FUEL BREAK GUIDELINES

Guidelines for the design of fuel breaks in the urban-rural interface
Disclaimer

While the State Fire Commission has made every effort to ensure the accuracy and reliability of the information contained in this booklet, the State Fire Commission does not accept any responsibility for the accuracy, completeness, or relevance to the reader’s purpose, of the information contained in this document and those reading it for whatever purpose are advised to verify its accuracy and to obtain appropriate professional advice.

The State Fire Commission, its officers, employees and agents do not accept any liability, however arising, including liability for negligence, for any loss or damage resulting from the use of, or reliance upon, the information contained in this document.
# Contents

1.0 Introduction .................................................................................................................. 4

2.0 The Urban-Rural Interface .......................................................................................... 5
   2.1 Urban-Rural Interface Type .................................................................................... 5
      2.1.1 Classic Interface (Type 1) .............................................................................. 5
      2.1.2 Mixed Interface (Type 2) .............................................................................. 6
   2.2 Urban-Rural Interface Protection .......................................................................... 6

3.0 Fuel Breaks ................................................................................................................... 8
   3.1 Definition .................................................................................................................. 8
   3.2 Functions .................................................................................................................. 8
   3.3 Fuel Break Classes ................................................................................................. 9
      3.3.1 Management Fuel Break (Class 1) ............................................................... 9
      3.3.2 Protective Fuel Break (Class 2) .................................................................. 10

4.0 Legal Framework Controlling Fuel Breaks ................................................................ 11

5.0 Fuel Break Design ....................................................................................................... 12
   5.1 Siting and Prioritisation ....................................................................................... 12
   5.2 Geometry ............................................................................................................... 15
   5.3 Connectivity .......................................................................................................... 16
   5.4 Bushfire Fuel Management .................................................................................. 18
      5.4.1 Bushfire Fuel ............................................................................................... 18
      5.4.2 Vegetation Types ....................................................................................... 19
      5.4.3 Measuring Fuel Load / Fuel Hazard ............................................................ 20
      5.4.4 Bushfire Fuel Management Methods .......................................................... 20
      5.4.5 Bushfire Fuel Management Standard ......................................................... 21

6.0 Fuel Break Design Tool ............................................................................................... 22
   6.1 Inputs ...................................................................................................................... 22
      6.1.1 Fuel Break Type ......................................................................................... 22
      6.1.2 Predominant Vegetation Type ..................................................................... 22
      6.1.3 Vegetation Community ............................................................................... 22
      6.1.4 Slope Class ................................................................................................. 23
      6.1.5 Effective Slope ............................................................................................ 24
      6.1.6 Maximum Fire Run ..................................................................................... 24
   6.2 Output .................................................................................................................... 24
      6.2.1 Design Specification ................................................................................... 24

Glossary .............................................................................................................................. 25

Appendix A ........................................................................................................................ 26
Fuel Break Design Tool Calculations ............................................................................... 26
1.0 Introduction

Bushfires are a regular occurrence within the Australian landscape that can result in significant loss of life, property, infrastructure, and environmental values. The urban-rural interface is where properties and people are most likely to be exposed to smoke, embers, radiant heat and direct flame. Consequently, risk to life and property is greatest in this zone, and losses most pronounced.

Absolute protection of life and property in the urban-rural interface can never be guaranteed; and it is ultimately the responsibility of the individual property owner for their own bushfire preparedness. However, sharing responsibility for bushfire risk management across individuals, communities, the private sector and governments can lead to much improved resilience outcomes. It is through a combination of household, community and landscape level risk management strategies, that bushfire risk can be most effectively managed.

Where bushfire fuel management is incorporated into a risk reduction strategy, the scale, intensity and type of fuel management will be a function of community risk profile, management objectives and feasibility of implementation.

The construction of fuel breaks in the urban-rural interface is a common risk management strategy used by both land managers and emergency management authorities. When appropriately designed, fuel breaks can provide an effective means to access the bushfire hazard for response and preparedness activities, as well as providing a level of protection to life and property.

In the past, guidelines for the formation of fuel breaks have provided principles for construction and rule-of-thumb design specifications relating to control-line breaching and fire control. These Guidelines seek to introduce a consistent and science-based approach to the design, construction and maintenance of fuel breaks in the urban-rural interface zone, where there is a life and property protection imperative. Consequently, fuel breaks designed in accordance with these Guidelines will have consistent design specification and clearly defined objectives.

These guidelines are designed to be used in conjunction with the *Tasmania Fire Service Fuel Break Design Tool*; an interactive tool that provides fire managers with a means to design fuel breaks that are tailored and adaptive to site conditions.

While the standards identified within these guidelines are considered to be best practice for the design and construction of fuel breaks, additional standards or other requirements may also apply. In addition, the construction of breaks and control lines for emergency response operations are outside the scope of these guidelines.

