



INDEPENDENT REVIEW  
OF THE EXTREME  
WEATHER EVENT  
SOUTH AUSTRALIA  
28 SEPTEMBER –  
5 OCTOBER 2016

Report presented to the  
Premier of South Australia

Review Authors  
Gary Burns  
Leanne Adams  
Guy Buckley

---

---

---

## Table of Contents

<b>Figures</b> .....	<b>iv</b>
<b>Glossary</b> .....	<b>v</b>
<b>Acknowledgements</b> .....	<b>ix</b>
<b>Executive Summary</b> .....	<b>xi</b>
THE BLACK SYSTEM EVENT (a loss of power to the entire State).....	xi
EMERGENCY MANAGEMENT – STRATEGIC AND OPERATIONAL – IN SOUTH AUSTRALIA.....	xii
OPERATIONAL RESPONSE AND COORDINATION.....	xiii
FLOOD RISK.....	xiii
Conclusion.....	xiv
<b>Recommendations</b> .....	<b>xv</b>
<b>1. INTRODUCTION</b> .....	<b>1</b>
<b>2. REVIEW TERMS OF REFERENCE (TOR)</b> .....	<b>3</b>
<b>3. REVIEW METHODOLOGY</b> .....	<b>6</b>
<b>4. WEATHER</b> .....	<b>7</b>
<b>4.1 Severe thunderstorm and tornado outbreak, 28 September 2016</b> .....	<b>7</b>
<b>5. EVENT TIMELINE</b> .....	<b>8</b>
<b>6. A BUSY WINTER</b> .....	<b>9</b>
<b>7. A STATE WITHOUT POWER (BLACK SYSTEM EVENT)</b> .....	<b>11</b>
<b>7.1 SA Power supply</b> .....	<b>11</b>
<b>7.2 The black system event</b> .....	<b>12</b>
<b>7.3 Public information</b> .....	<b>15</b>
<b>7.4 Industry</b> .....	<b>16</b>
<b>7.5 Fuel</b> .....	<b>17</b>
<b>7.6 Food and Retail</b> .....	<b>18</b>
<b>7.7 Police and Emergency Services</b> .....	<b>19</b>
State Emergency Services (SES) and Country Fire Service (CFS) State Control Centres.....	20
Police (SAPOL).....	20
SA Ambulance (SAAS) .....	21
Metropolitan Fire Service (MFS) .....	21
<b>7.8 SA Water</b> .....	<b>22</b>
<b>7.9 SA Health</b> .....	<b>22</b>
Aged Care .....	23
Emergency Management Arrangements.....	24
<b>7.10 Department of Planning, Transport and Infrastructure (DPTI)</b> .....	<b>25</b>
Traffic Management Centre (TMC) .....	26
<b>7.11 Telecommunications (mobile)</b> .....	<b>27</b>
ABC 891 Radio.....	29
UHF / VHF radio .....	30
Satellite phones .....	30

---

National Broadband Network (NBN) .....	30
South Australian Government Radio Network (SAGRN) .....	31
<b>8. IMPACT OF EXTREME WEATHER AND FLOODING .....</b>	<b>35</b>
<b>8.1 Damage assessment process .....</b>	<b>37</b>
<b>9. FLOODING .....</b>	<b>39</b>
<b>9.1 Dams .....</b>	<b>41</b>
<b>9.2 Angus and Bremer Rivers .....</b>	<b>43</b>
<b>9.3 Metropolitan rivers and creeks .....</b>	<b>45</b>
<b>9.4 Onkaparinga River .....</b>	<b>46</b>
<b>9.5 Gawler and Para Rivers .....</b>	<b>48</b>
<b>9.6 North of Gawler .....</b>	<b>52</b>
<b>9.7 Naracoorte Creek .....</b>	<b>54</b>
<b>9.8 Flood risk .....</b>	<b>55</b>
<b>9.9 SA Flood Inquiries Taskforce and Flood Reform Taskforce .....</b>	<b>56</b>
<b>9.10 Flood information system .....</b>	<b>57</b>
<b>9.11 Intelligence .....</b>	<b>57</b>
<b>9.12 Levees .....</b>	<b>59</b>
<b>10. EMERGENCY RESPONSE .....</b>	<b>61</b>
<b>10.1 Call receipt and dispatch .....</b>	<b>61</b>
<b>10.2 Effective allocation of resources .....</b>	<b>62</b>
<b>10.3 Coordinating multiple agencies and many tasks .....</b>	<b>63</b>
<b>10.4 Automatic Vehicle Location (AVL) and resource tracking .....</b>	<b>65</b>
<b>10.5 Emergency services and response agencies .....</b>	<b>66</b>
<b>10.6 Interstate resources .....</b>	<b>68</b>
<b>10.7 Sandbag activities .....</b>	<b>70</b>
<b>10.8 Rescues from fast moving water .....</b>	<b>72</b>
<b>10.9 Traffic management .....</b>	<b>74</b>
<b>11. EMERGENCY MANAGEMENT IN SOUTH AUSTRALIA .....</b>	<b>77</b>
<b>11.1 Emergency Management Act .....</b>	<b>79</b>
<b>11.2 Prevention, Preparedness, Response and Recovery (PPRR) .....</b>	<b>79</b>
<b>11.3 The Third 'R' - Resilience .....</b>	<b>80</b>
Being Resilient - The need to do more in South Australia .....	80
Resilience messages .....	82
<b>11.4 Natural Disaster Resilience Program (NDRP) – Grant Funding .....</b>	<b>82</b>
<b>11.5 State Emergency Management Plan .....</b>	<b>83</b>
<b>11.6 Control agency for black system events .....</b>	<b>85</b>
<b>11.7 Emergency Management Council .....</b>	<b>85</b>
<b>11.8 The State Emergency Management Committee .....</b>	<b>87</b>
<b>11.9 Advisory Groups/Committees .....</b>	<b>87</b>
State Mitigation Advisory Group (SMAG) .....	87
State Response Advisory Group (SRAG) .....	88
State Recovery Committee (SRC) .....	88
State Public Information and Warnings Advisory Group (SPIWAG). .....	89
<b>11.10 Assurance .....</b>	<b>90</b>

---

---

11.11	Emergency Control and Coordination Centres .....	91
11.12	State Crisis Centre.....	91
11.13	State Emergency Centre .....	92
11.14	Role of Emergency Management Australia and Defence.....	94
11.15	Zone Emergency Management Centres (ZECs), now Zone Emergency Support Teams (ZESTs) under the December 2016 SEMP .....	95
12.	<b>STATE EMERGENCY MANAGEMENT AND INCIDENT MANAGEMENT.....</b>	<b>97</b>
12.1	Control Centres.....	97
12.2	Incident information systems (electronic systems) .....	99
12.3	Incident management systems (people management systems) .....	101
12.4	Personnel for incident and emergency management roles .....	103
12.5	Fatigue management.....	104
12.6	Rostering and availability .....	105
12.7	Mapping Functional Support Group as a potential model for resourcing .....	107
12.8	Training and accreditation .....	108
12.9	Exercising .....	110
12.10	Debriefs and lessons management.....	110
13.	<b>PUBLIC INFORMATION .....</b>	<b>113</b>
13.1	Public information functional support group .....	114
13.2	Messages .....	114
13.3	Communication tools .....	115
13.4	Emergency Alert – a multi-agency capability .....	117
13.5	Community liaison and information .....	118
13.6	Relief and recovery information .....	119
13.7	Continuity of public information throughout PPRR phases .....	120
14.	<b>EMERGENCY RELIEF AND RECOVERY.....</b>	<b>122</b>
14.1	Relief centres .....	122
14.2	Relief funding and loss of power grant.....	124
14.3	Homelessness Code Blue response .....	126
14.4	Outreach to the community .....	126
14.5	Red Cross.....	127
14.6	Recovery Centre (Virginia).....	127
14.7	Assistant State Coordinator Recovery.....	128
14.8	Public health .....	129
14.9	Waste management .....	129
14.10	Natural Disaster Relief and Recovery Arrangements.....	130
15.	<b>AN ALTERNATIVE MODEL FOR CONSIDERATION.....</b>	<b>134</b>
15.1	South Australian Emergency Management Office.....	134
15.2	State Relief and Recovery Office .....	135
16.	<b>BIBLIOGRAPHY .....</b>	<b>138</b>
17.	<b>ADDITIONAL REPORTS ALSO CONSIDERED .....</b>	<b>141</b>
	Legislation .....	143
18.	<b>ATTACHMENTS .....</b>	<b>145</b>
	Attachment 1 – SA Health Flinders Medical Centre Standby Power Electrical Systems Post-incident Review, AURECON.....	145

---

---

Attachment 2 – Port Augusta Generator Failure Investigation Report, Systems Solutions Engineering .....	145
Attachment 3 – Australian Government, Bureau of Meteorology, Severe thunderstorm and tornado outbreak South Australia 28 September 2016 .....	145
Attachment 4 – Submission to Independent Review of the Extreme Weather Event South Australia 28 September – Dennis Mulroney and Peter Schar .....	145

## Figures

Figure 1 - Sequence of severe weather events from May - October 2016.....	9
Figure 2 – Damage to Port Victoria jetty.....	36
Figure 3 - Flood affected catchments - locality map - 4/10/2016 - DEWNR mapping support team.....	40
Figure 4 - Beerenberg dam, Hahndorf (DEWNR) .....	41
Figure 5 - Dam at Hahndorf (DEWNR).....	41
Figure 6 - Angas River (DEWNR)      Figure 7 - Bremer River, Callington Road (DEWNR) .....	43
Figure 8 - Langhorne Creek (DEWNR) .....	44
Figure 9 - Strathalbyn town centre (DEWNR).....	45
Figure 10 - River Torrens in flood, Felixstow .....	45
Figure 11 – Verdun township (DEWNR).....	46
Figure 12 - Shillabeer Road, Oakbank .....	47
Figure 13 - Mt Bold Reservoir water outflows (DEWNR) .....	48
Figure 14 - South Para (DEWNR)      Figure 15 - North Para River, Turretfield dam (DEWNR) .....	49
Figure 16 - Gawler River break outs (DEWNR).....	50
Figure 17 - Gawler River - Flood Map (DEWNR mapping support team) .....	51
Figure 18 - Wakefield River at Balaklava, including Balaklava hospital (DEWNR).....	52
Figure 19 - Wakefield River, looking south towards Port Wakefield (DEWNR) .....	53
Figure 20 - Naracoorte airport (DEWNR) .....	54
Figure 21 - Footbridge at Naracoorte Creek.....	54
Figure 22 - Minister Malinauskas addressing SES crews .....	68
Figure 23 – information about how to fill and lay sandbags .....	70
Figure 24 - Sand-bagging at Two Wells staging area.....	71
Figure 25 - Queensland 'if it's flooded, forget it' campaign.....	73
Figure 26 - Excerpt from sa.gov.au emergency section of the website.....	74
Figure 27 - Weather briefing in the SES SCC .....	97
Figure 28 - Community meeting at Virginia .....	118
Figure 29 – Information on mosquito control after floods and storms, in Khmer .....	120
Figure 30 - Emergency relief information .....	124

---

## Glossary

The following abbreviations and terms are used within this document.

<b>Term</b>	<b>Description</b>
ACMA	Australian Communications and Media Authority
AEMC	Australian Energy Market Commission
AEMO	Australian Electricity Market Operator
AFAC	Australasian Fire and Emergency Service Authorities Council
AGM	Annual general meeting
AIDR	Australian Institute of Disaster Resilience
AIIMS	Australasian Inter-service Incident Management System
ALERTS	Adtec Linked Emergency Response Telephone System
ANCOLD	Australian National Committee on Large Dams
ANZCTC	Australia-New Zealand Counter Terrorism Committee
ANZEMC	Australia-New Zealand Emergency Management Committee
ATM	Automatic Teller Machine
AVL	Automatic Vehicle Location
BCP	Business Continuity Plan
BoM	Bureau of Meteorology
CALD	Culturally and Linguistically Diverse
CBD	Central Business District
CEWT	Central Exercise Writing Team
CFS	Country Fire Service
CIMS	Critical Incident Management System (SAPOL System)
COAG	Council of Australian Governments
Comcen	SA Metropolitan Fire Service Communications Centre
CRIMSON	Critical Resource Incident Information Management System Online Network
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DASP	Damage Assessment Support Plan
DCSI	Department of Communities and Social Inclusion
DECD	Department of Education and Child Development
DEWNR	Department of Environment, Water and Natural Resources
DPC	Department of the Premier and Cabinet
DPTI	Department of Planning, Transport and Infrastructure
DSD	Department of State Development
EARS	Emergency Assessment Reporting System
EEP	Eastern Eyre Peninsula
EFTPOS	electronic funds transfer point of sale
EM	emergency management

---

EMC	Emergency Management Council
ESO	emergency services organisation
ESP	essential services power
FMC	Flinders Medical Centre
FRT	Flood Reform Taskforce
GIS	Geospatial Information System
GPS	Global Positioning System
IAP	Incident Action Plan
IC	Incident Controller
ICC	Incident Control Centre
ICCS	Incident Command and Control System
ICS	Incident Control System
ICT	Information, Communication and Technology
IMT	Incident Management Team
IRT	Impact Recording Tool
IVR	Interactive Voice Recording
kV	Kilovolt
LGA	Local Government Association
LGDRAG	Local Government Disaster Recovery Assistance Guidelines
LRC	Local Recovery Committee
MFS	Metropolitan Fire Service
MFSG	Mapping Functional Support Group
MoU	Memorandum of Understanding
MST	Mapping Support Team
MW	MegaWatts
NDRP	National Disaster Resilience Program
NDRRA	Natural Disaster Relief and Recovery Arrangements
NDSR	National Strategy for Disaster Resilience
NEM	National Electricity Market
NERAG	National Emergency Risk Assessment Guidelines
NGOs	Non-government organisations
NOCC	Network Operations Control Centre (SAGRN)
NRM	Natural Resources Management
NSDR	National Strategy for Disaster Resilience
ODG	Office for Digital Government
PC	Productivity Commission
PLS	Patawolonga Lake System
PCB	Police Communications Building
PFCP	Police forward command post

---

---

PIFSG	Public Information Functional Support Group
PIRSA	Department of Primary Industries and Regions SA
POC	Police Operations Centre
PPC	Personal Protective Clothing
PPRR	Prevention, Preparedness, Response, Recovery
PV	Photovoltaic
RCC	Regional Coordination Centre
RDO	Regional Duty Officer
SA	South Australia
SAAS	South Australia Ambulance Service
SACFS	South Australia Country Fire Service (see also CFS)
SAFECOM	South Australian Fire and Emergency Services Commission
SAGRN	South Australian Government Radio Network
SAHEMS	South Australia Health Emergency System
SAMFS	South Australia Metropolitan Fire Service (see also MFS)
SAPN	South Australia Power Networks
SAPOL	South Australian Police
SASESVA	South Australia State Emergency Service Volunteers' Association
SCC	State Control Centre
SDO	State Duty Officer
SEC	State Emergency Centre
SEICCC	State Emergency Information Call Centre Capability
SEMC	State Emergency Management Committee
SEMP	State Emergency Management Plan
SEMPO	State EM Planning Officer
SEMTO	State EM Training Officer
SES	State Emergency Service
SESIIMS	SASES Incident Information Management System
SIMT	State Incident Management Teams
SMAG	State Mitigation Advisory Group
SPIWAG	State Public Information and Warnings Advisory Group
SRAG	State Response Advisory Group
SRC	State Recovery Committee
SRRO	State Relief and Recovery Office
SSP	State Support Package
TMC	Traffic Management Centre
TOR	Terms of Reference
UHF	Ultra High Frequency (radio frequency)
UPS	Uninterrupted Power Supply

---

---

VHF	Very High Frequency (radio frequency)
ZEC	Zone Emergency Centre
ZEMC	Zone Emergency Management Committee
ZEMP	Zone Emergency Management Plan

---

## Acknowledgements

Information was provided to the Review by the following agencies and organisations:

Adelaide Airport Ltd	Department for the Environment, Water and Natural Resources
Adelaide City Council	
Australian Energy Market Operator	Department of Communities and Social Inclusion
Aged Care Industry Association	
Aldridge Traffic Controllers Pty Ltd	Department of Planning, Transport and Infrastructure
Alexandrina Council	Department of Primary Industries and Regions SA
Attorney General's Department	
Australian Energy Regulator	Department of State Development
BHP Billiton (Olympic Dam)	Department of the Premier and Cabinet
BNJ Group - Management Consultants Logistics	Department of Treasury and Finance
Broadcast Australia	District Council of Kimba
Bureau of Meteorology	ElectraNet
Bushfires SA Assistance	Emergency Management Committee
Business SA	Emergency Management Council
Cavpower - Power Systems - Regency Park	Environment Protection Authority
City of Holdfast Bay	Eyre Peninsula Local Government Association
City of Tea Tree Gully	Eyre Peninsula Mineral and Energy Resources Community Development Taskforce
Coorong District Council	
Correctional Services	Flinders Fertility
Country Fire Service	Flinders Medical Centre
Country Fire Service Volunteers Association	Gawler River Flood Authority
Department for Communities and Social Inclusion	Grains Research and Development Corporation
Department for Education and Child Development	Green Industries SA
SA Health	KordaMentha
	Local Government Association

---

Local Government Business Services	Royal Adelaide Hospital
Lower Eyre Health Advisory Council	SA Ambulance Service
Member for Flinders, Mr Peter Treloar MP	SA Fire and Emergency Services Commission
Minister for Agriculture, Food and Fisheries, The Hon Leon Bignell MP	SA Metropolitan Fire Service
Minister for Communities and Social Inclusion, The Hon Zoe Bettison MP	South Australian Police
Minister for Health, The Hon Jack Snelling MP	SA Power Networks
Minister for Police, Minister for Emergency Services, The Hon Peter Malinauskas MLC	SA State Emergency Service
Minister for Regional Development; Minister for Local Government, The Hon Geoff Brock MP	SA State Emergency Service Volunteer's Association
Minister for Sustainability, Environment and Conservation; Minister for Water and the River Murray, The Hon Ian Hunter MLC	SA Tourism
Minister for Transport and Infrastructure, The Hon Stephen Mullighan MP	SA Water
Nyrstar	Shadow Minister for Emergency Services, Duncan McFetridge MP
Office for Digital Government	South Australian Wine Industry Association Incorporated
Optus	State Emergency Management Committee
Port Lincoln City Council	State Emergency Services
Port Pirie Regional Council	State Mitigation Advisory Group
Premier of South Australia	Stockport Peak Body Community Association
Queensland Reconstruction Authority	Town of Walkerville
Red Cross	Treasurer, The Hon Tom Koutsantonis MP
Regional Development Australia Far North	Vodafone
	Western Adelaide Zone Emergency Management Committee

Over 300 individuals provided information to the Review

---

## Executive Summary

On 28 September 2016, South Australia experienced an extreme weather event which brought thunderstorms, destructive winds, large hailstones and heavy rain.

Between 3.00pm and 4.00pm tornados moved across the State, primarily in the Mid-North, which damaged 23 transmission towers and at 3.48pm triggered a State-wide power outage – a black system event.

Whilst power was restored to Adelaide and its environs within several hours, large areas of the State remained without power for several days.

There was significant loss to businesses and the community caused by the consequences of the loss of power and the damage inflicted by wind, rain, hail, flooding and storm surge.

This weather event was forecast well before it eventuated and public warnings had been issued. State emergency arrangements were in place and appropriate briefings had been provided to the Emergency Management Council in the lead up to, and during the event.

At 5.30pm, the State Coordinator declared the event a 'Major Incident' and the Chief Executive of the Department of Communities and Social Inclusion was appointed as Assistant State Coordinator Recovery.

An Independent Review (Review) was commissioned by the Premier of South Australia, The Honourable, Jay Weatherill, MP on Tuesday 4 October 2016. The objectives included to review: the emergency management response to the impacts caused by the extreme weather; the response to and management of the impacts of the State-wide power outage; and, the adequacy of the State's prevention, preparedness, response and recovery arrangements.

A number of other enquiries have been established to examine the electrical power issues associated with the State-wide power outage.

While emergency services dealt the myriad of tasks associated with the extreme weather, they were concurrently also required to deal with the consequences of a black system event.

Whilst most people were following safety advice and taking shelter from the storm to ensure their own well-being; emergency services, police, State government and local government employees, telecommunications and power network personnel, non-government organisations and volunteers were out in this weather or in various control, coordination or relief centres providing assistance to the community of South Australia.

Further, many volunteers, as they regularly do, put their lives on hold to assist the community. They worked long hours and many were then required to return to their usual paid employment with little rest or respite.

Essentially, there are four key themes covered by the review, all being referenced against South Australia's emergency management arrangements, being: the black system event, operational response and coordination, flood risk, and emergency management arrangements.

### **THE BLACK SYSTEM EVENT (a loss of power to the entire State).**

The significance of wide-spread power loss over several hours and in some areas days, identified new challenges for State and local governments, businesses, and individuals. There were problems associated with loss of power, including; access (lack of) to food, medications, fuel, credit card payments, cash, telecommunications, essential home appliances and water.

Many business continuity plans (BCPs) across the business sector and within government departments including emergency services, proved to be inadequate. BCPs lacked contingencies for back-up power or the planned contingencies failed.

---

There are established emergency plans to manage shortages of electricity, fuel and gas in South Australia. However, there is no plan for or wide spread, extended duration power outage and the associated consequences.

The egress of thousands of people from the Adelaide Central Business District (CBD) in a relatively short period of time was orderly despite the frustrations of access to public transport, inoperative traffic lights, traffic congestion, and poor weather and road conditions. However, it highlighted a need for an evacuation plan for the CBD and backup power for traffic lights to achieve a rapid exit from the CBD through identified traffic corridors.

The role of all communications including mobile tele-communications during emergencies is critical. Mobile phone towers have limited backup power or maybe overwhelmed which can result in communications difficulties and inability to access services such as Triple Zero (000). The National Broadband Network may add further complications to home users during emergencies due to the handset's reliance on electrical power.

A State plan to manage information, communication and technology (ICT) failure, particularly mobile communications, needs to be developed. The plan needs to include contingencies for when mobile telecommunications are unavailable.

Businesses and individuals should also assess their circumstances and develop or amend their own business continuity plans or individual safety plans accordingly.

## **EMERGENCY MANAGEMENT – STRATEGIC AND OPERATIONAL – IN SOUTH AUSTRALIA.**

South Australia's primary emergency legislation is the *Emergency Management Act 2004* (amended July 2006) which provides a basis for the establishment of emergency arrangements in this State. Four key principles which underpin the Act and emergency management are Prevention, Preparedness, Response and Recovery.

The State Emergency Management Plan (SEMP), is the primary plan to manage emergencies and is supported by a range of other plans and operating manuals at State and departmental level.

The response phase of an emergency is the phase that is most visible. During this emergency, responders provided a highly professional and capable response, under very trying conditions. Emergency services are generally well-equipped and trained, and have gained experience during past emergencies.

The various command, control and coordination centres performed well, but there are opportunities to improve their capability and capacity to support those in the field. There were issues concerning planning, staffing, fatigue and roster management, knowledge of role and function, training, exercising, interoperability of information management systems and the condition of the centres themselves have been identified in this review and recommendations made to improve these aspects.

Because this event was declared a 'Major Incident' by the State Coordinator an Assistant State Coordinator Recovery was appointed, and a recovery operation implemented, predominately focussed on the market gardens at Virginia. A Local Recovery Coordinator was also appointed.

The timing and the administration of the Loss of Power Grant, caused considerable consternation, not only with potential recipients, but also with those involved in emergency relief and recovery. Members of the community overwhelmed help lines with enquiries. Emergency relief centres became congested and the ability of these centres to effectively provide physical support and comfort to those seeking relief was severely hampered.

It would seem that recovery operations in South Australia are somewhat ad-hoc and inconsistent in the manner in which they are identified and carried out.

The Review proposes an alternative model for emergency relief and recovery to make these aspects of emergency management more effective and efficient.

---

It is in prevention and preparedness that significant gains can be made by improving South Australia's ability to withstand, or minimise the consequences of, events of this nature. It is not the domain of government alone, but also the responsibility of the broader community, business, and individuals to participate through shared-responsibility and develop their own resilience.

Resilience is often talked about; there is a national strategy agreed by the Council of Australian Governments (COAG), and whilst there is mention of it in plans and documents, it would appear that at this time, it is insufficient and requires a concerted effort to develop strategies, operationalise them and achieve government, community and public 'buy-in'.

The guiding principles of the *Emergency Management Act 2004*, are that the emergency management arrangements must: be based on an all hazards approach in addressing emergency prevention, preparedness, response and recovery; reflect the collective responsibility of all sectors of the community; and, recognise that effective arrangements require a co-ordinated approach from all sectors of the community.

Whilst the Act recognises that all sectors of the community, including local and State government, non-government organisations and individuals have a role to play, it is another thing to achieve those objectives. This is made particularly difficult with the disparate State of South Australia's structural arrangements and the lack of a robust assurance framework. The State government needs to commit to the strategic development of emergency management in South Australia to enable and develop a more holistic, cohesive approach to prevention, preparedness, response and recovery.

The Review proposes changes to the State Emergency Management Plan, continued development of an assurance framework and a new structural model to provide a point of focus for emergency management. This could be achieved by consolidating core components into one agency (the South Australian Fire and Emergency Services Commission) and placing all components (prevention, preparedness, response and recovery) of emergency management under one Responsible Minister (The Minister for Police and Emergency Services).

## OPERATIONAL RESPONSE AND COORDINATION

The SES is the Control Agency for a severe weather event and together with the CFS, MFS, SAPOL, DEWNR, PIRSA, local government/councils and the ADF provided the core operational response, in very difficult circumstances.

The response and coordination of operational crews from the emergency services was generally well-managed.

With events of this scale, complexity and duration there will always be opportunities for improvement. Some of the challenges that need to be addressed by response agencies include: managing the number of calls for assistance from the public; prioritisation, allocation and coordination of hundreds of tasks across multiple agencies; and, tracking operational resources such as vehicles during emergencies to ensure efficient and effective resource allocation.

Incident management is another area where improvements could be made such as: State control centre facilities upgrades; upgrade of connectivity to, and facilities of, incident control centres; better coordination and management of incident management and emergency management personnel; and, consistent training, exercising and development of those personnel.

## FLOOD RISK

Flooding is the most costly natural disaster in South Australia, currently average annual damages from flooding in the State in exceed \$32 million.

The significant rain event which commenced on 28 September 2016, occurred on an already saturated environment so even the smallest amount of rain would produce runoff with almost no loss. As little as 5mm of rain resulted in almost instantaneous spikes in river levels at gauges. All catchments in SA were effected.

---

Adelaide is built on a natural floodplain and there are many dwellings situated within known flood risk areas. Despite historical impacts, many places and communities in South Australia are not well adapted to floods. The time between floods and the fragmentation of responsibilities between councils, State Government, the Commonwealth and private land owners creates barriers to agreement on collective action to adapt to floods and the changing risk profile.

In SA there is currently very little dam safety legislation and governance and no provisions for how a dam is designed or constructed with regard to safety risk, nor any ongoing supervision to ensure dams are properly maintained. The challenges with identification and management of dams have been raised in previous reports. The increased level of risk that was evident during this event, and the impact on responders and the community, reinforces the need for policy development in relation to dam safety.

The flood intelligence activities undertaken by DEWNR during this event highlighted a number of gaps in information which impede the ability of hydrologists to predict potential flooding and the ability of the SES to warn the community and respond effectively to flooding. The two main information gaps are gaps in flood risk information (flood studies) and gaps in flood monitoring (rainfall and river level gauges). Both of these information sources are critical for understanding the vulnerability of a community to flooding, its likely impacts, and the severity of the flood in real time.

A recommendation of the SA Flood Inquiries Taskforce (DEWNR, 2012) was to 'clarify responsibilities for management of watercourse, levee banks and other infrastructure in relation to flooding'.

During this event many levees were overtopped and lost their structural integrity causing widespread flooding in areas they were designed to protect. There is also evidence in the aftermath of this event, of landholders creating new levees to protect their properties for future flooding vents without seeking any approval or giving appropriate consideration of where re-directed water would impact further downstream.

## Conclusion

When reading this Review, and considering the comments and recommendations made; do not forget that the overall assessment of the Review was that this State-wide, complex event was in general, well-managed, with coordinated, effective response and recovery operations put in place.

Government departments and other organisations have undertaken their own reviews and, in the case of the Department of Health and Ageing, sought independent investigations into generator failures at Flinders Medical Centre and Port Augusta Hospital. Many of the actions and recommendations contained within these reviews are already being implemented.

Those who were involved assisting South Australians during the response and recovery phases of the extreme weather and black system event deserve praise for their efforts, their dedication and commitment.

---

## Recommendations

- Recommendation 1. That relevant agencies, such as the Department of State Development, SA Police and emergency services, collaborate to establish an education campaign to encourage businesses in South Australia to develop Business Continuity Plans which, among other potential hazards such as flood and fire, also take into account the potential impact of an extended power outage.
- Recommendation 2. That SA Health, develop an emergency plan to manage an extended power outage or black system event which, in addition to the requirements outlined in recommendation 16:
- a) includes a process for identification and registration of vulnerable persons in the community to ensure an effective support is provided
  - b) enables access to pharmaceutical medicines for at risk persons
  - c) provides for the support of individuals with equipment in their homes to support their own health e.g. oxygen equipment
- Recommendation 3. That SA Health undertake a review of their emergency management arrangements. Health State Controllers should be consulted during this review and arrangements should be consistent throughout the department and across the State and compatible with State emergency management arrangements and information systems
- Recommendation 4. That the Department of Planning, Transport and Infrastructure review their Business Continuity Plan to:
- a) minimise the loss of public transport services
  - b) ensure ongoing fuel supply
  - c) improve public information e.g. electronic signage on buses, about alternative transport arrangements when there is a significant disruption to operations.
- Recommendation 5. That SA Police develop an evacuation plan for the Adelaide Central Business District (CBD) which includes:
- a) a Traffic Management Plan to assist in the movement of persons and vehicles away from the CBD
  - b) protocols for the early placement of a SA Police liaison officer within the Traffic Management Centre.
- Recommendation 6. Install UPS on traffic lights on main Central Business District (CBD) and arterial roads to allow an effective movement of traffic during a loss of power.
- Recommendation 7. That a State Plan be developed for managing the consequences of a black system event or other major power outage. The plan should include:
- a) public information strategies including providing advice on: the extent of the outage; anticipated and worst-case time frames for power restoration; services impacted by the outage; and, information about contingencies and actions by local and State government to provide support
  - b) identification of key providers that will supply fuel to emergency services and other critical services (vehicles and generators)

- 
- c) identification of priorities for provision of fuel and restoration of power
- d) arrangements for purchase of essentials, for government agencies and the public, when electronic payment systems fail; and
- e) arrangements for obtaining and distributing food.
- Recommendation 8. In order to increase resilience and public safety during emergencies, the State Emergency Management Committee should request the Australia and New Zealand Emergency Management Committee to place on the agenda, and consider establishing a national position, on redundancies for mobile communications (including phone tower back-up power) and the National Broadband Network.
- Recommendation 9. That the Office for Digital Government, in close partnership with telecommunications companies (e.g. Telstra, Optus, Vodaphone), develop a Control Agency Plan for Information and Communication Technology including mobile communications. The plan should consider:
- a) provision of back-up power to priority infrastructure
- b) back-up equipment requirements e.g. satellite phones for government ministers (including training and other support)
- c) potential impact on the National Broadband Network on emergency services when there is an extended power outage / black system event
- d) arrangements with commercial mobile network carriers to ensure emergency and support services have priority access to available mobile networks; and
- e) contingencies to ensure ongoing functionality of the Broadcast Australia network
- Recommendation 10. Consider bringing other agencies onto the SA Government Radio Network, in particular, Department of Education and Child Development and local government, to support more effective coordination and provide a reliable communications contingency during emergencies.
- Recommendation 11. Deliver consistent and regular training in the use of the SA Government Radio Network to all users to maximise the efficiency and effectiveness of the network in times of emergency e.g. reduce the issues associated with network busy signals.
- Recommendation 12. Identify, document and communicate contingency arrangements and procedures for emergency services in the event SA Government Radio Network paging is turned off to conserve power, or other loss of paging capacity.
- Recommendation 13. That the Attorney General's Department consult with local government regarding potential for them to provide logistical support associated with backup power supply to SA Government Radio Network towers in the event of an emergency.
- Recommendation 14. That the glossary of terms in the State Emergency Management Plan be reviewed to ensure all relevant language is included. All agencies need to ensure the use of clear communication and accurate use of terminology, including in describing the status of critical services e.g.
-

- 
- Triple Zero (000), SA Government Radio Network, electrical and water supplies and infrastructure.
- Recommendation 15. That Attorney General's Department explore options to overcome fatigue and welfare issues of SAGRN staff associated with emergency events of extended duration.
- Recommendation 16. That SA Police, emergency services, health facilities, utility providers and other key service providers, review their Business Continuity Plans giving consideration to factors such as:
- a) identification of: business critical needs; essential services power requirements; back-up power requirements for all facilities including State, regional and local facilities such as Police, SES, MFS and CFS stations; the need for any arrangements for back-up power to be included in contracts for design and or lease of Government premises
  - b) contingencies for black system events and extended power outages
  - c) regular back-up generator testing regime protocols, including testing under load and for long durations
  - d) contingencies for communications when mobile, landline and/or radios are not operational e.g. satellite phones; and
  - e) alternative State control centre facilities that are pre-identified, equipped and have procedures for moving to the alternative facility.
- Recommendation 17. Continue development of the Damage Assessment Support Plan to:
- a) integrate data produced from Control Agency Stage One Assessment into the Stage Two Assessment
  - b) develop a capability to undertake Stage Four Assessments which includes assessment of impacts to infrastructure, agriculture, businesses and the economy; and
  - c) consult with the Local Government Association regarding how/if their Emergency Assessment Reporting System (EARS) data can be utilised in the damage assessment process.
- Recommendation 18. That the Flood Reform Task Group, as proposed by the Department of Environment, Water and Natural Resources, develop a business case for Cabinet, based on the dam safety discussion paper (Pisaniello & Tingey-Holyoak, 2016) which identifies options and a way forward to address dam safety in SA.
- Recommendation 19. That, giving consideration to the previous recommendation, the Flood Reform Response Working Group identify and consider appropriate agency involvement and protocols for response to and management of dams which are in danger of losing their structural integrity or spilling.
- Recommendation 20. That the Flood Reform Task Group identify an appropriate mechanism for stakeholder agencies (including the State Emergency Service, Department of Environment and Natural Resources, Bureau of Meteorology and SA Water, as a minimum) to share data and information and develop plans and strategies for management of water levels in reservoirs and spill management during floods in South Australian water catchments.
-

- 
- Recommendation 21. That consideration and resources be given to support the implementation of recommendations in the report prepared on behalf of Department of Environment, Water and Natural Resources (Australian Water Environments, 2016), for flood warning classification of stream gauges and other locations.
- Recommendation 22. That resources be provided to support the implementation of recommendations in the South Australian Levee Bank Management Issues Paper (DEWNR, 2015) including:
- a) development of relevant policy; and
  - b) identification of responsibilities in relation to levee management and flood mitigation
- Recommendation 23. That the SES in collaboration with MFS Communications Centre (Comcen) investigate and implement options to reduce the number of calls coming into the Comcen, (particularly on 132500). Options could include better utilisation of the available options on the Interactive Voice Recording and community education to increase community resilience.
- Recommendation 24. Engage an independent business analyst to review the current call, receipt and dispatch process for emergency services i.e. the Metropolitan Fire Service, Country Fire Service and State Emergency Service, from the initial call for assistance through to response of emergency service resources, including the allocation and coordination of multiple taskings.
- Recommendation 25. That the State Emergency Service, in consultation with key stakeholders, identify and implement a robust system and procedures for prioritising, allocating and coordinating multiple tasks.
- Recommendation 26. That systems for Automatic Vehicle Location and personnel tracking be implemented within the emergency services sector.
- Recommendation 27. That the State Emergency Service explores options for providing suitable personal protective clothing to personnel from supporting emergency services during major flooding events and sandbagging operations.
- Recommendation 28. Establish an 'Interstate Deployment Support Plan' for incoming interstate resources. The plan should outline responsibilities and arrangements for this function. Consider including this plan into the State emergency management arrangements.
- Recommendation 29. That the State Emergency Service together with the Local Government Association and Country Fire Service establish a plan for coordinated provision of sandbags to the public, including options for what is provided, where and when, and the process for effective communication of availability to the public.
- Recommendation 30. That the State Emergency Service be provided with resources to enable them to deliver swiftwater awareness training to all first responders including emergency services, SA Police and council crews.
- Recommendation 31. That SA Police, as the control agency for search and rescue, and State Emergency Service who have the responsibility for providing search and rescue services under the State Emergency Management Plan, develop a swiftwater rescue capability plan that describes key
-

---

swiftwater risk locations, roles and responsibilities of emergency services, State swiftwater resources and dispatch arrangements.

- Recommendation 32. That the annexure to the State Emergency Management Plan, 'Traffic management during emergencies', be updated to include: responsibilities and processes for road closures; and, Department of Planning, Transport and Infrastructure requirements in regards to provision of road closure information, notification of changes in road closure status and publishing of that information.
- Recommendation 33. Develop practical policy outcomes to support resilience (e.g. the 72-hour model) and promote this broadly to community through media, awareness campaigns, policies etc. Research should be undertaken to gain insight into the types of messaging and activities that have the most impact on sustained behaviour change within the community before committing to a particular model.
- Recommendation 34. That, as with earthquake, SA Police be designated the Control Agency under the State Emergency Management Plan for black system events or other major power outages.
- Recommendation 35. That the Department of the Premier and Cabinet revise the ministerial documents relating to emergency management.
- Recommendation 36. That members of Emergency Management Council ensure they are prepared to undertake their roles and responsibilities during emergency events, including establishing:
- a) contingencies for communication e.g. satellite phone
  - b) access to relevant documents such as the State Emergency Management Plan, supporting plans, ministerial guidelines, agency plans and contacts in hard copy and/or portable device
  - c) formalised arrangements for briefings (up and down), and
  - d) arrangements for suitable representation e.g. relevant Chief Executive(s) or their deputy, at all Emergency Management Council meetings .
- Recommendation 37. That additional guidance be provided in the State Emergency Management Plan regarding the activation, structure and operation of Zone Emergency Support Teams. This should include:
- a) the reporting relationship between the Zone Emergency Support Teams, the State Emergency Centre and the State Coordinator
  - b) briefing requirements between the State Coordinator (or their representative) and the Zone Emergency Support Teams when the State Emergency Centre is activated
  - c) responsibilities for provision of local public information; and
  - d) the appointment of public information officers in Zone Emergency Support Teams (where there is no incident management team (established) to provide information to local communities
- Recommendation 38. That the State Emergency Management Plan be reviewed and updated including:
- a) a better description of the responsibilities of Hazard Leaders

---

b) establish a mechanism for a hazard leader to identify systemic failures in coordination of their hazard, with a clear process to raise those issues with SEMC and seek a remedy

c) establish resilience as a key heading in the plan, with clearly documented strategies and responsibilities; and

d) consider the Schar/Mulroney submission and taking a 'fresh eyes' approach

Recommendation 39. That the Department of Education and Child Development be included as a member of State Emergency Management Council and represented in the State Emergency Centre.

Recommendation 40. That regular training and exercising is conducted for all State Emergency Centre participants including Liaison Officers.

Recommendation 41. That an Emergency Management Assurance Framework be established as soon as possible to support the emergency management arrangements and the State Emergency Management Plan.

Consider establishing an Inspector General Emergency Management department or position.

Recommendation 42. That a review of the role and effectiveness of the State Emergency Management Committee (SEMC) including: the legislative functions; membership including the chair; roles and responsibilities; and, SEMC Advisory Groups be undertaken.

Recommendation 43. That the position of Deputy Director, Office for Digital Government is dedicated to the Office for Digital Government; and

that people throughout DPC are identified and trained to perform appropriate roles within the State Crisis Centre.

Recommendation 44. Review representation in the State Emergency Centre including:  
a) determining if there is a more suitable functional support group e.g. the Procurement Functional Support Group, to replace the Logistics Functional Support Group, and if so, Chief Procurement Officer, DPC, has responsibility for the management of this role within the State Emergency Centre.

b) That when the State Crisis Centre is not operating from a physical location, a State Crisis Centre liaison officer is attached to the State Emergency Centre.

Recommendation 45. That the recommendation made following the Pinery bushfire, 'to review control facilities at State, region and incident level', be expanded to include all emergency services facilities that will be utilised for major incidents other than bushfire e.g. flood and earthquake and to also be extended into metropolitan areas, and implemented.

Recommendation 46. That a single emergency service multi-agency control centre be established with sufficient capacity and capability to deal with all types of emergency incidents in SA. Also consider Police and State Emergency Centre.

Recommendation 47. Review existing electronic information systems used by emergency services organisations and other government agencies, and:

- 
- a) establish a single incident information system across the Emergency Services Sector (MFS, CFS and SES), and
- b) identify opportunities to consolidate incident information systems of other agencies
- Recommendation 48. Through the Emergency Management Workforce Project, identify and provide training and development for SA's emergency management sector personnel (government agencies, and non-government agencies including volunteers). State Emergency Management Committee should consider supporting recommendations from stage two of the project when the project report is tabled.
- Recommendation 49. Consider opportunities to identify synergies between the incident management systems used in SA being the, Australasian Inter-service Incident Management System (AIIMS) and ICCS Plus. This might include joint training and exercising in roles that are common across both systems.
- Recommendation 50. Review and update the role, function, workload and focus of the groups/committees that contribute to incident management and emergency management capabilities including the State Emergency Management Training Committee, Interagency Incident Management Sub-Committee and the Central Exercise Writing Team.
- Recommendation 51. Establish a State incident management and emergency management training capability which provides for:
- a) consistent training across the State
- b) personal development and endorsement processes for roles
- c) identification, recruitment and development of personnel from other government agencies; and
- d) incident management and State emergency centre functional role training and development across all sectors.
- e) skills maintenance including upskills, refresher training and exercises
- f) incident and strategic leadership training
- g) consistent training for inter-agency liaison officers at all levels
- Recommendation 52. Review and reinstate the State Emergency Management Training Officer and State Emergency Management Planning Officer (capability development) positions to operate with a broad, strategic and leadership focus.
- Recommendation 53. Establish a State-wide resourcing capability to support incident management teams, regional coordination centres, zone emergency centres, relief centres, recovery centres and State control centres. some of the features of such a capability should include:
- a) multi-agency, cross-government, State-wide pool of incident management and emergency management personnel building on the State incident management team concept currently facilitated by the Country Fire Service, and expanded to include all hazards, multi-agency teams with a roster that provides year-round coverage
- b) a system that enables staff and volunteers from any agency to identify their availability for upcoming shifts
-

---

c) a rostering system that enables one or more incident management teams, staging areas, regional coordination centres, State control centres and relief centres to develop, maintain and distribute rosters and structure charts in a more coordinated manner

d) identifying areas of expertise for key incident and emergency management functions (e.g. public information, alerts and warning, media liaison, logistics and resource management) that would benefit from a coordinated and resource pooling approach and take steps to implement (consider the Mapping Functional Support Group model as a potential service delivery model).

Recommendation 54. Establish a lessons management capability across the SA emergency management sector to collect, analyse and track lessons identified during debriefs and reviews following events and other sources such as interstate and overseas reviews and inquiries.

Recommendation 55. Update the SEMP Part 3, Annex F 'Debriefs' to provide more guidance regarding the types of debriefs, when they are required to be undertaken and at what level and guidance for undertaking and recording debriefs, and implementing lessons identified.

Recommendation 56. Review and update Part 3, Annex C, of the SEMP 'Public Information and Warnings' to:

a) clarify the role and responsibilities of the Public Information Functional Support Group and control agencies in relation to public information

b) define requirements and processes for liaising with the community, including holding community meetings

Recommendation 57. Update the Public Information Functional Support Group Plan to include:

a) standards, outputs, systems and processes required to be used by control agencies and the Public Information Functional Support Group during emergencies

b) guidance on the public information cycle through the prevention, preparedness, response and recovery phases which includes the responsibilities and information requirements during different phases, and effective transition between phases

c) establishing a public information intelligence cell within the Public Information Functional Service Group; and

d) identifying tools or resources to monitor social media

Recommendation 58. Task South Australian Fire and Emergency Services Commission with further developing the Emergency Alerts capability across government agencies including to:

a) establish and maintain a centralised training program for emergency alert initial and refresher training.

b) establish a pool of endorsed Emergency Alert personnel from across government agencies to enable control agencies to assist each other with the emergency alert function during emergencies.

c) develop supporting processes to ensure that the capability supports: emergencies involving any hazard; consistent issuing of alerts and warnings; consistent messages; and effective

- 
- communication and notification of alerts issued to relevant internal and external stakeholders.
- Recommendation 59. Develop a Disaster Waste Management Plan to form part of the State Emergency Management Plan which describe participating agencies and responsibilities for various aspects of waste management during and after emergencies.
- Recommendation 60. Develop a State Relief and Recovery Plan as a distinct part of the State Emergency Management Plan which should include:
- a) potential locations for suitable facilities for relief and recovery centres which: are in locations safe from hazards such as flooding and bushfire; and, have appropriate access and suitable ablutions.
  - b) formalisation of roles and capabilities of non-government organisations such as Red Cross.
- Recommendation 61. Conduct a review into South Australia's arrangements for relief and recovery grant, Local Government Disaster Recovery Assistance Arrangements and Natural Disaster Relief and Recovery Arrangement claims, the review should include governance coordination and criteria for provision and processing of relief/recovery grants
- Recommendation 62. Explore alternative emergency management models including the alternative model proposed above to establish a South Australian Emergency Management Office and State Relief and Recovery Office within the South Australian Fire and Emergency Services Commission, to ensure that all the objects and guiding principles of the *Emergency Management Act 2004*, and State Emergency Management Plan are addressed efficiently and effectively.

---

## 1. INTRODUCTION

On 28 September 2016, an intensifying low-pressure system moved across the State bringing thunderstorms, destructive winds, large hailstones and heavy rain. At 3.48 pm tornados in the State's Mid-North damaged 23 transmission towers triggering a State-wide power outage (known as a 'black system event').

