



Community Risk Study Report

Kenton- Peaceful Bay- Nornalup 2012



A community based study of risk in the Kenton, Nornalup and Peaceful Bay settlements within the municipal district of the Denmark Shire 2012. Study conducted by the Western Australian Local Government Association Emergency Management Services on behalf of and in conjunction with the Shire of Denmark and funded through the Agencies Working At Reducing Emergencies (AWARE) program.



Acknowledgements

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Emergency Management Western Australia (EMWA)
The Fire and Emergency Services Authority (FESA)
Kordabup/Owingup Volunteer Bush Fire Brigade
Nornalup Volunteer Bush Fire Brigade
Peaceful Bay Volunteer Bush Fire Brigade
The communities of Kenton, Nornalup and Peaceful Bay
Shire of Denmark Local Emergency Management Committee

Funding for this project was provided through the All West Australians Reducing Emergencies (AWARE) Fund.



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Executive Summary

In 2009, the Shire of Denmark commissioned the Western Australian Local Government Association (WALGA) to conduct a community centred risk study into natural and technological hazards that may impact on the community. That study funded through the All West Australians Reducing Emergencies (AWARE) fund was completed in 2011 and a study report *Shire of Denmark Risk Profile 2010* was produced and adopted by the Council on the 24th July 2012.

In 2011, the Shire of Denmark was granted further funding through the AWARE program to complete a risk study in the communities of Kenton, Nornalup and Peaceful Bay. This risk study focused on the risk to those three communities from all hazards and compliments the work done previously to analyse the risk to the Denmark townsite.

Natural Hazard Risk

During the workshops conducted in the three study communities, the subject of risk from natural and technological hazards was discussed with the attendees and an outline and explanation of the Shire of Denmark emergency risk management process was delivered. The risks identified through the community based risk study completed in 2010 were communicated and participants were asked to provide local area information that should be considered. In the three workshops conducted, no new information was divulged that would add significantly to the study already completed. It was clear from the outset that the major threat for these three communities was bushfire.

Bushfire Risk Methodology

The risk methodology used for the bushfire this study is based on the widely accepted Rural and Urban Bushfire Threat Analysis (RUBTA). The tool provides a system that emergency service managers can use to quantify decisions associated with hazards, risks and values to determine the threat that a specific hazard would pose. The tool has proved particularly useful when applied as it has been in this study to isolated rural communities. The participants in this study were all local residents of each of the sub-divisions and brought to the study a wide range of local knowledge and experience. The Keelty Report into the Perth Hills Fires "A Shared Responsibility" identified that Local Governments needed to do more to educate their community regarding the dangers bushfires present and encourage them to be aware of the danger and do more towards their own mitigation efforts. The Shire of Denmark has taken the lead in this regard and through the 2010 risk study established the benchmark for community involvement.

The local communities of Peaceful Bay, Nornalup and Kenton have a high representation of absentee land owners which in itself presents problems on three fronts, the absentee land holders who may lose their properties should a large fire impact the area, the Local Government who must ensure that all

property owners including themselves do all that is required, and lastly, the land holders who do all that is necessary to protect their properties but whose properties are endangered because others do not share that commitment. It has been demonstrated throughout this study that people who occupy their properties on a full time basis are acutely aware of their surroundings and their responsibilities while those who are not lack that knowledge and understanding particularly in the area of mitigation responsibility. To ensure the community was heavily involved in the risk process, a community wide letter of invitation was circulated throughout the community requesting attendance at the various workshops. ([Refer to Attachment A](#))

A guiding document was prepared and provided to each participant prior to each workshop. The guide outlined the reasoning behind the risk analysis process and explained the key concepts of the methodology used. ([Refer to Attachment B](#))

Recommendations for improvement of the Shires prevention and preparedness measures based on the finding in this study can be found on page 18.

Key Concerns

Kenton: Kenton presents as an extreme risk should an out of control bushfire impact the area. For people living in the estate, there would be little or no avenue for escape with the one road in and out situation that exists. By far the biggest threat is the very location of the sub-division which is nestled in among tall trees and a dense sub-structure representing fuels loads that defy measurement and have not been subject to burning of any description for decades. The sub-division, once part of a rural property has been allowed to overgrow to such an extent as to be undefendable should an intense fire take hold. Property owners who attended the study workshop were less critical of their own efforts than they were of the Shire's efforts in keeping leaf litter from the roadside drainage swales. The problems facing Kenton will be further examined later in this report.

Peaceful Bay: This area presents as a typical coastal settlement as could be found anywhere along the Western Australian coastline. This sub-division while surrounded by pockets of tall forest, woodland, pastoral land and coastal heath, does not present on the analysis of the risk as a high risk area. There is only one area, Flag Hill which is centrally located and is abutted by the caravan park which presents as higher than normal risk. There are clearly some major problems to be overcome when it comes to planning any mitigation measures, not the least of which is the sheer inaccessibility of the area for machinery both for the construction of access tracks and for fire response. This area was the subject of much conversation during their workshop.

Nornalup: This town site is located between the South Coast Hwy which represents the only major vehicular access route, running east to west and provides access across the Frankland River, to the area and the banks of the Frankland River. Tourism numbers in the area are significant due to the Department of Environment and Conservation Valley of the Giants Tree Top Walk. This popular tourist attraction also presents with ingress and egress

problems. The majority of houses in Nornalup are nestled among tall trees and are built on steep sloping blocks that would aid the speed of approaching flames. The river is fairly narrow and any fire in the surrounding DEC estate would present an ember attack problem for the community.

Risk Workshops

The community based risk analysis workshops were conducted over a three day period with each workshop being of two hours duration and scheduled for early evening midweek to allow for the best possible attendance. Attendance numbers varied for each of the three workshops but with the high number of unoccupied homes in each location, the numbers of people attending were more than acceptable.

Attendances:

Nornalup – 12 Peaceful Bay – 22 Kenton - 25

Nornalup Study

The Built Environment

The Nornalup town site is located on the banks of the Frankland River and within easy reach of the Valley of the Giants Tree Top Walk. There are 62 private dwellings constructed on the steep heavily wooded slope along Riverside Drive along with several larger rural holdings between McPhersons Road and Riverside Drive. Many of the dwellings are owned by absentee or part time residents. The majority of houses are nestled among tall trees and are built on steep sloping blocks that would aid the speed of approaching flames. The river is fairly narrow and any fire in the surrounding DEC estate would expose the community to severe ember attack. Nornalup River Chalets is a commercial tourist facility constructed between South Coast Highway and Riverside Drive. The chalets attract large numbers of tourists during summer months. The Community Centre is the only Shire owned building located opposite the Chalets and adjacent to South Coast Highway. The Community Centre also serves as a base for the Nornalup Volunteer Bush Fire Brigade.