The fuel break specifications calculated by the design tool will not guarantee life or property protection in all bushfire scenarios, and therefore cannot be relied on as the only means for managing bushfire risk.
2.0 The Urban-Rural Interface

The urban-rural interface is defined as: the line, area, or zone where structures and other human development adjoin or overlap with undeveloped bushland.

This is where the degree of risk to life and property is most pronounced, and historically where the greatest losses have occurred.

2.1 Urban-Rural Interface Type

Tasmania Fire Service classifies the urban-rural interface into two distinct classes based on the pattern of development within this zone:

a) Classic Interface (Type 1); or
b) Mixed Interface (Type 2).

By broadly classifying the urban-rural interface in this way, fire managers are better equipped to design and implement preparedness and response operations that are most effective for the physical characteristics of the interface.

A map produced by Tasmania Fire Service of Bushfire Interface Areas can be viewed at www.theslist.tas.gov.au.

2.1.1 Classic Interface (Type 1)

Areas where structures adjoin bushland fuels (incorporating Occluded Interface). There is a clear delineation between the built & natural environments, and there are multiple dwellings in close proximity to one another. E.g. a typical residential neighbourhood backing onto a bushland environment (see figure 1).

Figure 1: Classic interface (Type 1).
2.1.2 Mixed Interface (Type 2)
Areas where structures are scattered within bushland fuels. The built & natural environments are blended, and dwellings are spaced further apart. E.g. a typical rural/rural-residential area with large lot sizes and long driveways (see figure 2).

![Image of Mixed Interface (Type 2)](image)

Figure 2: Mixed interface (Type 2).

2.2 Urban-Rural Interface Protection

Life and property protection in the urban-rural interface is best achieved through a combination of risk management strategies, including:

- Strategic land use planning;
- Building and development control;
- Household planning and preparedness;
- Emergency response planning and preparedness; and
- Property, community and landscape level bushfire fuel management.

However; not all risk treatments will be available, appropriate or applied in every circumstance. Therefore community protection strategies must be designed to account for these potential limitations.

When appropriately planned and implemented, bushfire fuel management can be an effective means to support other risk reduction strategies. However, the type, scale and location of bushfire fuel management should be informed by:

a) The relative bushfire risk profile of the interface (or community);

b) Local values and site specific factors;

c) Overall landscape management objectives; and

d) The feasibility of implementation and ongoing maintenance.

In some situations bushfire fuel management may be undertaken close to communities, and the type of treatment may be intensive. Whereas in other cases bushfire fuel management may include broader-scale and more remote strategies. Additionally, bushfire fuel management may not be necessary, or some types of works may not be suitable or practical in some areas. Hence, thorough analysis and planning is essential.

The importance of the urban landscape and the fuels within it cannot be overlooked. It is the location, type, quantity and ongoing maintenance of vegetation and other flammable materials in close proximity to buildings, which is fundamental to bushfire survival.
Hence, the responsibility of the land owner for fuel management around their buildings, within the hazard management area, underpins the value of any additional community or landscape level bushfire fuel management.

Bushfire fuel management that contributes to the protection of the urban-rural interface can be summarised by a zoning approach (see figure 3):

**Hazard Management Area**

The area between a building and the bushfire-prone vegetation, which provides access to a fire front for firefighting, which is maintained in a minimal fuel condition and in which there are no other hazards present which will significantly contribute to the spread of a bushfire. Management of this area is ordinarily the responsibility of property owners.

**Asset Protection Zone**

Includes the Hazard Management Area, and involves intensive bushfire fuel treatment around specific assets and interface zones to provide a fuel reduced buffer. This zone may encompass multiple land tenures and include a range of fuel treatments and strategies, including fuel breaks.

**Strategic Fuel Management Zone**

Here the aim is to provide areas of reduced fuel in strategic locations, to reduce the speed and intensity of bushfires and reduce the potential for spot-fire development. Often this zone is located some distance from the urban-rural interface, and may include broad-scale fuel treatment.

**Land Management Zone**

Here the primary purpose is to meet the objectives of the relevant land manager such as; farming, recreation, conservation or forestry.

*Figure 3*: Combined fuel management strategy for the urban-rural interface.
3.0 Fuel Breaks

3.1 Definition

A fuel break is a natural or man-made change in fuel characteristics which affects fire behaviour so that fires burning into them can be more readily controlled.

In the urban-rural interface, a fuel break is an area or strip of land where bushfire fuel continuity has been substantially altered through the strategic removal or modification of vegetation.

Note:
- Fire trails and other access have their own design and construction criteria. Refer to *Tasmania Fire Service – Fire Trail Standards*.
- Firebreaks are a specific type of fuel break, and are characterised by having all vegetation removed down to bare mineral earth.
- Fuel breaks do not include areas subject to broad area planned burning for fuel reduction.