At 5.30 pm on 28 September 2016, the South Australian Police (SAPOL) State Coordinator declared the event a 'Major Incident', and the Chief Executive of the Department for Communities and Social Inclusion (DCSI) was appointed as Assistant State Coordinator in relation to recovery operations.

Power was restored to the metropolitan area within a few hours, but large areas of the State remained without power for an extended period. Port Lincoln for example, was not returned to full power supply until early in the morning of 1 October 2016.

There was significant financial loss incurred to businesses and the community due to the power outage (Business SA, 2016).

Considerable damage occurred across many parts of South Australia. Major flooding impact occurred on the Northern Adelaide Plains, including Virginia with around 1500 hectares inundated by floodwaters, 250 growers were affected and 727 greenhouses damaged. Over 10 000 tonnes of crops were lost with an estimated value of \$51 m.

Private losses included 43 dwellings with major damage, 53 with minor damage, and 38 out-buildings and 14 vehicles also damaged. There have been approximately 5 000 insurance claims made.

The elevated sea levels and storm tides on 28 and 29 September 2016, caused damage along the west coast of Eyre Peninsula. The high tide in the Spencer Gulf on the afternoon of 29 September coincided with significant storm surges and large, locally generated sea waves and swell, which caused flooding and erosion to coastal settlements on the eastern coast of Eyre Peninsula and the Yorke Peninsula. There was widespread cliff erosion, lowering of beaches and dune erosion along much of the South Australian coast.

Flooding in the Waterfall Gully precinct of the Cleland Conservation Park resulted in significant damage and the closure of the Mount Lofty Summit Trail.

There was damage to critical infrastructure such as roads, bridges and electrical infrastructure, and economic and social impacts in the intensive horticultural areas near Virginia, and viticultural areas in the Barossa and Langhorne Creek.

Following the extreme weather event of 28 September – 5 October 2016, the Premier of South Australia, The Hon Jay Weatherill MP announced that an Independent Review would be undertaken to investigate the circumstances surrounding the event and consider the adequacy of the State's prevention, preparedness, response and recovery plans.

This report is a consolidation of the findings of the Review based on incident information and information provided by organisations, individuals, groups and agencies during interviews and submissions.

Given the complicating factors of a black system event, the extreme weather emergency, and the broad spectrum of damage and flooding across the State; overall the response from all local and State government and non-government agencies was predominantly well executed.

It is easy to ask questions in retrospect without the constraints of a major emergency such as limited time, significant pressure, incomplete information, incident complexity and fatigued personnel. It can be assumed that all response and support personnel, endeavour to do the

---

best job they can, and make the best decisions possible based on the knowledge they have at the time.

While most people were following safety advice and taking shelter from the storm and generally looking after their own well-being, the emergency services, police, State government and local government, non-government organisations (NGOs), telecommunications and power network personnel were out in the severe weather or in various control/coordination centres providing assistance to the community of South Australia.

Further, many volunteers, as they regularly do, put their own well-being and comfort secondary to assisting the community. They worked long hours in a voluntary capacity and many were then required to return to their usual paid employment with little rest or respite.

Too often criticism is levelled at response agencies and responders for the decisions they make, the time taken to provide aid and a perceived lack of assistance. Much of this criticism comes from individuals and groups in the community who need to be far more resilient and take responsibility for their own safety, welfare and non-life/injury threatening problems.

The nature of reviews is such that a critical eye is cast over an event, including the lead up to, the response and the recovery from the event. This Review makes a number of recommendations aimed at improving emergency management in South Australia.

When reading this Review, and considering the comments and recommendations made, it should not be forgotten that the overall assessment of the Review was that this very complex event was, in general, well managed, with coordinated, effective response and recovery operations put into place by many local and State government and non-government agencies.

It should also be recognised that all government agencies involved in this event have conducted their own critical debriefs and reviews and in the case of SA Health, sought independent investigations into generation failures at Flinders Medical Centre (FMC) and Port Augusta hospital. Many of the actions and recommendations contained within these reviews are currently being implemented.

---

## 2. REVIEW TERMS OF REFERENCE (TOR)

The Premier of South Australia, The Hon Jay Weatherill MP appointed former Police Commissioner, Gary Burns to lead an Independent Review to investigate the circumstances surrounding the event and consider the adequacy of the State's prevention, preparedness, response and recovery plans.

The Review team comprises Mr Gary Burns, Mrs Leanne Adams, SES, Manager Policy and Projects, Superintendent Guy Buckley, SAPOL, Mrs Rachel Danjkov, DPC, Project Officer.

The Australian Emergency Market Operator (AEMO) is undertaking its own independent inquiry into the technical issues surrounding the power outage; and the Council of Australian Governments (COAG) Energy Minister's Council will also review this incident at a national level, and a more recent announcement is that a South Australian Parliament Legislative Council Select Committee has been established for similar purposes.

The TOR of this Review are;

### Objectives

The objectives of this Review are to:

- review the emergency management response to the State-wide impacts of the extreme weather events which occurred between Wednesday 28 September and Thursday 5 October 2016
- review the response to and management of the impacts of the State-wide power outage caused by damage to infrastructure resulting from destructive winds on Wednesday 28 September 2016
- consider the adequacy of the State's prevention, preparedness, response and recovery arrangements

### Principles

The principles of this Review and of lessons management in general:

- lessons management is a process involving: recording observations; analysing cause and effect; identifying how to improve and what needs to change; implementing changes required; and communicating lessons to all of those involved
- no blame: it's not an inquiry or investigation, it's a process to learn and improve
- focussing on the future and seize opportunities for improvement
- a systems view: identify any negative circumstances and how they might be avoided in future
- learning from what 'might have happened'
- gathering information from a variety of sources because all perspectives can be valuable

### Outcomes

The Review is to identify:

- activities that were done well, that should be repeated in future and captured in documentation for future events
- opportunities for improvement to response, incident management and emergency management arrangements, processes or activities

- 
- measures that could mitigate the impacts and consequences of future weather events of this magnitude
  - recommendations, actions and accountabilities to facilitate required changes

#### Inclusions

The Review is to consider, analyse and make recommendations as appropriate regarding:

1. The impact of State-wide power outage, including on:
  - 1.1. critical infrastructure
  - 1.2. South Australian Government Radio Network (SAGRN)
  - 1.3. transport and traffic management
  - 1.4. hospitals and health
  - 1.5. Telstra and other networks
  - 1.6. community preparedness and response
  - 1.7. business continuity planning
  - 1.8. access to food, water, cash, fuel and other essentials
2. The impact of various aspects of the weather event including:
  - 2.1. significant flooding in highly impacted locations such as Virginia
  - 2.2. damage from destructive winds
  - 2.3. damage to homes, businesses, primary industries, community assets and infrastructure
3. The adequacy, appropriateness, effectiveness and timeliness of response, incident management and emergency management activities including:
  - 3.1. The preparedness of control and supporting agencies, functional services, local councils and communities.
  - 3.2. Public information including:
    - alerts and warnings
    - State Emergency Information Call Centre Capability (SEICCC) and Triple Zero (000) and other relevant public assistance numbers
    - evacuation management
    - traditional, digital and social media, and press conferences
    - community liaison and information
    - continuity of public information through prevention, preparedness, response and recovery phases
  - 3.3. Incident management arrangements including: multi-agency incident management teams; availability of personnel to fill roles; coordination of personnel and; the capability, training and experience of personnel.
  - 3.4. Emergency management arrangements including: activation of the State Emergency Centre (SEC); roles and interaction of agencies in the SEC; the capability, training and experience of personnel; declaration of a major incident;

---

traffic management; interstate and Federal assistance; and, consideration of the impact of/on the updated State Emergency Management Plan (SEMP).

- 3.5. Access to and sharing of intelligence resources including weather, hydrological and water catchment and reservoir intelligence.
- 3.6. Damage assessment processes including responsibilities, coordination of resources, prioritisation of tasks, data collection and information sharing.
- 3.7. Reporting to, from and within the: State Emergency Service (SES) State Control Centre; the SEC; Emergency Management Council and other relevant command and control centres.
- 3.8. Relief arrangements including the establishment, communication of availability and effectiveness of relief centres and services.
- 3.9. Recovery including responsibilities relating to waste management.
- 3.10. Any other matters the Reviewer sees fit.

The Reviewer may issue interim recommendations at any point relating to any of the above items as appropriate.

#### Exclusions

The Review will not consider the extent of the damage to the State's electrical infrastructure or matters to do with the national electricity market.

---

### 3. REVIEW METHODOLOGY

The approach taken in the Review has been consistent with the terms of reference. Submissions were provided and people were interviewed in a way which sought to avoid individual blame, and concentrate on discovering how well arrangements worked and where they could be improved. It is important to note that this Review was not a Royal Commission or a form of Judicial Inquiry, where a forensic examination of witnesses occurs.

Given the TOR, which in effect, provides for an examination of the extreme weather event referenced against the State's emergency management arrangements, this Review will be based on an 'all hazard' approach, although highlighting the extreme weather together with a black system event. It should also be borne in mind that a black system event and the consequences of it may also be caused by other natural (e.g. earthquake) and man-made hazards (e.g. terrorism).

The aim is to seek improvement of the State's emergency arrangements and as such, more time and words will be spent on the challenges for the various government agencies and organisations involved and opportunities to improve, rather than the multitude of actions undertaken which were successful and well done.

It is common practice for emergency services and other agencies in SA to hold internal debriefs following a major event. There were debriefs specific to the extreme weather held at multiple levels including for local response, communities and businesses, agencies, State control centres, regional coordination centres, the State emergency centre, zone emergency centres, incident management teams support agency command centres and others.

All government agencies have carried out their own debrief(s) and identified opportunities for improvement and made recommendations within their own remit to be implemented to increase the efficiency and effectiveness of response.

The Review undertook a significant amount of research into reports from previous reviews and enquiries including reports from SA, across Australia and around the world.

Some of the key reports that have influenced the direction and findings of this report are referenced throughout the document and can be found within Section 16 Bibliography; Additional Reports also Considered are contained in Section 16.

The comments made concerning areas of improvement will be focussed on those observations which have a major impact within an agency and/or more broadly impact and provide opportunities for improvement to the State's emergency management arrangements and those government agencies and organisations which contribute to them, including local government and non-government organisations (NGOs).

On 2 November 2016, a call was made for submissions to the Review. Any individual or group could make a submission, which were required to relate to one or more of the Review's TOR.

Over 80 submissions or other documents were received from members of the public and government agencies.

The Review team met with stakeholders including ministers, State and local government representatives, emergency services personnel, industry leaders, community representatives, businesses and associations as well as affected individuals in person and through teleconference facilities.

Site meetings were held at the Port Lincoln Zone Emergency Centre and Virginia Recovery Centre as well as at various emergency service and other agency sites.

The Review has been mindful of the requirement to report by 26 January 2017, and inquiries have been made and issues researched and analysed in order to meet this deadline.

---

## 4. WEATHER

Extreme weather impacted SA between 28 September and 5 October 2016. The weather included a series of severe thunderstorms, tornados and damaging winds, heavy rain, large hailstones and high tides.

### 4.1 Severe thunderstorm and tornado outbreak, 28 September 2016

The Bureau of Meteorology (BoM) prepared a comprehensive report on the severe thunderstorm and tornado outbreak on 28 September 2016 (Attachment 3) (Australian Government, BoM, 2016). This report describes in detail the meteorological conditions relating to the initial phase of a week of severe weather, below is a summary:

TIME	EVENT
11.30am - 1.00pm	Thunderstorms occur along a front extending from Woomera in the north and Port Lincoln in the south. Two cells over Eastern Eyre Peninsula (EEP) were beginning to show supercell characteristics.
1.00 - 2.00pm	Supercell thunderstorms impacted various townships across EEP including Kimba, Cleve, Arno Bay and Cowell before moving into Spencer Gulf.
	Reports of large hail (up to 5cm at Cleve), heavy rainfall with local flash flooding and damaging winds.
1.30 - 3.00pm	Thunderstorms impact Whyalla, Port Augusta and Woomera with very strong wind gusts.
2.30 - 3.00pm	Supercell thunderstorms begin to impact the eastern coastline of Spencer Gulf.
2.50pm	Reports of a tornado near Port Broughton.
3.00 - 3.30pm	The line of thunderstorms along and ahead of the front stretches from west of Hawker in the north to the Fleurieu Peninsula in the south. Supercells begin to impact the Mid North and Flinders districts. Large hail of 4-6cm recorded at Snowtown and Blyth.
3.30 - 4.30pm	A further six tornadoes are believed to have occurred at Crystal Brook, Blyth, Melrose, Wilmington, Mid North and at Andrews.
4.30 - 11.00pm	Thunderstorms begin to merge into a squall line during the evening and move through the State and eventually exist the State late in the evening.

Cyclonic winds battered small towns like Blyth and Melrose in the State's Mid-North, where tornadoes lifted the roofs off sheds and buildings.

---

*'It picked the machinery shed up... and it plucked it up out of the ground and threw it 30 yards or so out into the paddock. The hay shed was thrown about another 50 yards from that. It got pretty much flattened. It's held up by a truck trailer and a stack of hay at the moment.'*

*Blyth resident*

---

## 5. EVENT TIMELINE

The following graphic provides a summary of the timeline of the weather and impacts during the event from Monday 26 September through to Friday 7 October 2016.

<b>Mon 26 Sept</b>	<ul style="list-style-type: none"> <li>• Bureau of meteorology predicts severe weather for Wednesday</li> <li>• SES State Control Centre activated and the level of preparedness is increased to medium</li> <li>• SES briefs State Emergency Centre</li> </ul>
<b>Tues 27 Sept</b>	<ul style="list-style-type: none"> <li>• SES level of preparedness raised to high</li> <li>• flood watch issued for Mid North, Mt Lofty Ranges and Metro Adelaide</li> <li>• sandbags made available to the public at some locations</li> </ul>
<b>Wed 28 Sept</b>	<ul style="list-style-type: none"> <li>• storm force winds, lightning, thunderstorms, heavy rain, large hail stones and storm tides</li> <li>• wind damage to homes and businesses, 23 electrical transmission towers blown over in the Mid North</li> <li>• State-wide black system event, no telecommunications in some areas, Adelaide CBD without power and grid-locked without traffic lights, power restored in Adelaide and some suburbs after a few hours</li> </ul>
<b>Thurs 29 Sept</b>	<ul style="list-style-type: none"> <li>• Eyre Peninsula still without power</li> <li>• heavy rain, ground is saturated, dams threatening to burst, rivers overflowing, many roads blocked, starts to flood in many areas including Langhorne Creek, Clare and Onkaparinga, Gawler and South Para Rivers</li> <li>• flood emergency warnings, advice and watch and act messages issued at multiple locations</li> </ul>
<b>Fri 30 Sept</b>	<ul style="list-style-type: none"> <li>• mains power restored to much of the area south and east of Port Augusta but outages remain for most of Eyre Peninsula</li> <li>• catchments saturated and high water levels, flood warnings for many catchments</li> <li>• relief centres open to communities affected by flooding</li> <li>• multiple people rescued from floodwaters</li> <li>• SA ESOs, ADF and crews from WA and Vic assist with operations</li> </ul>
<b>Sat 1 Oct</b>	<ul style="list-style-type: none"> <li>• weather conditions moderate and in some rivers levels begin to recede</li> <li>• power restored to most of the State</li> <li>• many flood warnings are downgraded</li> <li>• flood emergency warnings for Port Wakefield and Galwer River</li> <li>• properties inundated north of Adelaide</li> <li>• large numbers of roads closed due to flooding</li> <li>• the township of Langhorne Creek is isolated due to all roads being cut off</li> </ul>
<b>Sun 2 Oct</b>	<ul style="list-style-type: none"> <li>• reservoirs at or near 100% capacity and spilling over</li> <li>• water levels decreasing in most areas but potential for more rain over coming days</li> <li>• areas impacted by floodwaters being assessed</li> <li>• severe thunderstorm warning issued</li> </ul>
<b>Mon 3 Oct</b>	<ul style="list-style-type: none"> <li>• river levels continue to decrease despite rain continuing in some areas</li> <li>• more fronts predicted over coming days</li> <li>• flood watch issued for Onkaparinga, Mount Lofty Ranges, Adelaide Metro, Gawler and Torrens</li> </ul>
<b>Tues 4 Oct</b>	<ul style="list-style-type: none"> <li>• increase in calls for assistance for flood and storm damage</li> <li>• tornadic winds reported in southern suburbs</li> <li>• dams spilling and threatening to overtop, levee breaches</li> </ul>
<b>Wed 5 Oct</b>	<ul style="list-style-type: none"> <li>• weather warms and rain eases</li> <li>• Langhorne Creek flood levels and Naracoorte Creek yet to peak</li> <li>• damage assessments undertaken at Virginia</li> </ul>
<b>Thurs 6 Oct</b>	<ul style="list-style-type: none"> <li>• breach in levee along the Gawler River in Buckland Park</li> <li>• water levels in most locations are stable or dropping but Naracoorte Creek continues to pulse</li> <li>• damage assessments undertaken in Adelaide Hills and Fleurieu Peninsula</li> <li>• no BoM flood warnings or SES advice or warning messages</li> </ul>
<b>Fri 7 Oct</b>	<ul style="list-style-type: none"> <li>• water levels stable or dropping</li> <li>• demobilisation activities commence and Victorian support force return home</li> <li>• no BoM flood warnings or SES advice or warning messages</li> </ul>

---

## 6. A BUSY WINTER

Over a period of five months between May and October 2016, emergency services organisations (ESO's), the State Emergency Service (SES), Country Fire Service (CFS) and Metropolitan Fire Service (MFS) were exceptionally busy and attended thousands of taskings. SES is the control agency for extreme weather and flooding and responded to a significant proportion of these events, particularly for trees down.



### 9 May 2016

- intense low pressure system
- tidal inundation causing significant coastal damage
- heavy rain and damaging winds resulting in many trees falling
- in-excess of 1 300 requests for assistance (RFAs) to Emergency Service Organisations (ESOs)



### 9-13 July 2016

- damaging wind gusts and strong to gale force winds
- power outages
- flooding in the Adelaide Hills
- record cold temperatures
- almost 3 200 RFAs to ESOs, the majority of them for fallen trees



### 23 July 2016

- damaging winds across a significant proportion of the State
- series of cold fronts
- power outages
- nearly 900 RFAs to ESOs, including trees down, damage to homes and a roof severely damaged at Tennyson



### 25-26 July 2016

- locally damaging winds
- trees down
- power outages
- flooding including Adelaide Hills
- nearly 900 RFAs to ESOs,



### 14-17 September 2016

- heavy rain caused widespread flooding in Mt Lofty Ranges, Adelaide metropolitan area and southern suburbs and dams at capacity
- almost 50 homes with significant damage
- flooding and evacuation of residents at Old Noarlunga
- 1 670 RFAs to ESOs



### 28 September - 5 October 2016 (this event)

- six tornados
- Statewide power outage
- heavy rain causing widespread flooding
- storm damage and trees down
- 4 280 RFAs to ESOs

*Figure 1 - Sequence of severe weather events from May - October 2016*

---

The extreme weather event that commenced on 28 September 2016 occurred at a time when there had been multiple recent extreme weather events (as per the Figure 1 above). The exceptionally high rainfall across the State resulted in saturated catchments which meant that any further rainfall caused a quick rise in water levels in rivers, creeks and dams. There was also an existing level of fatigue of emergency services staff and volunteers which impacted on availability and capacity of individuals and organisations.

---

*'The frequency of severe weather events requiring State-level coordination over the 2016 winter and spring seasons represents an unprecedented level of operational activity and provides some context for the conduct of operations in response to the September/October event.'*  
(SASES, 2016)

---

Emergency services in SA are stretched for resources even during 'business as usual' activities and everyday response to incidents (particularly when it comes to volunteer agencies during volunteers normal working hours). Consecutive and sometimes overlapping events compound the impact of minimal resources such as fatigue due to long working hours; stress due to high levels of emergency operations; volunteers needing to spend time in their paid employment; and the backlog of usual duties that doesn't go away while services are operational.

The internal DCSI audit report of emergency relief and State Recovery Office articulated it well in the Statement below. It also demonstrates that the impact of frequent events impacts the agencies involved in relief and recovery for an even longer period of time, compared to response agencies, to recover and resume normal business following an event.

---

*'The growth in size, impact and frequency of significant events, combined with the longevity of post-event recovery commitments, means that, increasingly, there is insufficient opportunity between events to develop and implement all necessary practice and improvement initiatives arising'*  
(DCSI, 2016)

---

Councils encountered many challenges with the multiple events. Some council areas were unable to remedy damage caused previously, before being impacted by another event. Consecutive events exacerbated the clean-up and undermined work that had already been undertaken.

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) and BoM have reported that 2016 was a year of extreme weather events, wetter than average overall, and the fourth warmest on record for Australia and that there is significant evidence that climate change will increase the frequency and intensity of extreme weather events (CSIRO & Bureau of Meteorology, 2016).

---

*'As the global climate system has warmed, changes have occurred to both the frequency and severity of extreme weather.'*  
*Extreme rainfall events are likely to increase in intensity by the end of the century across most of Australia*  
(CSIRO & Bureau of Meteorology, 2016).

---

All indications are that, increased frequency and severity of severe weather events are part of the 'new normal', and the SA emergency services sector will need to adapt to ensure that prevention, preparedness, response and recovery activities are sustainable in the long-term.

---

## 7. A STATE WITHOUT POWER (BLACK SYSTEM EVENT)

A large scale blackout of power system is called a black system event. (AEMC, 2016)

The comments that follow are a general overview across the many agencies and facilities that exist within Police, ESOs and other State government agencies that have some response or involvement within EM arrangements within the State. Individual government agencies have recognised that there is a need to review their own internal practices including each facility and function to ensure they have considered and addressed issues associated with a loss of power. In doing so, they now need to consider the impact of an extended loss of power not just those power outages of short duration.

Some police, ESO and State government facilities had no back-up generator capability or uninterrupted power supply (UPS) for critical business to continue. Government agency responses to the blackout were quite varied, as was their ability to function and continue their provision of service to the community. A number of government agencies were reactive to the events on the night, with their ability to evacuate staff from buildings impacted by a number of issues which should have been identified within a BCP.

Some staff did not know what was required and were not conversant with or have an understanding of documented plans that they should have followed. Those plans that were in place and practiced were implemented and worked well.

A number of back-up generators activated as planned, which is evidence of agencies with a robust maintenance and testing regime (including regular testing of back-up generators under load for sustained periods combined with the exercise of BCP's). Those agencies that had a documented, tested and practiced BCP stood up well against the power outage. With any situation a number of technical / mechanical faults occurred resulting in a loss of power with back-up power systems. Attendance of required trades/technicians to address the faults was compounded by issues not normally impacting the call out of responding technicians, such as the lack of communications and slowed road traffic network caused by the blackout.

In some government agencies back-up generator power or essential services power (ESP) was found not to be connected to the required critical business needs and equipment. Building and workplace re-design had occurred without consideration to moving ESP with that re-design. This showed a lack of testing and exercising within preparation and preparedness of existing BCPs.

### 7.1 SA Power supply

South Australia (SA) generates electricity from both renewable and non-renewable sources, which is sold to electrical retailers through the National Electricity Market (NEM) managed by the independent Australian Energy Market Operator (AEMO). Retailers obtain electricity through the transmission network and sell to households and businesses. AEMO has overall responsibility for the management of power system security within the NEM through cooperation and assistance of network service providers and market participants.

Additional electricity can be brought into SA from eastern States via the Murraylink (Riverland) and Heywood (Limestone Coast) electricity interconnectors.

Natural gas is the main source of non-renewable energy generated in SA. Natural gas-fired generation equates to the largest percentage of the States non-renewable energy generation.

SA has established significant levels of renewable energy through large scale wind generation developments (wind towers) and rooftop solar photovoltaic (PV) installation and around 45% of SA's power generation now comes from renewable energy resources.

However, integrating the changing supply mix while maintaining affordability, reliability and security of supply is a key challenge facing the energy sector (ElectraNet, 2016, p. 11).

Generated electricity travels long distances along high voltage wires, 132 kV or 275kV to supply substations. Transformers further reduce that voltage to 60kV or 33kV.

---

In SA the high-voltage transmission network and large transmission towers are operated and managed by ElectraNet. In 1998, the State government announced the privatisation of the Electricity Trust of SA and the resulting sale saw the establishment of ElectraNet. In October 2000, ElectraNet began trading as a private company, operating the high-voltage electricity transmission network. The network includes 91 high-voltage substations with approximately 5 600 circuit kilometres of transmission lines. (ElectraNet, 2016 b)

The electricity distribution network was also privatised and SA Power Networks (SAPN) are the distribution network managers within the State. Lower voltage electricity feeds into a transmission system to distribution substations, where the voltage is further reduced. This electricity is distributed along wires before being further reduced in voltage to supply electricity to homes and businesses. With few exceptions power lines, distribution stations and most household electricity meters are owned and operated by SAPN.

SAPN have:

- over 750 000 customers
- 95 000 small business customers
- 5 000 large business customers
- 400 zone substations
- 73 000 street transformers
- 720 000 stobie poles
- 200 000 km of wires, and
- Coverage of 179 000 square kilometres within the State. (ElectraNet, 2016 c)

It is not in the scope of the TOR of the Review to comment on the extent of the damage to the State's electrical infrastructure; or matters to do with the national electricity market; as this will be addressed through a number of other reports currently being undertaken by AEMO – Black System Event Report in SA, COAG Energy Council and the South Australian Parliament Legislative Council Select Committee.

## **7.2 The black system event**

One of the most significant severe thunderstorm outbreaks in recent decades was experienced in central and eastern districts of South Australia during the afternoon and evening of 28 September 2016. Multiple supercell thunderstorms produced damaging and destructive wind gusts, including at least seven tornadoes, very large hailstones and locally intense rainfall. These supercell thunderstorms and tornadoes impacted the South Australian power network, contributing to the State-wide power outage.'

---

*'On Wednesday 28 September 2016, at 03.48pm electricity supply was lost across the State of South Australia (Black System Event). The loss of supply corresponded with a widespread outbreak of supercell thunderstorms with an exceptional number of tornadoes'*

*'Five faults led to the Black System Event, with four of these occurring on three transmission lines (Brinkworth - Templars West, Davenport - Belalie and Davenport – Mt Lock) (AEMO, 2016).*

---

A damage assessment on 6 October identified that the faults were caused by the impact of supercell thunderstorms and tornadoes.

The BoM further reported that in some areas wind gusts peaked at 190 – 260 kilometres per hour.

---

*'On this occasion critical infrastructure was damaged  
by an extreme weather event'  
(Australian Government, BoM, 2016)*

---

The events of 28 September 2016 demonstrate that the risk of black system events and the widespread loss of electrical power, regardless of cause is real. The majority of metropolitan Adelaide had power restored within several hours, however, the Far North, West Coast and Eyre Peninsula were without power for a substantially longer period.

Port Lincoln has three generators that are support to and 'backup' the primary network. These generators successfully started when the primary network suffered storm damage, and supply to Port Lincoln was restored at about 7.15pm on 28 September 2016. However, early in the morning of 29 September 2016, two generators failed and the other was manually shut down shortly afterwards because of stability issues. The generator which was shut down was made available mid-morning on 30 September 2016, after repairs. However, it was not until mid-afternoon on 30 September 2016 that it was supplying electricity to Port Lincoln. Following repairs to the primary network, this generator was shut down to allow the reconnection of Port Lincoln to the main network at 8.55pm on 30 September, with all power to Port Lincoln being restored shortly afterwards.

Port Lincoln business owners, Eyre Peninsula local government officials and State government officials were highly critical of the unreliability of electrical power on Eyre Peninsula. Whilst storm damage may have caused the main network repair problems and power loss during this extreme weather event, the generator failure had been experienced earlier in the month resulting in an extended power outage and for it to occur again about two weeks later raised the levels of frustration.

The Review team met with a large cross section of agencies, businesses and individuals. A consistent message was that there is an expectation and requirement for a reliable and secure supply of electricity to the State.

This event has shown that the State must plan for and consider all the implications that come with an extended loss of power, not just short-term power outages which people have previously experienced and seem better able to cope with and manage. Owing to the reliance on electrical power, the SA community needs to become more resilient for longer outages by being better prepared for any future events.

Today's modern, digital and highly technical society involves complex networks, communications and infrastructure, which are often linked and interdependent. Electricity is, with few exceptions, integral to all our systems, needs and requirements as a modern society.

The loss of power quickly impacts upon essential services, critical infrastructure and the very fabric of our society. Electrical power is often taken for granted but modern society (at all levels) is heavily reliant and dependent on it.

Services impacted by the immediate and long term loss of power include:

- information, communication and technology (ICT)
- transportation
- essential services
- fuel
- water and sewerage
- food
- health care
- financial services, including access to cash
- emergency services

Widespread loss of power has occurred previously in SA and on many occasions throughout the world. Loss of power can occur for many reasons, at any time and on any network.

Some recent examples of black system events are listed having similar impact to what was experienced with a widespread and sustained loss of power 28 September 2016.

The causes of a widespread and prolonged power outage can include: extreme weather; terrorism; a criminal act; technical failure; human error; human pandemic; and accidents. Black System events are believed by some to be more likely in the future.

### International events

<b>13 March, 1989</b>	Entire province of Quebec, Canada - six million Quebec residents suffered an electrical power blackout lasting 12 hours.  On March 10, 1989, a coronal mass ejection CME (billion-ton cloud of ionized gas), 'about the size of 36 Earths' escaped. On the 12 March 1989 the gas cloud crashed against Earth's magnetosphere and caused the Northern Lights to be seen as far south as Texas and Cuba.
<b>11 August., 1996</b>	Outage affected 4 million people in nine States caused by heat, sagging power lines and unusually high demand for electricity.
<b>11 March, 1999</b>	Southern Brazil, 97 million of the 160 million people living in Brazil lost power in what was the biggest blackout ever at the time. A bolt of lightning struck an electricity substation, which in turn shut down Itaipu, which was the largest power plant in the world.
<b>14-15 August, 2003</b>	Northeast United States and Canada outages spread over an area of 9,300 square miles, 50 million people affected by the blackout and was the biggest power outage in U.S. history. New York City, Albany, Hartford, Toronto, Ottawa, Detroit, Cleveland and Ontario. Cleveland, the loss of power also meant a loss of water - as there was no way to continue pumping water to 1.5 million people.
<b>28 September, 2003</b>	Italy- almost all of the country's 57 million people. The event occurred during the early morning hours after Rome's Nuit Blanche, an all-night arts festival. Because of this, trains were still running at 3:01 a.m. when a fault on the Swiss power system caused the overloading of two internal lines near to the Italian border. About 110 trains carrying more than 30 000 passengers were stranded.
<b>4 November, 2006</b>	Germany, France, Italy, and Spain. German power company switched off a high-voltage line across the River Ems in order to let a cruise ship pass, 10-15 million Europeans lost power. The company said that the problems began in northwestern Germany when its network became overloaded, possibly due to that manual switch off (although transmission lines had been shut down in the past without incident). The blackouts stopped trains in Germany and trapped dozens of people in elevators in France and Italy. Austria, Belgium, and Spain were also affected by the outage.
<b>30-31 July, 2012</b>	India, largest electrical outage in history (so far), the July 31st blackout of India affected an area encompassing about 670 million people, which is around 9% of the world's population. On the 31st, three of the country's interconnected northern power grids collapsed for several hours, affecting 22 States from the country's Eastern border with Myanmar to its western border with Pakistan.
<b>29 August 2015</b>	Power to 710 000 customers on Vancouver Island and lower mainland was lost, 705 000 customers had power restored within 72 hours of the storm.
<b>21 November 2015</b>	Power outage left 1.2 million people in Russia with reduced or no power after transmission towers in Ukraine were blown up.

<b>1 September 2016</b>	Hurricane Hermine Florida knocked out power for more than 350 000 people in Florida and southern Georgia, many were without power for several days.
<b>21 September 2016</b>	Full power system collapse occurred on the island of Puerto Rico affecting its entire population of 3.5 million inhabitants (Wikipedia, 2016).

These incidents demonstrate that the wide spread loss of power is not a unique event. It is important to recognise, that wide-spread power loss can occur and that individuals, communities, business and governments need to improve their resilience to better withstand the impact of power loss, whether of short or long term duration.

---

*Power is coming back to some of the 50 million people affected by the blackout which hit Thursday, continued into Friday, and is the biggest power outage in U.S. history.*

*The outage affected a wide swath of territory in the U.S. and Canada - including New York City, Albany, Hartford, Toronto, Ottawa, Detroit, Cleveland and Ontario - and has officials in the two countries engaging in a blame game as to what went wrong.*

*In Cleveland, the loss of power also meant a loss of water - as there was no way to continue pumping water to 1.5 million people...But the New York metropolitan area is still in a major mess, with full power still not back, meaning that subway and train systems are also not back.*

...

*However, Canadian authorities said it appeared lightning had struck a power plant on the U.S. side of the border in the Niagara Falls region, setting off outages that spread over an area of 9,300 square miles with a population of roughly 50 million people.*

*Nine nuclear power reactors - six in New York and one each in New Jersey, Ohio and Michigan - were shut down because of the loss of offsite power..Traffic lights were out throughout downtown Cleveland and other major cities, creating havoc at the beginning of rush hour.*

*In New York City, subways and elevators lost electricity or resorted to limited backup power. Thousands of people streamed into the streets of lower Manhattan in 90-degree heat, and some subway commuters were still stuck underground hours after the blackout hit.*

*Amtrak suspended passenger rail service between New Haven, Conn., and Newark. Some northbound trains from Washington, a city that did not lose power, turned around at Newark.*

*In Cleveland, Olga Kropko, a University Hospitals labor and delivery nurse, said the hospital was using its back-up generators and had limited power. 'Everyone is very hot because the air conditioning is off,' she said. 'Our laboring moms are suffering.'*

*...For New York police, the focus was on the ramifications of the blackout rather than its cause. 'We're more concerned about getting the traffic lights running and making sure the city is OK than what caused it,' ...In Times Square, Giovanna Leonardo, 26, was waiting in a line of 200 people for a bus to Staten Island.*

*'I'm scared,' she said. 'It's that unknown 'What's going on?' feeling. Everyone's panicking. The city's shutting down.*

*Along several blocks near midtown Manhattan, deli owners brought their suddenly unrefrigerated food out on tables, iced in buckets. 'Half price on everything,' read one sign.*

*Excerpt taken from CBS news report of 15 August, 2003*

---

### 7.3 Public information

A major criticism emanating from the community and businesses of the West Coast power outage related to the information provided about the blackout; and the projected timeframes for return of

---

power. Messaging indicating that the power would be restored within 'two hours' impacted peoples' decision making about what level of BCP arrangements or alternatives they should implement. The messages meant people delayed implementing options; those delays in many cases coming at a significant cost. While SAPN were attending to network problems and upon repairing and restoring that part of the network, other faults were identified resulting in further delays to restoring the full network.

An example of the issues associated with this on-going messaging was a fish merchant with frozen fish stocks of significant value, who held off accessing a freezer truck, believing power was soon to be restored. After several messages and still without power, attempts were unsuccessful in accessing a local freezer truck, instead one was despatched at a higher cost from Adelaide with the associated delay in arrival. Problems with fuel supplies and road closures due to the weather meant even further delays on arrival times placing the stocks at risk.

Other examples included smaller businesses keeping staff at work believing power was to be restored soon, thereby incurring costs and bringing additional complications, without being able to provide their services.

If public notification messages had been sent advising that power may be restored in two hours but the potential exists for much longer delays, the community believe this would have allowed better, more relevant personal and business decisions to be made.

Power outage messaging received via the approved ABC 891 radio broadcasts was perceived as lacking relevance by a number of communities. These communities needed to have more information about local issues, the potential impact and what help was available. People in regional areas, especially those in more isolated and remote locations felt isolated and forgotten by the lack of information relative to their locations.

The loss of power, and subsequent loss of communications, meant many of the people most affected by the longer-term power outage did not receive information about a Loss of Power Grant provided by the government. Many did not have power restored prior to the closure of the offer and therefore were unaware of it. As there was no electronic lodgement ability, this disadvantaged those in rural communities most impacted by the extended power loss, who would have to travel (sometimes considerable distances) to lodge an application. This contributed to the communities feeling of isolation and being over looked.

Once power was restored and communications re-established, a number of public alerts were received by persons over the many communication mediums, with some of these messages not including time and/or date stamps. Many people commented that they could not tell if the message was old or current and therefore the messages were of less value when received. This was confusing and misleading.

## **7.4 Industry**

The impact of the extended loss of power had significant implications for industry. Many of the issues already identified resulting from the black system event were consistent across businesses and industry. Industry preparedness for an extended power outage varied greatly. The short-term loss of power is more manageable, whereas there are far greater and more significant problems associated with the extended loss of power.

Loss of revenue for BHP, Arrium and Nyrstar were significant and impacted their large-scale operations. All commented on the need for power security, reliability and affordability. Their operations require significant power and any power redundancies come at a significant cost, which is considered within their BCP cost/benefit analysis.

The initial primary concern for these companies was to safely shut down critical elements of their plants such as smelters and ensure employee safety. Even with adequate BCP's companies had to manage and maintain critical elements of their operations brought about by an extended loss of power, which otherwise could have resulted in long-term plant damage and ultimately significant shutdowns. Their ability to acquire additional power sources and communicate with personnel

---

within the power industry throughout the event assisted in maintaining those critical elements. The outcome for all could have been far worse; however, the extended power outage came at a significant financial cost to business.

Business SA estimated the cost of the blackout to South Australian businesses at \$367 million. (Business SA, 2016)

## 7.5 Fuel

From the Adelaide CBD to the far north and west coast, fuel and access to it, was a major concern for ESOs, agencies and the community alike. The State's main fuel distribution point does not have the capacity to pump fuel under a black system event. An enduring power outage would quickly impact the whole State supply network leading to a shortage.

The Department of State Development (DSD) is identified as the control agency under State Emergency Management Plan (SEMP) for an energy shortage. Energy includes liquid fuel, gas and electricity. There is an existing Energy Support Plan, but the plan focuses on:

---

*'..... those severe energy shortfall events where it is clear that private industry is unable to adequately manage the severe energy shortfall on its own and there is a need to restrict or ration remaining supplies.'* (DSD, 2014)

---

The plan does not adequately address the situation where there is a total loss of power. The plan also provides for liquid fuel shortages which in this event was not the issue; the issue was access to fuel stocks that existed. There is legislation and authorities that can be enacted to acquire fuel but these were not necessarily relevant within this event especially relating to liquid fuel.

There appears that little consideration has been given to dealing with an extended power outage leading to the inability to access and pump fuel. Government agencies had little pre-planned or contractual arrangements for access to, or delivery of fuel for emergency service vehicles and back-up generators.

The availability and access to fuel was a significant problem for all government agencies, not only from ability to respond, but also their ability to implement and sustain their BCP arrangements. A number of government agencies had supply contracts in place but suppliers could not supply the fuel as they could not pump it. Contracts do not have clauses to cover power outage events that would ensure supply. Some government agencies had contracts in place with fuel suppliers to refuel back-up generators, but priority was given within this event to critical sites (eg hospitals), and therefore their access to fuel was restricted.

The prioritisation of fuel requirements during the event was developed 'on the run' across agencies by existing fuel suppliers. It was evident that no consideration had been given to the fuel suppliers ability to deliver fuel at times of extreme demand. Under a 'no pressure/business as usual scenario' fuel is broadly accessible, but with many requests being made simultaneously in an emergency, the suppliers were quickly overwhelmed. They could not service all points in the short time frames required through the surge in demand.

Little consideration had been given within BCP arrangements about who the approved supplier was, who else they supplied, their ability to continue to supply fuel during a power outage and pre-determined documented and even contractual arrangements to protect the provision of supply.

It was evident there was a lack of preparedness in general terms for organisations, government agencies and business to access and distribute fuel even though supply stocks were not the issue. Government agencies, businesses and individuals, not unexpectedly, had not fully considered the loss of power and the subsequent inability to access and distribute fuel from service stations which are the main supply points relied upon, with few exceptions, for SA Police (SAPOL), ESOs and government vehicles in general.

Compounding access to fuel that was available, was the inability to pay because automatic teller machine (ATM), card services and electronic payment options were not available. People could

---

drive to where fuel was but businesses were unable to supply and if people were without cash, transactions not could take place. Many service stations had generator back-up which could keep their shop fronts working but few had their essential services power connected to fuel pumps. If they did, they would not or were resistant to sell fuel because of the limited alternative payment methods available.

Typical of these type of situations, people began using hastily arranged alternatives to access fuel, such as connecting external generators to pumps which then raises potential safety issues with access and delivery.

The State government has contractual arrangements in place with fuel retailers. An option exists to tighten or create new contract clauses to ensure the supply for SAPOL and ESOs and other critical government resources when lack of supply is not the issue.

Another observation made by the Review was that it appeared that the further away from the metropolitan area, the more resilient individuals and communities were. This is not to say they were not impacted but their ability to cope, cooperate and get things done as a community far exceeded that within the larger cities and metropolitan area.

## 7.6 Food and Retail

The food sector is comprised of a complex chain from production to consumer and the impact on the food sector varied during this event. Shorter power outages in the metropolitan area did not cause the same issues as in the Far North or Eyre Peninsula with the extended outage. If an extended outage had occurred in the metropolitan area or where food processing, production and preparation occurred this likely would have resulted in significant disruption to the supply chain with the potential to impact communities to a far greater extent.

The extended loss of power impacted retailers who did not have robust or resilient BCP arrangements. Back-up generators add cost for businesses but the alternative of having no back-up power can incur other costs such as the loss of revenue and refrigerated stock. Additional costs associated with the loss of information, communication and technology (ICT) can lead to the inability to sell and have people pay for transactions and purchases. Some businesses traded without cash or electronic payment defaulting to a manual system for the benefit of their customers which in turn incurred additional costs.

Upon losing communications, retailers lost the ability to offer electronic payments, EFTPOS facilities, cash out transactions, send or receive orders which included general grocery items, perishables and frozen foods. With banks and ATM's not operational, retailer and community access to cash was prevented. An increasing dependence on electronic financial transactions led to access and holdings of cash quickly running out.

---

*'inability to access ATM's or use credit cards for transaction purposes became quite extreme in communities where the power outage extended over days. This was particularly so at Ceduna where there are restrictions on certain social benefits cards.'*  
(LGA, 2016)

---

Retailers on Eyre Peninsula and in the Far North were impacted more severely by the extended power outage. Those not fully prepared or who had not invested in alternative power sources had the most difficulties. There were examples of considerable stock loss (for example approximately \$200 000 in perishable food products) by some retailers. This related to the tonnes of food product that had to be collected, transported and dumped at a cost.

A number of retailers were not impacted because they had made their own substantial investment in back-up generators. The costs to business varied for such preparation ranging from \$1000 to \$200 000 with on-going yearly costs to maintain that capability.

Some retailers made the point that this type of investment is required owing to the lack of electricity security and reliability within their region. Insurance pay-out on loss of goods does not always

---

cover the total actual expenses involved so the investment can be worthwhile if businesses are able to afford it.

Individuals in the community were unable to keep and store refrigerated food for any duration. Resilient individuals utilised their own generators, portable fridge/freezers and other methods to protect their food stores. There was no ability to prepare and cook food unless gas appliances were available.

People who were unprepared and had not thought about their own resilience or ability to sustain themselves at least for a few days, reacted by panic-purchasing, which quickly reduced available stocks of food.

The inability to communicate with suppliers to place orders, when coupled with the associated transport issues and the inability to access fuel meant re-supply brought additional challenges that are not normally an issue within the food supply chain.

Emergency management services and relief centres were impacted in that some centres did not have back-up power on site requiring portable supplies to be brought in. This hampered their ability to provide services and meals to impacted community members.

The challenges with transport impacted re-supply arrangements, which had to be coordinated across agencies. This worked well under State arrangements.

Accommodation businesses such as hotels and apartments reported that customers were unable to pay at the time, and some have still not paid their accounts.

A number of businesses that were not prepared for an event such as this, have commented that they are now taking action to prevent similar occurrence and associated consequences.

**Recommendation 1.**

That relevant agencies, such as the Department of State Development, SA Police and emergency services, collaborate to establish an education campaign to encourage businesses in South Australia to develop Business Continuity Plans which, among other potential hazards such as flood and fire, also take into account the potential impact of an extended power outage.

## 7.7 Police and Emergency Services

The impact of the power outage on emergency services was immediate and varied. The ability to provide service continuity in the longer term was impacted upon by their own prevention and preparedness arrangements and quality of their BCP. The capacity of agencies to implement and react as required within their business continuity arrangements effected their ability to respond.

The extended loss of power caused mobile and landline networks to fail or at best provide an intermittent and therefore unreliable network. This impacted upon the ESOs' ability to communicate with their personnel. As an example, on Eyre Peninsula it required the physical attendance to ESO personnel homes to advise personnel of alternative arrangements that had been put in place for an emergency service response. This was a drain on a number of agency resources which were involved in a large scale incident of this type.

All agencies have commercial arrangements in place with mobile network operators. Those arrangements do not give ESOs any priority of use within these networks. The use of the mobile device technology and broadband by ESOs/agencies is increasing and therefore the ability, if possible, to gain priority access to available mobile networks in times of emergency or significant events for ESOs, key agency personnel and members of the Emergency Management Council should be explored.

ESOs and other government agencies were well briefed and prepared for the significant weather events. The pre-event warnings and messages that were sent out, still did not necessarily convey the significance of what was approaching and the potential consequences.

---

*'... there has been a view expressed within local government that the public or community did not fully comprehend the warning messages they were receiving, nor did they understand what was expected of them.'*  
(LGA, 2016)

---

There were many positive examples relative to government agency response and business continuity arrangements. The Review however have identified a number of consistent issues that arose that require further consideration by each government agency.

### **State Emergency Services (SES) and Country Fire Service (CFS) State Control Centres**

The SES and CFS State Control Centres (SCCs) are located on different floors within the same building. Although they do not have an uninterrupted power supply (UPS), the SCCs functioned using power from automatic back-up generators.

SES, as control agency for the extreme weather event found their SCC insufficient in size for the number of personnel required to manage the events. As the need for space grew due to the numbers of personnel, not all ICT equipment was connected to the essential services power of the back-up generator which caused some operational limitations within the SCC.

