ISSC3

Guide for the Management of Vegetation in the Vicinity of Electricity Assets

A set of requirements for the management of the risks associated with the impact of vegetation on Electricity Assets for the benefit of public safety, community amenity and electricity supply reliability.

November 2016

1 Name

This Guide is called the "Guide for the Management of Vegetation in the Vicinity of Electricity Supply Infrastructure", and has been written for the purposes of assisting Network Operators achieve the safety requirements specified in the NSW Electricity Supply (Safety and Network Management) Regulation 2014 (NSW) and Australian Standard (AS) 5577 "Electricity Network Safety Management Systems" 2013.

2 Commencement

This Guide comes into effect as an interim Guide following its publication in November 2016. It supersedes the previous ISSC3 Guideline for the Management of Vegetation in the Vicinity of Power Lines (2005). At the time of publication the Committee is aware of developments in other States, and pending finalisation of a NSW Coronial Inquiry, that may necessitate further amendment to this Guide. When these matters are clarified the Guide will be reassessed and updated as necessary prior to its issue as a final Guide.

3 Revision History

This Guide was first published by the Department of Minerals and Energy as the "Guidelines for Tree Planting and Maintaining Safety Clearances near Power Lines" in 1983.

The Electricity Council of New South Wales updated the Second Edition 1990 in February 1992: "Guide to Tree Planting and Maintaining Safety Clearances near Power Lines - EC 3".

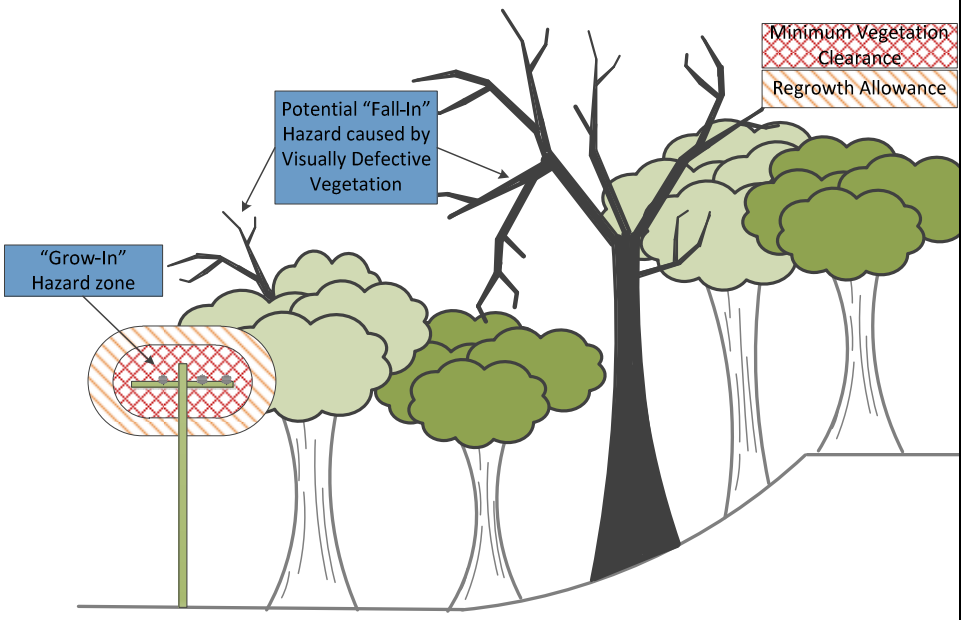
The Electricity Association of NSW (EA of NSW) published a revised guide ISSC3 on behalf of The Industry Safety Steering Committee (ISSC) in October 1996.

In July 2002, the Minister for Energy reconstituted the ISSC following the 'winding up' of the EA of NSW, and the newly formed ISSC, under the secretariat and chairmanship of the Department of Energy, Utilities and Sustainability a revised version of the document was released in 2005.

In February 2015, the ISSC reconvened a Working Group to review the content of the Guide with respect to industry changes throughout Australia and the progressive introduction of new vegetation management techniques. This updated document "Guide for the Management of Vegetation near Electricity Supply Infrastructure" was released in November 2016.

4 Definitions

ALARP	As Low as Reasonably Practicable: the level of risk that is tolerable and cannot be reduced further without the expenditure of cost, time and/or effort that is disproportionate to the benefit gained or where the solution is impractical to implement.
Bushfire Danger Period	The statutory Bushfire Danger Period as defined by the RFS which is nominally between October 1st to March 31st each year, but may vary from year to year and in specific locations due to local conditions.
Bushfire Prone Area	An area of land that can support a bush fire or is likely to be subject to bush fire attack, as designated on a Bush Fire Prone land map. A Bushfire Prone Area may also be defined by the Network Operator utilising data, advice and mapping information provided by the RFS or other available relevant sources.
Bushfire Risk Assessment	An assessment of the fire risk in the context of the operation of Electricity Assets as determined by the Network Operator utilising data, advice and information provided by relevant sources. Bushfire risk assessments may be used to define the various levels of risk within a Bushfire Prone Area to determine treatments and priorities.
Clearing Requirement	The clearing requirement is the sum of the Minimum Vegetation Clearance and the regrowth allowance. It is the expected outcome immediately after the vegetation Hazard Management Cycle has been carried out.
Electricity Assets	For the purposes of the Guide, the above ground electrical assets of an Electricity Supply Distribution Network (including supporting and related infrastructure such as warning signs) which can be interfered with or affected by vegetation to the extent of creating a hazard. This may include assets under private or public ownership, and includes customer-owned connection assets.
Electricity Supply Distribution Network	The Electricity Assets that are used to convey and control the supply of electricity to or from the premises of customers (i.e. consumers or generators). In NSW this typically includes electricity supply assets that operate up to and including a voltage level of 132kV.

Fall-in Vegetation Hazard	Visually defective vegetation (which is vegetation that is dead, dying and appears structurally unsound as identified from the perspective of the Network Asset as far as it is reasonably practicable to do so), that is outside the minimum Clearing Requirement distances from Electricity Assets and which may require pruning, cutting, or removal to obviate the risk of it falling, dropping, and contacting the assets. 
Grow-in Vegetation Hazard	Vegetation within the stated Minimum Vegetation Clearances for any asset described within this Guide.
Hazard Management Cycle	In the opinion of the Network Operator, after consideration of the regrowth allowance due to predicted environmental factors, the time required between return visits to areas to cut vegetation that enables maintenance of the Minimum Vegetation Clearance without trimming vegetation beyond that which is acceptable to the community. The objective of the Hazard Management Cycle is to avoid any encroachment into the Minimum Vegetation Clearance between cuttings as far as is reasonably practicable.
ISSC	Industry Safety Steering Committee
Minimum Vegetation Clearance	The minimum clearance area surrounding an asset which as far as reasonably practicable is kept free of all vegetation in accordance with the requirements of this Guide.

Network Operator	For the purposes of this guide the entity that has responsibility for the safe and reliable operation of an Electricity Distribution Supply Network in NSW, or its authorised representative. The Network Operator may or may not be the owner of the Electricity Assets, but will have legal responsibility for their safe operation in accordance with the Electricity Supply (Safety and Network Management) Regulation 2014 (NSW) and other relevant legislation.
Non Bushfire Prone Area	All areas not classified as a Bushfire Prone Area.
Regrowth Allowance	The additional clearance allowance required that is added to the Minimum Vegetation Clearance, as determined by the Network Operator, to prevent vegetation regrowth incursions into the Minimum Vegetation Clearance between Hazard Management Cycles.
RFS	Rural Fires Service of NSW
Transmission System	The electricity supply assets that typically operate at voltage levels at or above 132kV, and whose operation is undertaken by a licenced Transmission Network Service Provider in NSW.

5 Purpose of Guide

The purpose of this Guide is to provide a minimum standard for the management of vegetation in the vicinity of electricity supply infrastructure in NSW. The content of this Guide has been developed to assist in the fulfilling of a Network Operator's obligations pertaining to:

- The safety of the public, and persons near or working on the network including the maintenance of electrical safety clearances;
- The protection of property and Electricity Assets;
- Protection of the environment, including protection from ignition of fires; and
- Continuity of electricity supply.

