



A Guide to Constructing and Maintaining Fire-breaks



Government of Western Australia
Department of Fire & Emergency Services
Rural Fire Division



Introduction

This guide provides land managers with advice on constructing and maintaining fire-breaks on the rural-urban interface, farms, pastoral leases and reserves.

What is a fire-break?

A fire-break is a strip of land that has been cleared of all trees, shrubs, grass and other combustible material, providing a 'fuel free' area.

Fire-breaks are intended to allow access for firefighting vehicles and can provide a fuel free area from which prescribed burning can be undertaken. They may slow or stop the spread of a low-intensity bushfire however they should not be relied upon to prevent the spread of a fire.

Fire-breaks are often constructed with a machine such as a dozer, front end loader, grader, tractor or skid-steer loader.

In some situations, a suitable fuel-free area may be created by other methods such as hand tools, ploughing, herbicide treatment, grazing stock and controlled fire.

The effectiveness of fire-breaks

The effectiveness of a fire-break depends on the width of the fire-break, the weather conditions, flame length and whether embers are being produced. A fire-break will be more effective at preventing the spread of a fire if:

- It is close to the fire ignition point so that the fire is not at its maximum flame length.

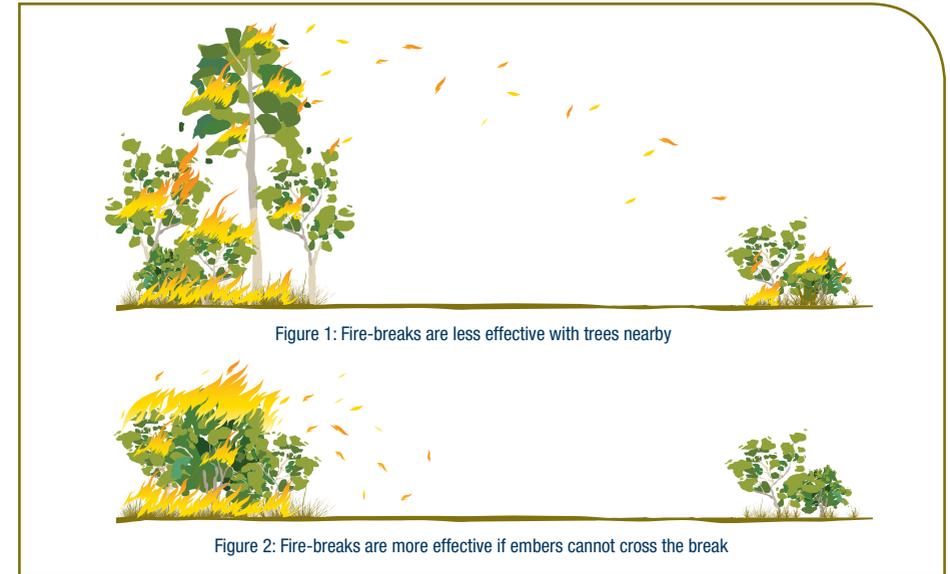
- It is approached by the flank (side) of the fire, as the flank will have a shorter flame length than the front (head) of the fire.
- It forms an effective break in both the vertical and horizontal continuity of the fuel, which reduces the flame length and makes the fire easier to suppress.
- Nearby trees and shrubs are not producing embers.
- It provides safe and efficient access for firefighting resources.

Fuse-breaks

In the situation where fires may spread along uninterrupted linear stretches of vegetation, which may act as a fire 'fuse' or 'wick' across the landscape, fuse-breaks may assist with containing the spread of a fire. Examples of a fire fuse in the landscape include vegetated roadside reserves, foreshore reserves, drainage channels and other vegetated linear reserves.

The guidance for the construction, maintenance, and width of fuse-breaks is the same as for the fire-breaks which run parallel to property boundaries. Fuse-breaks may also be used to provide access for emergency services; driveways, fire service access routes or other roads may effectively act as fuse-breaks across these linear stretches of fuel.

Front Image: A burned break being created alongside a graded break. Photo G. Daniels.



The requirement for fire-breaks

The local government may issue fire-break notices at any time, under the *Bush Fires Act 1954* (BF Act), that require landowners or occupiers of land to install and maintain fire-breaks around their property boundaries to help prevent the outbreak or spread of a bushfire. In some cases fire-break notices are in place throughout the year, in others they are only issued prior to the start of the summer bushfire season. The benefit to having fire-breaks in place throughout the year is that they support fuel management activities such as planned burning during the autumn, winter and spring seasons.