Both SES and CFS commented on the need to increase capacity and capabilities of their SCCs. There is no back-up to the back-up generator. Loss of back-up generation for the co-located but separated CFS and SES SCCs would have forced their move to alternative locations. This would have proved to be challenging in any scenario but when added to the many other issues associated with an extended power outage resulting complications would have increased the difficulty of managing this event State-wide.

### **Police (SAPOL)**

The Police Communications Building (PCB) was constructed in 1989 and houses the Police Operations Centre (POC) and State Emergency Centre (SEC). The building is rated to withstand a 1:500-year earthquake however the internal structures of the building are not. The building infrastructure (mechanical and electrical) is now at capacity and its service life has expired. The physical layout does not now provide sufficient amenities for all required agency staff when activated and there are other issues surrounding security and accessibility.

The centre's UPS and back-up generation operated correctly and sustained the centre throughout the incident. Police communications were not interrupted and their ability to provide a police response was maintained and supported throughout the extended power outage and weather event.

The PCB being the main coordination centre for the State in an emergency functioned as designed. This enabled the emergency management arrangements to be performed, albeit with the other complications associated with the extended blackout such as loss of mobile networks and social media etc.

The PCB back-up generator endurance was not challenged owing to the restoration of mains power within several hours and therefore re-fuelling was not an issue. The centre is a critical facility within State emergency management (EM) arrangements and there is no backup to the backup generator. In addition, there is no pre-wired capability to bring an alternate or temporary generator in to support or maintain the facility in the event of a generator failure. The loss of power to the PCB comes with significant State consequences.

SAPOL communications, in preparation of the warnings, activated extra call-taking capacity within the centre, however they were still tested with the increase in Triple Zero (000) and 131444 calls for assistance.

---

An emergency power failure at police headquarters (PHQ) caused the Police Call Centre (PCC) to re-locate and operate from the PCB as per BCP arrangements. Of concern is that as part of SA Ambulance (SAAS) BCP arrangements in the event of their SCC failing, they would also re-locate to the PCB in the exact location call centre operators took up position.

Given the growth in SAAS and other EM agency call centres and despatch needs, the PCB's ability to meet the redundancy needs of others is significantly compromised. A number of agency BCP arrangements need to be re-considered as the existing size, layout and ICT requirements have changed significantly over time.

SAPOL suffered other power failures at a considerable number of operational stations, both metropolitan and country due to failure of either a 'back up' problem or having no alternative power at all.

### **SA Ambulance (SAAS)**

The SA Ambulance service (SAAS) SCC back-up generators and UPS functioned as designed. SAAS is one of the few agencies that have a back-up generator to their back-up generator. In preparation for the warnings SAAS activated additional personnel in their communications centre but were still overwhelmed by the increase in Triple Zero (000) calls.

The increased volume of calls were, at least in part, attributed to:

- a surge in medical problems such as breathing difficulties, calls from people on home oxygen which required power for their medical equipment to operate, chest pain, falls, calls from other emergency services
- the power failure triggering activation of a large number of medical alarms which required a response., even though in most instances it didn't involve a person requiring support.

Because SA Health incident management team (IMT) room was not able to properly function it meant hospitals had to rely on SAGRN radio for communications. This was problematic because there were only a few handsets available and operating them within hospitals also caused reception problems.

SAAS could not access the health multi-agency talk-group. By default, SAAS SCC became a coordination centre for health utilising the SAAS multi agency talk group. The Medical Retrieval Coordinator performed a triage role of patients with subsequent advice as to where patients should be conveyed dependent upon health services capabilities and hospital availability.

The age, capacity and size of the SAAS SCC was an issue and there is a need for a better purpose-built centre to house SAAS SCC and communications facilities.

The loss of SAGRN paging was managed by SAAS because of the early advice of deactivation. It allowed impacted members time to arrange their alternative communication methods such as SAGRN and satellite phone. The incident has provided opportunity for BCP arrangements and alternatives to be further considered by SAAS.

Fuel for SAAS generators was not an issue but lack of access to fuel for their vehicles caused concern. This resulted in SAAS triaging taskings and not responding to lower level tasks to allow conservation of fuel for vehicles for emergency or urgent tasks. SAAS lacked fuel supply in this situation, and like most agencies, this had not been considered as part of their BCP arrangements.

### **Metropolitan Fire Service (MFS)**

The MFS Communications Centre (Comcen) receives Triple Zero (000) calls and other non-urgent calls via 132500, and dispatches relevant fire and emergency services i.e. MFS, CFS and/or SES. During the power outage Comcen continued to function as designed increasing their call taking capacity in the lead up to the event and subsequently, it coped well with the increase in calls.

Back-up generation worked well and all essential services power operated as planned within their BCP arrangements.

---

SAGRN remained operational and ultimately communications were not an issue within the event for the MFS. Normally MFS back-up communications contingency is the mobile telephone network (which failed during this event). MFS is reviewing BCP arrangements with a focus on communications issues during an extended power outage.

The withdrawal of SAGRN paging was an issue for their crews but they managed because there was sufficient time given, advising that this capability was being closed down to conserve SAGRN tower uninterrupted power supply (UPS) life.

MFS is one of the few government agencies that still holds bulk fuel and has the ability to pump under black out conditions as pumps are attached to their essential services supply. Unlike other agencies, fuel was not a critical issue for MFS.

With the loss of power, MFS had to consider the potential of lack of or loss of mains water because power loss may have affected the ability of SA Water to pump water around the network. This was certainly considered at Eyre Peninsula at Port Lincoln as part of their planning and alternative water sources were identified owing to the extended outage.

## **7.8 SA Water**

SA Water's BCP arrangements ensured the supply of water and sewer network, avoiding public health issues. In the metropolitan area the loss of power, of much shorter duration than the Far North and West Coast, still saw some immediate impacts to the network that were well managed. Redundancies and the use of portable back-up generators, at key pumping stations maintained the integrity of the network.

SA Water's close liaison and communication links with SAPN ensured a coordinated approach to power management and restoration of their network / assets as power became available.

The extended power loss on Eyre Peninsula was managed well due to lessons learned from previous power outages. As an example in Port Lincoln, a rotational system of back-up generation was implemented at key sites, ensuring town effluent did not become a major issue. Although labour-intensive, it was well coordinated locally and ultimately effective through their extended loss of power. Further pre-planned capital works commencing in 2017 will ensure greater water security for the town with further redundancies being placed at the town water supply from the Uley Basin.

## **7.9 SA Health**

Overall both metropolitan and country hospitals generally stood up well during the event.

The functionality of hospitals was impacted by the power outage. Despite back-up generation, common issues across health were experienced with the loss of power but in all, health professionals performed well in trying and stressful circumstances and high levels of demand for services.

Flinders Medical Centre (FMC) was without power for about three and a half hours due to the black system event. Not all, but parts of FMC were without normal or emergency power for about one and a half hours due to the failure of the main generator.

The power outage resulted in the loss of 17 embryos at the Flinders Private Fertility Clinic located within the hospital because of the loss of power to the facility incubators in which they were located (rather than the loss of frozen embryos as reported by some media). The Flinders Private Fertility Clinic has now moved to a more modern and capable facility with State of the art redundancies. A similar incident would not have the same impact upon their incubation process or procedures. See Attachment 1: SA Health Flinders Medical Centre Standby Power Electrical Systems Post-incident Review, AURECON

The generators failed at Port Augusta and Cummins Hospitals which had significant impact on their operations. The Cummins Hospital had a second generator delivered from Port Pirie.

SA Health commissioned an investigation into the failure of the backup generator at the Port Augusta Hospital, which was without any power at all for about five and a half hours. This

---

Investigation Report is attached see Attachment 2 – Port Augusta Generator Failure Investigation Report, Systems Solutions Engineering. The Department is already taking steps to implement the recommendations of both reports.

Many of the issues identified across other sectors were also experienced by metropolitan and country hospitals such as loss of communications, lack of adequate planning for an extended power outage, inadequacy of BCPs and lack of fuel for back-up generators.

Apart from the exceptions listed above, in the main, back-up generation in hospitals worked well and with few issues. A number of hospitals identified that there is a need to re-consider and build on existing BCP arrangements to ensure the impact of an extended power outage is included in their future planning.

A number of medical clinics closed down and people needing medical assistance were directed to local hospitals, which increased their workload.

Pharmacies, without back-up generation, were unable to dispense or keep cool pharmaceutical products as required. Information communication and technology (ICT) systems (including dispensing software) did not work, similar to EFTPOS and other payment methods. People were directed to hospitals for immediate dispensing of medications, which many of the hospitals were unable to do. Some communities were able to provide back-up generation to pharmacies to assist them to operate in a limited capacity. A lack of BCP meant many pharmacies, especially those impacted by the longer term power outage closed.

Aged care facilities activated their BCP arrangements and back-up generators worked as designed for most minimising the impact of the power outage and associated issues on residents. Care for the aged and frail was of concern especially as the duration of the event grew.

Those that did not have a back-up system for home oxygen equipment were directed toward hospitals or became reliant on agencies support, further compounding the issues at hospitals and within Health.

Personal and medical alarms did not work with the loss of communications and power. Upon the restoration of power many alarm activations caused resource issues, especially with SAAS and country health practitioners, because each alarm had to be personally checked. Domestic care and health assistance for elderly and disabled was impacted primarily owing to the lack of fuel and communications.

A number of discussions raised concerns about registration, coordination and contact with vulnerable persons (eg oxygen dependent). The process for validating a person who qualifies with these needs has little accountability, yet a person registered as a vulnerable person can have considerable impact upon a number of agencies and power distributors. The issues associated with vulnerable persons during a power outage require a coordinated approach, to the administration of and response to vulnerable persons.

## Aged Care

A submission was received from the Aged Care Industry Association after an industry forum that was held to receive feedback on the impact of the power outage and weather event.

South Australian residential aged care providers support over 18 000 older South Australians every day in a variety of ways from metropolitan to remote locations. Overall the industry response to the event was well managed and their ability to adapt and ensure continuity of care to their range of residents was seen as a success.

In their submission they identified that the event highlighted issues relating to communication between SA Health and the aged care industry. Improvement in the areas of Intelligence sharing (pre-event especially), an understanding of each other's roles in an emergency and joint preparation leading into an emergency event are topics for discussion and advancement.

---

Channels of communication and the clear identification of the roles and responsibilities of the Commonwealth Department of Health and the South Australian Department the Health and Ageing in emergency situations will assist in management of future emergency situations. The aged care industry peak bodies are well placed to support this process.

**Recommendation 2.**

That SA Health, develop an emergency plan to manage an extended power outage or black system event which, in addition to the requirements outlined in recommendation 15:

- a) includes a process for identification and registration of vulnerable persons in the community to ensure an effective support is provided
- b) enables access to pharmaceutical medicines for at risk persons
- c) provides for the support of individuals with equipment in their homes to support their own health e.g. oxygen equipment

## Emergency Management Arrangements

SA Health is an integral part of South Australia's emergency management arrangements it is a very large organisation and is generally well prepared in this regard having its own emergency management unit and five very experienced State Controllers.

The system in place for managing emergencies is the Gold, Silver, Bronze command structure (strategic, tactical, operational), as is the case with SAAS. This, like other government agencies usually relates to people being placed into these roles, based on position in the organisation and not necessarily capability.

---

*Health needs more trained people who can assist EMU staff during SCC activations*

*Difficulties arise when experienced staff leave as they leave a gap in corporate knowledge and operational capability*

*More training for Health commanders at all levels*

*Have a clear understanding on the roles of the SCC and LHN's (Local Health Network)*

*Inconsistencies across the organisation*

*Need for State based training and exercise programs*

*Very few exercises involving metropolitan hospitals over the last 5 years.*

*Should consider being on the same information management system (CIMS)*

*Should consider using ICCS Plus or AIIMS in lieu of or in conjunction with gold, silver, bronze.*

*Serious consideration should be given to the development of a State Disaster Medicine Management Course*

---

The South Australia Health Emergency System (SAHEMS) is used for information management and was developed specifically for Health.

Similar to other government agencies involved in emergency management in South Australia, a disconnect can occur due to the use of different systems.

In 2014 SA Health was one of the nine government agencies which signed the 'Common Incident Management Framework Control Agency Agreement'. One of the aims of this document was to bring a closer working relationship between government agencies to resolve incidents.

The preponderance of emergency management systems throughout South Australia, adds complexity, not only to operations, but to training and exercising.

---

It was also apparent that what should be a standard response to an emergency incident anywhere in the State, might vary, because centrally developed policies may not be adopted by all hospitals and consistent, regular training and exercising both within the Department and at State level is not provided.

The adoption of common standards and operating procedures should be instilled throughout the entire organisation. People in SA Health involved in emergency management response should be able to operate in any location with little in role, function and procedures changing, other than information such as contact names and numbers peculiar to that location.

**Recommendation 3.**

That SA Health undertake a review of their emergency management arrangements. Health State Controllers should be consulted during this review and arrangements should be consistent throughout the department and across the State and compatible with State emergency management arrangements and information systems

## **7.10 Department of Planning, Transport and Infrastructure (DPTI)**

A number of transportation issues arose from the power outage across the greater metropolitan area. Electric trains and trams, transport signals, traffic lights and extraction fans within the Adelaide Railway station failed.

The Adelaide Railway Station is serviced by three generators. One is owned by the Government of South Australia and was undergoing maintenance on 28 September 2016. The two other generators are owned by Adelaide State and Environs Redevelopment (ASER). One of these generators failed soon after ignition and the other operated for 90 minutes (adequately servicing all operational needs of the station platform extractor fans) before overheating and also failing.

The Adelaide Railway Station was unable to be used and so diesel trains, which could have operated without electrical power were not available, requiring more buses. Issues with refuelling added to the difficulties of moving people from the CBD.

The public transport network had to adapt to multiple events occurring across the network, including all electric trains and trams stopping on the rails and being unable to operate, as well as planning for the next day's peak period not knowing the extent of the power outage, with fuel conservation and need for re-fuelling a key consideration.

DPTI experienced a number of generator and re-fuelling issues and are reviewing their practices, to ensure a more effective and coordinated response around any future event of such magnitude.

DPTI plans were implemented to manage and change transport arrangements to enable people to reach their destinations. The magnitude of this event overwhelmed DPTI resources, but overall their BCP arrangements were implemented and eventually people were provided with transport. In accordance with the DPTI BCP buses were directed to other locations to assist passengers when electric trains and trams were unable to operate.

Some individuals became agitated by their inability to access public transport, communicate with transport providers, family and friends or be able to organise alternative arrangements and access information relevant to their predicament. Many people waited for hours at stops with no buses arriving; driving past because they were already full; or empty buses showing the 'not in service' banner. To most it appeared that there was no coordination or consideration to the resultant surge of people trying to get out of the CBD owing to this event. Journeys that would normally take 30 minutes were extending into hours.

Better messaging and timely information to the public may assist in future to alleviate many of the frustrations felt or perceived by the public. The lack of communications or the inability to communicate owing to the black out further complicated matters for DPTI in providing advice to the public. The possibility of better use of electronic signage on buses (as an example) to assist in communicating messages to the public could be considered.

---

DPTI and public transport personnel should be recognised for their efforts and flexibility demonstrated within the event. DPTI were organising contingencies such as express buses stopping at all stops, drivers stopping for members of the public outside normal practice and assisting people in gaining access to available public transport.

### Traffic Management Centre (TMC)

The DPTI Traffic Management Centre (TMC) was well prepared for the power outage. TMC is heavily reliant on electrical ICT infrastructure and the TMC back-up generation is designed with considerable endurance. It is regularly tested under load. The TMC itself performed well throughout the events of the power outage and extreme weather.

DPTI is one of the few government agencies that still has bulk fuel holdings so access to and the ability to re-fuel their generators was not an issue.

There are over 890 traffic lights across the State which TMC operate and coordinate. Within that number, 132 are owned and maintained by the Adelaide City Council but operated by DPTI through the TMC. Only 46 of the 890 traffic lights have an ability to function without power on UPS. Many of those UPS units are the result of recent upgrades and new infrastructure projects. UPS installations are planned to align with new works and a small number of sites per year are being upgraded with this capability.

Loss of power resulted in loss of connectivity to the ICT systems in the TMC and their ability to observe and control intersections. UPS units would have assisted in maintaining connectivity. Additionally, loss of powered intersections resulted in increased call rates and requests for police attendance at a time when they were already attending to an array of tasks associated with the events of the day.

If the UPS capability existed on main arterial roads away from the CBD, the significant traffic management issues that arose would have been alleviated. This would have allowed SAPOL to focus their activities on more urgent matters within the event and not heavily on traffic control.

The power outage, combined with the extreme weather event, resulted in an exodus from the CBD of workers and shoppers, with the vast majority compressed into the immediate period after the blackout. It was not an evacuation.

The catalyst for this exodus did not generate levels of fear and panic that may have resulted if the blackout occurred because of an incident such as a terrorist attack or gas explosion. The mass exodus may have stretched peoples' patience due to the vehicular congestion and public transport issues, people left unhurriedly, and drivers basically accepted the traffic conditions.

A terrorist attack, or gas explosion or similar or threat of these, would be a different matter and may require an evacuation of the CBD or part(s) of the CBD. An evacuation plan of the CBD does not exist. This needs to be developed and should include a traffic management plan to ensure the safe and orderly evacuation of persons from the CBD.

The loss of traffic lights had enormous consequences on main arterial roads within the suburbs and the ability to efficiently move people away from the CBD. Once people had left the CBD, main arterial roads that were without traffic lights further compounded peoples' difficulties travelling to their destinations.

There was actually a reduction in the number of car crashes because in the main, the public were patient, considerate and took a cautious approach to navigating the many uncontrolled intersections. The ability of the TMC to assist diminished with the loss of connectivity to their network.

The number of requests for police to control intersections was overwhelming. SAPOL attendance had to be prioritised to ensure it was able to perform normal functions in addition to the surge demand for services. It was not possible to staff every intersection; in some instances well-meaning members of the public took it upon themselves to assist in traffic control at various

---

locations and in various forms of dress. This was not an ideal or safe practice in the poor weather which brought reduced visibility.

Within the CBD SAPOL personnel were used to control key intersections in difficult weather conditions. This worked well as did the police liaison officer placed within the TMC and communications between the POC and TMC to coordinate traffic movement.

A more considered and coordinated approach to prioritise police attendance at intersections (because they cannot be at all intersections) and the placement of the police liaison officer in the TMC should be formally documented.

A more coordinated response between agencies would be beneficial in the event of a large area or large scale black out and associated traffic management issues.

<b>Recommendation 4.</b>	That the Department of Planning, Transport and Infrastructure review their Business Continuity Plan to: a) minimise the loss of public transport services b) ensure ongoing fuel supply c) improve public information e.g. electronic signage on buses, about alternative transport arrangements when there is a significant disruption to operations.
<b>Recommendation 5.</b>	That SA Police develop an evacuation plan for the Adelaide Central Business District (CBD) which includes: a) a Traffic Management Plan to assist in the movement of persons and vehicles away from the CBD b) protocols for the early placement of a SA Police liaison officer within the Traffic Management Centre.
<b>Recommendation 6.</b>	Install UPS on traffic lights on main Central Business District (CBD) and arterial roads to allow an effective movement of traffic during a loss of power.
<b>Recommendation 7.</b>	That a State Plan be developed for managing the consequences of a black system event or other major power outage. The plan should include: a) public information strategies including providing advice on: the extent of the outage; anticipated and worst-case time frames for power restoration; services impacted by the outage; and, information about contingencies and actions by local and State government to provide support b) identification of key providers that will supply fuel to emergency services and other critical services (vehicles and generators) c) identification of priorities for provision of fuel and restoration of power d) arrangements for purchase of essentials, for government agencies and the public, when electronic payment systems fail; and e) arrangements for obtaining and distributing food.

## 7.11 Telecommunications (mobile)

In Australia, mobile phone towers are regulated under the *Telecommunications Act 1997* and mobile phone services currently reach 99 % of the Australian population. The reliability of wireless service in an emergency has become increasingly critical as more Australians disconnect their landlines for mobile phones.

Events of this nature exposed weaknesses in wireless communications during emergencies and pose questions of whether carriers should be required to make their networks more resilient.

Mobile communications are critical to the management of emergencies both from an internal and external view, more so now than ever before and is still growing. Power disruption and increased mobile traffic may occur resulting in significant difficulties when dealing with emergencies and increase the risk of loss of life and/or property.

---

## Internal

This refers to the use by responding agencies and can include the following actions:

- calling out of personnel by mobile phone and/or paging before or during an emergency
- deployment of personnel and/or resources by mobile phone and/or paging
- provision of situation reports from the field to the control/command/coordination centres
- provision of reports/tasks/actions/instructions via Wi-Fi internet
- transmitting public warnings via AlertSA, SMS, Wi-Fi internet.

## External

This refers to the use by government agencies / organisations/people affected by the event but not part of the response and can impact the following activities:

- access to Triple Zero (000) or other assistance lines
- access to information concerning the emergency
- access to Alert SA, SMS and other public warning messages
- ability to contact relatives/friends.

The critical nature of mobile communications necessitates a comprehensive emergency telecommunications plan and a very close working relationship with the providers of these services. Contact with these organisations should occur before, during and after the emergency to ensure a holistic approach is taken with regard to emergency arrangements, particularly during the response phase.

Many submissions received by the Review and face to face discussions were critical of the vulnerability of the mobile and existing landline networks. The perceived 'quick loss' in general terms of the mobile network or inability to access the network owing to the volume of use was a State-wide issue.

Mobile towers operated for approximately four hours but the duration varied depending on a number of site specific factors. Many towers had no backup generation, whether by solar or generator, and public perception was that there was little evidence of any attempt by telecommunication companies to provide generators to the relevant sites to get the networks back-up and running. This was not correct as companies were attending to tower problems.

Submissions received and discussions with relevant community members, indicated that some local communities would be willing to assist in times of emergency to keep the mobile towers and exchanges powered, especially those in more remote and isolated locations.

This may be an opportunity in the future for telecommunication companies to develop if they are not prepared to invest in greater site redundancies.

---

*'Our council or emergency services would happily make sure the units were started and refuelled as necessary if basic training and equipment was provided.'*

*Mayor District Council of Kimba*

---

Telephone exchanges without backup generation and/or no UPS power meant landline communication was lost in a short time. This was experienced extensively across the Eyre Peninsula owing to the duration of the power loss leaving much of the community feeling isolated, vulnerable and unable to communicate with ESOs, friends, relatives or other agencies as required.

Triple Zero (000) was incorrectly reported as being down. The service was available but could not be accessed in some locations because of the loss of landline and mobile capability to access the service.

---

The loss of mobile and landline communications also impacted on ESOs, however, SAGRN was invaluable and allowed networked communications across the majority of the State and within agencies.

Problems experienced by people when making telephone calls to ESOs included:

- poor reception
- limited or no network coverage
- running out of battery on individual devices, and
- inability to provide information about their precise location to assist emergency services in response to them.

Many people are unaware that when calling Triple Zero (000) in an emergency that, if their particular carrier service is out, the roaming capabilities of mobile phone allows Triple Zero (000) calls to be carried on another service network. It was the case on the Eyre Peninsula where one service was unavailable but another carrier's towers were still in operation. The ability to request an emergency service response by Triple Zero (000) was still available depending upon location, time and local impact of the outage and any restorative power.

---

*'Special roaming capabilities of mobile phones when calling 000 mean that when you are out of your service provider's coverage area but are in another carrier's mobile phone network coverage area, your call will be carried on the other carrier's network.'*  
(ACMA, n.d.)

---

When calling Triple Zero (000) some information is provided to the agency call-taker. The accuracy of that information can be affected by a number of factors. Australian mobile networks do not automatically transmit Global Positioning System (GPS) information to emergency call takers. The important consideration for individuals, when calling to report an emergency, is to be prepared to provide detailed information and the exact location to the emergency service call taker, so a response can be directed.

With the loss of communications came even more reliance on the community receiving information and updates via battery operated radios through the emergency broadcaster and local radio stations if they were still transmitting. Some were critical of the nature of that information indicating they would have liked more detailed local information which would have allowed them to make better, more informed decisions and plans for their situation.

### **ABC 891 Radio**

The Review received a submission from Broadcast Australia. A privatised company responsible for the delivery of television and radio services for Australia's national broadcasters – ABC and SBS.

Their network comprises 622 sites (404 owned by them), covering 99% of Australia's population with 113 South Australian sites and a 24/7 monitoring and technical support. They deliver services on behalf of the ABC, SBS and commercial broadcasters throughout Australia.

ABC radio is the designated source of communications in time of emergency. Broadcast Australia is integral to the ability for those messages to be delivered. During this event approximately 200 services (radio and television) across 45 State sites were impacted by the weather and power outages. 24 back-up generators came on line and restored services in the larger metro and regional areas.

Broadcast Australia was also impacted with loss of communications to their sites with the mobile network loss. Their BCP arrangements were initiated to ensure sites were maintained. 22 State based sites are without back-up generation in regional SA. Those sites provide radio service to more than 110 000 South Australians. Some of these sites have other telecommunications capabilities located with them which are all impacted without power.

---

The loss of power to those sites reduced the ability for communities surrounding the site to receive emergency broadcasts and further isolated them with the loss of other communications capabilities.

This has highlighted some of the vulnerabilities that still exist within the network infrastructure that Broadcast Australia will re-visit within their risk management and emergency planning process.

### **UHF / VHF radio**

Feedback from agencies located on the Eyre Peninsula identified the local communities' effective use of UHF/VHF radio channels. The network is supported by some repeater infrastructure but in the main are line of sight transmissions.

Local communities on the Eyre Peninsula who are regular users of this type of communication, commented on how they utilised this to great effect during the power outage. A number of ESOs have now also increased their ability to operate these networks to better support the community in times of an extended power outage.

### **Satellite phones**

A number of agencies used satellite phones with varying degrees of success. There were limited numbers of these devices across agencies, some were fixed and located in vehicles which impeded their portability.

The training and understanding of how to use satellite phones varied. Many premises did not have external aerials therefore users had to go outside to use the phones because they could not receive calls inside premises.

A number of agencies were unaware they had satellite phones located in places or were available to access them. Numbers for those phones were recorded on electronically stored documents within computers that were not accessible because of the power outage.

The event has provided an impetus for agencies to review the need for and use of satellite phones.

### **National Broadband Network (NBN)**

Those households and businesses on the National Broadband Network (NBN) had no landline capability if they had not purchased a backup power supply unit (BPSU) through their carriage service provider at the time of installation. Even with a BPSU this only provides a limited period of operation during a power failure. Community understanding of this vulnerability appeared to vary widely.

Previous landline communications technology using the copper network was powered by the source at the telephone exchange. This is why hardwired telephone access was generally available during the power outage.

Many people now use portable or cordless telephones in the home, whereby the base station requires main power in order to communicate with the portable handset which itself is powered by a rechargeable battery. This type of telephone had no landline access even though the network was still accessible.

UPS capability and backup power at telephone exchanges is limited. The move to the NBN and use of fibre to node, or fibre to the premises, requires the power to now be at those locations. There is limited power at those locations so the period of operation for home phones under the NBN service is limited during an extended power outage.

The loss of landline and the ability to call Triple Zero (000) means people then use the mobile network. This is often already at, or near capacity, in times of emergency or is not available with the loss of mobile towers owing to the power outage.

A number of issues also arose in other areas associated with the loss of landline capability such as personal, lift, fire and other alarms and elevator phones which rely on the landline capability.

**Recommendation 8.**

In order to increase resilience and public safety during emergencies, the State Emergency Management Committee should request the Australia and New Zealand Emergency Management Committee to place on the agenda, and consider establishing a national position, on redundancies for mobile communications (including phone tower back-up power) and the National Broadband Network.

**Recommendation 9.**

That the Office for Digital Government, in close partnership with telecommunications companies (e.g. Telstra, Optus, Vodaphone), develop a Control Agency Plan for Information and Communication Technology including mobile communications. The plan should consider:

- a) provision of back-up power to priority infrastructure
- b) back-up equipment requirements e.g. satellite phones for government ministers (including training and other support)
- c) potential impact on the National Broadband Network on emergency services when there is an extended power outage / black system event
- d) arrangements with commercial mobile network carriers to ensure emergency and support services have priority access to available mobile networks; and
- e) contingencies to ensure ongoing functionality of the Broadcast Australia network

### South Australian Government Radio Network (SAGRN)

With 20 000 active users across 22 agencies and over 210 sites State wide, SAGRN provides emergency communications services 24 hours a day, 7 days a week, 365 days a year through a trunked radio network. Through a system of interconnected repeater sites, it has resilience and availability that is not met by many other commercial carrier services.

The SAGRN is one of the largest public safety radio networks in the world as it covers over 226 000 km<sup>2</sup> and 96% of the State's population.

The SAGRN provides a State wide paging network as well as both analogue and digital voice radio communications. SAPOL, SAAS and South Australian Department of Fisheries use encrypted digital radios while all other users use unencrypted analogue radios. The network is also utilised by SAPOL for in-vehicle mobile data terminals.

In times of emergency, any network load/congestion is managed through established plans and processes.

An important feature of the SAGRN is that it enables full communications interoperability between all agencies managing, responding to and/or supporting emergencies. A multi-agency talk group was used with great success for the extended power outage on the Eyre Peninsula and Far North where the SAGRN was the only networked communication available for some time by ESOs.

SAGRN sites have UPS capability with endurance well above that of other commercial telecommunications sites. With the restoration of power in the greater metropolitan area the loss of power to towers in the metro was not a significant issue when compared to the towers on the Eyre Peninsula or in the Far North owing to the duration of the outage.

Given the power outage and the extent of damage caused by the weather SAGRN functioned extremely well and proved a reliable means of contact across the majority of the State.

A list of existing SAGRN users appears in the table below.

**SA Government - State Budget funded agencies**

Courts Administration Authority

---

Department for Correctional Services
Department for Communities and Social Inclusion
Department for Environment Water and Natural Resources
Office for Digital Government
Passenger Transport (DPTI)
Transport SA (DPTI)
Department of Health
Department of Primary Industries and Regions
SA Ambulance Services
South Australian Police
<b>Community Emergency Service Fund (ESL) funded agencies</b>
SA Country Fire Service
SA Metropolitan Fire Service
SA State Emergency Service
SA Government - Public Non-Funded Corporations (PNFC's)
Adelaide Convention Centre
Forestry SA
SA Water
<b>External entities (non - SA Government)</b>
Australian Federal Police
Australian Customs and Border Protection Service
Royal Flying Doctor Service
St John Ambulance

**Table 1 – agencies currently using SAGRN**

To assist in achieving an efficient, effective and coordinated response to emergencies in SA consideration should be given to extending the number of users on SAGRN.

For example, a properly integrated solution with a SAGRN radio in every school office and at Department of Education and Child Development (DECD) head office and regional centres could be of real benefit during a major emergency, including the threat of one.

However, government agencies would need to be very clear about what they wish to achieve in using the SAGRN. Importantly, they would need to then integrate those requirements into their operational plans/procedures and regularly exercise (practice) the procedures, preferably on a number of occasions throughout the year. They will also need ensure all staff expected to use the SAGRN are properly trained in how to use it.

Local Government/Councils are an integral component of emergency response and have close working relationships with the SES and CFS. During this incident, there were occasions where a better coordinated response could have improved access to resources, response times, and efficiency.

Local government does not use the SAGRN during emergencies. During these events consideration should be given for council resources to be issued SAGRN's or CFS VHF radios when working on the fire ground. Allocation of these radios would be for coordination/control functions with the councils utilising their own radio networks for internal command. Obviously, a limiting factor would be the cost and network fees.

A positive outcome within the black system event was the continued operation of the SAGRN. Significant investment has been made in the network and continues to be made with a current upgrade of the SAGRN in progress.

---

Loss of power to mobile phone towers caused failures within a few hours (once their UPS ran down or where there was no generator back-up), whereas SAGRN sites operated well beyond that. This allowed time for planning and coordination within BCP arrangements to ensure the integrity of the network. The SAGRN has well developed preparatory arrangements, for example a site with known access problems during poor weather had its UPS endurance almost doubled. Further redundancy protections will be in place by 2017 for key assets within the SAGRN. These redundancies were planned prior to this event.

Despite preparatory arrangements there were still issues with the network, but overall the SAGRN provided effective communications for ESOs when no other networked communications were available. There were unavoidable factors outside of SAGRN control associated with weather events, such as damage caused by lightning strikes. But, ESO feedback was that the SAGRN was vital and remained in service when required.

The SAGRN lost some network coverage in the far west and far north of the State, but local communications were still available within reach of local towers. The repairs required for such events are considered within their planning and repairs occurred within acceptable time frames.

Portable generators were coordinated and moved around the network to charge SAGRN sites and maintain the network. This was prioritised and coordinated within State emergency management arrangements through the SEC and local Zone Emergency Centres (ZEC).

Councils on Eyre Peninsula advised that they may be able to assist in the future thereby alleviating ESO resources being required to service SAGRN towers. Dialogue is required between local councils and SAGRN to confirm that capability, the ability to make potential use of it and any willingness for this to occur to alleviate any future potential burden on ESOs.

A decision was made, by the State Controller Communications in consultation with the SAGRN Network Operations Control Centre (NOCC) to turn off paging within the network. As paging consumes more power, this would extend UPS battery life and the ability for voice communications to be maintained. A number of ESOs utilise paging as their direct method of contact to personnel. Although this was communicated via the SEC to agencies, some agencies identified the message was not received by all of their members. Because the type of paging will be amongst the first actions to conserve power on SAGRN agencies who heavily rely on it will need to consider alternatives to ensure contact with their personnel.

The Eyre Peninsula community had a separate extended power outage earlier in the month on 8 September 2016. That event highlighted a number of issues which the ZEC, to their credit, were quick to remedy and implement solutions. When the event of 28 September 2016 occurred many of those earlier learnings were already in place. This was evident with the early activation of the multi-agency talk group where communications were maintained between ESOs and local plans put in place to ensure continued response by ESOs to the needs of the Eyre Peninsula community.

Learnings from the Pinery fire had also been implemented such as the inclusion of key SAGRN personnel within the SEC. This was advantageous for the State Controller Communications and their presence allowed a broader understanding of the State communications issues from a strategic and operational perspective. This enabled better planning and coordination of use.

As with other significant events there were problems associated with end-users of the SAGRN. There was the now common name of 'radio disciplines' a lack of awareness and understanding of how to properly use the network including interpretation of network busy signals and resultant queuing. A sound user understanding would have increased the efficiency in the use of the network, and extended the battery life of towers through less power usage.

A number of agency de-brief comments incorrectly Stated that the SAGRN 'was down' and inoperable, however, this was not the case. There were some issues within the network owing to loss of power and network connectivity on very few sites, but when considered from the overall State perspective in the duration and spread of the power outage and weather event, the SAGRN performed extremely well. Care needs to be taken of the context and use of terminology within agency de-briefs reports to ensure the correct interpretation and reporting.

---

An issue, not dissimilar in many agencies was the impact of the duration of the event on SAGRN staff. They commented that the duration of this event stretched their ability to staff the many responsibilities that came with the emergency response (there are only 4.3 positions located in AGD committed to SAGRN). Fatigue and welfare issues were of concern and would have become even more problematic had the duration of the event gone much further. Alternatives and options need to be explored to overcome this issue to the future.

<b>Recommendation 10.</b>	Consider bringing other agencies onto the SA Government Radio Network, in particular, Department of Education and Child Development and local government, to support more effective coordination and provide a reliable communications contingency during emergencies.
<b>Recommendation 11.</b>	Deliver consistent and regular training in the use of the SA Government Radio Network to all users to maximise the efficiency and effectiveness of the network in times of emergency e.g. reduce the issues associated with network busy signals.
<b>Recommendation 12.</b>	Identify, document and communicate contingency arrangements and procedures for emergency services in the event SA Government Radio Network paging is turned off to conserve power, or other loss of paging capacity.
<b>Recommendation 13.</b>	That the Attorney General's Department consult with local government regarding potential for them to provide logistical support associated with backup power supply to SA Government Radio Network towers in the event of an emergency.
<b>Recommendation 14.</b>	That the glossary of terms in the State Emergency Management Plan be reviewed to ensure all relevant language is included. All agencies need to ensure the use of clear communication and accurate use of terminology, including in describing the status of critical services e.g. Triple Zero (000), SA Government Radio Network, electrical and water supplies and infrastructure.
<b>Recommendation 15.</b>	That Attorney General's Department explore options to overcome fatigue and welfare issues of SAGRN staff associated with emergency events of extended duration.
<b>Recommendation 16.</b>	That SA Police, emergency services, health facilities, utility providers and other key service providers, review their Business Continuity Plans giving consideration to factors such as: a) identification of: business critical needs; essential services power requirements; back-up power requirements for all facilities including State, regional and local facilities such as Police, SES, MFS and CFS stations; the need for any arrangements for back-up power to be included in contracts for design and or lease of Government premises b) contingencies for black system events and extended power outages c) regular back-up generator testing regime protocols, including testing under load and for long durations d) contingencies for communications when mobile, landline and/or radios are not operational e.g. satellite phones; and e) alternative State control centre facilities that are pre-identified, equipped and have procedures for moving to the alternative facility.

---

## 8. IMPACT OF EXTREME WEATHER AND FLOODING

Considerable damage was caused by strong winds, tornadoes, hail and flooding across many parts of SA. Detailed assessments of building and vehicle losses were undertaken in impacted locations by a multi-agency damage assessment team. The total assessments recorded are in the table below.

Damage	No.
Major Damage (water inundation higher than 150mm above floor boards and/or structural damage)	43
Minor Damage (water inundation less than 150mm above floor boards)	53
Outer Buildings Damaged	38
Vehicles Damaged	14
Injury	1
Total assessments recorded on system	910

*Table 2 - impact assessment summary as at 14 October 2016*

In the Mid-North, 23 electricity towers and three high-voltage circuits were brought down by the storm, causing a shutdown of power to the entire State. Power supply was restored to most of the Adelaide region within six hours, although more than 25 000 properties were still without power the next day. Parts of the Eyre Peninsula, Far North and Far West regions were without electricity for up to three days.

Major types of damage during this event included:

- road pavement failures due to intrusion of water
- flood damage to roads and creek crossings
- damage to footbridges
- landslips and rock falls due to weakness induced by saturated soils
- failure of septic systems
- damage to drainage infrastructure
- coastal impacts including significant erosion of beaches and sand dunes
- damage to jetties and boating facilities
- fallen trees and vegetation damage which require significant effort by councils to clear up and remove
- building debris caused by strong winds deposited on roads and public lands
- impacts of loss of power (see next section)

There was significant damage to roads, bridges and other infrastructure with initial estimates for repairing Department of Planning, Transport and Infrastructure (DPTI) infrastructure estimated at \$20 million for departmental roads, \$3.5 million for rural jetties and around \$1.2 million for passenger rail infrastructure.

Councils in SA manage approximately 75 000 km of roads including 50 000 km of unsealed roads. Many of these are important transport routes to support primary production in rural areas. Council-managed roads suffered considerable damage with initial damage estimates - \$15 million.

At least eleven councils, rural and metropolitan, suffered substantial damage to their coastal environment such as erosion of sand dunes to major damage to sea walls. Preliminary estimates indicate a repair bill in excess of \$2 million, but may be much higher (LGA, 2016).



*Figure 2 – Damage to Port Victoria jetty*

Damage caused to specific assets include:

- the power outage in the Adelaide Central Business District (CBD) cause the loss of traffic signals resulting in grid-locked traffic, building lifts, transport and other electrical infrastructure
- the River Torrens Linear Park was severely affected by high water levels which caused widespread damage and erosion along multiple council boundaries
- large amounts of waste and contaminated water and soil was generated by flooding of the Gawler River Floodplain
- severe damage to metropolitan and regional jetties (e.g. Port Germein jetty and sea wall with costs estimated at over \$1 million for the jetty and approximately \$400 000 for the sea wall)
- storm surges caused coastal damage and erosion, particularly on the West Coast and eastern coast of the Spencer Gulf
- 95% of the unsealed road networks in the Mt Barker council were damaged
- major roads needed to be closed including critical transport routes such as Port Wakefield Road, the Barrier and Spencer Highways.
- minor flooding within the Snowtown hospital
- Department of Education and Child Development (DECD) received reports from 31 sites State-wide advising of impact damage
- homes, sheds and equipment were damaged by tornadoes and very strong winds including at Blyth, Snowtown and Mid-North, Port Lincoln, Hallett Cove and Aldinga
- >11 000 applications were made for loss of power grant, 134 emergency relief grants paid (\$76 670), 120 flood clean up grants paid (\$56 450)

More difficult to measure, are the less visible impacts on the community such as the physical and emotional impact on vulnerable people including homeless people.

Economic and social impacts included:

- damage to jetties leading to financial loss of local businesses relying on the tourist economy
- economic impacts on businesses when holiday-makers cancelled travel plans due to weather and road conditions, including road closures along Port Wakefield Road which is a major thoroughfare to popular tourist destinations such as Yorke Peninsula and the Flinders Ranges
- economic and social impacts associated with flood losses, to current and future crops, in the intensive horticultural areas near Virginia

- 
- many schools were closed either due to severe weather, flooding on nearby roads or flooding of the school itself
  - community events were cancelled
  - Sealink Ferry services were cancelled
  - Department of Environment, Water and Natural Resources (DEWNR) conservation parks were closed

## **8.1 Damage assessment process**

The SA Damage Assessment Support Plan (DASP) was updated in 2016 in response to recommendations from the Pinery and Sampson Flat bushfires. During these events it was identified that the processes and responsibilities for damage assessment needed clarification.

The DASP outlines responsibilities, authorities and mechanisms to gather information about the damages and community losses that occur during and immediately after a significant incident. (Government of South Australia, 2016). The plan relies on relationships among State government agencies and other specialists. Control agencies undertaking a damage assessment during and immediately after an emergency event will base their plans on the DASP.

During significant events, information is collected about damage caused during an emergency and is shared with agencies that have a role in responding to, or assisting in recovery, from the impact of an emergency.

A centralised impact recording platform, called the Impact Recording Tool (IRT), created by DCSI, is now the primary recording mechanism used to capture and store damage assessment data.

On Thursday 29 September 2016 the State Recovery Office requested that the SES undertake a 'stage two impact assessment' in accordance with the DASP. SES made a request to SAPOL who, as per the DASP, appointed a Damage Assessment Manager to arrange and coordinate damage assessment requirements.

Six damage assessment teams were established and deployed the IRT. The damage assessment teams assessed 670 properties over four days.

The teams provided feedback that the IRT worked well during the event, particularly given that it was the first time the system had been used during an emergency. Some work is being undertaken to make minor adjustments and improvements to the system and the process.

Challenges identified relating to the damage assessment process include the disconnect between a 'stage one impact assessment' process conducted by the control agency and the 'stage two impact assessment' process. Presently a stage four impact assessment process does not exist.

Local government has identified that 'there is still a gap in the way damage assessment is performed. There appears to be a conflict between the detailed collection process focussed on individual properties and inhabitants opposed to a very rapid assessment that gives a 'helicopter' view of the impacts of an event. Councils that have used the LGA's emergency assessment reporting system (EARS) feel that there is considerable potential for the system to be integrated with the State system so that local information is quickly and accurately conveyed to incident management teams.' (LGA, 2016)

---

**Recommendation 17.**

Continue development of the Damage Assessment Support Plan to:

- a) integrate data produced from Control Agency Stage One Assessment into the Stage Two Assessment
- b) develop a capability to undertake Stage Four Assessments which includes assessment of impacts to infrastructure, agriculture, businesses and the economy; and
- c) consult with the Local Government Association regarding how/if their Emergency Assessment Reporting System (EARS) data can be utilised in the damage assessment process.

---

## 9. FLOODING

Flooding is the most costly natural disaster in South Australia, currently average annual damages from flooding in the State in exceed \$32 million.

Under the State Emergency Management Plan (SEMP); DEWNR is the designated hazard leader for flood, which requires them to undertake a leadership role for planning of emergency management activities pertaining to flood, and ensuring that all activities across Prevention, Preparedness, Response, Recovery (PPRR) to do with that hazard are coordinated. The SES is the control agency for flood and will take charge of a flood or severe weather emergency and provide leadership to all other agencies responding (SA Government, 2016).

The significant rain event which commenced on 28 September 2016, occurred on an already saturated environment so even the smallest amount of rain would produce runoff with almost no loss. The top 100mm soil was at 100 % saturation which can take months without rain to dry out. As little as 5mm of rain was resulting in almost instantaneous spikes in river levels at gauges

The flooding resulting from the persistent rain during this event, affected all catchments in SA to a greater or lesser extent. The map below identifies general areas where catchments areas were flooded.

Adelaide is built on a natural floodplain and there are many dwellings situated within known flood risk areas. Despite historical impacts, many places and communities in South Australia are not well adapted to floods. The time between floods and the fragmentation of responsibilities between councils, State Government, the Commonwealth and private land owners creates barriers to agreement on collective action to adapt to floods and the changing risk profile.



---

## 9.1 Dams

Due to high rainfall in the months leading up to and during this event, the ground and all South Australian catchments were saturated. Dams, including farm dams, were already at capacity meaning that any additional rain resulted in dam levels higher than planned. Dams with effective spillways released water via those spillways. Other dams, due to poor design construction or maintenance threatened to lose their structural integrity and burst. Some of the thousands of dams across the catchment did burst and cause additional flooding.

A rural dam at Greenock burst its banks and threatened to cause flooding of properties and roads in the Greenock township. Fortunately, only a relatively small amount of water flowed into back yards in the township.

Another dam at Tooperang burst and threatened properties and there were fears of dam failure at many locations including at Mount Torrens, Greenock, Verdun, Port Elliott, Hahndorf, Sevenhill and Hahndorf.



*Figure 4 - Beerenberg dam, Hahndorf (DEWNR)*



*Figure 5 - Dam at Hahndorf (DEWNR)*

A flood emergency warning was issued for people in the Auburn area due to a dam north of the township threatening to burst.

Emergency service personnel were responded to dams that were bursting or showing signs that their integrity was being compromised. Response crews are trained to deal with flooding however, to determine the best course of action in relation to the dam required input from a qualified geotechnical engineer.