This Guide is intended to provide a minimum requirement for the establishment and maintenance of vegetation clearances from electricity supply infrastructure in order to achieve and maintain currently accepted levels of safety, risk and reliability performance of electricity supply networks.

Variation from the specific clearance requirements in this Guide may be at the discretion of the Network Operator on the basis that an alternative risk management outcome has been determined to be consistent with the risk outcomes of this Guide.

6 Scope and Application of Guide

6.1 Scope

This Guide applies specifically to all Electricity Assets in NSW that are associated with an Electricity Supply Distribution Network, whether they are publicly or privately owned and/or operated.

It outlines the vegetation management requirements to be applied in the vicinity of Electricity Assets in the absence of a comprehensive site-specific risk assessment.

It is applicable to the following Electricity Assets:

- Overhead power lines;
- Poles, towers and other power line support structures;
- Kiosk Substations / Switching Stations;
- Electricity supply substations and associated infrastructure and related fenced areas;
- Network Operator communication cables attached to power line support structures;
- Street Lighting Luminaires (for the purposes of protection of the asset); and
- Waterway warning signs advising of overhead power line crossings.

6.2 Exclusions

This Guide does not specifically apply to transmission electricity supply assets (as may be operated by a TNSP), although they may be instructive for the management of some aspects of transmission electricity supply assets.

This Guide does not apply to the following circumstances, assets, or vegetation management requirements.

- Electricity network asset corridor clearing beyond the minimum Clearing Requirement for the purposes of efficient long term corridor management; and
- Any third party communication cables not owned by a licenced network operator but are installed on power line support structures where the use of the structure by a third party is based on a formal joint-use agreement.

6.3 Application

The requirements of this Guide are applicable to the maintenance of existing electricity supply infrastructure that has been constructed and is available for service. It is not applicable to the management of vegetation during the design and construction phase of new assets, which is provided for by the associated planning and construction approvals for those assets.

This Guide:

- Outlines the clearance requirements for vegetation management adjacent to Electricity Assets belonging to a Network Operator;
- Provides a standard set of vegetation clearances to be maintained for vegetation in the vicinity of Electricity Assets; and
- Maintains the risk of vegetation contact and human contact with live electricity supply assets at levels consistent with current public safety requirements, regulatory safety obligations, and community expectations.

The requirements of this Guide have been determined to provide the minimum risk outcomes required in the management of hazards arising from vegetation in the vicinity of Electricity Assets in the absence of site-specific vegetation hazard related risk assessments. They are based on empirically–determined hazard remediation requirements that also provide for ensuring the amenity of vegetation is maintained consistent with community expectations.

The onus remains at all times on a Network Operator to assess and understand the risks from the proximity of vegetation to their electricity supply assets relevant to their particular operational and environmental circumstances and to take any necessary action to address these risks consistent with regulatory obligations and community expectations.

This Guide is to be read and applied in conjunction with any other codes, guides, standards and legislation relevant to NSW Vegetation Clearance Requirements.

Schedule 1 - Vegetation Management: Clearance and Hazard Management Requirements provides specific vegetation clearances that reflect current vegetation management practice in NSW commensurate with the present understanding of public safety, risk management, operational efficiency, vegetation amenity expectations, and statutory obligations.

Alternate vegetation clearance requirements to those outlined in this Schedule may be applied to achieve an improved risk position, better safety outcomes, enhanced network reliability outcomes, improved community amenity, or operational efficiency.

Should a Network Operator choose to apply clearances different from those provided in Schedule 1, it should only do so on the basis of a comparative risk assessment against the risk outcomes generated by the Schedule 1 clearances and having determined that any such variation does not introduce a lesser public safety and risk outcome than that achieved by adhering to the requirements of Schedule 1.

Further, it is recognised that the clearances provided in Schedule 1 may not cover every situation. Where this is the case, the onus is on the Network Operator to determine a vegetation clearance risk treatment approach that yields equivalent or improved risk and safety outcomes generated by the clearances provided in Schedule 1. To assist in this, Schedule 2 has been provided.

Schedule 2 - Vegetation Clearance Principles contains the principles on which the vegetation clearance standards have been determined, based on relevant Australian Standards, industry experience, scientific and empirical evidence.

The Network Operator is to ensure that the principles in this schedule are applied in conjunction with other requirements such as those contained in relevant codes, regulations, or standards when developing clearance requirements not provided in Schedule 1.

7 Legislative and Regulatory Framework

7.1 Safely Working Near Power Lines

The trimming, cutting or removal of vegetation near Electricity Assets as required under this Guide must be done in a manner that protects the health and safety of persons performing inspection, trimming and removal activities. All works undertaken for the trimming and removal of vegetation within the approach distances defined in the WorkCover Code of Practice[1] shall be conducted by accredited persons in accordance with the relevant "Electrical Safety Rules" of the Network Operator, relevant company safe work method policies and procedures, and the following instruments:

- WorkCover Code of Practice "Work Near Overhead Power Lines 2006" noting the specific exclusion in Chapter 5 for Network Operators based on the instruments further below;
- ENA 023-2009 "Guideline for Safe Vegetation Management near Overhead Lines";
- AS 4373 (2007) "Pruning of Amenity Trees"; and
- Electricity Supply (Safety and Network Management) Regulation 2014 (NSW).

7.2 Vegetation Management Obligations and Rights

Network Operators must take all reasonable steps to ensure that the design, construction, commissioning, operation and decommissioning of its network are safe[2]. Safety management is a key requirement in all vegetation management activities.

The Electricity Supply (Safety and Network Management) Regulation 2014 (NSW) refers to AS 5577 "Electricity Network Safety Management Systems" to define the fundamental principles to be considered in the development of a Network Safety Management System.

AS 5577 states that "*the Network Operator cannot delegate its accountability for the safety and integrity of the electricity network*" including for vegetation management to any other individual or party.

The three main instruments that outline a Network Operators obligations associated with managing the risk of vegetation contact or proximity to electrical assets are:

[1] WorkCover Code of Practice "Work Near Overhead Power Lines 2006"
[2] Electricity Supply (Safety and Network Management) Regulation 2014 (NSW)

- Electricity Supply Regulation (Safety and Network Management) 2014 (NSW)
- Work Health Safety Act 2011 (NSW)
- Code of Practice - Electricity Transmission and Distribution Asset Management

These three instruments require the Network Operator to have systems in place to manage the safety, reliability and fire risks associated with their networks, as well as the health and safety of its workers and the general public due to the operation of the network, to levels which are ALARP.

While management of safety risk is the key objective of The Electricity Supply Regulation (Safety and Network Management) 2014 (NSW), Part 5 of the regulation provides requirements regulating the removal and trimming of trees by Network Operators so as to minimise damage to or destruction of trees growing under or near Network Assets. In particular section 36 states:

- a Network Operator must not remove any tree, or trim any tree in a way that substantially damages the tree unless it is necessary for protection of the Network Assets or the safety of persons or property under or near the Network Assets; and
- the Network Operator has considered alternative methods and is of the opinion none of those methods are feasible (including being economically feasible) in the circumstances; and
- the Network Operator is acting in accordance with a tree management plan.

The requirements for tree management plans and associated consultation with councils and the public are detailed in the above regulation, Section 37 and Section 38 respectively.

In addition to the general requirements for preservation of trees, further notification requirements and limitations are detailed below including those relevant to heritage listed items, critical habitats, wilderness areas, coastal wetlands, littoral rainforests and national parks.

7.3 Notification and Consent Requirements

The notification and consent requirements for Network Operators to implement their relevant Safety Management Systems in relation to vegetation management are stated in the following four instruments:

- State Environmental Planning Policy (Infrastructure) 2007 (NSW) (ISEPP)
- National Parks and Wildlife Act 1974 (NSW)
- Environmental Planning & Assessment Act 1997 (NSW)
- Electricity Supply Act 1995 (NSW)

These provide Network Operators with a range of exclusive powers to manage their obligations outlined in this guide.