Each local government determines their own minimum fire-break standards and how these standards apply to various property sizes.

Landowners or occupiers of land may be issued a fire-break notice in writing. The notice may also be published in the Government Gazette, local newspaper or the local government website.

The requirements within a fire-break notice may vary for different sized lots and may include other requirements for reducing bushfire risk such as the inclusion of an Asset Protection Zone. It will often specify the dates of the restricted and prohibited fire periods and the process for obtaining a permit to conduct a hazard-reduction burn.

Any variation to a fire-break notice must be approved in writing by the relevant local government. A variation may be sought if the required fire-break would be impractical, ineffective or environmentally unsound, and an effective alternative can be identified. Instructions on applying for a variation to a fire-break notice may be found on the relevant fire-break notice or the local government website.

Fire-break siting and design

Fire-break design can vary depending on the location and purpose of the break.

Some fire-breaks carry vehicular traffic and will need to be constructed to a standard similar to a public road or driveway. In these cases, construction standards and advice may be obtained from the local government or the Australian Road Research Board.

In most cases, a graded, scraped or ploughed fire-break is sufficient. In some instances, however, hand tools, grazing, herbicides or controlled fire may replace the use of machinery. The following information primarily pertains to machine-constructed breaks.

Siting of fire-breaks

Fire-breaks are usually required by local government to be on the perimeter of a property. Any request to vary the location or extent of a fire-break must be approved in writing from the relevant local government. Where a landholder has flexibility in the positioning of a fire-break, the following principles should be considered.

- **Landscape position:** on sloping or undulating terrain, fire-breaks should be placed low in the landscape. This will result in a fire reaching the break while travelling downslope, making it slower, less intense and therefore less likely to cross the break. This is also a safer location for firefighters to approach a fire.

- **Slope:** on sloping ground, fire-breaks should be constructed across the slope to follow the contour. This will slow the flow of water along the break and reduce the incidence of erosion. If it is necessary to install a break down a slope, additional measures may be required to reduce water erosion.
- **Waterways and wetlands:** where possible, avoid fire-breaks that cross water ways and their foreshore areas or wetlands and their buffers. Water crossings are susceptible to erosion, waterlogged soils can become un-trafficable, and increase the likelihood of vehicles transporting weeds and soil-borne diseases. These areas also tend to consist of vegetation types with high fuel loads, which make fire-breaks less effective.
- **Fuel:** fire-breaks are most effective at slowing the rate of spread of a fire in vegetation types that do not generate embers. Fire-breaks are more effective and easier to install in light fuels such as grass, rather than scrub, woodland or forest, however it is not always possible to choose the location of a fire-break.
- **Soil type:** the structure and texture of soil will affect how prone a fire-break will be to erosion. Where possible, fire-breaks should not be constructed on fragile soils. Soils with a high proportion of organic material should also be avoided owing to their environmental significance, potential for waterlogging and the possibility that they will ignite during a fire.

Fire-break design

To be effective, the required width for a fire-break depends on its purpose and the nature of the surrounding fuels. Where a fire-break is required by a local government, their fire-break notice, will stipulate the required width.

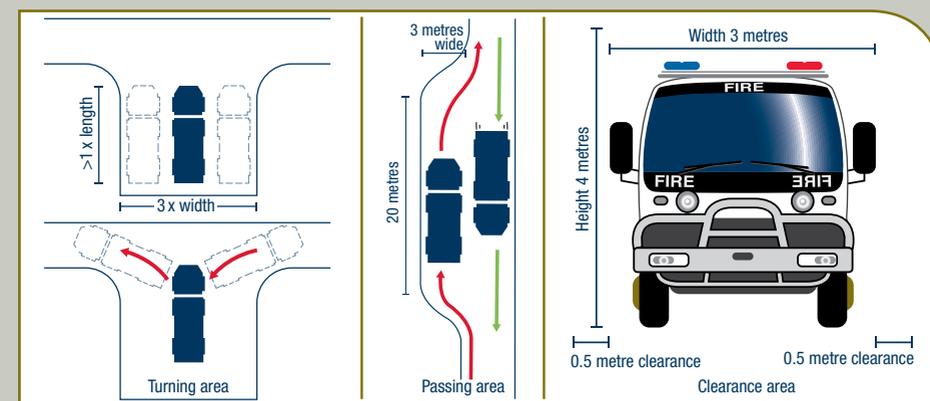
It is recommended that fire-breaks be at least three metres wide, with an additional horizontal clearance of half-a-metre on both sides and a vertical clearance of four metres, to allow the passage of firefighting vehicles. On very large properties and in treed landscapes, this width should be increased to at least five metres to increase the effectiveness in preventing fire spread. Fire-breaks between ten and fifteen metres wide are common for pastoral properties and plantations. Tall shrubs and tree branches growing alongside a fire-break may need regular pruning to ensure they do not facilitate flames spreading across the fire-break.