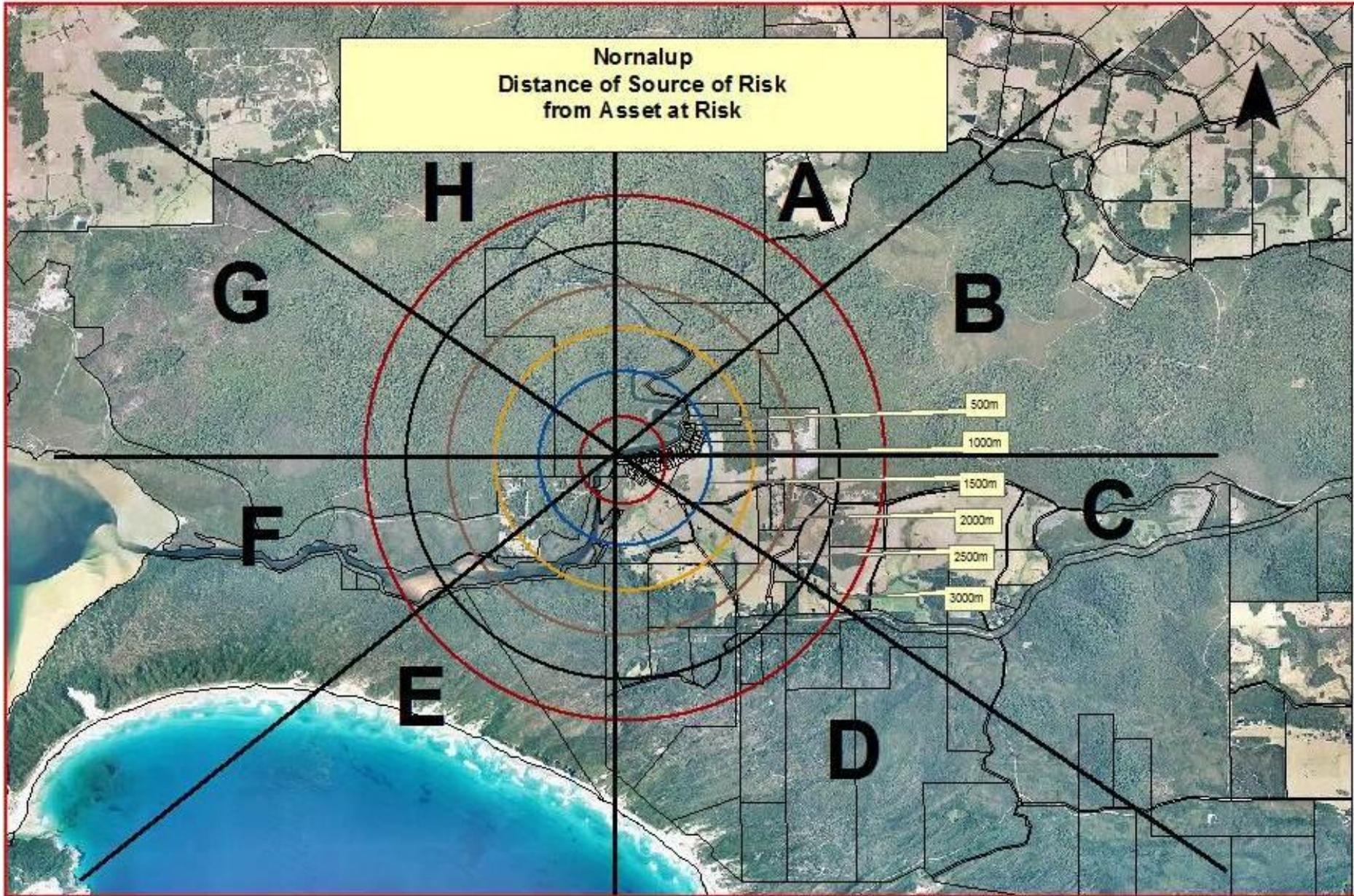
Ingress and Egress

Riverside Drive follows the Frankland River in an Easterly direction. The road is sealed for a distance of around 700 metres and then turns into a narrow gravel track which follows the course of the river through thick woodland. The road joins another bush track known as McPhersons Road which re-joins South Coast Highway.



Figure 1: Continuation of Riverside Drive





Nornalup Risk Matrix

Shire of Denmark Bush Fire Risk Register (Nornalup)												
Bush Fire Risk Source/Land	Scaling Factor	Community Risk	Risk of Ignition	Bush Fire Behaviour			Response capacity				Resultant Index Value	Risk Value
				Fuel Load	Slope	Result	Detection	Travel	FL Construction	Result		
Sector A&B												
Boxhall	0.8	80	30	90	60	150	120	60	120	300	560	448
Sector C												
Rural	0.3	80	15	20	10	30	30	15	30	75	200	60
Sector D												
Conspicuous	0.5	80	30	60	10	70	60	60	120	240	420	210
Sector E												
Ficifolia	0.6	80	30	10	10	20	60	30	120	210	340	204
Sector F												
Frankland	0.8	80	30	90	70	160	30	15	120	165	435	348
Sector G&H												
Douglas Hill	1.2	80	30	90	60	150	120	60	120	300	560	672
											RIV	RIV x Scaling Factor = RV

NOTE: The place names in the above matrix are names familiar to the residents of the Nornalup community and were assigned by the workshop attendees. These place names may or may not be associated with other naming protocols used by other agencies. The risk value figure indicates the severity of the risk posed to the community by the corresponding land parcel.

Note: Values in the above table are explained in ATTACHMENT B: Community Risk Workbook

Kenton Estate Study

The Built Environment

The Kenton Estate is located on the southern side of the South Coast Highway approximately 33 kilometres west of Denmark. The original land on which this sub-division stands was once part of a larger rural property. The estate consisting of 18 residences is predominately absentee land holders and represents as an extreme risk should an out of control bushfire impact the area. Once rural land, the area has been allowed to revert back to virgin bushland with a thick impenetrable understory associated with tall forest.

