WILDLAND FIRE

Table of Contents

Page

1.0 SCOPE 2
1.1 Hazard 2
1.2 Changes 2
2.0 LOSS PREVENTION RECOMMENDATIONS 2
2.1 Construction for All Locations Exposed to Wildland Fire 2
2.2 Protection Against Ember Attack 3
2.3 Protection Against Radiant Heat and/or Direct Flame Impingement 4
2.4 Yard Storage 7
2.5 Exterior Exposure Sprinkler Protection 7
2.6 Water Supplies 9
2.7 Pre-Incident and Emergency Response Planning 9
3.0 SUPPORT FOR RECOMMENDATIONS 9
3.1 Loss History 10
3.2 Fire Spread on a Slope 10
4.0 REFERENCES 10
4.1 FM 10
4.2 Others 10
APPENDIX A GLOSSARY OF TERMS 11
APPENDIX B DOCUMENT REVISION HISTORY 12

List of Figures

Fig. 2.3.2. Depiction of predominant land slope 5
Fig. 2.3.4. Depiction of reduced-fuel zone 7
Fig. 2.5.1. Determination of wall sections requiring exterior sprinkler protection 8
Fig. A.1. Illustrations of brushland and grassland heights 11
Fig. A.2. Illustrations of forest and woodland heights 12

List of Tables

Table 2.3.2.A. Determining Radiant Heat Exposure to Buildings using Distance and Ground Slope for Brush/Grassland Exposures 5
Table 2.3.2.B. Determining Radiant Heat Exposure to Buildings using Distance and Ground Slope for Forest/Woodland Exposures 6
Table 2.5.1. Exterior Sprinkler Design Water Flow[1, 2] 8

©2022-2026 Factory Mutual Insurance Company. All rights reserved. No part of this document may be reproduced, stored in a retrieval system, or transmitted, in whole or in part, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without written permission of Factory Mutual Insurance Company.

1.0 SCOPE

This data sheet provides recommendations on how to mitigate the exposure from wildland fire. The terms ″wildland fire″, ″wildfire″, ″bushfire″, “forest fire”, ″grass fire″ and ″brush fire” all refer to uncontrolled fires in areas of combusible vegetation.

This data sheet addresses wildland fire as it affects industrial and commercial properties.

This data sheet is applicable to areas of the world with a large amount of vegetation along with weather patterns that include periods of low rainfall. Such climates typically have cool, wet winters and hot, dry summers with little or no rain for two to three months.

Some areas of the world are well known for severe wildland fires. These include southern Australia, the western United States, Canada, and southern Europe. The threat of a wildland fire is obvious when the site is surrounded by brush, forest, grass, or crops, but a building may also be exposed if it is located at a wildland/urban interface.

Several countries have developed maps to show zones that are exposed to wildland fire. Consult with local planning, fire, or forestry authorities to determine if your facility is in such a zone. The maps should have been drawn following a hazard analysis by the authority, which can be used as a starting point in evaluating the potential for wildland fire exposure. Consider drought history if there is local information available.

Use local maps and the following distances as a guide for determining whether there is a wildland fire exposure:

- Within 0.5 miles (0.80 km) of any forest/woodland
- Within 200 ft (60 m) of brush/grassland

The following vegetation and landscaping features are not considered wildland fire exposures:

A. Vegetation regarded as low threat due to moisture content or fuel load, including maintained lawns, golf courses (greens and fairways), maintained parks and sports fields, irrigated and landscaped vegetation and agriculture (e.g., well-maintained vineyards and orchards with minimal grass, commercial nurseries, and market gardens).

B. Strips of vegetation less than 65 ft (20 m) wide perpendicular to the exposed building wall and not within 65 ft (20 m) of the building or other vegetation.

C. Multiple areas of vegetation less than 0.6 acres (0.25 hectare) or 27,000 ft^2 (2,500 m^2) and not within 65 ft (20 m) of the building or any other area of vegetation.

D. A single area of vegetation less than 2.5 acres (1 hectare) in area and more than 330 ft (100 m) from other areas of vegetation or the building.

E. Permanent non-vegetated areas, including waterways, exposed beaches, roads, footpaths, parking lots, and rocky outcrops.

1.1 Hazard

Wildland fires can occur when prolonged dry weather causes a low moisture level in grass, brush, and trees. Combined with strong winds, it increases the intensity of a fire spreading over a wide area, exposing buildings and equipment in the vicinity.

For more information, refer to the FM publication *Understanding the Hazard: Wildland Fire Exposure*. (P0414).

1.2 Changes

October 2026. Interim revision. Minor editorial changes were made.

2.0 LOSS PREVENTION RECOMMENDATIONS

2.1 Construction for All Locations Exposed to Wildland Fire

2.1.1 Proper site selection is the best solution for avoiding the effects of wildland fire. Locate important equipment and structures away from any wildland fire exposures and locate in areas with maintained and irrigated landscaping.

©2022-2026 Factory Mutual Insurance Company. All rights reserved.

2.1.2 Use FM Approved equipment, materials, and services whenever they are applicable and available. For a list of products and services that are FM Approved, see the *Approval Guide*, an online resource of FM Approvals.

2.1.3 Avoid underfloor spaces because burning vegetation or wind-blown embers may enter. Cast floors in concrete-slab on the ground. If the floor slab must be raised, ensure the supports are brick, concrete, or protected steel with two hours' fire resistance to resist floor collapse. Protect openings to underfloor void spaces with steel-framed, close-weave corrosion-resistant bronze or steel wire mesh. Do not use aluminum or plastic screens. Ensure screen mesh does not exceed nominal 1/8 in. (3 mm) in size.