For the safety of firefighters, fire-breaks should provide a circuit that connects to formal access routes

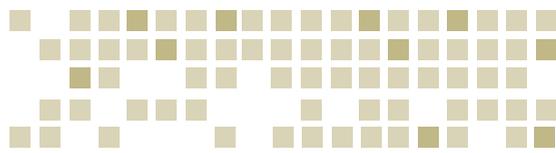
and should not terminate at dead ends. They should be kept clear of obstructions that would block a heavy vehicle's path.

As Urban and Rural Tankers (Tankers) have large turning circles, it is recommended that curves have a minimum inner radius of 6 metres to improve accessibility. Turning areas suitable for Tankers should be provided at the termination of a fire-break and at least every 500 metres where possible. These should be greater than the length of a Tanker in depth and three tankers in width (10 metres by 9 metres). A passing area adjacent to the fire-break should be provided every 200 metres. These should be at least 20 metres in length and 3 metres wide.

If a driveway, emergency access way or fire service access route forms part of a property's fire-break it may be subject to a Bushfire Management Plan and the associated access requirements of the Guidelines for Planning in Bushfire Prone Areas. Check with the landowner and refer to the Department of Planning, Lands and Heritage for more information.



Above: Minimum dimensions required for a fire-break and turning area to ensure safe access for firefighting vehicles.



Low-fuel breaks

In some circumstances, methods other than machine grading and scraping may achieve an efficient low-fuel break. However, it is advised that owners or occupiers of land consult their local government to ensure they meet the requirements of the fire-break notice.

Ploughed breaks

In areas where erosion is difficult to prevent, it may be preferable to construct a ploughed fire-break, rather than a graded one. Ploughing incorporates plant material into the soil, helping to bind the soil and prevent erosion. Ploughing will result in an inferior trafficable surface for vehicles and is only suitable if it is able to produce a minimal fuel surface, such as on previously mowed or slashed grass.

Herbicide treated break

Herbicide may be used in conjunction with slashing or mowing to create a low-fuel area in grass fuels. The advantages of this approach are that the soil surface is undisturbed and the roots binding the soil are retained, preventing erosion. However this may not create a mineral earth break, so may be less effective at preventing the spread of a fire.

Use of herbicides should comply with the Code of Practice for the Use of Agricultural and Veterinary Chemicals in Western Australia. Owners or occupiers of land can contact the Department of Primary Industries and Regional Development for more information.

For information on using herbicides near water catchment areas, refer to the Department of Health's best practice policy statement on use of herbicides in water catchment areas at www.health.wa.gov.au

Grazed break

Grazing stock can be managed to reduce grass fuels. Grazed breaks can be much wider than a machine break. They are cost-effective and may be less prone to erosion. However they will also be less effective at preventing fire spread, because some vegetation will be retained.

Heavy grazing and animal traffic can reduce the surface vegetation to mineral earth. However, this is not advisable as it can degrade the soil structure and leave the area prone to erosion. Be aware that land degradation caused by excessive grazing can be investigated by the Commissioner of Soil and Land Conservation in relation to the land managers compliance with the *Soil and Land Conservation Act 1945* or its regulations.

The grazing of native vegetation where it results in substantial damage is clearing under the *Environmental Protection Act 1986* (EP Act). Refer to the section on 'Protecting the environmental values of native vegetation' for further information.

Burnt break

Fire can be used to create areas of reduced fuel load in an environmentally sensitive manner. A burnt break will usually be anchored from a mineral earth break and is not a practical approach when isolated from other fire-control methods. The controlled use of fire is best applied as part of a comprehensive bushfire management strategy. Landowners or occupiers of land should seek advice and permission from their local government when proposing to apply controlled fire.