For people living in the estate, there would be little or no avenue for escape with the one road in and out situation that exists. By far the biggest threat is the very location of the sub-division which is nestled in among tall trees and a dense sub-structure representing fuels loads that defy measurement and have not been subject to burning of any description for decades.



Figure 2: The Karri Drive Cul-de-Sac

The sub-division, once part of a rural property has been allowed to overgrow to such an extent as to be undefendable should an intense fire take hold. Property owners who attended the study workshop were less critical of their own efforts than they were of the Shire's efforts in keeping leaf litter from the roadside drainage swales. The significant thing about this estate is that home sites appear to have been hewn out of virgin forest with little if any separation between bush and building as the following photographs show. There is clear evidence to show that should this estate come under direct attack from a significant bushfire, it would be totally undefendable except by air. In 2010 the local community established a bush fire ready group in an effort to assist property owners prepare their homes and families in the event of a bush fire.

Ingress and Egress

The entry to the estate is via Kent Drive, designated a No-Through-Road. The majority of homes are constructed at the top end of Kent Drive or along Karri Drive, a Cul-de-Sac. Essentially the estate is restricted to one ingress and egress route. The other route residents –can take to leave the estate should Kent Drive become impassable would be through an open pastoral property at the southern end of Kent Drive. This is the designated strategic access.

Note: Kenton Estate is not the only subdivision in Denmark with ingress and Egress constraints.

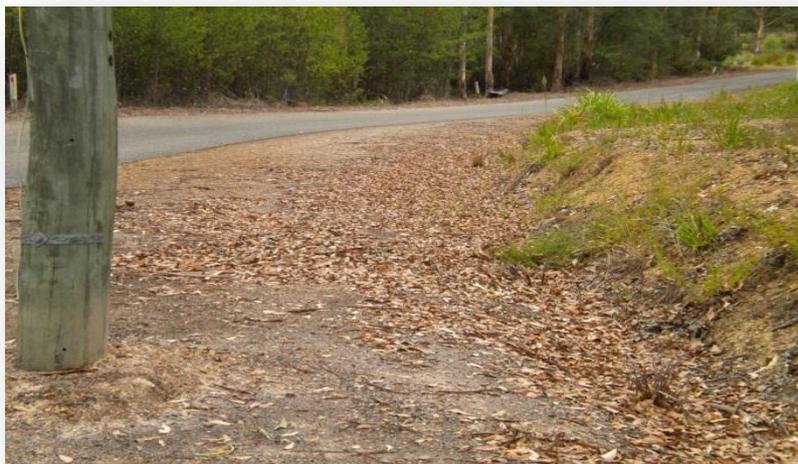
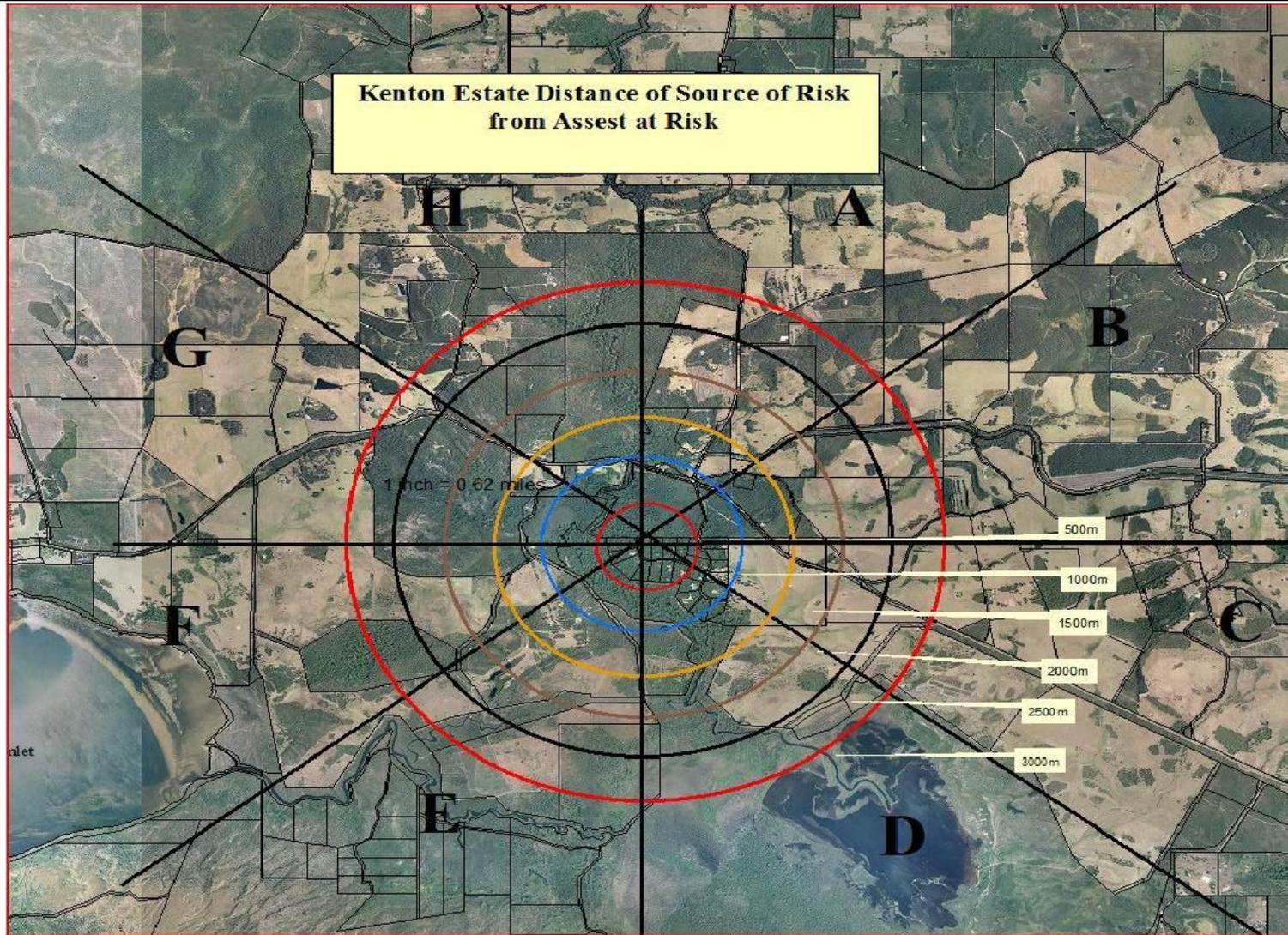