The ISEPP and National Parks and Wildlife Act 1974 (NSW)(NP&W Act) both define a number of activities as "exempt developments" and "routine agricultural management activities" respectively. This therefore excludes vegetation

management for the management of risk under this guideline by Network Operators from a range of requirements that would normally be imposed.

These exemptions are however bound by a number of limitations (as outlined in Clause 7.4 Limitations of Exemptions) to ensure the impact to the environment and community are minimised to the extent reasonably necessary to manage the risks from vegetation hazards.

Vegetation management work defined as an "exempt development" or "routine agricultural management activity" is not required to obtain consent from any parties and/or landowners.

Under clause 43(1)(k) of the ISEPP any vegetation management complying with a tree management plan prepared in accordance with clause 37 of the Electricity Supply (Safety and Network Management) Regulation 2014 (NSW) that is within the limits of the legislations may be carried out without consent on any land (excluding the limitations defined in clause 7.4).

The Electricity Supply Act 1995 (NSW) provides further clarification as to the responsibility, cost allocation and powers of entry associated with the management of vegetation in the proximity to Network Operators electrical assets. Clauses in the Electricity Supply Act 1995 (NSW) relevant to these topics include:

- Division 2 "Power and Duties of Network Operators and Retailers", Section 48 "Interference with Electricity Works by Trees"
- Division 2A "Special Powers for bushfire prevention"
- Division 3 "Powers of Entry"

7.4 Limitations of Exemptions

As per the ISEPP clause 41(2)(b) the exemption defined in clause 7.3 are only applicable to existing or established assets.

Additionally, as per the Environmental Planning & Assessment Act 1979 (NSW) the exemptions defined in clause 7.3 are also not applicable if the land on which the vegetation management is proposed to be undertaken is classified as:

- a critical habitat of endangered species, populations and ecological communities (as defined in Part 3 of the Threatened Species Conservation Act); or
- is, or is part of, a wilderness area (as defined in the Wilderness Act 1987 (NSW) or the National Parks and Wildlife Act 1974 (NSW).

Further to these limitations, any vegetation management proposed within the following regions shall be limited to the minimum possible extent reasonably necessary to carry out the required vegetation management work and shall involve no more than the minimum impact on such land or heritage areas, such as

- Land covered by State Environmental Planning Policy No 14 – Coastal Wetlands (NSW);
- Land covered by State Environmental Planning Policy No 26 – Littoral Rainforests (NSW);
- Land covered by the National Parks and Wildlife Act 1974 (NSW); and
- A State or local heritage item or a heritage conservation area.

The exemptions within National Parks and Wildlife Act 1974 (NSW)(NP&W Act) for "routine agricultural management activities" is not applicable to land referred to in Part 3 (Urban Areas) of Schedule 1 of the Native Vegetation Act 2003.

7.5 Interim Protection Orders

In addition to the above requirements any work associated with land subject to an interim protection order (as defined in Division 2 of the National Parks and Wildlife Act) shall adhere to the orders requirements / limitations.

8 Contributions and Disclaimer

8.1 Contributors

In the development of this Guide, the following parties are represented on the committee:

- NSW Electricity Distributors
    - Essential Energy
    - Endeavour Energy
    - Ausgrid
- NSW Government Agencies
    - Department of Industry, Skills and Regional Development, NSW (Department of Industry)

Whilst due care has been exercised in the compilation of this Guideline, much of the content has been sourced externally to the ISSC and the Department of Industry. The Department of Industry cannot accept responsibility for the content.

8.2 Disclaimer

This Guide has been prepared on the basis that the user will be appropriately trained, qualified, authorised and competent.

This Guide does not purport to ensure compliance with all relevant statutes and regulations, such as work health and safety laws. Users shall satisfy themselves as to the requirements of all relevant laws.

Schedule 1

Vegetation Management: Clearance and Hazard Management Requirements

S1 - 1 Specific Clearance Requirements

S1 - 1.1 General

The vegetation hazard reduction clearances provided in this Schedule have been empirically derived based on the experience of the electricity distribution supply industry in NSW.

They represent the current industry understanding of the vegetation hazard reduction requirements in order to manage the risk to a level that is consistent with overall community expectations regarding public safety, environmental amenity and operational efficiency.

They represent a deterministic standard of vegetation hazard management requirements in order to meet these expectations.

Additional clearances may be required to meet specific operational, maintenance and performance requirements of Network Assets, or to mitigate specific risk conditions as determined by the Network Operator.

S1 - 1.2 Overhead Line Conductors

The Minimum Vegetation Clearances are given in Table 1 below.

In the event that the clearances provided in Table 1 do not provide guidance in relation to the voltage rating, construction or span length for a given span within the network, the Network Operator will determine acceptable minimum clearances or any other actions required in order to achieve the objectives of this Guide and attain a level of risk consistent with that provided for by the clearances specified.

Where different clearances are specified for above and below the conductor compared to horizontal to the conductor, a rectangular clearance window shall be maintained bounded by these clearances, unless the Network Operator has determined a different profile that yields the same minimum risk outcomes.

Any vegetation found within these clearances shall be treated as being subject to a Grow-in Vegetation Hazard and remediated in accordance with the requirements of this Guide.

In addition to the minimum vegetation clearances defined in Table 1, all overhead lines shall also be assessed for the requirements stated in Section S1 - 3.7: *Vegetation above Conductors and "Clear to the Sky" risk reduction strategy.*

Further, the clearances given in Table 1 shall be increased by 0.5m for situations where there are overhead bare conductor power lines in Bushfire Prone Areas.

Table 1 Minimum Vegetation Clearances (in metres) for span lengths 0 to 300m

An additional 0.5m clearance is to be added to all bare conductor clearances for bush fire prone areas

Voltage	Conductor Type	Clearance Profile	Portion of Span	Span Length (X metres)			
				X ≤ 50	50 < X ≤ 100	100 < X ≤ 200	200 < X ≤ 300
LV	**Bare Conductor**	All directions from any conductor	First & Last 1/6th	1.0	1.0	1.5	3.5
			Middle 2/3rd			2.5	4.0
	Covered Conductors[3]	All directions from any conductor	First & Last 1/6th	0.5	0.5		
			Middle 2/3rd				
	Insulated Conductors[2]	All directions from any conductor	First & Last 1/6th	0.5	0.5	0.5	1.0
			Middle 2/3rd			1.0	
11 - 22kV	**Bare Conductors** *(not including steel)*	All directions from any conductor	First & Last 1/6th	1.5	1.5	2.0	4.0
			Middle 2/3rd		2.5	3.5	5.0
	HV Aerial Bundled Cables	All directions from any conductor	First & Last 1/6th	0.5	0.5	0.5	1.0
			Middle 2/3rd			1.0	
	Covered Conductor Thick (CCT)[1]	All directions from any conductor	First & Last 1/6th	1.0	1.0	1.0	1.0
			Middle 2/3rd				
11 - 33kV	**Steel Conductor**	All directions from any conductor	First & Last 1/6th	1.5	1.5	1.5	2.0
			Middle 2/3rd			2.5	4.0
33 - 66kV	**Bare Conductors** *(not including steel)*	All directions from any conductor	First & Last 1/6th	2.0	2.0	3.0	4.5
			Middle 2/3rd		3.0	4.0	6.0
132kV	**Bare Conductors** *(not including steel)*	All directions from any conductor	First & Last 1/6th	3.0	3.0	3.5	5.5
			Middle 2/3rd		4.0	5.0	6.5

Notes:

1) CCT clearances have been increased to 1.0m to ensure electrical safety clearances are maintained.
2) Includes nominated communication cables owned by Network Operators (e.g. optic fibre, pilot wire etc.) but excludes third party communications cables.
3) For LV Covered Conductor spans in excess of 100m, the requirements for Bare Conductors shall apply

Table 2 Minimum Vegetation Clearances (in metres) for span lengths 300m to 600m

An additional 0.5m clearance is to be added to all bare conductor clearances for bush fire prone areas.