---

The uncertainty regarding appropriate response to dams highlights a need for greater collaboration around regulation and maintenance of, and response to, incidents involving dams.

Initially it was difficult to find suitable and available geotechnical engineers to provide advice. There was also confusion regarding who was responsible for paying for the technical advice and for performing and paying for mitigation activities i.e. SES as the responders or the landowner.

As a result of the large number of dams that responders were being called to, the planning section in the SES SCC developed a new procedure which was provided to IMTs and responders. The procedure outlined the requirements for SES response and a process to follow to minimise risk of dam breach and risk of flooding downstream communities. It also outlined potential risks such as owners having unrealistic expectations and abusing crews, which had already been experienced during this event by crews in some instances.

Previously requests for assistance from emergency service personnel to dams only occurred occasionally and was not documented in SES procedures. The SES and DEWNR have identified that research needs to be undertaken and protocols developed to ensure coordinated and effective multi-agency response to these events in future.

In SA there is currently very little dam safety legislation and governance. While dams provide multiple benefits they can also present risks to downstream communities.

SA Water owns the majority of large and extreme hazard dams and voluntarily complies with Australian National Committee on Large Dams (ANCOLD) guidelines.

For smaller, private dams there are limited provisions for dam safety with the exception of some regulations around siting and construction of dams in the *Development Act 1993* and *Natural Resources Management Act 2004*. But neither Act provides for assessment of how a dam is designed or constructed with regard to safety risk, nor any ongoing supervision to ensure dams are properly maintained.

The challenges with identification and management of dams have been raised in previous reports including the Queensland Floods Commission of Inquiry (2012) and the SA Flood Inquiries Task Force report (DEWNR, 2012).

The University of SA was commissioned by DEWNR on behalf of the Flood Inquiries Task Force to develop an options paper on dam safety. The paper identifies that policy options need to be discovered and implemented to provide adequate dam safety assurance to community, especially in relation to dam failure flood risk (Pisaniello & Tingey-Holyoak, 2016).

---

*Floods from dam failures constitute a widespread hazard to people, property and the environment ...Failures of large dams (commonly those higher than 15 m) are spectacular and receive greater attention than those of smaller dams. However, small dam failures, particularly those of privately-owned farm dams, occur with greater frequency ...and overtopping due to inadequate spillway flood capability is their most common cause of failure... these threats and losses are exacerbated by climate change due to the significant predicted increases in rainfalls in many regions both in Australia (including SA) and around the world.*

*(Pisaniello & Tingey-Holyoak, 2016)*

---

The paper also identified that the safety of private farm dams is unregulated and is putting community lives at risk.

---

*'dam failure flood risks are significant ...between 70 - 90% of hazardous private dams have highly inadequate spillway flood capabilities ...and/or other structural dam safety problems, representing unacceptable individual dam failure flood risks....safety risks are linked to land development risks and need to be accounted in land use planning policy.*

*(Pisaniello & Tingey-Holyoak, 2016)*

---

The dam safety paper provides the following general recommendations for SA policy makers:

1. Established minimum and best practice assurance benchmarks should be integrated into policy for safe catchments;
2. A supervisory system should be implemented to plan, design, review and maintain dams according to acceptable safety practice in line with the benchmarks and ANCOLD guidelines;
3. Within this system most dams, but especially those that could pose either considerable individual or cumulative hazard, need registration and regulatory control, and spillway flood capabilities should be particularly in focus.
4. The system should be fit-for-purpose (i.e. simpler, cheaper obligations for low hazard dams and increasingly more stringent requirements for higher hazard dams) and include provision of inexpensive safety design/review and monitoring solutions.

The increased level of risk that was evident during this event, and the impact on responders and the community, reinforces the need for policy development in relation to dam safety.

## 9.2 Angus and Bremer Rivers

The Angus and Bremer River catchments are part of the Lower Murray River Basin that discharges into Lake Alexandrina. There is a long history of flooding in and around the townships in these catchments including Strathalbyn and Langhorne Creek.



**Figure 6 - Angus River (DEWNR)**



**Figure 7 - Bremer River, Callington Road (DEWNR)**

Langhorne Creek is an example of a South Australian township that has developed in harmony with the natural cycle of floods. Floods in the area enrich the soil and provide a valuable source of irrigation water for agriculture (McCarthy, et al., 2006).

In a report commissioned by DEWNR it was Stated that 'several tributaries converge upstream of, or within Strathalbyn which have caused flooding in the past and has been addressed by some flood mitigation works' (Tonkin Consulting, 2016). This appears to be supported by evidence of less flooding in the Strathalbyn area than previous events.

---

Due to heavy rains prior to the severe weather on 28 September 2016, Langhorne Creek, Ashbourne, Strathalbyn and Finnis had already been identified as areas of concern for potential flooding and houses in these areas were already sandbagged to protect them during recent storm events.

Rivers, creeks and tributaries reacted quickly to small amounts of rain and as little as 5mm created almost instantaneous spikes in river levels at gauges.

Around the Langhorne Creek area, water levels were higher than the 2002 floodwaters that affected the area. Roads were inundated and quickly became impassable.



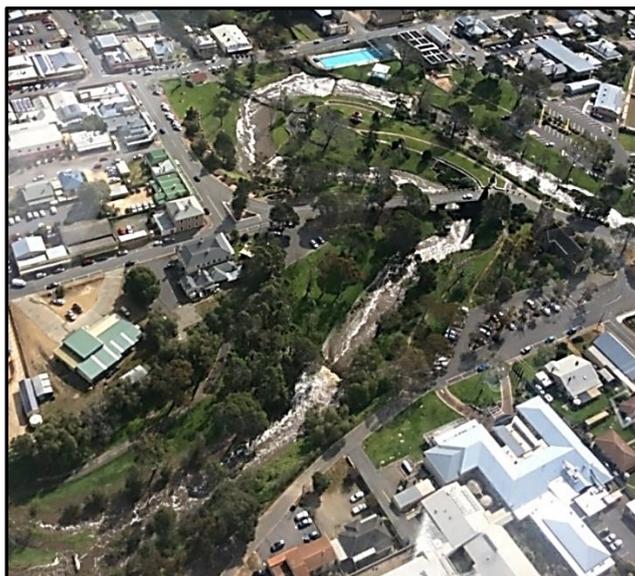
*Figure 8 - Langhorne Creek (DEWNR)*

The Langhorne Creek community is aware of the flood risk in their area and took the necessary precautions to minimise flood damage to properties. They are also generally prepared to be isolated for a period of time due to inaccessible roads. The community IMT identified the need for, and in conjunction with SAAS and SES established, a medivac plan for Langhorne Creek, because floodwaters were too high for emergency vehicles to travel through.

The Bremer and Angas both peaked several times and there was potential to cause major damage to the surrounding area. The Rodwell Creek which flows from Wistow and Bugle Ranges added to the higher levels at the gauges in the Bremer River around Hartley and Woodchester.

An initial generalised flood warning for the Angus and Bremer rivers was issued on Thursday 29, followed by another generalised flood warning on the Friday, and a final warning issued on the Saturday.

Threat to the community in the area were fast flowing water, dangerous driving conditions, potentially contaminated water, potential electrical issues around flooded properties, high wind, flying debris, inundated agricultural land, full farm dams and potential for levy breaches or collapse.



*Figure 9 - Strathalbyn town centre (DEWNR)*

### **9.3 Metropolitan rivers and creeks**

The River Torrens is the most significant river on the Adelaide Plains and runs from the Adelaide Hills near Mount Pleasant through to Adelaide and empties into the Gulf St Vincent at West Beach. It is fed by the 'numbered creeks' (First through to Fifth creeks) as well as other creeks and tributaries.

As a result of the heavy rain, SES issued a flood advice on 3 October 2016 for an elevated risk of flooding of the Torrens. Then on 4 October a watch and act message was provided to the community to advise of flooding of the river and to take care around the water.

Moderate flooding occurred across the Torrens River catchment. Flooding was reported at multiple locations along the extent river from Birdwood in the Adelaide Hills, along Linear Park and at the West End Brewery on Port Road.

Linear Park runs along 35 kilometres of the River Torrens. It contains tracks for cyclists and pedestrians as well as other infrastructure such as playgrounds, park furniture and barbecues. Areas directly alongside the river bank are kept clear of buildings for flood mitigation however, due to the extent of the flooding there was still a large amount of park infrastructure damaged.



*Figure 10 - River Torrens in flood, Felixstow*

Large sections of Linear Park were severely affected by high water levels and warnings and park closures required considerable coordination between bordering councils. There was debris strewn

---

along the park, five out of eight pedestrian bridges were under water and closed, and there were collapsed creek embankments and erosion of river banks.

Sturt River is another metropolitan waterway for which the SES issued an advice message. It advised residents of the potential for localised flooding along the Sturt Creek including Coromandel Valley and Marion

Waterfall Gully Road was also affected. It had already been significantly damaged two weeks earlier in another flood when large amounts of mud, rocks and other debris were washed onto the road. There was water impacting homes and blocking the road. This event impacted both Waterfall Gully Road and Waterfall Terrace Burnside.

Flooding of the Patawolong Lake System (PLS) can be a concern during some events when there are high levels of rainfall, particularly when high water levels within the system coincide with high tides.

There was also a notable flood in 2003 when the mechanisms of the Barcoo Outlet failed to operate correctly, resulting in flooding of Glenelg East. Since that time, the systems which operate the PLS have been made significantly more resilient.

In this event the system operated at levels slightly above normal, however there were no flooding concerns.

#### **9.4 Onkaparinga River**

The Onkaparinga River runs from its source between Mount Torrens and Charleston in the Mount Lofty Ranges, and flows for 95 kilometres in a south-westerly direction to an estuary at Port Noarlunga. Mount Bold Reservoir, which is on the Onkaparinga River system, is the largest reservoir in SA.

For catchment management purposes the Onkaparinga River is divided into the upper, middle and lower catchments.

Minor flooding occurred in the upper Onkaparinga River affecting roads from Lobethal to Hahndorf causing road closures. Levels in the middle Onkaparinga River between Mount Barker and Mount Bold reached minor flood levels affecting roads and pastoral land. Areas in the Lower Onkaparinga catchment below Mount Bold reservoir, such as Old Noarlunga and Port Noarlunga were monitored for potential riverine flooding and flooding caused by storm surge.

The Adelaide Hills were most affected on Tuesday and water flooded the main street in Hahndorf, where homes and businesses reported damage. There was also flooding in homes and buildings at Verdun and Aldgate.



*Figure 11 – Verdun township (DEWNR)*



*Figure 12 - Shillabeer Road, Oakbank*

Old Noarlunga had been flooded two weeks prior to this event, on 14 September 2016, which caused damage to around 60 homes. Residents in the area were nervous that they would be flooded again and some had not yet been able to return to their homes since that event. The MFS pumped large volumes of water to reduce the risk of homes being inundated and assisted council to block stormwater entrance points to reduce further flooding.

The release of water from Mt Bold contributed to flooding in the Noarlunga area on 14 September 2016. Downstream tributaries were completely full, the catchment response was unprecedented and the water that was released had nowhere to go. In addition, the amount of rainfall that was received was much greater, and fell more quickly, than was predicted which reduced the ability of SA Water to release water in a timely way without causing damage.

On 14 September, SA Water released water from Mt Bold reservoir at the rate at which it was coming into the reservoir. This is consistent with SA Water spill management procedures and is based on experience from previous events. The purpose of the reservoir is for water storage, so the objective of the spill management procedure is to manage the reservoir level. The goal is to maximise the amount of water held so that the cost to the consumer is minimised. The purpose of the reservoir is not for flood mitigation.

Following the flooding on 14 September 2016, SA Water reviewed their spill management procedure. In addition, the SES Chief Officer met with the CEO SA Water, A/CEO DEWNR and the BoM Regional Director, to discuss issues surrounding releases from Mt Bold reservoir. At the meeting agreements were made for closer liaison and communication between the agencies, both prior to and during events. The agencies agreed to a greater degree of collaboration involving: sharing data; communicating requirements for information; and, sharing combined knowledge; and, contributing to procedures for prediction and management of future flooding event.

Once the BoM predicted that more rain was expected on 28 September 2016, SA Water reduced the level of Mt Bold to 80 %. This is a different strategy compared to the previous event. Due to the predicted weather, SA Water decided to commence releasing water on the Monday to minimise the risk of flooding downstream. To adequately reduce the level before the weather impacted, an early start to releasing water was imperative.

The amount of water released was in response to a number of factors including: lessons learned from the 14 September event; a more accurate prediction from the BoM; better communication between SA Water, the BoM and DEWNR; and, the prediction that further rainfall would follow the 28 September 2016 event enabling topping up of the reservoir after the weather event.

There were ongoing discussions between SA Water, the BoM and DEWNR regarding predicted rainfall, potential hydrological impact of water coming into and leaving Mt Bold and the amounts and timing of release required to minimise the risk of flooding.



*Figure 13 - Mt Bold Reservoir water outflows (DEWNR)*

There was some minor flooding again at Noarlunga however this was due to full storm water pipes rather than riverine flooding.

The release strategy chosen by SA Water for this event resulted in a positive outcome. SA Water has identified additional learnings including establishing a more formal arrangement with the BoM so that the information required by SA Water to undertake effective planning and implement appropriate water release strategies is available.

## **9.5 Gawler and Para Rivers**

The Gawler River is located to the north of Adelaide and flows from the township of Gawler to the sea near Buckland Park. It receives very little inflows along its length and its hydrology is dominated by the catchment inflows of its two major tributaries the North and South Para Rivers, which have a catchment area of over 1000 km<sup>2</sup> (Australian Water Environments, 2008). There are natural and man-made levees along much of its length many of which are in poor condition because they haven't been constructed to appropriate standards and/or have not been maintained.

Floods in the Gawler River are driven by flows from the upstream rural catchments of the North and South Para Rivers. These two river systems join immediately downstream of the town of Gawler. The capacity of the Gawler River channel falls from east to west and varies. Major overtopping in large floods occurs along much of the river length. Even modest flows are likely to cause flooding (at least in parts) of the lower Gawler River, on a relatively regular basis.

Significant flooding commences within Gawler township from both the North Para River and South Para River. Mitigation works within Gawler, construction of the Bruce Eastick Flood Mitigation Dam on the North Para, and modifications to the South Para Reservoir, have reduced the extent of this flooding for a 1 in 50 ARI event and greatly reduced flood extents for events around the 1 in 20 ARI and less. Flooding from the 1 in 20 ARI still occurs in the lower reaches of the Gawler River (west of Virginia) due to the limited capacity in this area (Australian Water Environments, 2015)



*Figure 14 - South Para (DEWNR)*



*Figure 15 - North Para River, Turretfield dam (DEWNR)*

When floodwaters overtop the banks of the Gawler River they spread north and south along the floodplain and are unable to return to the river channel. This is exacerbated by the limited capacity of the Gawler River and the progressive reduction in channel capacity from Gawler to the sea. The Gawler River has had a long history of flooding causing significant economic losses (Australian Water Environments, 2008).

Given the history of flooding in the area, and the various studies that have been undertaken, and despite mitigation activities having reduced the potential for flood in some areas, there is still an expectation that during sustained rain events, floodwaters will break out of river channels. Further mitigation activities are required to reduce the risk of flood on the Gawler River Floodplain.

The Gawler River Floodplain Management Authority has engaged Australian Water Environments to carry out a hydrological review of the 2016 flood and identify alternative flood mitigation options for the lower Gawler River. This will include collation of rainfall and streamflow data from across the Gawler River, North Para and South Para, and a summary of the flood and its magnitude characterised at key locations across the catchment. This report will provide detailed information about the hydrological component of this event.

Figure 17 shows the key locations where break outs occurred and flowed onto agricultural properties causing extensive damage. Figure 18 illustrates the extent of the flooding.

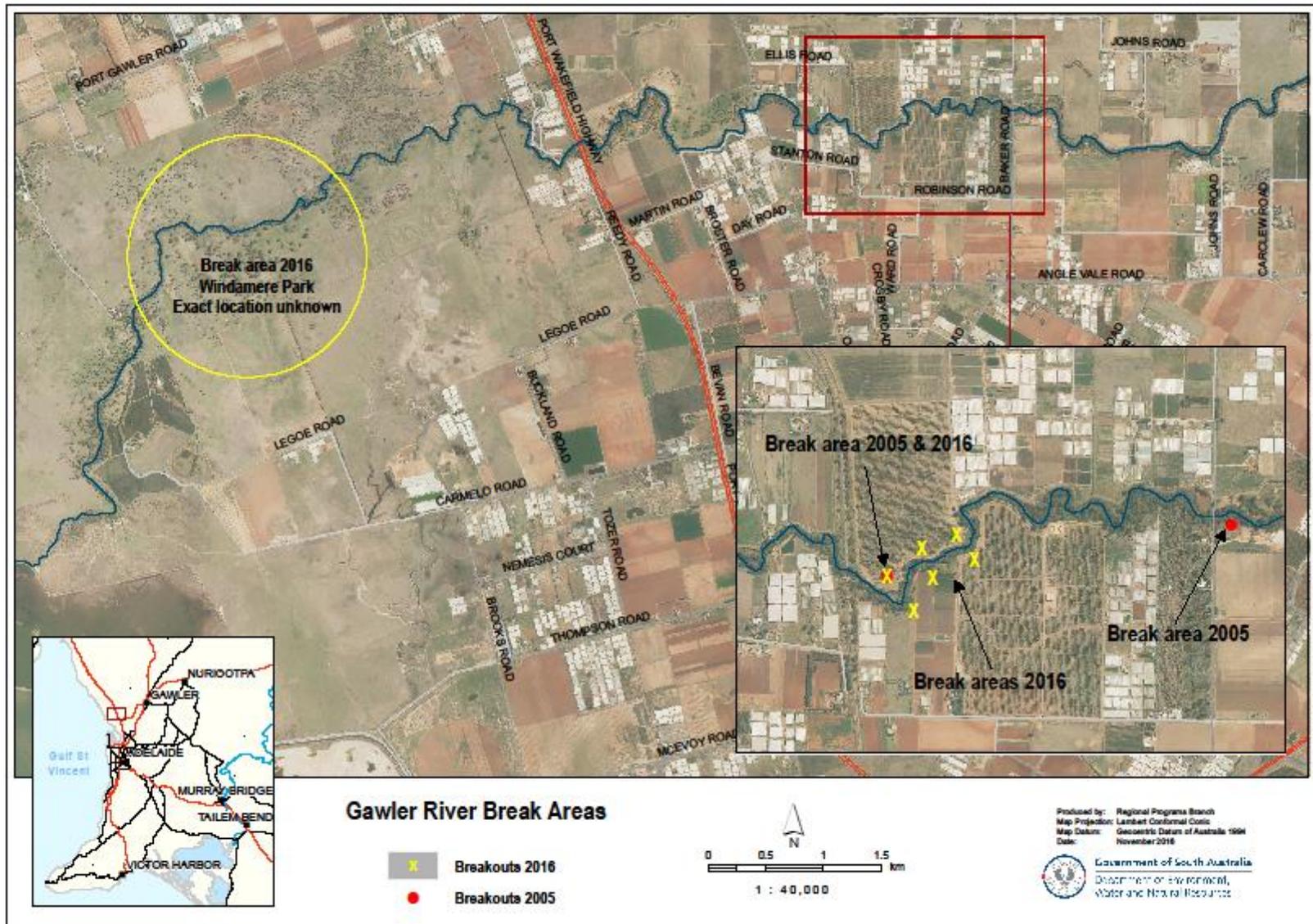


Figure 16 - Gawler River break outs (DEWNR)

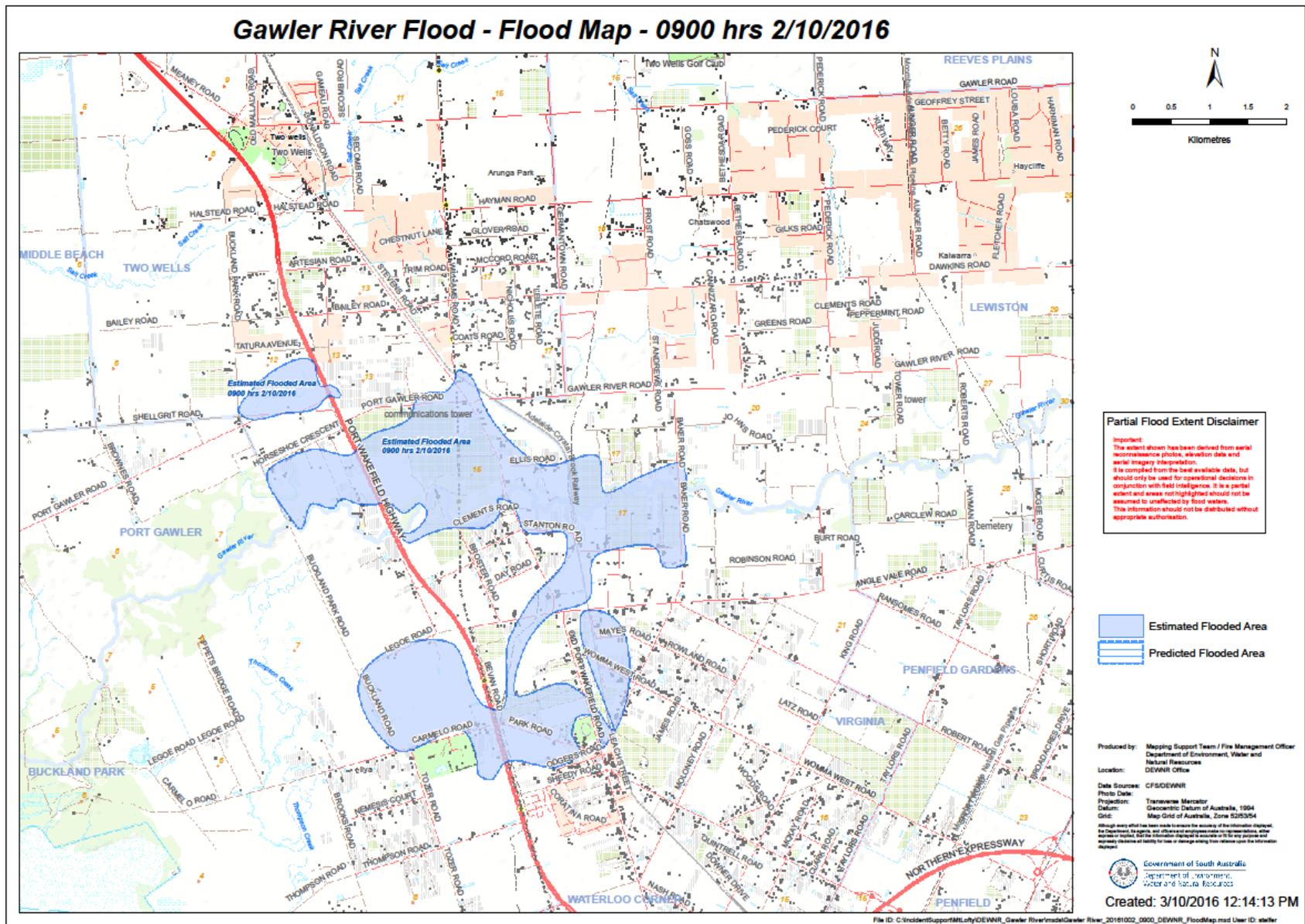


Figure 17 - Gawler River - Flood Map (DEWNR mapping support team)

---

Primary producers in the Northern Adelaide plains were impacted, with initial costs estimates of damage of more than \$51 million, with up to 300 primary producers affected and around 1500 hectares of farming land (open fields and 727 greenhouses) inundated. It is notable that the damage was concentrated in a small area of high-value land.

Emergency relief and recovery arrangements were established to support the local community and businesses.

The river level at Gawler township peaked on Friday 30 September. The levels in the Gawler River downstream of the Gawler township continued to rise during Saturday morning with moderate flooding with a number of properties inundated.

Water flowed from Gawler to the sea and breached the road at the Old Port Wakefield Road bridge.

Major flooding occurred in the North Para, South Para and Gawler Rivers and the at Little Para and South Para Reservoirs were spilling.

## 9.6 North of Gawler

All catchments north of Gawler were at capacity with many rivers breaking out.

The township of Bowmans was flooded, as a result of a breach of the Wakefield River north of Bowmans. Approximately 20 houses were inundated and one family was evacuated and taken to alternate accommodation. Emergency services door knocked other premises but no further evacuations were required.

A number of breakouts occurred in the lower reaches of the Wakefield River, threatening the township of Port Wakefield and spreading water into low lying farmland. Port Wakefield and Mallala Roads were closed with diversions in place for several days.



*Figure 18 - Wakefield River at Balaklava, including Balaklava hospital (DEWNR)*

The Barrier, Wilkins and Horrocks Highways and the Port Wakefield to Balaklava road were all closed due flooding.

The Light River which runs parallel to the rail line alongside Mallala Road was under threat of flood water and trains were cancelled due to the water impinging on the rail corridor.

SAPOL undertook door knocking Middle Beach and Webb Beach Communities to advise of the predicted tidal surge. The Parham Caravan Park was closed and relocated. The South Westerly winds caused a tidal surge of around 2.4 m along the upper Spencer Gulf.



*Figure 19 - Wakefield River, looking south towards Port Wakefield (DEWNR)*

About mid-day on Friday 30 September, reports were received of flooding in the small, rural township of Koolunga which is on the Broughton River. By late afternoon, waters were impacting many rural properties along the Broughton River, the township of Wandearah experienced flooding and there was water across many of the roads in the area.

There are no flood gauges on the Broughton River and no flood modelling which, if it had been available, could have been used to predict flooding and provide advice to potentially affected communities. The only intelligence available was local knowledge of previous events. CFS and SAPOL were deployed to monitor the lower Broughton River flood progress.

As a result of the lack of available intelligence there was no advance warning advice provided to the Koolunga community of flooding and they were caught unaware. The impact of the floodwaters could potentially have been mitigated against, if advance warning had been provided to residents.

Flooding occurred in the Barossa Valley on the North Para River around Nuriootpa and downstream, and at Balaklava on the Wakefield River. There was significant local government response to flooding particularly in and around mitigation wall at Nuriootpa.

The town of Clare was impacted by flooding in the main street. The local caravan park was evacuated and town infrastructure, such as the information centre, was under threat. Surrounding the town there were a number of strategic dams at risk.

Many local roads were blocked by trees downed by strong winds.

There were a number of dams in the area that were causing concern. A rural dam broke its banks at Greenock, which caused flooding of properties and roads in the Greenock Township.

The Gilbert River threatened the towns of Riverton and parts of Stockport were flooded. The local caravan park was threatened and the Gilbert Valley Senior Citizens Retirement Home was put on watch with sandbags in place. The town was noticeably better prepared than previous occasions, with sandbags already in place.

The townships and roads in the areas of Hamley Bridge, Tarlee and Saddleworth were also affected by the rising floodwaters of the Gilbert River.

The Beetaloo Reservoir was at 100 % capacity, and spilling over which posed a risk of flooding of the Crystal Brook (creek), with several houses in Beetaloo Valley at risk, and the Crystal Brook Township Caravan Park. People in the area were contacted and made aware of the situation.

---

## 9.7 Naracoorte Creek

Naracoorte recorded 120mm of rainfall over the period of a week. There were concerns about the rising flood water and emergency service crews supported the community by providing sandbags.

A watch and act message was issued for Naracoorte on Tuesday 4 October 2016 and the river continued to 'pulse' over the following few days.

While Naracoorte and surrounding areas became waterlogged, the damage caused by flooding of the Naracoorte creek was largely confined to back yards and rural areas. Most of the requests for emergency service assistance in the area related to storm damage and trees down rather than flooding.



*Figure 20 - Naracoorte airport (DEWNR)*



*Figure 21 - Footbridge at Naracoorte Creek*

---

## 9.8 Flood risk

It is recognised that hazards such as storms, floods and bushfires are not only responded to when an emergency occurs but events occur within a broader emergency management context. In addition to response this also includes prevention, preparedness and recovery (PPRR).

Responsible agencies such as hazard leaders, control agencies, local government and other service providers undertake planning and activities across the PPRR spectrum to mitigate potential consequences, prepare the community and provide resources and systems to enable communities to recover following an emergency.

Zone emergency management plans are developed for each of South Australia's 11 emergency management zones, as part of this process flood hazard risk management reports are developed where the Zone Emergency Management Committee (ZEMC) determines it to be a priority. 9 of the 11 Zones have prepared a flood risk assessment, including the four zones of metropolitan Adelaide, and the Barossa, Limestone Coast, Far North, Murray Mallee, and Yorke Mid North Zones.

Flood hazard risk management reports provide an assessment of flood risks in the zone and consider the impacts on people, environment, economy, public administration, social setting and infrastructure.

The plans present a view of stakeholders' understanding and perception of risk across the zone. They are a preliminary representation of flood risk in the zone and present a strategic view of the risks and priorities for treatment for input to the zone emergency management plan and for broad zone planning purposes.

Options for flood mitigation include structural measures (infrastructure), land use planning, development and building controls, and flood emergency measures. Identifying appropriate and effective mitigation strategies and crucial to minimising damage caused by flooding. However, mitigation measures can be very complex and difficult to achieve because there are many stakeholders. Control improvements and treatment options for flood risks can include activities such as:

- community education programs including on flood risk, insurance for floods
- Bureau of Meteorology (BoM) flood warning service
- SES warning messages and information
- land-use planning
- community information through councils
- local government emergency management plans.
- stormwater management plans
- promote mitigation research
- community education – general resilience

There are many groups including multiple local councils, various State government agencies and authorities who have a level of responsibility for mitigation however the specific responsibilities are not well defined. Mitigation activities can be very difficult and expensive to implement and it can be a significant challenge for groups such as mitigation authorities, to progress these activities, due to the inability to acquire funds or the commitment required from any of these groups.

At the Local Government Association (LGA) Annual General Meeting (AGM) held 21 October 2016 it was agreed that the LGA will investigate whether there is sufficient evidence across Local Government to liaise with the State Government in order to develop guidelines and/or appropriate legislation to enable the control and management of the flooding caused by rivers and creeks on private land.

---

## 9.9 SA Flood Inquiries Taskforce and Flood Reform Taskforce

The South Australian Government convened the Flood Inquiries Taskforce in 2011 to review inquiries into the major floods which occurred in 2010 and 2011 in Queensland and Victoria, and to determine the implications for SA. The taskforce concluded in July 2012, making a total of 15 strategic recommendations.

One recommendation was to form a Flood Reform Taskforce (FRT) to implement and monitor all recommendations. In 2015, DEWNR reviewed the progress of the FRT recommendations (DEWNR, 2016a).

In summary seven recommendations, plus part of recommendation 1.1, have been completed, these are:

- 1.1 Integrate River Murray planning and operation into flood management arrangements
- 1.2 Prepare policies to support decisions to evacuate before and during floods
- 2.1 Improve flood risk assessment at State, zone and local levels
- 3.1 Develop and implement a flood intelligence decision support system
- 3.2 Develop a business case for a flash flood warning service for SA
- 4.1 Undertake a flood monitoring review
- 5.1 Facilitate the broader adoption of the Community FloodSafe Program
- 6.4 Regulate the construction of new levees

Seven recommendations, plus part of recommendation 1.1, are yet to be completed, and still require the attention of the FRT:

- 1.1 Integrate reservoir planning and operation into flood management arrangements
- 1.3 Clarify responsibilities for management of watercourses, levee banks and other infrastructure in relation to flooding
- 2.2 Develop and maintain knowledge of persons and communities vulnerable to flood
- 6.1 Assess the need for a safety regulator to manage risks of structural failure of dams, levee banks, and decommissioned mine sites
- 6.2 Reform development controls to explicitly reflect flood risk
- 6.3 Review regulation of hazardous materials in times of flood
- 7.1 Undertake a flood response capability and capacity review
- 7.2 Assurance of the operational capabilities and capacities of agencies and organisations with functions under the SEMP.

For the remaining recommendations, a work plan has been established and a great deal of work has been progressed during 2016. The FRT and its working groups are reconvening during 2017

Throughout this Review the value of these recommendations has been highlighted. The steps that have already been taken have provided a better understanding of the status of flood risk, mitigation strategies and intelligence requirements.

The recommendations that are yet to be completed will be very important to the response to, and mitigation and management of any future flooding events. Many of these measures will assist in reducing the impact on communities. It is very important that this work continue to be supported through to implementation.

---

## 9.10 Flood information system

This event demonstrated the need to have up to date and relevant flood intelligence as well as the challenges that lack of intelligence can result in. One of the key outcomes of the Flood Reform Taskforce was to propose the development and implementation of a flood intelligence decision support system

As the Control Agency for flood, the SES leads the emergency response and is responsible for ensuring that the public is adequately informed and warned regarding potential floods, including providing relevant and timely information about the need to evacuate. DEWNR, in its role as Flood Hazard Leader, is required to ensure that appropriate processes are in place so that the SES have access to information to enable them to provide warning, and ensure implementation of relevant community education programs.

To meet these responsibilities DEWNR and the SES are working collaboratively to deliver an improved flood warning and hazard management system and supporting processes. This is an initiative to improve flood management in SA, particularly with respect to flash flooding.

The broader scope of the program is to improve the State's capability and capacity to provide timely flood warnings; to facilitate safe, effective and coordinated emergency response; and provision of flood information to the community. The program will deliver flood warning, especially for flash flood scenarios, flood intelligence and community education and flood awareness.

The Flood Information System is being developed to provide:

- visualisation of current and forecast data
- analysis of current and forecast data
- visualisation of flood exposures
- integration of known flood intelligence

This system will be hugely beneficial for effective, coordinated and evidence-based management of flood emergencies in the future.

## 9.11 Intelligence

The intelligence function within incident management is necessary to support decision-making. This involves collecting information, processing information into timely, accurate and relevant intelligence, and then providing that intelligence to relevant agencies and parts of the incident management structure and ultimately to the public.

Intelligence was provided by a variety of sources including weather information from the BoM and hydrological intelligence from the DEWNR and BoM hydrologists. This information was critical for prediction of floodwaters, planning activities and for public information and warnings.

---

*The embedding of a meteorologist from the Bureau of Meteorology proved critical for the flow of information and updates on wind, flood and coastal risks. This arrangement improved the connectivity between DEWNR's hydrologists working in the SCC and the Bureau's flood desk. The establishment of dedicated computing links from the SCC back to the Bureau's ICT environment proved essential for the meteorologists to undertake their functional support role.*

*(SASES, 2016)*

---

Flood monitoring is dependent on weather forecasts provided by BoM. Real-time monitoring of watercourses and rainfall in SA is undertaken by a number of organisations including DEWNR (incorporating Natural Resource Management Boards), the BoM, SA Water and councils.

Flood warnings are based on predictions of flood levels and timing that are uncertain. The prediction depends on the quality of real-time rainfall and river level data, the capability of rainfall

---

and hydrological forecast models and the level of service required (DEWNR, 2016b). In South Australia, the Bureau of Meteorology has responsibility for forecasting and warning for riverine catchments. SASES has responsibility for forecasting for flash flood catchments, as well as 'value adding' to Bureau forecasts riverine catchments with information such as likely impacts and areas affected.

The flood response activities by DEWNR during this event highlighted a number of gaps in information which impede the ability of hydrologists to predict potential flooding, which in turn, constrains the capability of the SES to warn the community and respond effectively to flooding. The two main information gaps are gaps in flood risk information (flood studies) and gaps in flood monitoring (rainfall and river level gauges). Both of these information sources are critical for understanding the vulnerability of a community to flooding, its likely impacts, and the severity of the flood in real time.

The gaps in the stream gauge network have been assessed on behalf DEWNR (Australian Water Environments, 2016) in an effort to identify, prioritise and resolve these gaps. However, funding for gauges is problematic because they require an initial investment to purchase and install a new gauge and then ongoing maintenance and calibration costs. There is no agency identified as being responsible for gauges and therefore no clear direction on how to address gaps in the network.

This event highlighted some of the gaps in the gauge network. There are no flood gauges on the Broughton River and there is no flood modelling which, if available, could have been used to predict flooding and provide advice to potentially affected communities.

There are gaps in the gauge networks including in the Mid North, which effected the ability of BoM and DEWNR to provide flood predictions in this area. There is a need to expand the monitoring network and DEWNR has undertaken some studies to prioritise potential gauge sites.

DEWNR was not fully aware of the impact that an outage of its servers could have on external parties. During the outage, DEWNR staff relied on the mobile phone network to communicate with gauging stations and relay readings manually to the BoM. Had this outage continued, it would have hampered the Bureau's ability to provide timely and accurate warnings for areas such as the Gawler River catchment.

There were also problems encountered with some SA Water gauging stations. In some locations this required SA Water staff to communicate manual readings to the BoM. In addition, storm tide prediction could be improved by installing a tide gauge in the Pirie River

There is also opportunity to improve the connection between the SES and local government to enhance intelligence gathering.

---

*'More liaison and preparation between council and the control agency to share information/intelligence is required.'*

*'Council intelligence and data was not utilised to its full potential - intelligence at the local level does not equate to State knowledge.'*

*'Information flow to councils from the SES should have occurred sooner or conversely councils should have made a greater effort to liaise with the control agency.'*

*(LGA, 2016)*

---

In 2015 a contract was confirmed for an embedded meteorologist from the BoM at the SES SCC during winter. This arrangement follows the lead of arrangements previously established between BoM and the CFS during the fire danger season.

The BoM will 'expand upon forecasts and outlooks, articulating uncertainties in the forecast, possible other scenarios and their likelihoods...the primary service will be a briefing service focused on enhancing situational awareness'. The ability to be provided with the briefing, be able

---

to ask questions and discuss various options and scenarios greatly enhances the ability of SES to be able to plan effectively in the lead up to, and during, significant events.

Likewise, an MOU has been between SES and DEWNR which provides for 'flood incident management support arrangements' where DEWNR provides 'expertise in flood hydrology' at the SES SCC 'for the purpose of providing hydrological advice on developing flood situations'.

---

*The operationalisation of the MOU between DEWNR and SES for the provision of mapping and hydrological support was effective and SES received outstanding support from that agency*  
(SASES, 2016).

---

These relationships between BoM, DEWNR and the SES have proven to be invaluable for providing weather and hydrology intelligence enabling SES to undertake more effective planning and response activities It has also resulted in enhanced relationships high levels of trust and cooperation.

## 9.12 Levees

A recommendations of the SA Flood Inquiries Taskforce (DEWNR, 2012) was to 'clarify responsibilities for management of watercourse, levee banks and other infrastructure in relation to flooding'.

A levee is an embankment which has been raised to prevent a river from overflowing. It is estimated that the collective total of levee banks in SA could total well in-excess of hundreds of kilometres (DEWNR, 2015). There is very little policy regarding management roles and responsibilities for levee banks. In some council areas levees are a major mitigation measure however there is no database on where levees are located and no determination for who is responsible for maintaining these.

During this event many levees were overtopped and lost their structural integrity causing widespread flooding in areas they were designed to protect. There is also evidence in the aftermath of this event, of landholders creating new levees to protect their properties for future flooding vents without seeking any approval or giving appropriate consideration of where re-directed water would impact further downstream.

<b>Recommendation 18.</b>	That the Flood Reform Task Group, as proposed by the Department of Environment, Water and Natural Resources, develop a business case for Cabinet, based on the dam safety discussion paper (Pisaniello & Tingey-Holyoak, 2016) which identifies options and a way forward to address dam safety in SA.
<b>Recommendation 19.</b>	That, giving consideration to the previous recommendation, the Flood Reform Response Working Group identify and consider appropriate agency involvement and protocols for response to and management of dams which are in danger of losing their structural integrity or spilling.
<b>Recommendation 20.</b>	That the Flood Reform Task Group identify an appropriate mechanism for stakeholder agencies (including the State Emergency Service, Department of Environment and Natural Resources, Bureau of Meteorology and SA Water, as a minimum) to share data and information and develop plans and strategies for management of water levels in reservoirs and spill management during floods in South Australian water catchments.
<b>Recommendation 21.</b>	That consideration and resources be given to support the implementation of recommendations in the report prepared on behalf of Department of Environment, Water and Natural Resources (Australian Water Environments, 2016), for flood warning classification of stream gauges and other locations.

---

**Recommendation 22.**

That resources be provided to support the implementation of recommendations in the South Australian Levee Bank Management Issues Paper (DEWNR, 2015) including:

- a) development of relevant policy; and
- b) identification of responsibilities in relation to levee management and flood mitigation

---

## 10. EMERGENCY RESPONSE

Providing effective and coordinated response of multiple emergency services to a large number of events is challenging and complex. The three SA emergency services, State Emergency Service, Country Fire Service and Metropolitan Fire Service, have some capabilities in common, such as being able to undertake a basic (non-technical) rescue or to clean up debris from a road following a vehicle accident or storm.

Some other capabilities are specific to a single agency eg SES for severe weather, and floods, and in technical activities to remove a fallen tree from a roof; CFS for bushfire response; and MFS for house and building fires in the metropolitan areas.

Each agency has multiple capabilities, each of which involve having the relevant training and equipment, and there are also capabilities in which each of the emergency services specialise.

There are many aspects of emergency response, for each agency individually and all the agencies together, that need to be coordinated to ensure that the most efficient and effective response is provided to maximise the safety and protection of the community.

### 10.1 Call receipt and dispatch

Call-takers in the MFS Communication Centre (Comcen), also known as Adelaide Fire, receive Triple Zero (000) calls for fire and rescue. The Comcen undertakes the 'call receipt and dispatch' function for the MFS, CFS and SES. The Comcen also answers calls on the 132500 SES flood and storm response line (132500).

During extreme weather there is a dramatic increase in calls on Triple Zero (000) and 132500. To ensure there is adequate call-taking capability in the Comcen for when severe weather is predicted, a staffing matrix is used to establish a suitable number of call-takers for the predicted scale and impact of the event.

During the peak of this event over a 48-hour period, Comcen received 2279 calls and dispatched a total of 2311 units from the three agencies (MFS, 2016)

Despite increased staffing, it can be expected that during an extreme weather event, at some point the number of incoming calls will exceed the capacity of the call-takers. The MFS is currently considering ways in which they can increase the number of call-takers available to them at peak times additional means of managing this workload also need to be considered.

The public are encouraged to call 132500 when they require SES assistance but the situation is not an emergency, however many of the calls received on Triple Zero (000) are also for non-emergency situations. To address this, Comcen and SES developed a procedure whereby SES provides a liaison officer to attend the Comcen to assist with prioritisation and allocation of SES calls. An SES liaison officer was provided during this incidents and MFS found this invaluable in assisting Comcen staff to effectively dispatch SES units.

When people call 132500 they are initially directed to an interactive voice recording (IVR). The IVR explains the options for information available relating to the current even. Another option offers the caller the opportunity to seek further information which then diverts the caller to the Comcen. This requires a call-taker to attend to the request for further information.

During this event approximately 25% of the calls on 132500 and diverted into the Comcen were for information only, eg enquiries about where sandbags or relief centres were located. On a normal day this would not be a concern because it would only result in a small number of calls however, in this instance, it resulted in excess of 500 calls.

Requests for assistance on 132500 can also take a considerable amount time to process because the call-taker needs to request enough of information from the caller to: establish if an emergency service response is required; ensure the details are accurate; and, ensure an accurate assessment of the level of priority can be made so resources can be assigned quickly to the most urgent situation.

---

The success of community take-up of the 132500 number can be attributed, in part, to the large amount of news outlets picking up the details from SES public information during events. During individual news segments reporters may read out the number multiple times, encouraging people to ring.

The Comcen has identified that triaging of incoming calls needs to be more effective to ensure Comcen operators' time is spent on the highest priority calls. It has already been determined that Comcen and SES will work together to identify options for: improved management of the IVR; more effective information options for callers; alternatives to diversion to emergency call takers; and, procedures to handle volume of inbound calls for information or requests for assistance. (MFS, 2016)

There is also an opportunity to provide more education to the community about when to call for SES assistance (and when not to). There is evidence that over time, the general community has become less resilient and have increased expectations that someone will come to assist them.

It needs to be reinforced that during extreme weather events all responders are very busy so anything that members of the community can safely and reasonably do by themselves or with their neighbours, friends or family, they should do so. It is not reasonable for the community to expect that emergency service personnel, including many of whom are volunteers taking time away from their usual job and families, to attend non-emergency situations that are better dealt with at a later time when the emergency and severe weather conditions have eased.

**Recommendation 23.**

That the SES in collaboration with MFS Communications Centre (Comcen) investigate and implement options to reduce the number of calls coming into the Comcen, (particularly on 132500). Options could include better utilisation of the available options on the Interactive Voice Recording and community education to increase community resilience.

## 10.2 Effective allocation of resources

There are many challenges during extreme weather events to being able to identify the nearest, fastest and most appropriate response to an incident. Some of these challenges include:

- the very large number of taskings that result from extreme weather
- understanding the priority of an incident (a caller's interpretation of an emergency is often different to a responder's interpretation)
- knowing where resources are currently located at any point in time
- knowing which emergency service resource is the closest at the time and if it has the appropriate capability (training and equipment) for the task
- understanding if a resource is already tasked with a number of jobs or if they will be available as soon as they finish the one they're currently attending to

Call-takers/dispatchers do not always have accurate or complete information to make the best decision about which resource to send. In many instances the required response is pre-determined in that it is already programmed into the response system. This is entirely appropriate and generally works well for day-to-day operations however can become problematic during extreme events.

Some of the challenges that are exacerbated during incidents involving many taskings include:

- confusion about which agency/ies or council resources have been responded
- responders having no knowledge as to whether other agencies have also responded to an incident and if so, which agencies and resources
- poor resource allocation and stop-calls resulting in inefficient use of volunteer time

- 
- crews driving long distances and zig-zagging across large areas to attend to tasks
  - crews from other areas without local knowledge attending incidents, where there are local resources available.

These challenges can result in less-than-ideal selection of resources to respond, duplication of resources, sending multiple resources to a minor response, and inaccurately triaged incidents.

During this event there were some resources that were extremely busy and others that could have been better utilised.

Issues with allocation of resources that were identified in several different locations across the State are described below.