2.1.4 Insulate new wall cavities and roof cavities with mineral wool, fiberglass batts, or other noncombustible materials.

2.1.5 Make building structural frames of reinforced concrete or steel.

2.1.6 Construct any overhanging projections or buildings of noncombustible materials or use a minimum 1-hour fire-rated assembly.

2.1.7 Fit air-intake openings on air-handling systems with automatic dampers actuated by smoke detectors.

2.1.8 Provide a means to deactivate smoke evacuation systems in advance of a wildland fire, to prevent such a system from activating and drawing smoke-filled make-up air into the building.

2.1.9 Install important utility supply lines and pipes below ground. For sections of the systems that need to be above ground, construct them of noncombustible materials.

2.1.10 Where it is not practical to install underground power lines, support critical power lines with concrete or steel poles rather than wooden poles. Alternatively, provide an onsite diesel-driven emergency generator for essential production operations.

2.1.11 Do not directly connect combustible attachments such as wooden fences to the building. Provide a minimum 5 ft (1.5 m) separation with a masonry or metal barrier.

2.2 Protection Against Ember Attack

2.2.1 Design the physical shape of the building to reduce the number of re-entrant corners and changes in roof profile where burning embers can accumulate. Where practical, avoid changes in roof elevation, overhanging eaves, parapets, inset windows and doors, and roof valleys.

2.2.2 Remove all combustible vegetation within the first 5 ft (1.5 m) of buildings and equipment.

2.2.3 Use noncombustible construction materials or FM Approved assemblies for all exterior walls.

2.2.4 Do not use roofing systems that contain combustible exposed materials, such as wood shingles, vegetative roofs, fabric or membrane roofs, or roofs with exposed combustible foam insulation, on buildings exposed to wildland fire. For new roofs, re-roofs, and re-covers, use one of the following roof covers:

- Concrete or clay tile
- Steel lap seam or standing seam
- Steel shingles
- Ribbed or corrugated cement panels
- Gravel-surfaced multi-ply roofs
- Ballasted single-ply roofs
- FM Approved roof assemblies with a Class A exterior fire rating (per ASTM E108)

2.2.5 To the extent possible, eliminate all gaps larger than 1/8 in. (3 mm) in size, louvers, and vents through which embers can enter the building. If vents are necessary, cover vents in the walls or roof with close-weaved bronze or steel wire mesh. Fit weep holes in brickwork walls with screens. Also, fit chimneys with corrosion-proof metal screens. Ensure the screen mesh does not exceed nominal 1/8 in. (3 mm) in size.

2.2.6 If roofs are installed over combustible substrates, make roofs of continuous materials that fit tightly with no gaps larger than 1/8 in. (3 mm) in size. Precast and poured concrete, profiled steel sheeting, and slates are all suitable. For concrete or terracotta (clay) tile roofs, have gaps under the first row and at the roof eave eliminated by using starter tiles or by filling the gaps with mortar. Seal the rib opening of metal roof decks at the eave and ridge with noncombustible or fire-resistant materials (e.g., a metal insert or mineral wool).

©2022-2026 Factory Mutual Insurance Company. All rights reserved.

2.2.7 Use normally closed, exterior doors and frames that are minimum one-hour fire rated and constructed to stop embers being blown through the gaps. Pay particular attention to the gap under the doors, (e.g., drop door sills). Do not use doors that have glass windows. If windows are required, use wire glass.

2.2.8 Do not use operable windows, single-pane annealed glass windows, or windows with combustible frames. Use windows with noncombustible frames and with tempered or double-pane glass. If operable windows are necessary, protect the window with external metal screens that are close-weaved bronze or steel wire mesh. Ensure the screen mesh does not exceed nominal 1/8 in. (3 mm) in size.

2.2.9 Use noncombustible (e.g. wired or tempered glass) or FM Approved roof skylights and light bands.

2.2.10 Provide scuppers or interior roof drains. Avoid rainwater gutters on the roof because they collect leaf debris that can be easily ignited.

2.2.11 Provide roof drains with noncombustible drain covers and steel or cast-iron drainpipes for at least the first 3 ft (1 m).

2.3 Protection Against Radiant Heat and/or Direct Flame Impingement

2.3.1 Locate facilities that are to be in or adjacent to wildland fire exposures on level or gently sloping terrain. Avoid steep slopes, ridges, hilltops, and gullies.

2.3.2 If a building or facility is situated within 510 ft (155 m) of forest/woodland and/or within 200 ft (60 m) of brush/grassland that is designated as a wildland fire exposure by relevant authorities, evaluate the radiant heat exposure as follows:

A. Measure the horizontal distance to the vegetation from the building walls in all exposure directions.

B. Categorize the exposing vegetation as either brush/grassland or forest/woodland (see the glossary of terms, Appendix A).

C. Classify the predominant land slope (by degrees or gradient; see Figure 2.3.2) within 510 ft (155 m) in all exposure directions as one of the following:

1. Flat
2. Upslope (i.e., land under vegetation that slopes upward when viewed from the building; upslope can be treated the same as flat)
3. Downslope (i.e., land under vegetation that slopes downward when viewed from the building; a downslope of less than 5°(1:11) can be treated the same as flat)

D. Determine the exposed wall category based on the exterior wall construction and window type in accordance with Data Sheet 1-20, *Protection Against Exterior Fire Exposure*.

E. Use Table 2.3.2.A for brush/grassland, or Table 2.3.2.B for forest/woodland fire exposures, to determine the radiant heat exposure to each identified wall or section of wall.

