

SOUTH WEST EMERGENCY MANAGEMENT DISTRICT

Risk assessment report

'Highlighting potential disaster impacts'

Disclaimer:

The risk assessment results discussed in this report are based explicitly on the credible worst-case hazard scenarios outlined in Section 2 and the views of those who participated in each risk assessment workshop. Risks and impacts other than those discussed here are possible depending on the nature of future hazards.

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Front and back cover: Canal rocks - courtesy of Heather Taylor.

The SEMC's State Risk Project is an initiative of the State Government of Western Australia and is joint-funded under the Commonwealth Government's National Partnership Agreement on Natural Disaster Resilience.



Version	Date	Comments
1.0	29/05/2017	Version complete.

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Executive summary

This document summarises the results of the *State Risk Project* risk assessment workshops conducted in the South West Emergency Management (EM) district. It covers five priority hazards, as identified by the South West District Emergency Management Committee (DEMC): animal or plant pests or diseases (animal and plant biosecurity), fire (bushfire), electricity supply disruption, flood and storm. The impacts of these five hazards were assessed across five key impact areas (economy, public administration, people, environment and social setting) as 252 specific risks, called risk statements.

Within the larger emergency risk management process, this report sits between the risk analysis and risk evaluation steps as it presents the results of the analysis to stakeholders to evaluate which risks require treatment (Figure 1).

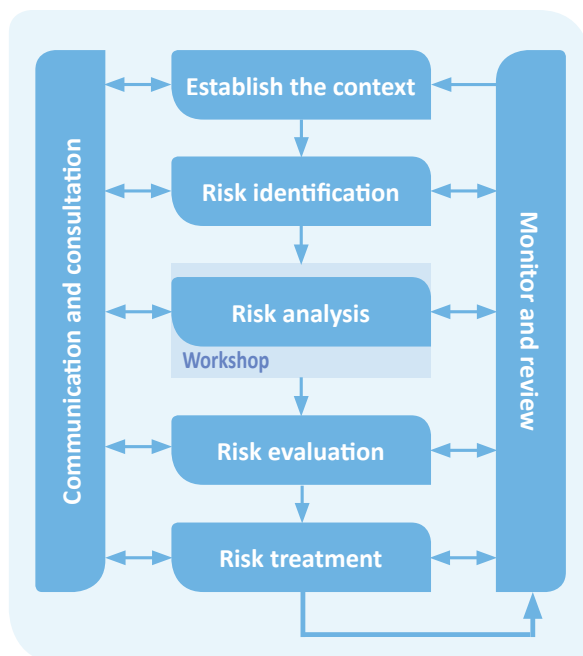


Figure 1: Emergency risk management process¹.

Twenty-eight agencies were represented and the workshop series followed the methodology and criteria outlined in the *Western Australian Emergency Risk Management Guide 2015* and the *National Emergency Risk Assessment Guidelines 2015 (NERAG)*². The risks were assessed using the tailored *NERAG* consequence table for the South West EM district. The consequence levels are based on the gross area product (\$15.630 billion) and the population (180,776) of the EM district (Appendix C).

The assessment results for the five hazards reveal that there are no extreme risks, 25% of the risks were assessed as high, 27% were medium, 30% were low and 18% were very low. In addition, about 5% of the risks could produce catastrophic consequences.

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² *National Emergency Risk Assessment Guidelines* (2015) Australian Government Attorney-General's Department

The flood hazard stands out as it has the highest number of high and medium risks, 31% and 38% respectively. Impacts include increased demand on public facilities for evacuation and shelter, disruption of the tourism industry, and damage and inundation of agricultural land. The flood scenario is anticipated to cause damage and disruption to roads, bridges and freight routes. It is thought that most bridges in the district would stand during this scenario, although abutments could experience erosion and be damaged. This damage could result in financial losses of \$64 million (a major consequence), although repairs could be carried out relatively quickly. Disruption to travel on the South Western and Forrest Highways is of particular concern.

All hazards pose a risk to human life and the majority (60%) of the risks in the people impact category are high risks. The animal and plant biosecurity, bushfire and storm scenarios have the potential to create catastrophic impacts (greater than 19 fatalities or greater than 181 serious injuries). With respect to the animal and plant biosecurity hazard, the potential deaths are related to suicide as foot and mouth disease would not cause fatalities directly.

Nearly five per cent of the assessed risks could produce catastrophic consequences for the South West district. These relate to the animal and plant biosecurity hazard (five statements), storm (two statements) and bushfire (five statements). These risk statements relate to the death and injury of people, disruption to meat exports, damage to marine infrastructure, impacts to electricity infrastructure and coal mines, and the costs of recovery activities.

The animal and plant biosecurity scenario poses catastrophic consequences to the South West economy. A potential outbreak of foot and mouth disease (FMD) could impact farm revenues, meat exports and the meat processing industry, cause business failure and result in significant costs associated with the destruction and disposal of livestock. A key factor influencing the risk is the duration of the event, which could extend for several years, which would be nation-wide and could take up to 10 years to fully recover. Response and recovery activities are likely to be significant and result in large costs.

The storm scenario could cause extensive damage (>\$625 million) to ports and marinas including vessels, reducing their operations. The bushfire scenario could produce catastrophic consequences to electricity infrastructure, including the Muja Power Station.

Electricity supply emerges as the utility which is impacted by multiple scenarios: bushfire, flood, storm and electricity supply disruption. One of the fires in the bushfire scenario occurs south of Muja and it is anticipated that it would significantly damage the power station and enter the coal mine which supplies the power station, disrupting generation. The scenario would require recovery activities resulting in considerable costs (>\$625 million) to the district. The ensuing power outages and communication failures would affect the dissemination of information to the public. This was considered a high risk for the community's wellbeing as well as keeping them informed on the emergency situation. There is a similar concern for the electricity supply scenario where dissemination of public information would be impacted by the loss of power. Wind damage from the

storm and damaged assets (including underground assets) from the flood would result in high costs and cause supply disruptions. Access to damaged sites to carry out repair work could also be an issue during a flood. In addition, power supply disruption has a notable influence on water and sewerage systems such that pumps would not work.

The electricity supply disruption scenario leads to the only high risk for the environment impact area. During the course of the five days of the power outage there is a high chance of sewage being spilled into the environment as pumps would not be working. The impact to the environment will depend where sewage is spilled; the Busselton sewerage treatment plant is located next to a state-recognised wetland. Significant infrastructure has been put in place by the Water Corporation to prevent spills into this wetland. However, if sewage is spilled, clean-up and ongoing environmental monitoring would need to be carried out.

The *NERAG* uses a prioritisation system to rank risks for treatment decisions and/or for further investigation. There are no Priority 1 (highest priority) statements, 4% are Priority 2, 28% are Priority 3, 16% are Priority 4 and 52% of the statements are Priority 5 (lowest priority). The following table (Table 1) shows the Priority 2 statements in full and those risk statements with catastrophic consequences. Catastrophic consequence statements are included because if these impacts do occur they could potentially stretch or outstrip the district's resources and therefore should be considered during the treatment phases.

Table 1: Risk statements for the South West EM district with Priority level 2 or catastrophic consequences. Note: AP Bio = animal and plant biosecurity; Elec = electricity supply disruption.

Hazard	Risk statement	Impact area	Consequence	Risk level	Confidence level	Priority level
AP Bio	will impact exports (e.g. due to restrictions imposed by importing countries), resulting in financial losses.	Economy	Catastrophic	High	High	2
AP Bio	will impact the meat processing industry, resulting in financial losses.	Economy	Catastrophic	High	Moderate	2
AP Bio	will result in response and recovery activities (including animal destruction, environmental clean-up), resulting in costs to the district.	Economy	Catastrophic	High	High	2
AP Bio	will impact the health of people and cause death(s).	People	Catastrophic	High	Moderate	2
AP Bio	will impact the health of people and cause injury and/or serious illness.	People	Catastrophic	High	High	2
Storm	will impact the health of people and cause death(s).	People	Catastrophic	High	High	2
Elec	will affect the Department for Child Protection and Family Support, impacting their ability to deliver core services.	Public administration	Major	High	Low	2
Elec	will disrupt sewerage systems causing sewage to spill into the environment, causing contamination.	Environment	Major	High	Low	2
Flood	will damage/inundate private buildings and contents, resulting in financial losses.	Economy	Major	High	Moderate	2
Bushfire	will impact electricity infrastructure, resulting in damages to lines and power outages, incurring costs to the district and financial losses.	Economy	Catastrophic	High	Highest	3
Bushfire	will result in recovery activities, resulting in costs to the district.	Economy	Catastrophic	High	Highest	3
Bushfire	will cause significant disruption to coal mining resulting in failure to generate electricity, resulting in financial losses.	Economy	Catastrophic	High	Highest	3
Bushfire	will impact the health of people and cause death(s).	People	Catastrophic	High	Highest	3
Bushfire	will impact the health of people and cause injury and/or serious illness.	People	Catastrophic	High	Highest	3
Storm	will cause damage to vessels, marinas, marine infrastructure, boat ramps and/or major ports, resulting in recovery costs and/or financial losses.	Economy	Catastrophic	High	Highest	3

1 Introduction

A series of risk assessment workshops were conducted in the South West Emergency Management (EM) district as part of the *State Risk Project*. The project aims to assess the risk posed to the state from all prescribed hazards using a consistent and comprehensive approach. This approach follows the ISO 31000:2009 standard and the methodology outlined in the *National Emergency Risk Assessment Guidelines (NERAG) 2015*. By assessing risks at state, district and local levels, this approach allows for comparison and the prioritisation of future resources with an emphasis towards prevention and preparedness activities.

Initially, the highest priority hazards for each district are assessed. The five priority hazards for the South West EM district, as identified by the South West District Emergency Management Committee (DEMC) are: animal and plant biosecurity, fire (for this assessment only bushfire was considered and is hereafter referred to as bushfire), electricity supply disruption, flood and storm. All hazards were assessed in a workshop setting (see Table 2 for schedule) and used a credible worst-case hazard scenario. The credible worst-case scenarios were developed by relevant hazard experts and are chosen with the rationale that planning and risk reduction activities for the largest event will address impacts of smaller events, even if the smaller events are more frequent.

During each workshop, presentations were given by relevant experts to provide the hazard context, outline the anticipated district vulnerabilities and impacts and describe the scenario. Following this, as a group, the participants work through a series of risk statements to estimate the potential consequences of the scenario event. Each risk statement depicts an impact that is likely to eventuate given the scenario (see Table 1 for examples) and is collectively assigned a likelihood, consequence and confidence level using the *NERAG 2015* criteria. Discussion was encouraged among participants allowing different aspects of the hazards and impacts to be evaluated. Decisions were based on group consensus. Risk statements are grouped into five impact areas: economy; people; public administration; social setting; and environment with an average of 50 risk statements assessed per hazard.

Data were captured and analysed following the workshop. The results are presented in this report.

Table 2: Location and date of risk assessment workshops.

Hazard	Location of workshop	Date of workshop
Animal and plant biosecurity	Bunbury	8 November 2016
Bushfire	Busselton	8 September 2015
Electricity supply disruption	Bunbury	30 August 2016
Flood	Bunbury	8 June 2016
Storm	Bunbury	27 October 2015

For each workshop, a range of representatives from relevant stakeholders in the district were invited. Agency representation for the workshops is shown in Table 3.

Table 3: Agencies involved in each risk assessment workshop for the South West district, listed in alphabetical order. Note: AP Bio = animal and plant biosecurity; Elec = electricity supply disruption.

Agency	Hazard				
	AP Bio	Bushfire	Elec	Flood	Storm
Bureau of Meteorology				x	
City of Bunbury		x		x	
City of Busselton		x		x	
Department for Child Protection and Family Support		x		x	x
Department of Agriculture and Food WA	x	x	x	x	x
Department of Defence		x		x	
Department of Education		x			x
Department of Fire and Emergency Services	x	x	x	x	x
Department of Health	x			x	
Department of Parks and Wildlife	x	x	x	x	x
Department of Transport	x	x		x	x
Department of Water				x	
Main Roads WA	x	x	x	x	x
Office of Emergency Management (Facilitators)	x	x	x	x	x
Premier Coal		x			
Public Utilities Office			x		
Shire of Bridgetown-Greenbushes					x
Shire of Capel	x			x	
Shire of Collie		x	x		
Shire of Dardanup	x	x			x
Shire of Harvey		x			
Shire of Nannup		x		x	
South West Local Government Emergency Management Alliance		x			
Telstra					x

Agency	Hazard				
	AP Bio	Bushfire	Elec	Flood	Storm
WA Country Health Service		x	x		x
WA Police		x	x	x	
Water Corporation			x	x	x
Western Power		x	x	x	x
Worsley Alumina		x			

2 Hazard scenarios

Five hazards were assessed for the South West EM district. Hazard scenarios were developed with the assistance of:

- Bureau of Meteorology (BOM)
- Department of Fire and Emergency Services (DFES)
- Department of Food and Agriculture WA (DAFWA)
- Department of Parks and Wildlife (P&W)
- Public Utilities Office (PUO)
- Synergy
- Western Power

Animal and plant biosecurity scenario

The animal and plant biosecurity scenario was developed by DAFWA and has approximately a 0.995% chance of occurrence in any given year.

An outbreak of foot and mouth disease (FMD) occurs in Queensland (QLD) and New South Wales (NSW) but is initially undetected. Four goats are transported overland from QLD via the checkpoint at Eucla. The owners are given a direction notice to travel to Kalgoorlie for inspection but ignore it, traveling to Burekup instead. The four goats are placed on a semi-rural block where vealers are raised from bobby calves. The goats begin to show some symptoms but these are dismissed as effects of the long trip.

FMD is transferred to the vealers through the fence within one to two days of the goat's arrival. The vealers initially incubate FMD without showing any symptoms. Three days after the goats arrive on the block all 24 vealers are sent to the Boyanup sales yard.

At the Boyanup sales yard 17 vealers are bought by a Busselton farmer; the remaining seven are sold to a farmer from Manjimup. The sales conclude with a total of 1128 cattle sold to 69 properties. Most of the properties are located within the South West district with some sent to feedlots in Mundijong, Tammin and Borden.

A national livestock standstill is called on the day after the Boyanup sales due to the outbreak in QLD and NSW.

Table 4 shows the number of stock infected with FMD over time in Western Australia (WA).

Table 4: Number of farms and stock infected by the foot and mouth disease scenario in the South West. Data from DAFWA.

Days after outbreak	Number of SW farms affected	Cumulative number of animals infected		
		Cattle (beef & dairy)	Sheep, goats & alpacas	Pigs
4	11	6820	504	2000
7	15	~8000	~700	2000
14	18	~9000	~800	2000
21	20	~9500	~800	2000

Bushfire scenario

The bushfire scenario was developed by BOM, DFES and P&W and has approximately a 0.995% chance of occurrence in any given year.

During an extended dry, hot period, a series of dry thunderstorms move over the South West. Winds are initially from the north-east, shifting to the north-west by late morning. A further wind shift occurs mid-afternoon shifting to the south-west and strengthening to approximately 90 km/h. The maximum temperature is in the low 40s with a minimum relative humidity of approximately 5%.

Fire danger indices are in excess of 100, with warnings issued for catastrophic fire conditions. A band of thunderstorms produce multiple dry lightning strikes, igniting multiple fires around the region.