3.2 Functions

Fuel breaks aim to provide the following:

a) **Access**
   
   Provide access to the bushfire hazard to permit preparedness activities to be undertaken, such as:
   - Bushfire hazard monitoring;
   - Planned burning; and
   - Other bushfire fuel treatments including mechanical removal and modification.

b) **Protection**
   
   Provide a degree of separation between the built assets and bushfire hazard to improve building defendability, by reducing:
   - Radiant heat load on the building; and
   - Ember attack from short range spotting.

c) **Advantage**
   
   Provide tactical advantage for emergency response operations, such as:
   - Back-burning; and
   - Direct attack.
3.3 Fuel Break Classes

Fuel breaks for the urban-rural interface are differentiated into Management Fuel Breaks (Class 1) and Protective Fuel Breaks (Class 2) based on the functional objective of the fuel break and the degree of reliance on the fuel break for property protection.

3.3.1 Management Fuel Break (Class 1)

A management fuel break is intended to compliment other relatively broader-scale fuel management treatments within proximity to the urban-rural interface (see figure 4). Therefore a management fuel break alone is unlikely to provide sufficient protection to life and property during bushfires.

![Figure 4: Management fuel break (Class 1).](image)

**Objectives:**

The objectives of a management fuel break are to:

a) Provide access to the bushfire hazard to permit the implementation of fuel management works such as planned burning or mechanical thinning;

b) Provide separation from the bushfire hazard to improve firefighter safety when undertaking burning operations;

c) Provide separation between buildings and the bushfire hazard to reduce the level of bushfire attack on buildings or other assets when undertaking burning operations; and

d) Provide access to the bushfire hazard during emergency response to enable firefighting operations such as back-burning and fire suppression.

**Performance Criteria:**

The following are the performance criteria for a management fuel break:

a) When fire weather conditions are conducive to undertaking safe planned burning or emergency back-burning operations; the radiant heat emitted from the main fire front and impacting on a building surface will be less than 12.5 kilowatts per square metre (kW/m²);

b) Access is provided to the bushfire hazard, of a suitable standard to enable prescribed fuel management treatments to be effectively undertaken;

c) Access is provided to the bushfire hazard, of a suitable standard to enable emergency response operations to be undertaken; and

d) Suitable access is provided so that fuel break maintenance can be undertaken.
3.3.2 Protective Fuel Break (Class 2)

A protective fuel break provides protection to life and property on the urban-rural interface in situations where it is unfeasible or undesirable to implement broader-scale fuel management works within proximity to the interface (see figure 5).

Hence, the minimum dimensions of a protective fuel break will be much greater than those of a management fuel break.

**Figure 5**: Protective fuel break (Class 2).

**Objectives**:  
The objectives of a protective fuel break are to:

a) Provide separation between buildings and the bushfire hazard to reduce the level of bushfire attack on buildings or other assets;

b) Provide separation from the bushfire hazard to improve firefighter safety when undertaking firefighting operations; and

c) Provide access to the bushfire hazard during emergency response to enable firefighting operations such as back-burning and fire suppression.

**Performance Criteria**:  
The following are the performance criteria for a protective fuel break:

a) When a bushfire is burning in conditions up to a Fire Danger Index of 50 (Severe Fire Danger Rating), the radiant heat emitted from the main fire front and impacting on a building surface will be less than 12.5 kilowatts per square metre (kW/m$^2$);

b) Access is provided to the bushfire hazard, of a suitable standard to enable emergency response operations to be undertaken; and

c) Suitable access is provided so that fuel break maintenance can be undertaken.
4.0 Legal Framework Controlling Fuel Breaks

The following legislative and regulatory provisions apply to the construction of fuel breaks:

**Emergency Management Act 2006:**
The Act has precedence for all emergency risk mitigation, allowing for mitigation actions to be undertaken in relation to any hazard in an emergency management context.

**Fire Service Act 1979:**
The Act allows for the treatment of fire hazards that constitute a fire danger, and for the formation of firebreaks.

**Land Use Planning & Approvals Act 1993:**
The cutting, removal, clearing and disturbance of vegetation is considered to be works under the Act. Therefore planning approval may be required before works are undertaken, and the permit authority should be consulted early in the planning process. (Note: this Act does not apply to the formation of fuel breaks during emergency operations).

**Other Legislation:**
Other acts, regulations or policies may apply in specific situations. Where applicable, the relevant regulatory or management authority should be consulted prior to works commencing.

Applicable legislation may include:

- Threatened Species Protection Act 1995;
- Nature Conservation Act 2002;
- Environmental Protection and Biodiversity Conservation Act 1999;
- Aboriginal Relics Act 1975; and

Those involved in the construction of fuel breaks will also need to be aware of other general legal responsibilities, such as those relating to workplace health and safety, trespass, and regulations regarding the use of vehicles and equipment.

Image 4: Fuel break in the urban-rural interface.
5.0 Fuel Break Design

Fuel break design should comply with the following:

5.1 Siting and Prioritisation

The following factors should be considered when determining the location and priority for a fuel break.

a) Interface Type

Fuel breaks are most suited to classic interfaces (Type 1) and individual assets.

b) Fire Path

The most likely path(s) of extreme fire should be determined, and the establishment of fuel breaks prioritised for those directions most exposed to the fire scenario.

c) Fire Run

Once the most likely path(s) of extreme fire is identified, the maximum potential fire run must be determined; that is, the distance that a head-fire could potentially move, unimpeded, through the landscape, along a consistent bearing.

