# Vegetation Management - Specification

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# 1. Introduction

## 1.1 Purpose

This document specifies the requirements for vegetation management associated with Powerlink's HV Network, including initial clearing.

## 1.2 Scope

This specification sets out the requirements for managing vegetation and clearing to be performed within and in proximity to all Powerlink network assets. It sets the minimumrequirements for clearing, and outlines risk management considerations and performance indicators as well as Powerlink's rights and obligations.

The requirements have been based on scientific principles, technical knowledge and experience. Application of this vegetation management specification should strikeabalance between ensuring electrical safety to individuals and property, the security (i.e. quality of supply) of the transmission network, the protection of the environment and whole of life costs.

### 1.2.1 Objectives

The objectives of the Vegetation Management Specification are:

- to minimise the electrical safety risk to all personnel and to the public;
- to minimise the risk of damage to property;
- to ensure the safe mechanical and electrical operation and maintenance of transmission assets and to minimise vegetation related interruptions to electricity supply;
- to meet Powerlink's legal, business and environmental obligations;
- to align outcomes across the various phases of the asset's life;
- to prevent damage to Powerlink assets while minimising vegetation disturbance;
- to manage vegetation in line with risk based principles, while minimizing emergency and unplanned corrective action;
- to manage fuel loads in identified high risk and bushfire prone areas;
- to engage with landholders about joint management obligations and risks;
- to consider risk factors in managing vegetation (e.g. rainfall and regional ecosystem type);
- to review and document risk ownership associated with the retention of incompatible species;
- to have efficient vegetation programs that engages with landholders, staff and contractors;
- to change from incompatible to compatible vegetation wherever practical; and
- to manage the risk of vegetation related multiple circuit outages that could result in significant power supply losses, including control burns.

## 1.3 References

| Document code | Document title |
| --- | --- |
| AS3959 | Australian Standard on the Construction of Buildings in Bushfire-Prone Areas |
| Maintenance of Electricity Corridors in Parks and Forests | Code of Practice for Maintenance of Electricity Corridors in Queensland's Parks and Forests *2007* (Qld) |
| Electricity Works on Protected Areas | Deed of Agreement for Electricity Works on Protected Areas *2010* (Qld) |
| Electrical Safety Act | Electrical Safety Act *2002* (Qld) |
| ESR2013 | Electrical Safety Regulations *2013* (Qld) |
| ENA DOC 038-2018 | Vegetation Risk Management for Overhead Electricity Networks – Guideline |

| Document code | Document title |
| --- | --- |
| Fire Safety | https://www.powerlink.com.au/transmission-lines |
| Fuel Assessment | Overall Fuel Hazard Assessment Guide |
| Fisheries Act | Fisheries Act *1994* (Qld) |
| Nature Conservation Act | Nature Conservation Act *1992* (Qld) |
| H-156762-001-5 | Powerlink Vegetation Management General Arrangement |
| Land Access | Land Access Protocols |
| Fire and Transmission line safety | Fire and high voltage transmission line safety |
| CEATI Project T163700 #4101 | The Business Case for Herbicide Use in Integrated Vegetation Management Programs (20 year evaluation period) |
| R.H. Miller, 2007 | Best Management Practices - Integrated Vegetation Management, ISA, Champaign, USA |
| J.W. Goodfellow and H.A. Holt, 2011 | Utility Arborist Association Best Management Practices, ISA, Champaign, USA |
| Right-of-Way Stewardship Council | www.rowstewardship.org/resource_pdfs/2014_rowsc_accreditation_standards.pdf |

## 1.4 Defined terms

| Terms | Definition |
| --- | --- |
| AER | Australian Energy Regulator. |
| AER Bushfire Prone Area Risk | Bushfire prone areas have risk ratings as reported to the AER, based on source data provided by Queensland Fire and Emergency Services. |
| Authorised person | A person with required qualification(s), formally authorised by the Regional Officer to work within electrical exclusion zones as defined under QLD Electrical Safety Regulations 2013, Schedule 2, Part 2. |
| Bed and banks | Land over which the water of the watercourse or lake normally flows or that is normally covered by the water, whether permanently or intermittently; but does not include land adjoining or adjacent to the bed or banks that is from time to time covered by floodwater. |
| Biosecurity Management | Powerlink jointly manages biosecurity threats with landholders and the community to meet its general biosecurity obligation. The location of know biosecurity threats, washdowns and vehicle hygiene requirements will be displayed on PQMaps, which should translate to EWPs. Powerlink will not seek to eradicate biosecurity threats unless it forms part of a broader documented program coordinated with regulators. |
| Blow-in Risk | Vegetation blowing onto network assets from outside of the clearing widths. |
| Bushfire | An uncontrolled fire burning in forest, scrub or grassland vegetation communities; also referred to as a wildfire. |
| Clearing | Remove or cut down, ringbark, push over, poison or destroy the vegetation in any way. It does not include, (i) destroying standing vegetation by stock, or pruning a tree; and (ii) removing or cutting down, ringbarking, pushing over, poisoning or destroying the vegetation in any way as a forest practice. |
| Clearing Areas | Clearing areas that are established at the time of construction, considering permits, approvals and landholder requirements. Within these areas, there may be constraints that are documented in geographical information systems (e.g. PQMaps and EWPs). |
| Clearing Widths | Clearing widths that are established at the time of construction and may not extend to the edge of the easements. |
| Compatible Vegetation | Compatible vegetation is that which will not come within the required vegetation clearance zones (e.g. 6m from the conductor) when at their mature height. |
| Conductor sag | Under maximum electrical load or windy conditions, conductors will sag from their normal ‘at rest’ position. Vegetation clearances must be maintained during maximum sag conditions. |
| Conductor Shadow Area (CSA) | The area between the vertical lines projected from the outer conductors onto the ground during still wind conditions. |
| Conductor Shadow + 6m Area (CSA + 6m) | The area between the vertical lines projected from the outer conductors onto the ground during still wind conditions + 6m on either side. |
| Constraints | Restrictions that can impact on the ability to achieve desired outcomes in an efficient manner. |

| Terms | Definition |
|---|---|
| Controlled Burns | Landholders and agencies may undertake control burns to reduce the likelihood and consequences of bushfires. Coordination of Powerlink's vegetation management programs with people undertaking control burns ensures their safety and reduces impacts on Powerlink's HV Network. |
| Corridor | A tract of land along which is maintained in order to form a passageway along the route of a power line or lines that is actively managed to ensure network assets can be operated and maintained safely and efficiently. The corridor includes the CSA +6m, clearing widths, easements and fall-in risks. |
| Corridor Risk | The risk that vegetation poses to the network assets across the corridor. |
| Critical Corridors | Corridors where the consequence of a multiple circuit outage on the overall network reliability is regarded as severe. They are made up of corridors containing multiple high voltage circuits where the simple sum of the operating voltages of the different circuits exceeds 1000kV, which may be considered a risk factor in formulating vegetation management programs. |
| Customer Complaint | An expression of dissatisfaction from a customer, landholder or member of the public (including complaints about vegetation management). Complaints must be recorded in corporate systems to enable analysis. |
| Dangerous Species | See "high risk species" |
| Debris | Dead, dying or unviable vegetative material produced during vegetation management (e.g. mulch). |
| Diameter at Breast Height (DBH) | DBH is a measurement unit for the size of vegetation at breast height (1.5m from ground level). |
| Easement | Easements registered in the Title Deeds Office as well as rights obtained in terms of way leave easements or other forms of agreement that permit Electricity works by Powerlink on land owned by other persons. |
| Emergency vegetation management | Vegetation management performed that has been rated as risk 4 or higher (see section 2.3.1 of A1673090). |
| Environmental Management Plan (EMP) | A plan that seeks to achieve a required environmental end state and describes how activities, that could have a negative impact on the environment or cultural heritage, will be managed and monitored, and impacted areas rehabilitated. |
| Environmental Work Plans (EWPs) | A spatial rendition of environmental requirements for a span or specific location, containing landholder contact details and constraints that need to be considered when undertaking works, especially clearing vegetation. |
| Fall-In Risk | The risk vegetation poses to the network assets from trees outside of the clearing width. |
| Fire Risk Management | Fire risk management includes a variety of activities with stakeholders to ensure the management of network assets considers preparedness, prevention, response and recovery. Actions are needed in planning, design, construction, maintenance and operational phases of the asset life. |
| Fire Affected Regrowth | Regrowth vegetation that has been effected by fire. Fire effected regrowth prior to herbicide application will require rescheduling to achieve effective results. Fire effected regrowth after herbicide application will require additional treatment to achieve effective results. |
| Fire Event | An event on the HV network caused by fire. |