Fire 1 is located in Collie near coal mines and power infrastructure (Figure 2). Fire 2 forms from two smaller fires in the Dunsborough and Cape Naturaliste areas which converge to form a major fire moving south impacting Yallingup, Cape Naturaliste, Dunsborough and Wilyabrup (Figure 3).

The fires start on 27 December 20XX. During the Christmas and New Year period, the population in the Cape Naturaliste area is nearly double its normal size due to holiday makers. Many of these visitors would be unfamiliar with the small roads in the area. Some of the subdivisions are also in forested areas and have winding roads.

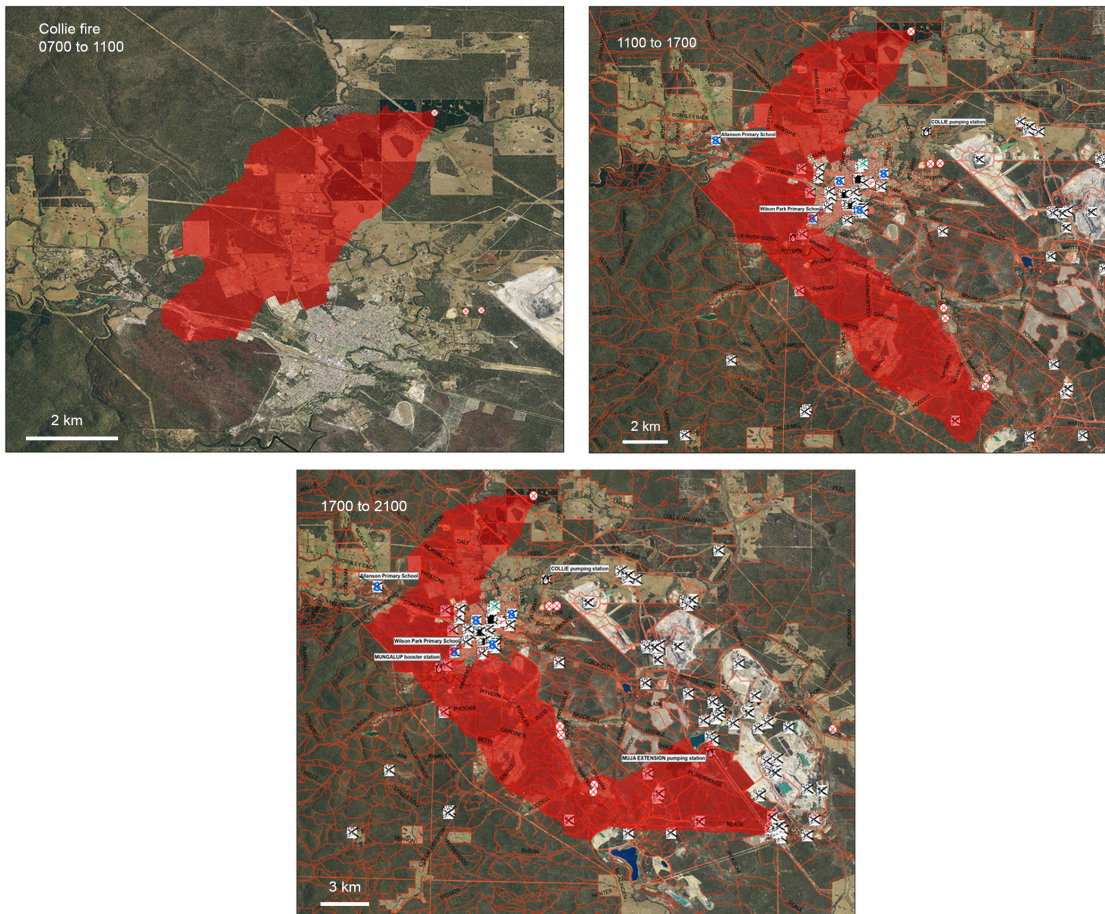


Figure 2: Collie fire (Fire 1) from 0700 to 1100; 1100 to 1700; and 1700 to 2100. Maps supplied by DFES.



Figure 3: Dunsborough fire (Fire 2) from 0700 to 1100; 1100 to 1700; and 1700 to 2100. Each yellow dot represents a dwelling. Maps supplied by DFES.

Electricity supply disruption scenario

The electricity supply disruption scenario was developed by PUO, Western Power and Synergy and has approximately a 0.995% chance of occurrence in any given year.

During a hot December weekend with extreme fire weather conditions, two bushfires are ignited – one south of Bunbury and one south of Muja.

The two bushfires cause significant damage and disruption to two Western Power electricity transmission lines which supply the lower South West district (Figure 4). This damage causes electricity to be cut off to the lower South West (south of Bunbury).

Western Power are unable to start repairing the damage for two to three days due to fire cordons. Once Western Power are able to get to their transmission lines, it takes

approximately another two to three days to repair the damage. This results in a power outage of four to five days for the lower South West affecting approximately 180,000 customers and any tourists. Bunbury Regional Prison is close to Fire 1 and would lose electricity. Bussell Highway remains open but the South Western Highway is closed.

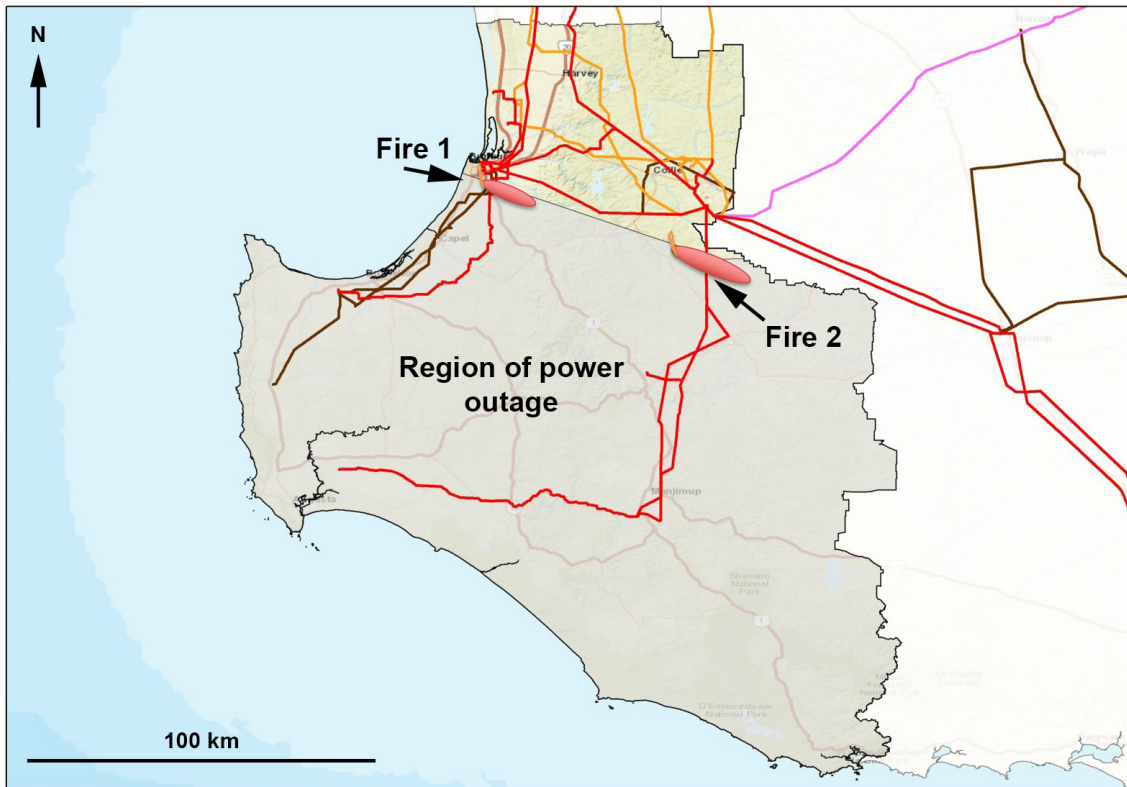


Figure 4: Region of power outage (grey shading) in the lower South West as a result of two bushfires impacting Western Power transmission lines. Coloured lines show transmission lines.

Flood scenario

The flood scenario was developed by BOM and has approximately a 0.499% chance of occurrence in any given year.

During the Australia Day weekend, the remnants of a tropical cyclone with a rainband result in heavy rainfall over the South West district over three to four days. Over 300 mm of rain falls over three days with a peak daily rainfall of 150 mm. Above average rainfall in the year preceding the event and wet catchments from rain in the weeks prior have exacerbated flooding.

Major flooding occurs in a number of locations in the South West including the following catchments (Table 5): Busselton Coast (2 days peak); Collie (1 day peak); Harvey (2 days peak); Lower Blackwood (3 days peak); Preston (2 days peak); Shannon River (2 days peak); and Warren River (2 days peak).

Table 5: Estimated flood severity over the course of the rainfall event for seven catchments.

Flood severity	Below minor	Minor	Moderate	Moderate	Moderate	Moderate	Moderate	Major	Major
Catchments	20/1	21/1	22/1	23/1	24/1	25/1	26/1	27/1	28/1
Harvey	Below minor	Minor	Major	Major	Moderate	Moderate	Minor	Below minor	
Collie	Below minor	Minor	Moderate	Major	Moderate	Minor	Below minor		
Preston	Below minor	Moderate	Moderate	Major	Major	Moderate	Minor	Below minor	
Busselton Coast	Below minor	Moderate	Moderate	Major	Major	Moderate	Minor	Below minor	
Blackwood (lower)	Below minor	Moderate	Moderate	Major	Major	Major	Moderate	Minor	Below minor
Warren River	Below minor	Moderate	Moderate	Major	Major	Moderate	Minor	Below minor	
Shannon River	Below minor	Moderate	Moderate	Major	Major	Moderate	Minor	Below minor	

Storm scenario

The storm scenario was developed by BOM, DFES and P&W and has approximately a 0.995% chance of occurrence in any given year.

A cool season front across a large part of the South West brings strong winds and heavy rain to many parts of the district. The storm occurs during the July school holidays.

During the storm, two tornadoes form and impact Bunbury and Busselton. The Bunbury tornado travels for 5-10 km through the Bunbury Port, Australind and the Kemerton Industrial Site (Figure 5). The Busselton tornado forms off the coast of Cape Naturaliste before travelling inland between Dunsborough and Busselton townsites (Figure 6).

The storm system impacts multiple locations and key assets including the Bunbury Port, tidal gates, schools, shopping centres, industrial sites, farms, residential areas and tourist facilities.

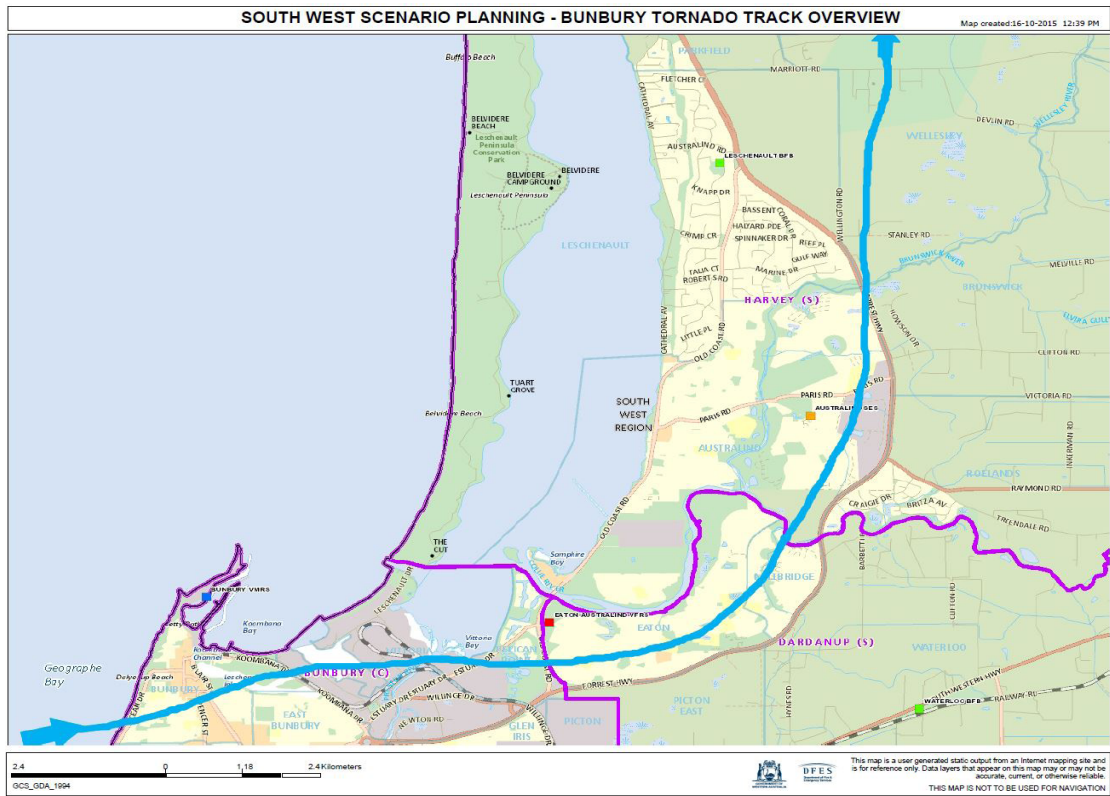


Figure 5: Bunbury tornado track overview. Map supplied by DFES.

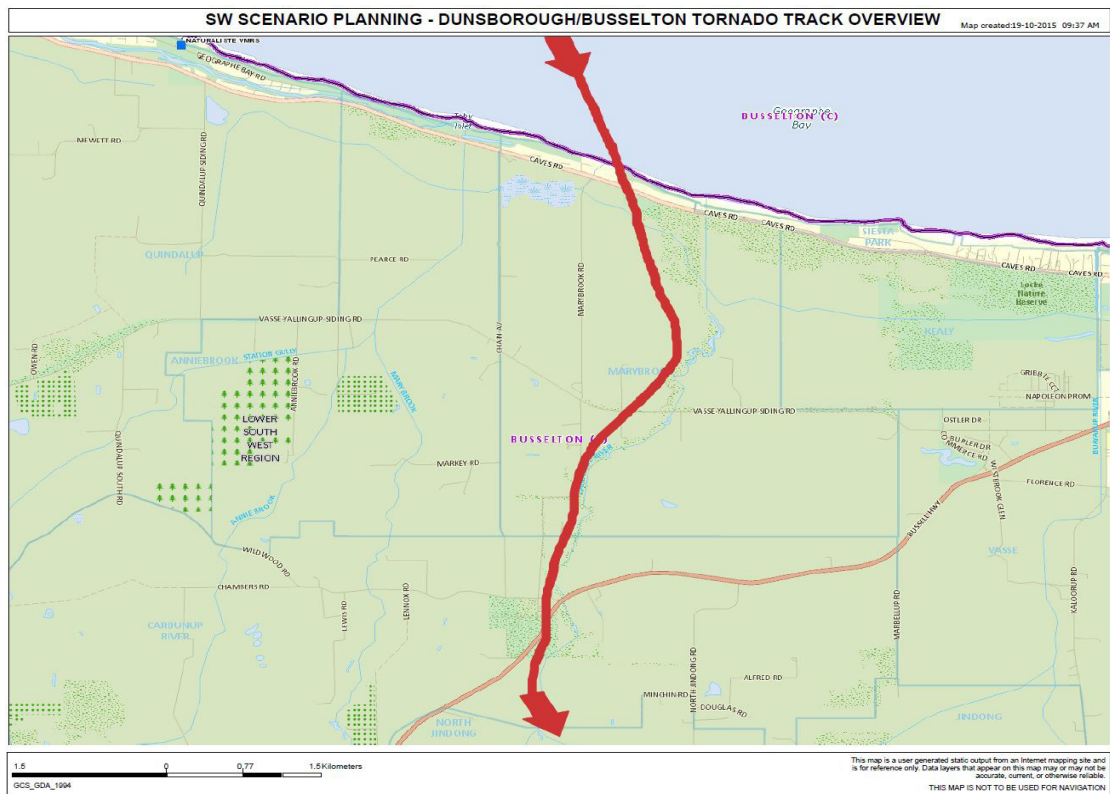


Figure 6: Dunsborough/Busselton tornado track overview. Map supplied by DFES.