In a small remnant bushland reserve, for example, this could be the distance between two parallel urban-rural interfaces, and may only be several hundred metres (see figure 6). In other situations, the potential fire run may extend for many kilometres into the greater landscape.

Fuel breaks can be prioritised for those interfaces exposed to long potential fire run distances, given the potential scale of fire impact on these interfaces.

Figure 6: Potential fire run.
d) Location Relative to Interface

The efficacy of a fuel break is relative to its proximity to the urban-rural interface. Therefore:

i. Fuel breaks should be located as close as possible to hazard management areas (or buildings);
ii. In some cases, a fuel break may serve as a hazard management area; and
iii. Bushfire fuel situated between a fuel break and a hazard management area (or building) should be subject to a fuel management regime of no lesser standard than that of the fuel break.

e) Bushfire Fuel Management

Urban-rural interfaces where bushfire fuel management is not planned, or is unfeasible, should be prioritised for protective (Class 2) fuel break construction. However, the value of a fuel break is limited if hazard management areas for buildings and assets are not in place. Therefore hazard management areas should be established prior to the implementation of a fuel break.

f) Existing Breaks

Where practical, fuel breaks should incorporate existing features that provide a break in fuel continuity. For example; roadways, trails, disturbed vegetation, sports fields, areas of rock and scree.

g) Gradient and Contour

The gradient of the land on which a fuel break is constructed will influence the cross-fall and gradient (slope angle) of any proposed trafficable surface within the fuel break. Therefore fuel break placement should consider both the requirement for connectivity, and the construction standard desired for trafficable surfaces.

h) Environment

Where practical, fuel breaks should be located where they will have the least amount of impact on the natural environment.

However, it must be recognised that the establishment of fuel breaks will often result in localised impact to environmental values.

An environmental impact assessment should be undertaken as part of the planning and approvals process, so that environmental impacts are recorded, quantified, evaluated, and if necessary offset.

Environmental considerations may include:

i. Rare and threatened flora species;
ii. Rare and threatened fauna species;
iii. Conservation significant fauna habitat;
iv. Conservation significant vegetation communities;
v. Land stability, erosion and landslip risk;
vi. Water catchment, waterway and aquatic environment sedimentation;
vii. Weed and pathogen management; and
viii. Geoconservation.
i) Cultural Heritage

Cultural heritage includes both:

i. Aboriginal heritage; and
ii. Historic heritage.

Fuel breaks should not be located where they will impact any features of cultural heritage significance.

The relevant cultural heritage authority should be consulted as part of the planning and approvals process.

j) Community Consideration & Engagement

Public opinion must be considered in any fuel break planning, and where practical, fuel break location and design be adapted to meet community expectations.

Social licence may be achieved through affording the community the opportunity to participate in the planning and decision making process regarding fuel breaks within their community.

There are likely to be both opponents and proponents, within and external to the affected community, for the development of fuel breaks. Issues that may arise, include:

i. Aesthetic impacts (e.g. impact to local, landscape and scenic character);
ii. Environmental impacts (e.g. ecosystem, habitat and species impact);
iii. Misuse, security and privacy (e.g. trailbikes, 4WD vehicles, rubbish dumping, access to properties, and crime);
iv. Community protection (e.g. individual, asset and community bushfire safety);
v. Health concerns (e.g. smoke and noise);
vi. Economic impact (e.g. loss of property value and damage to property);
vii. Community and individual’s role or responsibility for fuel break management; and
viii. Community trust and support for government agencies and land managers.

Tasmania Fire Service recommends adoption of the International Association for Public Participation (IAP2) Core Values for the Practice of Public Participation when undertaking community engagement.
5.2 Geometry

Fuel break geometry is an important factor when evaluating the suitability and practicability of implementing a fuel break. The following factors should be considered in fuel break design:

a) Width

The appropriate width of a fuel break is determined through an evaluation of bushfire fuel type, effective slope under the bushfire fuel, and the maximum potential fire run distance.

The design specification for fuel break width can be determined using the *Tasmania Fire Service Fuel Break Design Tool* (see Section 5).

A management (Class 1) fuel break will be significantly narrower than a protective (Class 2) fuel break, given the association of a management fuel break with other complimentary fuel management works.

The width of a fuel break may be measured between the nearest face of a building and the bushfire hazard, and may include portions of hazard management area (see figure 7).

The minimum fuel break width on the bushfire hazard side of a property boundary should allow for connectivity, and should reflect the *Tasmania Fire Service Fire Trail Standard*, which is a 4 metre carriageway width with 2 metres clearance either side.