Environmental and heritage protection

Fire-breaks are important for reducing bushfire risk and may be a legal requirement for your property, however, if not properly constructed and maintained they can be detrimental to environmental and heritage values. Environmental and heritage impacts that may result from poorly constructed and maintained fire-breaks include:

- The spread of weeds and plant diseases.
- Damage to environmentally sensitive areas including threatened species or communities.
- Damage to natural, historic and Indigenous heritage values.
- Erosion by wind and water.

Reducing the spread of weeds and plant disease

The use of earthmoving machinery in natural areas can spread weeds and plant disease such as Phytophthora dieback, caused by the plant pathogen *Phytophthora cinnamomi*. It is estimated that 40% of native plant species in the South-West Land Division are susceptible to dieback.

Dieback is spread through the movement of infested soil. Good environmental hygiene reduces this risk by minimising the movement of soil around or between worksites. Good environmental hygiene requires machines, equipment, and footwear to be clean (i.e. free of soil clods, mud and or plant material) on arrival at the worksite, and be cleaned at the conclusion of work before leaving the site. It is recommended that

works supervisors use a hygiene checklist and inspect all parts of machinery prior to use.

Fire-breaks should not be constructed when soil is wet. Moisture not only provides favourable conditions for the pathogen to establish at new sites, it increases the chances that infected soil will stick to machines, equipment, and footwear making it easier to spread. The spread of soil and plant material should be minimised by clearing the break in short sections and regularly emptying the machine blade or rake of soil and debris.

If a property abuts a National Park or Nature Reserve or has intact native vegetation, it is highly recommended that the following steps are undertaken:

- engage a registered Phytophthora Dieback Interpreter and have the area where the work is to occur mapped for disease occurrence;
- if the site is uninfested, pay particular attention to good environmental hygiene;
- if the site is infested or partially infested, develop a plan with the interpreter to reduce the likelihood of spreading the pathogen during the work;
- consider undertaking Green Card training in dieback awareness and management.

More advice on environmental hygiene is available from the Department of Biodiversity, Conservation and Attractions or from the Dieback Working Group.



Protecting the environmental values of native vegetation

The definition of 'clearing' in the EP Act includes burning, grazing, or any other activity that causes damage to native vegetation. The clearing of native vegetation to construct a fire-break is exempt from requiring a clearing permit if the clearing is in accordance with the local government fire-break notice under section 33 of the *Bush Fires Act 1954*. However a clearing permit may be required to undertake clearing activities that are outside of the requirement of a fire-break notice. Please refer to the Department of Water and Environmental Regulation for more information.

The clearing provisions of the EP Act require the clearing of native vegetation to be authorised by a clearing permit, unless the clearing is subject to an exemption. Exemptions for clearing that is a requirement of a written law, or authorised under certain statutory processes, are contained in Schedule 6 of the EP Act. Exemptions for low impact routine land management practices outside of environmentally sensitive areas are contained in the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (Clearing Regulations).

Clearing permit exemptions for fire prevention activities

Exemptions from the requirement for a clearing permit that may apply to clearing for fire prevention activities include:

- Clearing by an owner or occupier of land in accordance with requirements specified in a local government authority's annual fire-break notice made under section 33 of the BF Act (Schedule 6, clause 1 of the EP Act).

- Burning of bush during declared prohibited burning times, if regulated, permitted or defined by a person authorised by the Department of Fire and Emergency Services (DFES), in accordance with section 17(5) of the BF Act (Schedule 6, clause 10(a) of the EP Act).
- Burning of bush during declared restricted burning times, if a permit is obtained from a bush fire control officer, or chief executive officer of the local government if a bush fire control officer is not available, in accordance with section 18 of the BF Act (Schedule 6, clause 10(b) of the EP Act).
- Burning of bush for the purpose of protecting a dwelling house or other building, or a stack of hay, wheat or other produce, from damage by fire during declared prohibited burning times in accordance with section 23 of the BF Act (if a permit is obtained from a bush fire control officer, or chief executive officer of the local government if a bush fire control officer is not available) (Schedule 6, clause 10(d) of the EP Act).
- Clearing that is done for fire prevention or control purposes or other fire management works on Crown land by the FES Commissioner (Schedule 6, clause 12 of the EP Act).
- Burning of bush between the common boundary and the fire-break by the occupier of adjacent land to reduce fire hazard during declared prohibited burning times, if authorised by DFES, in accordance with section 22(2) of the BF Act (Schedule 6, clause 10(d) of the EP Act).
- Clearing by burning for fire hazard reduction by the owner of the land, outside the prohibited or restricted burning times and not within gazetted environmentally sensitive areas, in such a way as to minimise long term damage to the environmental

values of the vegetation (Clearing Regulation 5, item 3 of the Clearing Regulations).

