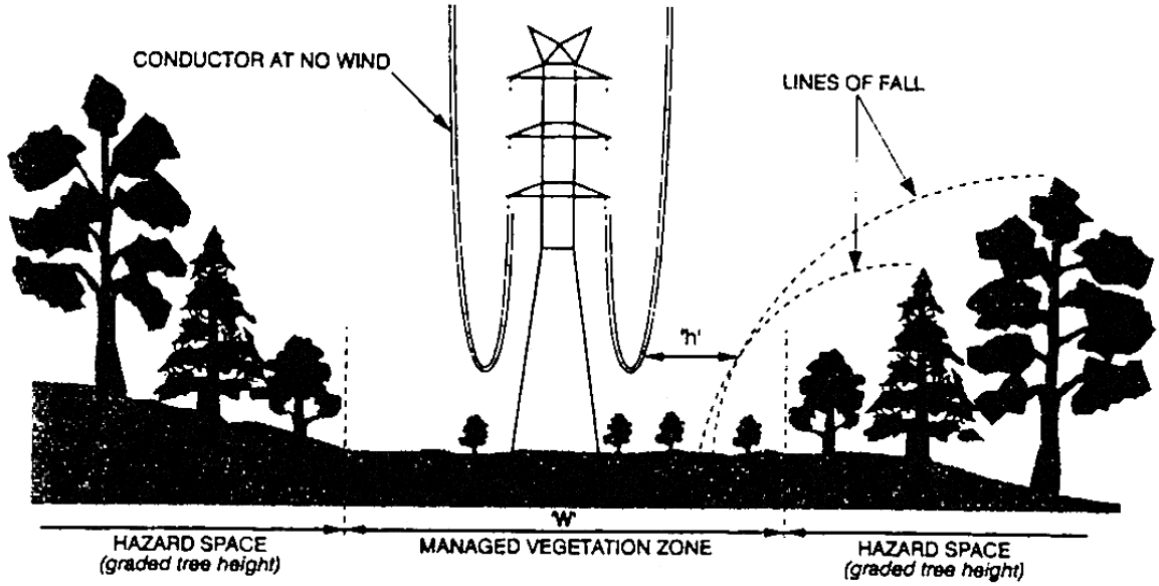


Figure 12 Typical profile within the managed vegetation zone

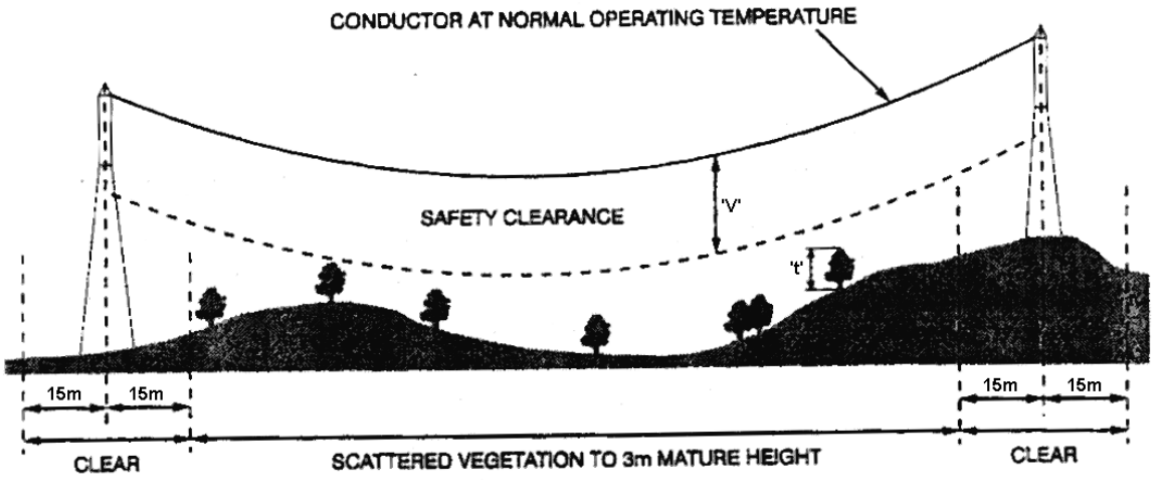


Figure 13 Plan view of managed vegetation zone for typical span (up to 400m)