---

*'... in my local area as a CFS volunteer it appeared to take a long time to be asked to assist and at that stage significant ramping of jobs had already occurred'... many of us were waiting to be of any assistance and were called upon only late in the piece'*

*'resources (were) spread thinly with regard to the emergency services in our rural area'*

*'It would be timely to do a review on area call outs for storm damage and where the emergency services crew were travelling from. For example, 90% or higher of the storm damage callouts for the Maitland SES crew were located in the Moonta area. This would highlight that with the population growth Moonta should in fact have its own SES crew'.*

*'Coordination of the SES and the council need to be improved. Coordination between neighbouring councils need to be improved'.*

---

### **10.3 Coordinating multiple agencies and many tasks**

During severe weather events, there are a very high number of calls from the public for assistance from emergency services. The Comcen may receive hundreds of calls in an hour and emergency services can be responded to thousands of jobs over a few days. This differs from other types of emergencies, such as bushfires, where there are generally a few calls that come in reporting the fire and additional resources are responded through a process of escalation. While days in the fire danger season will be busy, the calls won't be at the rate of a damaging storm.

The receipt and dispatch of many resources to a large number of incidents is very challenging for Comcen operators, SES units and IMTs as well as for the other agencies and local council resources. Currently SES units are using a combination of pager messages (arriving in quick succession) and the incident board on SES Incident Information Management System (SESIIMS) to receive and coordinate taskings.

Job-stacking is an SES process used whereby 'non-life threat' requests for assistance are triaged and prioritised. This process enables requests to be coordinated so that all life threat requests are dealt with immediately whilst other urgent but non-life threat requests are dealt with in a coordinated manner as soon as possible.

There are a number of parts to the job-stacking process that make this quite complex, require a large degree of human interpretation and intervention and, result in several potential points of failure. There is a great deal of reliance on the ability and experience of the operations officer who is sorting and tasking the jobs to ensure that nothing is missed.

Issues with job-stacking and management of multiple incidents has been highlighted in many previous debriefs. It has again been identified by SES volunteers and staff during this event, as well as the MFS, Comcen, SES Volunteer Association and CFS.

The SES is developing a multiple incident board to assist with this process for which implementation and training will commence shortly. However, even once this process is

---

established there are a number of issues that need to be considered and resolved to ensure that allocation of tasks is efficient and effective as possible and that the possibility of error is reduced.

Some of the complexities that are making the job-stacking and resource allocation particularly difficult, time-consuming, complex and increase the margin for error include:

- two different computer aided dispatch (CAD) systems, one for fire and one for emergency/rescue:
  - the rules governing the number of resources dispatched and the priority of response required are different in the two systems
  - there is a lack of transparency between the systems and the respective rules for response
  - the systems do not interact with each other and if a job is created on one and then allocated to an agency on the other system, the Comcen operator must cancel that job and create a new job in the other system which creates additional workload; and
  - when resources from different agencies are sent out on the two different systems there is no visibility to responding agencies as to which other resources (if any) are being responded
- two different incident information systems being used, SESIIMS and CRIIMSON (see 12.2 Incident information systems (electronic systems))
  - this adds complexity and potential confusion for operators and responders
  - it results in two different incident numbers being allocated for the same job, one in each system
- for various reasons, sometimes a job may not appear on a pager it appears on SESIIMS, to ensure the response is not overlooked it relies on the operations officer to notice the discrepancy and act upon it
- SES 'out of areas' response (areas where there isn't pre-determined SES response) which require the Comcen operator to contact the SES Regional Duty Officer (RDO) to determine the appropriate response adds more time to the response and additional activity for the Comcen call-taker and SES RDO; and
- currently SES and other ESO crews call in to Comcen via SAGRN or telephone to confirm they have completed a job, this cannot be automated, or done remotely and sometime due to workload, Comcen operators are unable to answer these calls and therefore tasks are not getting removed from the list.

Overall, the CRD process has become overly complicated and time-consuming. Multiple changes and adjustments have been made without giving full consideration to the call, receipt and dispatch process as a whole or any unintended consequences. There are different processes for the different agencies which may not be justifiable. There are multiple options for stream-lining and improving the process which would assist with multi-incident coordination and management. This would ensure more efficient and effective use of resources, reduce responder fatigue and provide a better service to the community.

**Recommendation 24.**

Engage an independent business analyst to review the current call, receipt and dispatch process for emergency services i.e. the Metropolitan Fire Service, Country Fire Service and State Emergency Service, from the initial call for assistance through to response of emergency service resources, including the allocation and coordination of multiple taskings.

**Recommendation 25.**

That the State Emergency Service, in consultation with key stakeholders, identify and implement a robust system and procedures for prioritising, allocating and coordinating multiple tasks.

---

## 10.4 Automatic Vehicle Location (AVL) and resource tracking

Another barrier in SA to effective allocation of resources is that with current systems, apart from crews calling in and notifying the Comcen of their location, there is no way of knowing where resources are located at any point in time. This can result in response times not being optimal because the dispatcher is not aware of available resources already in the vicinity of the incident.

When a major incident occurs, an IMT is established and personnel are assigned to roles within a defined organisational structure under an incident controller. Keeping track of emergency services resources, such as vehicles, personnel and equipment, that are responding to and attending emergencies is a critical function of the IMT.

One of the most significant challenges for IMTs is understanding in real-time what resources have been allocated to an incident and keeping track of where they are. For large emergencies such as this event, multiple vehicles from multiple SES units, CFS brigades and MFS stations operate at multiple locations and crews may be re-assigned many times during the day.

Previous events have shown that the process of tracking the location and status of all resources during a coordinated response to a major emergency currently makes up a significant portion of the total incident management workload.

---

*Considerable time is spent during incidents trying to determine which vehicles and personnel are in attendance, and therefore determining if we have adequate resources and if they are being provided with appropriate welfare and support.*

*(CFS, 2007)*

---

In SA resource tracking is undertaken using manual systems which rely heavily on verbal communications. This has the added disadvantage of needing to use radio networks for a large amount of voice traffic to convey location information as well as the considerable amount of time it takes to convey these messages.

In addition, faced with the immediate priorities of an incident, crews on the ground may fail to communicate their arrival at the incident, or may re-locate in response to immediate needs such as rapidly changing conditions, leaving the incident controller/operations controller with little or no visibility of their location.

Many interstate emergency services utilise automatic vehicle location (AVL) which provides the exact location of every vehicle to dispatchers and incident controllers in near real time. The information is updated through a regular GPS data signal sent back by each vehicle. If AVL was installed on emergency services' vehicles in SA this would improve response times by allowing the closest and most appropriate emergency vehicles to be dispatched directly from the field rather than from their fixed station locations.

---

*AVL systems would have provided controllers with an important tool for understanding and control during this fire.*

*Project Pinery Report (Noetic, 2016)*

---

There was limited visibility of resources during this incident due to the large quantity of resources from various agencies, allocated across the State. It was particularly highlighted when interstate emergency services crews were required to provide emergency response within SES response areas. The interstate crews, who were on local vehicles, could only provide verbal reports as to their location, which was especially difficult because they weren't familiar with the area. This reduced the ability for commanders to allocate crews to the nearest tasks or coordinate their tasks and activities.

Effective resource tracking enables more efficient allocation of resources and enhanced personnel safety. Personnel tracking can provide additional safety when crews are away from vehicles and

---

higher levels of resource tracking. There are significant benefits to both of these resource tracking activities and both required for the future of emergency response and incident management in SA.

The introduction of an electronic resource tracking system in SA would:

- enhance incident management
- improve resource allocation
- increase safety of personnel
- replace time-consuming voice communications between incident controllers and field crews and
- provide the incident control centre (ICC) with immediate and accurate location data
- enhance situational awareness for incident controllers,
- improve the ability to manage and dynamically re-assign and re-locate resources as circumstances change.

Resource tracking was highlighted as an issued during the Wangary fire (Noetic, 2005) and has long been on the agenda for ESOs. The current Minister for Emergency Services and South Australian Fire and Emergency Services Commission (SAFECOM) Chief Executive and the Chief Officers of SES, CFS and MFS are supportive and have been pushing to have this achieved. A multi-agency workshop was held earlier this year in an effort to establish the requirements for and ultimately purchase a resource tracking system for the sector.

<b>Recommendation 26.</b> That systems for Automatic Vehicle Location and personnel tracking be implemented within the emergency services sector.
---

## 10.5 Emergency services and response agencies

Under the SEMP the SES is the control agency for flooding and severe weather. Accordingly, the SES established control for the severe weather and flooding impacts through coordination of responses to requests for assistance and establishing the SES SCC and relevant ICCs.

The geographical spread of flooding and storm impacts spread from Port Pirie and Whyalla in the north through the Mid-North, Barossa, Clare Valley, Mount Lofty Ranges, Adelaide Metropolitan area through to Naracoorte in the State's south east.

Often when significant events occur, additional SES and other agency personnel and resources can be requested from unaffected areas and agencies. During this incident, this was more difficult due to the distribution, scale and complexity of the impacts. Many operational resources were already busy attending incidents in their own or nearby areas.

The work-effort support provided to SES from other services, agencies and groups was outstanding and key to the success of effective response. The relatively small number of SES staff and volunteers is insufficient to adequately staff all ICCs and other emergency centres. The response to this event was truly multi-agency and during the emergency response phase the SES, CFS, MFS, SAAS, SAPOL, ADF and interstate agencies worked effectively together to protect the community.

SA ESOs and other supporting agencies responded to and provided support for many different activities including:

- storm damage
- removing fallen trees
- flood mitigation including filling and laying sand bags and pumping water away from/out of assets
- door-knocking to notify residents of potential problems

- 
- assisting with traffic control
  - ongoing response to other emergencies such as road accidents
  - providing personnel for IMTs, ZECs, SCCs and the SEC

The MFS and CFS provided strike teams (four response vehicles and a command vehicle), to assist SES at a variety of locations performing a variety of functions.

SAPOL provided support to the community through traffic management particularly during the power outage when the traffic lights on many intersections in the CBD and Adelaide suburbs were not operating. They also established road closures on flooded and blocked roads.

SAAS were kept very busy particularly during the black system event which activated a large number of medical alarms. These needed to be responded to even though many were found to be triggered by the power failure rather than a medical emergency. There was also a surge in medical problems such as breathing difficulties, specifically calls from those people on home oxygen which required power, chest pain and falls.

Local councils are always involved in responses for storms and floods and this event was another busy one for council personnel. Councils, also suffering for the compounding effects of consecutive storm events, were again required to respond to their communities to assist with storm damage and the effects of flooding on council property.

DEWNR has excellent capabilities for emergency response and incident management and they were invaluable both in the role of flood hazard leader, as well as contributing to the incident response and management effort in general. DEWNR provided invaluable skills in a wide range of roles during this event including:

- seasonal 'fire crews' for technical chainsaw activities and other storm and flood responses
- personnel to assist with staffing of the SES SCC and IMTs
- aerial reconnaissance
- hydrologist and mapping support personnel to the SES SCC and mapping to the IMT at Roseworthy

All of the above DEWNR contributions were in addition to them dealing with day to day business and the impacts on national parks including closing access the public and protecting assets.

---

*'The operationalisation of the MOU between DEWNR and SES for the provision of mapping and hydrological support was effective and SES received outstanding support from that agency'.*

*(SASES, 2016)*

---

An issue raised by the South Australian Country Fire Service Volunteer Association related to the personal protective clothing (PPC) of CFS firefighters.

---

*'(CFS) personal protective clothing was not suitable for operating in very wet conditions, that they're 'not fit for purpose, cumbersome and post a danger to the wearer. Soaked PPC and waterlogged boots was an issued raised by many volunteers, who cited that this not only posed a safety risk, but also contributed to exhaustion, with the weight of the PPC a hindrance in performing tasks'.*

*South Australian Country Fire Service Volunteer Association*

---

SES personnel have PPC suitable for operating in wet conditions. While there is some PPC issued in some instances to CFS and MFS personnel, not all personnel will have this PCC available to

them. CFS and MFS personnel generally respond wearing leather boots which are not suitable for operating in wet conditions and once they're wet they are uncomfortable and heavy.

**Recommendation 27.**

That the State Emergency Service explores options for providing suitable personal protective clothing to personnel from supporting emergency services during major flooding events and sandbagging operations.

## 10.6 Interstate resources

Personnel from the Victorian SES (VicSES) and Country Fire Authority (CFA) and Western Australian Department of Fire and Emergency Services (DFES) were called upon to provide operational and incident management personnel to support SA emergency services during this event.



*Figure 22 - Minister Malinauskas addressing SES crews*

Interstate deployments occur across Australia for a variety of incidents every year. These deployments provide critical support to agencies in the grip of an emergency and interstate crews assist with operational activities and enable local crews to rest and recover after a busy time and so that they are able to continue operations once interstate crews depart. Interstate deployments are also a very valuable opportunity for emergency service personnel to work with other agencies and observe the systems and operations in other States.

---

*'we still have a lot to learn but this deployment showed to me as an individual how far we have come with our sister agencies'*

*'working with the SA agencies was a pleasure, friendly, helpful and always ready to help'*

*'relationships with other organisations was a highlight. Went very well. Goodwill clearly evident.'*

*'it was good to work consistently with another agency (SES) and see their protocols and methodology with respect to approaching an incident'*

*'despite the colour of our uniform we work as one. At no time did I see any 'them and us' I was proud of crews from both CFA and Vic SES, along with SA SES*

*'we had the opportunity to learn a lot from our SES counterparts and we took the opportunities whenever we could.'*

*Comments from Victorian SES and CFA personnel*

---

While the benefits of interstate support are clear, there are also challenges when receiving personnel from other agencies. Much work has been done at a national level to establish arrangements that support interstate deployments but there are still gaps in the procedures for when SA receives interstate support.

The logistical effort required to effectively support and coordinate large numbers of incoming crews is often under-estimated. Management of deployments includes ensuring they are transported, fed, accommodated, coordinated, briefed and kept informed during their deployment.

This event highlighted challenges that are often identified during interstate deployments including: difficulty communicating; lack of understanding of command structures; poor information flow to crews regarding both the operations and the logistical plan for their movements and arrangements; long travel distances from accommodation to area of operation etc.

Effectively supporting incoming deployments requires a considerable planning effort as well as identification of information needs for these crews. Thorough and detailed briefings are also essential.

Both CFS and SES have plans for how they provide multi-agency support to other States. It would be beneficial for SA emergency services to establish a plan for receiving interstate support. There are many similarities with coordinating interstate deployments to support any SA emergency service. A combined plan would reduce the amount of planning required i.e. not having to plan for each service individually, it will likely identify additional resources available and it would enable agencies, other than the control agency, to support an interstate deployment during incidents. This would alleviate the need for the control agencies to manage interstate deployments as well as all the other responsibilities they are undertaking.

An SA interstate deployment (incoming) plan should include:

- liaison officer and deployment support requirements
- location(s) for interstate liaison personnel to be established to ensure effective communication and information exchange with relevant control agency
- options for accommodation for large groups at strategic locations (CBD, metro and regional)
- options for provision of vehicles suitable to the operation
- communications plan including communications equipment
- additional PPE requirements

- preferred composition of teams of incoming deployments
- information for briefings about SA emergency services, command and control, terminology, systems and protocols

**Recommendation 28.** Establish an 'Interstate Deployment Support Plan' for incoming interstate resources. The plan should outline responsibilities and arrangements for this function. Consider including this plan into the State emergency management arrangements.

## 10.7 Sandbag activities

During flood and storm events the SES encourages members of the community to undertake measures in order to prepare for potential impacts. Community preparedness and resilience is an important part of lessening the impact and damage caused by extreme weather and flood events.

The SES advocates for 'community resilience' and provides equipment, information, and advice on how to prepare and mitigate damage before, during and after flooding events. The SES in collaboration with councils and the CFS strategically establish sandbag distribution points comprising of sandbags and suitable sand fill, which are open to public, to attend and 'self-fill'.

Sandbag Quick Reference Guide



## Sandbagging

Sandbags will not stop the water completely but can reduce the amount of water entering your home.

During low level flooding, sandbags placed in the right locations around your home can reduce the impact of flooding. As little as 25 sandbags can reduce the damage to your home built on a slab. It is not necessary to place a sandbag wall around your house to provide protection.

Sandbags or similar products can be purchased from many hardware or garden supply stores.

**How do I fill the sandbag?**

- Only use sand to fill hessian bags. Do not use dirt.
- Only fill sandbag two-thirds full.
- Do not over fill the sandbag as it will be too heavy to carry.
- Do not tie the top of the sandbag.
- Take care when filling and lifting the sandbag, to avoid injury.



2/3 full

**Figure 23 – information about how to fill and lay sandbags**

One of SES' objectives for the event was to '...increase community awareness and preparedness for storms and flooding'. Among other measures this involved the distribution of sandbags to the community from 44 locations across the State (primarily SES, CFS and council depots). Over 314 000 sandbags were utilised in both preventative and response operations during the emergency.

While this service was very well received and widely adopted, there were a number of issues including:

- variability of service provided in different locations, i.e. some locations had only sandbags, others also supplied sand, and others also had personnel to assist with filling sandbags
- in some locations there was 'panic acquisition' of sandbags where people who were not at risk of flooding and did not need sand bags, were collecting them 'just in case'
- some media releases did not have complete information on locations and services at the sand bag locations

- 
- some councils were not prepared to advertise the location through media releases (although they did release the information on the relevant council websites)
  - misinformation circulating in the media about the sandbags posing a health threat following an event
- 

*‘need to provide sand with sand bags, it is a big issue among the community’*

*‘traffic management around distribution points  
(for sand bags) requires management’*

*‘develop protocols around sand bag management with councils’*

*‘need to reduce people taking sand bags in low-risk areas’*

*‘messages about contacting your local council on what to do  
with used sand bags is not helpful’*

---

Interstate emergency service personnel commented on the pro-active approach in SA of distributing sandbags and the level of resilience it is helping to build within the community. There is evidence from this event that in many locations where sandbags were utilised in high risk locations, it reduced and in some instances, eliminated potential damage.

A staging area was established at Two Wells primarily to provide a location for filling, collection and dissemination of sand bags. 100 ADF personnel and crews from CFS and SES were deployed as well as some local community members assisted with filling sandbags. This provided a crucial resource to protect areas around the Gawler and Light areas.



**Figure 24 - Sand-bagging at Two Wells staging area**

The coordination of a staging area for sandbagging could be improved in future with effective planning prior to establishing the facility as well as appropriate staffing including a staging area manager and support personnel for day and night shifts.

**Recommendation 29.**

That the State Emergency Service together with the Local Government Association and Country Fire Service establish a plan for coordinated provision of sandbags to the public, including options for what is provided, where and when, and the process for effective communication of availability to the public.

---

## 10.8 Rescues from fast moving water

Between 28 September and 5 October 2016 there were approximately 30 people rescued by emergency services personnel and police from fast-moving water (referred to as swiftwater rescue). Most of these rescues involved people who had either attempted to drive through floodwaters or who undertaken 'recreational' activities in the dangerous and fast-flowing water.

Incidents where people made poor decisions and put themselves in harm's way through 'recreational activities' in floodwaters included when:

- thrill seekers kayaked in flooded rivers and were flung from their kayaks and into the water of the River Torrens at Lockleys
- a group of people floated down the River Torrens in Flinders Park in an inflatable boat and another on a rubber ring
- three people were rescued after attempting to kayak through fast-moving floodwaters in the Adelaide Hills.

Several incidents were captured in video footage and posted online. This could have had additional negative consequences by giving motivation to others to attempt dangerous activities. It also had positive ramifications because SAPOL officers were able to review the video footage and locate, identify and deal with the individuals involved.

---

*. 'the men put themselves at great risk as the river was flowing very fast and the water is full of hidden debris including tree branches, logs, and other rubbish.'*

*SAPOL Statement to ABC*

---

Many individuals chose to drive through floodwaters, some even bypassed road closure signs to do this. Several of those individuals needed rescuing.

When drivers are faced with water over the road they will usually stop to observe the water and make an assessment as to whether it might be safe to travel through. With floodwaters and swollen catchments, it can appear that the water is not deep and is only moving slowly, or not at all. However, this can be deceptive and underneath the surface the water may be flowing rapidly, have a very strong current and it may contain a lot of debris. It can take a surprising low level of water to shift a vehicle or cause it lose contact with the road and float away, even if the vehicle a 4WD.

---

*'a bloke drove through the road closed sign, stalled the car probably 200 metres along the road and sat there'*

*Police Officer in the Barossa*

---

When people make poor decisions around floodwater, they not only put themselves in danger, they also risk the safety of others who may attempt to assist them if they get into trouble. Potential rescuers may include SAPOL personnel and emergency services, they could also include members of the public who are not trained or equipped to deal with such an emergency.

Fortunately, there were no significant injuries or deaths during this event but the behaviour of some members of the community around floodwaters and the types of situations people got themselves into are consistent with a report 'An analysis of human fatalities from floods in Australia 1900-2015'. (Haynes, et al., 2016)

---

*The highest proportions of both men and women died while attempting to cross a bridge, causeway, culvert, road, etc.*

*Children and young people (0-19 years) accounted for the greatest proportion of fatalities engaged in activities near the water and in or near stormwater drains*

*(Haynes, et al., 2016)*

---

Other community behaviour that created obstacles and additional challenges for emergency service personnel and SAPOL, was sightseeing. This caused additional and unnecessary traffic on already dangerous and congested roads, and it blocked roads and access where people gathered (with their vehicles) near floodwaters and along river banks to watch the unusual spectacle.

A submission made to the Review by a member of the public made the following suggestion:

*'there should be laws that make it an offence to enter disaster zones and bypass any road closure into disaster zones; it should also cover entering flooded rivers against public warnings. Penalties could include the cost of rescuing such people'.*

*Submission to Review Team*

---

Recommendations from the Queensland Commission of Inquiry (Queensland Floods Commission of Inquiry, 2012) recommended a comprehensive public education campaign about the dangers of driving into floodwaters through various media and education initiatives.

Subsequently, a campaign was developed in Queensland with the catch-cry of 'if it's flooded, forget it'. This is gaining traction as a national flood awareness message and has been taken on by the SES in SA.



**Figure 25 - Queensland 'if it's flooded, forget it' campaign**

The SES had already been actively promoting safety messages and were delivering the FloodSafe program to educate the community about the dangers of floods. Production of a flood safety campaign including videos and educational products was already underway.

In addition, every SES advice message, warning and media release produced, prior to predicted heavy rain and during actual flood events, provides the community with information relevant to an event or risk. SES personnel providing interviews to radio and television also use every possible opportunity to promote flood safety messages.

## Stay away from floodwater

Don't drive, ride, boat, walk, play or swim in floodwater.

The majority of flood-related deaths in Australia are due to people entering floodwater. People and vehicles can be swept away in fast moving floodwater. It's often deeper and faster than it looks. If you do become stranded, stay with your vehicle.

Floodwater can be contaminated by sewage or toxic chemicals.

Floodwater can contain submerged objects and debris that can cause injuries.

*Figure 26 - Excerpt from sa.gov.au emergency section of the website*

It is important that SES continues to develop and provide public education and increase awareness about the dangers of floods.

The SES has also been enhancing its swiftwater rescue capability over recent years and has continued to do so since this event. Some of the enhancements include a proposal to deliver additional training to assist crews to remove casualties from vehicles, additional and smaller (child) sized personal floatation devices, emergency vehicles specifically designated for the swiftwater capability and ancillary equipment for waterproof radios.

The SES currently provides swiftwater awareness training to personnel from other emergency services and to councils. Most SES units are also provided with land-based swiftwater training and equipment which enables them to effect a rescue from land e.g. a river bank. There are also SES swiftwater technicians who are highly trained and equipped to undertake rescues in floodwaters.

During this event, in addition to undertaking rescues, SES swiftwater teams, were able to apply their knowledge and skills to other supporting activities such as: reconnaissance and intelligence gathering on water levels; confirming potential breaches of levees, dams and rivers; and, safety assessments for particular locations such as caravan parks and townships.

### **Recommendation 30.**

That the State Emergency Service be provided with resources to enable them to deliver swiftwater awareness training to all first responders including emergency services, SA Police and council crews.

### **Recommendation 31.**

That SA Police, as the control agency for search and rescue, and State Emergency Service who have the responsibility for providing search and rescue services under the State Emergency Management Plan, develop a swiftwater rescue capability plan that describes key swiftwater risk locations, roles and responsibilities of emergency services, State swiftwater resources and dispatch arrangements.

## **10.9 Traffic management**

Throughout this event there were many challenges to effective traffic management. During the black system event, traffic lights in the Adelaide CBD and many suburbs had no power and were not operational. Many SAPOL personnel were responded to manage traffic at major intersections and coordination was established between SAPOL and the DPTI Traffic Management Centre (TMC).

In the days following the black system event, heavy rains resulted in flooding, large amounts of water and debris over roads and damage to roads, access tracks and bridges. SAPOL, DPTI, local councils and emergency services all worked to assess and manage impacted roads to ensure the community was kept safe. Hundreds of roads, including several major highways, across the State were closed at various times during the event and conditions were constantly changing.

---

Due to the sheer number of roads impacted and the geographic spread of flooding, managing road closures was very complex, difficult and resource-intensive. All agencies, including councils and DPTI, were very busy with the high volume of work. Resources, including people and traffic management equipment such as signage, were stretched. This meant that some tasks needed to be prioritised over others, there were unavoidable delays in dealing with some tasks and a shortage of resources to be able to manage all road closures effectively.

---

*'Management and reporting of road closures and water over water (was a challenge)'*

*Port Adelaide Enfield*

*'information in relation to road closures, (there was) confusion due to the volume and misunderstandings with locations and whole sections of roads'*

*Barossa ZEC*

*'Opportunities for improvement in the administration of the Traffic SA portal. Council reported roads that were cut off, (but) website staff couldn't accept our advice. They contacted SA Police for confirmation. SA Police then rang us to have someone go and check the road we had already rung about. Good to have SA Police as the primary verification agency but a procedure would be useful to assist the flow of information'*

*Barossa Council*

*'Response from DPTI for management of flood issues on State controlled roads was poorly resourced in our area. Seemed to defer all requests for road closure signage to council.'*

*Barossa Council*

---

The liaison established between the TMC, SAPOL and other agencies was very beneficial and assisted with coordinating traffic management and road closures. The TMC commenced coordinating and recording all road closures on their website reported to them including council road closures. This provided a much more complete picture of road closures across the State than during previous events. So while there were still challenges, this was a significant improvement on previous events and DPTI provided excellent service and response given the circumstances.

The SEMP includes guidelines for 'Traffic management during emergencies' (SA Government, 2016). These were developed following the Sampson Flat fire, which was extremely complex in terms of road closures and the subsequent processes for assessing, clearing and re-opening roads that had been blocked and damaged by fire and hundreds of fallen trees. The guidelines provide information regarding the physical processes of how this is managed however it doesn't outline: responsibilities for road closures and management; coordination of road closure information; and, processes and authorisation for providing updates to the TMC.

The guidelines State that 'information regarding road closures will be provided by the Control Agency through a range of information sources, including the SAPOL website, Control agency websites, DPTI website, social media, main stream media, community meetings etc.'

This Statement isn't clear about responsibilities or processes and it would be more simple for the agencies involved as well as the community if road closure information was consolidated, easy to find and not duplicated across multiple sources of information. A single point of truth is required for road closures across the State. That information can then be linked to from other agencies websites and/or localised information provided on council websites (that is consistent with information on the DPTI site).

---

**Recommendation 32.**

That the annexure to the State Emergency Management Plan, 'Traffic management during emergencies', be updated to include: responsibilities and processes for road closures; and, Department of Planning, Transport and Infrastructure requirements in regards to provision of road closure information, notification of changes in road closure status and publishing of that information.

---

## 11. EMERGENCY MANAGEMENT IN SOUTH AUSTRALIA

When the Department of the Premier and Cabinet's (DPC) Security and Emergency Management Office (SEMO) was closed in 2006 their responsibility to provide 'leadership of whole of government emergency management' was transferred to SAFECOM.

To reflect this change clause (p) was added to section 8 Functions and Powers of Commission in the *Fire and Emergency Services Act 2005* specifying that SAFECOM was to:

undertake a leadership role from a strategic perspective with respect to emergency management within the State and to maintain an appropriate level of liaison with other bodies responsible for the management of emergencies in the State;

Under section 9(1) of the *Emergency Management Act 2004*, (the Act) State Emergency Management Committee (SEMC) has the following functions:

- (a) to provide leadership and maintain oversight of emergency management planning in the State
- (d) to undertake risk assessments relating to emergencies or potential emergencies where SEMC thinks fit or where requested by the Minister
- (g) to co-ordinate the development and implementation of strategies and policies relating to emergency management (including strategies and policies developed at a national level and agreed to by the State);

SAFECOM is a major contributor to the delivery of SEMC functions. SAFECOM's responsibilities include:

- intergovernmental liaison
- representation on and provision of support to the Australia-New Zealand Emergency Management Committee
- provision of support to the Minister for Emergency Services on the Law, Crime and Community Safety Council
- membership of Australia-New Zealand Emergency Management Committee (ANZEMC) Sub-committees and Working Groups
- jurisdictional representation on national committees and work programs
- coordination of jurisdictional input into national reviews
- contribute and/or lead development of State and national emergency management policy
- management of commonwealth and State grant programs
- membership and executive officer support to State committees and advisory groups; and
- leadership and/or oversight of State strategic emergency management projects on behalf of SEMC.

The Premier of South Australia is the Responsible Minister for this Act with the Chief Executive, DPC chairing meetings of the SEMC. DPC has very few people dedicated to counter terrorism and emergency management.

The Minister for Police and Emergency Services, through the various government agencies for which he has responsibility, has the largest commitment to not only operational response to emergencies, but also strategic and policy development.

The Minister for Communities and Social Inclusion has responsibility for the relief and recovery aspects of an emergency, noting that recovery extends well beyond 'people' aspects.

Emergency management in South Australia does not sit with one Responsible Minister.

---

In 2003, when new emergency management arrangements in South Australia were developed, the Premier was made Responsible Minister. This was to engender greater commitment from government department chief executives. The Premier was also provided with the peak 'strategic' body in South Australia; SEMO to ensure cross government leadership, strategy and policy development and coordination of arrangements.

Since then, some government agencies' emergency management strategic capability and capacity has been eroded. In some instances, agencies do not have sufficient numbers of staff with appropriate skill-sets to effectively fulfil their roles as a hazard leader, control agency, or functional support group member.

Critical areas include emergency risk management, strategic policy, research and development, planning and training, areas where the cost/benefit is difficult to quantify but where any deficiencies are quickly exposed during emergency incidents and/or subsequent investigations or inquiries.

Following the closure of SEMO, SAFECOM and SAPOL were expected to take on increased responsibilities and absorb the three unfunded personnel transferred from SEMO within the existing budget.

Meanwhile, State and national initiatives (e.g. NSDR; requirements associated with National Partnership Agreements for Disaster Resilience; inquiries like the Productivity Inquiry into Natural Disaster Funding Arrangements; leadership of the State's emergency risk management programs etc.) have expanded SAFECOM's responsibilities and associated workload.

Emergency management in SA is comprised of a series of committees and State government agencies supposedly seamlessly meshed with local government NGOs, private companies and then communities and individuals, operating under the *Emergency Management Act 2004* and SEMP.

The philosophy behind these arrangements are sound and provides SA with a robust means in which to manage emergencies in the holistic perspective of PPRR (including resilience). The level of success in the implementation of those objects and guiding principles as described in the Act are mixed and the observations during this Review show that opportunities for improvement exist, but are limited by the current emergency management structure.

The response to an event usually highlights the gaps and opportunities for improvement in arrangements and planning, including in prevention, preparedness and recovery.

A broader approach needs to be taken so as to actively involve all those sectors mentioned in the plan including local government, NGOs and business and achieve the objectives of the *Emergency Management Act 2004*.

There are opportunities for agencies in the State Emergency Centre, as part of their respective plans, to brief key stakeholders and partners on a regular basis, leading up to, and during the event so as to improve preparedness and then during the event to gain additional intelligence, assistance and improve the response to the event.

For instance, when the first briefing of the SES State Control Centre took place, all of the support/functional agencies within the SEC, should have then provided a similar brief (obviously removing confidential material) to those organisations included in their particular emergency plan. These briefings cascading down to ensure cohesive, holistic actions.

As example, for the Health support service this would have included providing relevant information to public and private hospitals, nursing homes, aged care facilities and people at home with medical issues likely to be affected by the coming event. Similarly, for ICT Office for Digital Government (ODG) this would be the provision of briefings to the various telecommunication companies who may have then placed their own control centres into the same state of readiness and activation as SEC, and establish that initial dialogue before the event arrived.

There are many examples for each of the agencies and functional/support agencies represented in the SEC. For some, these cascading briefs occur, but it needs to be formalised as part of the

---

SEMP and associated plans and becomes a normal protocol in the way in which emergencies are managed in SA, and this starts well before an emergency arises.

### **11.1 Emergency Management Act**

The *Emergency Management Act 2004* is the principal legislation for managing emergency response in South Australia.

(1) The objects of this Act are—

(a) to establish an emergency management framework for the State that—

- (i) promotes prompt and effective decision-making associated with emergencies; and
- (ii) makes provision for comprehensive and integrated planning in relation to emergencies; and

(b) to promote community resilience and reduce community vulnerability in the event of an emergency.

(2) The objects of this Act are to be achieved through—

(a) establishing the State Emergency Management Committee; and

(b) providing for the appointment of a State Co-ordinator; and

(c) the preparation, review and maintenance of the State Emergency Management Plan; and

(d) making provision for declarations relating to emergencies and disasters; and

(e) establishing structures for risk prevention and preparedness; and

(f) establishing structures to support a seamless transition from response to recovery in relation to an emergency.

(3) The guiding principles under this Act are that emergency management arrangements must —

(a) be based on an all hazards approach in addressing emergency prevention, preparedness, response and recovery (PPRR); and

(b) reflect the collective responsibility of all sectors of the community, including both State and local government, the business and non-government sectors, and individuals; and

(c) recognise that effective arrangements require a co-ordinated approach from all sectors of the community, including both State and local government, the business and non-government sectors, and individuals.

### **11.2 Prevention, Preparedness, Response and Recovery (PPRR)**

South Australia's emergency management arrangements involve the following activities:

Prevention - which seeks to eliminate or reduce the impact of hazards themselves and/or to reduce the susceptibility and increase the resilience of the community subject to the impact of those hazards.

Preparedness – which establishes arrangements and plans and provides education and information to prepare the community to effectively deal with emergencies.

Response – which activates preparedness arrangements and plans to put in place effective measures to deal with emergencies if and when they occur.

Recovery – which assists a community in the restoration of emotional, social, economic and physical wellbeing, reconstruction of the physical infrastructure and restoration of the environment.

---

### 11.3 The Third 'R' - Resilience

Resilience requires an increased focus within South Australia's emergency arrangements.

The National Strategy for Disaster Resilience (NSDR) was endorsed by COAG in February 2011 to guide federal, State and local governments, businesses, community leaders and the not-for-profit sector.

In South Australia, the priority actions of the NSDR are also strategic priorities for the State Emergency Management Committee (SEMC). SEMC has established the SA NSDR Steering Group (co-chaired by SAFECOM and Department of the Premier and Cabinet (DPC) that reports bi-monthly on the implementation of the NSDR in South Australia.

The NSDR describes a disaster resilient community as one where:

- people understand the risks that may affect them and others in their community.
- people have taken steps to anticipate disasters and to protect themselves
- people work together with local leaders using their knowledge and resources to prepare for and deal with disasters.
- people work in partnership with emergency services, their local authorities and other relevant organisations before, during and after emergencies.
- emergency management plans are resilience-based, to build disaster resilience within communities over time.
- the emergency management volunteer sector is strong
- businesses and other service providers undertake wide-reaching business continuity planning that links with their security and emergency management arrangements
- land use planning systems and building control arrangements reduce, as far as is practicable, community exposure to unreasonable risks from known hazards, and suitable arrangements are implemented to protect life and property, and
- following a disaster, a satisfactory range of functioning is restored quickly.

#### Being Resilient - The need to do more in South Australia

Many of the submissions received by the Review from members of the public indicated that individuals were concerned about their own lack of preparedness or the preparedness of others. There were submissions indicating the need for individuals to be prepared by having radios, emergency kits, the ability to charge mobile phones and being able to sustain themselves during extended power outages and emergencies.

---

*'We need to remain vigilant as climate change will bring more of this and we need to not forget the importance of battery powered radio. We need a campaign to highlight the importance of being prepared as we are also at risk of other severe weather events in the future'*

*Submission from a member of the public*

*'(There was a) general lack of community preparedness and resilience e.g. emergency kits with battery powered radios, torches, etc. While the loss of power was a problem for many people, the subsequent loss of telecommunications including internet in some locations was very difficult. Australians have become very reliant on technology for information, communication, work and entertainment.'*

*Port Pirie council*

---

---

On the Eyre Peninsula, the power outage was extended and it affected individuals, businesses and essential services such as access to doctors, hospitals, chemist, fuel, money and the ability to pay for food, medication and other essentials. During interviews with business and community members, it became clear that they were not prepared for such a long power outage. They did not appear to comprehend the seriousness of the weather warnings and did not undertake adequate planning and actions to mitigate the potential consequences of the event.

The power outage was exacerbated by the inability of people to communicate with others. There was a strong feeling of isolation on the Eyre Peninsula and feeling like they had been forgotten and 'out of sight, out of mind'.

---

*'(it) felt like we were a couple of hours away from community panic'*

*Port Lincoln resident*

---

Some communities, particularly rural communities, considered that they would be resilient but were taken by surprise and did not feel ready when the power outage occurred. Other communities, particularly small ones, had stronger community networks and were more resilient.

The flooding of homes and property also highlighted that some residents were not aware that they lived in a high flood risk area and had not undertaken adequate preparations. Due to advertising and community engagement by the CFS, it was widely understood that communities in high fire risk areas in SA need to be prepared and develop a bushfire plan. However, there is much less awareness in the community about households and businesses being prepared for floods and preparing flood plans.

---

*There were some people with flood plans, a lot of households have fire plans but it was the first time I'd heard of people actually having flood plans*

*Barossa ZEMC*

---

Evidence and research continues to show that being prepared for an emergency improves people's ability to cope with the impacts of an emergency. The Red Cross in Australia and around the world works to reduce the impacts of disasters on people and work with communities before, during and after emergencies to help reduce vulnerability, ensure immediate needs are met and provide humanitarian support. At a practical level this means working in partnership with the community, building on existing networks, resources and strengths, identifying and supporting the development of community leaders and empowering the community to exercise choice and take responsibility (Australian Red Cross, 2016).

In SA, the Red Cross has been working to bring together agencies that are working towards increasing the resilience of South Australians. They are striving to coordinate public information about resilience, so that the various agencies cooperate and present a consolidated community resilience message rather than multiple, potentially conflicting and competing messages.

The Red Cross deliver a number of programs including the emergency RediPlan which is a national community education program to build community resilience. It is centred on face to face engagement, and is supported by a RediPlan guide including an emergency plan template for participants to complete. Red Cross works closely with hazard leader agencies such as the CFS, MFS and SES in the planning and delivery of RediPlan to ensure that messaging is consistent and complimentary.

The NSDR and the notion of building resilience are broad concepts and Prevention, Preparedness, Response and Recovery all have an impact on resilience. Most resilience-building efforts focussed on preparedness. Building resilience in people and community before an event happens can improve the way they respond and recover.

---

The Productivity Commission Report on Natural Disaster Funding strengthens the case for governments investing in mitigation in order to reduce the costs (financial, social, environmental etc.) associated with events. Despite mounting evidence for this upfront investment and high level policy directions there remains a significant imbalance between investment in prevention and preparedness compared with response and recovery.

Addressing resilience and driving the resilience agenda needs to be a multi-faceted approach with interventions at all levels.

While significant projects have been undertaken in South Australia around disaster resilience, circumstantial evidence from recent events (including the September 2016 Extreme Weather event) suggests that there is further work to be done in supporting communities and government to take a resilience-based approach to emergency management.

In South Australia, there is no defined policy or approach for building resilience, for example New Zealand and Canada use the 72-hour model, asking individuals and communities to prepare and be self-reliant for 72 hours. Various campaigns have been developed and public information is provided to promote and support this model (SF72 San Francisco's hub for emergency preparedness based on the 72-hour model).

### **Resilience messages**

More needs to be done throughout the emergency management sector to educate politicians and the public about the disaster resilience agenda.

The Government, the Opposition and other politicians need to be better informed about resilience-based and shared responsibility approaches to emergency management, and to promote consistent messages to the public.

The types of messages they need to understand and to be able to communicate include that:

- social and economic costs of disasters in the future will be difficult to manage unless communities become more resilient
- national investment in cost-effective resilience and preventative activities can reduce the impact on government budgets of having to respond to disasters by more than 50%. (Australian Business Roundtable for Disaster Resilience and Safer Communities, 2013)
- more investment is requirements in preparedness and building local capacity and capability, rather than focussing resources on responding to events
- if individuals and communities are self-sufficient (e.g. they can support themselves for 72 hours following an emergency), authorities can focus their resources on where help is really needed
- with increasing frequency and intensity of weather events and the number of people impacted, emergency management agencies cannot manage this alone
- preventing, preparing, responding to and recovering from disasters needs to be a shared responsibility from all sectors of society (government, business, NGOs and individuals) and everyone needs to play their part.
- long-term and sustained behaviour change will take time and significant additional resources with the need for strong, bi-partisan support

Another important aspect that needs to be understood is that reacting to events, for example providing household level grants, can reduce resilience and create further reliance on government and it sets an undesirable precedent for future events.

### **11.4 Natural Disaster Resilience Program (NDRP) – Grant Funding**

A key driver of the resilience agenda, supporting prevention and preparedness measures, is through the NDRP grants administered by SAFECOM.

---

The Commonwealth provides SA with approximately \$2 million of funding per annum for resilience building initiatives under a National Partnership Agreement. The matched funding model in South Australia requires grantees to provide approximately 25% of overall project funding.

This funding model differs to other jurisdictions which provide 50:50 State/territory funds to match Commonwealth provided grant funds. The South Australian funding model potentially creates a barrier, particularly for the community sector and non-government organisations, to access funding for community wide initiatives. Consequently, the majority of funding goes to State government agencies that are able to contribute to overall project costs.

In line with the NSDR's push towards 'shared responsibility' it is crucial that NGOs and community groups are not structurally disadvantaged from accessing mitigation funding.

If the State Government considers increasing its contribution in line with other States (i.e. so that a 50:50 State/Commonwealth funding model is established the intent of the NSDR, namely shared responsibility, can be more achievable, enabling NGOs and smaller community organisations better access to necessary funding.

In a sense, the South Australian government and the emergency management sector is in its infancy when it comes to committing to a resilience-based approach to EM.

Despite the preponderance of evidence about the importance of investing in preparedness and building the resilience of people and communities, the emergency management culture and allocation of resources in South Australia, is still heavily response focussed.

**Recommendation 33.**

Develop practical policy outcomes to support resilience (e.g. the 72-hour model) and promote this broadly to community through media, awareness campaigns, policies etc. Research should be undertaken to gain insight into the types of messaging and activities that have the most impact on sustained behaviour change within the community before committing to a particular model.

Whole of sector EM support is currently spread across two small teams at SAFECOM (Emergency Management Office, including the Resilience Program Coordinator) and DPC (Security and Emergency Management).

The current staffing of one temporary grant funded position focussed on the resilience agenda only allows for a limited scope of activities. The current focus is on providing executive support to the NSDR Steering Group and capturing the work being done that addresses and aligns with the NSDR priority areas.

There is significant opportunity for SAFECOM, supported by the NSDR Steering Group to identify gaps in the sector and drive new pieces of work that bring agencies together to address problems.

SAFECOM is also well placed to further develop broad community relationships, i.e. with peak industry bodies, and direct funding support to external organisations that are well placed to run cost-effective projects thereby driving the 'shared responsibility' agenda of the NSDR.

Better efficiencies could be achieved if the limited resources were pooled across the domains of Security and Emergency Management. This would leverage the existing governance roles with the and could better support the State Emergency Management Committee if driven chiefly from one central point.

## 11.5 State Emergency Management Plan

The *Emergency Management Act 2004* was amended in July 2016, which triggered the re-writing of the SEMP which came into effect on 16 December 2016.

The Premier of South Australia has responsibility for the Act and the Government of SA has the primary responsibility for managing emergencies within this State, emergency management is supported by DPC and SAFECOM which provides State-wide policy advice and support.

---

The SEMP is the key plan for managing emergencies in SA.

Amendments to the *Emergency Management Act 2004* placed new requirements on the content of the SEMP, which must now, vide section 5A(1):

*'detail strategies for dealing with emergencies in the State, including strategies—*

- (a) for the prevention of emergencies; and*
- (b) relating to preparedness for emergencies; and*
- (c) for the containment of emergencies; and*
- (d) for the co-ordination of response and recovery operations; and*
- (e) for the orderly and efficient deployment of resources and services in connection with response and recovery operations.*

In addition, the SEMP must meet the Act's objectives and guiding principles - section 2(1):

- (a) to establish an emergency management framework for the State that—*
  - (i) promotes prompt and effective decision-making associated with emergencies; and*
  - (ii) makes provision for comprehensive and integrated planning in relation to emergencies; and*
- (b) to promote community resilience and reduce community vulnerability in the event of an emergency.*

During the 28 September 2016 event, emergency management authorities used a combination of the 'old' SEMP and introduced aspects of the 'new' SEMP. This initiative proved beneficial and demonstrated opportunities for improved outcomes in future events.

However, given that this Review proposes recommendations which will impact the SEMP, there is a need to undertake a fresh review of the SEMP.

A submission by retired police officers Mr Peter Schar and Dennis Mulroney (see Attachment 4) (very experienced in emergency management) proposes:

---

*'The SEMP December 2016 update does not reflect the new requirements of the Act and is deficient in many respects including content that it does not align with the Act; lack of clear, specific and directive strategies; and conflicts in roles, terminology and definitions.*

*Also, in some areas there has been fundamental changes to the emergency management arrangements some of which conflict with lessons learnt over the past decade.'*

*Peter Schar and Dennis Mulroney, Retired Police Officers*

---

Whilst this Review, does not necessarily support all the recommendations made in the Schar/Mulroney submission, there are many relevant observations which require immediate attention and a 'fresh eyes' approach to ensure that the SEMP reflects the intention of the legislation and best practice.