| Terms | Definition |
|---|---|
| Fire Start | Any fire that starts in and originates from Powerlink's network. For the purposes of this specification, only fire starts from vegetation growing into HV network will be considered. |
| Fuel Loads | Fuel loads as defined under the overall fuel hazard assessment guide. |
| Fuel Arrangement | The arrangement of combustible material (e.g. vegetation) that effects the rate ignition and spread. Fuel arrangement links to the fire behaviour, including: rates fuel will be consumed, the intensity of the fire and flame height. |
| Ground Span | The area between two consecutive structures that requires active management. |
| Grow-In Risk | The risk vegetation poses to the network assets inside the clearing width area. |
| Hazardous Marginal Trees | A marginal tree that has been assessed to be unhealthy. |
| Herbicide | Registered chemicals applied to vegetation designed to kill the selected species. |
| High Risk Species | Vegetation species that has potential to have rapid and unexpected growth (e.g. Agave, bamboo and palms species). High risk species should be removed immediately. |
| High Voltage (HV) | All of Powerlink's transmission network is considered high voltage (HV). |
| Incompatible Vegetation | Incompatible vegetation is that which will come within the required vegetation clearance zones, (<6m from the conductor) when at their mature height considering sag. |
| Integrated Vegetation Management | Various long term investigations have proven that the selective removal of incompatible species utilising herbicides as the lowest overall cost approach. The need to adopt non-selective treatments (e.g. mega-mulching, slashing or broadcast herbicide application) indicate a loss of control in vegetation management programs. These methods may be warranted in the short term in instances where fuel load reductions are needed, but selective removal of incompatible species utilising herbicides should be resumed as soon as sufficient foliage has returned to allow for herbicide application to be effective. |
| Intensive Spans | Spans where herbicide application is restricted, requiring annual cycle times to ensure >6m clearance from conductors can be achieved. |
| Land for future network infrastructure | Land that has been purchased for strategic business purposes (e.g. land or easements for future network requirements). Not applicable to this document. |
| Landholder | A person with a legal interest in a land parcel. The legal interest will depend on the tenure (e.g. freehold, lease or crown land). |
| LiDAR | Light Detection and Ranging, used for measuring vegetation distances from conductors, density and height above ground. |
| Line of Sight | In relation to vegetation management, it should be possible to see the conductor from one structure to the next, for each span from a position on the ground. This condition may be waived under special circumstances (e.g. over canopy construction). |
| Marginal Trees | A tree outside the clearing area that has potential to fall within electrical exclusion zones. |
| Native Vegetation | Any naturally occurring vegetation that is indigenous to the surrounding area, including trees, shrubs and grasses. As described in regional ecosystem mapping. |

| Terms | Definition |
|---|---|
| Near Ground Level (NGL) | Means vegetation is cut as near to ground level as possible, but not to exceed 50mm from ground level. |
| Network Land Assets | Land that needs to be actively managed, including by controlling vegetation, to ensure the safety, security and reliability of the HV Network. |
| Network Land Assets for Future Use | Land that has been purchased or secured based on projected future network requirements. Not applicable to this document. |
| Non-network Land | Land that has been purchased for the operation of the business, but has no direct link to network assets (e.g. Virginia Office and Narangba Warehouse). Not applicable to this document. |
| Occupier (of land) | A contact person that is present at the property at the time of vegetation management, but is not the landholder (e.g. manager or tenant). |
| Organic Properties | Properties that are seeking to prevent the application of registered herbicides. These properties should be referred to Landholder Relations to determine if there are opportunities to formally transfer risk. The associated spans should be identified as intensive spans. |
| Partial Spans | Spans where not all incompatible species need to be treated even though it is not protected (e.g. Gorge crossings where there is >10m clearance from conductors). |

| Terms | Definition |
| --- | --- |
| Performance Indicators (based on maintenance regions: SQ, CQ and NQ) | Completing the annual vegetation management plan (plan is submitted 6 months prior to commencement of FY, including contractor prices)<br>• Good = all work completed under budget<br>• Moderate = all work completed at budget<br>• Poor = some work is not completed and/or over budget<br>Corrective action (ME/MA) expenditure for land maintenance<br>• Good = <1% (0% for 500kV or critical corridors)<br>• Moderate = 1-3%<br>• Poor = >3%<br>Fire risk management associated with land maintenance<br>• Good = 100% of spans have fuel loads <Very High (<4) within “AER High Bushfire Prone Areas” and 100% of spans on 500kV built sections or critical spans within “AER Moderate Bushfire Prone Areas”<br>• Moderate = <100-95% of spans have fuel loads <Very High (<4) within “AER High Bushfire Prone Areas”<br>• Poor = <95% of spans have fuel loads <Very High (<4) within “AER High Bushfire Prone Areas”<br>Landholder complaints and significant issues are recorded in PQConnect – relevant to land maintenance activities<br>• Good = All complaints and significant issues are recorded into PQConnect<br>• Moderate = 1 complaint or significant issue not recorded in PQConnect<br>• Poor = >1 complaint or significant issue not recorded in PQConnect<br>Safety and Environment incidents and near hits are reported – relevant to land maintenance activities<br>• Good = All incidents and near hits are recorded in PQSwitch<br>• Moderate = 1 incident or near hit not recorded in PQSwitch<br>• Poor = >1 incident or near hit not recorded in PQSwitch<br>Spans with vegetation >6m from conductors (12 month rolling average)<br>• Good = >99%<br>• Moderate = 99-95%<br>• Poor = <95%<br>Spans with vegetation within untrained distances (12 month rolling average) as per QLD Electrical Safety Regulations 2013, Schedule 2, Part 2<br>• Good = <1%<br>• Moderate = 1-3%<br>• Poor = >3%<br>Spans with vegetation within electrical exclusion zones (12 month rolling average) as per QLD Electrical Safety Regulations 2013, Schedule 2, Part 2<br>• Good = 0<br>• Moderate = 1<br>• Poor = >1<br>No electrical events caused by vegetation are considered acceptable<br>Work has a warrantee period (construction and maintenance)<br>• Good = >12 months<br>• Moderate = 12-6 months<br>• Poor = <6 months |

| Terms | Definition |
| --- | --- |
| Permit | Any approval required to clear vegetation in the form of a lease, license, agreement or permit. |
| Protected Area | Areas that are protected due to their conservation value, including cultural heritage. These areas will be marked on Environmental Work Plans (EWPs), which should outline the control measures required, including reporting requirements. |
| Protected Vegetation | Vegetation that is protected under legislation that may require permits, approvals or offsets to enable its management. Identified protected vegetation will be recorded on EWPs with conditions and control measures documented (e.g. Red Cedar Tree on 1020-SPN-092G). |
| QFES | Queensland Fire and Emergency Services. |
| QPWS | Queensland Parks and Wildlife Services. |
| Regions | Vegetation management is broken into geographic regions to assist with the efficient delivery. These currently include Southern, Central and Northern. |
| Regrowth | Saplings, suckers and other vegetation that has regrown during the cutting cycles. |

| Terms | Definition |
|---|---|
| Risk Factors (Span) | AER Bushfire Prone Area Risk (measuring point)<br>• High = High-Very High Potential<br>• Moderate = Medium Potential<br>• Low = Potential Buffer Impact<br>Annual Rainfall Risk (measuring point)<br>• High = >1600mm<br>• Moderate = 1200-1600<br>• Low = <1200<br>Change in Elevation Risk (span characteristic)<br>• High = >40m<br>• Moderate = 20-40m<br>• Low = <20m<br>Ground Clearance Risk (span characteristic)<br>• High = <7m<br>• Moderate = 7-10m<br>• Low = >10m<br>Maximum Slope Risk (span characteristic)<br>• High = >25%<br>• Moderate = 5-25%<br>• Low = <5%<br>Regional Ecosystem Type Risk (span characteristic)<br>• High = Wet Tropics and Southeast Queensland<br>• Moderate = Einasleigh Uplands and Central Queensland Coast<br>• Low = Brigalow Belt and New England Tableland<br>Span Length Risk (span characteristic)<br>• High = Spans >700m must be assessed by an Engineer<br>• Moderate = Spans 600-700m should have input from Engineer and/or consult design drawings + use spatial analysis<br>• Low = Spans <600m should be visually assessed to consider sag + use spatial analysis<br>Vegetation Span Risk (measuring point)<br>• High = > or = 4<br>• Moderate = 2-3<br>• Low = 1 |
| Risk Management | The management of hazards, consequences and likelihood associated with vegetation. It considers scale (e.g. zones, regions, built sections and spans) in applying treatments to manage associated risks in an efficient and effective manner. |
| Risk Transfer | Formal transfer of risk associated with the retention of incompatible species or other land maintenance (e.g. access or weeds). Risk transfer needs to be documented formally with Landholder Relations with agreed performance criteria and auditing included. |