F. If the level of radiant heat is higher than 12.5 kW/m^2 for combustible wall construction, or higher than 30 kW/m^2 (rounded up from 27 kW/m^2 in Data Sheet 1-20 for this application only) for noncombustible exposed wall construction, then the wildland fire exposure exceeds the passive protection of the exposed building.

Example: For grassland with a downslope of 5° to 10° and a vegetation-to-wall distance of 40 ft (12 m), Table 2.3.2.A lists the radiant heat exposure as >20 kW/m^2. At that level of radiant heat exposure, a combustible wall would require one of the protection options described in Section 2.3.3, but a noncombustible wall would not. In this case, a reduced-fuel zone should be provided to a minimum of 80 ft (24 m) to prevent ignition when the building exterior is combustible.

©2022-2026 Factory Mutual Insurance Company. All rights reserved.

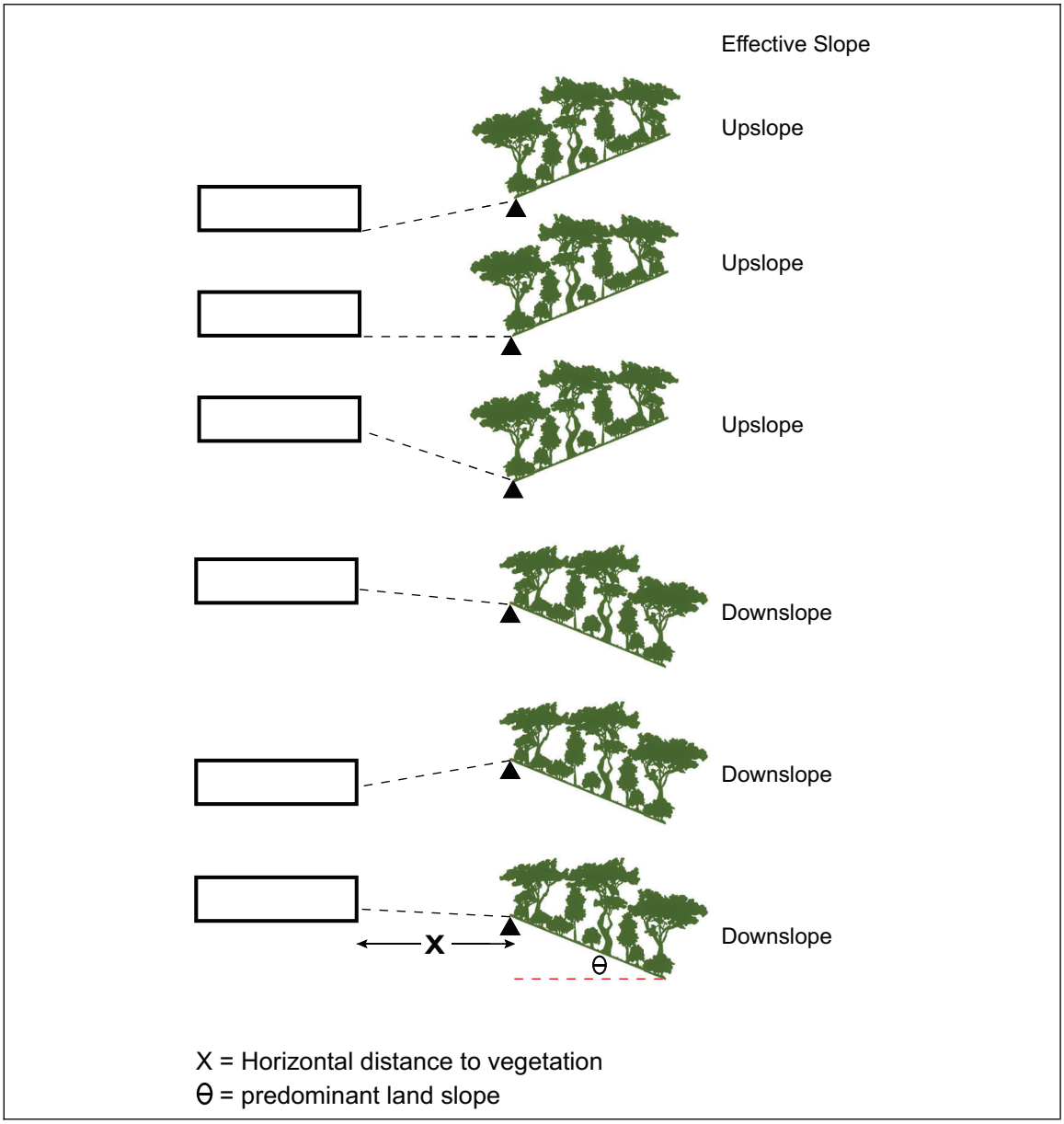


Fig. 2.3.2. Depiction of predominant land slope

Table 2.3.2.A. Determining Radiant Heat Exposure to Buildings using Distance and Ground Slope for Brush/Grassland Exposures

Vegetation	*Brush/Grassland Radiant Heat Exposure*[1]				
	<12.5 kW/m^2	>12.5 kW/m^2	>20 kW/m^2	>30 kW/m^2	>40 kW/m^2
Flat land, upslope, or up to 4° (1:14) downslope	≥65 ft (≥20 m)	50–64 ft (15–19 m)	33–49 ft (10–14 m)	15–32 ft (5–9 m)	<15 ft (<5 m)
Downslope 5° to 10° (1:11 to 1:5.5)	≥80 ft (≥25 m)	50–79 ft (15–24 m)	33–49 ft (10–14 m)	15–32 ft (5–9 m)	<15 ft (<5 m)
Downslope >10° to 20° (1:5.5 to 1:2.5)	≥100 ft (≥30 m)	65–99 ft (20–29 m)	50–64 ft (15–19 m)	33–49 ft (10–14 m)	<33 ft (<10 m)
Downslope >20° (>1:2.5)	≥195 ft (≥60 m)	150–194 ft (45-59 m)	100-149 ft (30-44 m)	65-99 ft (20-29 m)	<65 ft (<20 m)

Note 1: Do not make interpolations.