3 Assessed risk statements

A total of 252 risk statements were assessed across the five hazards: animal and plant biosecurity (43); bushfire (59); electricity supply disruption (46); flood (48); and storm (56).

Table 6 shows the number of risk statements for each hazard separated into the five impact areas (economy, public administration, people, environment and social setting).

The statements were generated to cover all foreseen impacts of the scenario events across the five impact areas.

The risk statements were assessed using the tailored *NERAG* consequence table for the South West EM district found in Appendix C. The consequence levels are based on the gross area product (\$15.630 billion) and the population (180,776) of the South West EM district.

Table 6: Number of risk statements assessed for each hazard in the South West district. Note: AP Bio = animal and plant biosecurity; Elec = electricity supply disruption.

Hazard	Impact area				
	Economy	People	Public administration	Social setting	Environment
AP Bio	14	2	15	9	3
Bushfire	17	5	15	17	5
Elec	14	4	16	9	3
Flood	14	5	17	8	4
Storm	19	4	14	13	6

4 South West EM district risk profile

The risk profile for the South West EM district for the five assessed hazards is shown in Figure 8 (following page). This diagram shows the percentage of risk statements for each hazard as they sit on the *NERAG 2015* risk matrix. The matrix is used to categorise risk statements by their likelihood, consequence and risk level. The bar graph below (Figure 7) combines the data and categorises it by hazard and risk level.

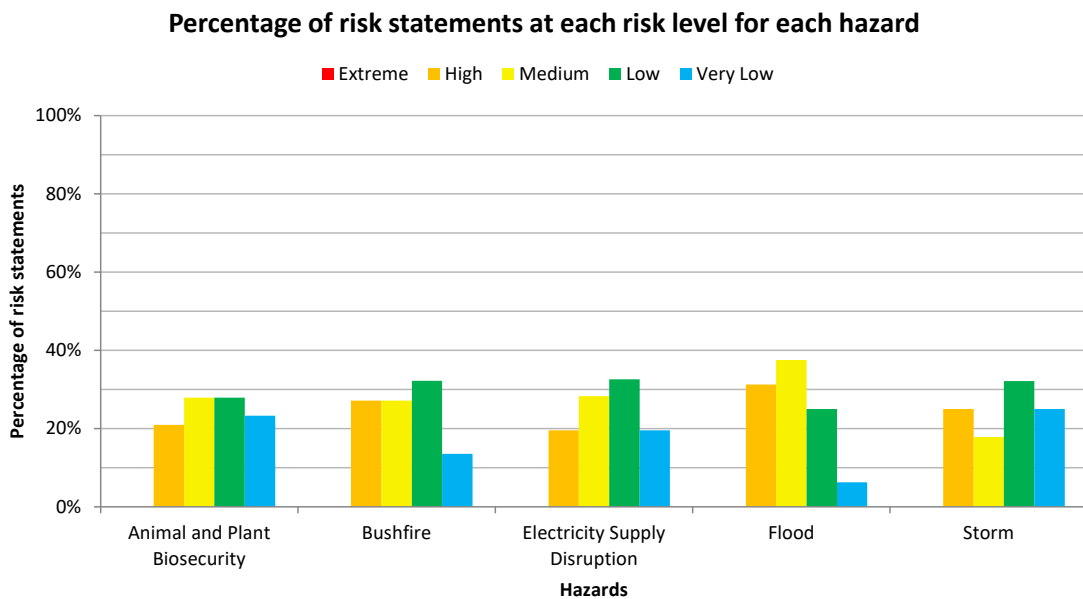
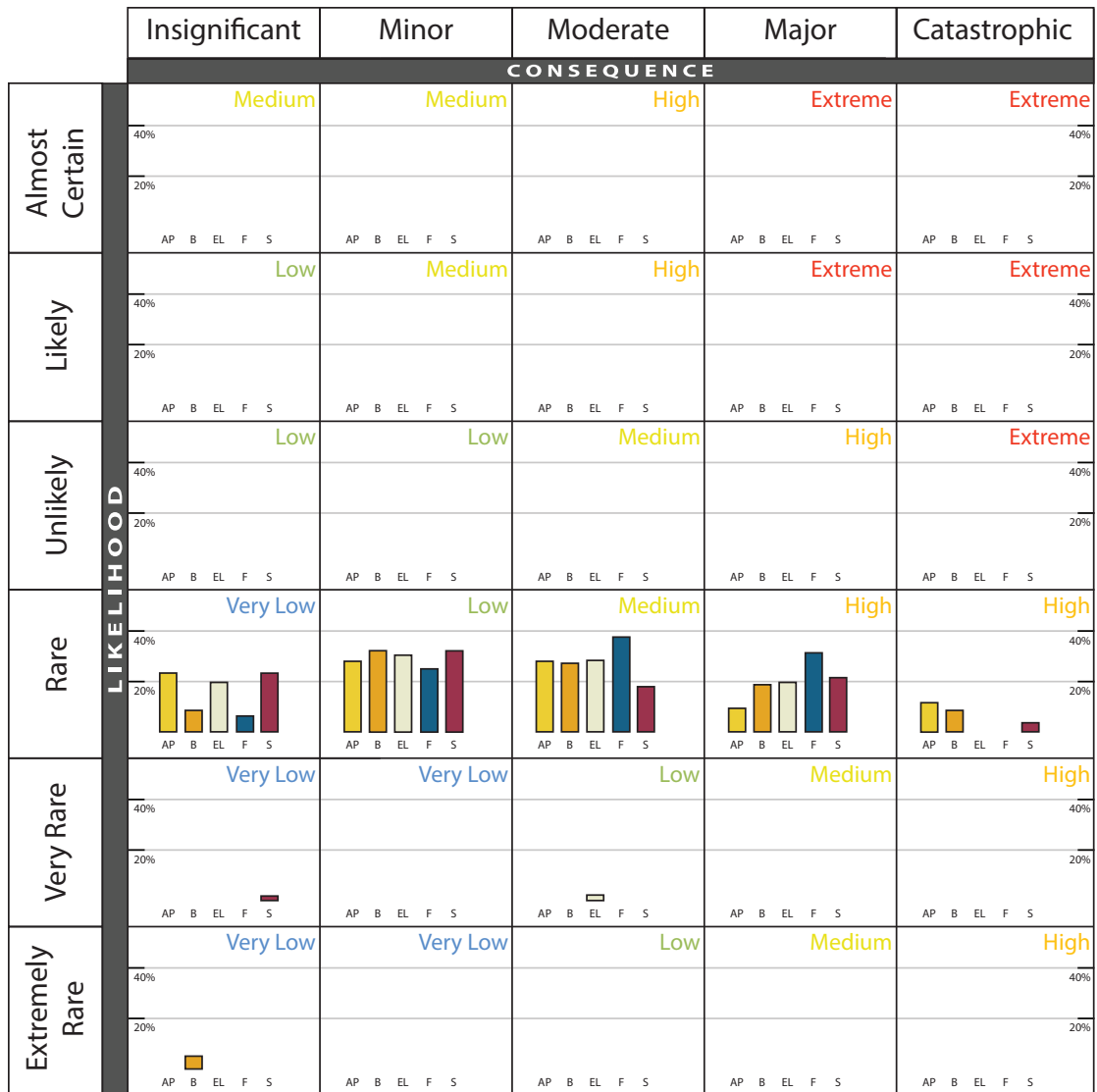


Figure 7: Percentage of risk statements at each risk level for each hazard. Note each hazard sums to 100%.

Of the 252 statements assessed for all five hazards, 25% are high risks, 27% are medium, 30% are low and 18% are very low risks. Individual hazard risk assessment summaries can be found in Appendix A.

Figures 7 and 8 show that individual hazards have roughly an equal number of risk statements at each risk level. Flood is the exception, having the highest percentage of high and medium risks across the five hazards. Notable high risks for flood are an increased demand on public facilities for evacuation and shelter, damage to road transportation infrastructure, disruption of the tourism industry, and damage and inundation of agricultural land.

South West EM District Risk Profile



Legend

- Animal & Plant Biosecurity (AP)
- Bushfire (B)
- Electricity Supply Disruption (EL)
- Flood (F)
- Storm (S)

Key

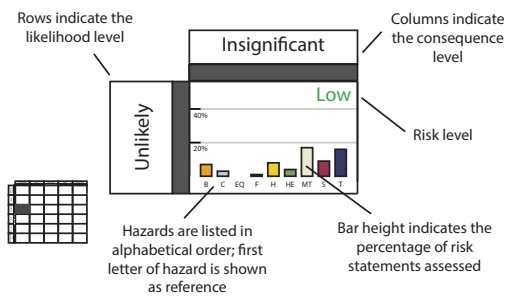


Figure 8: Percentage of risk statements for each hazard assessed in the South West EM district, categorised by their likelihood, consequence and risk level.

Most of the risk statements have been assessed with minor (30% of the statements) or moderate (28%) consequences. However, about 5% of the assessed risks could produce catastrophic consequences for the South West EM district. The risk matrix (Figure 8) shows there are high risks from the animal and plant biosecurity (5 statements), bushfire (5) and storm (2), which have catastrophic consequences. These risk statements relate to the death and injury of people, impacts to electricity infrastructure and coal mines, damage to marine infrastructure, disruption to meat exports and recovery activities. These catastrophic consequences can stretch or strain the district’s resources and should be considered during the risk treatment phase.

Another way to look at the risks to the South West EM district is by separating them into the five impact areas (Figure 9). The people impact area has the largest proportion (60%) of high risks followed by economy (32%) and public administration (29%) because of the high impact the hazards have on the district’s population, economy and governing agencies’ activities. The environment and social setting impact areas are dominated by low risks (Figure 9).

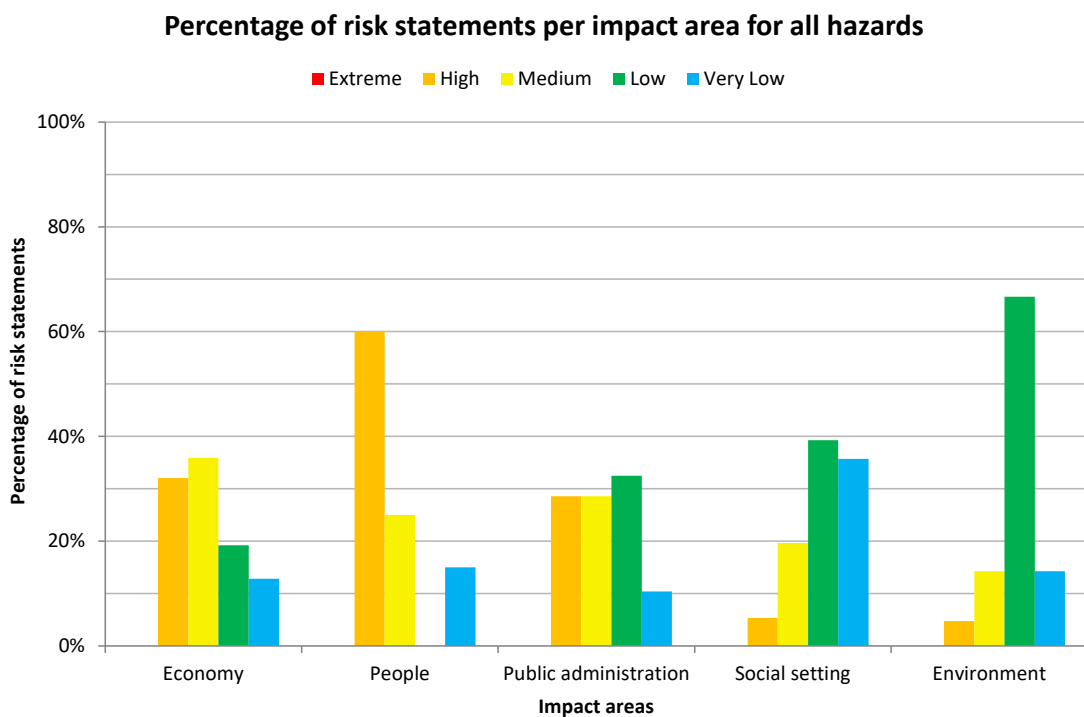


Figure 9: Percentage of risk statements per impact area for all hazards. Note each impact area sums to 100%.

Common themes from high risk statements

ECONOMY



- Damage and disruption to transportation infrastructure and freight routes.
- Impacts to agriculture and pastoral activities including meat exports, resulting in a loss of revenue.
- Damage to private and commercial buildings and contents, resulting in financial losses.
- Impacts to communication and power infrastructure.
- Disruption to tourism activities resulting in financial losses.
- Require response and recovery activities resulting in costs to the district.

PEOPLE



- Emergency events causing injuries/illnesses (*for animal and plant biosecurity and bushfire these are catastrophic consequences*).
- Emergency events causing deaths (*for animal and plant biosecurity, bushfire and storm these are catastrophic consequences*).
- Increased surge on emergency services.

PUBLIC ADMINISTRATION



- Surge on emergency and government services, impacting their ability to maintain core functions.
 - Increased demand on public facilities for use as welfare and evacuation sites.
 - Disruption to power, water and sewerage service delivery.
 - Response and recovery activities by local governments and state agencies disrupting their normal services.
 - Increased public information management (*electricity supply disruption only*).
-

SOCIAL
SETTING



- Loss of income and employment (*bushfire only*).
- Lack of timely public information, warnings and general communication as a result of disrupted power supply (*bushfire only*).
- Damage to private homes affecting community wellbeing.

ENVIRONMENT



- Disruption to sewerage systems causing environmental contamination (*electricity supply disruption only*).

5 Analysis of risk profile

In order to understand any potential relationships, the assessed risks have been grouped into categories to determine common themes or if certain areas and sectors are at higher risk.

In the following tables, risk statements are represented by showing the hazard name under the assigned risk level. Where a number follows the hazard name, more than one statement from that hazard fits into that category and risk level. There may also be more than one statement for a hazard in a category. For example, statements addressing horticulture, crops and agriculture infrastructure would all appear in the impacts to agriculture and pastoral activities category. Risk statements were written for each hazard to address anticipated impacts; therefore there are categories where not all hazards appear.

Risks to economy

Seventy-eight economy risk statements were assessed across the five hazards (Table 7). The statements address impacts to a significant industry or the decline in economic activity across the district (see Appendix C for criteria).

Table 7: Impacts to economy by hazard and risk level. Note: AP Bio = animal and plant biosecurity; Elec = electricity supply disruption.