| Terms | Definition |
|---|---|
| Route Length | The aggregate length of lines in kilometres, measured as the sum of each span between structures, where the length of each span is considered only once irrespective of how many circuits it contains. This is the horizontal distance and does not include vertical features such as line sag or terrain. |
| ROW Corridor | Right of way corridor, including clearing widths, easements and buffer zones. |
| Rural Spans | Spans within the rural zone. |
| Safe Working Area Vegetation | Vegetation that needs to be removed to provide a safe working area, primarily around the base of structures. |
| Sag | The vertical displacement of the conductor below the point at which the conductor is attached to the supporting structure and includes any extra displacement caused by hot weather or high load current. |
| SAP | Powerlink's asset and financial management system. |
| Security Risk Vegetation | Vegetation that needs to be removed for site security. |
| Sensitive Area | An area defined by Powerlink to identify a location requiring special consideration of environmental, cultural or aesthetic values. |
| Spatial Analysis | Spatial analysis can include LiDAR or satellite surveys; analysis of spectral results that has 2D or 3D results. Spatial analysis can vary in the level of accuracy, which needs to be considered in its application for vegetation management programs. Spatial analysis can produce performance indicators and risk factors that informs decision making. |
| Stakeholder Management | There are various interests that need to be considered when managing vegetation, including: customers, staff, contractors, suppliers, landholders and government agencies. Stakeholder management must be considered as part of the development of vegetation management programs. |
| Structures | Tower and poles used for overhead HV transmission. |
| Swing | The horizontal displacement of the conductor caused by wind and not considered currently in the scope of this document. |
| Tree Growth Regulators | The application of chemicals that slows the growth rates of trees. Tree growth regulators should considered where tree pruning is required. |
| Tree Pruning | Tree pruning involves cutting back branches/stems, but does not include removing its trunk. Tree pruning sites should be reduced over time in consultation with the tree owners. |
| Tree Removal | A tree that has been removed through negotiations. This may include stump grinding and/or chipping of the debris. The tree may have been pruned previously or developed as a marginal tree. It does not include regrowth treatment. |
| Tree Replacement Program | The purchase, planting and/or maintenance of replacing vegetation within, or directly associated with, vegetation management practices. Community goodwill should be considered if undertaking tree replacement programs, including coordination with local government and not for profit organisations. |
| Tropical Spans | Spans within the tropical zone. |

| Terms | Definition |
| --- | --- |
| Vegetation Infringement | Any instance where vegetation has entered electrical exclusion zones (12 month rolling average) as per QLD Electrical Safety Regulations 2013, Schedule 2, Part 2. Using Powerlink's vegetation risk rating system, this equates to any risk 5 or above, with risk 6 and 7 automatically triggering the need for reporting to the regulator. |
| Vegetation Management | The management of existing vegetation to ensure a safe, reliable and environmentally sound supply of electricity. It includes the selective application of herbicides, lopping, pruning and mechanical treatment of incompatible vegetation. |
| Vegetation Management Programs | Annual program of works that is prepared 6 months prior to the commencement of the financial year, including input from contractors and stakeholders. |
| Vegetation Zones | Powerlink has identified three broad zones for vegetation management purposes:<br>• Tropical spans that require 2 yearly inspections to ensure vegetation management has been performed by contractors.<br>• Rural spans that require 4 yearly inspections to ensure vegetation management has been performed by contractors.<br>• Intensive spans that require annual inspections to ensure vegetation management has been performed by contractors. |
| Watercourse | Watercourse Characteristics & Appropriate Actions (A1935816). |
| Weed Species | Plants that have been recognised as a biosecurity threat under the Biosecurity Act. Powerlink will support coordinated approaches to control weed species where it is appropriate and efficient to do so as part of vegetation management programs. |

# 2. Requirements

The overall objective of vegetation management is to minimise ground disturbance, while removing incompatible vegetation in an efficient and cost effective manner.

The underlying principles for vegetation clearing for new assets is that construction clearing should result in no vegetation management work being necessary for the first cycle after commissioning (e.g. initial chemical treatment of regrowth is to be included in the construction project costs). This requires that that vegetation management is considered during the planning, design and construction phases of a project and that any departures from this standard (e.g. vegetation is to be retained within the CSA+6m zone due to cultural heritage issues) will not impact on maintenance vegetation management programs. Line design must allow for the mature height of vegetation or else the vegetation should be programmed for clearing during construction. Where vegetation is found to be incompatible and control measures instruct the retention of the incompatible vegetation, stakeholders requiring the retention of the vegetation should be given the option of risk transfer. Where the risk is not transferred, additional costs associated with maintenance programs should be documented and communicated to stakeholders. The associated additional costs will be discussed with the stakeholder and documented in PQConnect.

## 2.1 Requirements

**Vegetation management requirements** are listed in Table 1 below. These requirements are to be applied in conjunction with the EMPs, EWPs, property owner agreements and easement terms and conditions as applicable.

**Table 1 - Vegetation Management Requirements**

| Item | Requirements | Follow up |
|---|---|---|
| Biosecurity Management | Appropriate and efficient measures should be undertaken to minimise the risk of biosecurity threats being spread as a results of Powerlink's activities. Spraying weeds should only be undertaken where it is essential for access to assets and where landholders have an active and coordinated approach to managing biosecurity threats. | Open up discussions to minimise the impacts of biosecurity threats. |
| Centre-line for a transmission line | Clear a width of 6m each side of the centreline (CSA + (6+6) m) of all incompatible vegetation. Vegetation, where cut, is to be cut to NGL, or left high enough to be clearly seen. Treat stumps with herbicide, or remove as agreed. Chemical treatment of regrowth is acceptable provided there are no clearance or fire risk issues posed by adopting this method.<br>Vegetation linkage corridors for small fauna are to be left as appropriate. Visual screening at road crossings should be achieved by selective clearing to maintain strips of compatible vegetation adjacent to the road. Vegetation in this area should be less than 3.5m in height when at mature height unless stipulated in EWPs. | Regrowth of incompatible vegetation shall be treated with herbicide where possible. |
| Conductor stringing | Preference shall be given to non-intrusive methods for stringing conductors in order to minimise ground disturbance (e.g. helicopter stringing). | Compatible vegetation left to regrow where safe. |
| Ground Access to Assets | A maximum 6m wide track for vehicle access should be located within the easement width where possible. Ground disturbance should be minimised, but where disturbance has occurred, de-stumping, re-compaction of soil, cutting stumps to NGL and treating with herbicide should be adopted. Where cut and fill is necessary to construct ground access to assets, wider clearing to accommodate these works, may be required. It is preferred for the track alignment to consider natural water flows and joint use requirements. | Regrowth of incompatible vegetation shall be treated with herbicide where possible and debris managed so as to not to cause an obstruction for vehicles. |
| Hazardous Marginal Trees | Marginal trees that have been assessed to be unhealthy and a threat to the network assets. | Tree pruning or removal that is cost effective and efficient. |
| Landholder/ Stakeholder Constraints | Landholder or other stakeholders may place restrictions or constraints on the vegetation management techniques that can be applied. These need to be recorded in PQConnect and displayed in the relevant EWPs for staff and contractors. Vegetation clearance of >6m (from conductors) must be achieved at all times, including sag. Seek further advice if this is not possible due to landholder or stakeholder expectations. | Open up discussions to minimise constraints where possible. |
| Site Security | Clearing, including the removal of vegetation that can fall onto security fencing, needs to ensure that site security is not compromised. See H-156762-001 for details. | Maintain site security. |

| Item | Requirements | Follow up |
|---|---|---|
| Tree Pruning | Tree pruning should be minimised and reduced over time. Negotiate tree removals and replacements where it is safe and economical to do so. Exceptions apply where protected vegetation requires pruning (e.g. Red Cedar Tree on 1020-SPN-092G) and should be recorded and displayed on EWPs. | Open up discussions to minimise tree pruning where possible or transfer risk. |
| Towers, poles and stay wires | Clear all vegetation except ground covers within the tower position and within a maximum (depending on the tower type and voltage) radius of 10 m beyond the footing position, including de-stumping or cutting stumps to NGL and treated with a herbicide. This includes clearing to poles and stay wires where applicable, but clearing should not extend beyond initial clearing. See H-156762-002 for further details on construction clearing requirements. | Regrowth of incompatible vegetation shall be treated with herbicide where possible. |
| Vegetation within clearing area | Clearing of all incompatible vegetation within the clearing area should occur at all stages of the asset life. EWPs should identify areas where restrictions on clearing apply. Specific agreements for the clearing or pruning of vegetation outside the clearing area must be sought from the landholder, unless Powerlink has an agreement in place to do so. Traditional owners should be contacted via Powerlink's Cultural Heritage Specialist where appropriate. | Regrowth of incompatible vegetation shall be treated with herbicide where possible. |