©2022-2026 Factory Mutual Insurance Company. All rights reserved.

Table 2.3.2.B. Determining Radiant Heat Exposure to Buildings using Distance and Ground Slope for Forest/Woodland Exposures

Vegetation	*Forest/Woodland Radiant Heat Exposure*[1]				
	<12.5 kW/m^2	>12.5 kW/m^2	>20 kW/m^2	>30 kW/m^2	>40 kW/m^2
Flat land, upslope, or up to 4° (1:14) downslope	≥130 ft (≥40 m)	100–129 ft (30–39 m)	65–99 ft (20–30 m)	50–64 ft (15–19 m)	<50 ft (<15 m)
Downslope 5° to 10° (1:11 to 1:5.5)	≥180 ft (≥55 m)	130–179 ft (40–54 m)	100–129 ft (30–39 m)	80–99 ft (25–30 m)	<80 ft (<25 m)
Downslope >10° to 20° (1:5.5 to 1:2.5)	≥260 ft (≥80 m)	195–259 ft (60–79 m)	165–194 ft (50–59 m)	130–164 ft (40–49 m)	<130 ft (<40 m)
Downslope >20° (>1:2.5)	≥510 ft (≥155 m)	410–509 ft (125–155 m)	330–409 ft (100–124 m)	260–329 ft (80–99 m)	<260 ft (<80 m)

Note 1: Do not make interpolations.

2.3.3 If the wildland fire exposure exceeds the passive protection of the exposed building per Section 2.3.2, do one of the following, listed in order of preference:

A. Remove exposing vegetation to create a reduced-fuel zone to a distance that satisfies Section 2.3.2. See Section 2.3.4 for additional details.

B. Improve the passive protection of the exposed walls and windows by changing combustible exposed walls to classify as noncombustible, or noncombustible exposed walls to classify as 1-hour fire-rated exposed walls in accordance with Data Sheet 1-20. For example, if a noncombustible exposed wall is needed, single-pane annealed glass windows can be replaced with tempered glass windows. Alternatively, the same windows can be protected with minimum ¾-hr fire-rated automatic shutters.

C. Provide exterior sprinkler protection for walls and/or windows in accordance with Section 2.5 and Data Sheet 1-20.

2.3.4 Before and during the fire danger season, ensure there is a reduced-fuel zone around all buildings, outdoor structures, and yard storage to a distance that satisfies Section 2.3.2. It is not necessary to remove all trees within the reduced-fuel zone; however, remove trees and shrubs so there is no continuous canopy or line of vegetation from wildland/bushland to the buildings. Do not allow trees to overhang buildings, fire pump houses, tanks, or open reservoirs.

To maintain a reduced-fuel zone, do the following:

A. Remove dead leaves, bark, pine needles and twigs beneath trees and shrubs, and dried grasses.

B. Remove trees or prune limbs that overhang buildings.

C. Prune lower branches of trees to 6 ft (2 m) and remove vegetation beneath to provide a vertical fire break.

D. Remove accumulated debris in trees and shrubs and prune dead branches.

E. Retain the moisture content of foliage by regular watering in summer.

F. Keep grass short and lawns mowed, including under trees.

G. Provide a separation between the tree canopies.

©2022-2026 Factory Mutual Insurance Company. All rights reserved.

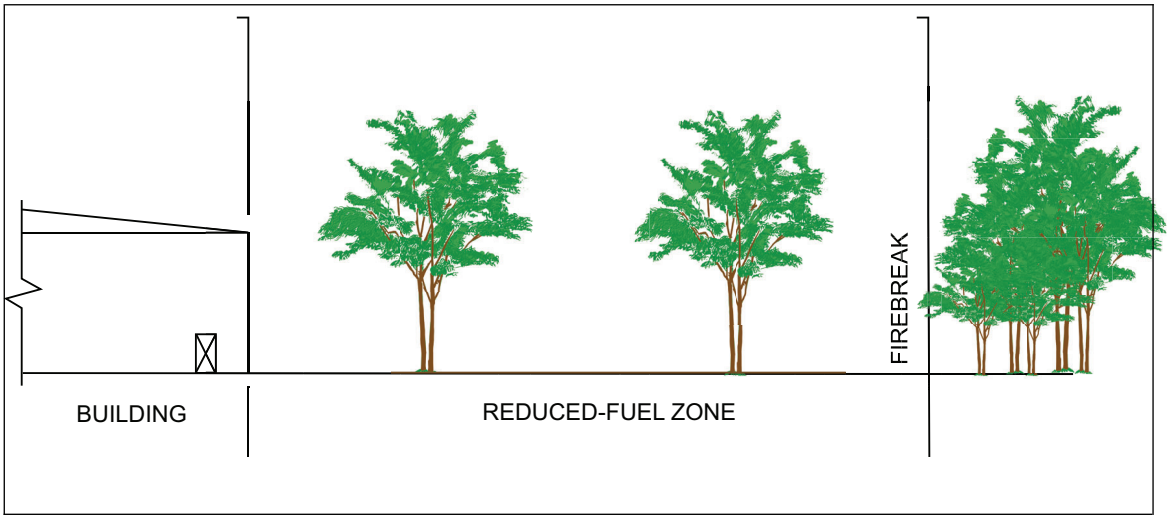


Fig. 2.3.4. Depiction of reduced-fuel zone

2.3.5 When planting new trees and shrubs, do the following:

A. Select types that will not readily ignite and burn fiercely, such as plants with high water or salt content, or low amounts of volatile oils (e.g., salt bush, tamarisk, boobialla, manzanita, juniper). Landscape specialists can assist with proper selection. Do not plant shrubs under trees or against buildings.