Voltage	Conductor Type	Clearance Profile	Portion of Span	Span Length (X metres)		
				300 < X ≤ 400	400 < X ≤ 500	500 < X ≤ 600
11 - 22kV	**Aluminium Conductor Steel Reinforced** (ACSR)	Horizontal from any conductor	First & Last 1/6th	4.0	5.5	8.0
			Middle 2/3rd	7.0	9.5	12.5
		Above & Below any conductor	Entire Span	5.0	5.0	5.0
33 - 66kV	**Aluminium Conductor Steel Reinforced** (ACSR)	Horizontal from any conductor	First & Last 1/6th	4.5	6.0	8.5
			Middle 2/3rd	7.5	10.0	13.0
		Above & Below any conductor	Entire Span	6.0	6.0	6.0
132kV	**Aluminium Conductor Steel Reinforced** (ACSR)	Horizontal from any conductor	First & Last 1/6th	5.0	7.0	9.5
			Middle 2/3rd	8.5	11.0	14.0
		Above & Below any conductor	Entire Span	6.5	6.5	6.5
11-33kV	**Steel Conductor**	Horizontal from any conductor	First & Last 1/6th	3.5	5.0	7.0
			Middle 2/3rd	6.0	8.5	11.0
		Above & Below any conductor	Entire Span	4.0	4.0	4.0

Note:

The clearances in Table 2 have been based on the experience gained through the application of the clearances outlined in Table 1 and expanded for application to spans greater than 300m.

S1 - 1.3 Poles

In addition to The Minimum Vegetation Clearance requirements that apply in the proximity of the conductors, a minimum clearance of 2 m is to be achieved in all directions around a pole irrespective of the material from which the pole is made.

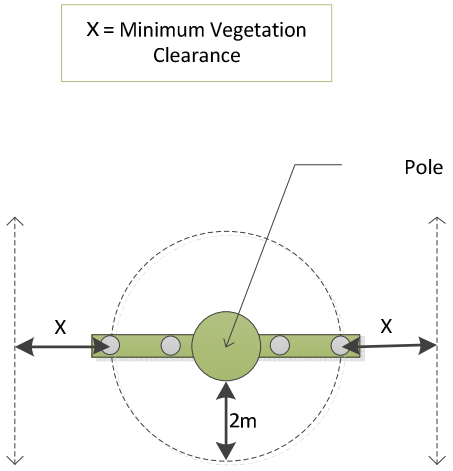


Figure 1. Vegetation clearance requirements around poles

S1 - 1.4 Towers

In addition to the Minimum Vegetation Clearance requirements that apply in the proximity of the conductors, a minimum clearance of 3 m is to be achieved in all directions around the structure of a tower or a 12m radius from the centre of the tower, whichever is greater.

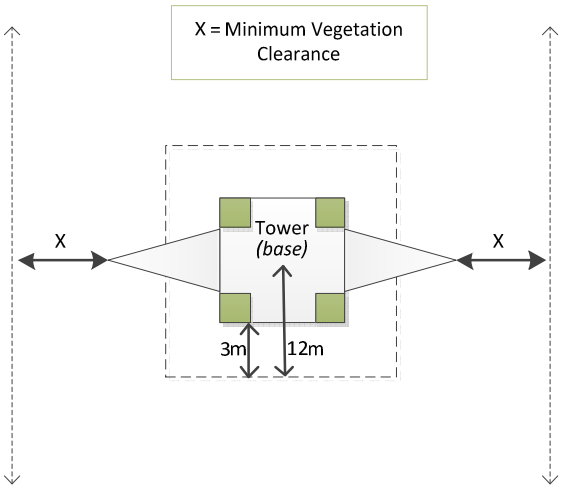


Figure 2. Vegetation clearance requirements around towers

S1 - 1.5 Kiosk Substations and Switching Cubicles

Kiosk substations and switching cubicles shall have no vegetation within the easement or specified buffer zones other than maintained lawns or grasses, or where the Network Operator has determined that the vegetation, due to its type, is not considered a hazard and does not impede access to the assets.

There shall be no vegetation overhanging the assets within 2 m of the top of the cubicle.

For kiosk substations and switching cubicles without a formal easement (e.g. those installed in the road verge) the vegetation shall be cleared to a minimum of 1 m horizontally and 2 m above the cubicle.

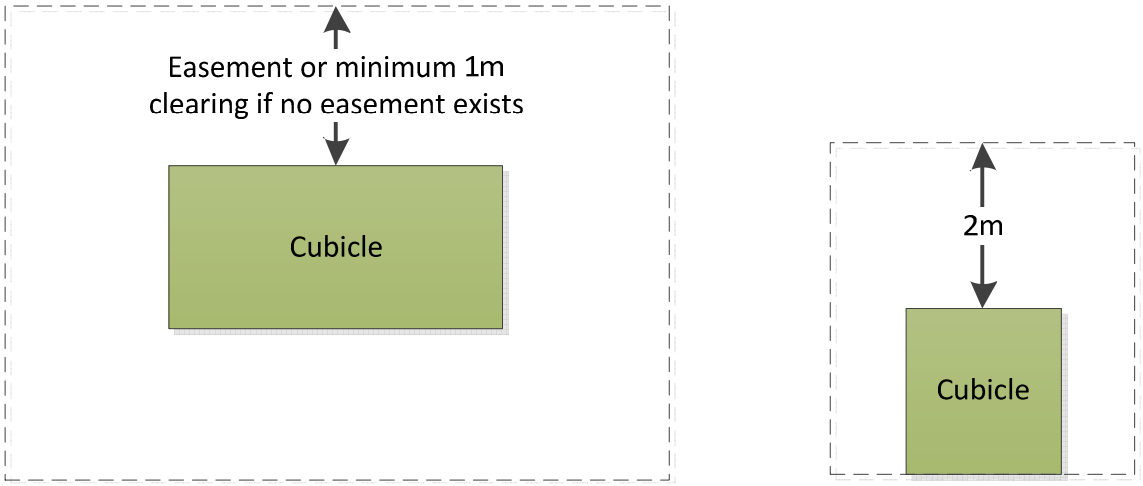


Figure 3. Vegetation clearance requirements around Kiosks and Cubicles

S1 - 1.6 Major Substations

Major substations and ground distribution substations and related installations that have exposed outdoor electrical equipment shall have a minimum 3 m vegetation clearance surrounding the external fence.

Additionally, major substations with live exposed outdoor electrical equipment (e.g. air insulated busbars) shall have the 3 m clearance extended clear to the sky in accordance with the principles outlined in Section S1 - 3.7 . Major substations with no live exposed outdoor equipment shall have adjacent vegetation cleared to a height that prevents unauthorised access to within the fenced area and is not necessarily required to have this vegetation cleared to the sky.

All assets with live exposed outdoor electrical equipment shall also be inspected for Fall-in Vegetation Hazards, and any hazards identified remediated in accordance with the requirements of this Guide.

Major substations in Bush Fire Prone areas shall have a total 10 m asset protection zone established surrounding the boundary fence, where only maintained lawn or grasses are permitted.

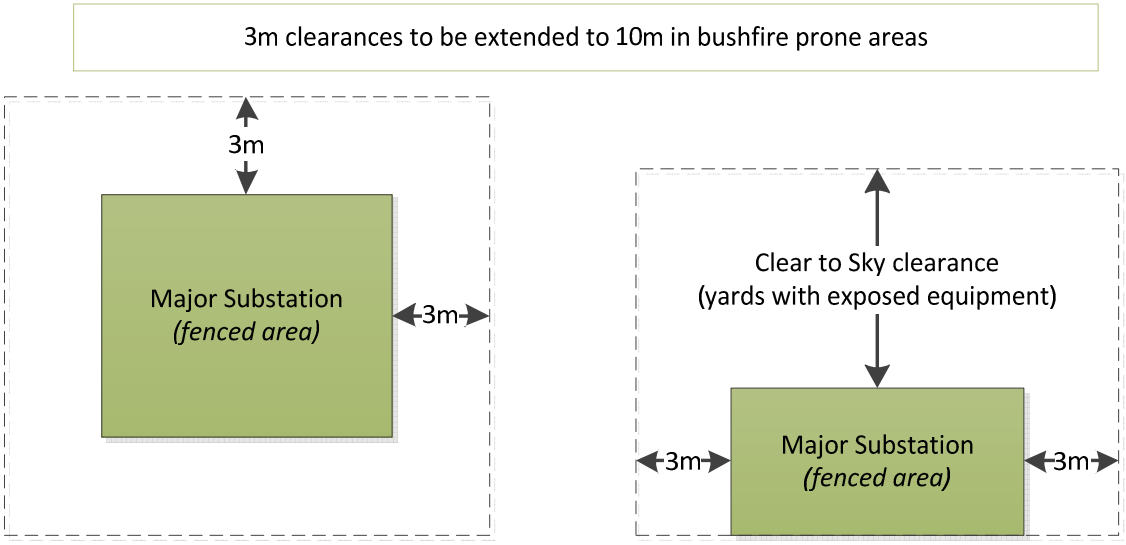


Figure 4. Vegetation clearance requirements around Major Substations

S1 - 1.7 Street Lighting Luminaires

For the purpose of protection of the asset, Street light luminaires shall have a minimum of 2 m of vegetation clearance in all directions, except above the luminaire where a minimum of 1 m is required.