As part of construction clearing, towers, poles and stay wires are to be clear of all vegetation within a radius of 10m, but no further than the edge of the initial clearing. Vegetation within the shaded area in H-156762-002 should be cut at NGL and appropriate herbicides applied unless EWPs indicate otherwise (99% kill rate) with the aim of providing safe work areas around structures. Underground cable clearing requirements are defined in H-156762-003.

Vegetation management of clearing areas should meet the requirements set out in H-156762-002 and H-156762-003 during construction unless EWPs identify constraints. De-stumping or cutting vegetation at NGL is only applicable at the time of construction.

In the maintenance phase, all incompatible species should be removed from the easement with selective chemical treatment of herbicides wherever possible. Vegetation maintenance treatments should be performed in alignment to H-156762-004 & H-156762-005. Noting there are more stringent treatment requirements in high bushfire pone spans. If incompatible vegetation is identified, but EWPs identify constraints, discuss risk transference with the landholder/stakeholder linked to the constraint. Risk transference will need to be documented with Landholder Relations business partner support.

Corridors associated with cables are inspected by lines staff on a regular basis, with notifications raised as required for vegetation management to be performed. Drawing H-156762-003 defines requirements that are expected, which typically means that grasses and shallow rooted vegetation are required near underground electrical cables to ensure that root systems don't accelerate deterioration of these assets. Where deep rooted vegetation is identified near electrical cables, they should be treated as hazardous marginal trees.

## 2.2 Site Security

Transmission substation and other HV sites are considered to be critical infrastructure and security of these sites is therefore of paramount importance. Consequently, there is a need to easily see into the substation yard and any vegetation screening should not be so dense as to form a hedge effect, but rather be planted in such

a way as to allow unobstructed lines of sight between the plants. The unobstructed areas should be the same width as the mature width of the plants used in the vegetation screen and should be arranged in such a way that individual plants are interspersed with open gaps. See H-156762-001 for further details.

During the planning and design of new substations, methods used in AS3959 should be considered to determine the appropriate clearing distances from vegetation. The same methods can be applied during design reviews, but limitations may exist as a result of historical approvals and agreements.

It is preferred that vegetation screens are planted on the outer edge of the property rather than nearer to the substation security fence, in order to allow the maximum clear area outside the security fence. In addition, people should not be able to gain access to a substation by climbing a tree and jumping down inside the substation yard.

It is required that an area, 5m outside the substation security fence be kept clear of any vegetation and other obstructions. Where this cannot be achieved, defects should be recorded in SAP with priority ratings applied. This includes vegetation that has a risk of making contact with security fencing around the substation. Where our control of the land outside the fence is less than 5m, clearing should be maintained to the extent of the property and further in consultation with the adjacent landholder(s).

Only ground cover vegetation should be permitted within substation security fencing and in some areas no vegetation maybe a requirement (e.g. cap banks). Notifications should be raised where legacy issues exist with vegetation within security fences (e.g. Belmont and Ashgrove West) with priority ratings recorded.

During the maintenance phase, substation and communication sites are inspected as part of Civil Maintenance programs on a regular basis, but notifications may be raised for vegetation management to be performed.

## 2.3 Risk Management

Risk management is an integral part of effective vegetation management and will be considered in the following stages:

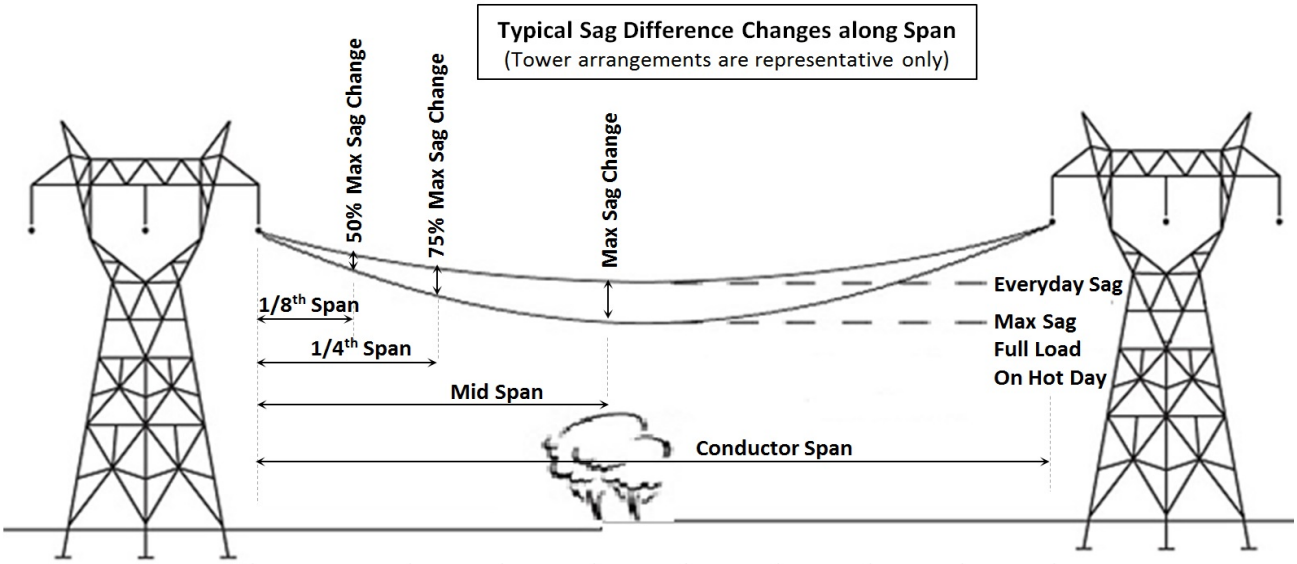
- Planning: considering risk factors associated with corridor selection;
- Design: considering risk factors with over-spanning native vegetation and the mature height of the vegetation;
- Construction: considering risk factors for retaining incompatible species, documenting reasons in EWPs and discussing risk transference with stakeholders requesting the retention of incompatible species;
- Maintenance: considering risk factors for annual vegetation management programs and the most efficient delivery methods; and
- End of Life: considering stability of vegetation in the context of surrounding landuse.

Risk factors that need to be considered in the development of annual vegetation management programs, include:

- Built asset requirements (e.g. insulator replacements or construction schedule);
- SAP notifications;
- Spatial survey results;
- Contractor submitted program and unit rates (i.e. $/ha or $/span);
- AER Bushfire Prone Area Risk (measuring point);
- Fuel loads on easements (measuring point);
- Annual Rainfall Risk (measuring point);
- Change in Elevation Risk (span characteristic);
- Ground Clearance Risk (span characteristic);
- Maximum Slope Risk (span characteristic);
- Regional Ecosystem Type Risk (span characteristic);
- Span Length Risk (span characteristic); and
- Vegetation Span Risk (measuring point).

Where ground clearance information is not available, Figure 1 provides guidance for spans <600m in length.

**Figure 1 - Typical Sag Difference Changes along a Span**




| Conductor Span | 100m | 200m | 300m | 400m | 500m | 600m | 600m+ |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Max Sag Change | 1m | 2m | 3m | 4m | 5m | 6m | 6m |

*Refer Objective Document 'A2947839 for catenary calculations*

For spans >600m in length, input from an Engineer, detailed sag information from design drawings and/or spatial survey results should be used to determine clearing requirements.