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Disruption to transport routes</i>		Flood	Bushfire	Elec Storm	AP Bio
<i>Impacts to agricultural and pastoral activities</i>		AP Bio Flood (2)	AP Bio (4) Bushfire (2) Flood (2)	Bushfire (2) Elec Storm (2)	AP Bio Storm
<i>Impacts to aviation</i>				Flood	Elec Storm
<i>Impacts to bridges or their approaches</i>			Bushfire Storm		
<i>Impacts to commercial activities</i>		AP Bio (3) Elec Storm	Bushfire Elec (2)	AP Bio	Elec
<i>Impacts to commercial buildings, contents and services</i>		Flood Storm	Bushfire		

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Impacts to communication infrastructure</i>		Storm	Bushfire Elec	Flood	
<i>Impacts to marine infrastructure and industry</i>		Storm			Elec Storm
<i>Impacts to mining infrastructure and industry</i>				Elec	
<i>Impacts to natural gas distribution</i>				Storm	
<i>Impacts to power supply infrastructure</i>		Bushfire (2) Flood Storm	Elec		
<i>Impacts to private buildings and contents</i>		Flood Storm	Bushfire		
<i>Impacts to sewerage systems</i>			Elec Flood	Bushfire	Storm
<i>Impacts to tourism</i>		Bushfire Flood	AP Bio Bushfire Elec Storm		
<i>Impacts to transport infrastructure</i>		Flood	Storm		
<i>Impacts to water supply infrastructure</i>			Elec Flood	Bushfire Storm	
<i>Response and recovery activities</i>		AP Bio Bushfire Storm			
<i>Workforce productivity losses</i>					AP Bio

Overall, most (68%) economy risk statements were assessed as either high or medium risk.

Flood and storm had the highest number of high risk statements because these hazards impacted large parts of the district causing financial losses in a number of different areas. This included damage to above-ground infrastructure, such as telecommunication and power supply equipment, as well as coastal and marine infrastructure. The flood scenario was anticipated to cause damage and disruption to roads, bridges and freight routes. It is thought that most bridges in the district would stand during this scenario, although abutments could experience erosion and be damaged. This damage could result in financial losses of up to \$64 million (a major consequence), although repairs could be carried out relatively quickly. The disruption that the flood could cause on the transportation network, particularly the South Western and Forrest Highways could cost at least \$1 million per day due to increased travel time for heavy vehicles.

The flood and storm scenarios were also assessed as causing significant damage to private and commercial buildings. Houses in previous floods in the area were not completely destroyed; however, there are a significant number of older houses across the district that are built to lower building standards and could be destroyed in larger events. Across the district, damage to residential buildings could equate to between \$62.5-\$625 million (a major consequence). Commercial buildings would also sustain damage during these scenarios resulting in similar financial losses. Further losses would result from business closure, with some businesses potentially closed for multiple days.

The animal and plant biosecurity scenario poses a similar number of high risks to the South West economy. A potential outbreak of FMD could impact farm revenues, meat exports, cause business failure and result in significant costs associated with the destruction and disposal of livestock. A key factor influencing the risk is the duration of the event, which could extend for several years. It is expected that there would be a loss of export markets for several years, which would be felt nationwide and could take up to 10 years to fully recover. Response and recovery activities are likely to be significant and result in large costs. There are cost-sharing arrangements for this hazard contained within the Emergency Animal Disease Response Agreement (EADRA), an agreement between Australian state and territory governments and livestock industry groups. For FMD the costs are shared for the response and 'proof of freedom' stages: 20% industry and 80% government (the Commonwealth Government shares 50% of this total).

Disruption of electricity for the lower South West as part of the electricity supply disruption scenario would cause considerable financial losses for commercial activities (major consequences). The loss of power would prevent use of electronic transactions and ATMs in the affected areas as well as petrol station pumps.

The high economic risks from the bushfire scenario stem from impacts to tourism, response and recovery activities and impact to power supply infrastructure. One of the fires in the bushfire scenario occurs near Collie (Figure 2) and impacts the Muja Power Station and coal mine. This was assessed as causing catastrophic consequences such

that the power station would be destroyed and fire would enter the coal mine. This power station is a state strategic asset and would also impact areas outside of the South West EM district.

Risks to people

Twenty risk statements assessed the impact to people across the five hazards. These statements addressed deaths, injuries or illnesses, as well as further deaths or illnesses/injuries as a result of the event's impact on emergency services (primarily medical transport) and on health services. The risk posed to each of these elements by the assessed hazards is shown in Table 8.

Table 8: Impacts to people by hazard and risk level. Note: AP Bio = animal and plant biosecurity; Elec = electricity supply disruption.

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Deaths</i>		AP Bio Bushfire Elec Flood Storm			
<i>Disease outbreak</i>			Flood		
<i>Emergency services</i>		Bushfire Elec	Flood (2) Storm		
<i>Health services</i>			Bushfire		Bushfire Elec Storm
<i>Injuries and illnesses</i>		AP Bio Bushfire Elec Flood Storm			

Deaths and injuries for all hazards were assessed as high risk to the district. Catastrophic consequences were assessed for the animal and plant biosecurity and bushfire scenarios for both injuries/illnesses and deaths, and for the storm scenario for deaths. For the South West EM district, a catastrophic consequence is at least 19 deaths or more than 19 critical injuries with permanent incapacitation, or more than 181 serious injuries (Appendix C). Deaths and injuries for bushfire, flood and storm were related to direct

impacts from the hazards themselves. The fire in the Dunsborough area, during peak holiday season, would affect a significant number of visitors. These individuals may be unfamiliar with local roads, the conditions of bushfires and because they are on holiday, they may not be paying attention to the media or warnings. Confusion and panic could contribute to individuals becoming trapped. The sudden, intense and destructive nature of the tornadoes in the storm scenario could equally be the cause of numerous deaths.

For the animal and plant biosecurity hazard, both the deaths and illnesses relate to the mental health issues anticipated in this scenario. While it is anticipated that there could be a catastrophic consequence (at least 19 deaths), there is a degree of uncertainty. If compared to the FMD outbreak in the United Kingdom in 2001, the impacts of an Australian outbreak would differ. In normal circumstances, Australian suicide rates among farmers are higher than the UK and could be heightened in this event. The UK also has a larger domestic market and was able to recover quicker than the Australian export-based market is expected to. Ultimately, the outcome may rest on the amount of funds invested in the recovery.

Injuries and deaths from the electricity supply disruption scenario could be a result of a road crash due to the number of people using the road and the disruption of traffic lights. There are also a number of people that rely on home-based life support systems (e.g. respirators) which could stop working without electricity, resulting in death. Heat-related deaths and/or injuries could also occur due to the loss of air conditioning systems in people's homes.

Emergency services (e.g. ambulance, medical transport) could become overwhelmed during the bushfire scenario such that there could be additional deaths directly attributable to the hazard. With the electricity supply disruption scenario, the loss of electricity could impact all emergency services, resulting in additional deaths.

Health issues from stagnant water and waterborne disease from the flood were assessed as a medium risk. Public messaging would be critical in preventing a disease outbreak, however there is still a risk as some people would not listen or follow warning messages. Similarly, deaths from a flood would likely be from individuals not heeding warnings and entering the flood waters on foot or in a vehicle.

Risks to public administration

Seventy-seven risk statements were assessed across the five hazards that addressed public administration impacts. These statements pertain to the continuity of an agency's core services. For example, at medium risk or higher, either a significant reduction in services would occur or external assistance from outside the EM district would be required to maintain service levels (see Appendix C for criteria).

Table 9: Impacts to public administration by hazard and risk level. Note: AP Bio = animal and plant biosecurity; Elec = electricity supply disruption.

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Availability of essential supplies</i>			Bushfire		
<i>Demand on public facilities</i>		Flood		Storm	
<i>Disruption of educational services</i>			Elec		
<i>Disruption to aviation services</i>				Elec Flood	Storm
<i>Emergency services</i>		AP Bio Bushfire (2) Flood Storm (3)	Elec	Elec Flood	Bushfire
<i>Government services</i>		AP Bio Elec	AP Bio Elec Flood	Bushfire Elec (3)	Bushfire
<i>Health services</i>		Bushfire	Flood Storm	Elec	
<i>Home-care services</i>			Flood	Bushfire Storm (2)	
<i>Impacts to communication service delivery</i>			Elec Flood Storm	Bushfire	
<i>Impacts to port and marina services</i>		Storm			
<i>Impacts to power supply service delivery</i>		Bushfire Flood Storm	Elec		
<i>Impacts to public transport services</i>				Storm	
<i>Impacts to sewerage service delivery</i>		Elec	Bushfire		Flood
<i>Impacts to water supply service delivery</i>		Bushfire Elec			Flood

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Public information</i>		Elec		AP Bio	
<i>Public unrest</i>				Bushfire	
<i>Response and recovery activities</i>		Bushfire Flood (2)	AP Bio (2) Bushfire Flood (3) Storm (2)	AP Bio (7) Elec	AP Bio (2) Flood

Overall, 29% of the public administration risk statements were assessed as high risk.

The flood and storm hazards would cause a large increase in demand on emergency services due to the widespread nature of these hazards and the number of people requiring assistance. These hazards, and the bushfire, are also likely to cause damage or disrupt road networks, hampering emergency services response. In addition, the storm has a high risk of damaging emergency service buildings, such as the Bunbury and Busselton Police Stations, further impacting their response. The increased demand on Police services for the animal and plant biosecurity is due to the need to maintain cordons/road blocks as part of the national stock standstill to stop the spread of FMD.

The high risk for government services for animal and plant biosecurity relate to the increased demand on DAFWA services. As DAFWA is the hazard management agency (HMA) for this hazard they will be the lead response agency and will likely not be able to provide their other services within the district. Also, because FMD would cause state and nation-wide impacts, it was suggested that this scenario would be managed at a state level.

The increased demand for public facilities was assessed as a high risk for the flood scenario as a number of evacuation centres would likely be set up to accommodate people evacuated from low-lying areas. Because a number of the pre-designated evacuation sites are located in low-lying areas, other public buildings may need to be used.

Damage to the power network from bushfire, flood and storm will require external resources for repairs. With the flood scenario, the main impact will be to the residential electricity distribution network as it is more vulnerable than transmission lines. In addition, any underground power components are susceptible and the duration of the impact would depend on how long these took to dry out. If electricity is lost, which is the case for the electricity supply disruption scenario, impacts to the water and sewerage networks are likely. Pumps within these networks require electricity to operate and without electricity significant additional resources (e.g. backup generators, sewerage pumping trucks) from outside of the South West EM district will be required to keep these networks operating.

The dissemination of public information throughout the electricity supply disruption scenario was assessed as a high risk, especially for the Public Utilities Office (PUO) as they are the HMA for this hazard. Any official messaging from the PUO would be developed in head office in Perth and likely disseminated by Western Power. However, given the loss of electricity and subsequently communication infrastructure, delivering messages to affected customers (about 180,000 customers) would be difficult and mobile information sites may have to be set up at various sites around the district.

Response and recovery activities for bushfire and flood were assessed as a high risk for both state and local governments with significant local government resources being diverted towards recovery efforts. Many local governments would seek assistance from outside of the district or from other nearby local governments.

Risks to social setting

Fifty-six risk statements assessed the impact to the social setting across the five hazards. The social setting focuses on the impacts to community wellbeing, community services and culturally important activities and objects (see Appendix C for criteria). It should be noted that the assessed impacts are for the district community as a whole, not individual local governments or towns.

Table 10: Impacts to social setting by hazard and risk level. Note: AP Bio = animal and plant biosecurity; Elec = electricity supply disruption.

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Availability of essential supplies</i>				Bushfire (2) Elec Flood Storm	
<i>Breakdown of social networks</i>					Bushfire
<i>Community services and events</i>				Bushfire	
<i>Culturally significant facilities and customs</i>				Bushfire	AP Bio Bushfire (2) Storm (2)
<i>Death/injury of animals</i>				Bushfire	Storm

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Displacement or isolation of communities</i>			Bushfire Flood Storm	Flood	AP Bio Elec Storm (2)
<i>Educational facilities</i>				Flood	Bushfire Elec Storm
<i>Facilities for vulnerable people</i>				Bushfire Elec Flood	Storm
<i>Impacts to people's health</i>			Bushfire	Bushfire Flood Storm	Elec
<i>Impacts to tourism</i>			Bushfire		AP Bio (2)
<i>Loss of income</i>		Bushfire	AP Bio (2)	Elec Storm	
<i>Psychological and emotional stress</i>			AP Bio (2)		AP Bio
<i>Public information</i>		Bushfire		Elec	
<i>Public unrest</i>			Elec		
<i>Residential building damage</i>		Bushfire	Flood	Storm	
<i>Social service providers</i>				Elec Flood	Storm

The highest risks to the social setting of the South West EM district relate to loss of income, residential building damage and dissemination of public information as a result of the bushfire scenario. The potential loss of the Collie coal mine, and subsequently the power station, would have a significant impact on local employment such that people move out of the district. It is expected losses from low tourist numbers following the fires would also have an effect. Due to the extent of the two simultaneous bushfires there would be damage to a number of residential buildings and businesses which would impact the community wellbeing. It is anticipated that some residents may permanently move out of the district as a result of these fires. During the bushfire scenario, power outages and communication failures occurred which affects the dissemination of public information. This was considered a high risk for the community's wellbeing as well as keeping them informed on the emergency situation.

There is a medium risk that some communities will become isolated during the bushfire and flood events; also people may move out of the district following these events and the storm scenario.

An outbreak of FMD in the district would likely cause a loss of income and psychological and emotional stress for those in the agriculture industry. This may result in some people leaving the district.

Despite these higher risks, the majority (75%) of the social setting risk statements were assessed as low or very low risks. The district community would require some external resources to restore it to normal function and there may be limited/temporary reductions in services following these events.

Risks to environment

Twenty-one risk statements were assessed across five of the hazards for the environment. These statements address impacts to ecosystems, species and landscapes (see Appendix C for criteria).

Table 11: Impacts to environment by hazard and risk level. Note: AP Bio = animal and plant biosecurity; Elec = electricity supply disruption.

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Contamination from toxic substances</i>					Bushfire Elec (2)
<i>Debris or pollutants entering the riverine or marine environment</i>		Elec	Flood Storm		
<i>Flora and fauna</i>				Bushfire (3) Flood (2) Storm (3)	
<i>Invasive non-native flora and fauna</i>				Bushfire	
<i>Issues with carcass disposal</i>				AP Bio (2)	
<i>Soil erosion</i>			Flood	AP Bio Storm	
<i>Spread of diseases</i>				Storm	

The highest risk to the environment is from the spilling of sewerage into the environment following an extended electricity supply disruption where power is lost to sewerage treatment plants. During the course of the five days of the power outage there is a high chance of some sewage being spilled into the environment as pumps would not be working. The impact to the environment will depend where sewage is spilled; the Busselton sewerage treatment plant is located next to a state-recognised wetland. Significant infrastructure has been put in place by the Water Corporation to prevent spills into this wetland. However, if sewage is spilled, clean-up and ongoing environmental monitoring would be carried out.

The flood and storm scenarios could also cause contamination and pollution of waterways with the influx of flood waters and the potential for agricultural run-off. Flood waters may also bring and deposit soil and silt into waterways and wetlands.