This is further supported by other comments provided to the Review where there was a feeling that, whilst the new SEMP was an improvement on the previous version, there is still an opportunity to undertake a broader review of the SEMP. This would have the objective of ensuring best practice, and to establish a strategic and comprehensive view of emergency management for the future.

---

## 11.6 Control agency for black system events

The black system event on 28 September 2016 was caused by destructive winds during an extreme weather event. As per the arrangements in the SEMP, the SES was the designated the Control Agency. However, a Declaration of a Major Incident was issued because of the power outages not the weather. A black system event has no designated Control Agency.

This did not impact the effectiveness of emergency management, given the extent of wind and water damage and the demands on SES. However, it highlights the need for an agency to be designated as a control agency for a black system event because of the range of other associated issues such as, loss of communications, traffic management, limited access to fuel, food and cash and the potential for public panic and disorder.

The Department of State Development (DSD) has the role of Control Agency for electricity, fuel and gas shortage and has well developed plans and arrangements to deal with an event of this nature. However, this Department, may not necessarily be the best option for a wide spread power outage of extended duration. DSD have no ability to return power in an event of this nature, and whilst they will liaise with the various private companies involved in providing South Australia's electrical power they are unable to control those companies.

In effect, the black system event of 28 September 2016 whilst long in duration in some areas of SA, lasted less than six hours for the majority of Adelaide and surrounding suburbs. What emergency services were managing, was in fact, the consequences of a State-wide power outage. This included managing the decanting of the CBD (it was not an evacuation on this occasion), traffic issues, access to fuel, food, loss of communications, public order (not in this instance, but highly probable if the event were of a longer duration).

During the extended power outage on Eyre Peninsula, this event; although still being managed with SES as the control agency, in the first instance; in fact, transitioned from the ZEC to an ICC and ultimately the PFCP with the Police Commander assuming the control and coordination role with exceptional support from the various agencies and local government represented within that centre.

### **Recommendation 34.**

That, as with earthquake, SA Police be designated the Control Agency under the State Emergency Management Plan for black system events or other major power outages.

## 11.7 Emergency Management Council

The Emergency Management Council (EMC) is a committee of Cabinet and the SEMP 2016, describes its objective:

'to ensure the adequacy of the SEMP, emergency management preparedness and mitigation arrangements of government for all emergencies (natural or human-caused, including terrorism) and ensure over-arching strategic coordination of emergency management arrangements across the State'

The Emergency Management Council met on seven occasions between 28 September 2016 and 1 October 2016. The Premier of South Australia chaired all of these meetings and led the government response.

The role and function of the EMC during an emergency is not addressed in the SEMP. This needs to be rectified so as to provide Ministers and other persons undertaking leadership roles and attending these meetings with a clear understanding of the role and function of EMC and government strategic and policy expectations.

The EMC can issue tasks and actions in line with its role and function and should ensure that these actions are being attended to and reported on at the following meetings. The EMC will also be considering broader potential impacts for the State resulting from the emergency event (e.g. impact on industry, tourism).

---

In addition to the Recommendation that SEMP be revised (Recommendation 38), the guidelines for Ministers, prepared by DPC also needs to be updated and should include more information concerning communications and options available in the event of mobile phone failure (e.g. satellite phones).

These plans and guidelines should be accessible to the Minister at all times in hard copy and/or a stand-alone fully charged, portable device (and capable of being recharged in the event of power failure).

Whilst the EMC meetings provide attendees with briefings and information about the emergency event, attendees should also be receiving regular situation reports from their respective government agencies which they then may share with the attendees of the EMC.

Government agency representation at these seven meetings varied. It is the view of the Review that relevant Chief Executive's (or Deputy Chief Executives if Chief Executive is unavailable) attend all meetings to ensure appropriate/ consistent advice to Ministers are provided. Subject matter experts may be invited when necessary.

There needs to be a clear delineation between the role of an agency Chief Executive and the relevant Minister in operational matters associated with an emergency. A single point of contact should be established (in planning and enacted in an operation) between the Minister and the agency (usually the Chief Executive). This prevents confusion of role and misunderstandings/contradictory information/actions within an agency.

In addition, for minor enquiries (which may be brought to the attention of the Minister by other politicians, members of the public or media) which do not need the attention of the Chief Executive, consideration should be given to a link being established using a nominated Ministerial staff member contacting the Chief Executive's nominated person (e.g. executive/staff officer).

Similar to briefings at the SEC and other command/control areas, EMC meetings should be time constrained, only dealing with information and actions relevant to and at the strategic level for which that particular body exists. In most instances meetings should be of about 15 to 20 minutes duration.

**Recommendation 35.**

That the Department of the Premier and Cabinet revise the ministerial documents relating to emergency management.

**Recommendation 36.**

That members of Emergency Management Council ensure they are prepared to undertake their roles and responsibilities during emergency events, including establishing:

- a) contingencies for communication e.g. satellite phone
- b) access to relevant documents such as the State Emergency Management Plan, supporting plans, ministerial guidelines, agency plans and contacts in hard copy and/or portable device
- c) formalised arrangements for briefings (up and down), and
- d) arrangements for suitable representation e.g. relevant Chief Executive(s) or their deputy, at all Emergency Management Council meetings .

---

## 11.8 The State Emergency Management Committee

The SEMP 2016, describes the role of the State Emergency Management Committee (SEMC) as: *'a strategic planning committee that reports to the EMC on matters related to the preparedness of the State against identified hazards or protective security matters'*.

SEMC was established under section 6 of the *Emergency Management Act 2004* and is the prominent strategic planning committee that provides leadership and maintains oversight of emergency management planning for SA.

Under Section 9 of the Act, SEMC's functions are to:

- (a) provide leadership and maintain oversight of emergency management planning in the State*
- (b) prepare and keep under review the SEMP*
- (e) ensure agencies and organisations with functions in the SEMP are aware of those functions and are provided with adequate information for the purpose of understanding and carrying out those functions*
- (f) monitor the capacity of agencies and organisations with functions in the SEMP to properly carry out those functions*
- (g) coordinate the development and implementation of strategies and policies relating to emergency management*
- (h) monitor and evaluate the implementation of the SEMP in relation to a major incident, a major emergency or a disaster*

DEWNR has commenced a project to develop an emergency management assurance framework to support SEMC.

## 11.9 Advisory Groups/Committees

There are four advisory groups that report to SEMC being the:

### State Mitigation Advisory Group (SMAG)

SMAG's functions are to:

- Advise the State Emergency Management Committee (SEMC) on all aspects of mitigation in South Australia across the full spectrum of prevention, preparedness, response and recovery activities including strategic policy advice.
- Provide oversight of South Australian Emergency Risk Management, consistent with national standards and using nationally agreed methodologies, as appropriate.
- Promote the development of effective emergency risk management practices by Hazard Leaders, Zone Emergency Management Committees, State and Local Government including through facilitation and support of research, training and sharing of information.
- Support Hazard Leaders to develop adaptive, flexible, resilience-based Hazard Plans, and provide oversight and assurance of those Plans.
- Support Zone Emergency Management Committees to develop adaptive, flexible, resilience based Zone Emergency Management Plans, and provide oversight and assurance of those Plans.
- Support and progress SEMC initiatives as directed

---

## State Response Advisory Group (SRAG)

SRAG's functions are to:

- Advise the SEMC of South Australia's level of response preparedness.
- Support the State Coordinator and Assistant State Coordinators in the management of response operations as required.
- Collaborate with the State Mitigation Advisory Group (SMAG), State Recovery Committee (SRC) and the State Public Information and Warnings Advisory Group (SPIWAG) to ensure that emergency management in South Australia is a seamless process that recognises planning, preparation, response and recovery.
- Advise the SEMC on policy and planning aspects of response management.
- Develop strategic policies and procedures to ensure effective inter-agency coordination in relation to response matters and the coordination of response and recovery arrangements.
- Develop and maintain the State emergency response section within the State Emergency Management Plan with particular reference to the:
  - o roles and responsibilities of all agencies supporting the response process;
  - o identification of agencies responsible for particular aspects of the response process;
  - o planning of systems and procedures for the coordination of the response; and
  - o resolve urgent matters regarding the plan.
- Provide expert advice and guidance to hazard leaders to ensure plans include appropriate aspects as they relate to the response section within the State Emergency Management Plan.
- Investigate and report on any response matters referred by the SEMC.
- Approve functional sub-committees' plans and coordination arrangements.
- Provide oversight of the establishment, management, training and operation of the Zone Emergency Support Teams.

## State Recovery Committee (SRC)

Outside of an event, the State Recovery Committee undertakes planning and preparedness to ensure the State's disaster recovery capacity.

During and following an emergency event, the State Recovery Committee drives the State's recovery activities.

The State Recovery Committee's functions are:

Reporting to SEMC

- Advise the SEMC on preparedness for recovery planning and operations.
- Advise the SEMC on policy and planning aspects of recovery management.
- Investigate and report on any recovery matters referred by the SEMC.

Planning

Review and revise the Recovery chapter of the State Emergency Management Plan with particular reference to the;

- roles and responsibilities of all agencies supporting the recovery process,
- planning of systems and procedures for the delivery of recovery services to affected people, communities and agencies, and the
- need for emphasis on working with local communities, strengthening what is already in place.

---

Establish and maintain links to relevant national emergency management forums

- Collaborate with the Mitigation and Response Advisory Groups to ensure that emergency management in South Australia is a seamless process that recognises prevention, preparation, response and recovery.
- Provide advice and guidance to Hazard Leaders, Functional Support Groups and Zone Emergency Management Committees to ensure integration of the key aspects of recovery.
- Develop, maintain and review strategic policies and procedures to ensure effective inter-agency coordination in relation to recovery matters.

Operational Support

- Support the State Coordinator and any Assistant State Coordinator in the management of emergency operations as required.
- Support the Assistant Coordinator Recovery and/ or Chair of the State Recovery Committee in coordinating the recovery process.

Monitor and review

- Monitor and coordinate State recovery activities and processes to ensure preparedness.
- Evaluate recovery operations and report on key findings.

### **State Public Information and Warnings Advisory Group (SPIWAG).**

Under the authority of SEMC, SPIWAGS functions are to:

- a) Identify, establish, and ensure the maintenance of the standards by which public information and warning (PIAW) activities are conducted across all levels of government
- b) Maintain the State Emergency Management Plan (SEMP) PIAW annexure and report to SPIWAG on compliance with it
- c) Maintain strategic oversight of PIAW systems to ensure their capability including the State Emergency Information Call Centre Capacity
- d) Ensure representation on national committees, reference groups and working parties is maintained to provide input to and maintain knowledge of best practice in PIAW to:
  - Identify and recommend the development of new systems to provide for currency of warning tools
  - Identify and promulgate best practice in policies and procedures
- e) Maintain a register of PIAW capability within Control Agencies, Hazard Leaders, Functional Support Groups and Zone Emergency Support Teams that can be drawn upon to support large scale emergencies.
- f) Ensure the Public Information Functional Support Group is provided with the register of PIAW capability.
- g) Ensure agencies conduct appropriate training in the strategies, policies, procedures, and use of all PIAW systems used to distribute public information and warnings including but not limited to Emergency Alert, Alert SA and SEICCC.
- h) Liaise closely with SMAG, SRAG and SRC to ensure consistency in PIAW activities

Additionally, Task Forces can be created to undertake specific projects (e.g. Flood Review Task Force) and make recommendations for action.

Committee arrangements are necessary in SA and bring a cohesive approach to emergency management but without an appropriate 'assurance' regime, many key projects and recommendations can linger.

---

## 11.10 Assurance

When the SEMP was being reviewed during 2016, a number of issues were raised by agencies, many related to assurance.

For many people involved in these committees (both attending and undertaking nominated tasks), emergency management, is additional to their busy roles in their business as usual activities.

A scan of committee minutes identified issues with attendance, regularity of meetings, and task completion.

It is implicit under section 9(1) of the *Emergency Management Act 2004* functions and powers of SEMC

- (e) to ensure that agencies and organisations with functions under the State Emergency Management Plan are aware of those functions and are provided with adequate information for the purpose of understanding and carrying out those functions;
- (f) to monitor the capacity of agencies and organisations with functions under the State Emergency Management Plan to properly carry out those functions;

SEMC is responsible for providing assurance to the government and community of SA that the State has adequate emergency management arrangements and sufficient capability and capacity to manage hazards and associated risks, and effectively respond to and recover from emergencies and disasters.

Currently there is no process to assess the effectiveness of SEMC, its Advisory Groups, Sub-committees and working groups/task forces. Committee Terms of Reference are regularly reviewed but these are reviewed independent of each other rather than holistically. A more holistic approach would ensure that there is no overlap or duplication of effort, and more importantly, no significant gaps.

Many of SEMC's functions under 9(1) of the *Emergency Management Act 2004* need to be reviewed and re-written to provide SEMC greater clarity about its role.

Although SEMC schedules meetings on a bi-monthly basis, following the 24 March 2016 meeting and rescheduling and cancellation of subsequent meetings, SEMC did not meet until 11 August 2016.

SEMC is not an 'operational' committee. However, consideration should have been given to holding an extraordinary meeting after the 28 September 2016 extreme weather event in recognition that it had such a large impact. Instead SEMC did not meet until the next scheduled meeting on the 24 November 2016, nearly two months later.

The functions of SEMC described in the *Emergency Management Act 2004* do not have any 'teeth' and do not provide SEMC with authority to 'ensure' that all committees, agencies and organisations to properly carry out their functions, and meet their objectives in a timely manner, including the implementation of EMC/SEMC recommendations.

To address a recommendation of the Flood Reform Taskforce SEMC has funded a project to develop an Emergency Management Assurance Framework using State Significant Project funds from the Natural Disaster Resilience Program (NDRP).

The framework's objective is to support SEMC in its statutory function under section 9(1)(f) of the *Emergency Management Act 2004*: 'to monitor the capacity of agencies and organisations with functions under the State Emergency Management Plan (SEMP) to properly carry out those functions'. It is important to note that the 'framework' will not be the solution for SEMC to deliver on this function, but rather the first step in a long journey.

A number of States in Australia which experience significant emergency events have implemented a position of Inspector General for Emergency Management (IGEM) or similar.

This framework would provide the minimum position South Australia should adopt regarding governance and assurance.

---

Consideration should also be given to the establishment of an IGEM position, or additional duties allocated to a current position, including:

- ensuring continuous improvement of emergency management
- development and maintenance of an assurance framework
- system-wide reviews of emergency management
- evaluation of State-wide training and exercise arrangements
- reporting on the implementation of emergency plans (all levels)
- auditing of the State's emergency management arrangements, including government agencies contributing to these arrangements.

### **11.11 Emergency Control and Coordination Centres**

There are a number of core bodies within the Act and SEMP which provide the strategic direction and coordination of emergency management within SA. This section will deal with the State Crisis Centre (SCC), the State Emergency Centre (SEC) and the Zone Emergency Centres (ZECs).

Other command/control centres exist within all government agencies and dependent on the type and scale of event may or may not be needed.

During this event the SES were the Control Agency and activated its State Control Centre. Other government agencies operating in support of the SES or requiring a command/control centre in their own right, such as Police, CFS, SAAS, DEWNR also opened their respective centres.

In the response phase of an emergency event the ability to effectively manage an emergency incident, with regard to planning, is always affected by a number of issues, including:

- no plan exists
- the plan does not meet the necessary standard or is out dated
- people who are in key positions have limited knowledge of the plan
- people who are in key leadership positions operate outside of the plan.

Generally, there are a series of cascading plans and 'practice guides' which should clearly articulate key strategies, roles and function of key government agencies, positions and key centres critical to the response phase of an event and how they contribute to, assist and support those involved with the event.

Operating to these plans generates the best opportunity for success and is more likely to prevent poor outcomes, inefficient responses, mistakes, false expectations and misinformation.

There is a need to understand the various roles and functions of key command, control and coordination centres during an event that requires the activation of one or more of these centres.

Not all centres necessarily need to be activated. For many incidents, only an IMT is established, or a PFCP.

The activation of other centres comes about through either pre-determined triggers or the incident becomes of such a magnitude that the Control Agency activates their RCC and/or SCC (POC) and further (if considered necessary) requests the activation of the SEC. All these subsequent centres are designed to provide strategic leadership and assist the IMT/PFCP in resolving the incident – not assume command at a 'tactical' level.

More detail about the operations of these centres are provided in other areas of this report.

### **11.12 State Crisis Centre**

The State Crisis Centre (DPC) generally activates when the SEC is activated.

The SEMP (2016) describes the SCC as

---

‘...the central liaison point for the Premier and Executive Government and provides a focal point for dealing with the media and State government policy matters. ... The role of the SCC is to support the Premier with State level policy advice and guidance. The SCC contributes to the coordination of government agencies and liaises with Australian Government and other State/territory jurisdictions’

Officials within the SCC were able to provide briefings to relevant Ministers and organise and support EMC meetings. However, there was some disconnect with SAPOL liaison officers located in the SEC which contributed to late briefings and briefing papers not fully meeting the political considerations of this event.

The number of trained people required for the SCC if it were to operate physically over a 24-hour period for several days, is inadequate and places a significant burden on those few who now perform these roles.

For an event of this nature, it is not necessary to have the SCC fully staffed and operating in a physical sense, however, policy and procedural modifications are necessary to ensure that the Premier and EMC are provided with up to date and informative briefings relevant to the EMC role and function.

The Review considers, that a member of the SCC be attached to the SEC as an EMC/SCC liaison officer and be responsible for the preparation of EMC briefing papers (to be authorised by the State Coordinator or nominated representative).

This would eliminate the need for SAPOL to provide a Liaison Officer to the SCC, other than when the SCC is operational. The position would be a link between the SCC and the SEC and would not release information outside the SEC which has not been authorised for release.

Further challenges with staffing the SCC are exacerbated due to the Deputy Director, Security and Emergency Management, DPC having two roles, one being with ODG, and the other being within the SCC. It is the view of the Review, that the role within ICT is so crucial during emergencies that this position should be dedicated to the ICT support agency.

Therefore, to adequately staff the SCC and have some level of redundancy (people on leave, people sick, prolonged event, etc.) suitable people throughout DPC should be identified and trained for the various roles within the SCC.

### **11.13 State Emergency Centre**

The SEC when activated has representatives from the Control Agency, Support Agencies and Functional Support Groups.

The functions carried out in the SEC are to:

- coordinate support to the Control Agency by the Support Agencies, and Functional Support Groups
- provide information to the State Coordinator
- exercise the powers and functions of the State Coordinator in a declared emergency
- coordinate information sharing between Control Agency/s, Support Agencies, Functional Support Groups and executive government
- address strategic issues in support of response and recovery operations; and
- engage with Emergency Management Australia.

During this event the SEC successfully operated using the updated SEMP (December 2016). This included a number of new and/or revised support agencies and Functional Support Groups.

This event, as previously mentioned was complicated because of there being no designated control agency for a black system event.

---

For all, but particularly some of the smaller organisational areas within government (eg. SAGRN, ODG), the duration of the event caused issues with fatigue, replacement staff, and the need to staff multiple centres. This issue needs to be reviewed, and decisions made about whether these smaller, but critical organisations need to be in the SEC all of the time, or some of the time.

Currently, within the SEC arrangement a Logistics Functional Support Group (managed by SAFECOM) exists and its role and function is 'coordinating non-specialist supply and catering support when existing capabilities have been exhausted during an emergency'.

This FSG has existed during the time that government agencies maintained their own stores and supplies. This arrangement no longer exists.

In reviewing this event, and considering the need for transport (there is a Transport FSG), food, fuel, accommodation, it may be more appropriate that this function be managed through a procurement process.

The Chief Procurement Officer, (DPC), has responsibility for procurement in SA and therefore knowledge of government contracts and the ability to source 'logistical' support in the event of an emergency. It is also more likely to assist the Transport FSG with obtaining transport in the event of any difficulties being experienced in this regard.

Emergency management arrangements are outlined in the SEMP and include: activation of the SEC; roles and interaction of agencies in the SEC; the capability, training and experience of personnel; declaration of a major incident; traffic management; interstate and Federal assistance; and, functions and responsibilities of control agencies, supporting agencies and functional support groups.

The SEC is established to inform the State Coordinator, and act as a problem solving centre. However, the SEC needs to operate at a strategic level and does not need to know all the details of the event, only those which are relevant to its role.

The multi-agency SEC debrief identified a number of challenges and areas for improvement within the centre.

---

*The provision of Liaison Officers from agencies and functional services – level within an organisation, fatigue, knowledge of plans, roles and functions, relief arrangements, impact on ability to conduct business as usual activities.*

#### *SEC debrief*

---

Liaison Officers do not need to be the most senior persons from an agency, and do not need to make on the spot decisions committing their department to a course of action. However, they do need to have a sound knowledge of the agency or function they represent and the key agency contacts to seek approvals and information in a timely manner.

They also need to have a thorough understanding of their role and function, how to use information systems, provide succinct, informative briefings and contact key contacts so they can perform the liaison function effectively and efficiently. The selection of the suitable operators together with regular, ongoing training and exercising that build confidence and familiarity in the role, will ensure effective agency liaison over an extended emergency event.

At time, the SEC had difficulties in obtaining up to date information from the Control Agency Liaison Officer (SES on this occasion), which affected its situational awareness. This has been a common problem in past events, including Sampson Flat and Pinery and is usually due to the control agency being extremely busy.

A number of factors affect the timeliness of information including:

- IMTs not passing information up to the SCC and to the SEC
- the IMT being too focussed on the operation (not carrying out all the functions of Australasian Inter-service Incident Management System (AIIMS))

- 
- the SCC not providing the Liaison Officer the up to date information (poor functionality of the SCC would contribute to this)
  - the Liaison Officer not being proactive enough in seeking the information
  - the SEC being slow to seek information from other sources (e.g. POC/PFCP) through the appropriate Liaison Officer and/or functional support group
  - different information management systems and unfamiliarity with the Critical Incident Management System (CIMS) used in the SEC.

The SEC briefings were problematic in that they were not consistently timed e.g. on 28 September 2016 they were held at 0800, 1300, 1700, 1900 and 2030hrs. This makes it difficult for the control agency and other agencies to ensure that relevant briefing points are provided to their representative in a timely manner and that other briefings that should occur prior to the SEC briefing are planned and can occur.

During this event, difficulties in obtaining and communicating information were exacerbated by the power outage and communications difficulties and failures. This had a flow on effect as important information such as sandbagging operations, locations and times were not up to date and therefore not always accurate.

At present, DECD is not represented within SEMC or the SEC. During this event, largely due to the power outage and the resultant communications failures, the Chief Executive of this Department, had limited information from the State level about the event and potential issues for schools.

Given that DECD has sites situated across the State and has linkages to all forms of educational institutions together with their tens of thousands of staff and students within South Australia there appears to be a need to ensure that emergency information is immediately available.

Additionally, schools may form 'safe places/refuges' in an emergency and so contribute to the management of the emergency.

#### **11.14 Role of Emergency Management Australia and Defence**

Emergency Management Australia (EMA) is a division of the Commonwealth Attorney-General's Department and the Australian Government lead for disaster and emergency management. EMA works with State and territory governments and the international emergency management community, delivers critical programs, policies and services that strengthen and maintain Australia's national security and emergency management capability.

While State and territory governments are responsible for emergency management in their jurisdictions, EMA coordinates Australian Government support, both physical and financial.

EMA operates the Australian Government Crisis Coordination Centre (CCC), which is an all-hazards, 24/7 facility, that provides whole-of-government situational awareness to inform national decision-making during a crisis.

The CCC coordinates physical Australian Government assistance during disasters and emergencies.

Additional to support provided by State and territory governments, the Australian Government has a range of assistance measures to help hardest hit communities recover from disasters.

During this event, EMA deployed an Emergency Management Liaison Officer from Canberra to SA who was located in the SES SCC, or the SEC when it was activated. This was an effective strategy to improve flow of information between jurisdictions and there were clear, timely and open communications between EMA and SES. (SASES, 2016).

A representative of Defence is positioned within the SEC during an emergency event to provide assistance if required under Defence Aid to the Civil Community (DACC) which includes State/Territory government departments, police and emergency services. This aid is provided

---

when the emergency is of such a magnitude that State/Territory resources are inadequate, unavailable or cannot be organised quickly and their support is requested.

Defence assistance was provided during this event (e.g.: sandbagging), the work effort and support of ADF personnel was greatly appreciated.

Access to Defence and EMA assistance is not restricted to the control agency and may be requested by any participating agency via the SEC arrangements.

### **11.15 Zone Emergency Management Centres (ZECs), now Zone Emergency Support Teams (ZESTs) under the December 2016 SEMP**

The SEMP (December 2016) describes the role of the ZEST as:

.....to support the resolution of an emergency by providing coordination of local resources in:

- Performing assigned or designated tasks from the Control Agency
- Supporting the sharing of information between the agencies involved
- Supporting community impact planning and assessment
- Supporting the development of public information to affected communities
- Supporting relief and recovery operations
- Remaining activated until recovery operations are established

The ZECs performed well under difficult circumstances and a degree of isolation. ZEC debriefs, provided a number of recommendations, generally associated with their local arrangements.

However, the ZEC located at Port Lincoln, experienced loss of power associated problems that were not experienced in Adelaide (power out for less time) such as access to pharmacies and potentially critical medication.

Difficulties for ZECs also arose from the nature of the event and the designation of the control agency being based around a storm event. For example, the Port Pirie and Barossa ZECs the issues were with storm associated problems, whereas the problems at Port Lincoln ZEC were predominately about the loss of power event and managing the multitude of consequences.

Some observations of ZECs included:

---

*Lack of information from the SEC flowing back to the ZEC regarding actions being undertaken to assist the ZEC*

*Need support with resources that can't be obtained locally (e.g.: Media Liaison Officer)*

*Medical plan for black out required which includes pharmacies*

*Local government need to be included in the ZEC*

*Local Government 'talking head' needs to be identified. Then have similar media updates for local area as at State Level (Control Agency, Police and Local Government representative (e.g.: Mayor)*

---

The concept of ZECs and under the new SEMP, Zone Emergency Support Teams (ZESTs) is sound and encourages a strong partnership approach by government/local government and local organisations.

Whilst ZECs operated independently of the SEC, the black system event caused State wide communications difficulties increasing the isolation of the ZECs and highlighting the need for a closer relationship with the SEC.

There is debate within the emergency management sector about the SEMP and the relationship of ZECs (and now ZESTs) to the SEC. This needs to be clarified, as ZECs/ZESTs offer the State Coordinator an opportunity for increased situational awareness, the ability to identify any support the ZEC/ZEST may require with human and physical resources and improve the coordination of resources in a large emergency event.

- Recommendation 37.** That additional guidance be provided in the State Emergency Management Plan regarding the activation, structure and operation of Zone Emergency Support Teams. This should include:
- a) the reporting relationship between the Zone Emergency Support Teams, the State Emergency Centre and the State Coordinator
  - b) briefing requirements between the State Coordinator (or their representative) and the Zone Emergency Support Teams when the State Emergency Centre is activated
  - c) responsibilities for provision of local public information; and
  - d) the appointment of public information officers in Zone Emergency Support Teams (where there is no incident management team established) to provide information to local communities
- Recommendation 38.** That the State Emergency Management Plan be reviewed and updated including:
- a) a better description of the responsibilities of Hazard Leaders
  - b) establish a mechanism for a hazard leader to identify systemic failures in coordination of their hazard, with a clear process to raise those issues with SEMC and seek a remedy
  - c) establish resilience as a key heading in the plan, with clearly documented strategies and responsibilities; and
  - d) consider the Schar/Mulrone submission and taking a 'fresh eyes' approach
- Recommendation 39.** That the Department of Education and Child Development be included as a member of State Emergency Management Council and represented in the State Emergency Centre.
- Recommendation 40.** That regular training and exercising is conducted for all State Emergency Centre participants including Liaison Officers.
- Recommendation 41.** That an Emergency Management Assurance Framework be established as soon as possible to support the emergency management arrangements and the State Emergency Management Plan. Consider establishing an Inspector General Emergency Management department or position.
- Recommendation 42.** That a review of the role and effectiveness of the State Emergency Management Committee (SEMC) including: the legislative functions; membership including the chair; roles and responsibilities; and, SEMC Advisory Groups be undertaken.
- Recommendation 43.** That the position of Deputy Director, Office for Digital Government is dedicated to the Office for Digital Government; and that people throughout DPC are identified and trained to perform appropriate roles within the State Crisis Centre.
- Recommendation 44.** Review representation in the State Emergency Centre including:
- a) determining if there is a more suitable functional support group e.g. the Procurement Functional Support Group, to replace the Logistics Functional Support Group, and if so, Chief Procurement Officer, DPC, has responsibility for the management of this role within the State Emergency Centre.
  - b) That when the State Crisis Centre is not operating from a physical location, a State Crisis Centre liaison officer is attached to the State Emergency Centre.

---

## 12. STATE EMERGENCY MANAGEMENT AND INCIDENT MANAGEMENT

### 12.1 Control Centres

The SES SCC was activated pre-emptively on Monday 26 September when the BoM predicted severe weather for 28 September 2016. Two IMTs, being the North IMT (Port Pirie) and South IMT (Netley), were activated at 7:00 am on Wednesday 28 September 2016. On Saturday 1 October 2016, another IMT was established at Roseworthy to manage the flooding in northern areas including at Port Wakefield and Virginia.

As the event unfolded, specific SCC functions were expanded out into pre-determined office locations within the SES State headquarters building. However, the number of personnel required to perform the functions required for this event was far greater than any previous event which resulted in all available workstations across the entire floor being utilised.



*Figure 27 - Weather briefing in the SES SCC*

Office space became an even greater issue when the power black-out occurred. SES has a back-up generator to support essential activities. Continuous power to the SCC itself and the eastern side of the floor, and essential ICT was sustained. However, all air conditioning stopped working and workstations and appliances on the western side of the floor were no longer operational. Personnel needed to prioritise which work was the most urgent and others were working off battery power or helping out where they could.

---

*‘physical layout of SCC/offices being used is a challenge to good communications’*

*‘insufficient, not adequate to deal with incident of this scale’*

*‘a rabbit warren with large numbers of people spread out in offices’*

*‘noise of operational and social conversations whilst trying to review docs/edit/prepare’*

*‘loss of power reduced the number of PCs that could be used, rationalised use – meant some people couldn’t do their work’*

*‘public information function is noisy and disruptive within the SCC, it needs its own space’*

*‘difficult to work together and difficult to conduct debriefs’*

*Comments from the SES SCC debrief*

---

---

The SES SCC and CFS State Coordination Centre have both been identified as being inadequate for operations (AFAC, 2015) during previous events and this was demonstrated again during this event. Both SCCs have been established in locations that were primarily office space and have been adapted in an effort to facilitate effective operations.

---

*'current SACFS SCC operational facilities (are) less than adequate when compared to other State level operational facilities. There appears to be duplication of agency control centres to enable all mandated activities and functions to be undertaken. ... During the January fires the following emergency coordination centres were activated at the State level, the SEC, the SACFS SCC and the SAMFS SCCF (State Control Centre Fire), each requiring staffing from individual agencies.... this could lead to an inefficient use of scarce human resources and a breakdown in effective communications.'*

(AFAC, 2015)

---

The SES SCC does not have enough physical space the arrangement of offices does not effectively facilitate work flow, and it was often crowded and congested.

Additional issues relating to the current SCC accommodation include:

- no onsite car parking for operational vehicles.
- access to the premises can be difficult
- unreliable core building services such as lifts, air conditioning and power supply
- insufficient space to facilitate: control and coordination activities; expanding roles in public information; accommodation of critical support personnel from agencies such as the DEWNR and the BoM
- the building does not comply with current earthquake construction standards, meaning it may be rendered unusable at a time when it is needed most.

The Statement below relates to the CFS SCC during the Pinery fires. The same issues exist for both CFS and SES SCC facilities.

---

*The SCC is office space that has been minimally adapted to the needs of its role in command, control, coordination and communication. Its size and layout are not conducive to the shared situational awareness and close collaboration required in a major incident. The specific needs of the State Coordinators are not well supported. There is little scope in the layout for the State Coordinator to manage across functions or to gain a comprehensive view of the situation*

(Noetic 2016).

---

Many interstate emergency services have multi-agency coordination and control centres. There are many benefits to this including cost. It is cheaper in the long run to maintain one SCC rather than three. It minimises duplication of personnel, systems and equipment. It is also much easier to establish effective inter-agency liaison and communication which leads to more efficient and effective incident management and response.

This consolidation of control centres in SA would also flow onto consolidation of back-up facilities. If all agencies are co-located in the one SCC facility this would logically flow on to there being a single back-up facility rather than each agencies needing to maintain their own back-up facility and resources.

Another benefit of multi-agency centres relates to staffing. Some positions are duplicated in each SCC e.g. administration support and logistics, and the agency liaison positions that are required when there are separate SCCs would not be required because they are already in the same room.

---

This reduces the number of personnel required which is a very beneficial where availability of staff is already a significant issue.

Concerns regarding the functionality of the current building continue. The Chief Executive SAFECOM and the Chief Officers of CFS, MFS and SES are continuing to work together to identify viable options for future accommodation arrangements. In support of this and with reference to the recommendation made during the Australasian Fire and Emergency Service Authorities Council (AFAC) independent operational audit, the following recommendations are made:

Two key recommendations following the Pinery bushfire are described below.

---

*‘to review control facilities at State, region and incident level’  
and  
‘to review ICT capability and contingencies for control facilities to ensure they remain  
robust across a range of reasonable circumstances’  
(Noetic, 2016)*

---

This event also highlighted that some ICC facilities were inadequate including the SES district headquarters at Port Pirie. The SES ICC facility at Netley was upgraded in 2016 and was greatly improved both technically and functionally, however landlines and site access continued to cause problems during this event.

Other challenges with many existing incident control facilities included:

- lack of space
- poor layout
- inadequate ICT connectivity and infrastructure, and,
- achieving a balance between locating facilities in reasonable proximity to high risk locations as well as having access to local resources such as food and accommodation.

<b>Recommendation 45.</b>	That the recommendation made following the Pinery bushfire, ‘to review control facilities at State, region and incident level’, be expanded to include all emergency services facilities that will be utilised for major incidents other than bushfire e.g. flood and earthquake and to also be extended into metropolitan areas, and implemented.
<b>Recommendation 46.</b>	That a single emergency service multi-agency control centre be established with sufficient capacity and capability to deal with all types of emergency incidents in SA. Also consider Police and State Emergency Centre.

## 12.2 Incident information systems (electronic systems)

In the emergency management sector there are several electronic incident information systems used by different agencies to support emergency management and operations. These systems are used as incident information databases, operational tools for incident management and internal agency communication during incidents.

The CFS and MFS use CRIIMSON (Critical Resource Incident Information Management System Online Network) which is a bespoke system developed in-house by CFS. The system was initially set up over a decade ago and it has continued to be developed each year to capture new processes, enhance operations and incident management activities and to be able to share information across agencies.

The SES uses SESIIMS (SES Incident Information Management System) which is based on the Intermedix WebEOC professional platform. WebEOC is a platform used by many agencies and

---

emergency services across Australia and New Zealand. The WebEOC platform has add-on modules that can be tailored to the requirements of agencies. SESIIMS has only been in place for a few years and is being progressively developed and enhanced.

SA Health has recently developed and implemented a bespoke incident management system.

SAPOL have installed CIMS (across SAPOL and within the SEC, this system is also based on the Intermedix WebEOC professional platform).

---

*'why are there multiple systems?'*

*'how do the systems share information?'*

*'how do we marry up the information to make a common operating picture?'*

*'information flow, didn't make it back to the SCC in time,  
causing disparity in information'*

*'validity of information'*

*'the use of multiple systems was captured as an issue following Pinery'*

*'daily incident number differences (CFS and SES different)'*

*Comments made during the SEC multi-agency debrief*

---

South Australian agencies have implemented their own electronic incident management systems for a variety of reasons including that: they needed a platform on which to manage their business; each agency has different methods of operation and therefore different system requirements; and, it is relatively easy to make changes/enhancements in a system that only effect one agency.

Some of the disadvantages of multiple incident management systems include:

- some personnel need to operate more than one system and need to have initial training, refresher training, log-in credentials and access to each system
- users from one agency performing a role in support of another agency may not have access to or know how to use the relevant system
- incidents are duplicated on SESIIMS and CRIIMSON and the same incident is given a different number of each system which is confusing and could lead to errors
- potential for information being recorded against an incident in more than one system which could result in duplication, missed information, no single point of truth and confusion about which system to access or enter information
- users may not know which system to go to find the information they need
- the cost of licensing and ongoing changes and upgrades to multiple systems
- the work effort in delivering training and refreshers throughout the State and developing and maintaining training material for multiple systems.

---

*'I learnt that CFS and SES have their own systems for incidents (CRIIMSON and SESIIMS).  
This was problematic when trying to find information regarding incident. Some in  
CRIIMSON e.g. Roseworthy IMT as they were CFS/DEWNR'*

---

---

*'Files could not be shared between the agencies, at one stage a CFS liaison at the SES SCC was asked to download all relevant photos from CRIIMSON and upload them to SESIIMS to allow the SES SCC to access them to gain situational awareness. This took that person away from their core role for a considerable amount of time.'*

*'Lack of common systems between agencies SESIIMS (SES) and CRIIMSON (CFS)'*

*'Roseworthy IMT data was placed on CFS CRIIMSON system, air recon flight data, photos and logs were placed on CFS CRIIMSON system'*

*'IMT using CRIIMSON and inputted logistics requirements and intel on CRIIMSON. Was not always communicated through to SCC'*

*Comments from SES and CFS debriefs*

---

This Review will not recommend any particular preference of electronic incident information system however, it does highlight that the ongoing development, maintenance and utilisation of multiple systems, particularly in the emergency services sector is undesirable. Multiple systems increase the margin for error and confusion and therefore risk, as well as increasing the cost across the sector for system software and personnel. In a State as small as SA, this is not a sensible option.

**Recommendation 47.**

Review existing electronic information systems used by emergency services organisations and other government agencies, and:

- a) establish a single incident information system across the Emergency Services Sector (MFS, CFS and SES), and
- b) identify opportunities to consolidate incident information systems of other agencies

### **12.3 Incident management systems (people management systems)**

In 2011 the Chief Officers of the CFS, MFS, SES and SAPOL together with five other SA government agencies signed the Common Incident Command and Control System Agency Agreement which was an agreement confirming those agencies would use common incident management arrangements during emergencies.

The agreement was expanded in 2014 to include all control agencies appointed in the SEMP and was re-named the Common Incident Management Framework Control Agency Agreement (CIMF) (SA Government, 2014). In this agreement it was Stated that it would eventually form part of the SEMP and the 2016 update of the SEMP incorporated new wording to this effect.

The purpose of the CIMF was to enhance incident management systems already used by agencies. SA ESOs and other emergency services and agencies across Australia use the Australasian Inter-service Incident Management System (AIIMS) and SAPOL uses Incident Command and Control System (ICCS) Plus in line with police in other jurisdictions.

At the time of initial discussions about the agency agreement the emergency service system (AIIMS) and the police system (ICCS) had some key differences including that ICCS included Intelligence and Investigation functions. Since that time there have been two updates of AIIMS, and a third is in progress and both systems have very similar incident management structures.

On this occasion, as with most events in SA, personnel from agencies worked very well together in IMTs, in the SES SCC (where the structure is modelled on AIIMS but tailored to State control functions rather than incident management) and at other incident management facilities. It is common in SA to see agencies working side by side in a seamless fashion during bushfires and other emergencies where each person understands their role, function and responsibilities and uses common terminology due to sharing a common incident management system. This

---

cooperative, inter-agency approach was commented on, and seen as very positive, by interstate colleagues attending the SCC.

---

*Some successes of using common systems highlighted during the SES SCC debrief:*

*'ability for multi-agencies to integrate in the SCC under common AIIMS system'*

*'fantastic to see all agencies working together to achieve outcomes'*

*'great to have access to liaison officers such as: LGA and SAPOL'*

*'great interoperability with DEWNR, they provided many staff for positions'*

*'good cooperation between emergency services and government agencies'*

---

A feature of incident management systems that often provides challenges is that they are systems of management i.e. they are people-based. They are systems comprised of people who are trained at different levels, have different agency and personal backgrounds and cultures, they have different levels of incident management experience, inter-personal skills, management skills, personalities and they are likely to be fatigued and under stress.

While there is no alternative to a people-based system for this purpose, operating in this environment is always going to be imperfect. Challenges with incident management are frequently raised during incident debriefs for any incident in SA, interstate and overseas. This incident also exposed some shortfalls in incident management .

Debriefs conducted with Police and emergency services agencies, and other government agencies highlighted a number of common concerns regarding command, control and coordination, and the skill level of persons in leadership positions. The application of AIIMS and ICCS Plus principles were also mentioned.

---

*Inexperience of roles and lack of practice*

*The difference between POC Commander and Executive Officer needs to be clearly identified*

*The nature of the incident will determine the level of substantive rank appointed to the Police Commander*

*Functional management not applied at all briefings/meetings*

*IMT and SCC not understanding roles – particularly with operations*

*Not enough staff trained in critical roles*

*Differences in application of emergency management arrangements in different physical locations*

*Better understanding of roles and functions is needed*

*More training and exercising at leadership level is needed*

*Comments from debriefs with Police and emergency service agencies*

---

---

Some additional challenges included: interagency and interstate confusion regarding the SA command and control structure; inconsistencies in the application of AIIMS; poor information flow; confusion about responsibilities for rosters for each location; lack of detailed briefings including what crews were required to do, where their area of operation was, who they were reporting to and what resources they had available to them.

Ideally it would be beneficial for emergency services and SAPOL to use the same incident management system. Unfortunately, this isn't achievable in the short-term to because of alignment with respective agencies at a national level.

However, there are some activities that could be undertaken to increase interoperability. These could include:

- consistent use of common terminology
- joint training and exercising
- standard processes for requesting resources from other agencies
- memorandums of understanding and joint-agency plans.

## 12.4 Personnel for incident and emergency management roles

Without exception, all government agencies and the emergency services found it challenging to maintain the staffing levels required for the various operational centres.

There are insufficient numbers of personnel trained within individual emergency services and government agencies, in all incident management and emergency management roles, to manage a protracted event.

These were challenges sourcing personnel for IMTs, RCCs, SCCs, ZECs, relief and recovery centres and the SEC, many of which are staffed 24 hours a day. A number of other emergency services and supporting agencies also activate, operate and staff their own command centres for their operational requirements.

Even with the active involvement of many agencies, there were not enough resources available for incident management or, at times, crews to support the operations. Personnel were stretched and in limited supply within a couple of days following the blackout.

The shortage of personnel made it very difficult to undertake all the required planning activities such as to:

- collect and interpret information
- undertake thorough planning
- prepare incident predictions and situation reports; and
- to conduct briefings.

---

*'seemed to run out of staff quickly, were other organisations looked at to fill positions?'*

*'given the control agency responsibilities it was important to have suitable SES staff and/or senior volunteers in positions, however with so many control and coordination facilities established: SEC, SCC, IMT x3 and Zone Emergency Centres, it was not always possible'*

*'need to be more proactive in seeking external agency support to fill rostered positions prior to the shift commencement'*

*'with such a small number of staff, balancing the duration and number of consecutive shifts against welfare considerations was a challenge'*

*Issues raised during the SES SCC debrief*

---

---

The IMT at Roseworthy was established at the CFS group control centre using CFS and DEWNR personnel with very little involvement from SES. This was a previously untried scenario i.e. where agencies other than the control agency were performing the incident controller and all incident management roles.

It was relatively straight forward in some respects e.g. establishment of standard AIIMS functions, however in other ways such as the reporting structure and requirements and the use of incident information systems, this proved difficult. The personnel in the IMT utilised the CFS system CRIIMSON while SES, as the control agency, was using SESIIMS.

There were regular teleconferences held between the IMTs and the SES SCC and good liaison was established. However, with the shortfall of IMT personnel, and confusion relating to varying processes such as development of Incident Action Plans (IAPs), situation reports and incident sectorisation, there were gaps and omissions in the planning processes at SCC and IMT levels. This could possibly also be attributed to assumptions made by personnel from each agency about how the other agencies and their systems worked and who was responsible for what.

Local government also identified shortfalls in the current capacity of the council field organisation to respond to damages caused by large storm events.

---

*'Field staff need to be trained in emergency management and responsive measures and tools need to be established for various types of storm events.'*

*'There were limited resources for such a long duration event and lack of understanding of the roles of multi-agency teams.'*

*(LGA, 2016)*

---

South Australian ESOs have relatively few personnel resources compared to some interstate counterparts. This has some benefits because many SA personnel have worked together at incidents of multiple occasions. They understand how each other works, they have developed strong working relationships and have established and practiced systems and processes. This familiarity enables personnel to work more effectively together.

Some personnel from interstate supporting this event were impressed and commented on the ease with which the different South Australian agency personnel worked side-by-side in a cooperative and productive fashion.

The CFS has established four State IMTs (SIMT) that are intended to provide cohesion, stability and continuity to support and manage high level incidents. The SIMTs are intended to increase the State's capability to support and manage incidents and all agencies are encouraged to participate to achieve a multi-agency SIMT with the appropriate endorsements across all agencies. Many of these personnel were deployed across the State during these events.

Some personnel from emergency services and other agencies are highly experienced and can operate in a variety of roles, however they can (obviously) only be used in one location for one role at a time. The pool of available personnel looks quite impressive on paper however once an incident has been running for more than a few days across multiple locations, the ability to find rested, competent and experienced personnel is severely limited. This is a significant risk in that if (when) there is very large incident of longer duration, the ability of the State to manage it efficiently and effectively would be severely compromised.

Insufficient numbers of personnel can result in fatigue of personnel and increased stress due to the workload and ultimately is a risk to the health and safety of all involved.

## **12.5 Fatigue management**

The SES in particular, as well as other agencies found it a challenge to sustain operations as well as manage business as usual activities. The SES has a small staff of approximately 50 personnel and were maintaining the SCC 24 hours a day as well as two to three IMTs at any point during the

---

event. DEWNR and other agencies provided significant support however, as with any event that extends longer than a few days, resources very quickly become depleted and fatigued.

Some of the observed impacts of fatigue during this event included individuals: feeling tired and overwhelmed; becoming susceptible to illness; falling asleep during shifts including briefings; physical injury; and, mental stress and anxiety.