Clearing permit exemptions for fire suppression activities

Exemptions from the requirement for a clearing permit that may apply to clearing for fire suppression activities include:

- A bush fire control officer may, at any time of year, take appropriate necessary measures to protect life and property for the purpose of controlling or extinguishing a bushfire or for preventing the spread or extension of the fire, in accordance with section 39(1)(d) of the BF Act (Schedule 6, clause 10(d) of the EP Act).
- The captain, or in his absence the next senior officer, of a bush fire brigade may, at any time of year, in consultation with the occupier of the land, take reasonable necessary measures to protect life and property for the purpose of controlling or extinguishing a fire, in accordance with section 44(1)(c) of the BF Act (Schedule 6, clause 10(d) of the EP Act).
- The FES Commissioner or the officer or any member of the brigade who for the time being is in charge of the incident, or a person employed in the Department who is authorised by the FES Commissioner may undertake and direct any clearing which appears necessary to protect life and property, or to control and extinguish the fire, in accordance with section 34(a) the *Fire Brigades Act 1942* (Schedule 6, clause 11 of the EP Act).

Clearing that does not fit with an exemption will require a clearing permit. Guidance relating to the regulation of native vegetation clearing, exemptions, environmentally sensitive areas and other related

matters can be found on the Department of Water and Environmental Regulation website.

Other Clearing approvals that may be required

In addition to the above, in some cases separate approvals may be required including:

- A 'permit to take' under the *Wildlife Conservation Act 1950* may be required for impacts to rare flora. Please contact the Department of Biodiversity, Conservation and Attractions for more information on this matter.
- Under the *Country Areas Water Supply Act 1947* (CAWS Act) there are a number of water source catchments where clearing controls apply. These include the:
 - Mundaring Weir catchment area
 - Wellington Dam catchment area
 - Harris River Dam catchment area
 - Warren River water reserve
 - Kent River water reserve
 - Denmark River catchment area

A CAWS Act Licence to clear is required in these catchments if:

- An EP Act exemption applies; or
- compensation has previously been paid to retain the subject vegetation. Contact the Department of Water and Environmental Regulation for more information on clearing within these areas.

- Referral under the *Environment Protection and Biodiversity Conservation Act 1999* may be required for impacts to 'matters of national environmental significance'. Please contact the Commonwealth Department of the Environment and Energy for more information on this matter.

Protecting heritage values

There are many lists or registers of natural, historic and Indigenous heritage places throughout Australia. Significant heritage places are identified and grouped into lists that guide their protection and management. The relevant local government may have established lists identifying heritage places under the provisions of the local planning scheme or local laws.

All Aboriginal sites are protected by the *Aboriginal Heritage Act 1972*, whether or not they have previously been identified or registered. Individuals are obliged to report any potential Aboriginal Heritage sites if it reveals evidence (artefacts or other signs) of previous Aboriginal activity. Sites can be identified from the Department of Planning Lands and Heritage Aboriginal Heritage Inquiry System, an internet based heritage site search tool.

Reducing wind and water erosion

Removing plants and disturbing the soil can leave the ground surface vulnerable to erosion. Wind erosion may occur when soil particles on a fire-break's surface are blown away by the wind.

This will occur on most loose soil surfaces if wind speeds exceed 20 km/h. Adjacent vegetation can reduce wind speeds and help prevent erosion. However, this must be balanced with the need to maintain an effective fire-break.

The effect of wind erosion can be reduced by aligning fire-breaks so that the prevailing winds blow across, rather than along them. This may not be possible in all instances, depending on the construction and location of fire-break requirements local government have specified in their local laws under the *Local Government Act 1995*.

Water erosion occurs when raindrops hit the soil surface displacing soil particles and where water flowing over the land surface carries soil particles. Water erosion is preventable by reducing the volume and speed of the water flowing across the surface of a fire-break. The most effective way to prevent water erosion is to locate fire-breaks on flat terrain. Where this is not possible, good drainage is important. This includes structures to divert water away from the fire-break, allowing the fire-break to shed water to reduce the volume and slow the flow of water along the break.