Risks by theme

Risk statements were assessed across the five impact areas (economy, public administration, people, social setting and environment) following the *NERAG* consequence criteria. However, some risks crosscut multiple impact areas. By combining them into themes, common risks are highlighted for different sectors and actors.

The ten themes identified for the South West EM district are: buildings; community; education; environment; government; health; industry/commercial; tourism; transport; and utilities. The environment category is not shown here as the data are the same as Table 11.

The colour coding in these tables follows the impact areas: pink – economy; orange – public administration; blue – people; and purple – social setting.

Buildings

Flood and storm came out as having high risks across most categories related to buildings (Table 12). Interestingly, the economic loss from damage to homes for both of these hazards was assessed as higher risks than the impact to the wellbeing of the community as a result of the damage; whereas for bushfire, this is the opposite.

The increased demand on public buildings for the flood scenario is due to designated evacuation sites not being suitable and a number of other public facilities being required for evacuation. For the storm scenario, there is a high risk of storm surge damage to emergency service buildings, such as the Bunbury and Busselton Police Stations, impacting their response.

The impact to buildings was not evaluated for the animal and plant biosecurity and electricity supply disruption scenarios as they would not impact buildings.

Table 12: Risks related to buildings. Note: AP Bio = animal and plant biosecurity; Elec = electricity supply disruption.

Buildings					
Category	Extreme	High	Medium	Low	Very Low
<i>Demand on public facilities</i>		Flood		Storm	
<i>Emergency services</i>		Storm		Flood	Bushfire
<i>Impacts to commercial buildings, contents and services</i>		Flood Storm	Bushfire		
<i>Impacts to private buildings and contents</i>		Flood Storm	Bushfire		
<i>Residential building damage</i>		Bushfire	Flood	Storm	

Community

The highest risks to the district community are related to loss of income and the lack of timely public information as a result of the bushfire scenario (Table 13).

During the bushfire scenario, power outages and communication failures occur which affect the dissemination of public information. This was considered a high risk for the community’s wellbeing as well as keeping them informed on the emergency situation. There was a similar concern for the electricity supply scenario where dissemination of public information would be impacted by the loss of power. This was a lower risk than the bushfire hazard, likely due to the lower urgency of the situation.

Home-care services were anticipated to be impacted by the flood event. Damage or road closures could cause a significant reduction in the delivery of these services. In response, it was suggested that some of these services could be moved or delivered on different days.

Displacement and dispersal of the community for the bushfire, flood and storm scenarios were assessed as medium risks. These medium risks relate to long term (>14 days)

displacement/evacuation of parts of the community, primarily due to people’s homes sustaining damage. If people’s homes do not sustain damage, they may evacuate to safe areas for a few days before returning to their homes. As such, short term (<14 days) displacement was a lower risk.

Table 13: Risks to the community. Note: AP Bio = animal and plant biosecurity; Elec = electricity supply disruption.

Community					
Category	Extreme	High	Medium	Low	Very Low
<i>Availability of essential supplies</i>			Bushfire		
<i>Availability of essential supplies</i>				Bushfire (2) Elec Flood Storm	
<i>Breakdown of social networks</i>					Bushfire
<i>Community services and events</i>				Bushfire	
<i>Culturally significant facilities and customs</i>				Bushfire	AP Bio Bushfire (2) Storm (2)
<i>Death/injury of animals</i>				Bushfire	Storm
<i>Displacement or isolation of communities</i>			Bushfire Flood Storm	Flood	AP Bio Elec Storm (2)
<i>Facilities for vulnerable people</i>				Bushfire Elec Flood	Storm
<i>Home-care service</i>			Flood	Bushfire Storm (2)	
<i>Loss of income</i>		Bushfire	AP Bio (2)	Elec Storm	
<i>Psychological and emotional stress</i>			AP Bio (2)		AP Bio
<i>Public information</i>		Bushfire		Elec	
<i>Public unrest</i>				Bushfire	
<i>Public unrest</i>			Elec		
<i>Social service providers</i>				Elec Flood	Storm

Education

The highest risk to education is related to the electricity supply disruption scenario. Schools in the lower South West EM district would be impacted because there would be no power or water (the water supply system does not function without power) and without these services, schools cannot operate (Table 14). Water Corporation would send water tankers to schools that are still operating in December (some schools might be on holiday already). There would be some disruption to schools but this could be managed by the resources within the district. Damage to school buildings from the flood scenario would result in longer-term disruptions for those schools; however it is anticipated that students could be moved to other locations if need be.

Table 14: Risks related to education. Note: AP Bio = animal and plant biosecurity; Elec = electricity supply disruption.

Education					
Category	Extreme	High	Medium	Low	Very Low
<i>Disruption to educational facilities</i>			Elec		
<i>Education facilities</i>				Flood	Bushfire Elec Storm

Government

There is a wide spread of risk levels for all government theme statements (Table 15).

The highest risks for the government sector relate to emergency and government services, and response and recovery activities for all hazards. The increased demand on emergency services for bushfire, flood and storm scenarios is related to their response to these hazards and trying to reach people that need assistance or evacuating. In the case of the animal and plant biosecurity hazard, there will be a high demand on WA Police services, initially to create roadblocks and checkpoints; however this demand would decrease over time.

The logistic and organisational requirements of the animal and plant biosecurity scenario would create a significant impost on involved agencies (DAFWA primarily) and require external assistance. Because it is likely to have Australian-wide impacts, the response and management of this scenario would be at state level.

Response and recovery to the hazards will result in significant costs for the district and will affect the services the response agencies normally provide. The high recovery costs and impact to business relate to animal and plant biosecurity, bushfire and storm. In the case of animal and plant biosecurity, recovery could take up to 10 years.

Most of the electricity supply disruption scenario risk statements were assessed as lower risks because this hazard generally causes disruption rather than damage and does not require the typical response that a natural hazard does.

Table 15: Risks related to government activities. Note: AP Bio = animal and plant biosecurity; Elec = electricity supply disruption.

Government					
Category	Extreme	High	Medium	Low	Very Low
<i>Emergency services</i>		AP Bio Bushfire Flood Storm	Elec	Elec	
<i>Government services</i>		AP Bio Elec	AP Bio Elec Flood	Bushfire Elec (3)	Bushfire
<i>Public information</i>		Elec		AP Bio	
<i>Response and recovery activities</i>		AP Bio Bushfire Storm			
<i>Response and recovery activities</i>		Bushfire Flood (2)	AP Bio (2) Bushfire Flood (3) Storm (2)	AP Bio (7) Elec	AP Bio (2) Flood

Health

All hazard scenarios were assessed to have high risks for deaths and injuries and illnesses. Deaths for the animal and plant biosecurity, bushfire and storm scenarios were assessed as having catastrophic consequences (at least 19 deaths), with the former being related to potential suicides. Illnesses for the animal and plant biosecurity hazard were assessed as having catastrophic consequences and are related to the potential increase in mental health illnesses.

The bushfire scenario was anticipated to cause an increased demand on WA Health services affecting their service delivery (orange row – Health services, Table 16) due to the size of two simultaneous fires and the potential high number of deaths and injuries. However, this increased demand was not expected to result in any further deaths (blue row – Health services, Table 16).

While there is a high risk of death and injuries from these hazards, these deaths had a lower risk of affecting the district community’s wellbeing and social fabric (purple row – Table 16). The wellbeing of localised communities would likely be affected but there are resources available in the district to assist these communities.

Table 16: Risks related to health. Note: AP Bio = animal and plant biosecurity; Elec = electricity supply disruption.

Health					
Category	Extreme	High	Medium	Low	Very Low
<i>Deaths</i>		AP Bio Bushfire Elec Flood Storm			
<i>Disease outbreak</i>			Flood		
<i>Emergency services</i>		Bushfire Elec	Flood (2) Storm		
<i>Health services</i>			Bushfire		Bushfire Elec Storm
<i>Health services</i>		Bushfire	Flood Storm	Elec	
<i>Impacts to people’s health</i>			Bushfire	Bushfire Flood Storm	Elec
<i>Injuries and illnesses</i>		AP Bio Bushfire Elec Flood Storm			

Industry/commercial

The highest risks to industry and commercial activities relate to agriculture, general commercial activities and marine infrastructure (Table 17). The flood scenario is likely to cause significant damage to unharvested crops and products (such as grapes and vegetables) and cause soil erosion on productive lands. Floods could also cause significant damage to private dams and other farm infrastructure. The storm would cause extensive damage (>\$625 million) to ports and marinas, including vessels, reducing their operations.

The animal and plant biosecurity hazard would cause decreases in farm revenues, potentially up to \$60 million. This scenario would also impact most related industries such as dairy, livestock movement and the domestic meat market, causing financial losses. Given a full recovery could take 10 years, financial losses are anticipated to be high.

The electricity supply disruption scenario would significantly disrupt commercial and small businesses due to loss of power and electronic payment systems. With the power disruption likely to last for five days, \$60 million in lost revenue is anticipated as it is in peak tourist season.

Table 17: Risks related to industrial/commercial activities. Note: AP Bio = animal and plant biosecurity; Elec = electricity supply disruption.

Industry/commercial					
Category	Extreme	High	Medium	Low	Very Low
<i>Impacts to agricultural and pastoral activities</i>		AP Bio Flood (2)	AP Bio (4) Bushfire (2) Flood (2)	Bushfire (2) Elec Storm (2)	AP Bio Storm
<i>Impacts to commercial activities</i>		AP Bio (3) Elec Storm	Bushfire Elec (2)	AP Bio	Elec
<i>Impacts to marine infrastructure and industry</i>		Storm			Elec Storm
<i>Impacts to mining infrastructure and industry</i>				Elec	
<i>Impacts to port and marina services</i>		Storm			
<i>Workforce productivity losses</i>					AP Bio

Tourism

The highest risk for tourism is the damage to or isolation of tourist attractions and infrastructure (Table 18). One of the bushfires occurs in the Dunsborough/Cape Naturaliste area which would impact a number of tourist areas and isolate the Cape until repairs are completed. The flood scenario could also cut off tourist areas until any necessary repairs were carried out or flood waters subside. The flow-on effect of the bushfire to the community from the decline in tourism could break the social fabric of the community (purple – Impacts to tourism – Table 18) as many rely on the tourist dollar for income. Significant external resources could be required to return the community to normal function.

Table 18: Risks related to tourism. Note: AP Bio = animal and plant biosecurity; Elec = electricity supply disruption.

Tourism					
Category	Extreme	High	Medium	Low	Very Low
<i>Impacts to tourism</i>		Bushfire Flood	AP Bio Bushfire Elec Storm		
<i>Impacts to tourism</i>			Bushfire		AP Bio (2)

Transport

The flood scenario is anticipated to cause damage to road infrastructure across the district, especially bridges, which will cause disruption to transportation routes (Table 19). If heavy vehicles are unable to use the South West or Forrest Highways, then the extra travel costs could be \$1 million per day. While the bushfire and storm hazards may not cause as much physical damage to transportation as the flood, they could cause disruptions that prevent or delay emergency services from providing assistance where required.

Table 19: Risks related to transport. Note: AP Bio = animal and plant biosecurity; Elec = electricity supply disruption.

Transport					
Category	Extreme	High	Medium	Low	Very Low
<i>Disruption to aviation services</i>				Elec Flood	Storm
<i>Disruption to transport routes</i>		Flood	Bushfire	Elec Storm	AP Bio
<i>Emergency services</i>		Bushfire Storm			
<i>Impacts to aviation</i>				Flood	Elec Storm
<i>Impacts to bridges or their approaches</i>			Bushfire Storm		
<i>Impacts to public transport services</i>				Storm	
<i>Impacts to transport infrastructure</i>		Flood	Storm		

Utilities

Communication, power, sewerage and water utilities have the highest risks in the South West EM district (Table 20).

The bushfire, flood and storm hazards are likely to cause significant damage to the power supply infrastructure within the district (pink row – Impacts to power infrastructure) which will result in disruption to power supply and affect the ability of Western Power to maintain core services (orange row – Impacts to power supply service delivery). This is particularly significant for the bushfire scenario which will likely destroy the Muja Power Station and the fire would enter the coal mine and the affect coal supply. This is of concern because the power station and associated infrastructure is part of the South West Interconnected System (SWIS), a strategic state asset. Tornado and wind damage from the storm and access issues and damaged assets (including underground assets) from the flood, would result in high costs and cause service disruption. The disruption of power supplies from the electricity supply disruption scenario was assessed as a medium risk because this scenario was limited to the lower part of the South West EM district.

Costs from damage to the sewerage and water infrastructure (pink rows, Table 20) were assessed to generally be of lower risk than the disruption of service delivery (orange rows, Table 20). Flood is the exception, where damage costs are a higher risk. Power supply disruption has a notable influence on water and sewerage systems.

Table 20: Risks related to utilities. Note: AP Bio = animal and plant biosecurity; Elec = electricity supply disruption.

Utilities					
Category	Extreme	High	Medium	Low	Very Low
<i>Impacts to communication infrastructure</i>		Storm	Bushfire Elec	Flood	
<i>Impacts to communication service delivery</i>			Elec Flood Storm	Bushfire	
<i>Impacts to natural gas distribution</i>				Storm	
<i>Impacts to power infrastructure</i>		Bushfire (2) Flood Storm	Elec		
<i>Impacts to power supply service delivery</i>		Bushfire Flood Storm	Elec		
<i>Impacts to sewerage systems</i>			Elec Flood	Bushfire	Storm
<i>Impacts to sewerage service delivery</i>		Elec	Bushfire		Flood
<i>Impacts to water supply infrastructure</i>			Elec Flood	Bushfire Storm	
<i>Impacts to water supply service delivery</i>		Bushfire Elec			Flood

6 Risk evaluation

The next step in the risk management process is to evaluate the risks, determining whether the risk is acceptable or requires treatment (Figure 10).

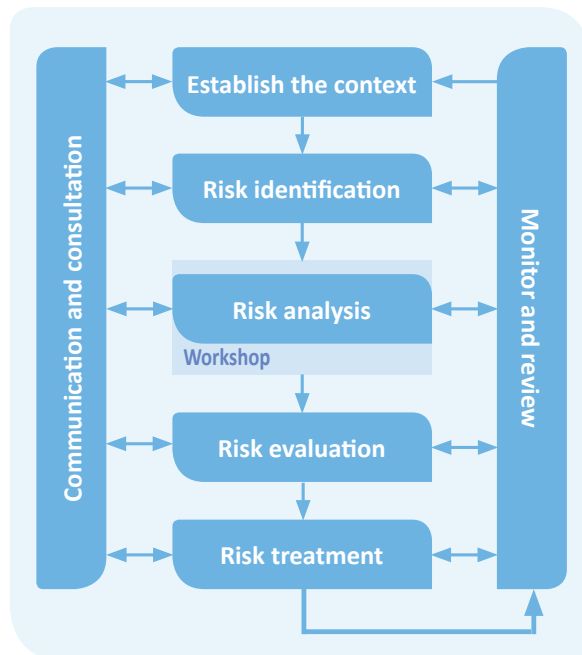


Figure 10: Emergency risk management process³.

The *NERAG* uses a prioritisation system to rank risks for treatment decisions and/or for further investigation. *NERAG* priority is based on the risk level and confidence associated with each assessed risk. Priority ranges from 1 (highest priority) to 5 (lowest priority). The following prioritisation of risks is a helpful tool to focus attention on the more significant risks. However, the determination of whether a risk is acceptable or should be treated has governance, financial and societal implications and is best administered by the appropriate level(s) of government.