Vegetation will only need to be cut to natural ground level to create safe work areas or to achieve required clearance from conductors, provided herbicide application is effective, the vegetation is >6m from conductors considering sag and the site remains safe (e.g. considering falling dead timber).

Risk factors will be considered as inputs in determining investment strategies for land maintenance expenditure. The annual review process will also consider the following inputs:

- Safety (annual review of vegetation related hazards, near hits and incidents);
- Environment (review of EWPs and forecast of climatic conditions);
- Asset condition and performance (annual review of asset performance, planned outages and asset condition to determine if adjustments are needed);
- Financial performance (review of financial performance to determine if adjustments are needed, including allocated budgets); and
- Stakeholder issues (review stakeholder feedback, including landholder constraints and complaints).

Hazards associated with vegetation will have the following context:

- Level 1 functional location in SAP (e.g. built section);
- Lowest level functional location in SAP (e.g. ground span);
- Voltage of the associated transmission line;
- Ground clearance of the transmission line;
- Network operations and dynamics;
- Vegetation growth rates;
- Vegetation health;
- Vegetation position and proximity to network assets;
- Vegetation type;
- Proximity to high risk bushfire prone and high consequence areas; and
- Site conditions and constraints.

The context should be documented as part of the annual planning process and documented into corporate systems to allow transparency.

Consequences associated with vegetation management include the following possibilities based on global examples and with Powerlink consequence (in brackets):

- Safety: electrocution associated with vegetation management (extreme);
- Safety: fires are started from vegetation related network events (minor to catastrophic);
- Reliability: network events are caused by vegetation or control burns (moderate to catastrophic);
- Financial: vegetation management can result in insurance payouts and escalating maintenance costs (insignificant to catastrophic); and
- Stakeholder: a perception of poor or inadequate vegetation management can result in negative media coverage (insignificant to catastrophic).

While Powerlink has never experienced high negative consequences, the potential magnitude of these consequences demands that vegetation management considers them as a possible scenario even if the likelihood is very rare.

The objective of maintaining vegetation clearance >6m at all times considering sag is an effective risk mitigation strategy, however, may not be achieved within budget allocations in all instances. Performance indicators have now been developed to assist with driving the appropriate outcomes and to define risk tolerance.

Powerlink's vegetation management programs seek to manage associated hazards and consequences in an efficient manner. The results of the annual program should also translate into reductions in the likelihood of the consequences outlined above from ever being realised.

Powerlink's evaluation of risk associated with vegetation management is increasingly moving from subjective assessment to quantitative measures, including data from LiDAR surveys and spatial analysis. Results will be utilised as a measure of residual risk following the application of risk treatments.

Risk management is also scale dependent and linked to the following categories:

- Zones (Tropical, Rural and Intensive Spans);
- Regions (Northern, Central and Southern);
- Level 1 functional locations in SAP (e.g. Built Sections and Substations); and
- Lowest level functional location in SAP (e.g. ground spans and ++++-SIN-LAND).

Annual programs will consider all scales to enable effective management of risk.

The following suite of approaches and techniques are used for management of risk:

- The use of tolerances which have been defined as part of performance criteria.
- Avoidance of vegetation at the planning stage, though it is often difficult given that the choice of route will include other considerations.
- Transference of risk is legislated in other jurisdictions in Australia, but not in Queensland. However, Powerlink wishes to engage in voluntary discussions with landholders/stakeholders about risk transference where there are mutual benefits.
- Reduction of likelihood and consequences maintaining vegetation >6m from conductors at all times.
- Treatment techniques for vegetation management includes the following elements:
    - Predominantly selective treatments (applying registered herbicides where possible)
    - Documents use of different techniques as part of daily worksheets
    - Land asset condition assessments to perform an audit function on the effectiveness of treatments, including spatial results
    - Competency of staff/contractors performing treatment techniques
    - Competency of staff/contractors auditing treatment techniques
    - Condition of equipment
    - Expenditure trends combined with audit results provide an indication of the effectiveness of the vegetation management programs
    - Utilising appropriate technologies to record, report and review

- Site Specific Implementation Treatments are developed as part of the annual planning process, including:
    - Built Sections, Towers and Spans
    - Substation and Communication Sites (inspections are performed as part A of Civil Inspections)
    - Washdown Sites
- Setting Management Objectives and Tolerance Levels includes:
    - Performance indicators
    - Clearances on and off the right of way (ROW)
    - Conditions on and off the ROW
    - Compatible and incompatible species
    - Zones and different tolerances
    - Stakeholder impact management
    - Stakeholder concerns and interactions
- Adaptive Management and Monitoring as part of land maintenance delivery considers the following:
    - Performance Indicators
    - Technical requirements
    - Safety
    - Economics/Budget
    - Social
    - Environment
    - Weather conditions
    - Risk Factors
    - Data management
    - Management review and continual improvement.

Stakeholder Management will be conducted annually as part of the annual program review process. Vegetation management programs will document how stakeholders are being considered and integrated into annual programs. Stakeholders include:

- Customers;
- Staff;
- Contractors and Suppliers;
- Landholder Relations; and
- Other Key Stakeholders (e.g. fire planning groups).

Management Planning – Tactical annual plans and reviews need to be prepared and reviewed annually. The plans need to be finalised 6 months prior to the commencement of the financial year to allow for peer review and budget preparations. Tactical annual plans should:

- Establish context (safe, reliable, affordable and responsible);
- Carry out annual reviews of asset condition, network performance, LiDAR surveys, spatial analysis and management trends;
- Assess future exposure and impact forecast (annual outlook) and considerations for annual plans;
- Review annual plans submitted by contractors with stakeholder/landholder input 6 months prior to the commencement of the financial year, including risk treatments;
- Plan implementation with monthly reporting against performance criteria at the Network Maintenance Forum or Project Meetings;
- Carry out site specific condition assessments, including LiDAR and spatial analysis;
- Develop and maintain plans for the assessment of Hazardous Marginal Trees;
- Develop and maintain plans for burning stacks and windrows (construction only);
- Audit plan, results and implement continual improvements (as identified);
- Monitor the competency of workers performing vegetation management; and
- Review Network event investigations associated with vegetation, including fire events.

Management Planning – Strategic (full review every 5 years or triggered by significant external influences), including:

- Review of Management objectives and principles;
- Reassessment of the ROW resources to be managed (e.g. lengths, clearing width, clearing area and other asset attributes);
- Review of the land use classifications of adjacent lands (e.g. state government definitions);
- Review of the vegetation management tasks and maintenance activities used, based on coordinated asset condition monitoring programs (e.g. LiDAR surveys, spatial analysis and audits);
- Review of SAP data structures for vegetation management;
- Review of maps and/or geospatial record system describing the ROW resource base;
- Review of environmental limitations and safeguards appropriate to the sites and ecosystems that occur on the transmission system (e.g. Environmental Work Plans);
- Review of the means of monitoring work, including feedback mechanisms for revising processes as appropriate to more effectively achieve objectives;
- Review of future exposure and impact forecast (5 year outlook); and
- Review of performance indicators and continual improvement.

Understanding Vegetation and Ecosystem Dynamics includes:

- Knowledge of Vegetation Managers
    - Species identification and response to treatments
    - Contract management
    - Herbicide efficacy
- Commitment to R&D, including establishing trials (e.g. Environmental Monitoring Points and Taskforce efficacy).
- Maintaining knowledge, including appropriate training and events such as:
    - Land Maintenance Forums;
    - Utility Arboriculture Association membership and participation; and
    - Training plans for Easement Officers.

### 2.3.1 Critical Corridors

Critical corridors are those where the consequence of a multiple circuit outage on the overall network reliability is regarded as significant. They are made up of corridors containing multiple high voltage circuits where the simple sum of the operating voltages of the different circuits exceeds 1,000kV and those additional corridors containing circuits regarded as significant to system security.

The greatest risk of a multiple circuit outage exists in bushfire situations is either from direct flashover or from a decision of the Network Operator to switch the circuits out because of an unacceptably high risk from an approaching bushfire.

Critical corridors should be identified in the planning and design phase to ensure that vegetation control measures will be compatible for the life of the asset. If corridors are subsequently identified as critical (i.e. after planning and design), vegetation control measures may need to be renegotiated with stakeholders with details included in annual program reviews.