![Figure 7: Fuel break width – measured between building and bushfire hazard.](image)

b) Length

The length of a fuel break will largely be guided by the extent of interface to be protected, and the influence of the various fuel break siting and prioritisation considerations including connectivity.

c) Horizontal Alignment

Where terrain constraints permit, fuel breaks should be constructed as straight as possible so as to provide good sight lines and a consistent edge from which to work from.
5.3 Connectivity

Connectivity refers to the ability for firefighters and equipment to access and traverse a fuel break; and may be related to a construction standard to permit either foot or vehicular access. The following factors must be considered in fuel break design:

a) Access Points

A critical requirement for all fuel breaks is the provision of access to allow for construction, maintenance, bushfire hazard monitoring, bushfire fuel management, and emergency response operations. The following criteria apply to the provision of access points:

i. A minimum of 1 access point must be provided per fuel break;
ii. Fuel break access points must be constructed to a standard no less than that of the carriageway constructed within the fuel break;
iii. Access points should be provided every 400 metres of continuous fuel break;
iv. Access points should provide connection between the fuel break and the asset zone (or urban area);
v. Access points should prevent any unauthorised access to the fuel break, using devices such as gates, bollards or permanent obstacles; and
vi. Keys for gates and bollards must be provided to Tasmania Fire Service.

b) Vehicular Construction Standard

Wherever practical, fuel breaks should provide vehicular access. The following criteria apply:

i. The carriageway in a protective (Class 2) fuel break should be located on the property side of the interface. That is; the trail should be sited as far away from the bushfire hazard as is practical (see figure 8). This affords firefighters the greatest degree of protection from radiant heat possible, if accessing the fuel break during response operations.

Figure 8: Fire trail placement within a protective (Class 2) fuel break.
In a management (Class 1) fuel break, the trafficable surface may be better located adjacent to the bushfire hazard to permit better access for fuel management works (see figure 9).

![Figure 9: Fire trail placement within a management (Class 1) fuel break.](image)

ii. Trail construction must conform with the following General Trail Construction Principles:

**Erosion Control:**
- Minimise soil disturbance;
- Incorporate appropriate erosion control measures, such as catch drains or water bars, with consideration to soil erodibility class and gradient;
- Maintain formed natural drainage lines;
- Incorporate runoff tracks;
- Avoid stream flow interference; and
- Avoid potential landslip zones.

**Trafficability:**
- Constructed as straight as practicable;
- Minimise cross fall;
- Minimise gradient;
- Sufficiently clear of vegetation above and on either side;
- Ensure gentle curves;
- Provide passing bays;
- Avoid no-through roads; and
- Provide turnaround points.

iii. Where feasible, vehicular trails should be constructed in accordance with the *Tasmania Fire Service Fire Trail Construction Standard:*

- All-weather, 4-wheel drive construction;
- Load capacity of at least 20 tonnes, including for bridges and culverts;
- Minimum carriageway width of 4 metres;
- Minimum vertical clearance of 4 metres;
- Minimum horizontal clearance of 2 metres from the edge of the carriageway;
• Cross falls of less than 3 degrees (1:20 or 5%);
• Dips less than 7 degrees (1:8 or 12.5%) entry and exit angle;
• Curves with a minimum inner radius of 10 metres;
• Maximum gradient of 15 degrees (1:3.5 or 28%) for sealed fire trails, and 10 degrees (1:5.5 or 18%) for unsealed fire trails;
• Gates if installed at fire trail entry, have a minimum width of 3.6 metres, and if locked, keys are provided to TFS;
• Passing bays of 2 metres additional carriageway width and 20 metres length provided every 200 metres; and
• Terminate with a turning area for fire appliances provided by one of the following:
  - A turning circle with a minimum radius of 10 metres; or
  - A hammerhead “T” or “Y” turning head 4 metres wide and 8 metres long;

5.4 Bushfire Fuel Management

5.4.1 Bushfire Fuel
Bushfire fuel is defined as any plant material such as grass, leaf litter and live vegetation which can be ignited and sustains a fire. It is usually measured in tonnes per hectare (t/ha), or classified by hazard score.

Bushfire fuel can be further classified as:

- **Fine fuel**: such as grass, leaves, bark and twigs less than 6mm in diameter that ignite readily and are burnt rapidly when dry; and
- **Heavy fuel (Coarse fuel)**: dead woody material, greater than 25mm in diameter, in contact with the soil surface (fallen trees and branches).

It is the availability, arrangement, size, quantity and moisture content of the fine fuel that plays a key role in determining the rate of spread and intensity of a bushfire.

The arrangement of bushfire fuel in the vertical plane can be categorised into separate strata based on its position in the vegetation profile together with bark fuels (see figure 10):

- **Canopy Fuel**: The crowns (leaves and fine twigs) of the tallest layer of trees in a forest or woodland.
- **Bark Fuel**: The flammable bark on tree trunks and upper branches.
- **Elevated Fuel**: Shrubs and juvenile understorey plants up to 2-3m height.
- **Near-Surface Fuel**: Grasses, low shrubs and heath, sometimes containing suspended components of leaves, bark and twigs.
- **Surface Fuel**: Leaf, twigs and bark on the ground. Includes the partly decomposed fuel (duff) on the soil surface.
5.4.2 Vegetation Types

Bushfire fuel characteristics such as quantity, flammability, size and arrangement are largely driven by the structural and floristic characteristics of a vegetation community. Hence, vegetation type plays a significant role in determining fire behaviour, and resultant fuel break widths.