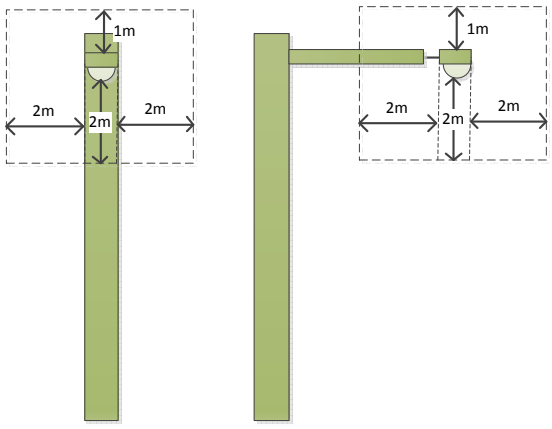


Figure 5. Vegetation clearance requirements around Street Lights

S1 - 1.8 Waterway Crossing Warning Signs

In accordance with the Crossings of NSW Navigable Waters: Electricity Industry Code, Waterway crossing signs are to be visible to operators of watercraft to make them aware of the potential hazard at least 100m from the crossing. This is to enable the operators sufficient time and distance to manoeuvre the watercraft away from the crossing if necessary. This distance may need to be greater depending on the prevailing local conditions (e.g. topography, winds and currents).

To facilitate this, the Minimum Safe Clearance for waterway crossing signs is to be such that the entire face of the sign is visible to operators of watercraft:

- from any point on the waterway at least 100m from the sign.
- from water level to 5 metres above the surface of the water.

Any vegetation that is encroaching or, due to regrowth, will encroach or is likely to obscure the view of the sign prior to the next Hazard Management Cycle shall be cleared. Care is to be exercised that vegetation removal will not lead to erosion which jeopardises the stability of the sign.

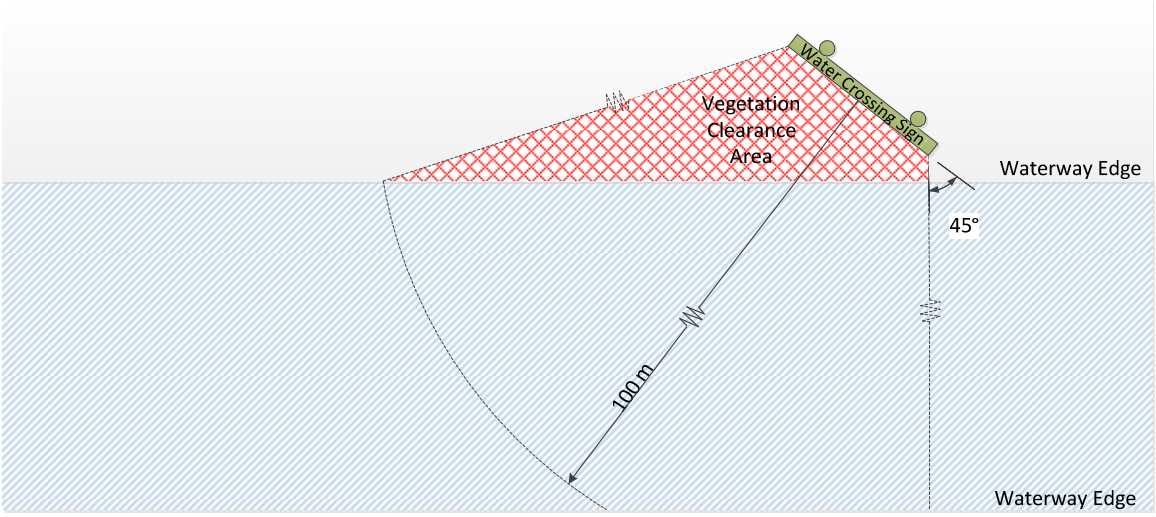


Figure 6. Vegetation clearance requirements for Waterway Crossing Warning Signs

Particular attention should be given to ensuring that the trimming of vegetation associated with waterway crossing signs complies with any specific requirements of environmental protection legislation such as the Environmental Protection and Biodiversity Conservation Act 1999 (Cth), Threatened Species Conservation Act 1995 (NSW) and the Fisheries Management Act 1994 (NSW). For example, an exemption permit may be required under Section 205A of the Fisheries Management Act 1994 (NSW), to allow mangrove clearing works for maintaining the visibility of waterway crossing warning signs, maintenance of access tracks, etc.

Where the environmental impacts outweigh the assessed reduction in risk to navigation from visibility of waterway crossing warning signs, it may be appropriate to consider a reduction in the amount of vegetation clearing, particularly in situations where signage is an optional risk treatment in accordance with the Crossings of NSW Navigable Waters: Electricity Industry Code or this Guide.

S1 - 2 Vegetation Hazard Management Cycles

A Network Operator shall develop and implement a system for the routine inspection, identification, and remediation of vegetation hazards.

Cyclic processes are to be established in accordance with vegetation growth cycles and other factors pertinent to the assets and the environment in which they are domiciled.

Hazard Management Cycles shall be of a sufficient period to ensure that vegetation hazards are identified and remediated with sufficient time between cycles to allow for re-growth and any other changes in environmental factors that may influence public safety and public risk.

S1 - 3 Vegetation Hazard Remediation

S1 - 3.1 General

The Network Operator shall develop and implement a plan for the regular identification and remediation of Vegetation Grow-In and Fall-In hazards. The remediation of hazards shall be in accordance with the minimum Clearing Requirements. Priority attention is to be given to remediating hazards in Bushfire Prone Areas in accordance with the requirements of this guide.

An objective of a Network Operator's vegetation hazard management plan is to avoid any encroachment into the Minimum Vegetation Clearance between Hazard Management Cycles as far as is reasonably practicable. At the time of trimming, additional cutting of the vegetation beyond the Minimum Vegetation Clearance may be required to prevent incursions due to regrowth between cycles.

Due to the number of environmental factors that impact the growth rate of vegetation and the wide variations in selecting efficient Hazard Management Cycles for vegetation management programs, it is not practical to provide clearances that incorporate vegetation regrowth without being overly prescriptive, and therefore potentially conservative.

Regrowth allowances are therefore to be determined by the Network Operator in accordance with the principles outlined in this Guide and to meet the particular needs of their assets and the environment in which they are domiciled.

The Network Operator shall determine regrowth allowances based on its vegetation Hazard Management Cycles and the significance of the vegetation affected. The regrowth allowance shall at a minimum take into consideration the following aspects:

- Type of vegetation;
- Surrounding environmental conditions;
- Local experience, and
- The Hazard Management Cycle period.

The Network Operator is required to review the effectiveness of its processes for determining regrowth allowances to ensure that the overall objectives of this Guide in achieving public safety and public risk outcomes are maintained in between vegetation Hazard Management Cycles.

S1 - 3.2 Minimum Clearing Requirements

The minimum Clearing Requirements are the sum of the Minimum Vegetation Clearance and the Regrowth Allowance. At the time of completion of the Hazard Management Cycle remediation activities the minimum Clearing Requirement shall be achieved.