B. Select deciduous rather than evergreen trees as they require lower maintenance. All the leaves drop together in the autumn instead of continuously. Deciduous trees include aspen, poplar, maple, and oak.

C. Select smooth bark, rather than fibrous or rough bark trees, as these will not hold wind-blown embers.

2.3.6 Contact the local fire authority to conduct prescribed low-intensity burning in the nonhazardous periods of the year to remove vegetation where needed.

2.4 Yard Storage

2.4.1 Avoid combustible yard storage. In a wildland fire, it could be ignited and expose the building. If practical, use noncombustible shipping containers to store combustible materials in the yard.

2.4.2 Do not store valuable items outdoors.

2.4.3 If yard storage is unavoidable, adhere to the following:

A. Keep yard storage to the minimum levels possible.

B. Provide a minimum separation of yard storage from buildings in accordance with Data Sheet 1-20 or other applicable Data Sheets such as Data Sheet 8-22, *Baled Storage*; Data Sheet 8-24, *Idle Pallet Storage*; Data Sheet 8-27, *Storage of Wood Chips*; and Data Sheet 8-28, *Pulpwood and Outdoor Log Storage*.

C. Locate storage on the side of the building that presents the least exposure from a wildland fire. Consider exposure direction and building construction combustibility when choosing a location.

D. Provide fire breaks within the yard storage per Data Sheet 1-20 or other applicable data sheet.

E. Do not place storage under awnings, platforms, decks, or porches.

2.5 Exterior Exposure Sprinkler Protection

2.5.1 If exterior exposure sprinkler protection is provided, design the system in accordance with the following:

A. Determine the sections of exposed walls that need exterior sprinkler protection for all parts of the walls that are nearer to the exposing vegetation than allowed per Section 2.3.2. See Figure 2.5.1.

B. Provide a water flow rate per linear foot (meter) in accordance with Table 2.5.1.

©2022-2026 Factory Mutual Insurance Company. All rights reserved.

C. If the actual wall height is greater than 30 ft (9.1 m), provide additional levels of exterior sprinkler protection, evenly spaced vertically up the wall.

D. Provide the most practical horizontal sprinkler spacing between 6 ft and 12 ft (1.8 m and 3.7 m). Multiply the flow rate obtained in step B above by the horizontal sprinkler spacing chosen to get the minimum flow rate per sprinkler.

E. Ensure the design considers the operation of all exterior sprinklers provided for the wildland fire exposure.

Example: A 15 ft (4.6 m) high combustible wall that is expected to receive >30 kW/m^2 (per Table 2.3.2.A or 2.3.2.B), would need a single level of sprinklers. If the horizontal spacing of the sprinklers is 10 ft (3 m), then design each sprinkler to consider a minimum flow of 27 gpm (100.8 L/min).

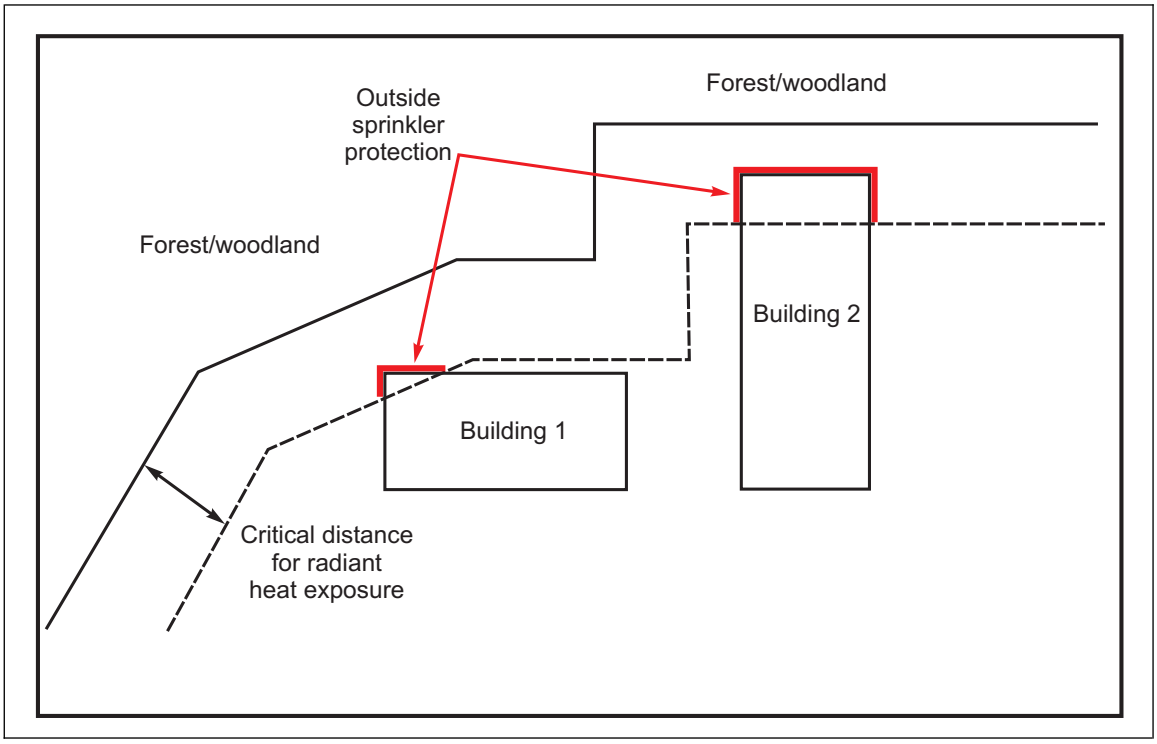


Fig. 2.5.1. Determination of wall sections requiring exterior sprinkler protection