Vegetation type has been categorised into the following broad classes based on dominant bushfire fuel characteristics:

- Dry Eucalypt Forest & Woodland
- Grassland, Fernland & Weed
- Highland Treeless Vegetation
- Moorland, Sedgeland, Rushland & Peatland
- Non-eucalypt Forest & Woodland
- Rainforest & Related Scrub
- Scrub, Heathland & Coastal Complexes
- Wet Eucalypt Forest & Woodland

The bushfire fuel characteristics associated with these vegetation classes are further differentiated by vegetation community type, as defined by the Tasmanian Vegetation Mapping Program which can be accessed at: http://dpipwe.tas.gov.au/conservation/flora-of-tasmania.

The Tasmanian Vegetation Map “TasVeg” can be accessed here: www.thelist.tas.gov.au
5.4.3 Measuring Fuel Load / Fuel Hazard

The quantity of bushfire fuel within an area can be expressed in tonnes per hectare (t/ha), or by hazard score (hazard rating); and there are several field-based methods and tools available for estimating bushfire fuel hazards.

Tasmania Fire Service has adopted and recommends the *Victorian Overall Fuel Hazard Guide* for general bushfire fuel hazard assessments.

Bushfire fuel hazard assessment may be used to identify current fuel state, thereby informing fire management regimes and works schedules. However, localised fuel assessment should not be relied on for estimating quasi-state fuel load or hazard score without supporting research, documentation and advice from Tasmania Fire Service.

Tasmania Fire Service has defined bushfire fuel characteristics for all vegetation communities described by the *Tasmanian Vegetation Mapping Program*; which are referenced by the *Tasmania Fire Service Fuel break Design Tool*.

5.4.4 Bushfire Fuel Management Methods

Vegetation modification and removal may present a significant undertaking in fuel break establishment. The choice of initial method should also consider future maintenance costs and feasibility. A low maintenance regime is more likely to be sustainable in the long term.

Methods used to remove and manage fuels include:

- **Manual removal**: using hand tools such as saws, rakes, hoes and shovels;
- **Mowing**: using mowing equipment to maintain grassed and lawn areas which have been suitably prepared;
- **Slashing or Trittering**: using mechanical equipment to chip and slash down fuels, more suited to uneven ground;
- **Managed Grazing**: using grazing and browsing animals to maintain grassed and low shrub areas, generally requiring fencing to maintain sufficient grazing pressure;
- **Ploughing and Grading**: using ploughs or graders to construct a mineral earth break (note: the potential for erosion and weed invasion, particularly in steep areas, is significant using this method);
- **Planned Burning**: using relatively high frequency prescribed fire to remove fine fuels before they build up; and
- **Herbicide**: using chemical products to kill live fuels (note: this method is only effective if applied at the appropriate time and requires a planned approach).
5.4.5 Bushfire Fuel Management Standard

For a fuel break to be effective for its intended purpose, the quantity of fine fuels throughout the vegetation profile must be significantly and uniformly reduced.

The following is the fuel management standard for a fuel break:

- a) Overall fuel load (measured from the surface, near surface, bark and elevated strata) within a fuel break must be reduced and maintained below a maximum overall fuel load of 2 t/ha, or overall fuel hazard rating = Low;
- b) Fine fuels in the surface, near surface and elevated strata must be significantly reduced;
- c) Bushfire fuels are permitted to re-accumulate between fire danger periods, but must be managed below the fuel management threshold at the beginning and during the fire danger period (e.g. for slashing or trittering to be effective, the cut material must be removed or allowed to decompose before the fire danger period); and
- d) Where fuel breaks exceed 8 metres in width, it is permissible to establish a ‘shaded’ fuel break for the remaining width extending towards the bushfire hazard. E.g. a fuel break with a prescribed width of 25 metres may be comprised of 8 metre completely cleared fuel break, and a 17 metre shaded fuel break (see figure 11).

5.4.5.1 Shaded Fuel break

A shaded fuel break is established using the same fuel management prescriptions as a conventional fuel break, with the exception that some canopy trees are retained.

The following standards apply to shaded fuel breaks:

- a) Trees selected to be retained should be representative of the dominant and co-dominant species for the vegetation community, and must be evaluated in regard to health and senescence;
- b) Trees that are suppressed, diseased, or damaged should be prioritised for removal unless retained for habitat reasons such as nest hollows or seeding;
- c) A minimum separation of 3 metres is recommended between tree crowns;
- d) Where practical, retain trees in clumps;
- e) Retain 30% maximum canopy coverage; and
- f) Lop tree branches ≤ 2 metres above the ground (unless a sapling to be retained).