It is acknowledged that vegetation does not grow at a linear rate due to environmental influences. At times, therefore, there may be vegetation that grows to a position inside the minimum vegetation clearance despite meeting the minimum Clearance Requirement at the time of cutting. Notwithstanding this, the clear objective of the Hazard Management Cycle is to avoid any encroachment into the Minimum Vegetation Clearance between cutting cycles as far as is reasonably practicable.

S1 - 3.3 Bushfire Danger Period Preparedness

In accordance with the requirements of The Electricity Supply (Safety and Network Management) Regulation 2014 (NSW), a Network Operator shall develop and implement a plan that specifically addresses the increased risk from vegetation hazards during the Bushfire Danger period.

Bushfire Risk Assessments shall be undertaken as part of the implementation of this plan and/or as part of the Network Operators general hazard identification processes. The objective of such assessments is to identify and remediate vegetation hazards that pose a particular risk of bushfire initiation.

The remediation of such hazards is to be undertaken in a time frame appropriate to the risk in relation to the commencement of the Bushfire Danger Period, and in order to contain the risk to ALARP.

S1 - 3.4 Fall-in Vegetation Hazards

Fall-In Vegetation Hazards shall be identified as part of the vegetation management process and the general asset management and inspection processes implemented by the Network Operator.

A Network Operator shall assess the risk of Fall-in Vegetation Hazards that are readily visible from the perspective of the Network Asset as far as it is reasonably practicable to do so.

In assessing the potential risk of a Fall-in Vegetation Hazard consideration is to be given to the length of the vegetation beyond the potential breaking point compared to the distance from the network asset.

S1 - 3.5 Hazard Remediation Prioritisation

Where Grow-In hazards are identified, the vegetation encroachments need to be addressed based on the risk posed by the encroachment, and in a way that allows time to plan and carry out the work safely and having due regard for the urgency required, Hazard Management Cycles, and other hazard rectification priorities.

The remediation of Fall-In Vegetation Hazards may require significant planning and implementation effort, particularly if large scale or significant vegetation has been assessed as presenting a hazard as outlined in Section S1 - 3.4 above. Where such hazards are identified, the remediation prioritisation shall be assigned on the basis of the perceived risk that the hazard may introduce, consistent with other requirements of this Guide in regard to undertaking remediation works in accordance with community expectations and environmental amenity.

In any event, the priority assigned to the remediation of any hazard will be in accordance with the risk introduced, and not whether the hazard is from outside or within the Minimum Vegetation Clearance.

S1 - 3.6 Special Circumstances and Exceptions

S1 - 3.6.1 Protected areas, vulnerable lands and environmental heritage

In situations where the Network Operator believes that the Minimum Vegetation Clearances are not achievable (e.g. will impact upon the health or amenity of trees within protected areas or vulnerable lands and/or significant/heritage listed trees), consideration may be given to reduce the minimum vegetation clearance for the impacting vegetation provided that the overall objective of the Guide is maintained and risk is maintained at a level consistent with the objectives of this Guide.

This may require more frequent Hazard Management Cycles to be applied to this particular set of circumstances. The Network Operator shall ensure that it has

appropriate management processes in place to record, and provide ongoing management of the special circumstance requirements.

In these cases the Network Operator will apply its respective company's process for assessing exceptions or consider the acceptability of an exception on a risk- based, case-by-case basis.

S1 - 3.6.2 Bush Fire Prone Areas

The consideration of exceptions in bushfire prone areas, which if approved will be in place over the Bushfire Danger Period, must be undertaken with adequate time for the appropriate assessment and response prior to the deemed bushfire period commencement date.

Consideration by the Network Operator shall occur in a timely manner with respect to the Bushfire Danger Period and shall consider the potential risk posed by the exception. The Network Operator may nominate a higher frequency Hazard Management Cycle or other solution to manage this risk.

S1 - 3.7 Vegetation above Conductors and "Clear to the Sky" risk reduction strategy.

"Clear to the Sky" vegetation hazard reduction measures involve the practice of removing all vegetation above the Electricity Assets to the width of the minimum Clearing Requirement. This is shown in Figure 7 below.

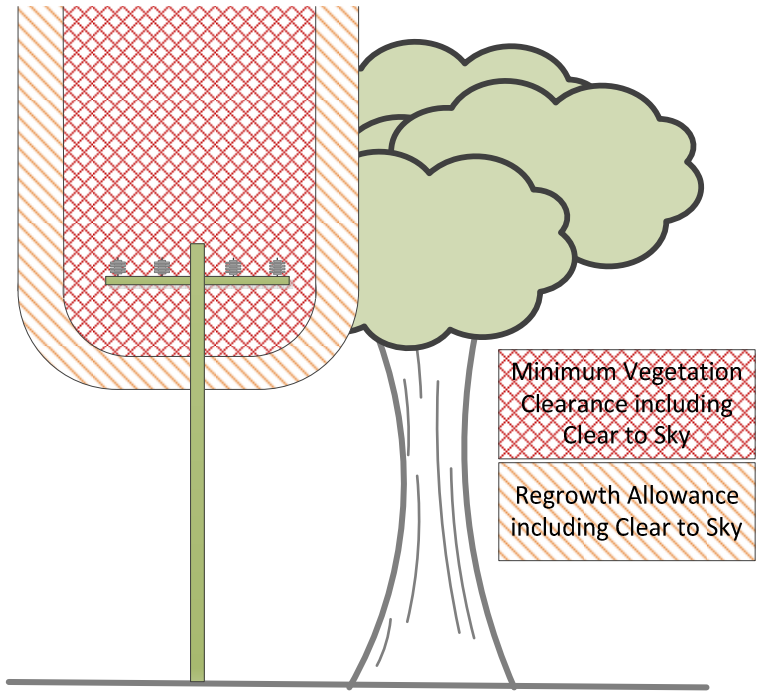


Figure 7. "Clear to the Sky" Hazard Reduction

In general, the following circumstances shall require the application of "Clear-to-the Sky" hazard remediation:

- For distribution assets in Bushfire Prone Areas where a Bushfire Risk Assessment has identified that a high risk exists, 'Clear to the Sky' vegetation hazard reduction is to be maintained unless it is impracticable to do so. Vegetation that directly overhangs power line conductors within the width of the minimum Clearing Requirement is to be cleared in accordance with the requirements of this Guide. Vegetation that does not directly overhang conductors but is within the horizontal boundaries of the Minimum Vegetation Clearance should be removed where practicable and where consistent with the community and environmental amenity requirements of this Guide.

- For Subtransmission line assets (operating at voltages from between 33kV up to an including 132kV) – "Clear to the Sky" vegetation management should be maintained if substantiated by risk assessment unless prevented by local environmental considerations other factors outlined in Section S1 - 3.6 Special Circumstances and Exceptions. In the case of Subtransmission line assets, security of supply, as well as bushfire risk, will be an important consideration in the risk assessment.

The undertaking of "Clear to the Sky" hazard remediation should only be considered on the basis of a risk assessment with due regard to environmental and community amenity, and the significance of the vegetation affected.

Schedule 2

Vegetation Clearance Principles for Power Lines

S2 - 1 Minimum Vegetation Clearances for Power Lines

S2 - 1.1 General

Development of vegetation clearance requirements (either not in line with those stated in Schedule 1 or beyond its scope) shall at a minimum take into consideration the principles and considerations outlined in this Guide.

The assumptions and calculations used in the development of such clearances shall be recorded by the Network Operator and not establish a lesser public safety and risk outcome than that achieved by adhering to the requirements of Schedule 1.

The overarching principles of any clearances developed under the principles described in Schedule 2 are based on the requirements of the Network Operators to minimise the risks associated with vegetation near electrical assets to a level of ALARP.