Figure 11 shows that the majority (52%) of the South West risk statements are classified as Priority 5, meaning that these are broadly acceptable risks which require no further action other than monitoring and review during the next risk assessment phase. Nine risk statements (3%) have been classified as Priority level 2, indicating that these risks have a high priority for further investigation and/or treatment. Two of these risk statements, related to electricity supply disruption, have been classified as Priority 2 because of their low confidence level. Further investigation is required to confirm the level of risk. None of the South West risk statements assessed are Priority 1.

Table 22 contains the Priority 2 risk statements in full and those risk statements with catastrophic consequences. Catastrophic consequence statements are included because if these impacts do occur they could potentially stretch or outstrip the district's resources and therefore should be considered during the treatment phases.

³Adapted from AS/NZS ISO 31000 - Reproduced under SAI Global copyright Licence 1411-c083

Percentage of all risk statements at each priority level

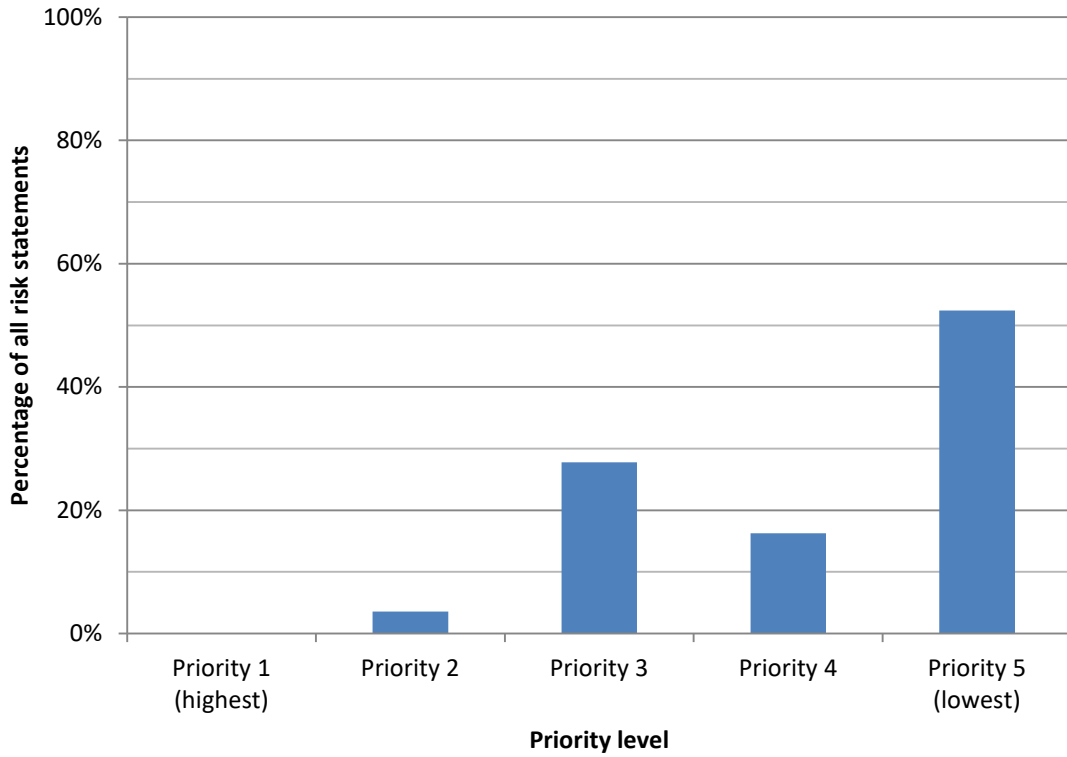


Figure 11: Percentage of all risk statements at each priority level. Priority 1 – highest; Priority 2 – high; Priority 3 – medium; Priority 4 – low; Priority 5 – lowest.

Table 21: Risk statements for the South West EM district with Priority level 2 or catastrophic consequences. Note: AP Bio = animal and plant biosecurity; Elec = electricity supply disruption.

Hazard	Risk statement	Impact area	Consequence	Risk level	Confidence level	Priority level
AP Bio	will impact exports (e.g. due to restrictions imposed by importing countries), resulting in financial losses.	Economy	Catastrophic	High	High	2
AP Bio	will impact the meat processing industry, resulting in financial losses.	Economy	Catastrophic	High	Moderate	2
AP Bio	will result in response and recovery activities (including animal destruction, environmental clean-up), resulting in costs to the district.	Economy	Catastrophic	High	High	2
AP Bio	will impact the health of people and cause death(s).	People	Catastrophic	High	Moderate	2
AP Bio	will impact the health of people and cause injury and/or serious illness.	People	Catastrophic	High	High	2
Storm	will impact the health of people and cause death(s).	People	Catastrophic	High	High	2
Elec	will affect CPFS, impacting their ability to deliver core services.	Public administration	Major	High	Low	2
Elec	will disrupt sewerage systems causing sewage to spill into the environment, causing contamination.	Environment	Major	High	Low	2
Flood	will damage/inundate private buildings and contents, resulting in financial losses.	Economy	Major	High	Moderate	2
Bushfire	will impact electricity infrastructure, resulting in damages to lines and power outages, incurring costs to the district and financial losses.	Economy	Catastrophic	High	Highest	3
Bushfire	will result in recovery activities, resulting in costs to the district.	Economy	Catastrophic	High	Highest	3
Bushfire	will cause significant disruption to coal mining resulting in failure to generate electricity, resulting in financial losses.	Economy	Catastrophic	High	Highest	3
Bushfire	will impact the health of people and cause death(s).	People	Catastrophic	High	Highest	3
Bushfire	will impact the health of people and cause injury and/or serious illness.	People	Catastrophic	High	Highest	3
Storm	will cause damage to vessels, marinas, marine infrastructure, boat ramps and/or major ports, resulting in recovery costs and/or financial losses.	Economy	Catastrophic	High	Highest	3

7 Future actions

A preliminary risk treatment discussion will be held with relevant agencies to review the risk assessment results and begin the conversation concerning risk tolerability and potential treatment strategies.

Appendix A: Individual hazard risk assessment summaries

This appendix contains a summary of the assessed risks for each of the hazards separated into the five impact categories.

Animal and plant biosecurity

This section summarises the risk to the South West EM district from the animal and plant biosecurity scenario. The percentage of risk statements at each risk level for the scenario is shown in Figure 12.

Percentage of risk statements at each risk level for animal and plant biosecurity

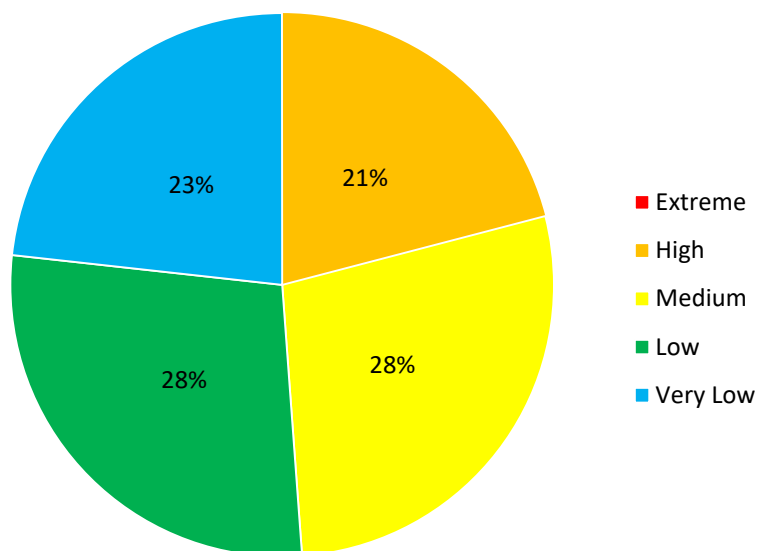


Figure 12: Percentage of risk statements at each risk level for animal and plant biosecurity.

Animal and plant biosecurity risk assessment

Extreme risks

Nil.

High risks

Closure of the meat export market will result in financial losses (about \$600 million per year) for businesses in the South West; and Australia-wide. The local meat processing industry would be impacted and flood the local market with meat products that cannot be exported. Decrease in farm revenues and business failure are likely. Recovery and response activities are likely to be significant and last for about 10 years. Cost-sharing arrangements between the Government of Western Australia, Commonwealth and industry are in place to cover recovery costs.

Medium risks

Reputational damage and loss of trust in the agriculture industry will result in financial losses for the industry and would take many years to recover. Impacts to the movement of livestock within the district and Australia would cause financial losses, depending on the length of movement restrictions. The destruction of animals would be compensated, but potentially not at 100% and the loss of genetics would be difficult to compensate. Impacts to tourism, both domestic and international, is another medium risk.

Low risks

The only low risk was related to impacts to the local meat retail industry as some people may be put off buying meat and prices would drop.

Very Low risks

Disruption to freight routes and labour mobility likely in the short term due to road blocks and disinfection practices. Likely to have a positive effect on the poultry industry.

ECONOMY



Extreme risks

Nil.

High risks

Both the deaths and illnesses risks relate to the mental health issues anticipated in this scenario. While it is anticipated that there could be a catastrophic consequence (at least 19 deaths), there is a degree of uncertainty. If compared to the FMD outbreak in the United Kingdom in 2001, the impacts of an Australian outbreak would differ. In normal circumstances, Australian suicide rates among farmers are higher than the UK and could be heightened in this event. The UK also has a larger domestic market and was able to recover quicker than the Australian export-based market is expected to.

Medium, Low and Very Low risks

Nil.

PEOPLE



Animal and plant biosecurity risk assessment

PUBLIC ADMINISTRATION



Extreme risks

Nil.

High risks

Increased demands on DAFWA to manage this event. The event would cause nation-wide impacts and therefore would be managed at the state level. Increased demand on WA Police services initially as they provide assistance with setting up roadblocks and checkpoints across the district. The speed of recovery in the district would depend on the resumption of the export market which lies with the Commonwealth Government and could take up to 10 years to fully recover.

Medium risks

Increased demand on veterinary services is anticipated such they may not be able to provide their normal services. There would be an increased demand on Department of Environment Regulation (DER) regarding approvals for the disposal of carcasses; although sites for disposal are pre-identified. Department for Child Protection and Family Support (CPFS) and WA Health would provide mental health advice and messaging but may need to seek resources from outside of the district to do this.

Low risks

P&W and Main Roads WA would assist with incident management and roadblocks, and could need some additional resources to do so. Local governments and Main Roads WA have access to heavy machinery if required for animal disposal. Impacts to the Department of Water are limited to assisting with wash-down facilities. District, state and national media communication would be required, but this is typically done by the media liaison officers involved. The other medium risk is to the Department of Education who foresee potential issues with people moving through the district impacting school attendance and staffing.

Very Low risks

Response by St John Ambulance and DFES impacting their ability to maintain core services were very low risks.

SOCIAL SETTING



Extreme and High risks

Nil.

Medium risks

An outbreak of FMD in the district would cause loss of income and psychological and emotional stress for those in the agriculture industry, resulting in some people moving away. However, many may not be able to afford to leave the district.

Low risks

Nil.

Very Low risks

Distress among the public from seeing media coverage would be a short-term impact. Some members of the public may feel isolated as others look for people to blame. Impacts on the community from the loss of tourism and loss of the livestock sector's reputation were assessed as to be minimal. Disruption to farmer's markets across the district might occur but it could lead to other community events being increased.



Animal and plant biosecurity risk assessment

Extreme, High and Medium risks

Nil.

Low risks

No impacts to the groundwater from carcass burial are anticipated as these are well designed with multiple linings. Unmanaged disposal of carcasses is not considered to be an issue and therefore would not impact the environment. Increased livestock numbers on farms is unlikely to have any significant effects.

Very Low risks

Nil.

Bushfire

This section summarises the risk to the South West EM district from the bushfire scenario. The percentage of risk statements at each risk level for the scenario is shown in Figure 13.

Percentage of risk statements at each risk level for bushfire

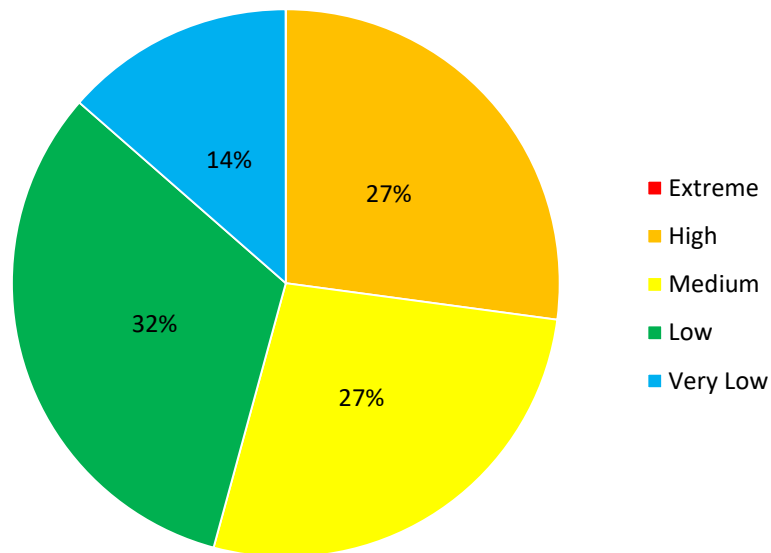


Figure 13: Percentage of risk statements at each risk level for bushfire.

Bushfire risk assessment

ECONOMY



Extreme risks

Nil.

High risks

Significant damage/destruction of the Muja Power Station as a result of the bushfire which would cause electricity losses within and outside of the district. Fire may also enter the coal mine leading to disruption of mining and disruption in electricity generation. The scenario would result in recovery activities resulting in significant costs (>\$625 million) to the district. Impacts to tourism in the district will result in reduced revenues, especially around the Dunsborough area where the second fire scenario took place.

Medium risks

Financial losses will result from damage to private and commercial buildings, communication infrastructure, bridges, agriculture infrastructure and crops. Additional financial losses would arise from disruption to aspects that support the tourism industry, interruptions to major events and closure of major transportation routes.

Low risks

Impacts to water and wastewater systems are expected to be minor, as are impacts to horticulture industry infrastructure and livestock.

Very Low risks

Nil.

PEOPLE



Extreme risks

Nil.

High risks

The potential for deaths and injuries was assessed as high risk with catastrophic consequences such that at least 19 deaths, or more than 19 critical injuries, or more than 181 serious injuries could occur. Emergency services, including medical transport services, could be overwhelmed resulting in further deaths.

Medium risks

Access to hospitals and medical centres in Dunsborough and Collie could be an issue, preventing people from seeking medical treatment.

Low risks

Nil.

Very Low risks

The potential for health services (hospitals and medical centres) to become overwhelmed resulting in further deaths was assessed as very low risk.

Bushfire risk assessment

PUBLIC ADMINISTRATION



Extreme risks

Nil.

High risks

Increased demand on emergency and health services due to the size of the fires and number of people involved, resulting in a reduction in their core services. Impacts to power infrastructure would result in a reduction of services in some areas and complete losses in other areas, including Yallingup. Damage to water supply infrastructure and the need for recovery works to be undertaken by state agencies are also high risks.