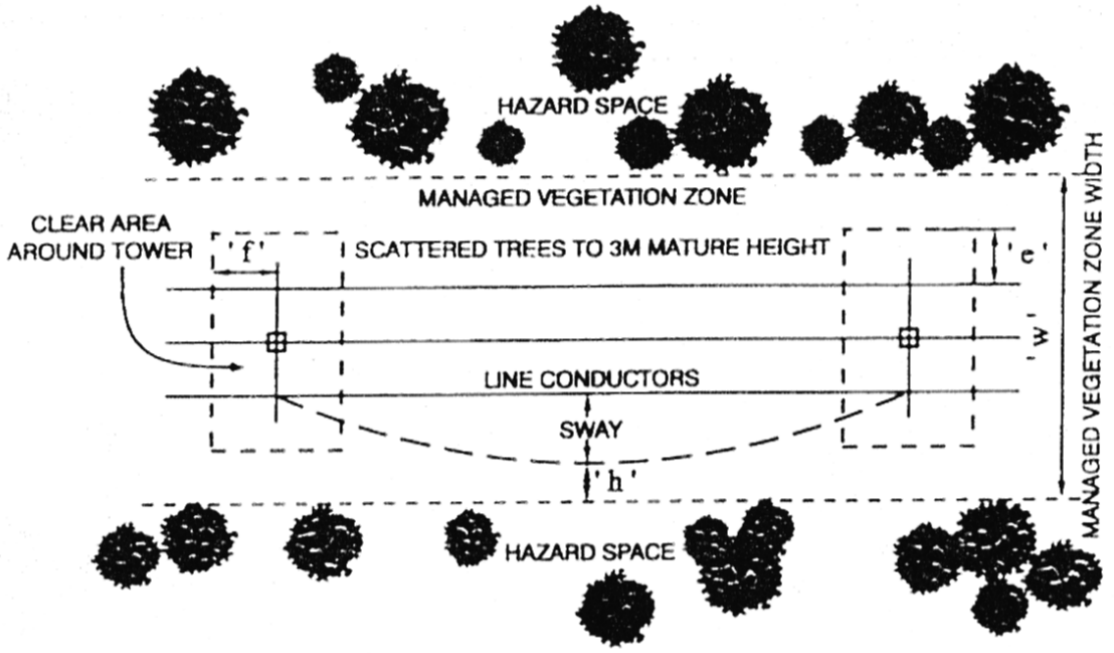


Figure 14 Plan view of managed vegetation zone option for long span (>400m)