Figure 11: Shaded fuel break.
6.0 Fuel Break Design Tool

The following provides guidance for the Tasmania Fire Service Fuel break Design Tool.

The Fuel break design tool can be accessed from: www.fire.tas.gov.au

For support using the tool, please contact Tasmania Fire Service.

6.1 Inputs

6.1.1 Fuel Break Type

Refer to Section 3 for a definition of management (Class 1) and protective (Class 2) fuel breaks.

The user must select the fuel break type, informed by the broader bushfire hazard management strategy identified within a bushfire mitigation plan (or fire management plan).

A management fuel break should be selected where a bushfire fuel management regime is planned directly adjacent to the fuel break, and where fuel management will extend for a distance greater than 100 metres from the edge of the fuel break.

A protective fuel break should be selected where there is no, or limited, planned bushfire fuel management beyond the fuel break.

6.1.2 Predominant Vegetation Type

The user must select the predominant vegetation type; determined by evaluating the vegetation for a distance extending at least 150 metres perpendicular to the interface.

The vegetation at multiple points along the interface will need to be evaluated in response to changes in vegetation type.

The vegetation type which will be the most significant driver of the expected fire behaviour must be selected.

Select vegetation type from the following options:

- Dry eucalypt forest and woodland
- Grassland fernland and weed
- Highland treeless vegetation
- Moorland sedgeland rushland and peatland
- Non eucalypt forest and woodland
- Rainforest and related scrub
- Scrub heathland and coastal complexes
- Wet eucalypt forest and woodland

6.1.3 Vegetation Community

The user must select the vegetation community from the available options listed in the dropdown list.

The vegetation communities listed are mostly based on Tasmanian Vegetation Monitoring and Mapping Program (TVMMP) vegetation mapping units. The TasVeg state-wide vegetation map can be accessed from ListMap: www.thelist.tas.gov.au.
Where the vegetation community is forest or woodland that is subject to a planned bushfire fuel management regime, the user may select from the following fuel managed vegetation communities:

- **Fuel managed dry eucalypt forest and woodland (Fuel Hazard Rating = Low)**
- **Fuel managed dry eucalypt forest and woodland (Fuel Hazard Rating = Moderate)**
- **Fuel managed wet eucalypt forest and woodland (Fuel Hazard Rating = Moderate)**
- **Fuel managed wet eucalypt forest and woodland (Fuel Hazard Rating = Low)**

These fuel managed vegetation options may apply to management (Class 1) fuel breaks in dry or wet forest environments. However, an ongoing fuel management regime that corresponds with the prescribed fuel hazard rating of the vegetation class must be assured.

### 6.1.4 Slope Class

The type of slope under the classified vegetation in relation to the interface must be determined (see figure 12).

The slope must be evaluated under the vegetation assessed above, over a distance greater than 150 metres.

**Downslope**
Where the classified vegetation is downhill from the edge of the interface.

**Upslope**
Where the classified vegetation is uphill from the edge of the interface.

**Flat**
Where the classified vegetation is neutral from the edge of the classified vegetation.

![Figure 12: Slope classes.](image)
6.1.5 Effective Slope
Effective slope is defined as the slope under the classified vegetation which most influences the bushfire attack.

Where the slope class under the classified vegetation is downslope, the gradient of the land under the classified vegetation must be determined.

The gradient should be measured over a distance greater than 150 metres.

The user must input the slope value in degrees, between 1 and 30 (see Table 1).

6.1.6 Maximum Fire Run
The maximum potential fire run distance calculation is relevant to those interfaces that adjoin small, or linear remnant pockets of vegetation. These remnant pockets may be fully enclosed by urban-rural interface (sometimes referred to as Occluded Interface), or may present as linear fingers that extend into developed areas.

The user must choose if the maximum potential fire run distance is equal to, or greater than 300 metres; or less than 300 metres.

The maximum potential fire run can be calculated by measuring the actual distance along a single bearing between the edge of the interface and the point at which there is a significant break in bushfire fuel continuity. The break needs to be of sufficient dimensions, both length and width, to prevent a fire front from breaching the break via direct flame contact, radiation, or short range spotting. This is largely dependent on the bushfire fuel type, but in general terms is usually 10 to 30 metres in width.

When in doubt; select the default ≥ 300 metres option, or seek professional advice from Tasmania Fire Service.

6.2 Output
The user must select the ‘calculate’ button to initiate the calculations to derive the fuel break width specification.