Figure 3: Ingress & egress routes Kenton



Figure 4: High fuel loadings around homes and out buildings

Shire of Denmark Bush Fire Risk Register (Kenton)



Bush Fire Risk Source/Land	Scaling Factor	Community Risk	Risk of Ignition	Bush Fire Behaviour			Response capacity				Resultant Index Value	Risk Value
				Fuel Load	Slope	Result	Detection	Travel	FL Construction	Result		
Sector A												
Kentdale	1.2	80	15	55	20	75	15	60	120	195	635	762
Sector B												
Rail Trail	1.1	80	15	70	20	90	15	60	120	195	665	731.5
Sector C												
Highway Block	1	80	15	20	10	30	15	30	120	165	485	485
Sector D												
Owingup	0.9	80	15	70	0	70	15	180	120	315	865	778.5
Sector E												
Kent River Reserve	0.8	80	15	70	10	80	15	180	120	315	885	708
Sector F												
Irwin Inlet	0.8	80	30	65	10	75	15	60	120	195	650	520
Sector G												
Dempster	1	80	30	80	30	110	15	30	120	165	660	660
Sector H												
Mehineup	1.2	80	30	80	30	110	15	30	120	165	660	792
											RIV	RIV x Scaling Factor = RV

NOTE: The place names in the above matrix are names familiar to the residents of the Nornalup community and were assigned by the workshop attendees. These place names may or may not be associated with other naming protocols used by other agencies. The risk value figure indicates the severity of the risk posed to the community by the corresponding land parcel. Note: Values in the above table are explained in ATTACHMENT B: Community Risk Workbook

Peaceful Bay Study

Built Environment

Peaceful Bay is located 51 kilometres west of Denmark and 33 kilometres east of Walpole. Peaceful Bay is a sea side holiday retreat nestled among thickly vegetated sand dunes. The homes which number 258 are primarily of timber or steel frame and fibro clad construction. The blocks are well laid out and all properties have a street frontage. A caravan park occupies an area of land at the base of Flag Hill with a general store adjacent the most significant land feature in the sub-division and identified in this study as being the area of highest risk which presents the highest degree of difficulty for both suppression and mitigation.



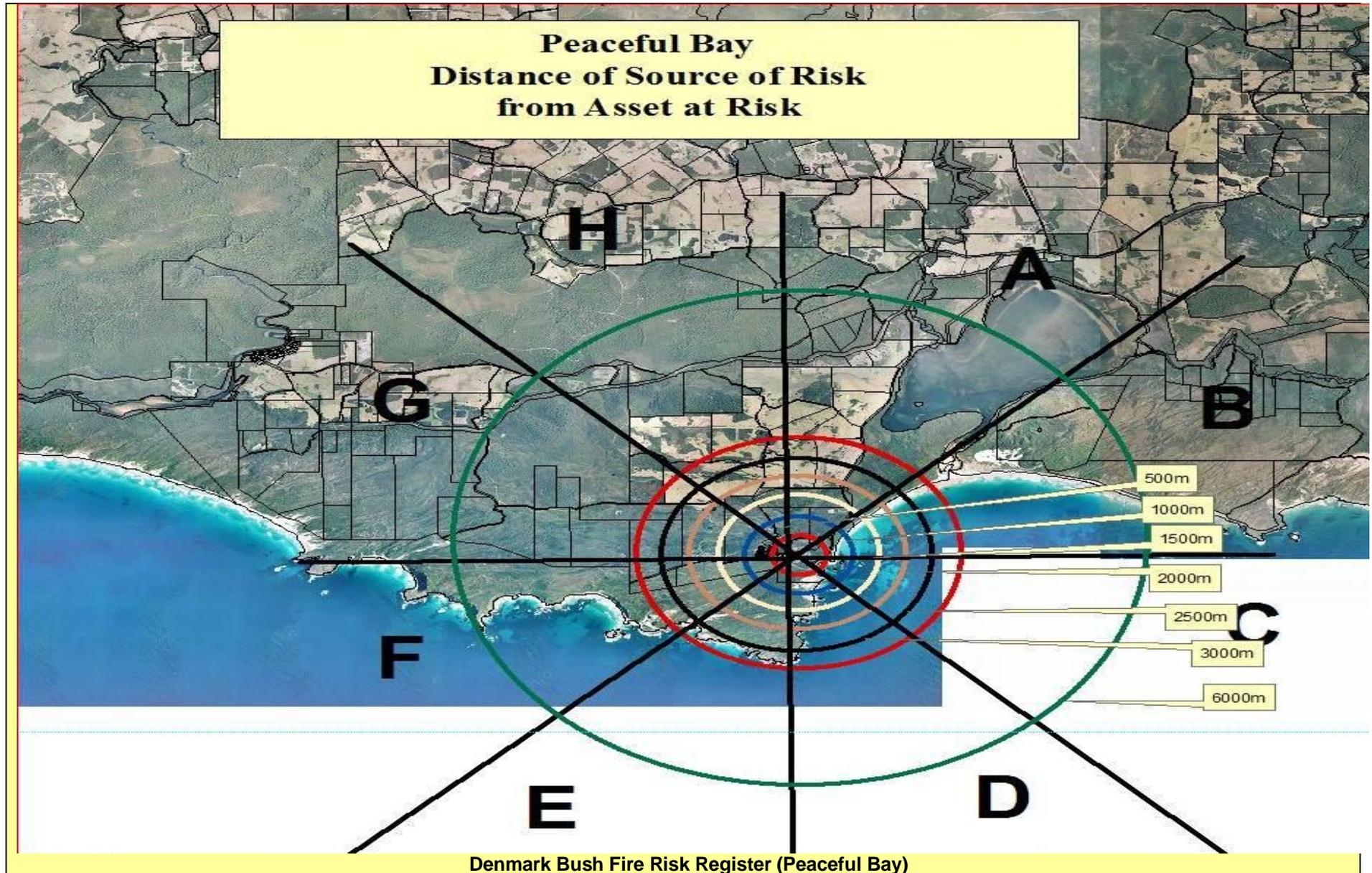
Peaceful Bay is essentially a sub-division in two halves with the majority of holiday type housing concentrated within the Peaceful Bay Road loop and a smaller sub-division of permanent housing to the west bounded by Rame Head Road and Peppermint Way. The predominant vegetation type in this area is coastal heath with surrounding areas being the DEC estates of the Irwin

National Park, the Rame Head National Park and the reserve vested in the Shire of Denmark which directly abuts the sub-division on the south western side. The sub-division has a response capability with a well-constructed fire shed which is home to the Peaceful Bay Volunteer Bush Fire Brigade which comprises of 1x 2.4 1x Lt and approximately 30 active members.