Table 2.5.1. Exterior Sprinkler Design Water Flow[1, 2]

Wall Construction	*Vertical spacing, ft (m)*	*Water flow,[3] gpm/ft (L/min/m)* External heat flux, kW/m^2 ≤30	>30	>40
Combustible[4]	10 (3.0)	1.8 (21.6)	2.3 (27.8)	2.7 (32.5)
	15 (4.6)	2.1 (25.9)	2.7 (33.6)	3.2 (39.6)
	20 (6.1)	2.4 (29.8)	3.1 (38.9)	3.8 (46.5)
	30 (9.1)	3.1 (38.1)	4.0 (49.9)	4.8 (60.1)
Noncombustible	10 (3.0)	0.8 (10.1)	1.4 (17.7)	1.9 (24.0)
	15 (4.6)	1.1 (14.1)	1.9 (23.2)	2.5 (30.8)
	20 (6.1)	1.4 (18.4)	2.3 (28.6)	3.1 (37.8)
	30 (9.1)	2.2 (26.5)	3.2 (39.6)	4.1 (51.4)

Note 1. Horizontal sprinkler spacing should be between 6 ft and 12 ft (1.8 m and 3.7 m).
Note 2. Sprinkler pressure should be between 7 psi and 90 psi (0.48 bar and 6.2 bar).
Note 3. Water flow listed as flow gpm/ft (L/min) per unit length of wall (ft [m]).
Note 4. For heat fluxes between 12.5 and 30 kW/m^2, the sprinkler operating pressures would be than the minimum 7 psi (0.48 kPa) and therefore have not been included.

©2022-2026 Factory Mutual Insurance Company. All rights reserved.

2.5.2 Install exterior sprinklers in accordance with Data Sheet 2-0, *Installation Guidelines for Automatic Sprinklers*. Arrange them to operate automatically. Install exterior sprinklers that meet the following criteria:

- FM Approved nonstorage sprinklers
- Vertical sidewall only (upright or pendant)
- Quick response
- 165°F (72°C) temperature-rated
- Installed between 6 and 12 in. (150 to 300 mm) away from the wall
- Installed with the deflector directing the flow towards the wall
- Installed having the thermal element “visible” from the most likely radiant source

2.6 Water Supplies

Consider providing an enhanced water supply at locations in areas without a well-gridded public water supply if the site is exposed to wildland fire, per FM Data Sheet 3-29, *Reliability of Fire Protection Water Supplies*. Facilities that are high value or are critical to business continuity might benefit from having an enhanced water supply. Size the gravity tank, or pump and tank, in accordance with FM Data Sheets for the occupancy and yard storage hazard.

If you have an onsite water supply, consider providing the gravity or suction tank(s), or reservoirs, with a reserve of water for the fire service to refill their appliances. If a reserve is provided, ensure it is in addition to the automatic sprinkler demand.

2.6.1 Do not use wooden or plastic tanks. Ensure all exposed exterior piping is constructed of noncombustible materials or they should be buried.

2.6.2 Construct fire pump house walls and roof of noncombustible or fire-resistant materials.

2.6.3 Use either diesel-driven pumps or electric pump(s) with backup diesel generator.

2.6.4 Position hydrants around the building and on the roof so every wall and roof surface, and yard storage area, can be reached (refer to Data Sheet 3-10, *Private Fire Service Mains and Connections*).

2.7 Pre-Incident and Emergency Response Planning

2.7.1 For all locations exposed to wildland fire, develop a written pre-incident plan with the fire service. See Data Sheet 10-1, *Pre-Incident Planning and Emergency Response*, for details.

3.0 SUPPORT FOR RECOMMENDATIONS

Wildland fires can be classified into two types: forest/woodland, and brush/grassland.

Forest/woodland fires burn among trees and can be subdivided into three types: ground fires, surface fires, and crown fires.

- Ground fires are slow-moving, smoldering fires involving deep buried fuels such as roots, buried logs, duff, peat, and other material.
- Surface fires involve low-level fuels such as leaves, needles, woody debris, grass, and shrubs.
- Crown fires involve shrub and tree crowns and canopies, these are fast-moving fires which can release a tremendous amount of heat.

Brush/grassland fires burn faster than surface forest fires because they are exposed to the full force of the wind. The flames can rise up to five times the height of the brush/grass.

There are three ways wildland fire can damage a building:

1. Flying embers blown by the wind can land on and ignite combustible external elements of the building construction, combustible yard storage, vegetation, or debris. Embers can also enter a building through openings in the building envelope. Embers are the most common wildland fire ignition source.
2. Heat radiating from flames near the building can raise the temperature of the exposed building components, causing them to reach their autoignition point.
3. Fire can spread to the walls of the building so there is direct flame impingement.

©2022-2026 Factory Mutual Insurance Company. All rights reserved.

A wildland fire exposure can be mitigated by creating a reduced-fuel zone defensible space around the site and developing a building envelope that provides a total ember, flame, and heat barrier.

3.1 Loss History

The type and height of vegetation (e.g., grass versus pine trees) around a building dictates how much of a safe distance must be maintained between a building or structure and a wildland fire exposure. Thinning out forests and prescribed burning can significantly reduce the exposure. This tends to be an ongoing program of fuels management as there is no “one-time fix.” Often it is necessary to do additional thinning every 10 to 15 years, and to revisit prescribed burn sites every 5 to 7 years.