6.2.1 Design Specification
The output is the minimum fuel break width in metres.

<table>
<thead>
<tr>
<th>Degrees</th>
<th>Ratio</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>1:1</td>
<td>100</td>
</tr>
<tr>
<td>34</td>
<td>1:1.5</td>
<td>66</td>
</tr>
<tr>
<td>26</td>
<td>1:2</td>
<td>50</td>
</tr>
<tr>
<td>21</td>
<td>1:2.5</td>
<td>40</td>
</tr>
<tr>
<td>18</td>
<td>1:3</td>
<td>33</td>
</tr>
<tr>
<td>15</td>
<td>1:3.5</td>
<td>28</td>
</tr>
<tr>
<td>14</td>
<td>1:4</td>
<td>25</td>
</tr>
<tr>
<td>12</td>
<td>1:4.5</td>
<td>22</td>
</tr>
<tr>
<td>11</td>
<td>1:5</td>
<td>20</td>
</tr>
<tr>
<td>10</td>
<td>1:5.5</td>
<td>18</td>
</tr>
<tr>
<td>9</td>
<td>1:6</td>
<td>16</td>
</tr>
<tr>
<td>9</td>
<td>1:6.5</td>
<td>15</td>
</tr>
<tr>
<td>8</td>
<td>1:7</td>
<td>14</td>
</tr>
<tr>
<td>8</td>
<td>1:7.5</td>
<td>13</td>
</tr>
<tr>
<td>7</td>
<td>1:8</td>
<td>12</td>
</tr>
<tr>
<td>7</td>
<td>1:8.5</td>
<td>11</td>
</tr>
<tr>
<td>6</td>
<td>1:9</td>
<td>11</td>
</tr>
<tr>
<td>6</td>
<td>1:10</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>1:11</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>1:12</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>1:13</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>1:14</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>1:15</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>1:16</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>1:17</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>1:18</td>
<td>5.5</td>
</tr>
<tr>
<td>3</td>
<td>1:19</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>1:20</td>
<td>5</td>
</tr>
</tbody>
</table>
Glossary

Asset Protection Zone: Includes the Hazard Management Area, and involves intensive bushfire fuel treatment around specific assets and interface zones to provide a fuel reduced buffer.

Back Burn: A fire started intentionally along the inner edge of a fireline during indirect attack operations to consume fuel in the path of a bushfire.

Bushfire Attack: Attack by burning embers, radiant heat or flame generated by a bushfire, which might result in ignition and subsequent damage to or destruction of a building.

Bushfire Fuel: Any plant material such as grass, leaf litter and live vegetation which can be ignited and sustains a fire; usually measured in tonnes per hectare (t/ha), or classified by hazard score.

Bushfire Mitigation Plan: A plan that provides guidance for the planning and management of potential bushfire threat in specified areas.

Direct Attack: A method of fire attack where wet or dry firefighting techniques are used. It involves suppression action right on the fire edge which then becomes the fireline.

Effective Slope: The slope under that classified vegetation which most influences the bushfire attack.

Ember Attack: Attack by smouldering or flaming windborne debris that is capable of entering or accumulating around a building, and that may ignite the building or other combustible materials and debris.

Hazard Management Area: The area between a building and the bushfire-prone vegetation, which provides access to a fire front for firefighting, which is maintained in a minimal fuel condition and in which there are no other hazards present which will significantly contribute to the spread of a bushfire.

Landuse Management Zone: Here the primary purpose is to meet the objectives of the relevant land manager such as; farming, recreation, conservation or forestry

Planned Burning (Prescribed Burning): The controlled application of fire under specified environmental conditions to a predetermined area and at the time, intensity, and rate of spread required to attain planned resource management objectives.

Strategic Fuel Management Zone: Here the aim is to provide areas of reduced fuel in strategic locations, to reduce the speed and intensity of bushfires and reduce the potential for spot-fire development.

Urban-Rural Interface: The line, area, or zone where structures and other human development adjoin or overlap with undeveloped bushland.
Appendix A

Fuel Break Design Tool Calculations

The calculation of radiant heat flux in kW/m$^2$ is based on the methodology for determining bushfire attack level (BAL) as described in Australian Standard AS3959-2009 *Construction of buildings in bushfire-prone areas*.

Refer to Appendix B of AS3959 for procedure and equations applicable for the calculation of radiant heat flux.

The following are constants for the purpose of fuel break width calculation:

- Heat of combustion ($H$) = 18 600 kJ/kg
- Flame temperature ($T_f$) = 1100 K
- Atmospheric transmissivity ($\tau$) = 1
- Flame emissivity ($\epsilon$) = 0.95
- Elevation of receiver ($h$) = 2 m
- Radiant heat flux threshold ($q$) = 12.5 kW/m$^2$
- Moisture factor ($M_f$) = 5
- Age of vegetation (age) = 20 yrs
- McArthur Fire Danger Index (fuel break class 1) (FDI) = 24
- Grassland Fire Danger Index (fuel break class 1) (GFDI) = 24
- Average wind speed at 10 m above ground (fuel break class 1) ($V$) = 26 km/h
- Ambient temperature (fuel break class 1) ($T_a$) = 305 K
- McArthur Fire Danger Index (fuel break class 2) (FDI) = 50
- Grassland Fire Danger Index (fuel break class 2) (GFDI) = 70
- Average wind speed at 10 m above ground (fuel break class 2) ($V$) = 45 km/h
- Ambient temperature (fuel break class 2) ($T_a$) = 308 K