Fatigue is a common challenge for all emergency services and CFS identified fatigue management as a major theme from 2014-15 fire season (Thomason, 2015).

Recommendations have been made in the past such as developing fatigue management policies and ensuring safety advisory and incident controllers monitor work hours. However, these recommendations do not address the underlying issues and place unrealistic expectations on individuals who have very little visibility of work hours and numbers of shifts.

Effort needs to be put into the systems and people that undertake shift planning and manage the systems for availability and rostering.

## 12.6 Rostering and availability

Within IMTs a significant proportion of time during shifts, of personnel such as resources, logistics and planning officers, is spent on identifying available incident management and response personnel, preparing rosters and resourcing plans. It is also a challenge at SCC, ZEC, SEC, RCCs, relief centres etc. to prepare rosters with disjointed knowledge about who, from various agencies and locations, is able to perform particular roles and if they are available.

It is a very time consuming, complicated, manual and frustrating process for personnel. It is not uncommon to have prepared a roster only to find that, as a shift is about to commence multiple personnel are not available because:

- they had called in to say they were no longer available but the message was not passed on
- no-one had communicated with them that they were on shift
- they had already worked the set number of shifts allowed for their agency
- they were rostered into another role at another location
- their supervisor hadn't passed on details etc.

Rosters need to be prepared for multiple positions in multiple control centres and IM facilities, for day and night shift for extended durations. The current 'process' can result in errors. There are many contributing factors to this including varying agency protocols and working arrangements, multiple points of contact to pass on availability information and operator error due to lack of training, poor systems, fatigue and the sheer complexity of rosters. This was a problem during this event and is a common problem during large, multi-agency incidents.

---

*The IOA understood that there were some inconsistencies in the manner in which additional resources to support the incidents were being sourced. These were predominately related to either the IMT/SIMT sourcing resources directly from the SCC, or regional coordinator liaising directly with adjoining regions and/or SCC referring requests back to regions. This resulted in the IMT/SIMT not having a complete appreciation of the process for fulfilling the requests or the resources deployed at the incident*

*(AFAC, 2015).*

---

Errors in rosters can inject additional risks into an already risky operating environment, including not having enough personnel to conduct operations or incident management activities. It can occur not just for individuals but also with grouped resources such as strike teams. In this instance if there is an error made with a single strike team, this could result in the incident ground being short

---

by five vehicles and 30 people. This is a significant workforce to be reduced by and to somehow operate effectively without until they can be sourced. Requesting the resources again will require additional time to action.

Rosters that are not filled can particularly be a problem for night shift. There is already a tendency to under-resource night shift because there is a perception that night shift is 'quiet'. If some personnel that were 'rostered' on also do not arrive (eg due to miscommunication), this puts additional stress and pressure on the rest of the team to perform the same tasks with less people, resulting in a high level of fatigue.

Where night shift is short-staffed this is not simple to find additional personnel to backfill because people are either unavailable, already rostered on subsequent shifts, not-rested or asleep. An insufficiently resourced night shift inevitably leads to triaging of tasks and a bigger workload for the next day shift.

Issues raised during debriefs demonstrate some of the problems:

---

*'incomplete or unrealistic rostering'*

*'rostering should have been more into the future, not just 1-2 days'*

*'availability and fatigue of personnel at all levels'*

*'seemed to run out of staff quickly, were other organisations looked at to fill positions?'*

*'rostering is critical; rosters need to be complete with sufficient time to communicate'*

*'there was no roster established for the Two Wells staging area therefore no staging area manager or staging area support for a significant proportion of the incident'*

*'it was important to have suitable SES staff and/or senior volunteers in positions, however with so many control and coordination facilities established: SEC, SCC, IMT x3 and Zone Emergency Centres, it was not always possible'*

*'ensuring rostered positions were filled – need to be more proactive in seeking external agency support to fill rostered positions prior to the shift commencement – having vacancies resulted in Chief of Staff (CoS) and SCC Manager playing too much of a 'hands on' role and took focus away from 'big picture'.*

*'with such a small number of staff, balancing the duration and number of consecutive shifts against welfare considerations was a challenge'*

---

Technology is available to assist with some of these activities. At present some of this technology is being adopted in a relatively ad hoc manner for example operational SES units or CFS brigades using phone applications to communicate availability for response. Whilst this is assisting those units/brigades to meet their immediate needs it isn't being adopted consistently and could result in incompatible systems. This will be of little use for planning and rostering multiple agencies during more significant incidents.

In a State with such limited resources that is experiencing events more often, of longer duration, more extensive and with less 'break' between events, significant and strategic action needs to be undertaken to make better use of the available resources. Identification of additional personnel, provision of consistent training and coordination of rostering would increase the resources available and free up time of other personnel with more effective, efficient and accurate systems.

More effective rostering would also reduce fatigue by ensuring adequate breaks are provided and reduce the stress of those preparing rosters. It would also assist with planning further in advance.

Having one consolidated system would also ensure that incident management locations such as staging areas base camps are not inadvertently left off the list.

---

## 12.7 Mapping Functional Support Group as a potential model for resourcing

In the 2016 update to the SEMP a new Mapping Functional Support Group (MFSG) was established. This was instigated by DEWNR who had already been providing a mapping capability to support CFS fire operations for over a decade. The DEWNR Mapping Support Team (MST) has become an integral part of IMTs and personnel are deployed as soon as a SIMT is deployed. The MST, along with CFS, have developed, an agreed suite of mapping products such as State overview maps, maps for incident action plan and division/sector maps that are regularly prepared for fires.

MST members work in pairs and can be deployed to ICCs, SCCs or other locations as required. During this severe weather event MST teams were deployed to the SES SCC and to the IMT at Roseworthy. While the role of the MST is evolving for flood events and the product requirements are still being developed, the MST was invaluable at these locations providing excellent resources to assist with decision making and to communicate plans.

Over time, the DEWNR MST found it increasingly difficult to supply sufficient numbers of personnel from within the agency, particularly where the mapping capability was required in multiple locations and for incidents of long duration. The MFSG under the new SEMP is being established so that mapping and Geospatial Information System (GIS) specialists from across government can be called upon during events. These operators will already have specialist mapping skills and will be provided with additional training in AIIMS, the mapping support role in IMTs, the interaction with other functions in the IMT, and the various products that are to be produced with events involving a variety of hazards. The MFSG will provide a professional and specialised mapping capability for events of all hazard types with DEWNR continuing to take the lead role.

There are many specialist areas other than mapping within IM and EM that do not need to be performed by emergency services personnel. Given the limited number of emergency services personnel and their capabilities in largely operational, command and control activities, it might be prudent to primarily use them in these roles and identify other individuals from other agencies that could fulfil non-operational roles.

There is an opportunity for the MFSG model to be applied to other specialist functions of IM and EM. This would reduce the requirement for control agencies to find personnel for every position, thereby reducing the impact on control agencies and freeing them up to effectively perform their control agency responsibilities.

Providing a surge capacity for each function and could involve:

- Identifying functions/roles that would benefit from this model
- identifying a lead agency
- identifying personnel with specialist skills drawn from across government (could potentially include local, State and federal governments)
- providing specialised training for specific roles (which builds on incident management system training e.g. AIIMS)
- establishing coordinated team systems, availability, rosters and leadership

Some of the specialised IM and EM functions/roles that could benefit from such an approach include:

- emergency alerts and warnings
- social media
- traditional media e.g. media releases, press conferences
- community liaison (in the community during an event)
- public information (coordination of the functions above for an event)

- 
- intelligence
  - management support including administration, control centre management, logging, records management
  - logistics including catering, transport arrangements and accommodation,
  - interstate deployment support liaison units

There are already many professionals working in similar functions across government that are not currently in IM or EM roles. Indeed, there are some government agencies that specialise in areas such as those listed above that are currently not utilised during emergencies. These people are potential resources that could be trained for these roles.

## **12.8 Training and accreditation**

Training in SA for the various EM and IM roles is insufficient. Training in the incident management systems (AIIMS or ICCS Plus) is available and delivered across the sector. However, training in specific roles is unavailable in many instances or is developed in-house or sourced from interstate. This leads to inconsistencies across agencies in what is delivered and to what level. It also, in many instances, becomes too time consuming for one agency to do alone and there is either delivered very infrequently or not at all.

Training (consistency, regularity and lack of) was a common concern amongst all government agencies. The concerns being, the number of trained personnel, the standard of training, the devolution of some core training to government agencies, consistency of training, recording of training, frequency of exercising and training.

There is no central record of emergency management training in South Australia, and therefore no clear picture of Statewide capability, capacity and resources.

Addressing the 10 functions of the control agency is required under the SEMP, and whether using AIIMS or ICCS Plus, there is a need for this to be reinforced for commanders/controllers of operations.

The focus by government agencies on core business, and budgeting for core business, have placed other activities such as emergency management on the side of the table. The SEMP requires government agencies to train their own personnel in emergency management activities. However, there is no oversight in any real sense, of this and it can result in inconsistent training and exercising.

This has been demonstrated in this event, in that all government agencies commented on access to trained staff for a prolonged emergency event and the observations regarding knowledge of position roles and functions, plans and information management systems.

In 2008-2009 SEMC conducted a training needs analysis (TNA) to examine the State of training and exercising in the EM sector. It was found that there was considerable variation across the sector in regards to quality and quantity of training, and that significant gaps exist State-wide. This indicated a clear need for a State training plan to be developed and significant support for a central training committee/body to be established.

One of the key outcomes of the TNA was the need to establish a State Emergency Management Training Committee (SEMTC) to provide more effective planning and coordination of EM training. It was to provide a forum that can effectively plan for and address emergency management training and higher level exercising requirements of organisations identified in the State's EM arrangements.

The South Australian Emergency Management Workforce Mapping Project (SA Government, 2016), was funded through the National Disaster Resilience Program (NDRP) to identify the gap in knowledge of the current EM sector in SA and the capabilities required of people working within the sector. The current phase of this project involves identify existing training and educational activities

---

to increase professional development opportunities in the sector. It is intended that it will build the State's capability to provide relevant training and professional development.

Similar activities to map IM training and development requirements have been undertaken at national level and SA agency level. While much of this has been mapped out, agencies have had limited success in closing training and development gaps for their personnel.

The Australian Fire Authorities Council (AFAC) is developing a nation-wide accreditation program to ensure consistency when personnel are deployed interstate. When agencies request support from interstate they need to be able to know that the function and level of the role that they understand to be requesting is congruent with the abilities and experience of the person that arrives to fill that role.

This is a step in the right direction nationally, however it poses real problems for SA because (a) the training required for many of these roles is not available in SA, even though people are performing those roles already, (which is a risk in itself) and (b) there is no consistent training, endorsement or accreditation system for personnel in SA.

Some agencies have developed some training modules and development pathways however; they are not consistent across agencies nor are they delivered to the extent that those agencies have identified that they need to be within their own agency. This exposes South Australian agencies for events in SA and it will limit the ability of personnel to be able to meet the standards required for deployment across State borders and the capacity of SA to provide support to other States in their time of need.

Another problem with not having standardised training and accreditation for personnel State-wide is that the capabilities of personnel, who are at supposedly the same level, rank or role, vary markedly. This is an issue for staff and volunteers in IM and EM roles. At some point an individual may have been 'endorsed' by their agency for a particular role however as time progresses their skills may or may not be maintained, they may or may not participate in exercises (if there are any available to participate in), they may have used their skills to varying degrees at different types or incidents or not at all. Over time it is sometimes revealed that individuals may not as proficient at performing a role as they once were or thought they were.

---

*'inconsistent use of AIIMS'*

*'poor level of training'*

*'Little, inconsistent or no training provided beyond the initial system training in AIIMS'*

*'inconsistencies in agency implementation and application of AIIMS'*

---

Sometimes personnel may not be chosen for a role because of their skills rather because they were available at the time. Where a person has attended many incidents in an IM role this can give the impression that they are skilled at what they do however, it is sometimes because they are nearly always available to respond. This builds their own confidence and the confidence of others in their abilities when this is not necessarily warranted. It can also reinforce inadequate performance.

This becomes a real issue during incidents because personnel may be allocated to roles when they are not necessarily good at them. This adds to the pressure for section managers who not only have to work in a stressful environment with a very high workload and few resources, sometimes the personnel allocated to them are not performing their role well, or even at all. This provides additional, unnecessary and undesirable obstacles to effective incident management.

As long as there are no set standards, skills maintenance or consistent training and endorsement it is very difficult for supervisors, due to the shortage of personnel, to address shortfalls in performance ability.

---

Historically, Commonwealth funding was provided via the State Support Package (SSP) to the SES for two whole-of-government EM roles, the State Emergency Management Training Officer (SEMTO) and the State Emergency Management Planning Officer (SEMPO). When the SSP ceased the State Government budget allocation to SES was adjusted so that the two roles continued to be funded on an ongoing basis. A subsequent restructure of the SES resulted in the loss of the SEMTO position and a resultant reduction in emergency management training across the sector.

This reduction in training was further exacerbated when the Australian Emergency Management Institute (AEMI) introduced course fees in 2012, and then closed in early 2015.

## **12.9 Exercising**

The Central Exercise Writing Team (CEWT) was established in 1984 coordinates all significant multi-agency emergency exercises conducted within SA. CEWT provides expert advice, assistance and guidance to emergency services and government agencies in the preparation and delivery multi-agency exercise activities.

The CEWT Terms of Reference (2015) include that it is to:

- develop an annual exercise program to meet the requirements of the SEMP
- research, design, conduct and evaluate approved multi-agency exercises
- assist with the exercise requirements of individual government agencies
- develop and deliver training and development of government personnel to undertake planning, delivery and debriefing of major multi-agency exercises
- advise State Response Advisory Group (SRAG) on the status of the multi-agency exercise program, any other significant exercises; and
- advise SRAG on levels of exercise preparedness and significant debriefing issues following major multi-agency exercises.

It is apparent that the CEWT role, tasks and actions are demanding and intensive and have grown significantly, since its inception. In the last financial year CEWT conducted over 70 exercises.

There is an unrealistic level of expectation of CEWT members. These members participate in CEWT activities only on a part time basis because all have very busy primary jobs within their respective government agencies.

In recent times the committee has expanded from its original membership of five agencies to ten agencies in 2016 bringing about an expanded role and exercise function. However, this has not reduced the high expectation placed on the committee nor the subsequent workload.

In many cases CEWT has taken on training and exercise activities that do not fit within its 'Terms of Reference'.

The closure of the national emergency management training centre at Mount Macedon, the Australian Government introducing a user pay system for EM courses/training and the abolishment of the State EM Trainers position have all contributed to the increased expectations and work load as there are few options, other than CEWT.

A far more strategic approach to training and exercising needs to be taken so as to build capability and capacity.

## **12.10 Debriefs and lessons management**

Agencies undertook debriefs for this event, over a lengthy period of time, and it seemed that some may have not conducted a debrief if the Review hadn't requested information of them.

Not all events will require all government agencies to undertake debriefs, but an event of this nature, where the SEC has been activated and where a Major Emergency has been declared

---

should have ensured debriefs were conducted and within timeframes as close as reasonable possible to the event.

The SEMP States that the Control Agency should conduct a multi-agency debrief within three weeks of the completion of the response to an incident. This is almost impossible to meet in an incident of this nature, particularly when there is a reliance on other participants to conduct their own debriefs and in doing so liaise with external organisations/individuals.

The records of, and actions arising from the Multi Agency debrief should be reviewed by the relevant committees within the State's emergency management framework (including the EMC) so that holistic action can be taken where issues have been identified that have a broad State impact.

Some of the issues identified by this Review were raised in various debriefs and are of State level significance requiring the attention of the various committees and the Emergency Management Council.

Many of these issues identified during debriefs for this event have also been raised following previous events.

The Australian Emergency Management Lesson Management Handbook 2013 describes lessons management as 'collecting, analysing and disseminating experiences from operations, exercises, programs and reviews. A consistent approach to the management of lessons is an essential component for an organisation to become a learning organisation. Organisations are seen to be learning when their structure, systems and cultures are able to evolve based on past experiences' (Emergency Management Australia, 2013)

Establishing an organisational lessons management capability or process is common practice within emergency service organisations and other sectors such as Defence both nationally and inter-nationally. It facilitates a systematic process for collection of observations and identifying lessons, and an evidence-based approach to prioritising and allocating resources for remedial action.

The SA Country Fire Service has an established lessons management capability for their organisation, but a similar capability in other SA agencies is difficult to find. There is also no overarching framework for identifying, implementing and coordinating lessons across the SA emergency management sector.

There are existing lessons management tools and resources in other emergency services and defence agencies around Australia, e.g. databases to record and administer observations and lessons, tools, systems and lessons management networks. This provides opportunities for the SA emergency management sector to leverage good practice from other agencies and implement a lessons management capability in a cost-effective and efficient manner that is consistent with best practice.

Implementing an effective lessons management capability for the SA emergency management sector could provide a consolidated and consistent approach, improve efficiency and effectiveness, and contribute to organisational learning across the sector.

**Recommendation 48.**

Through the Emergency Management Workforce Project, identify and provide training and development for SA's emergency management sector personnel (government agencies, and non-government agencies including volunteers). State Emergency Management Committee should consider supporting recommendations from stage two of the project when the project report is tabled.

**Recommendation 49.**

Consider opportunities to identify synergies between the incident management systems used in SA being the, Australasian Inter-service Incident Management System (AIIMS) and ICCS Plus. This might include joint training and exercising in roles that are common across both systems.

<b>Recommendation 50.</b>	Review and update the role, function, workload and focus of the groups/committees that contribute to incident management and emergency management capabilities including the State Emergency Management Training Committee, Interagency Incident Management Sub-Committee and the Central Exercise Writing Team.
<b>Recommendation 51.</b>	Establish a State incident management and emergency management training capability which provides for: a) consistent training across the State b) personal development and endorsement processes for roles c) identification, recruitment and development of personnel from other government agencies; and d) incident management and State emergency centre functional role training and development across all sectors. e) skills maintenance including upskills, refresher training and exercises f) incident and strategic leadership training g) consistent training for inter-agency liaison officers at all levels
<b>Recommendation 52.</b>	Review and reinstate the State Emergency Management Training Officer and State Emergency Management Planning Officer (capability development) positions to operate with a broad, strategic and leadership focus.
<b>Recommendation 53.</b>	Establish a State-wide resourcing capability to support incident management teams, regional coordination centres, zone emergency centres, relief centres, recovery centres and State control centres. some of the features of such a capability should include: a) multi-agency, cross-government, State-wide pool of incident management and emergency management personnel building on the State incident management team concept currently facilitated by the Country Fire Service, and expanded to include all hazards, multi-agency teams with a roster that provides year-round coverage b) a system that enables staff and volunteers from any agency to identify their availability for upcoming shifts c) a rostering system that enables one or more incident management teams, staging areas, regional coordination centres, State control centres and relief centres to develop, maintain and distribute rosters and structure charts in a more coordinated manner d) identifying areas of expertise for key incident and emergency management functions (e.g. public information, alerts and warning, media liaison, logistics and resource management) that would benefit from a coordinated and resource pooling approach and take steps to implement (consider the Mapping Functional Support Group model as a potential service delivery model).
<b>Recommendation 54.</b>	Establish a lessons management capability across the SA emergency management sector to collect, analyse and track lessons identified during debriefs and reviews following events and other sources such as interstate and overseas reviews and inquiries.
<b>Recommendation 55.</b>	Update the SEMP Part 3, Annex F 'Debriefs' to provide more guidance regarding the types of debriefs, when they are required to be undertaken and at what level and guidance for undertaking and recording debriefs, and implementing lessons identified.

---

## 13. PUBLIC INFORMATION

The public information function undertaken by control agencies during emergencies includes the provision of incident information to the media and to the community and the provision of timely and accurate advice and warnings through various media channels.

Under the SEMP the control agency, in this event the SES, is responsible to ensure that the public is adequately informed and warned so as to support community safety. All agencies also have a responsibility to ensure that public information is provided as part of the normal process of engagement with the community. In an emergency situation, the timeliness of that information is critical.

It is well recognised among emergency services that the thirst for information from the community and the capacity for this information to inform and protect the community is a critical feature of effective emergency management. Through the rapid expansion of access to information, individuals and groups have become accustomed to being able to access the information they need about anything, immediately.

Emergency services need to be proactive with public information and ensure they have excellent situational awareness during incidents and that they are able to communicate effectively to the community about the risk to them and actions they need to take to protect themselves.

There were many challenges in providing information to the public during these events particularly during the power outage. Many individuals were unable to access the internet, some mobile phones had no connection and many had no way of being recharged, this reduced people's ability to access information. Some media outlets themselves had no power and were unable to broadcast or provide information on social media. The ABC was unable to disseminate information from the ZEC due to no mobile phone coverage or ability to use a landline.

The challenges with providing public information during this event are similar to challenges during many recent events in SA and across Australia. Some of these were identified during a public information debrief held by SES and included challenges relating to:

- limited number of qualified personnel to fill the roles including public information officer and alerts and warnings officers
- accessing up to date information from the field from the various impacted locations
- providing information that needed to be collected from a variety of sources e.g. location of sandbagging facilities
- ability to produce alerts and warnings in a timely manner given the limited number of personnel qualified and available to perform this role, and the quantity of messages that needed to be a distributed
- cumbersome processes to ensure all media channels are provided with information regarding alerts and warnings

There were also some successes highlighted, such as:

- development of a media plan which included strategies for various phases of the event
- provision of suitable personnel to provide interviews to radio and television
- SES established a presence on Facebook a few weeks prior to the event
- many positive comments regarding the content of SES posts on Facebook and Twitter
- effective use of Hootsuite
- ability to access photos and video footage from responders and the public
- use of AUSLAN interpreters

---

### 13.1 Public information functional support group

During a Declaration of a Major Incident, the Public Information Functional Service (which is the Public Information Functional Support Group (PIFSG) under the new SEMP), has a responsibility to 'assist conduct of response and recovery operations by coordinating the release of official, timely, and accurate information to the media and public concerning the disaster/major emergency, including measures being undertaken or planned to respond to such situations' (SA Government, 2016). There was a declaration made for a 12-hour period during this event due to the State-wide power outage.

The SEMP also States that the 'release of public information rests with the control agency', which was the SES for the event, apart from the 12-hour declaration period. Outside of a declaration, SAPOL have the role of providing a coordination function and is responsible for ensuring the control agency is exercising its powers and functions.

Some wording in the SEMP makes it difficult to distinguish between the responsibilities of the control agency and the PIFSG. For example, the PIFSG '*supports the release of public information by ensuring consistent and coordinated free flow of accurate information to the media and the community*'. There is a ver similar responsibility listed for the PIFSG.

The intent of the SEMP is more likely to be that the PIFSG provides strategic oversight of public information activities and ensures that public information is coordinated and consistent.

During this incident there appeared to be confusion regarding which parts of public information was the responsibility of the control agency and the PIFSG, there was also confusion about who was responsible and/or authorised to release information about the incident. At different times there were spokespersons from a variety of agencies and levels of government making Statements during radio or television interviews or making comments on social media.

The PIFSG plan needs to ensure the agreed authorisations for release of information or social media comment and the types of information or comment that may or may not be appropriate for release by individuals and agencies.

### 13.2 Messages

Throughout this event there was a lot of different messages and information that needed to be conveyed to the community. Some of the information and message requirements included:

- severe weather warnings
- flood warnings
- the location of sandbags available to the public
- actions required of the public to prevent flooding and storm damage
- cautions to advise on what not to do e.g. walk or drive through floodwaters
- information about what to do when returning home after floods
- location of relief centres and other support
- evacuations
- school closures

Some comments made about the initial weather information that was provided was that '*initially councils were slow to respond ... this is about understanding of the message*' (LGA, 2016). Some councils were of the view that more emphasis on the potential effects of this event could have assisted them to understanding the potential severity and proactively undertake additional preparatory steps to minimise damage and prepare the community.

Other issues with messaging in the media were highlighted at various debriefs and are outlined overleaf.

---

*'Metro-centric focus, rural communities felt they were being ignored...not provided with relevant and timely information and they felt that the media wasn't covering their plight.'*

*'Input from (politicians) was unhelpful as they made it into a political issue where there were communities at risk and extreme weather occurring.'*

*'Directing people to go to websites that they couldn't access'*

*'review the terminology of messaging ...when to be alarmist vs when to be cautious'*

*'Multiple alerts are sent by various agencies about the same risk e.g. BoM and SES. Would be better if joint framework was agreed.'*

*'Need to agree protocols for messaging (social media) between SES/State/Control Centre(s)/Council etc. i.e. closure of Linear Park.'*

---

Some information provided by the SAPN, indicated that power should be restored within two hours. This resulted in businesses only planning for a short-term outage. Some of them delayed seeking back-up power or putting away stock because they were anticipating that the power would be quickly restored. However, as this did not occur, in some instances for several days, there were stock and business losses that could possibly have been avoided if they had been told initially to plan for an extended outage. Messages from SAPN and Telstra need to be pro-active, timely and as accurate as possible. A best and worst case scenario for potential duration of an outage may assist with preparedness and resilience at all levels.

There were some inconsistencies in communication at the emergency and incident management level which may have also lead to misunderstandings by the community. For examples there was information circulating suggesting that there was no water at Port Lincoln however, this was not the case. There was concerns for the water supply in the town however water was available throughout the event.

### **13.3 Communication tools**

A plethora of tools exist for agencies to communicate with the public which provides many options for reaching potential audiences but also creates a very complex environment within which to issue information.

Following are some of tools now used by emergency services to ensure the public is provided with appropriate advice and warnings during events.

- Emergency Alert is a national telephone based warning system that sends text messages to mobiles and voice messages to land lines during emergencies. It is primarily used in the most extreme circumstances where there is a perceived threat to life and/or property
- Alert SA provides the official SA Government website and mobile app for access to timely, personalised incident information to keep the public up to date and help them make informed decisions about their safety. It provides real-time event and warning information on an interactive map of SA including incident, flood, storm, earthquake, power outages, road closures, traffic delays and transport disruptions. It displays a range of official information sourced from emergency services, relevant government agencies and community partners
- SES flood and storm response line 132500 provides the community with the ability to request assistance if required, or to use menu options to find information they are seeking such as the location of relief centres. Depending on the option selected by the caller, 132500 either terminates at the Comcen who can respond and emergency service crew if required, or it terminates at the State Emergency Information Call Centre Capability (SEICCC)
- SEICCC provides call centre overflow capability arrangements and contributes to public safety by enabling emergency services and the State recovery office to draw on additional call centre

---

resources to meet demand for information about an emergency. The SEICCC is staffed by call-takers from various parts of government who provide additional information, much of which they access from sa.gov.au

- The website, sa.gov.au has been developed and greatly enhanced during 2016 to provide 'information and services for South Australians'. This website consolidates information from all SA government agencies and has a page that brings all relevant information pertaining to a particular emergency including information across the PPRR spectrum
- individual agency social media sites including twitter and facebook
- media releases which alert and provide content to media agencies
- press conferences including using AUSLAN interpreters
- emergency services have agreements with the ABC who will convey emergency messages over radio and television during significant events
- 89.1 ABC radio is listened to extensively, particularly in country areas, during emergencies. This can be an excellent tool for local emergency services and agencies to communicate with their communities.

All of the above tools were utilised during this event to provide information to the public in an effort to keep them informed and support their safety. There was a very high demand from individuals and groups seeking information via websites and social media of emergency services, essential services, local councils and community groups.

Councils also found they were able to get good reach into their communities regarding road closures, services and sand-bagging through social media and websites and they used sa.gov.au to access and provide information to their communities.

During an emergency event, politicians, the public (including those immediately affected by the emergency) and media are very active on a variety of social media platforms, including facebook and twitter.

These mediums offer a very effective tool to communicate with the public as well as an opportunity to gain intelligence on events, which may not have yet come to the notice of emergency management authorities. While the information available to emergency services can be very beneficial, it can be very time-consuming to monitor.

Equally, Statements are made by politicians, media and the general public that are not correct and if this misinformation is not corrected as soon as possible, then public confidence and concern may be heightened which may lead to inappropriate action being taken by the public.

If hundred/thousands of people are commenting against posts, scanning them for intelligence would be too cumbersome and labour intensive. Consideration should be given to acquiring 'social media listening' software which will segregate and triage the information.

Consideration should also be given to establishing an intelligence cell within the public information functional service group (PIFSG) to monitor social media and mainstream media.

---

*'language used in warnings needs to be targeted to specific stakeholders and consider the language limitations of ethnically diverse communities'*

*'Alert SA was widely used by councils and functioned effectively when power supplies were available'*

---

---

*'ABC 891 radio station is a major source of public information in a situation where almost all communication technology has failed. I felt that the ABC 891 radio broadcast was at times inappropriate ...(and) politicised a natural disaster from the outset when no information was available as to the cause of the outage.*

*This resulted in the broadcast of misinformation and increased public disquiet unnecessarily. What was required of the public emergency broadcaster at this time was to inform the public of facts as they became known.*

*Political commentary and analysis should be left until the immediate situation had resolved.'*

*Individual submission*

---

In country areas ABC 89.1 Radio is an important source of information and there were many comments made that this resource could have been used much more effectively to communicate with the public. The station is diverted to interstate coverage overnight which provided no information regarding the power or weather situation.

### **13.4 Emergency Alert – a multi-agency capability**

Emergency Alert is the national telephone based warning system that was implemented following the Black Saturday events of 2009, as a way of sending targeted and intrusive warnings to members of the community at risk from emergencies.

The only agencies enabled with its use are SAPOL (both independently and as the State emergency coordinating authority), SAMFS, SACFS and SASES.

There were 92 scaled warnings issued by the SES during this event these included: emergency warnings; and watch and act, advice and reduced threat messages. This was very time-consuming and labour intensive.

At times there were delays in the length of time taken for some warnings to be issued. In one instance an IMT requested through the SES SCC that a warning be issued for Saddleworth. It was not issued until after the water had started receding.

In the Bowmans area which was inundated and no warning was issued for this area until after the water had peaked. This however was due to a lack of intelligence relating to water levels rather than problems with the issuing of a warning.

---

*'there was no appreciation of timely warning messages to the public e.g. none sent out to the Waterfall Gully Road flood until 12 hours after the crisis.*

*'the SES and CFS AFLO's (liaison officers) were not advised when warning messages or ALERTS messages were sent to the public'*

---

The protracted nature and geographical spread of the flooding event revealed a need to increase the pool of people capability of performing this function and develop a multi-agency capability and capacity in the use of Emergency Alert.

The ability of agencies to support the control agency with this function is reduced due to the very agency specific training. The duration, mode of delivery and complexity of training and assessment tasks vary across the four agencies.

A higher degree of interoperability could be achieved by centralising the initial and refresher training which occurs in a number of other jurisdictions.

Training conducted uniformly, with standard, structured training and assessment strategy, over a set duration, would ensure individuals can provide a consistent and reliable service, regardless of which agency they come from or the particular emergency situation.

---

Training should be followed up with the same, regular, structured refresher training to maintain competency

---

*.... there was comprehensive messaging and warnings provided to the community throughout the event. The Emergency Alert application was utilised to send 59,752 text messages, 28,516 voice messages and 887 fax messages regarding 18 separate risks events. The majority of these messages related to flooding or dam bursts. During the same period SES distributed 34 Watch and Act messages, 33 Advice messages and 23 Emergency Warning messages. These warning messages were for 20 separate locations across a broad geographic area*

*(SASES, 2016)*

---

### **13.5 Community liaison and information**

Emergency services personnel are always engaging with the community when they attend incidents and at the local level during emergencies.

The coordination of formal engagement activities such as newsletters and community meetings has been undertaken on many occasions during bushfire events but rarely during emergencies involving other hazards such as floods.

Holding community meetings is a public information function that is relatively new to SES. A meeting was held at Virginia Institute on Wednesday 5 October 2016 to provide information and advice to the community in and around that area. The meeting was attended by around 100 members of the community and while some attendees felt angry and upset about the event, the meeting was generally appreciated as an opportunity to gain first-hand information and ask questions.



**Figure 28 - Community meeting at Virginia**

There was also a community newsletter prepared to provide advice about the situation, what emergency services were doing and what residents could do to support themselves.

At various times and in various locations emergency service personnel including SES, CFS and MFS as well as SAPOL undertook doorknocking in areas that were under threat of flooding. Generally, the contact was to provide advice only rather than to request evacuation.

It was raised at Port Lincoln that providing community information at key locations would have been beneficial. During the power outage, the Port Lincoln Hotel was able to continue operating because there was a back-up generator on site. The hotel continued to provide meals, accommodation, warm showers and heaters as the temperatures were very cold. It became a hub

---

for the community because it could provide accommodation for elderly people and young families who did not have power at their homes, and travellers and workers who were stranded in Port Lincoln.

Locals also came to the hotel seeking information but staff didn't have a lot of information because they did not have operating phones or internet. It would be beneficial for control agencies to provide information at key locations, particularly where there has been a power failure, so that communities can be kept informed.

At the Port Lincoln ZEC they have since arranged the appointment of a Community Engagement Officer who will be located in the ZEC for future events to provide the media and the community with information to disseminate.

### **13.6 Relief and recovery information**

Those affected by the floods include primary producers at Virginia, many of whom are from Vietnamese or Cambodian backgrounds. Appropriate communication with these communities has been a priority and provided through different formats such as ethnic radio and newspapers, translated written information and trusted community sources and organisations.

Public information messages for relief and recovery activities were issued including [www.sa.gov.au/recovery](http://www.sa.gov.au/recovery) website, social media (Facebook and twitter) and traditional media. Other agency media channels were monitored, including SES, PIRSA, EPA, DSD, SAPOL, SA Water and SA Power Networks, to share information as appropriate. (DCSI, 2016)

Key messages include:

- relief centre closures;
- recovery centre establishment (location, opening hours and services);
- emergency grants available and closure of Loss of Power Grant;
- access to volunteers for clean-up assistance;
- sharing other agency information (SA Health mosquito information, EPA waste levy, Foodbank Flood Appeal and PIRSA grants for primary producers);
- mental health and wellbeing; and
- promotion of key communication channels including the recovery hotline.

Communication products were developed including fact sheets on emergency relief centres and available grants, Gawler area relief information, Northern Adelaide Plains Flood Recovery Centre information and information for small businesses (developed by the Department of State Development). All fact sheets were translated into Vietnamese and Khmer to cater for the prominent languages spoken in the affected area.



Figure 29 – Information on mosquito control after floods and storms, in Khmer

**13.7 Continuity of public information throughout PRR phases**

It is important that the community can access the information that they need throughout all phases of an incident. Members of the public do not necessarily know (or care) who is providing the information as long as they are able to find what they need. There needs to be continuity and consistency of information to the community throughout the PRR cycle.

The various agencies responsible for distribution of including, such as SES, EPA, SA Water and the State Recovery Officer, worked hard to ensure relevant information was produced and distributed in a timely manner. The increased use and promotion of the sa.gov.au website is assisting with bringing all of the information together.

Following the 911 World Trade Centre disaster there was an extensive report prepared on the information, technology and coordination lessons from that event. The report identified that crisis-related information needs of the community (across the PRR spectrum) include:

- Immediate and emerging threats to civilians and guidance for personal protection
- Ongoing advisement of continuing threats and what to do
- Ongoing advisement of recovery and restoration activities
- Continuing awareness and education (Dawes, et al., 2004).

It would be beneficial for some work to be done to ensure that all appropriate information is being provided in a format and location that is understood and accessible by those that need to see it.

**Recommendation 56.** Review and update Part 3, Annex C, of the SEMP 'Public Information and Warnings' to:

- a) clarify the role and responsibilities of the Public Information Functional Support Group and control agencies in relation to public information
- b) define requirements and processes for liaising with the community, including holding community meetings

---

**Recommendation 57.**

Update the Public Information Functional Support Group Plan to include:

- a) standards, outputs, systems and processes required to be used by control agencies and the Public Information Functional Support Group during emergencies
- b) guidance on the public information cycle through the prevention, preparedness, response and recovery phases which includes the responsibilities and information requirements during different phases, and effective transition between phases
- c) establishing a public information intelligence cell within the Public Information Functional Service Group; and
- d) identifying tools or resources to monitor social media

**Recommendation 58.**

Task South Australian Fire and Emergency Services Commission with further developing the Emergency Alerts capability across government agencies including to:

- a) establish and maintain a centralised training program for emergency alert initial and refresher training.
- b) establish a pool of endorsed Emergency Alert personnel from across government agencies to enable control agencies to assist each other with the emergency alert function during emergencies.
- c) develop supporting processes to ensure that the capability supports: emergencies involving any hazard; consistent issuing of alerts and warnings; consistent messages; and effective communication and notification of alerts issued to relevant internal and external stakeholders.

---

## 14. EMERGENCY RELIEF AND RECOVERY

Emergency relief is given very little attention in the SEMP 2016. The largest section on emergency relief within the plan is provided as a definition:

*'The provision of immediate shelter, life support and human needs of persons affected by or responding to, an emergency. It includes the establishment, management, and provision of services through emergency relief centres'* (SA Government, 2016)

This role is undertaken by DCSI (Housing SA) and is a critical component of any emergency. Relief is part of emergency response, but also closely associated with Recovery and requires a complimentary working relationship with both aspects (relief and recovery) to operate effectively and efficiently.

The Emergency Relief Functional Support Group (ERFSG) has a position within the SEC and establishes relief centres in consultation with, and the approval of, the Control Agency.

There are opportunities for improvement, and increased efficiency, of relief and recovery operations to alleviate confusion of roles and responsibilities and provide a stronger nexus between relief and recovery.

---

*Current relief and recovery arrangements in SA seem to be somewhat disjointed... This appears to result in some conflict over ownership and boundaries of where relief and recovery starts and finishes. Ideally the model would be more integrated due to the synergies and natural progression from relief to recovery with the former being integral in informing early recovery activities*  
*Red Cross*

---

The development of a State Relief and Recovery Plan (similar to Victoria's) would go a long way to improving the current arrangements.

Observations included:

- need better transition between relief and recovery
- recovery needs to sit under the NDRP
- information collected on people in the relief phase and case management not transitioned effectively to recovery
- require a proper case management system for recovery
- recovery will be long term and some locations were covered in water for weeks and months, the Virginia area will take years to rehabilitate and re-establish crops and businesses, the negative physiological effects on the community following an event such as this can be long term.

### 14.1 Relief centres

DCSI with support from other agencies established emergency relief centres to offer advice and assistance to communities affected by the extreme weather and flooding event. During this event there were eight relief centres established with the aim of providing 'care and comfort' to members of their respective communities.

Relief Centre Location	Number Registered
Ceduna	310
Clare	748
Gawler (Evanston Gardens)	196
Port Augusta	940
Port Lincoln	4,988
Port Pirie	1,276
Virginia (Mobile Relief Service)	16
Whyalla	1,490
<b>Total</b>	<b>9,964</b>

*Table 3 - number of families registered at relief centres*

The biggest impact on relief (and recovery) centres was the announcement of the loss of power grant (see the next section of this report). Without the requirement to administer the grant, the need for many of the relief centres would have been minimal and of short duration.

There were some issues regarding the suitability of some relief centres including the location, access and facilities.

In some instances, there was a delay in activation of centres. This can be attributed to the approval process for activation which requires the Control Agency to approve the proposed location, prior to activating a relief centre, to ensure it will not be under threat of flooding.

Control Agencies will always be very busy coordinating response during incidents. A more efficient method would be for suitable options for relief centres to be pre-determined and documented in a State relief plan.

Control agencies such as SES and CFS would be consulted during the planning process regarding suitability of the facility during a major flood or fire.

This pre-planning would also provide the opportunity to ensure that proposed facilities have the suitable requirements such as access, back-up power, toilets, showers and parking.

Pre-determining of facilities for relief (and recovery) centres prior to an event will ensure that the process of activation of facilities during an emergency is much quicker. Agencies involved can be assured that the facilities will be suitable and it will streamline arrangements.

---

*'Everyone is used to evacuation centres being for fire, I don't think anyone has thought the suitability for locations given the potential for either flood or another type of event'.*

*'...two locations suggested were totally inappropriate and the other suggestion.. would mean you'd have to get everybody to drive through potential floodwaters to get there.'*

*'The establishment of relief centres and the parameters for their establishment has been questioned by councils. The LGA has received feedback form rural areas that they appear only to be established in the larger regional centres'.*

*'Councils need notification of where the relief centres are so we can assist with access requirements etc.'*

*(LGA, 2016)*

---

The communication between agencies regarding establishing relief centres during an emergency could also be improved. It is important that all relevant stakeholders, such as councils, are provided with information regarding the location and services being provided at relief centres.

---

## 14.2 Relief funding and loss of power grant

There were a number of grants made available to fund relief including:

- loss of power grant (\$280 per adult and \$140 per child, up to \$700 per family)
- emergency relief grant for immediate essential needs
- flood clean-up grant
- recovery assistance grants for primary producers who suffered direct damage as a result of the Gawler River Floodplain floods; and are intending to re-establish their primary production businesses.



30 September 2016

# Emergency Relief Information

Three emergency relief grants are available for people whose homes have been affected by the severe weather and floods.

1. **The Loss of Power Grant** for immediate essential needs is not means tested and is available to support people directly impacted by power outages during the declared Major Incident 28-29 September 2016.

To be eligible you must meet all of the following criteria:

- your principal place of residence must have been continuously without power from 3.50pm Wednesday 28 September to at least 12pm Thursday 29 September
- have suffered hardship as a result of the power outage
- unable to meet your immediate essential needs for food, clothing, medical supplies or temporary accommodation.

This grant is not asset tested. Eligible people will receive \$280 per adult and \$140 per child up to a maximum of \$700 per household.

To apply for the Loss of Power Grant, you will need to complete an application form available online or at relief centres and lodge in person at an Emergency Relief Centre

2. If you have been affected by the severe weather event but have not experienced at least 18 hours of power outage you may be eligible for **The Emergency Relief Grant** for immediate needs when you are unable to access your home. Eligible people will receive \$280 per adult and \$140 per child up to a maximum of \$700 per family.

To be eligible your home must be inaccessible because of the severe weather or flood and you are unable to meet your own immediate and essential needs such as food and medications.

3. **The Clean-up Grant** is to assist with the clean-up of flood damaged homes. This is paid per residence, up to a \$700 maximum, depending on the level of damage to your home. To be eligible at least one room inside your home must have been damaged by the floods.

For more information or to apply for a grant, download the application form online at [www.sa.gov.au/recovery](http://www.sa.gov.au/recovery) or visit an Emergency Relief Centre, currently at the following locations:

- Ceduna**  
Ceduna GP Plus
- Clare**  
The Valleys Lifestyle Centre
- Port Augusta**  
Port Augusta West Football Club
- Port Lincoln**  
Ravendale Sporting Complex
- Port Pirie**  
Lions Football Club
- Whyalla**  
Whyalla Hockey Association

**For the latest relief centre locations or for more information**

[www.sa.gov.au/recovery](http://www.sa.gov.au/recovery)   [1800 302 787](tel:1800302787)   [f SARecoveryInfo](https://www.facebook.com/SARecoveryInfo)   [@SA\\_DCSI](https://twitter.com/SA_DCSI)

Figure 30 - Emergency relief information

The announcement of the loss of power grant and the assistance it provided should have been a good news story, but it ultimately caused considerable anger amongst affected communities and

---

had a significant detrimental impact on relief and recovery organisations including hotlines and relief centres.

Some of the problems with administration of the loss of power grant included:

- it was announced without notification to agencies
- people had to travel to relief centres to lodge forms which was a long drive for some rural people, and there was no option to complete the forms online
- relief centres were inundated with people seeking the grant which took focus away from those who were seeking relief for their immediate needs
- some of the most effected people were not aware of the grant because they didn't have power or telecommunications.
- the timeframe was intended for people to seek relief in the first 12-24 hours however the processing time took weeks in some cases
- 10,578 calls were taken by the recovery hotline and the vast majority were in relation to grants
- the criteria for the grant was not clear so there were a lot of unnecessary calls seeking clarification of who was eligible which could have been avoided if there was appropriate information provided in the first instance
- a measurable increase in social problems associated with the influx of money into communities e.g. gambling, alcohol and domestic violence

The announcement of this Grant resulted in DCSI requiring additional resources to deliver the various relief and recovery responses.

---

*To give a perspective to scale of impact of the Loss of Power Grant, of the 15,091 grants arising from this event issued as at the date of this report, only 289 were Emergency Relief or Clean-up grants. Two relief centres (Port Lincoln and Whyalla) handled only Loss of Power Grants. Without the Loss of Power Grant, the demands and needs of communities across the State were manageable.*

*(DCSI Internal Audit Report 28 November 2016)*

---

Many of the loss of power grants were accessed by people considered not eligible and conversely many people who should have been able to access the grants were unable to do so, for a variety of reasons which included; were not aware due to telecommunications failures, living in remote areas and unable to attend a relief centre, unable to submit via the internet, were away from their home and returned outside of the time in which to claim.

There is also the important consideration that at times, cash grants can undermine individual and community resilience. This is contradicts the objective of providing grants in the first place.

There needs to be consultation and liaison with the control agency and the Relief Functional Service prior to announcing grants, and in fact, prior to an emergency. This would enable appropriate criteria to be established and ensure there is a framework including technology and people within which it can be effectively distributed without impacting other response, relief or recovery efforts.

When the Review team visited Port Lincoln and met with local business managers, local government and emergency services, the loss of power grant was clearly one of the most contentious aspects of this event.

Similarly, information received from the Flinders Electorate (synopsis of a survey undertaken by Mr Peter Treleor, Member for Flinders), reinforced these concerns.

---

*Most common complaint about the relief grant was that people didn't know about it in time – and then when they finally did it was about to close or had already closed...*

*The second most common complaint was that the grant closed with little warning. We believe the closure was announced on the radio on a Saturday and it closed on the following Monday. This left little time for people – if indeed they even heard the information. A Flinders EO Staff member personally went to the relief centre that day it closed off and the staff at the centre told her it hadn't closed – she gave them the print out from the website where it said it was closing that evening. They didn't know about it.*

*Many of those who didn't apply were quite elderly – precisely the people that would've needed it the most – amongst the most vulnerable in our community...they couldn't get warm, they were scared as they lived alone, they didn't know what was going on. These people aren't waiting on the grant because they were too late to apply!*

*Synopsis of survey undertaken by Mr Peter Treloar, Member for Flinders*

---

The relief and recovery section of the SEMP requires clear policy for announcements of emergency grants, taking into account building resilient communities (who and why), consistency of grant allocation, the method of processing grants and communications to the community (how) and the timing of the announcement of grants (when).