A fire-break in an environmentally sensitive area.

Fire-break drainage

Fire-breaks require careful planning, design and construction as inappropriate installations can increase the likelihood and severity of erosion.

Planned earthworks should be discussed and negotiated with neighbours if surface water will be diverted onto neighbouring properties. In some situations, a Notice of Intent to Drain may need to be lodged with the Office of the Commissioner of Soil and Land Conservation. More information can be found on the Department of Primary Industries and Regional Development website – www.dpird.wa.gov.au



Above: Water erosion on a fire-break without adequate erosion-prevention measures.

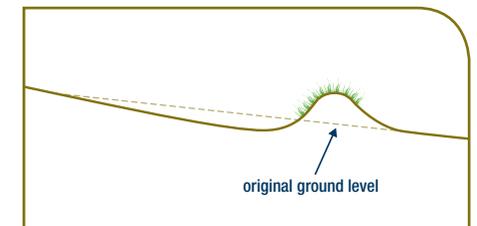
Remove windrows

Leaving windrows along a fire-break will increase the likelihood of water erosion; water flow will be intercepted by the windrow and channelled along it, gaining speed and volume until it breaks through a weak point. The concentrated flow at the breakthrough point can scour the fire-break surface, creating a gully. Windrows should be levelled while the constructing machine completes its final run by lifting the blade to ground level and spreading the soil.

Contour banks

Contour banks intercept surface water flowing towards a fire-break. They can be slightly graded to carry water to a suitable outlet, such as a natural watercourse, or dam. In the event of no available outlet, the ends of the bank should turn upslope so that water will pond behind the bank to be absorbed into the soil.

Contour furrows are smaller versions of contour banks, constructed with a ripper or mouldboard. The optimal spacing and size of contour banks are dependent upon site characteristics such as the amount of rainfall, gradient of the slope, soil type and the vegetation.



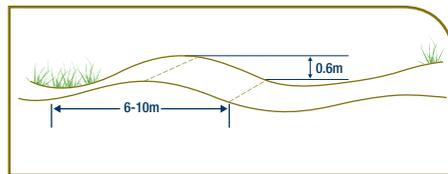
Above: A cross-section of a contour bank showing how water flowing towards the fire-break will be captured by the bank and diverted to a stable outlet.



Left: A grader constructing a fire-break. Note the windrows on the edge of the break will need to be spread to ensure the fire-break sheds water. Source D. Atkins.

Check banks

Check banks are low banks constructed across a fire-break along the contour but with a slight fall for moving water away slowly. Their optimal size depends upon prevailing conditions and they are designed to allow vehicles to cross slowly. However, they should not be too deep or too high because this might impede vehicle movement and reduce sight lines.



Above: Check bank cross-section looking from alongside the fire-break. The dimensions shown are approximate and should be varied to suit the soil type and amount of water received.

A check bank reduces the speed of water as it hits the bank, then drains to the downhill side of the break into a broad shallow depression (sill) to allow ponding. Water will either infiltrate the soil in the sill or, if the sill fills, flow slowly across the landscape. The optimal size and spacing of check banks depends on the amount of water the fire-break will receive and the water permeability of the soil.



Above: A Check bank installed on a fire-break

Water turn-outs

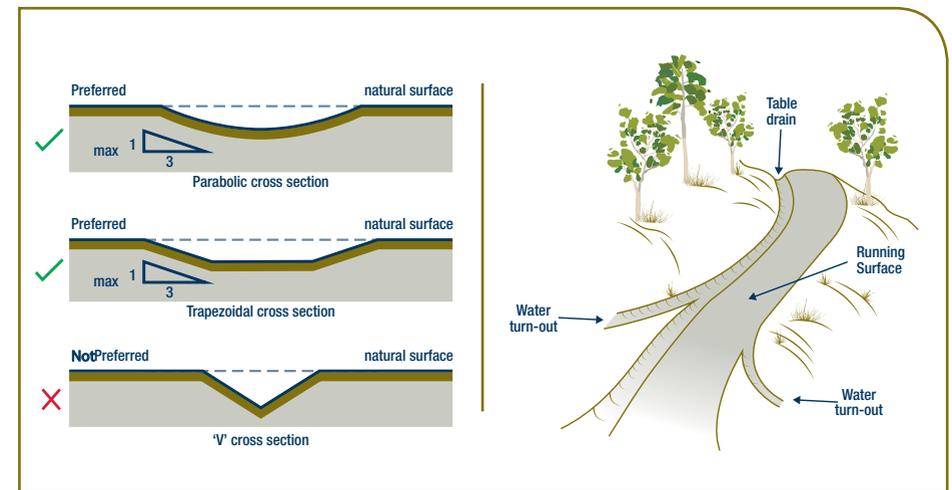
Water turn-outs, also known as spoon drains, mitre drains or spur drains, are shallow drains that carry water away from the fire-break surface.