S2 - 1.2 Minimum Vegetation Clearances – Principles

At a minimum, new vegetation clearance envelopes should take in to account the following considerations to ensure the needs of all stakeholders are considered:

- technical (e.g. conductor movement, insulator swing)
- practical (e.g. strength / direction of wind, shape of clearance)
- safety (e.g. minimum safety, electrical and approach clearances)
- environmental (e.g. benefit of trees to the community / environment)
- risk (e.g. probability and consequence of a hazard)

Rationalisation of clearance envelopes is possible (e.g. across differing conductor types), however this is largely dependent on the range of conductors installed throughout the Network Operator's network and the environment in which they operate.

The following sections provide details on some of the principles outlined above.

S2 - 1.3 Electrical Clearance

In addition to providing sufficient vegetation clearances to cater for power line conductor movement, a clearance allowance is required to be added to the calculated vegetation clearances to provide for the minimum electrical safety clearance requirements appropriate to the asset.

Clearance requirements are to be determined to:

- meet the safety clearance requirements commensurate with the nominal design voltage of the assets,
- provide protection against switching and other electrical surges; and
- ensure safe approach distances are maintained for both Network Operators and the general public.

S2 - 1.4 Conductor Sag

The vertical position of a conductor changes significantly due to variations in temperature. The temperature for the conductor (and therefore vertical position) is affected by the conductor tension, solar parameters, wind, ambient temperature and the electrical load on the conductor.

The limits of the vertical movement due to conductor sag are ultimately defined by the minimum and maximum design temperatures for the span. Calculations to determine the change in conductor position due to temperature may be based on the methods defined in AS/NZS 7000, Appendix S "Conductor Sag and Tension".

Figure 8 illustrates the change in conductor position due to temperature.

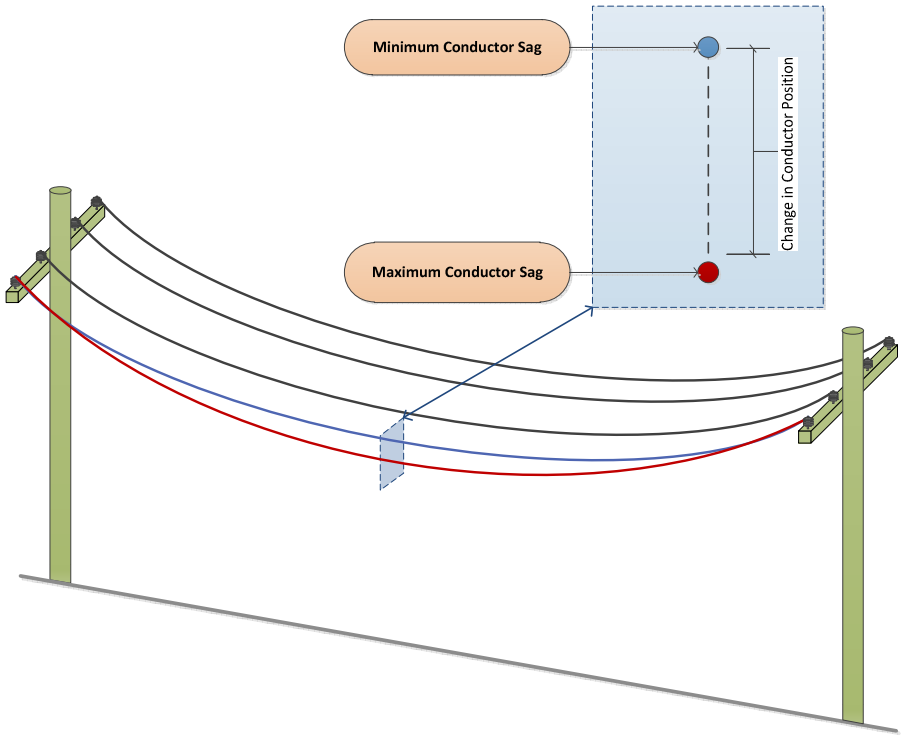


Figure 8 – Conductor Sag

S2 - 1.5 Conductor Blowout

The horizontal position of the conductor is predominantly affected by wind and the weight of the conductor. As wind increases the horizontal movement / conductor blowout also increases.

Figure 9 below illustrates the movement of a conductor under wind conditions.

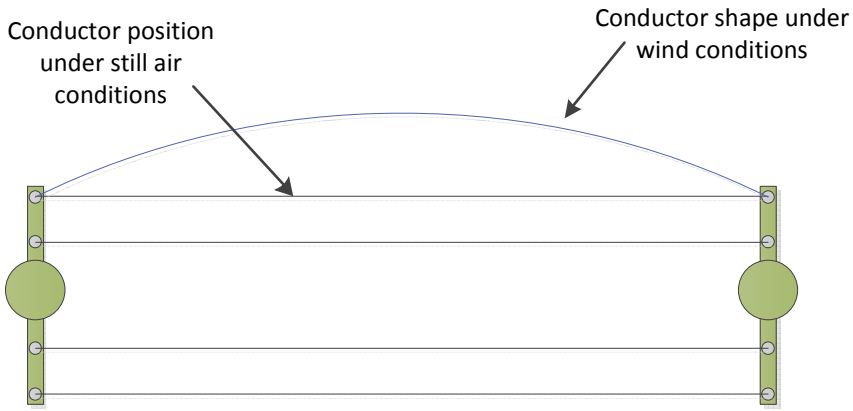


Figure 9 – Conductor Blowout

The appropriate wind value to use in these calculations is the key factor in deriving vegetation clearances and must take into consideration both technical and practical aspects. Particularly as span length increases, further considerations should be given to the use of span reduction factors (gust widths), wind only being applied to limited sections of the span or at a range of inception angles including cardinal direction, height, dynamic movement of the conductor, probability of exceedance based on wind return periods and probability of exceedance coinciding with increased fire danger periods.

Wind on the conductor impacts both the conductor temperature and horizontal tension and therefore needs to be considered at all conductor temperatures within the lines design range.

Since conductor temperature rapidly approaches ambient temperate (regardless of electrical load) as wind increases, blowout does not necessarily need to be considered at the maximum conductor sag.

Where there is a significant difference between the conductor temperature / sag at the lines maximum design temperature and under wind conditions. Consideration may need to be given to conductor blowout under low non-continuous winds and rapid step changes in conductor temperature.

Calculations to determine conductor blowout may be based on the methods defined in AS/NZS 7000, Appendix R "Conductor Blow Out and Insulator Swing".

Figure 10 illustrates the movement of a conductor due to wind.

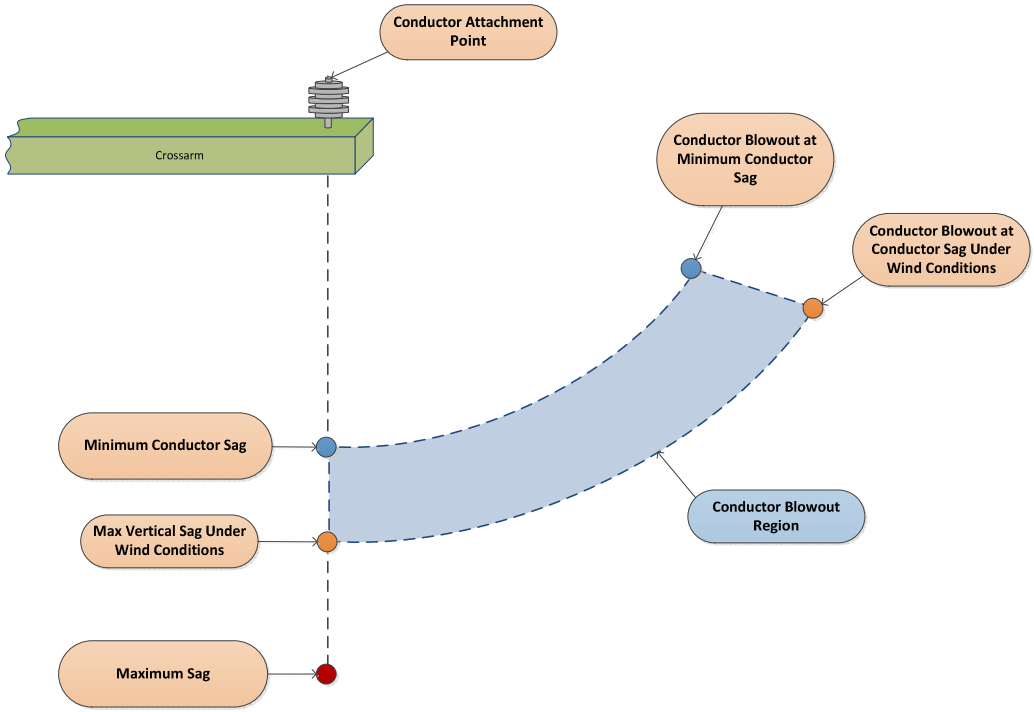


Figure 10 - Conductor Blowout (detail)

S2 - 1.6 Insulator Swing

In addition to conductor blowout, wind on conductors can also cause insulator movement allowing the conductor blowout to be further increased. Due to the number of variables in such a calculation (e.g. type (ceramic / polymeric), weight, surface area etc.) and the relatively small impact on the final clearances it is not practicable or considered necessary to perform these calculations for each span.