Medium risks

Local governments would undertake recovery works impacting on their ability to provide their normal services. Impacts to sewerage systems due to a loss of power would affect the functioning of these services. Impacts to arterial road networks would occur; however, goods can be brought in from the east from the Great Southern district.

Low risks

Impacts to communications, government offices/works depots and home-based services such that their services would be disrupted. The possibility that the bushfire scenario would lead to social unrest is considered a low risk.

Very Low risks

Impact to emergency service buildings is considered a low risk because even the loss of one fire station is not anticipated to impact DFES's firefighting abilities. An increased backlog in government service provision is also a very low risk.

SOCIAL SETTING



Extreme risks

Nil.

High risks

Community wellbeing is anticipated to be affected by building damage and loss of income and employment. The lack of timely public information due to power outages is also anticipated to affect the community.

Medium risks

Impacts to the community wellbeing from deaths was assessed as a medium risk for the whole district; as was disruption caused by evacuation and impacts to tourism.

Low risks

Community wellbeing could be affected by death of animals, disruption to aged-care facilities, isolation of towns, increased demand on public buildings, impacts to people's health and impacts to the aesthetics of the district.

Very Low risks

Very low risks for the social setting relate to reduced function of education facilities, impacts to heritage buildings, art galleries, museums and a breakdown of community social networks.

Bushfire risk assessment

ENVIRONMENT



Extreme, High and Medium risks

Nil.

Low risks

Impacts to native and non-native vegetation, health of wildlife and a surge in non-native flora and fauna resulting in impacts to native flora and fauna.

Very Low risks

Contamination to the surrounding environment from the release of toxic substances and non-natural substances was assessed as a very low risk.

Electricity supply disruption

This section summarises the risk to the South West EM district from the electricity supply disruption scenario. The percentage of risk statements at each risk level for the scenario is shown in Figure 14.

Percentage of risk statements at each risk level for electricity supply disruption

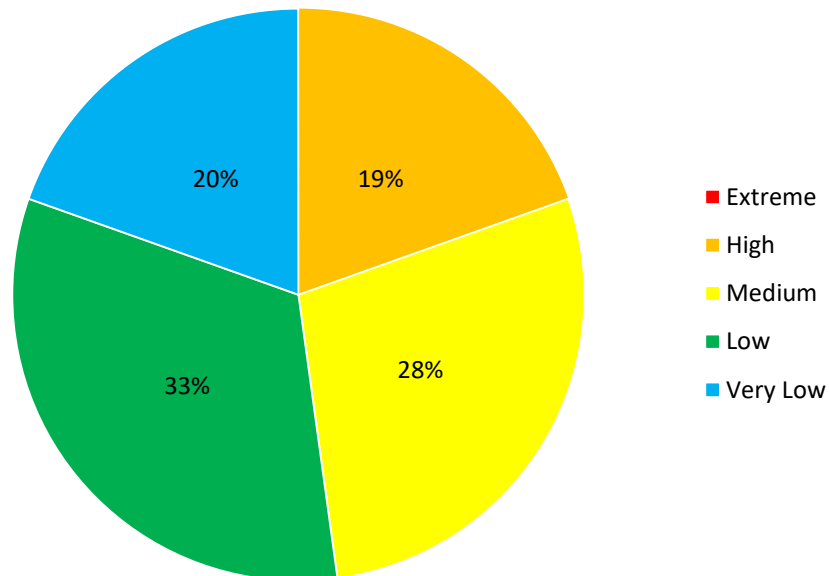


Figure 14: Percentage of risk statements at each risk level for electricity supply disruption.

Electricity supply disruption risk assessment

Extreme risks

Nil.

High risks

Impacts to the electricity supply will cause disruption to businesses across the district. Approximately \$12 million per day is currently spent across the district and so losses could exceed \$60 million over five days.

Medium risks

Risks assessed as medium relate to impacts to the power supply, electricity market, water supply, sewerage, food storage and tourism. Financial losses are anticipated for Western Power stemming from the cost of repairing fire-damaged power infrastructure and additional flow-on costs from backup generators. While there would be no direct impact to water supply or waste water infrastructure, there would be impacts related to the loss of power and the loss of water production and sewage treatment. There are about 30 supermarkets which would need backup generators to keep their cold storage areas operating. Tourism would also be impacted, but there would be areas unaffected, such as Bunbury.

Low risks

There would be impacts to the various supply chains that operate within the district, especially relating to food and fuel resupply, although there would be still other areas within the district that would have power and could receive supplies. Mining could be impacted but they would likely keep producing and stockpile their products. Impacts to agriculture would be likely in the dairy industry as milking cannot occur without power; however this loss is not anticipated to exceed \$6 million.

Very Low risks

The Bunbury Port would have no direct impacts from this scenario other than some products not being able to make it to the port. This scenario occurs over the weekend of the Iron Man at Busselton. It is anticipated that this event could still continue as planned as there would need to be significant logistics to host it at a different time because it fits into an international calendar. Impacts to aviation in Busselton would be limited.

ECONOMY



Electricity supply disruption risk assessment

Extreme risks

Nil.

High risks

The possibility of injuries and deaths from this scenario were assessed as high because there is the possibility of at least one death resulting from a road crash, due to the number of people using the road or the lack of traffic lights. There are also a number of people that rely on home-based life support systems (e.g., respirators) which could stop working without electricity, resulting in death. Heat-related deaths and/or injuries could occur due to the loss of air conditioning systems in people's homes.

Medium and Low risks

Nil.

Very Low risks

The impact to the health services resulting in further deaths was assessed as a very low risk as emergency services would still operate in hospitals and larger hospitals have backup electricity supplies. In addition, any person that needs hospital treatment could be moved to Bunbury Hospital which would still have power. Nursing homes could be more affected as they do not have the same management structure as larger hospitals.

PEOPLE





Electricity supply disruption risk assessment

Extreme risks

Nil.

High risks

High risks for the public administration impact area relate to the Water Corporation (water supply and sewerage systems), CPFS and the public information management. Water Corporation resources from outside of the district would be required to manage the water and sewerage systems. They would also have to manage staff fatigue for this prolonged five-day event. CPFS would lose power to their South West offices; however they would still open and operate, but at a limited capacity. All phone calls to CPFS offices would be diverted to the regional head office. Public messaging could be difficult for this scenario due to the lack of power and communications to distribute the message however it could be possible to set up mobile caravans at various sites to provide information directly to the public. Any public messaging regarding the power outage would come from the Public Utilities Office (the hazard management agency) through Western Power and DFES for any fire related messaging.

Medium risks

Medium risks related to impacts on Western Power, Police, communications, educational facilities and Bunbury Regional Prison. Western Power staff would need access to the areas of their network that are burnt in order to repair them. These staff members would likely need to be brought in from Perth as this is where the power transmission line specialists are located. Communications would be impacted and would require backup power supplies to continue operating, however, there is unlikely to be enough generators in the state to supply power to all communication sites so these would need to be prioritised. Schools and other education facilities would be significantly affected because they are not able to operate without water or sewerage services. This would reduce the Department of Education's ability to provide their core services, although they would not need any additional resources from outside of the district. The Bunbury Regional Prison has two diesel generators which provide adequate power to all essential area and services which includes all security infrastructure.

Low risks

Low risks related to impacts to the core services of DFES, local governments, WA Health, Human Services and the aviation industry. Most of these agencies would have some impact to their core services but all indicate that they have some sort of backup power supply on site. One of the main issues raised during the workshop was securing a supply of fuel for backup generators. So while many agencies and their offices have backup generators they may not be able to obtain fuel for them.

Very Low risks

Nil.

Electricity supply disruption risk assessment

SOCIAL SETTING



Extreme and High risks

Nil.

Medium risks

The only medium risk in the social setting impact area is the potential for the scenario to cause social unrest and looting. There is likely to be an increase in crime and opportunistic thefts and WA Police may need to bring in additional resources to manage and respond to this.

Low risks

Impacts to day-to-day functionality of facilities for vulnerable people and social service providers are likely to be temporary and isolated as they would provide the services where they can. Disruption to the social fabric from the release of public information related to the event was assessed as a low risk. It is anticipated that there would be some disruption to the social fabric of the community because there would be uncertainty within the community about the situation and when the power would be restored. This would be exacerbated by the difficulties in communicating messages due to the loss of power.

Very Low risks

Very low risks to the social setting related to the effects on the community from any deaths, the day-to-day function of educational facilities and isolation of communities. Impacts to these aspects are likely to be isolated and short term.

ENVIRONMENT



Extreme risks

Nil.

High risks

The highest risk to the environment is from the disruption of sewerage systems. It is highly likely that sewage will be spilled during this scenario as a result of the disruption to pump stations and limited storage capacity at treatment facilities. When sewage is spilled into the environment, particularly into rivers, it is likely to be quickly diluted by the large volumes of water. If this occurs, additional resources would need to be brought in from Perth to manage the clean-up operation. In Busselton, the waste water treatment facility is located next to the wetlands which are a recognised ecosystem. If sewage spilled into this wetland it would be a major recovery activity, although Water Corporation does have significant resources in place to prevent this from occurring.

Medium and Low risks

Nil.

Very Low risks

The two risk statements assessed as very low risks related to the potential for contamination from chemicals and/or milk. There are some chemical plants north of the impacted area, but there are also requirements for bunds or lined pits to store waste chemicals. It is unlikely that farmers would need to dispose of milk in this scenario. If it did occur, there is an approved disposal process. The majority of farmers would have backup generators and fuel supplies such that they can pump milk and continue milking.

Flood

This section summarises the risk to the South West EM district from the flood scenario. The percentage of risk statements at each risk level for the scenario is shown in Figure 15.

Percentage of risk statements at each risk level for flood

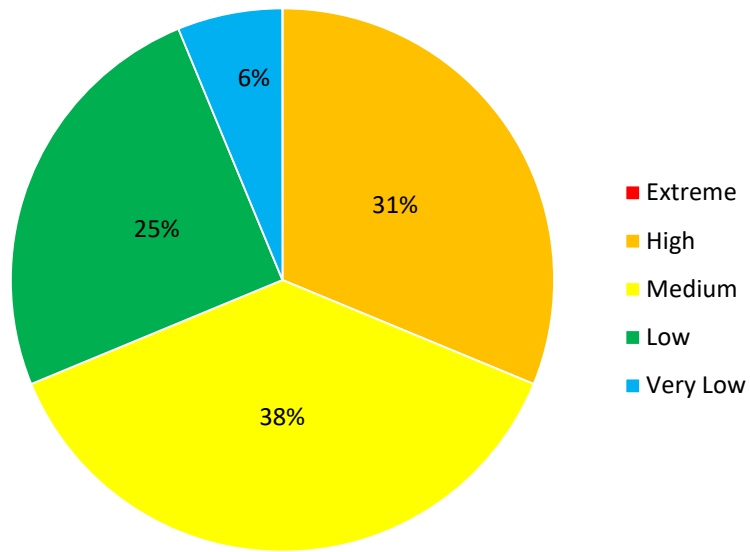


Figure 15: Percentage of risk statements at each risk level for flood.

Flood risk assessment

Extreme risks

Nil.

High risks

Across the district, damage to buildings could be a major consequence (\$62.5-\$625 million). Houses in previous floods were not completely destroyed; however, there are a significant number of older houses across the district that are built to poorer building standards/codes. Commercial buildings would also sustain damage during the flood scenario resulting in financial losses. Most bridges would stand during this scenario, but abutments could erode away and be damaged. It is anticipated that repairs could be carried out relatively quickly. Railway bridges in the district are expected to withstand flood impacts as they are typically well engineered. The disruption that the flood could cause on the transportation network, particularly the South Western and Forrest Highways, could be at least \$1 million per day due to lost revenue because of increased travel time for heavy vehicles. Any damage that occurs to power supply infrastructure as a result of the flood could be difficult to repair due to closed/damaged roads. Flooding would likely damage horticulture crops and grapes from rain damage and soil erosion, as harvest would still be occurring during January. Tourism could also be affected as people may cancel plans if they anticipated the storm coming.

Medium risks

Risk statements assessed as medium risks related to impacts to the sewerage network, water supply, livestock and the dairy industry. Both the sewerage and water supply systems are designed to operate in a submerged and wet environment so are unlikely to be damaged. However, if the power is disrupted then both of these systems would not be able to operate because they require power for their pumps. In addition, the sewerage system and treatment plants would not be able to cope with the influx of water. The dairy industry, a large industry in the South West, would likely be disrupted as trucks would not be able to get to the farms in the district and without power would not be able to pump milk.

Low risks

Impacts to communications would be minimal unless a bridge that was carrying communications infrastructure was damaged. There are a number of airstrips in the district that may be flooded although it is anticipated that this would not cause damage.

Very Low risks

Nil.

ECONOMY



Flood risk assessment

PEOPLE



Extreme risks

Nil.

High risks

Deaths and injuries were assessed as high risks. During the workshop it was thought that there could be at least two deaths and/or two critical injuries as a result of this flood scenario. This was based on the intensity of previous events and the severe weather in New South Wales, Australian Capital Territory and Tasmania in June 2016.

Medium risks

Health issues from stagnant water and waterborne disease was assessed as a medium risk. Public messaging would be critical in preventing a disease outbreak, however there is still a risk that some people would not listen or follow warning messages. The remaining two risk statements relate to the overwhelming of emergency services resulting in further deaths and injuries. Disruption of emergency services is dependent on where people are located and which roads are open or closed at the time.

Low and Very Low risks

Nil.

Flood risk assessment



Extreme risks

Nil.

High risks

High risks for public administration concerned the increased demand on emergency services, public facilities, power supply and the requirement for local governments to undertake recovery works. DFES and WA Police indicated that they would be stretched during this scenario and would require additional resources from outside the district. A number of evacuation centres would likely be set up to accommodate people that need to be evacuated out of low-lying areas. Because a number of the pre-designated evacuation sites are located in low lying areas, other public buildings may need to be used. Local governments would need to undertake recovery works after the event which they would need to divert a significant amount of resources towards. In most cases these local governments would either seek assistance from neighbouring governments or from others outside the district.

Medium risks

Impacts to the provision of CPFS services was assessed as a medium risk because they would require staff from outside the district in order to cope and manage the welfare side of the event. Home-based social services such as Meals on Wheels and Silver Chain would be impacted by disruption of the roads and power supply networks; although in most cases they could provide these services on different days. An increased demand of WA health services is likely and they would have to reduce their normal services in order to deal with any patients directly resulting from the flood event. This would depend on the hospital workforce and whether they would be able to get to hospital and health care sites in order to provide health services. Other medium risks are: undertaking of recovery works by DAFWA, Department of Water and the Department of Education.

Low risks

Disruption to the aviation industry and impacts to emergency service buildings were assessed as low risks as any impacts are unlikely to cause large disruption.

Very Low risks

Impacts to the provision of sewerage and water supply and response by the Department of Defence are all very low risks as these activities are within normal business parameters.

Flood risk assessment

SOCIAL SETTING



Extreme and High risks

Nil.

Medium risks

The two social setting risk statements assessed as medium risks relate to impacts to the community wellbeing as a result of building damage and the potential long term displacement of people away from their homes. Due to this flood scenario and the damage caused to people's homes, some people may move out of the district. People may need to be evacuated away from their homes for more than two weeks which may result in permanent dispersal and people not wanting to come back to the district.