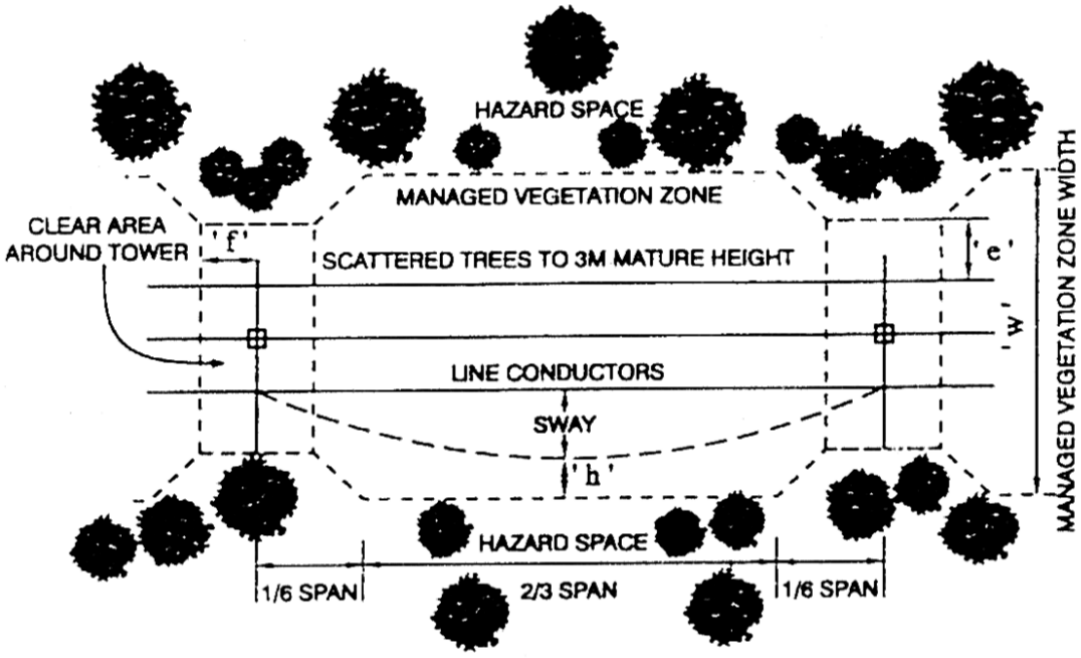


Table 7 Horizontal vegetation clearances required from transmission line towers

Voltage (kV)	Dimension 'e' (m)	Dimension 'f' (m)
110	9.0	15.0
220	10.0	15.0

Notes regarding Figure 17, Figure 18 and Table 7:

(a) Figure 17 shows a typical plan view of the managed vegetation zone

(b) Figure 18 shows an option for limiting the cleared width close to the tower and may be considered for longer spans (generally >400m) in hilly terrain

(c) The cleared width limit near the tower is dimension 'e' and is contained in Table 7.

(d) For both situations as per figures 17 and 18, the area immediately around the tower is to be kept clear of vegetation and shrubs to ensure emergency access and working area is available. The dimensions of the clear area are dimensions 'e' and 'f' contained in Table 7. Suitable species of limited height and density may be allowed/retained within this clear area around the tower by agreement with TasNetworks.

(e) Dimension 'e' – clearance measured horizontally from the still air position of the outermost conductor.

(f) Dimension 'f' – clearance measured horizontally from the centre of the tower.

Vegetation Fuel Loads

The volume or type of vegetation within an easement can determine whether burning vegetation poses a risk to the mechanical and electrical integrity of overhead transmission line conductors.

TasNetworks manages fuel loads within easements through regular vegetation clearing (hand and/or mechanical) combined with herbicide application where appropriate to control vegetation regrowth.

In some cases, long-term management of vegetation fuel loads may involve a modification of easement vegetation type, by the removal of undesirable species and replacement with, or encouragement of natural growth of a more suitable species.

Customer Consultation

Where vegetation control work on a transmission line easement is required, TasNetworks will consult with the respective property owner, or their representative, with regard to the vegetation control required. By way of confirmation, a Wayleave Clearing Environmental Assessment record is offered to the property owner, or their representative, detailing the extent of work and the method to be employed. The vegetation shall be cleared, as far as agreeable to stakeholders, in accordance this standard. Vegetation control may in some cases involve a modification of vegetation type, by the removal of unsuitable species and replacement with, or encouragement of, natural growth of a more suitable species.