Embers in a severe fire can travel a mile or more. But ember ignition of a building typically depends on the building materials and design. Building materials and building layout greatly influence the ignitability of a structure.

With ongoing climate change and more development at the wildland/urban interface, wildland fires and bushfires have become more frequent and more destructive. In 2020, in the USA, approximately 58,000 fires burned roughly 10.3 million acres (4.15 million hectares). The 2020 August Complex Fire in California, USA is the largest on record for the state, and burned more than 1 million acres (400,000 hectares) and destroyed 935 structures. The 2018 Camp Fire was the deadliest and most destructive wildland fire in California’s history, burning 153,000 acres (62,000 hectares), destroying 18,800 structures, and killing 85 people.

The December 2019 bushfires in southeastern Australia burned more than 46 million acres (18.6 million hectares), destroyed nearly 6,000 structures, and killed at least 34 people. In 2007, wildland fires in southern Greece consumed 500,000 acres (202,000 hectares) of forest and olive groves.

Although residential homes continue to be most at risk, wildland fires are a serious threat to many industrial and commercial enterprises.

3.2 Fire Spread on a Slope

As the slope increases, more of the ground fuel is brought closer to the radiant and convective heat from the flame front, thereby decreasing the time to ignition and increasing the rate of spread and intensity of the fire.

4.0 REFERENCES

4.1 FM

Data Sheet 1-20, *Protection Against Exterior Fire Exposure*
Data Sheet 1-42, *MFL Limiting Factors*
Data Sheet, 1-45, *Air Conditioning and Ventilating Systems*
Data Sheet, 2-0, *Installation Guidelines for Automatic Sprinklers*
Data Sheet 3-1, *Tanks and Reservoirs for Interconnected Fire Service and Public Mains*
Data Sheet 3-2, *Water Tanks for Fire Protection*
Data Sheet 3-4, *Embankment-Supported Fabric Tanks*
Data Sheet 3-7, *Fire Protection Pumps*
Data Sheet 3-10, *Private Fire Service Mains and Connections*
Data Sheet 8-22, *Baled Storage*
Data Sheet 8-24, *Idle Pallet Storage*
Data Sheet 8-27, *Storage of Wood Chips*
Data Sheet 8-28, *Pulpwood and Outdoor Log Storage*

4.2 Others

CSIRO/Standards Australia. *Building in Bushfire-prone Areas: Information and Advice.* SAA HB36-1993.

Country Fire Services-South Australia. *Building for Bushfire Safety: Siting, Design, and Construction Guidelines for Building in Bushfire Prone Areas of South Australia.* Department of Environment and Planning.

National Fire Protection Association (NFPA) Firewise Communities Program. *Communities Compatible With Nature.* FWC-010-08-BK.

©2022-2026 Factory Mutual Insurance Company. All rights reserved.

National Fire Protection Association (NFPA) Firewise Communities Program. *Firewise Guide to Landscape and Construction.* FWC-200-08-PH.

National Wildland/Urban Interface Fire Protection Program. *Wildland/Urban Interface Fire Hazard Assessment Methodology*.

Weber, J. K. *The Complete Australian Bushfire Book.* Penguin, Australia. 1989.

APPENDIX A GLOSSARY OF TERMS

Brush/grassland: Areas with shrubs and grassland typically less than 10 ft (3 m) high. May have taller vegetation so long as the overstory foliage cover is less than 10% (see Figure A.1).

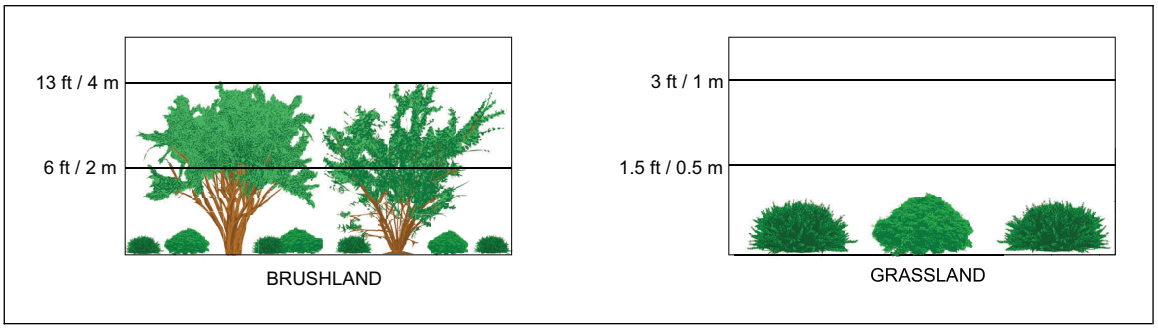


Fig. A.1. Illustrations of brushland and grassland heights

Bushfire: See **Wildland fire**.

Downslope: Refers to the ground slope under the exposing vegetation in relation to the building. When standing at the exposed building facing the exposing vegetation, the slope of the ground under the vegetation slopes downward when going away from the exposed building. Very steep downslopes spread wildland fires quickly toward exposed buildings.

Ember attack: Attack by smoldering or flaming wind-borne debris that is capable of entering or accumulating around a building and that may ignite the building or other combustible material and debris.

Exposed property: A property that lies within 0.5 miles (0.80 km) of forest/woodland or within 200 ft (60 m) of brush/grassland.

FM Approved: Products or services that have satisfied the criteria for Approval by FM Approvals. Refer to the *Approval Guide*, an online resource of FM Approvals, for a complete list of products and services that are FM Approved.