Low risks

Low risk statements related to impacts to community wellbeing as a result of deaths within the community, availability of essential supplies, short term evacuation, day-to-day functionality of educational facilities and social service providers. These risk statements were assessed as low risks because there would be limited impacts to the wider district community, however it should be noted that more localised impacts could occur in some of the smaller communities.

Very Low risks

Nil

ENVIRONMENT



Extreme and High risks

Nil.

Medium risks

All of the environment risk statements were assessed as medium risks. The statements related to impacts to flora and fauna, soil erosion and contamination of riverine/estuarine environments. The consequences for these statements could be significant in localised areas, however, over the whole of the South West district the consequences were thought to be moderate.

Low and Very Low risks

Nil.

Storm

This section summarises the risk to the South West EM district from the storm scenario. The percentage of risk statements at each risk level for the scenario is shown in Figure 16.

Percentage of risk statements at each risk level for storm

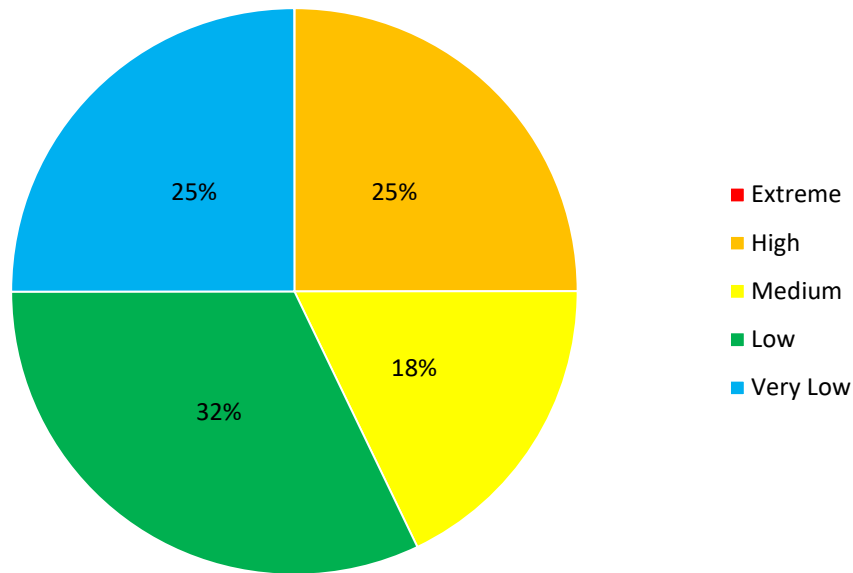


Figure 16: Percentage of risk statements at each risk level for storm.

Storm risk assessment

ECONOMY



Extreme risks

Nil.

High risks

Damage to buildings (private and commercial), marine, communication and power infrastructure were assessed as high risks resulting in significant financial losses. Damage to commercial buildings would prevent commercial and small businesses from functioning. Response and recovery activities would also require assistance from outside of the EM district.

Medium risks

Damage to transportation infrastructure including bridges and culverts, and impacts to the tourism industry pose medium risks to the district.

Low risks

Disruption to transportation routes is anticipated although mostly for the road rather than rail network. Damage to water, gas supply, agriculture and horticulture industry infrastructure are low risks.

Very Low risks

Very low risks for the district relate to damage to the sewerage network, aviation infrastructure, fishing industry and damage to crops.

Storm risk assessment

PEOPLE



Extreme risks

Nil.

High risks

Potential deaths from the storm scenario were assessed to have catastrophic consequences such that at least 19 deaths could occur. Potential injuries were also assessed as a high risk.

Medium risks

The only medium risk related to the potential for emergency services to become overwhelmed such that additional deaths may occur.

Low risks

Nil.

Very Low risks

The single very low risk related to the potential for health services to become overwhelmed such that additional deaths may occur.

PUBLIC ADMINISTRATION



Extreme risks

Nil.

High risks

An increased demand on emergency services is likely to occur after this event causing an interruption to the provision of their services. Damage to response agency buildings may cause a disruption to their response, especially if the Bunbury police station is damaged. Disruption to power and marine services are also high risks.

Medium risks

Medium risks relate to recovery works undertaken by local government and state agencies, increased demand on health services and communication infrastructure affecting service provision.

Low risks

Interruptions to health care and home-based services are anticipated especially if buildings are damaged and people need to be evacuated. Other low risks are the disruption of public transport services and the increased demand on public facilities.

Very Low risks

The only very low risk statement is the disruption to the aviation industry affecting the service provision.

Storm risk assessment

SOCIAL SETTING



Extreme and High risks

Nil.

Medium risks

The only medium risk for the social setting is the effect long-term displacement and/or evacuation would have on the wellbeing of the community. The event may result in some residents permanently relocating from the district.

Low risks

Impacts to the community wellbeing from deaths in the community, damage of homes and retail outlets and the loss of income/employment were assessed as low risks.

Very Low risks

Very low risks for the district's social setting include: death of animals, short term displacement, function of educational and aged-care facilities, disruption of social service providers and isolation of towns across the district.

ENVIRONMENT



Extreme and High risks

Nil.

Medium risks

The only medium risk to the environment from the storm is debris and pollutants entering the marine, estuarine and riverine environments, causing contamination.

Low risks

Low environmental risks relate to: impacts to the health of wildlife, damage to flora, soil erosion and the potential spread of vegetative diseases.

Very Low risks

Nil.

Appendix B: District profile

The South West region covers an area of approximately 23,900 km². It is the most populous and fastest growing area outside of the Perth and Peel regions, with 12 local governments and a combined population of approximately 180,000.

The South West is a popular tourist destination and is known for its beautiful coastline and towering forests. The region's diverse range of industries includes agriculture, forestry, fishing, tourism, retail and construction, along with the export of alumina, coal, titanium dioxide, lithium, tantalum and silicon. Notably, the region is home to the Margaret River wine region which attracts tourists from around the world.

Natural and man-made hazard events occur throughout the region. The highest priority hazards, as identified by the South West DEMC are: animal and plant biosecurity, bushfire, electricity supply disruption, flood and storm.

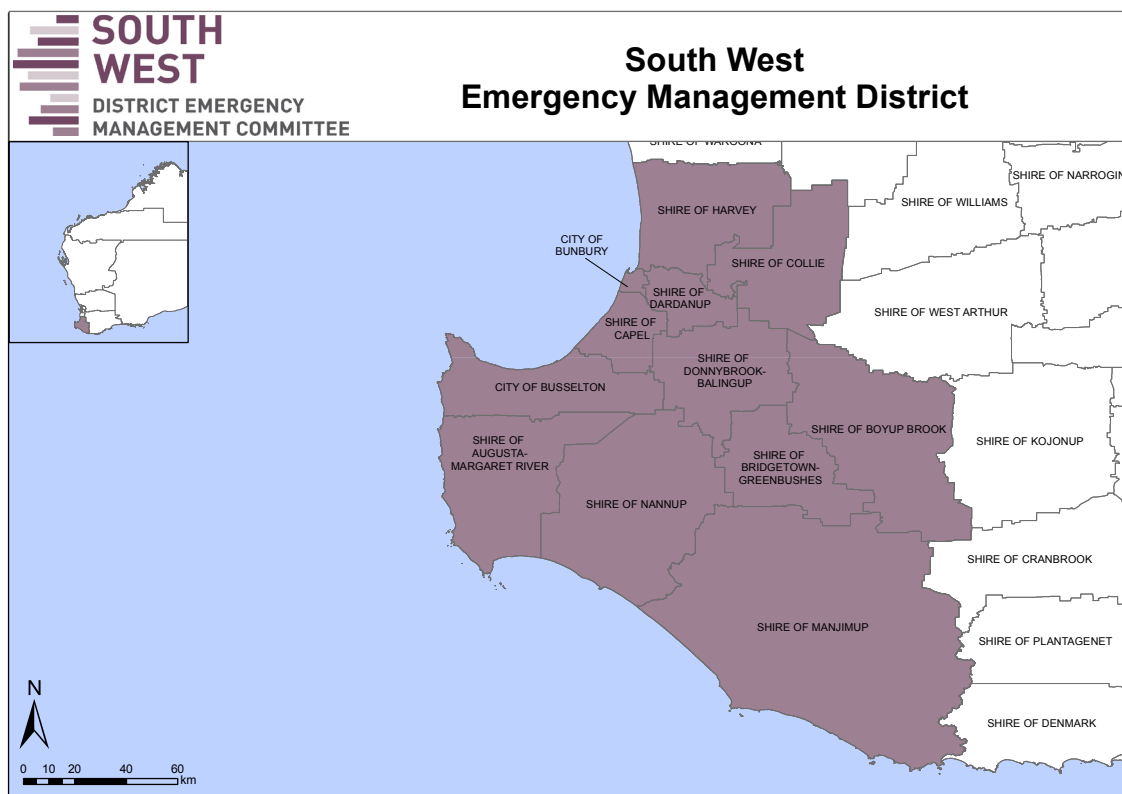


Figure 17: South West EM district map.

Appendix C: South West EM district consequence table

(based on population: 180,776; gross area product: \$15.630 billion)

	Insignificant	Minor	Moderate	Major	Catastrophic
People*					
Mortality	Not Applicable.	At least 1 death.	At least 1 death.	At least 2 deaths.	At least 19 deaths.
Injuries / Illness	1 serious injury or any minor injuries.	1 person critically injured with long-term or permanent incapacitation or 1 person seriously injured.	1 person critically injured with long-term or permanent incapacitation or more than 2 serious injuries.	More than 2 critical injuries with long-term or permanent incapacitation or more than 19 serious injuries.	More than 19 critical injuries with long-term or permanent incapacitation or more than 181 serious injuries.
Economy					
Loss in economic activity and/or asset value	Decline of economic activity and/or loss of asset value less than \$625,200.	Decline of economic activity and/or loss of asset value between \$625,200 and \$6,252,000.	Decline of economic activity and/or loss of asset value between \$6,252,000 and \$62,520,000.	Decline of economic activity and/or loss of asset value between \$62,520,000 and \$625,200,000.	Decline of economic activity and/or loss of asset value greater than \$625,200,000.
Impact on important industry	Inconsequential business sector disruption.	Significant industry or business sector is impacted by the emergency event, resulting in short-term (i.e. less than one year) profit reductions.	Significant industry or business sector is significantly impacted by the emergency event, resulting in medium-term (i.e. more than one year) profit reductions.	Significant structural adjustment required by identified industry to respond and recover from emergency event.	Failure of a significant industry or sector.
Environment					
Loss of species and/or landscapes	No damage to ecosystems at any level.	Significant loss or impairment of an ecosystem or species recognised at the local and regional levels. and/or Minor damage to ecosystems and species recognised at the state, local or regional level	Minor damage to ecosystems and species recognised at the national level. and/or Significant loss or impairment of an ecosystem or species recognised at the state level and/or Severe damage to or loss of ecosystems and species recognised at the local/regional level.	Permanent destruction of an ecosystem or species recognised at the local/regional level. and/or Severe damage to or loss of an ecosystem or species recognised at the state level. and/or Significant loss or impairment of an ecosystem or species recognised at the national level.	Permanent destruction of an ecosystem or species recognised at the national or state level. and/or Severe damage to or loss of an ecosystem or species recognised at the national level.
Loss of environmental value	Inconsequential damage to environmental values of interest.	Minor damage to environmental values of interest.	Significant damage to environmental values of interest.	Severe damage to environmental values of interest.	Permanent destruction of environmental values of interest.
Public Administration					
Governance Functions	Governing bodies' delivery of core functions is unaffected or within normal parameters.	Governing bodies encounter limited reduction in delivery of core functions.	Governing bodies encounter significant reduction in the delivery of core functions. and/or Governing bodies are required to divert some available resources to deliver core functions or seek external assistance to deliver some of their core functions.	Governing bodies encounter severe reduction in the delivery of core functions. and/or Governing bodies are required to divert a significant amount of available resources to deliver core functions or seek external assistance to deliver the majority of their core functions.	Governing bodies are unable to deliver their core functions.
Social Setting					
Community wellbeing	Community social fabric is disrupted Existing resources sufficient to return the community to normal function No permanent dispersal.	Community social fabric is damaged Some external resources required to return the community to normal function No permanent dispersal.	Community social fabric is broken Significant external resources required to return the community to normal function Some permanent dispersal.	Community social fabric is significantly broken Extraordinary external resources are required to return the community to functioning effectively Significant permanent dispersal.	Community social fabric is irreparably broken Community ceases to function effectively, breaks down Community disperses in its entirety Community unable to support itself.
Community Services	Inconsequential / short term impacts.	Isolated / temporary reductions.	Ongoing reductions.	Reduced quality of life.	Community unable to support itself.
Culturally important objects	Minor damage to objects of cultural significance.	Damage to objects of identified cultural significance.	Damage or localised widespread damage to objects of identified cultural significance.	Widespread damage or localised permanent loss of objects of identified cultural significance.	Widespread and permanent loss of objects of identified cultural significance.
Culturally important activities	Minor delay to a culturally important community event.	Delay to or reduced scope of a culturally important community event.	Delay to a major culturally important community event.	Temporary cancellation or significant delay to a major culturally important community event.	Permanent cancellation of a major culturally important community activity.

*Criteria for people have been rounded up to the nearest whole person.

Appendix D: Glossary and risk matrix

Annual Exceedance Probability (AEP)	The probability of an emergency event of a given size or larger occurring in any given year, expressed as a percentage.
AS/NZS ISO 31000:2009	International standard for risk management which forms the basis of the Emergency Risk Management process.
Consequence	Impact(s) of an event on the five key areas: environment, economy, people, social setting and public administration.
Emergency	The occurrence or imminent occurrence of a hazard which is of such a nature or magnitude that it requires a significant and coordinated response.
Emergency Risk Management (ERM)	A systematic process which contributes to the wellbeing of communities and the environment. The process considers the likely effects of hazardous events and the controls by which they can be minimised.
Hazard	Source of potential harm or a situation with a potential to cause loss.
Impact	To have a noticeable or marked effect on.
Level of risk (risk level)	Magnitude of a risk or a combination of risks, expressed in terms of the combination of consequences and their likelihood.
Likelihood	Chance of something happening. It is used as a general descriptor of probability and may be expressed qualitatively or quantitatively.
Recovery	The support of emergency affected communities in the reconstruction and restoration of physical infrastructure, the environment and community, psychological and economic wellbeing.
Response	The combatting of the effects of an emergency, provision of emergency assistance for casualties, reduction of further damage, and help to speed recovery.
Risk	The combination of the probability of an event and its negative consequences.

The matrix⁵ below calculates risk levels based on the consequence and likelihood levels assigned to a risk statement. Please note the likelihood of a statement in this report is determined by multiplying the scenario probability (AEP) by the probability of the risk statement occurring (as determined in workshops).

	Consequence level				
Likelihood	Insignificant	Minor	Moderate	Major	Catastrophic
Almost Certain (63% per year or more)	Medium	Medium	High	Extreme	Extreme
Likely (10% to <63% per year)	Low	Medium	High	Extreme	Extreme
Unlikely (1% to <10% per year)	Low	Low	Medium	High	Extreme
Rare (0.1% to <1% per year)	Very low	Low	Medium	High	High
Very Rare (0.01% to <0.1% per year)	Very low	Very low	Low	Medium	High
Extremely rare (<0.01% per year)	Very low	Very low	Low	Medium	High

⁵ from the *National Emergency Risk Assessment Guidelines* (2015) Australian Government Attorney-General's Department

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