## 2.4 Compliance Requirements

The practical implementation of Powerlink's obligations to maintain quality of supply and protect its transmission network, as a condition of its transmission authority under the Electricity Act 1994, would include vegetation clearing and/or pruning to avoid flash over resulting from vegetation proximity to the conductors, in either clean air or under fire conditions.

The Electrical Safety Regulations (s148) states:

> *"An electricity entity must ensure that trees and other vegetation are trimmed, and other measures taken, to prevent contact with an overhead electric line forming part of its works that is likely to cause injury from electric shock to any person or damage to property."*

For practical implementation, this must include vegetation removal and/or pruning to avoid flash over resulting from vegetation proximity to the conductors, either directly (air gap is too small) or indirectly (from burning vegetation).

Vegetation shall be removed so that the Untrained Persons Exclusion Zone distance (as prescribed by the QLD Electrical Safety Regulations 2013, Schedule 2, Part 2) for the applicable transmission line operating voltage is maintained between the conductor under its maximum sag condition at all times. In cases where tree pruning occurs, the amount of vegetation removed shall allow for the regrowth of vegetation between tree pruning events. Performance indicators have been established to assist with driving electrically safe outcomes.

Any work that is proposed to be conducted within the untrained person's exclusion zones as defined under the QLD Electrical Safety Regulations 2013, Schedule 2, Part 2 is required to be approved by Powerlink. Safety Advice, as defined within the Electrical Safety Legislation, shall be provided before the work proceeds.

Environmental legislation also places restrictions on vegetation management. If these restrictions were identified at the planning and design phase, there may be no conflicts with the requirements of the keeping vegetation a safe distance away from Powerlink's HV Network. Environmental control measures should be identified in EWPs, which are used as key reference material when clearing vegetation. If there is a conflict with the environmental control measures and safety requirements, seek advice from safety and environment support staff.

### 2.4.1 Powerlink Easement Conditions

Powerlink has legal rights and obligations under easement terms and conditions. These terms and conditions may vary depending on the circumstances at the time the easements were registered. Generically, the following clause is included in Powerlink's *Standard Easement* terms and conditions:

The landowner /user may not "*plant upon the Easement Land trees whose size or height would in any way interfere with the statutory clearance that may exist from time to time*".

Adherence to this should be monitored, reported and any infringing action discouraged.

Typically, Powerlink will not allow vegetation >1m within the CSA + 6m zone or >3.5m within the remaining clearing area as described in H-156762-002 for construction, unless design considerations allow for taller vegetation to exist. Vegetation maintenance treatments should be performed in alignment to H-156762-004 & H-156762-005. Noting the more stringent treatment requirements in high bushfire prone spans and moderate for 500kV built sections and critical spans.

### 2.4.2 Powerlink Land Access Agreements

In response to changing community expectations, Powerlink has developed Land Access Agreements with some landholders. Where constraints on vegetation management are significant (e.g. costs are >$5,000/span), the Maintenance Facilitator Easements should be advised and the Landholder Relations group may need to become involved.

### 2.4.3 Other Powerlink Controlled Land

Vegetation management covered under this specification only relates to the land assets under Powerlink's control or ownership, associated with its network. It does not include requirements for non-network land, mothballed assets or land for future network requirements.

### 2.4.4 Land where Powerlink holds no legal rights

Powerlink may need to manage vegetation where it holds no legal rights (e.g. marginal tree off easement). In these circumstances, the landholder must consent to the works in writing and input from safety/environmental/ cultural heritage/landholder relations professionals may be provided on appropriate control measures.

## 2.5 Minimising Ground Disturbance

Powerlink's governing principle regarding vegetation management is to **minimise ground disturbance** consistent with the safe operation of the transmission line.

Vegetation should be left in deep valleys, environmentally sensitive areas and legally protected areas, provided that the vegetation poses no threat (including an unacceptable risk from fires) to the operation and reliability of the transmission line. In the case of the construction of new transmission lines, preference should be given to non-intrusive methods for stringing purposes (e.g. helicopter stringing) in order to minimise vegetation removal and erosion.

Vegetation clearing should be conducted in a manner to minimise soil erosion and restrict the invasion by incompatible or weedy species. Trees, shrubs, grass, natural features and topsoil, that are not removed, should be protected from damage where possible. Grading of the earth, or any necessary disturbance, should generally be limited to access roads, the tower/substation pad only and associated earthworks/drainage.

All cut or living vegetation left on the easement should be assessed in terms of fuel loads and fire risk, particularly in AER high bushfire prone areas.

Minimising ground disturbance will also assist Powerlink in reducing the risk of biosecurity threats invading easements, supporting Powerlink to meet its general biosecurity obligations.

Watercourse characteristics and appropriate actions are outlined in the relevant guidelines. Generally, minimisation of ground disturbance in watercourses is to be achieved, including actions that may impact on hydrological flows.

## 2.6 Clearing

A wide range of clearing techniques can be used depending on the circumstances. When establishing a new easement, heavy machinery (e.g. dozers and mega-mulchers) may be the most suitable. During maintenance, Powerlink's preference in maintenance is to selectively apply herbicide to vegetation regrowth. Pruning of vegetation at all stages should be minimised. The following clearing types are used by Powerlink:

| Clearing Types | Description |
|---|---|
| Dozer Clearing<br>Broad acre application, best suited to initial clearing (i.e. establishing the easement) | **Clearing Methods:** Methods could include:<br>• Dozer with blade 100mm above ground level<br>• Dozer and stick rake<br>**Suitable for:** Initial clearing of predominately forest or woodland areas or previously cleared dense mature regrowth areas on non-erosive soil types.<br>**Not suitable for:** Waterways or watercourses and adjoining banks; steep areas; cultural heritage sites; active or potential erosion prone areas; and other environmentally or visually sensitive sites.<br>**Burning:** If the use of fire is part of the land management practice of the area, then stacks should be burnt and as soon after clearing as practical.<br>**Outcome:** Initial ground disturbance with >70% vegetation cover likely to be removed/disturbed. Low timber stacks situated as close to edge of clearing with suitable separation from timbered edge if to be left unburnt.<br>**Note**: Layover clearing has limited ability to be used for selective vegetation removal. |
| Mulching<br>Broad acre efficient and fast clearing method with ability to provide a uniform finish | **Clearing Methods:** Methods could include:<br>• Heavy duty front or rear mounted mulching (e.g. mega-mulcher) – front mounted is more effective<br>• Grooming (e.g. excavator mounted head)<br>**Suitable for:** Initial clearing of predominately forest or woodland areas or previously cleared dense mature regrowth areas on erosive soil types.<br>Areas where uniform finish is essential (e.g. visually sensitive areas or urban areas). Areas within the AER high bushfire risk area may be considered on a case-by-case basis (refer to Maintenance Facilitator Easements). |

| Clearing Types | Description |
|---|---|
| | **Not suitable for:** Watercourses and adjoining banks; cultural heritage sites; rocky/uneven ground; and areas where selective low growing vegetation needs to be protected.<br>**Outcome:** Uniform coverage of mulch with stumps cut at NGL.<br>**Note**: Mulching has limited ability to be used for selective vegetation removal. |
| Slashing<br>Efficient and fast method in light vegetation conditions | **Clearing Methods:** Methods could include:<br>• Tractor and slasher (rotary or flail)<br>• Skid steer and slasher (rotary or flail)<br>**Suitable for:** Areas of light vegetation or regrowth. Predominately used for maintenance activities and grassy areas requiring access.<br>**Not suitable for:** High density stands or where DBH exceeds 100mm.<br>In watercourses and adjoining banks, cultural heritage sites. In areas where certain low growing vegetation needs to be protected.<br>**Outcome:** Uniform coverage of mulch with stumps cut at NGL. |
| Chopper Roller<br>Broad acre and very efficient method in moderate to light regrowth vegetation conditions | **Clearing Methods:** Methods could include:<br>• Drum roller behind dozer or front-end loader<br>**Suitable for:** Predominately used for maintenance activities for reduction of fire risk.<br>**Not suitable for:** Very high density stands. In watercourses and adjoining banks, cultural heritage sites. Areas where certain low growing vegetation needs to be protected. Stony areas or where DBH exceeds 100mm.<br>**Outcome:** Chopped up vegetation in 100mm lengths with some ground disturbance, particularly in turning areas.<br>**Note:** Difficult to source equipment. |
| Selective Hand-clearing<br>Efficient method for low volume clearing or on steep slopes | **Clearing Methods:** Methods could include:<br>• Chainsaw<br>• Herbicide<br>**Suitable for:** Very selective and should incorporate herbicide application. Watercourses and adjoining banks, cultural heritage sites. Areas where certain low growing vegetation needs to be protected.<br>**Not suitable for:** Broad-scale initial clearing.<br>**Outcome:** Stems left in situ and cut near to ground level (NGL) and felled on contour. Heads to be lowered to improve decomposition and all stumps treated with a suitable herbicide where possible. |
| Chemical treatment of regrowth<br>Efficient method for regrowth up to 4 metres in height and where time allows. | **Clearing Methods:** Methods could include:<br>• Stem injection<br>• Cut stump<br>• Basal spray<br>• Overall spray technique<br>**Suitable for:** Regrowth vegetation.<br>**Not suitable for:** Organic farms or other areas that do not permit the use of chemicals.<br>**Outcome:** Selective treatment of incompatible vegetation, while minimising ground disturbance. Target vegetation dies within 3-4 months and decomposes. |