Ingress and Egress

Ingress to the Peaceful Bay settlement is via Peaceful Bay Road which is a ring road and presents the only viable access away from the area. The road is sealed and wide enough to accommodate heavy traffic flows with Ficifolia Road a gravel road to the west traversing dense coastal heath and forest.



Bush Fire Risk Source/Land	Scaling Factor	Community Risk	Risk of Ignition	Bush Fire Behaviour			Response capacity				Resultant Index Value	Risk Value
				Fuel Load	Slope	Result	Detection	Travel	FL Construction	Result		
Sector A												
Flag Hill	1.2	80	30	55	40	95	15	60	120	195	690	828
Irwin DEC	1.2	80	30	5	10	15	15	60	120	195	530	636
Sector B												
Quarram	0.4	80	15	45	50	95	30	60	120	210	705	282
Sector C												
Beach	1	80	15	5	40	45	15	15	120	150	485	485
Sector D												
						0				0	0	0
Sector E												
Irwin Nat Park	0.8	80	30	80	40	120	30	60	120	210	770	616
Sector F												
Raime Head Nat Park	0.8	80	30	55	40	95	30	60	120	210	720	576
Sector G												
Ficifolia Block	1	80	30	80	20	100	15	60	120	195	700	700
Sector H												
Shire Reserve	1.2	80	30	65	20	85	15	60	120	195	670	804
											RIV x Scaling Factor = RV	

NOTE: The place names in the above matrix are names familiar to the residents of the Nornalup community and were assigned by the workshop attendees. These place names may or may not be associated with other naming protocols used by other agencies. The risk value figure indicates the severity of the risk posed to the community by the corresponding land parcel.

Note: Values in the above table are explained in ATTACHMENT B: Community Risk Workbook

Recommendations

Recommendation 1: That the Shire of Denmark ensures that there is clear understanding between all bushfire response agencies (FESA, DEC and Police) for the need of early evacuation of the Kenton and Peaceful Bay should a bushfire be assessed as having a likelihood of impacting on these settlements.

Recommendation 2: That the Shire of Denmark rigorously enforces fire break notices and requires strict adherence to Shire's planning laws relating to bushfire hazard separation zones.

Recommendation 3: That the Shire of Denmark urgently review future planning of sub-divisions having due regard to the Department of Planning/FESA publication "*Planning for Bushfire Protection*".

Recommendation 4: That prior to the commencement of the 2012/13 bushfire season, the Shire of Denmark embark on a public education program within the communities of Kenton, Nornalup and Peaceful Bay to heighten public awareness of bushfire risk particularly for absentee land holders and rental occupants.

Recommendation 5: That the Shire of Denmark review further static water points for the filling of fire appliances in Peaceful Bay, Nornalup and Kenton.

Recommendation 6: That the Shire of Denmark investigate methods of evacuation for large numbers of holiday makers during the holiday periods at Peaceful Bay.

ATTACHMENT A Community Invitation Letters



953 South Coast Highway, Denmark Western Australia 6333

File Ref: GRT.111 LS/NH Tel (08) 9848 0300 Fax (08) 9848 1985
Contact: Lee Shelley

27 February 2012

Dear Resident

The Shire of Denmark Emergency Risk Management Project

As part of its emergency management role under the State Emergency Management Act 2005, the Shire of Denmark has secured grant funding to conduct a Risk Management Project that is funded under the All West Australians Reducing Emergencies (AWARE) Program.

Stage One of this program which was focused on the Denmark townsite and its immediate environs was conducted in 2010 and has involved community consultation in the form of surveys and risk identification workshops being conducted with local resident representatives, emergency volunteers, Police and members of the Local Emergency Management Committee.

Stage Two of this risk assessment is now being conducted and the project will focus on the areas of Peaceful Bay, Nornalup and Kentdale.

You are invited to attend a risk identification workshop and information session.

LOCATION: KENTDALE HALL
TIME: 6.00PM TO 8.00PM
DATE: 23 MARCH 2012

Your attendance at this workshop will not only assist the Shire of Denmark to understand the natural man made risks that pose a threat to your community and will give you a valuable opportunity to gain relevant information vital to your personal preparation for emergency events in the future.

Above all these workshops are your chance to have your say on the risks facing your community.

Please RSVP by COB 13 March 2012 with the name and numbers attending to health2@denmark.wa.gov.au or by phoning Lee Shelley on 9848 0300 during business hours.

Yours Sincerely

Dale Stewart
Chief Executive Officer

All communications to:
Chief Executive Officer, PO Box 183, Denmark WA 6333
Email: enquiries@denmark.wa.gov.au
www.denmark.wa.gov.au



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Stage Two of this risk assessment is now being conducted and the project will focus on the areas of Peaceful Bay, Nornalup and Kentdale.

You are invited to attend a risk identification workshop and information session.

LOCATION: PEACEFUL BAY PROGRESS ASSOCIATION HALL
TIME: 6.00PM TO 8.00PM
DATE: 22 MARCH 2012

Your attendance at this workshop will not only assist the Shire of Denmark to understand the natural man made risks that pose a threat to your community and will give you a valuable opportunity to gain relevant information vital to your personal preparation for emergency events in the future.

Above all these workshops are your chance to have your say on the risks facing your community.

Please RSVP by COB 13 March 2012 with the name and numbers attending to health2@denmark.wa.gov.au or by phoning Lee Shelley on 9848 0300 during business hours.

Yours Sincerely

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Chief Executive Officer

All communications to:
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Stage Two of this risk assessment is now being conducted and the project will focus on the areas of Peaceful Bay, Nornalup and Kendale.

You are invited to attend a risk identification workshop and information session.

LOCATION: NORNALUP COMMUNITY HALL
TIME: 6.00PM TO 8.00PM
DATE: 20 MARCH 2012

Your attendance at this workshop will not only assist the Shire of Denmark to understand the natural man made risks that pose a threat to your community and will give you a valuable opportunity to gain relevant information vital to your personal preparation for emergency events in the future.