An allowance for insulator swing should be added to the electrical clearances proposed to simplify the clearance calculations whilst mitigating any necessary increase in clearance to allow for insulator swing.

S2 - 1.7 Conductor Type & Tension

The type of conductor and the tension it is under can significantly impact the size of the curves shown in Figure 8, Figure 9 and Figure 10, and therefore the vegetation clearances required around it. This needs to be considered by the Network Operator when determining alternate vegetation clearances to those given in Schedule 1.

S2 - 1.8 Conductor Temperature

Currently conductor temperature and tension cannot accurately be measured at the time of cutting. All vegetation clearance envelops developed need to take this into account and be suitable for the conductors being at any point between its minimum and maximum sag at the time of cutting.

This can be achieved by defining all clearance values relative to the conductor position at the time of cutting, whilst allowing for the conductor to be in any position in the development of the clearance envelope.

S2 - 1.9 Conductor Clearance Envelope – at a point

The possible clearance envelope taking into consideration the aspects outlined above is illustrated below in Figure 11.

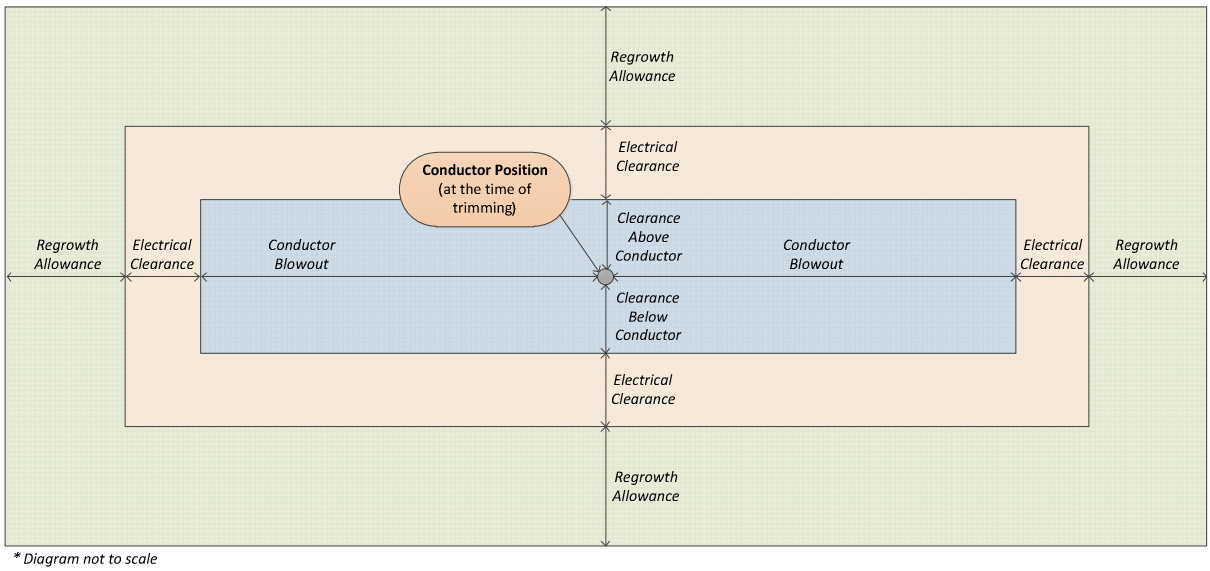


Figure 11 - Conductor Clearance Envelope (at a point)

S2 - 1.10 Conductor Clearance Envelope – along the line

Clearance envelopes change along the span (e.g. it is smaller at the structure point of a power line than it is at mid-span, as greater conductor movement is possible mid-span).

The introduction of sophisticated imaging technology into vegetation hazard identification and management processes can result in the analysis of vegetation and conductor separations being undertaken to a much higher level of accuracy in comparison to traditional visual inspection methods.

It is recognised that such advanced techniques may not be widely used by all Network Operators for a variety of reasons. Whilst they may allow more accurate identification of vegetation hazards, this does not necessarily assist or improve the vegetation trimming processes in the field. This is due to the fact that there may be practical and/or physical reasons why a Network Operator may not be able to trim to the same degree of accuracy or with the granularity implied by the advanced imaging techniques.

The level of simplification largely depends on the range of conductors and span lengths that exist within the network and the practicalities associated with vegetation management.

The clearances in this Guide have been rationalised on a conductor-type basis using a "two-step" (e.g. 1/6th, 2/3rd section length) clearance mechanism, as shown in Figure 12.

Theoretical clearances envelops may however converge to zero at structures, at which point a minimum clearance value shall be selected that takes into account the relevant factors outlined above.

Increased or decreased rationalisation of the clearances can be achieved at the Network Operators discretion in order to find the correct balance between risk mitigation, practically, and operational efficiency.

The application of advanced imaging technique for the development of more efficient clearance envelopes are required to generate the same risk outcomes as the clearances given in Schedule 1 would yield.

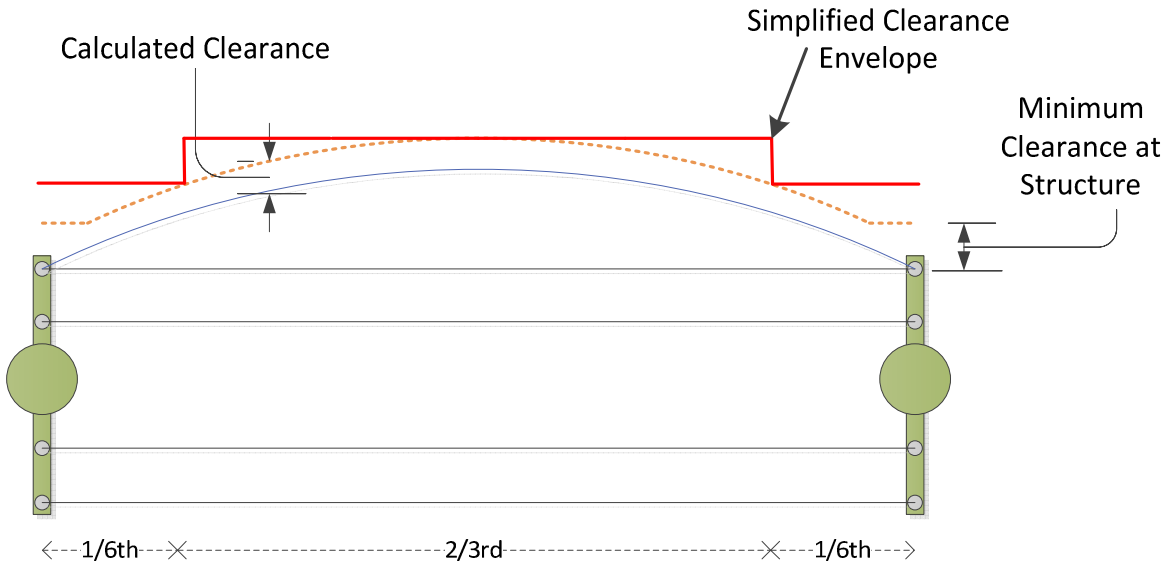


Figure 12 - Conductor Clearance Envelope (along the line)