*Note: Pruning of a small number of plants may be necessary as part of the above practices.*

In selecting the most suitable clearing type, staff and contractors are reminded that they should strike a balance between ensuring electrical safety to individuals and property, the security (i.e. quality of supply) of the transmission network, the protection of the environment and whole of life costs.

## 2.7 Herbicide Application

Powerlink encourages the responsible and lawful application of herbicides to modify the species composition of vegetation associated with its network land assets. This approach should result in the efficient removal of incompatible species.

There are various restrictions placed on the use of herbicides, including:

- Queensland state regulatory requirements;
- Distributing herbicides in hazardous areas;
- Product label instructions; and
- Landholder requirements.

For more details, see the Distribution of Herbicides Procedure.

Powerlink staff and contractors who apply herbicides should hold appropriate licenses and be competent in the techniques being used. Staff and contractors must retain appropriate records when applying herbicides. Records of herbicide application need to be maintained for a period of 7 years.

Powerlink must not operate, authorise or direct another person to carry out distribution of agricultural chemicals unless a contract of insurance covering loss or damage to property has been taken out. It must also ensure any person contracted to ground spray is suitably insured. Persons applying chemical on behalf of Powerlink need to be over the age of 17 and hold appropriate qualifications.

## 2.8 Fire Risk Management

Fire risk management requires coordinated responses across the business with other land managers to be effective. It needs to be considered at all stages of the asset life with a focus on asset protection, which will also provide improved safety for staff, emergency services staff and the general public.

Other than considering wildfires in the planning and design phase, very little can be done in the maintenance phase to mitigate the risk of wildfires impacting on the network. Wildfires are known to cause power outages with contributing factors including:

- Voltage of the asset;
- Designed insulation (air gap from structures and the ground);
- Conductive smoke and conductive particles;
- Reduction in air density caused by the heat of the fire;
- Volatilisation of gases (and associated charged particles); and
- Reduced ground clearance caused by heat (i.e. conductor sag beyond designed limits).

Of these, flames close to the conductors have the greatest effect. The air gap required to prevent flashover when there is a fire is ten times longer than the gap required when there is no fire. It should be noted that in a large canopy or “crown” fire, the easement vegetation will have little effect as the fire will engulf the entire easement, moving from one side of the easement to the other. The risk of flashovers being caused by such fires is highly likely and near impossible to predict or manage.

Therefore, Powerlink’s focus once assets have been built is on risk management through control burning programs. When stakeholders advise of their activities to perform controlled burning programs near our network assets via calling 1800 353 031, Network Operations will consider potential impacts on the network and provide advice.

As part of annual vegetation management program reviews, maintenance service providers should assess fuel loads in AER high bushfire prone areas. Fuel loads should be <very high in AER high bushfire prone areas with performance indicators in place to provide guidance.

Annual vegetation management program reviews should also:

- assess fuel loads on PQ land assets and what the consequences are likely to be if fires occur on those land assets;
- assess vegetation management programs and how they could be adjusted to assist with managing risks (e.g. conducting slashing ahead of schedule to allow the easement to be safely used as a fire break), while remaining within budget allocations;
- adjust vegetation management programs to ensure they are effective (e.g. hold off herbicide application until after fires to ensure that the work is effective);
- provide advice to agencies to exclude planned burns from land assets where fuel loads may present a risk to safety and the network; and
- advise stakeholders of the dangers associated with fires near transmission lines (e.g. through the use of information sheet: "Fire and high voltage transmission line safety").

Failing to coordinate with stakeholders can result in poor safety outcomes, impacts on the HV network and inefficient/ineffective management of the associated vegetation.

Powerlink aims to ensure fires are not generated from vegetation contacting its HV Network. This should be achieved through maintaining vegetation >6m from conductors at all times. Excluded from the scope of this document are risks associated with the network causing fires (e.g. from dropped conductors or CT explosion), which is a part of other asset management requirements.

### 2.8.1 Statutory Requirements

Controlled fires are administered under the Fire and Rescue Service Act 1990.

Consequences as a result of a breach of the Electrical Safety Act and regulation 2013 may be triggered in the event of the electrical network being impacted by fires.

Other constraints identified in planning and approval processes can link to various legislative requirements and should be summarised in EMPs with relevant information translated into EWPs.

### 2.8.2 Planning & Design

Powerlink planning and development of infrastructure needs to strike the right balance between social, safety, environment, reliability and cost. Mitigation of fires should be considered in the planning and design phases of the electrical network, as the location and design of assets is influenced by environmental factors which contributing to the frequency and intensity of fires. The relative fire risk to planned infrastructure has implications on the extent of vegetation clearing required to adequately protect assets from the potential impacts of fire.

Flame heights can typically reach twice the height of the retained vegetation. Flames >1m can be unpredictable and may flare up depending on site conditions, fuel loads and fire weather. Fuel arrangement and height should be considered when making commitments to stakeholders about vegetation that can be safely retained.

Vegetation management decisions regarding fire mitigation should be detailed in EMPs, EWPs and safety in design documents to guide design, initial clearing for new construction projects and ongoing maintenance requirements. Details of any agreements with landholders/stakeholders regarding fire management needs to be documented in corporate systems. Powerlink may coordinate with landholder's to facilitate burns to reduce fuel loads adjacent to transmission assets.

### 2.8.3 Construction

Vegetation clearing in construction must consider fire risk management. Any burning of cleared vegetation

should be undertaken in accordance with the burning stacks and windrows requirements outlined in this document.

Where practicable, timber of economic value (e.g. millable, fencing or landscaping) should be salvaged. In low-moderate AER bushfire risk areas, timber wastes may be mulched or retained onsite as fauna microhabitat and/or utilised in erosion and sediment controls. Retention of cut vegetation on cleared areas in line with fuel load and land use requirements should always be considered.

The problem with burning large stacks (and windrows in particular) is the volume of heavy fuel involved and the long periods of time (days or weeks) required to burn them, increasing the potential for fire escape. If the stacks or windrows have not been constructed with sufficient aeration to enable the fuel to cure sufficiently, burning may also result in extended periods of smoke that last for days or weeks, resulting in potential health impacts.

In general, stacks of vegetation are preferable to windrows as stacks are smaller, more manageable, contain fine fuels (such as branches, sticks, leaves, grass) and tend to be less tightly packed than windrows. This aeration allows the fuel to cure and burn more quickly and efficiently, generating fewer smoke problems.

Buffer zones for burning stacks are outlined in Table 2 below.

**Table 2 - Windrows should be constructed outside these buffer zones**

| Feature | Buffer Distance (m) |
|---|---|
| Transmission Powerlines (CSA + 6m) | 25 |
| Property boundary | 40 |
| Building | 50 |
| Native vegetation retention area | 20 |
| Existing vegetation | 20 |
| Wetland, river or drainage line | 20 |
| Aboriginal burial site | 50 |
| Aboriginal scarred tree or stones | 20 |
| Artefact scatter or other relic or place | 10 |

Before planning to burn stacks, contact QFES (1800 020 440) to confirm approval and conditions for conducting burns. Do not light fires until you have confirmed that conditions, resources and approvals are all in place to perform the burn. Other stakeholders will need to be contacted to confirm permissions have been granted (e.g. landholder and local authority).

Immediately prior to lighting stacks, create a disturbance/noise to scare away wildlife that may be taking shelter. If you are in doubt with any aspect of burning stacks, do not proceed and consider alternatives for managing the vegetation debris.