Water turn-outs redirect water flowing along the fire-break or in the border drain, into the landscape. They should have a trapezoidal (flat) or parabolic (bowl) shaped bottom to prevent gullying, and should curve away from the fire-break to slow the speed of the drainage water before it is discharged.

The angle of incline is important where there is a cross slope. Ideally, turn-outs will curve along the contour (or slightly downward), as this ensures water redirection with the least chance of scouring and erosion.

On slopes, it is important that turn-out arms follow the contour as too much tilt in either direction will reduce their effectiveness. The required spacing of water turn-outs depends on the amount of water received and the soil type. If the slope is steep, check banks as well as turn-outs may need to be installed more frequently.

Vegetating water turn-outs can further slow water flow and prevent erosion, however this must be balanced against the need to maintain an effective fire-break.



Above: Water turn-outs are used to carry water away from the fire-break surface or adjacent drain and release water slowly into the landscape.



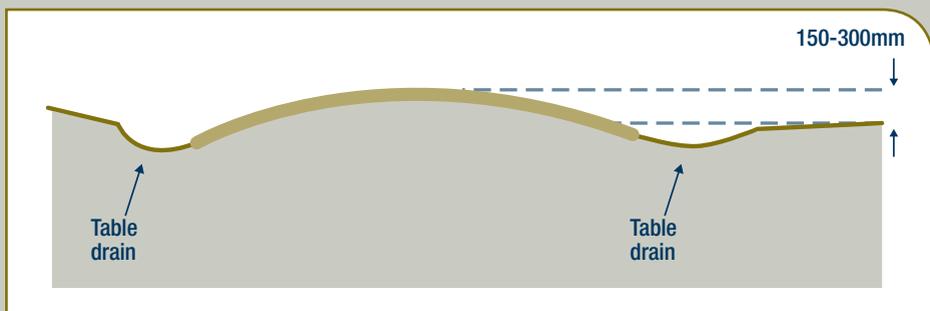
Above: Water turn-out designed for effective draining of water from a fire-break.

Surface shape

Fire-breaks generally require a formed surface because surface irregularities provide an opportunity for erosion. Care should be taken to prevent the blade of the constructing machine from bouncing or digging in as the gouges produced will be prone to erosion.

The fire-break surface should not be lower than the surrounding landscape, or water will be channelled along the fire-break, encouraging erosion of the surface.

Permanent fire-breaks that may experience high rainfall should be formed with a camber or cross-grade to allow water to drain away from the fire-break surface. The camber should be gently parabolic, rather than peaked, to slow the flow of water.



Above: Cross section of a fire-break showing a gentle camber to drain water from the running surface into adjacent drains.

Assistance

Contact your local government for more information on constructing and maintaining fire-breaks in your local area. For information about this guide, contact:

Rural Fire Division

Phone: 9395 9300

Email: ruralfire@dfes.wa.gov.au

Further Information	Agency	Contact Details
Environmental hygiene	Department of Biodiversity, Conservation and Attractions	(08) 9219 9000 www.dbca.wa.gov.au
	Dieback Working Group	www.dwg.org.au
Clearing of native vegetation	Department of Water and Environmental Regulation	(08) 6364 7000 www.dwer.wa.gov.au
Water resource management and protection		
Matters of national environmental significance	Department of Environment and Energy	1800 803 772 www.environment.gov.au
Soil erosion	Department of Primary Industries and Regional Development	(08) 9368 3333 www.dpir.wa.gov.au
Use of herbicides		
Aboriginal heritage sites	Department of Planning Lands and Heritage	(08) 6551 8088 www.dplh.wa.gov.au
Construction standards and advice	Australian Road Research Board	(08) 9227 3000 www.arrb.com.au



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