Above all these workshops are your chance to have your say on the risks facing your community.

Please RSVP by COB 13 March 2012 with the name and numbers attending to health2@denmark.wa.gov.au or by phoning Lee Shelley on 9848 0300 during business hours.

Yours Sincerely

Dale Stewart
Chief Executive Officer

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Email: enquiries@denmark.wa.gov.au
www.denmark.wa.gov.au

ATTACHMENT B: Community Risk Workbook



Community Bushfire Risk Management Project 2012

Local Government Consulting with the local community on bushfire risk

Nornalup
Kenton
Peaceful Bay



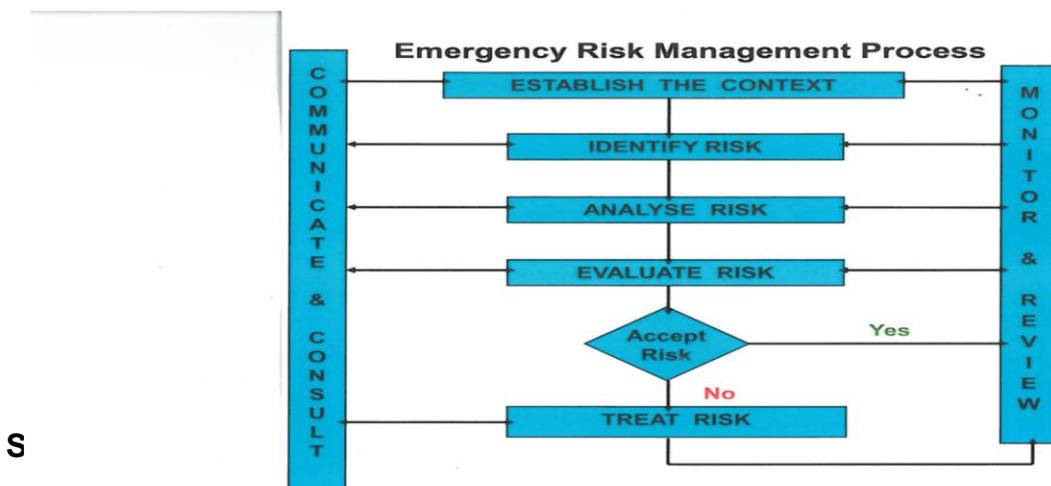
About this program

It is important that local government, the Brigade network and various elements of any potentially effected community, are engaged in this process. Local Government, through the *Bush Fires Act (1954)* has carriage of the responsibility for fire i.e. prevention, preparedness response and recovery (PPRR) within all lands, excluding DEC estate (where DEC has this responsibility - *CALM Act (1984)*) and Gazetted Fire Districts (where FESA has this responsibility – *Fire Brigades Act (1942)*). The Brigade network has a vested interest to reduce fire severity and frequency, plus a stronger sense of historical fire data and significance. Finally, it should be argued that the community owns the risk and in many cases, presents much of it to neighbouring land-owner/occupiers. Having the community involved through effective representation, would provide an ideal vehicle to enhance the community understanding of the various bush fire risks and should enable community-centred risk management (including local land-owner risk reduction strategies).

The risk evaluation process

The process we will be contributing to through this project has been designed to assist local communities identify sources of bush fire risk and plan to manage a reduction of this risk to their communities. It is suggested that this should occur through collaboration with their respective Local Governments, Bush Fire Brigade networks and with also organisations that have property interests, within those communities. This should also include Fire and Rescue Brigades, where a ‘Gazetted Fire District’ exists (*Fire Brigades Act:1942*).

The platform through which the assessment of risks are determined, is an amalgam of the International Standard ISO 31 000:2009 (***Risk Management – Principles and Guidelines***)¹ and the various risk assessment tools, available through the Australian Standard for ***Building in Bush Fire Prone Areas*** (AS 3959:1999). It also reflects the Bush Fire Threat Analysis process, developed through collaboration between FESA and the DEC, for formal risk assessment. This will provide rigour to any assessments, ensuring that the various pieces of land presenting risk can be substantiated against others, ensuring a more effective use of resources in the minimisation of these risks. This will also ensure due diligence is exercised and therefore, a reduction of exposure to risk, with a demonstrated and recognised process being followed to identify risk.



Every community is different, in that they will see bushfire risk in different ways. At this stage you will need to consider the community from two perspectives being: **sources of risk** from bush fire and also the **elements** of the community that will be potentially impacted upon, by bushfire.

For this study, consider each piece of land that contains bush, scrub or otherwise flammable vegetation that surrounds the community. Attempt to gain agreement on discreet boundaries for each of these pieces of land (regardless of ownership) and identify them individually on the table below (Table 1). All land that surrounds a community, would present some risk to that community.

(The scaling factors can be determined from the following table 1, using proximity & aspect as factors.)

Sector	Distance from Outskirts of Town (assets)				
	0 – 1000 m	1001 – 1500 m	1500 – 2000 m	2001 – 2500 m	2501 – 3000 m
A	1.2	1	0.8	0.6	0.5
B	1.1	1	0.7	0.5	0.4
C	1	0.9	0.6	0.4	0.3
D	0.9	0.7	0.5	0.3	0.2
E	0.8	0.6	0.4	0.2	0.2
F	0.8	0.6	0.4	0.2	0.2
G	1	0.9	0.6	0.4	0.3
H	1.2	1	0.8	0.6	0.5

Table 1 – Step 1 - Scaling factors, proximity and aspect.

List each sector by name on the worksheet.

Important Note:

The above scaling factor is designed to consider risk to ‘whole of community’ and assumes that a ‘reasonable’ buffer exists between the source of risk (bushland) and the assets which may be at risk. In this case, ‘reasonable’ infers that there is a sufficient ‘hazard separation zone’ (reference – **Planning for Bush Fire Protection** (WAPC & FESA – Edition 2 – May 2010), specifically **Appendix 1 & 2 (Element 4)**, to give a ‘Hazard Assessment’ as **‘Medium’**, as worst case.

Where this is not the case, or where there are contiguous fuels/combustible vegetation throughout the community, the need to manage these fuels to meet ‘Medium’ must be presented to the landholders, before any of the risk treatments resultant from this assessment could reasonably be considered to be effective.