Under no circumstances should stacks be retained on easements or burned under energised lines.

Mulching as a clearing method should reduce the need for burning stacks and provides ground cover protection.

The Onsite Fire Prevention Procedure should also be implemented during construction to mitigate risks associated with unintentional fire starts from construction activities.

### 2.8.4 Operations

Powerlink's operational response to fires is coordinated by Network Operations (NO). Network Operations will monitor potential impacts on the network and may require support and advice. Consideration of network impacts, safety and environmental impacts will be balanced as part of their coordination function.

As part of seasonal preparedness, fire risk assessment is essential. This should include assessment and review of: fire history, vegetation types, forecast weather conditions, fuel load assessments and neighbouring landuse.

Important corridors are those where the consequence of a multiple circuit outage on the overall network reliability is regarded as significant. The greatest risk of a multiple circuit outage exists in bushfire situations either from direct flashover or from a decision of the Network Operator to switch the circuits out because of an unacceptably high risk from an approaching bushfire.

Critical corridors should be identified in the planning and design phases to ensure that vegetation management measures will be compatible for the life of the asset. If corridors are subsequently identified as critical (i.e. after planning and design), vegetation management measures may need to be renegotiated with stakeholders.

Key Powerlink and Ergon staff have received training as fire investigators.

As trained fire investigators, they will be able to assist external agencies in gathering evidence, protecting a scene and report writing.

### 2.8.5 Maintenance

Powerlink's maintenance response to fires is coordinated by OSD. Implementation of the vegetation management will ensure fuel loads are managed efficiently and integrated into annual program reviews.

As part of Land Asset Condition Assessments, Powerlink assesses vegetation risk and fuel loads on easements. Fuel load assessments determine the easement condition (1-5 rating) by applying the methodology outlined in the overall fuel hazard assessment guide (1 being low with no action required and 5 being extreme with action of some nature needed within 1 month to lower elevated fuels).

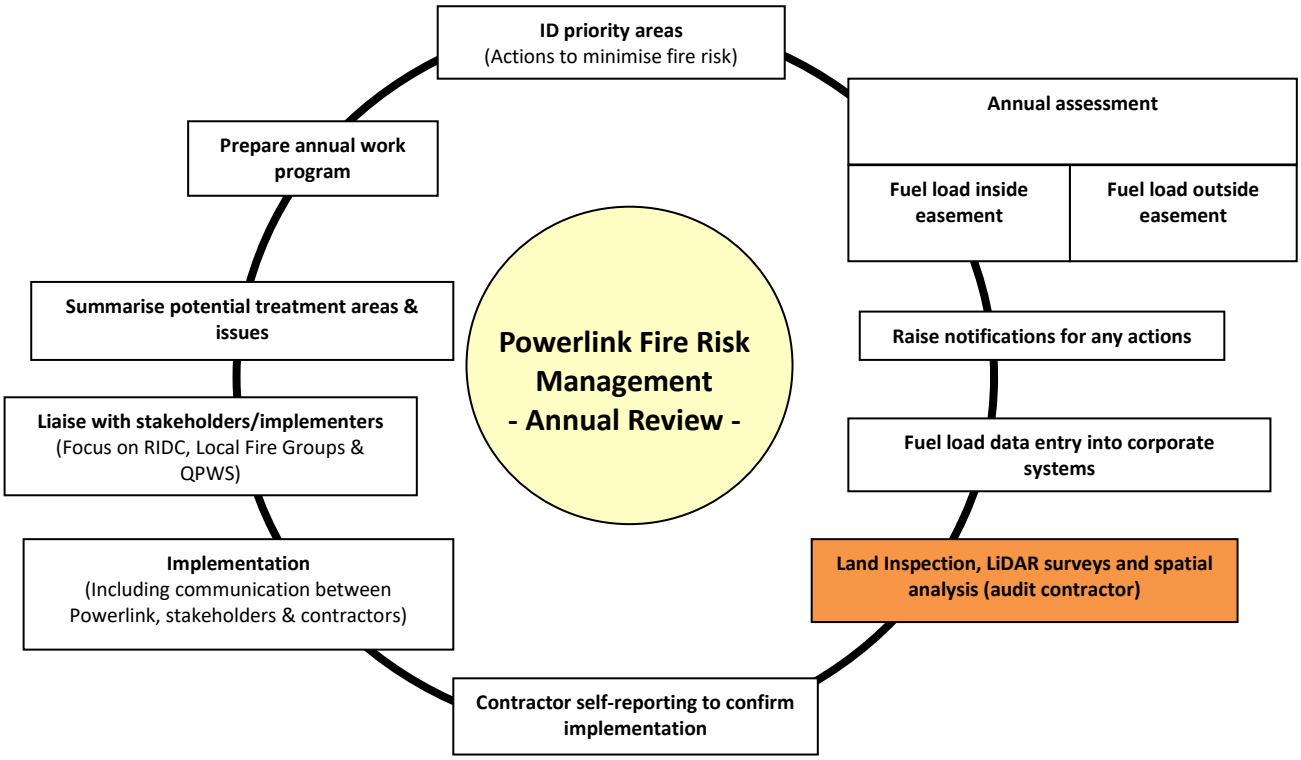
AER bushfire prone areas are defined by the state government and loaded into spatial systems for analysis at a span level. These spans are reported annually to the AER as part of RINS.

Powerlink creates EWPs for each level 1 functional location (i.e. substation, built section or communication site). EWPs are a visual rendition (map) of an area with information such as weeds, protected areas and landowner contact details marked on it. This same information can also be displayed electronically on PQ Maps. EWPs are important reference documents when undertaking fire risk management activities. They may also provide control measures relevant to fire risk management.

### 2.8.6 Annual Reviews & Emergency Response

As part of sound fire risk management, an annual review of fire risk should occur to identify and evaluate risk management measures (see Figure 2). This should coincide with annual program review for vegetation management.

**Figure 2 - Annual Review for Fire Risk Management**




### 2.8.7 Balancing Resources

Emergency services are experts in the area of fire risk management. In allocating resources, they review their capabilities and resources in the following areas:

- Prevention (e.g. maintaining appropriate fuel loads and coordinating land maintenance with control burn programs);
- Preparedness (e.g. monitoring fire weather and fires near Powerlink's network);
- Response (e.g. coordinating responses to fires); and
- Recovery (e.g. emergency restoration, opportunistic weed control and follow up herbicide treatment of regrowth).

Powerlink's approach to fire risk management needs to consider the correct allocation of resources and capabilities as part of annual program reviews and emergency response.

### 2.8.8 Stakeholder Management

Powerlink proactively engages with stakeholders on fire risk management to ensure its efforts are efficient and effective, and is an active member of the Queensland Fire and Biodiversity Consortium (QFBC). Key stakeholders in fire risk management includes QFES, QPWS, and landholders.

In addition, the Senior Strategist Land Assets, Research & Development represents Powerlink on the State Interdepartmental Committee (SIDC) on Bushfires. MSPs are encouraged to participate in regional and local fire coordination meetings where it is efficient and effective to do so.

### 2.8.9 Communication

Powerlink only encourages low intensity burns to be performed on easements (i.e. <1m flame height). If fire intensities are higher, only the edges of the clearing area should be considered a suitable location to establish fire breaks and should not be considered a safe place to escape from fires or igniting back burning.

Easements are often identified as a logical place to conduct prescribed burns or to fight wildfires, due to the comparatively lower fuel loads and removal of the upper canopy. However, stakeholders need to be aware there are risks associated with fires near high voltage transmission lines, which Powerlink has summarised in a brochure:

Fire and high voltage transmission line safety

This information is publically available and communicated to stakeholders. It links and references the National Guidelines on Electrical Safety for Emergency Personnel.

## 2.9 Records & Reporting

A range of corporate systems are used to record and report on vegetation related activities and issues. These include:

- SAP for financial, asset condition and workflow;
- PQConnect for landholder issues and concerns;
- PQSwitch for incidents, near hits and hazards; and
- PQMaps for spatial representation and generation of EWPs.

## 2.10 Monitoring Performance

Accountabilities for monitoring performance will vary throughout the life of the assets. Overall performance with this specification will be monitored by the Maintenance Facilitator Easements with an annual report provided to the Senior Strategist Land Assets, Research & Development. Performance will consider the effective and efficient delivery of this specification. Feedback on process improvements should be directed to the Senior Strategist Land Assets, Research & Development.