Forest/woodland: Areas with overstory foliage cover >10%. Trees are typically more than 30 ft (10 m) in height. May have a dense undergrowth or a thick layer of litter (see Figure A.2).

Noncombustible materials: Materials that will not allow self-propagating fire. They may contribute a negligible amount of fuel and they are not necessarily fire resistive.

Prescribed fire: The knowledgeable application of fire to a specific land area to accomplish predetermined land management objectives (controlled burn).

Re-entrant corner: This is a building angle pointing inwards.

Wildfire: See **Wildland fire**.

Wildland fire: An uncontrolled fire requiring suppression action, spreading through vegetative fuels.

Wildland/urban interface: An area of transition between wildland and human development.

Upslope: Refers to the ground slope under the exposing vegetation in relation to the building. When standing at the exposed building facing the exposing vegetation, the slope of the ground under the vegetation slopes upward when going away from the exposed building.

©2022-2026 Factory Mutual Insurance Company. All rights reserved.

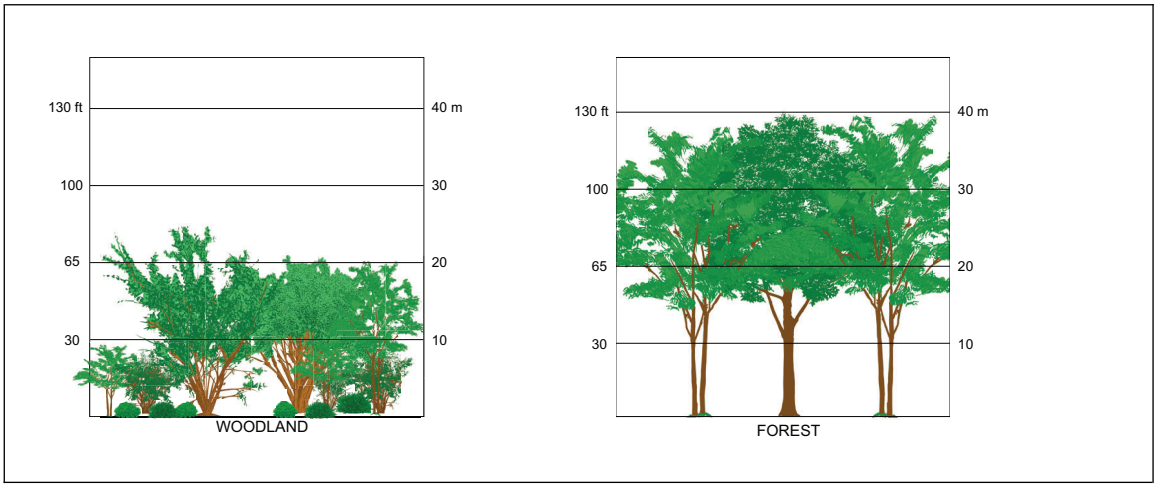


Fig. A.2. Illustrations of forest and woodland heights

APPENDIX B DOCUMENT REVISION HISTORY

The purpose of this appendix is to capture the changes that were made to this document each time it was published. Please note that section numbers refer specifically to those in the version published on the date shown (i.e., the section numbers are not always the same from version to version).

October 2026. Interim revision. Minor editorial changes were made.

January 2024. Minor editorial changes were made.

January 2022. This document has been completely revised. Significant changes include the following:

A. Reorganized the document to clarify recommendations that apply to either radiant heat or ember attack exposures.

B. Increased determination of exposure from brush/grassland fire from 100 ft (30 m) to 200 ft (60 m) to account for ember attack.

C. Added recommendations for noncombustible exterior wall construction and other passive protection for locations exposed to ember attack within 0.5 miles (0.80 km) of a forest/woodland exposure or 200 ft (60 m) of a brush/grassland exposure.

D. Added recommendation for pre-incident planning for locations within 0.5 miles (0.80 km) of a forest/woodland exposure or within 200 ft (60 m) of brush/grassland exposure.

E. Added recommendation to remove all combustible vegetation within 5 ft (1.5 m) of important buildings and equipment.

F. Simplified radiant heat exposure tables to separate guidance on forest/woodland exposures and guidance on brush/grassland exposures.

G. Relocated guidance on pre-incident planning and emergency response to Data Sheet 10-1.

H. Added recommendation to consider providing an enhanced water supply for new construction.

I. Provided visual examples of vegetation type, land slope, and separation distances.

J. Updated loss history.

K. Updated the guidance on exposure sprinkler protection.

January 2020. Revised Section 1.0, Scope to clarify that ember attack should be considered within 0.5 miles (0.8 km) of any forest/woodland wildland fire exposure.

January 2017. The following changes were made:

A. Changed the title of the document from *Wildland Fire/Bushfire Exposure* to *Wildland Fire.*

©2022-2026 Factory Mutual Insurance Company. All rights reserved.

B. Updated sprinkler protection guidance and water supply design for facilities exposed to wildland fire.

C. Added a new radiant heat exposure table.

D. Revised sections on emergency and contingency planning.

E. Clarified various recommendations throughout the document.

April 2011. The document title was changed and information was added on more recent wildland fire/bushfire activity around the world. Several new recommendations were also added.

May 2010. Replaced all references to Data Sheet 2-8N, *Installation of Sprinkler Systems (NFPA)* with references to Data Sheet 2-0, *Installation Guidelines for Automatic Sprinklers.*

May 2005. Editorial changes were made to the section 3.0, Support for Recommendations.

January 2001. This was the first publication of this document.

This data sheet is based upon an original document produced by FM Global Melbourne Operations.

©2022-2026 Factory Mutual Insurance Company. All rights reserved.