Step 2 – Determine the bushfire risk category – Identify the risk

There are considered to be seven categories of local community assets. Consider the four columns in **table 2** (being Conservation, Visitor, Forest and Community Protection values) **for your community**. From the descriptors, choose the Category that best fits your community. Obviously, having representation on the committee (and advice) from the conservation and tourism sectors may be beneficial, to ensure that those values are given appropriate consideration, along with the factors which are likely to be the first consideration for most residents.

This Category will be used throughout the remainder of the risk analysis process.

NOTE: Most communities being considered with this project would end up being category 1 or 2, often depending upon whether there is a reticulated water supply (hydrants and underground water supply infrastructure) and perhaps further consideration from columns 1, 2 or 3.

Refer to the table on page 5 of the work book.

Biodiversity/Conservation Values	Visitor Values	Forest Production Values	Community Protection Values
Category 1 Values – Areas with significant risk – multiple fatalities, from bushfire.			Index Value = 80
Fire vulnerable species – extinction likely with fire	Camping areas – high fire season Population, no refuge areas, poor escape potential/dead end access/egress.		Settlements, rural & special residential with native veg, poor access/egress, no reticulated water supplies. Public infrastructure, used daily with restricted access/egress.
Category 2 Values – Very high property impact. Some risk to life from bush fire. Very high biological values			Index Value = 50
<ul style="list-style-type: none"> • Fire vulnerable, critically endangered & priority 1 species. Risk of extinction if burnt. • Only known occurrences of fire vulnerable priority 2 species. • Several under-represented fire serial stages of vulnerable species populations. • Severely under represented structural types 	<ul style="list-style-type: none"> • Major recreational tourist areas, good access but, sheer numbers pose risk in event of fire. • Popular long distance walking & mountain-bike tracks. • Fire vulnerable heritage sites. • Fire vulnerable registered Indigenous sites. 		<ul style="list-style-type: none"> • Essential utilities. • Infrastructure posing significant environmental risk. • Urban areas. • Rural/Special residential subdivisions, poor access, reticulated water supplies with regular fuel modification to reduce risk. • Significant industrial/commercial infrastructure, essential for community vitality.
Category 3 Values – High Biological/property values. Low risk to life			Index Value = 30
<ul style="list-style-type: none"> • Fire vulnerable, endangered & priority 2 spp. Or ecological communities (non-human) • Long established (>15 yrs.) research plots + scientific reference areas to be kept free of fire. • Areas significant to the maintenance of overall structural diversity, species richness. • Under represented structural types (<i>e.g.</i> old growth forests). 	Old growth forest values.	<ul style="list-style-type: none"> • Pine plantation >100 ha + 8-20 years old. • Consolidated karri regrowth >1000 ha, 5 -30 years old. 	Public buildings with monthly use + good access.
Category 4 Values			Index Value = 20
<ul style="list-style-type: none"> • Short term research/monitoring plot to be kept fire free. • Threatened species habitats. • Under represented (whole of forest) fire serial stage. • Areas of regionally significant species richness, structural diversity. 	<ul style="list-style-type: none"> • Significant infrastructure (> \$1M), • low life risk. 	<ul style="list-style-type: none"> • Pine plantations <100 ha + 8-20 years old. • Pine plantations >100 ha, being < 8 yrs old, or >20 yrs old. • Hardwood plantations >100 ha. 	Scattered houses and/or Public utilities.

Table 2 – Determination of the Bush Fire Risk Category (from 'Parks of the Leeuwin Naturaliste Ridge and Surrounds –

Step 3 – Determine the risk of ignition – Evaluate the risk ‘A’

This stage of the risk analysis describes the likelihood of a fire occurring in a location, irrespective of whether the fire spreads. This factor **does not** consider the local fuel age, type or quantity.

At this point in the analysis, fire history and statistics are considered, which includes the history of lightning generated fires and fire resulting from human activity. Your local fire fighters (or local government) may be able to provide this history.

The following table (**table 3**) allocates a ‘likelihood’ rating, generally as a result of proximity to people, or other cause factors. The result (Index Value) may be raised or lowered by consensus, due to the history of fires on the subject land, which may have been caused by locally specific factors. (arson, industrial practices, rail-lines etc.)

Rating	Justification	Index Value
High	<ul style="list-style-type: none"> • Within 3 km of any recreational/high visitation area • Within 2 km of any town-site • Where regular fire history exists (i.e. 3 per annum) 	30
Moderate	Where the above does not apply, but the area is: <ul style="list-style-type: none"> • Within 100 m of any power-line • Within 500 m of any major arterial roadway & buildings • Where some fire history exists (i.e. 1 per annum, or less) 	15
Low	All other areas	5

Table 3 – Risk of Ignition Categories – Consideration against risk source.

Step 4 – Determine the likely head fire behaviour – Evaluate risk ‘B’

This stage considers potential fire behaviour, specifically at the most aggressive part, being the head of the fire. The considerations within this factor use the processes from both **ISO 31 000** (Risk Management –Principles & Guidelines)¹ and **AS 3959** (Building in Bush Fire Prone Areas) (This is also reflected in the **Planning for Bush Fire Protection** document (FESA and the WA Planning Commission, 2001)).

The first element of this analysis, is to consider bush fire fuel classification/structure and then bush fire fuel age (accumulation over time) (see **table 4**) which results in a ‘**ROS Index Value**’. If unsure of ‘Fuel Age’, an estimate of the ‘years since the area was last burnt’, should be used.

Following this, the gradient/slope is considered as another element (**table 5**), which gives an ‘**Index**’. These are then added together to determine the ‘**Head Fire Index**’ which is then entered into column 4 of **Appendix ‘A’**. For interest the ‘**Head Fire Behaviour**’ group can then be determined, by referring the Head Fire Index to the adjacent column of **table 6**.