Appendix C – Previous, current, and future vegetation management approaches

Table 8 Previous, current, and future vegetation management approaches

Activity	Previous	Current	Future
	Rural and urban areas		
Inspection	Linear and localised (rolling schedule of planned spans)	Risk based and state-wide	Risked based Entire state
Inspection frequency	Planned 2 year cycle Actual 4 to 6 year cycle	Annual	As determined by the vegetation risk profile and sustainable program (Influenced by growth rate, diameter of vegetation, species, weather patterns, priorities determined in last inspection, cut completed time, etc.)
Annual spans inspected	12%	100% (forecast)	100% or as determined by vegetation risk profile and sustainable program
Priorities determined	Localised	State-wide	State-wide
Priority system	PT1-PT720	PT1-PT365	PT1-PT365
Annual spans cut	12% – priority of individual trees unknown	11% (estimated) – PT1-PT180 2% (estimated) – PT365	11% (estimated) – PT1-PT180 2% (estimated) – PT365 Or as determined by vegetation risk profile and sustainable program
Cutting cycle	Linear and localised (rolling schedule of planned spans) Limited to those inspected	Commencement of risk based, state-wide cycle	Mature risk based, state-wide cycle
Cut timing	Planned 2 year cycle Actual 4 to 6 year cycle	Within 1 year (PT1-PT180) 1 year to 2.5 years (PT365)	Within 1 year (PT1-PT180) 1 year to 2.5 years (PT365) Or as determined by the vegetation risk profile and sustainable program
Cutting scope	3 metre 2 year regrowth specification	3 metre 2 year regrowth specification	3 metre 2 year regrowth specification

Activity	Previous	Current	Future
Priorities cut	PT1-PT720 (localised)	PT1-PT365 (state-wide)	PT1-PT720 (state-wide) or as determined by the vegetation risk profile and sustainable program
Out of clearance zone – over hang trees	No risk assessment No cutting	Risk assessment completed Vegetation cut if deemed high risk	Risk assessment completed Vegetation cut if deemed high risk
Hazard tree program	Nil	Draft program developed	Program ongoing
Data collection	Paper based, limited operational data	Paper based, improved strategic and operational data	Mature strategic and operational data Electronic data capture
Data system	Paper based, Microsoft Excel spreadsheet, contractor field based tablets	Paper based, Microsoft Excel spreadsheet, contractor field based tablets	Vegetation Management System including TasNetworks' field based tablets
Annual vegetation audits	Safety audits – 24 (2 / month) Productivity / Quality / Environmental audits - 96 (8 / month)	Safety audits – 24 (2 / month) Productivity / Quality / Environmental audits - 96 (8 / month)	Safety audits – 24 (2 / month) Productivity / Quality / Environmental audits - 96 (8 / month)
Contractor model	Competitive tender Contract awarded (2+2+2 years to single contractor)	Interim contracting arrangements in place Competitive tender now scheduled	Competitive tender with panel of contractors likely to be engaged
Annual operational Budget	$10.95 million per annum	$20.25 million per annum (reducing per annum)	$15 million per annum or as determined by the sustainable program

Activity	Previous	Current	Future
	High Bushfire Consequence Area (HBCA)	High Bushfire Consequence Area (HBCA) and Other Identified High Risk Areas	
Inspection	Linear and localised regional (rolling schedule of planned spans)	Linear and localised (rolling schedule of planned spans) Aerial inspections introduced	Linear and localised (rolling schedule of planned spans) or as determined by the vegetation risk profile and sustainable program Aerial inspection as determined by the vegetation risk profile and sustainable program
Inspection frequency	Annual	Annual	Annual or as determined by the vegetation risk profile and sustainable program
Priority system	PT1-PT365	PT1-PT365	PT1-PT365

Activity	Previous	Current	Future
Annual spans cut	All spans cut as required	All spans cut as required in HBCA and high risk areas (east coast in 2015-16)	All spans cut as required in HBCA and high risk areas or as determined by the vegetation risk profile and sustainable program
Cut timing	Annual	Annual	Annual or as determined by the vegetation risk profile and sustainable program
Cutting scope	3 metre 2 year regrowth specification	3 metre 2 year regrowth specification	3 metre 2 year regrowth specification
Priorities cut	PT1-PT365	PT1-PT365	PT1-PT365