Refer to tables 4 and 5 on page 7

Fuel Age (YSLB)	'Index Values' for Fuel Types against Years since last Burnt (YSLB)						
	Forest <10 metres	Forest >10 metres	Woodland	Karri Forest	Coastal Heath	Pine Plantation	Ag Land/Private Property
0-2	5	7	5	5	5	20	20
3-4	15	20	12	10	10	55	20
5-6	50	60	45	15	50	60	20
7-8	65	75	55	50	55	75	20
9-10	75	85	65	55	70	80	20
11-12	80	90	70	60	75	80	20
13-14	80	90	70	70	75	80	20
15-20	80	90	70	80	80	80	20
20+	80	90	70	80	80	80	20

Table 4 – Rate of spread against bushfire fuel structure

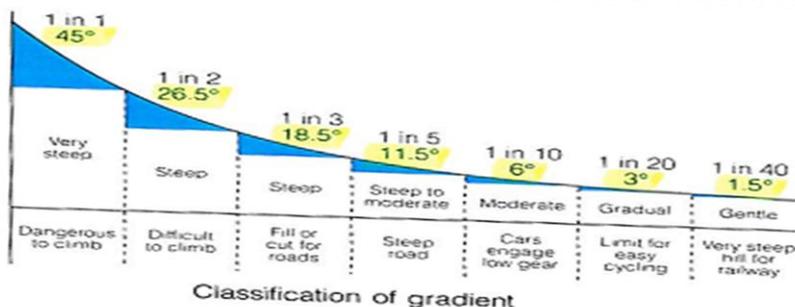
Note:

This table is designed to consider typical SW region fuel types. Further assessment would be required for other areas within the State.

Slope in degrees	Index	Slope in degrees	Index
0	0	30	60
5	10	35	65
10	20	40	70
15	30	45	75
20	40	50 +	80
25	50		

Table 5 – Slope leading to head fire index – consider mean slope for land parcel

Hint: Consider the mean slope of the ground within 300 metres of the asset being protected



Step 5 – Determine suppression capability – Evaluate risk ‘C’

This stage leads to the development of a rating, relevant to the suppression time (based on consideration of the factors: (a) being bush fire detection time + (b) travel time of suppression resources + (c) the time taken to construct 1 kilometre of fire-line (a bare earth break around the fire)). The result is a **response capability classification**, calculated in minutes.

6.1 Detection Time

Detection time is the first factor in the determining the response capability classification. For the more remote areas of the state, a fire may be able to develop to full rate of spread (ROS), before it is noticed and reported. This would have to be factored into the risk equation. For the south west region of WA, it is likely that a fire would be noticed relatively quickly, due a range of detection measures, especially where valued assets would be at risk. Therefore, it will be concluded that this may well happen within 30 minutes.

Where the subject property/values cannot be considered to enjoy this level of surveillance, careful reconsideration may need to be given to this element.

Decide on the time (in minutes) that it would be reasonably expected to take, for a fire to be detected in the subject piece of land.

Detection Time	Score
Within 15 Minutes	15
15-30 Minutes	30
31- 60 Minutes	60
61 – 120 Minutes	120
>120 Minutes	180

Table 7 – Bush Fire Detection Time

Travel Time

This is the presumed time taken for ground-based fire-fighting resources to be notified and travel to a fire and begin suppression effort, after detection of the fire. The determinants considered are distance to travel, the road surface, maximum road speed of fire trucks, etc.

The function of water-bombing aircraft is to provide a first strike capacity, to ‘buy’ the ground resources time, while they are mobile to the incident. For this reason, during this stage of the study, only consider travel time for ground resources.

The following table/matrix indicates the various travel time groups.

Travel time – Ground Resources	Score
Within 15 Minutes	15
15-30 Minutes	30
31- 60 Minutes	60
61 – 120 Minutes	120
>120 Minutes	180

Table 8 – Travel Time Factor**6.3 Fire-line Construction rates**

This standard is a function of the time taken to construct a kilometre length of fire-line (bare earth line around a fire). As a rough guide, the DEC 'Red Book' (specifically tables 9.2.3.1 and 9.2.3.2) can be used to estimate rates of construction, considering available machine types and the type of ground. Travel time for these earth-moving resources to arrive, must also be included.

In the case that a decision would be taken not to create bare-earth breaks (reserve too small, or acid sulphate prone soils, swampland, etc.) calculate the time it would reasonably take to create 1 km of a fire-limiting buffer, or any other thing that would be done to stop the spread of fire.

The following table indicates five classes for this process.

Class	Time/kms	Description of Setting	Score
Easy	< 30 mins	Within 1 km of road, or cleared/cropped land and not in machine sensitive area (caves, erosion potential, etc.)	Decide on the <i>actual minutes</i> , & then enter as the 'Score'. <i>These classes are provided to aid decision-making, through the descriptions.</i>
	30-60 mins	As above, but complex (slope, less suitable machine, heavy veg)	
Moderate	61 – 90 mins	>1 km from road, in remnant vegetation, and not in a machine sensitive area.	
	91 – 120 mins	As above, but complex (slope, less suitable machine, heavy veg)	
Difficult	> 120 mins	Inaccessible terrain and/or machine sensitive area.	

Table 9 – Fire Line Construction Classes.

NOTE: For plantations (where compartments of <50 hectares are constructed) it is acknowledged that 'breaks' would not normally be built. For this process, construction time should still be considered.

For wetlands (or other areas where a machine would not normally be utilised to construct mineral earth breaks), consider the time taken to construct/develop 1 km of whatever fire containment process would normally be used. Your local Fire Control Officer (FCO) would be able to provide this advice.

6.4 Fire Suppression Response Time

The preceding three scores (in minutes) are added together, to arrive at the total time required to detect and respond to a fire and then construct one kilometre of fire-line. This total will then be a factor to be considered in the vulnerability of an asset to bush fire.

Total Response Time (mins)	Resultant Response Class
< 119	Immediate
120 - 150	Rapid
151 – 180	Moderate
181 - 240	Slow
240 +	Poor

Table 10 – Total Bush Fire Suppression Response Capacity Classes.

Step 6 – Resultant vectors of risk

The consideration of the four factors (bush fire risk categories (*table 2*), risk of ignition (*table 3*), head fire behaviour (*table 6*) and suppression response class (*table 10*)), enables a determination of the overall threat rating, for the study area. *Table 11* (below) suggests an ‘Index Value’ score for each of the factors which, when added together, can be used to determine and quantify bush fire threat. This is the ‘**Resultant Index Value**’ and added to **Appendix ‘A’** (Column 6).

The process as far as this workshop goes is now complete. The information will now be added to the Shire’s Bushfire Risk Register. Treating the high risk areas by the application of the most suitable mitigation measures will now be subject of planning and available resource allocation. The Bushfire Risk Register and Treatment Schedule is a public document and are available by application to the Shire of Denmark.

Thank you for your participation