### **14.3 Homelessness Code Blue response**

The Homelessness Code Blue response is a relatively recent initiative which is 'a service to provide shelter, food and safety for rough sleepers during an extreme weather event. Housing SA instigates the response based on advice from the Emergency Relief Functional Service and coordinates participating agencies in the provision of response services' (Allwood, 2016).

The Code Blue response was activated on Wednesday 28 September 2016 for two nights following a Ministerial request. Non-Government Organisations (NGOs) opened their own facilities to provide food, shelter and support services. These facilities included Catherine House, Hutt Street Centre, Westcare building and St Johns Youth Service building.

The response was effective and well-coordinated during this event and provided much-needed support. An internal (DCSI) review of the 'Code Blue' response has been conducted which has deemed that relevant adjustments will be made to the documentation and it is planned that the service will be expanded into country areas.

### **14.4 Outreach to the community**

The Outreach service is a response instigated by Housing SA as part of the relief and recovery process and it provided by the Red Cross and Disaster and Recovery. It involves visiting people in affected areas who may be isolated or unable to attend a relief centre, to provide them with information and determine if they have support needs.

The Outreach service was initiated in the Virginia area on Friday 30 September during the transition from relief to recovery. Outreach volunteers distributed information packs in the flood affected areas.

Red Cross felt that there were other locations, in addition to Virginia area, that should be provided with support. This was based on reports from local volunteers who they felt these communities would benefit from some support. There were local volunteers Red Cross volunteers who were willing and available to provide the Outreach service in their communities and sent volunteers to Blyth, Fisherman's Bay and Bowmans. The visits were very well received, and some people commented that they felt they had been forgotten about.

---

On 8 October 2016, mobile relief services were provided to the Vietnamese Farmers Association of SA, to support farmers who experienced damage to their crops. The Emergency Relief Functional Service and Red Cross provided support on the day.

A review undertaken by DCSI after the event highlighted a success of the Outreach program as being 'the number of volunteers that the Red Cross and the Disaster and Recovery Ministries are readily able to draw upon.'

### **14.5 Red Cross**

Red Cross have international and national capability and capacity with regard to emergency relief and recovery. In South Australia, it has two Memorandums of Understanding (MOU), with regard to emergencies, one being with Housing SA (emergency relief). The other is with the Relief Functional Service and assist with psychological first aid, register.find.reunite, supporting outreach programs, providing support at community meetings. Red Cross also have a range of other services that they consider could be greater utilised.

They have inroads into communities and community groups and have a strong brand and reputation that people associate with help and support. They have a network of regional personnel so they can be on the ground quite quickly and they have local knowledge of their communities, vulnerable people in the area, local resources and needs. They also understand the demographics of the area and can request support of Red Cross interpreters for culturally and linguistically diverse (CALD) communities.

Red Cross recovery activities could include:

- training and education for community leaders and local agencies to further develop their disaster recovery capacity
- expert advice to community leaders and local agencies before and after a disaster
- outreach activities to provide psychosocial support to residents in their homes, business and places of temporary residence
- facilitate and provide psychosocial support at community events, including at memorials and anniversary services
- connecting local organisations with peers around Australia who have recovery experience
- facilitate disaster recovery support groups in partnership with the Australian psychological society
- support medium – long term recovery planning by advocating for community needs
- assisting people to prepare for future disasters.

Red Cross currently do not claim their expenses against the cost of an emergency to recoup the money that it costs them to provide support during emergencies. This is something that they could consider making arrangements for in the future.

### **14.6 Recovery Centre (Virginia)**

Members of the Review team visited the Recovery Centre at Virginia on 7 December 2016 and met with the appointed Local Recovery Coordinator (LRC) and recovery centre staff.

At the time of this visit, the recovery centre manager was developing documentation and mapping out the reporting arrangements across the various government agencies involved in the process. There were challenges due to multiple reporting lines and multiples requests for the same information being made to the recovery centre.

There appears to be a disconnect between relief and recovery, and confusion regarding: transfer of case-management records; criteria and processes for changeover from a relief centre to a recovery centre; record keeping issues; no process to identify risk and vulnerability; and, unclear processes for working and reporting.

---

There also seems to be a disconnect between relief centre staff and the Emergency Management Unit (Housing SA).

Observations and comments from the LRC supported these observations. He also advised that there was little in the way of guidance for a person taking on the role of LRC, that reporting relationships were unclear, and there was confusion in who had overall responsibility for the recovery centre.

#### **14.7 Assistant State Coordinator Recovery**

Recovery, without doubt, is a complex and difficult aspect of any emergency management operation and can last months and years, is costly and requires significant State and local government and volunteer resources.

The manager and staff of the State Recovery Office are very professional, knowledgeable and committed but their capacity to undertake the complete spectrum of their national and State obligations together with their strategic, training, and operational roles are significantly impacted by ongoing operations.

In South Australia a Duty Minister (for Recovery) is appointed, who also is involved in the relief phase of an emergency. The Review believes that this is not necessary and is a product of the fragmented nature of emergency management in South Australia.

It would seem that the arrangements in SA when it comes to recovery are ad-hoc, inconsistent and, in a legislative sense, formalised only after a Declaration has been made by the State Coordinator and at that time an Assistant State Coordinator Recovery is appointed (usually the Chief Executive of DCSI). A meeting of the State Recovery Committee is convened and a recovery hotline established.

The 'on ground' management for recovery usually sits with the Manager of the State Recovery Office and for some events a Recovery Coordinator (someone external to the Department and may be a person local to the area impacted and subject to the recovery operation) is established.

There seems to be little established criteria for the creation of this Coordinator, nor when a Recovery operation will occur.

During the period of this Review, three recovery operations were occurring, being, Pinery (fires), Virginia (floods) and then the Riverland (storm/hail damage). This is a huge commitment for a small team of staff from DCSI and reporting to the Manager of Housing SA, even with the support of other agencies and staff seconded from other areas.

Comparing the two recent emergency events in 2016, Virginia and the Riverland, highlights significant differences in the manner in which the emergencies were dealt with from a recovery perspective.

As there was an emergency declaration on 28 September 2016, an Assistant State Coordinator Recovery was immediately appointed, a State recovery operation was initiated, and the announcement of government grants occurred in quick time (e.g. loss of power). Soon after the event concluded (4 October, 2016) a Local Recovery Coordinator was appointed however, no Local Recovery Coordinator was announced for the Riverland until 5 December 2016.

The storm event in the Riverland was of a very short duration (around 15 minutes) but more damage than the Virginia market garden flood. Because it was over so quickly, there was no emergency declaration and as a result no Assistant State Coordinator Recovery was appointed. Financial assistance has taken weeks to be distributed.

On 28 December 2016, another severe weather event was experienced widely across South Australia, bringing similar issues including, widespread and prolonged power outages, flooding and storm damage. At the date of documenting this part of the report (17 January 2017) the Review is unaware of any announcement of government grants (loss of power).

Emergency Declarations are not frequent occurrences and are designed for the response phase of an emergency. They have little bearing on the recovery phase.

---

A State Relief and Recovery Plan needs to be developed which provides more clarity and information for the roles, responsibilities and coordination of agencies involved in relief and recovery.

It should describe the 'management principles for relief and recovery planning, outlines the services which may be required in relief and recovery situations, and provides information on the considerations involved in operational recovery. It also establishes a framework within which recovery agencies, regions and local government can prepare their own relief and recovery plans' (Emergency Management Victoria, 2015)

## **14.8 Public health**

Public Health worked with councils within the affected area around concerns regarding septic tanks and other public health issues, including mosquito activity. This led to the development of public health fact sheets on: staying safe and healthy during flood recovery; septic tank problems after flooding; and, mosquito control after floods and storms. Councils were then able to share this information to ensure consistent messaging across the affected areas.

SA Health met with the Local Recovery Coordinator, Adelaide Plains Council, City of Playford and pest controllers, to develop a strategy to deal with the expected increase in prevalence of mosquitoes.

SA Health also liaised with local health providers through the Primary Health Networks to provide emotional support services to affected communities.

Additional public information messages were released over subsequent weeks, encouraging members of the community to seek assistance if they were feeling overwhelmed by the impacts of the weather event.

There were concerns about exposure of emergency responders and the community to contaminated water. The SA Country Fire Service Volunteer Association raised concerns regarding contamination.

EPA was asked to assess and advised that due to the vast quantities of water involved any contaminants would be diluted to such an extent as to be of no danger to responders or the community.

---

*The glasshouses at Virginia are unregulated and there were containers everywhere. There was toxicity in the soil including waste water, sewerage systems. There was a bad smell and something in the water wasn't right. No one measured the chemical content and there are going to be plants growing in that soil*

*(EPA).*

---

Meetings of the Local Recovery Committee (LRC) were held to discuss major issues and priorities. These include de-watering, and waste management issues such as garbage, debris, green waste, septic tanks and biohazard waste.

## **14.9 Waste management**

The State Recovery Committee established a Waste Management Working Group (chaired by SAFECOM) which met for the first time on 7 October 2016. The group primarily focused on specific agricultural waste management issues in the vicinity of Virginia.

A key focus was the issue of waste management in the market gardens in northern Adelaide. Options to address waste included collection and disposal to licensed landfill, collection and processing of organic material at licensed composting operations.

PIRSA assumed responsibility for the working group which includes representation from the EPA, Green Industries SA, local councils and operators of relevant waste facilities.

---

*There is a view within local government that management of disaster waste requires a more coordinated approach. ... if Waste to Resources Fund is to be used for disaster remediation costs then there needs to be a clear and transparent process to effect the distribution of the funds*

*(LGA, 2016)*

---

The current arrangements and responsibilities for various aspects of disaster waste management are not clear. A defined process is required including which agencies need to be involved, what they are responsible for and how the function of disaster waste management is activated and coordinated.

A study commissioned by Zero Waste, reviewed the status of disaster waste management in South Australia. It found that there was no set framework for managing disaster waste but that traditionally it had been carried out through joint efforts of several organisations and individuals. Waste is largely managed and disposed/recycling using local government resources (Rawtec, 2015).

It was observed in the report that if SA experienced a major disaster 'that greater challenges would arise requiring more centralised management and additional resources beyond local government capacities'.

**Recommendation 59.**

Develop a Disaster Waste Management Plan to form part of the State Emergency Management Plan which describe participating agencies and responsibilities for various aspects of waste management during and after emergencies.

## **14.10 Natural Disaster Relief and Recovery Arrangements**

On 10 October 2016, the Department of Treasury and Finance (DTF) requested government agencies to provide expenditure costs associated with the extreme weather event for a Natural Disaster Relief and Recovery Arrangements (NDRRA) submission.

The Commonwealth Government was notified of a potential claim under the NDRRA.

A common issue raised by government agencies, councils and the Local Government Association concerned the NDRAA.

There were many comments about the complexity and difficulty in accessing the funding. The seemingly uncoordinated and inconsistent manner in which claims were made by government agencies and councils was potentially resulting in millions of dollars of eligible disaster funding not being claimed. There was a feeling that the intention of the process was to inhibit the submission of claims.

---

*Thirteen councils have indicated to the LGA that their road infrastructure has suffered considerable damage, which will likely see a repair cost exceeding \$15 million. Roads are generally regarded as 'uninsured' infrastructure. The cost of remediation is deemed an 'eligible measure' under the Local Government Disaster Recovery Assistance Arrangements (LGDRRA). These arrangements largely reflect the Natural Disaster Relief and Recovery Arrangements (NDRRA) that are in place between the Federal and State Governments. In South Australia, financial assistance to a council is subject to a threshold test based on a council's rate revenue at the amount of 2% of rate revenue or \$150 000- whichever is greater. An independent engineering assessment is required to verify the road damage sustained when making an application for financial assistance for the restoration of essential public assets. A separate category exists for 'counter disaster operations' that are in effect response activities that protect or sustain the community during and immediately after a disaster. However, this type of assistance is limited to councils with rate revenue of less than \$10 000 000. In effect this means that all metropolitan councils and larger rural councils are excluded from accessing this type of assistance. The issue of prompt and adequate asset damage assessment, and interpretation and application of the assistance guidelines (LGDRRA) has been on-going with councils. The LGA is of the view that the current arrangements require review so that a more seamless approach is achieved.*

*(LGA, 2016)*

---

The 2014 Local Government Disaster Recovery Assistance Guidelines (LGDRAG) were developed to provide a more sustainable means of supporting SA local government whilst ensuring alignment with the Commonwealth's Natural Disaster Relief and Recovery Arrangements (NDRRA). In October 2015, the Commonwealth Minister for Justice approved NDRRA Determination 2012, Version 2.0. The new arrangements provide few variations but aim to reduce complexity in comparison to earlier versions.

South Australia rarely reaches NDRRA threshold levels to enable State claims to be made for Category B expenditure (primarily restoration of assets). The reason for this is two-fold:

1. South Australia is impacted less frequently and less severely when compared to other Australian jurisdictions such as Queensland.
2. The relatively low level of NDRRA eligible disaster grants and financial reimbursements paid to local government by the State, limits the potential for Commonwealth prescribed threshold levels to be reached.

In terms of NDRRA eligibility South Australia has been well below threshold levels in recent years with the exception of 2007-08. Initial data indicates that threshold levels will be exceeded following the storm and flood events of September, October and November 2016.

South Australia would likely reach Commonwealth thresholds more frequently if support was provided to local government and if more effective State and local government cost capture measures were applied.

Currently DTF manage the LGDRAG. Anecdotally there are councils with little or no knowledge of the funding and most councils have limited expertise to enable them to collect the right type of impact/damage data in a timely manner to develop an 'eligible' claim.

Following the 28 September 2016 event SAFECOM organised for representatives from the Queensland Reconstruction Authority (QRA) to visit South Australia. In Queensland QRA coordinates recovery, provides extensive support to local government, develops systems to support data collection and claim development, conducts training etc.

QRA's observations about South Australia's relief and recovery arrangements included that coordination and governance could be improved, that State Government should be providing more

---

support to local government and that SA lacks systems and training. In their view these factors result in South Australia 'missing out on millions of NDRRA Commonwealth dollars' that the jurisdiction is legitimately entitled to.

According to the SEMP, Annex B (Natural Disaster Relief and Recovery Arrangements) the key roles and responsibilities in South Australia for administering the NDRAA are:

The State Recovery Committee Finance Sub-committee, chaired by DTF is responsible for:

- The collection (from State agencies) and reporting (to Emergency Management Australia) of State Expenditure on Eligible Measures
- Provision of advice on approval requirements for expenditure, and where necessary the seeking of any appropriate approvals.
- Informing the communication between the jurisdiction and the Commonwealth in relation to the NDRRA.
- Overseeing and co-coordinating Cabinet Submissions.

Several agencies contribute to the development of NDRRA claims (e.g. DCSI/State Recovery Office, DPC, PIRSA, and DTF).

During an event, the SRC Finance Sub-committee may co-opt members from key agencies at a senior level.

The responsibilities of DTF include to: act as the primary liaison point for the Commonwealth, State agencies and interstate counterparts regarding NDRRA; notify EMA of an Eligible Event; administer the claim process to the Commonwealth; and, manage all claims for local government assistance on behalf of the Minister for Finance in consultation with the SRC - Local Government Disaster Assistance Sub-committee.

All State government agencies must establish systems and processes to enable expedient and accurate capturing, recording and reporting of NDRRA Eligible Measures.

The NDRRA arrangements described in the SEMP include a list of 'responsible' agencies and governance by committee which again highlights the need for clear lines of accountability and responsibility. Further, there is little evidence of a 'partnership' between councils and local and State government. Whilst DTF have a significant role, it should be more than to act as a 'gate-keeper' for the correct form of application and a processing centre.

The approach to gaining NDRAA funding should be seen as a collective submission by of councils, local and State government agencies to ensure that SA receives all that is legitimately claimable. Vesting this role and the associated responsibilities within an agency committed to emergency management is more likely to obtain improved results than the current arrangements.

An alternative model for Relief and Recovery arrangements is proposed in the final section of this report.

**Recommendation 60.**

Develop a State Relief and Recovery Plan as a distinct part of the State Emergency Management Plan which should include:

- a) potential locations for suitable facilities for relief and recovery centres which: are in locations safe from hazards such as flooding and bushfire; and, have appropriate access and suitable ablutions.
- b) formalisation of roles and capabilities of non-government organisations such as Red Cross.

---

**Recommendation 61.**

Conduct a review into South Australia's arrangements for relief and recovery grant, Local Government Disaster Recovery Assistance Arrangements and Natural Disaster Relief and Recovery Arrangement claims, the review should include governance coordination and criteria for provision and processing of relief/recovery grants

---

## 15. AN ALTERNATIVE MODEL FOR CONSIDERATION

The following is a suggested for an alternative model for emergency management in South Australia. This should be explored to assess its viability and potential to bring about a more cohesive, coordinated, effective and efficient way in which to deal with emergencies (including counter terrorism), thereby meeting all the objects and guiding principles of the *Emergency Management Act 2004*.

There are few positions dedicated to the strategic development of emergency management in SA. The number of positions consolidated in this model assists by offering efficiencies, but any model, even if the status quo is maintained, requires additional positions. This can be achieved by creating new positions, funding positions through grants or, a more collegiate approach might be to second people from other government agencies to the Office to be involved in the various strategic projects, approved by SEMC.

This model, provides the Premier and the State of SA with a more coordinated, governable and strategic approach together with clear accountability for the progress of emergency management. It should provide the impetus to finalise many issues which have been being worked on for years and more effectively progress key elements of emergency management such as resilience and meet the objectives of the SEMP.

It is proposed that two new offices be created within SAFECOM that bring together emergency management, relief and recovery practitioners from across various State government agencies. The two new offices proposed are the South Australian Emergency Management Officer and the State Relief and Recovery Office.

Under this arrangement the SAFECOM Chief Executive would assume responsibility and have accountability for, strategic development of emergency management in South Australia.

### 15.1 South Australian Emergency Management Office

It is proposed that a South Australian Emergency Management Office (SAEMO) be established within SAFECOM.

SAEMO would report to the Chief Executive of SAFECOM, have responsibility for State strategy, policy, training and exercising of emergency management in SA, and provide secretariat support to the EMC and all committees under the SEMP.

Features of the South Australian Emergency Management Office and supporting arrangements include:

1. A suitably qualified Director appointed to lead and manage SAEMO
2. The following positions be brought into SAEMO:
  - a. emergency management positions in DPC (with the exception of Office for Digital Government positions)
  - b. positions within SAFECOM currently working on strategic emergency management projects
  - c. positions relating to Zone Emergency Management currently within SES
  - d. the positions that previously existed, being the State Emergency Management Project Officer and State Emergency Management Training Officer be re-established and appointed within SAEMO
  - e. grant and/or new and/or seconded (people from other agencies) positions to work on the multitude of strategic and policy emergency management issues
3. SAEMO would be responsible for:
  - a. outcomes of all tasks being undertaken by the various State level committees and working groups

- 
- b. development of the SEMP and ensuring that State level plans (those associated with Hazards and Control Agencies) are current and accurate
  - c. implement an Assurance Framework and facilitate the assurance process
  4. The Minister for Emergency Services is responsible for the *Emergency Management Act 2004*
  5. The Premier of South Australia retains the role of Chair of the Emergency Management Council
  6. SAPOL continue to be represented on the Australia-New Zealand Counter Terrorism Committee (ANZCTC) by the Deputy Commissioner
  7. The Chief Executive of SAFECOM represents the Government of SA on the ANZCTC and the ANZEMC in lieu of representatives from DPC
  8. SAPOL provides the second representative to ANZEMC (e.g. Assistant Commissioner of the Security and Emergency Management Service) as the representative of the State Coordinator (Police Commissioner)
  9. The Chief Executive of SAFECOM chairs the State Emergency Management Committee (SEMC)
  10. The SAEMO Director chairs the various Advisory Groups to SEMC

## **15.2 State Relief and Recovery Office**

It is proposed that an alternative model for Relief and Recovery arrangements be considered to increase the effectiveness and efficiency in which emergency relief and recovery in SA is managed and to consolidate arrangements and responsibilities.

It is proposed that a South Relief and Recovery Office (SRRO) be established within SAFECOM. SRRO would report to the Chief Executive of SAFECOM, have responsibility for State strategy, policy, training and exercising of relief and recovery arrangements in SA,

Features of the SRRO and supporting arrangements could include:

1. Appointment of a permanent State Recovery Coordinator (SRC) who is responsible for strategic management and coordination of State Recovery in South Australia and takes on the operational aspect of the SRC role during emergencies (previously the Assistant State Coordinator Recovery)
2. Consolidate SA government Relief and Recovery positions and functions into the SRRO in SAFECOM, including:
  - a. the Manager and staff of the (existing) State Recovery Office who would report to the SRC and be responsible for strategy, policy, planning, training, and support the SRC during operations
  - b. Emergency Relief strategy, policy, planning and training and existing Housing SA positions dedicated to emergency relief
  - c. DCSI would continue to support and contribute to emergency relief and recovery operations
  - d. The responsibility and accountability for coordinating and submitting NDRAA claims would be managed by the SRC and the SRRO
3. The Minister for Emergency Services will be the responsible Minister for the SRRO (as it sits in SAFECOM).
4. Update the *Emergency Management Act 2004*, include:
  - a. the roles and responsibilities of the State Recovery Coordinator

- 
- b. criteria to establish a State level recovery operation and any necessary powers thereby eliminating the requirement for an emergency declaration by the SRC to activate an Assistant State Coordinator (Recovery) (this position and section could then be removed from the Act)
  - c. when the SRC declares an event a State recovery operation, appropriate persons from those government agencies involved can be seconded to the operation for its duration or until their role is complete, this would eliminate the need to appoint additional Local Recovery Coordinators
5. Develop a State Emergency Relief and Recovery plan which describes (amongst other key elements) the various levels of recovery and responsibilities for same to ensure a consistent approach to recovery operations.

SAFECOM would then comprise of four components:

1. function support to the ESS areas of finance, ICT, capability, HR, WHS and PIAW (AlertSA/Emergency Alert/SEICC)(current roles)
2. strategic and policy development for MFS, CFS and SES (current)
3. South Australian Emergency Management Office (new), and
4. State Relief and Recovery Office (new).

**Recommendation 62.**

Explore alternative emergency management models including the alternative model proposed above to establish a South Australian Emergency Management Office and State Relief and Recovery Office within the South Australian Fire and Emergency Services Commission, to ensure that all the objects and guiding principles of the *Emergency Management Act 2004*, and State Emergency Management Plan are addressed efficiently and effectively.

---

---

*'congratulations to all the emergency personnel who  
looked after us so well during the crisis'*

*'THANK YOU. You were awesome in the middle of the chaos  
thanks to all of you because the work you've done made us to be  
safe everywhere we went (in) those days'*

*Submissions to the Review*

---

---

## 16. BIBLIOGRAPHY

- ACMA, n.d. *Emergency calls from mobiles/FAQ*. [Online]  
Available at: <http://www.acma.gov.au/theACMA/calling-the-emergency-call-service-from-a-mobile-phone-faqs>
- AEMC, 2016. *aemc.gov.au*. [Online]  
Available at: <http://www.aemc.gov.au/Markets-Reviews-Advice/Review-of-the-System-Restart-Standard/Final/AEMC-Documents/Fact-Sheet-%E2%80%93-Black-System-Events.aspx>  
[Accessed 13 01 2017].
- AEMO, 2016. *Preliminary Report - South Australian Separation Event 1 December 2016*, s.l.: s.n.
- AEMO, 2016. *Update Report - Black System Event in South Australia on 28 September 2016*, s.l.: s.n.
- AFAC, 2015. *AFAC Independent Operational Audit South Australian Fires of January 2005*, Melbourne: Australian Fire and Emergency Services Authorities Council.
- Allwood, T., 2016. *Review of emergency relief and State Recovery Office response to 28 September to 5 October severe weather event*, Adelaide: DCSI.
- Australian Business Roundtable for Disaster Resilience and Safer Communities, 2013. *Australian Business Roundtable Media Release*. [Online]  
Available at:  
<http://australianbusinessroundtable.com.au/assets/documents/Media%20releases/Media%20Release2.pdf>  
[Accessed 9 Jan 2017].
- Australian Government, BoM, 2016. *Severe thunderstorm and tornado outbreak South Australia 28 September 2016*, South Australia: s.n.
- Australian Red Cross, 2016. *Emergencies Happen: protect what matters most*, Australia: Australian Red Cross.
- Australian Water Environments, 2008. *Floodplain Mapping for the Gawler River Technical Report*, s.l.: Gawler River Floodplain Management Authority.
- Australian Water Environments, 2015. *Gawler River Floodplain Mapping Report*, Eastwood, SA: Gawler River Floodplain Management Authority.
- Australian Water Environments, 2016. *Flood warning classification of stream gauges and other locations*, Adelaide: Department of Environment, Water and Natural Resources.
- Business SA, 2016. *Blackout survey results understanding the effects of South Australia's state wide blackout out on Wednesday 28 September 2016*, Adelaide: Business SA.
- CFS, 2007. *CFS Centre for Lessons Learned - Post 2006-2007 Fire Season Summary*, s.l.: s.n.
- CSIRO and Bureau of Meteorology, 2016. *State of the Climate*, s.l.: Commonwealth of Australia.
- Dawes, S. S., Birkland, T., Tayi, G. K. and Schneider, C. A., 2004. *Information, Technology, and Coordination: Lessons from the World Trade Center Response*, Albany, NY: Center for Technology in Government.
- DCSI, 2016. *Recovery Summary Report - extreme weather event Sept/Oct 2016 number 5*, Adelaide : Department for Communities and Social Inclusion, Government of South Australia.
- Department of Families and Communities, 2005. *Collaboration is the Key - Lessons from the South Australian Government's Recovery Operation Lower Eyre Peninsula Bushfire January 2005*. [Online]  
Available at: [http://www.dcsi.sa.gov.au/\\_data/assets/pdf\\_file/0008/34595/2005-Eyre-Peninsula-Bushfire-Report-Collaboration-is-the-Key-Report.pdf](http://www.dcsi.sa.gov.au/_data/assets/pdf_file/0008/34595/2005-Eyre-Peninsula-Bushfire-Report-Collaboration-is-the-Key-Report.pdf)  
[Accessed 25 October 2016].

---

DEWNR, 2012. *SA Flood Inquiries Taskforce Final Report*, Adelaide: Department of Environment, Water and Natural Resources.

DEWNR, 2015. *Levee Bank Management Issues Paper*, unknown: unknown.

DEWNR, 2016a. *Flood Reform Taskforce Progress Update and Work Plan*, South Australia: s.n.

DEWNR, 2016b. *Flood Hazard Plan*, Adelaide: Government of South Australia.

DSD, 2014. *Energy Support Plan*. Adelaide(SA): Department of State Development.

ElectraNet, 2016 b. *Network Map*. [Online]  
Available at: <https://www.electranet.com.au/what-we-do/solutions/network-map/>  
[Accessed 09 12 2016].

ElectraNet, 2016 c. *About SA Power Networks*. [Online]  
Available at: [http://www.sapowernetworks.com.au/centric/corporate/about\\_sa\\_power\\_networks.jsp](http://www.sapowernetworks.com.au/centric/corporate/about_sa_power_networks.jsp)  
[Accessed 09 12 2016].

ElectraNet, 2016. *South Australian Energy Transformation RIT-T: Project Specification Consultation Report*, Adelaide: s.n.

Emergency Management Australia, 2013. *Handbook 8 - Lessons Management*, s.l.: Australian Institute for Disaster Resilience.

Emergency Management Victoria, 2015. *EMMV Part 4 - State Emergency Relief and Recovery Plan*, s.l.: s.n.

Government of South Australia, 2016. *Damage Assessment Support Plan*, Adelaide: Government of South Australia.

Haynes, K. et al., 2016. *An analysis of human fatalities from floods in Australia 1900-2015: Report for the Bushfire and Natural Hazards CRC*, s.l.: s.n.

LGA, 2016. *LGA Submission to the review of the extreme weather event South Australia September 2016*, Adelaide: Local Government Authority.

McCarthy, D., Rogers, T. and Casperson, K., 2006. *Floods in South Australia 1836-2005*, ACT: Commonwealth of Australia.

MFS, 2016. *Severe weather event and outage - Post incident analysis of Communications Centre, 28-29 September 2016*, Adelaide: Metropolitan Fire Service.

Noetic, 2005. *Project Phoenix*, Deakin West ACT: Noetic Solutions Pty. Ltd.

Noetic, 2016. *South Australian Country Fire Service Project Pinery*, Deakin West ACT: Noetic Solutions Pty. Ltd.

Queensland Floods Commission of Inquiry, 2012. *Queensland Floods Commission of Inquiry Final Report*, Brisbane: Queensland Floods Commission of Inquiry 2012.

Rawtec, 2015. *Disaster Waste Management Scoping Study Final Report*, Adelaide: Zero Waste, Government of South Australia.

SA Government, 2014. *Common Incident Management Framework Control Agency Agreement*, Adelaide: s.n.

SA Government, 2016. *SEMP part 3 - Annex C - Public Information and Warnings*, Adelaide: Government of South Australia.

SA Government, 2016. *South Australian Emergency Management Workforce Mapping Project*, Adelaide: s.n.

SA Government, 2016. *State Emergency Management Plan*. Adelaide: Government of South Australia.

SA Government, 2016. *State Emergency Management Plan*, s.l.: SA Government.

---

SASES, 2016. *submssion*, Adelaide: South Australian State Emergency Service.

Thomason, M., 2015. *Major themes identified from 2014-15 fire season*, Adelaide: SA Country Fire Service.

Tonkin Consulting, 2016. *Flood Risk Evaluation of Catchments - Summary Report*, Adelaide: Department of Environment, Water and Natural Resources.

University of South Australia, 2016. *Dam safety issues and the case for regulation in South Australia: a discussion paper*, Adelaide: University of South Australia.

Wikipedia, 2016. *List of Major Power Outages*. [Online]

Available at: [https://en.wikipedia.org/wiki/List\\_of\\_major\\_power\\_outages#2010.E2.80.932016](https://en.wikipedia.org/wiki/List_of_major_power_outages#2010.E2.80.932016)

[Accessed 09 12 2016].

---

## 17. ADDITIONAL REPORTS ALSO CONSIDERED

ACT Government, (2014). *Australian Capital Territory, Emergencies (Emergency Plan) 2014 (No 1), 29 August 2014* [Online] Available at: <http://www.legislation.act.gov.au/ni/2014-442/current/pdf/2014-442.pdf>

AEMO, (2016). *Load Shedding in South Australia on Sunday 1 November 2015, An AEMO Power System Operating Incident Report for the National Electricity Market*, [Online] Available at: <https://www.aemo.com.au/media/Load%20shedding%20in%20South%20Australia%20on%20Sunday%201%20November%202015.pdf>

AEMO, (2016). *MEDIA STATEMENT— Update as at 1030hrs AEST, Thursday 29 September 2016*, [Online] Available at: <https://www.aemo.com.au/Media-Centre/-/media/48B2B5FCF5724C5F8F3ABB293A7DCBE7.ashx>

AEMO, (2016). *Black System South Australia 28 September 2016 Third Preliminary Report*, [online] Available at: [https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security\\_and\\_Reliability/Reports/Integrated-Third-Report-SA-Black-System-28-September-2016.pdf](https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Reports/Integrated-Third-Report-SA-Black-System-28-September-2016.pdf)

AEMO, (2016). *Preliminary Report - South Australian Separation Event 1 December 2016*, [Online] Available at: [https://www.aemo.com.au/-/media/Files/Media\\_Centre/2016/1-December-SA-separation-report---081216\\_AEMO.pdf](https://www.aemo.com.au/-/media/Files/Media_Centre/2016/1-December-SA-separation-report---081216_AEMO.pdf) [Accessed 6 Jan. 2017].

AEMO, (2016). *Update Report – Black System Event in South Australia on 28 September 2016, An update to the preliminary incident report for the national electricity market. Data analysis as at 5.00 PM Tuesday 11 October 2016*, Published 19 October 2016 [Online] Available at: <https://www.aemo.com.au/Media-Centre/-/media/9027D5FB69294D408E4089249F38A36D.ashx>

AEMO, (2016). *Update to preliminary operating incident report into the South Australian State-wide power outage MEDIA RELEASE* [Online] Available at: <https://www.aemo.com.au/Media-Centre/-/media/9027D5FB69294D408E4089249F38A36D.ashx>

AFAC, (2013). *Conducting AFAC Independent Operational Audits Guideline Version 1.0 October 2013*

AFAC, (2014). *What is Operational Success for Fire and Emergency Services? Discussion Paper*.

Attorney-General's Department (2011). *Community Recovery Handbook 2011* [Online] Available at: <https://aidr.infoservices.com.au/collections/handbook>

Attorney-General's Department, (2010). *NATCATDISPLAN National Catastrophic Natural Disaster Plan*, [Online] Available at: <https://www.ag.gov.au/EmergencyManagement/Documents/NationalStrategyforDisasterResilience.PDF>

Attorney-General's Department, (2013). *National Strategy for Disaster Resilience Community Engagement Framework Handbook 6*, [Online] Available at: <https://www.emknowledge.org.au/resource/4785/Manuals-Handbooks/2013/Community-Engagement-Framework-Australian-Emergency-Management-Handbook-6>

Australian Government, (2014). *COMDISPLAN 2014 Australian Government Disaster Response Plan, 2014*

Australian Government, (2014). *COMDISPLAN 2014, Arrangements for Interstate Assistance (Fire and Emergency Services)*

Australian Government, (2015). *Crisis Management Framework*

Bushfire and Natural Hazards CRC, (2016). *Discussion Paper Learning for Emergency Services Looking for a new approach* [Online] Available at: <http://www.bnhcrc.com.au/publications/biblio/bnh-3054>

---

City of Melbourne, (2015). *Melbourne CBD Safety Plan* [Online] Available at: <http://www.melbourne.vic.gov.au/community/safety-emergency/emergency-management/Pages/Melbourne-CBD-Safety-Plan.aspx>

COAG, (2011). *National Strategy for Disaster Resilience: Building our nation's resilience to disasters*, [Online] Available at: <https://www.ag.gov.au/EmergencyManagement/Documents/NationalStrategyforDisasterResilience.PDF>

COAG, (2011). *National Strategy for Disaster Resilience*, [Online] Available at: <https://www.coag.gov.au/sites/default/files/communique/2011-13-02.pdf>

Disaster Resilient Australia, (2011). *National Strategy for Disaster Resilience: Communications Strategy for 2011-2021*

Disaster Resilient Australia, (2014). *National Strategy for Disaster Resilience South Australia Communication Plan*

Disaster Resilient Australia, (2015). *National Strategy for Disaster Resilience: Implementation Review Progress to Date*, [Online] Available at: <https://www.oem.wa.gov.au/resources/reports-and-reviews>

Disaster Resilient Australia, (2015). *National Strategy for Disaster Resilience: Implementation Review Priority areas for action* [Online] Available at: <https://www.oem.wa.gov.au/resources/reports-and-reviews>

ElectraNet, (2016). *South Australian Energy Transformation RIT-T: Project Specification Consultation Report 7 November 2016* [Online] Available at: <https://www.electranet.com.au/wp-content/uploads/resource/2016/11/20161107-Report-SouthAustralianEnergyTransformationPSCR-1.pdf>

Emergency Management Victoria (2016). *Emergency Management Operational Review 2015-16*

Emergency Management Victoria, (2016). *Emergency Management Manual Victoria*, [Online] Available at <https://www.emv.vic.gov.au/policies/emmv>

Government of New South Wales, (2012). *New South Wales State Emergency Management Plan (EMPLAN)*, [Online] Available at: [https://www.emergency.nsw.gov.au/media/admin/262/\\_/7a9tjyhcxjh44kw8c8/EMPLAN\\_20121201.pdf](https://www.emergency.nsw.gov.au/media/admin/262/_/7a9tjyhcxjh44kw8c8/EMPLAN_20121201.pdf)

Government of South Australia (2014). *Common Incident Management Framework Control Agency Framework*

Government of South Australia (2014). *Energy Support Plan*

Government of Western Australia, (2015). *State Emergency Management Committee (SEMC) Western Australia Emergency Preparedness Report 2015* [Online] Available at: <https://www.semc.wa.gov.au/publications/emergency-preparedness-reports>

Government of Western Australia, (2016). *Reframing Rural Fire Management: Report of the Special Inquiry into the January 2016 Waroona Fire: Volume 1 Report* [Online] Available at: <https://publicsector.wa.gov.au/waroona-bushfire-special-inquiry>

Government of Western Australia, (2016). *Reframing Rural Fire Management: Report of the Special Inquiry into the January 2016 Waroona Fire: Volume 2 Appendices* [Online] Available at: <https://publicsector.wa.gov.au/waroona-bushfire-special-inquiry>

Government of Western Australia, (2016). *State Emergency Management A Strategic Framework for Emergency Management in Western Australia* [Online] Available at: <https://www.semc.wa.gov.au/Pages/State-EM-Plan.aspx>

New Zealand Fire Service, (2012). *Independent Review Christchurch Earthquake* [Online] Available at <http://www.fire.org.nz/Documents/review/Independent%20Review%20-%20final%20report%20Oct%202012.pdf>

---

Northern Territory Government, (2016). *Territory Emergency Plan* [Online] Available at: <http://www.pfes.nt.gov.au/~media/Files/Emergency/Volunteer-Portal/Administration/Territory%20Emergency%20Plan%20Approved%20Feb%202016.ashx>

NYC Emergency Management (2015). *The Path Forward: A Roadmap for NYC Emergency Management*, [Online] Available at: [https://www1.nyc.gov/assets/em/downloads/pdf/nycem\\_biennial\\_2015.pdf](https://www1.nyc.gov/assets/em/downloads/pdf/nycem_biennial_2015.pdf)

Productivity Commission, (2014). *Natural Disaster Funding Arrangements Productivity Commission Inquiry Report Volume 1*, [Online] Available at: <http://www.pc.gov.au/inquiries/completed/disaster-funding/report>

Productivity Commission, (2014). *Natural Disaster Funding Arrangements Productivity Commission Inquiry Report Volume 2 Supplement* [Online] Available at: <http://www.pc.gov.au/inquiries/completed/disaster-funding/report>

Queensland Floods Commission of Inquiry, (2012). *Queensland Floods Commission of Inquiry Final Report* [Online] Available at: <http://www.floodcommission.qld.gov.au/publications/final-report/>

Queensland Government Inspector-General Emergency Management, (2014). *Emergency Management Assurance Framework*, <https://www.igem.qld.gov.au/assurance-framework/PublishingImages/IGEM-EMAF-Table.jpg>

Queensland Government, (2015). *Queensland State Disaster Management Plan* [Online] Available at: [http://www.disaster.qld.gov.au/Disaster-Resources/Documents/State-Disaster-Management-Plan\\_WEB.pdf](http://www.disaster.qld.gov.au/Disaster-Resources/Documents/State-Disaster-Management-Plan_WEB.pdf)

Queensland Reconstruction Authority, (2016). *Queensland Reconstruction Authority Annual Report 2015-16* [Online] Available at: <http://qldreconstruction.org.au/publications-guides/reports/annual-reports>

Tasmanian Government (2013) *2013 Tasmanian Bushfires Inquiry*, [Online] Available at : [http://www.dpac.tas.gov.au/divisions/osem/2013\\_tasmanian\\_bushfires\\_inquiry\\_report](http://www.dpac.tas.gov.au/divisions/osem/2013_tasmanian_bushfires_inquiry_report)

Tasmanian Government, (2015). *Tasmanian Emergency Management Plan Issue 8 (TEMP)*, [Online] Available at: <http://www.ses.tas.gov.au/h/em/publications/temp>

The Senate Environment and Communications References Committee, (2013). *Recent trends in and preparedness for extreme weather events* [Online] Available at: [http://www.aph.gov.au/Parliamentary\\_Business/Committees/Senate/Environment\\_and\\_Communications/Completed\\_inquiries/2010-13/extremeweather/report/index](http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Environment_and_Communications/Completed_inquiries/2010-13/extremeweather/report/index)

Victorian Government, (2011). *Review of the 2010-11 Flood Warnings and Response* [Online] Available at: <http://www.floodsreview.vic.gov.au/about-the-review/final-report.html>

## Legislation

*Australian Capital Territory Emergencies Act 2004*, Republication no 26 Effective 21 June 2016 [Online] Available at: <http://www.legislation.act.gov.au/a/2004-28/current/pdf/2004-28.pdf>

*Emergency Management Act 1986 (Victoria)*, [Online] Available at <http://www.legislation.vic.gov.au>

*Emergency Management Act 2004 (SA)* [Online] Available at: <https://www.legislation.sa.gov.au/LZ/C/A/EMERGENCY%20MANAGEMENT%20ACT%202004/2009.06.24/2004.30.UN.PDF>

*Emergency Management Act 2006 (Tasmania)*, [Online] Available at: [http://www.thelaw.tas.gov.au/tocview/index.w3p;cond=;doc\\_id=12%2B%2B2006%2BAT%40EN%2BSESSIONAL;histon=;pdfauthverid=;prompt=;rec=;rfauthverid=;term=;webauthverid](http://www.thelaw.tas.gov.au/tocview/index.w3p;cond=;doc_id=12%2B%2B2006%2BAT%40EN%2BSESSIONAL;histon=;pdfauthverid=;prompt=;rec=;rfauthverid=;term=;webauthverid)

---

*Fire and Emergency Services Act 2005 (SA)* [Online] Available at:  
<https://www.legislation.sa.gov.au/LZ/C/A/Fire%20and%20Emergency%20Services%20Act%202005.aspx>

*Natural Resources Management Act 2004 (SA)* [Online] Available at:  
<https://www.legislation.sa.gov.au/LZ/C/A/Natural%20Resources%20Management%20Act%202004.aspx>

*Queensland Disaster Management Act 2003*, current as at 1 July 2016, [Online] Available at:  
<https://www.legislation.qld.gov.au/LEGISLTN/CURRENT/D/DisastManA03.pdf>

*Development Act 1993 (SA)* [Online] Available at  
<https://www.legislation.sa.gov.au/LZ/C/A/DEVELOPMENT%20ACT%201993/CURRENT/1993.55.UN.PDF>

*Telecommunications Act 1997*, [Online] Available at:  
<https://www.legislation.gov.au/Details/C2013C00056>

*Western Australia Emergency Management Act 2005*, 21 September 2016 [Online] Available at:  
[https://www.slp.wa.gov.au/pco/prod/FileStore.nsf/Documents/MRDocument:29176P/\\$FILE/Emergency%20Management%20Act%202005%20-%20\[00-h0-01\].pdf?OpenElement](https://www.slp.wa.gov.au/pco/prod/FileStore.nsf/Documents/MRDocument:29176P/$FILE/Emergency%20Management%20Act%202005%20-%20[00-h0-01].pdf?OpenElement)

---

## **18. ATTACHMENTS**

**Attachment 1 – SA Health Flinders Medical Centre Standby Power Electrical Systems Post-incident Review, AURECON**

**Attachment 2 – Port Augusta Generator Failure Investigation Report, Systems Solutions Engineering**

**Attachment 3 – Australian Government, Bureau of Meteorology, Severe thunderstorm and tornado outbreak South Australia 28 September 2016**

**Attachment 4 – Submission to Independent Review of the Extreme Weather Event South Australia 28 September – Dennis Mulronev and Peter Schar**



Government  
of South Australia

The Hon. Jack Snelling M.P.

15 November, 2016

Mr G. Burns  
Independent Review into  
Extreme Weather Event

c/- Ms R. Ambler  
Executive Director, Cabinet Office  
Department of the Premier and Cabinet  
G.P.O. Box 2343  
ADELAIDE S.A. 5000

Dear Mr Burns

I write to as part of the independent review you are leading into the extreme weather event experienced by South Australia from 28 September to 5 October, 2016.

As you may be aware, on 28 September, 2016, the Flinders Medical Centre (F.M.C.) lost normal power supply and operated on its standby power systems for over three hours. After one hour and 45 minutes, there was a failure of one of the five generators for the site, causing loss of emergency power to a number of areas for one and a half hours, until the main power was restored to the site. I was advised this resulted in activation of F.M.C.'s business continuity plan to ensure continuity of care for patients.

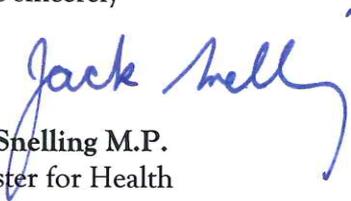
Following this incident, SA Health commissioned Aurecon, a Professional Service Contractor (Engineering), to undertake a comprehensive and independent post-incident review of the performance of the F.M.C. emergency stand-by power system.

I received the report today, and am now referring to you to consider as part of the broader independent review you are undertaking.

I have made an undertaking that the report will be made public. I therefore request that you release the report at the same time as you release the recommendations of your broader review.

Please contact Ms Cat Blaikie, Senior Ministerial Adviser in my office at [catherine.blaikie@sa.gov.au](mailto:catherine.blaikie@sa.gov.au) or by telephone on 8463 6285, if you would like further information.

Yours sincerely

  
Jack Snelling M.P.  
Minister for Health

encl. Flinders Medical Centre Standby Power Electrical Systems Post-incident Review – SA Health





**aurecon**

**Flinders Medical Centre  
Standby Power Electrical Systems  
Post-incident Review  
SA Health**

**1 November 2016  
Revision: 2  
Reference: 253946**

*Bringing ideas  
to life*



# Document control record

Document prepared by:

**Aurecon Australasia Pty Ltd**  
ABN 54 005 139 873  
Level 10, 55 Grenfell Street  
Adelaide SA 5000  
Australia

**T** +61 8 8237 9777  
**F** +61 8 8237 9778  
**E** adelaide@aurecongroup.com  
**W** aurecongroup.com

- A person using Aurecon documents or data accepts the risk of:
- a) Using the documents or data in electronic form without requesting and checking them for accuracy against the original hard copy version.
  - b) Using the documents or data for any purpose not agreed to in writing by Aurecon.

Document control						aurecon	
<b>Report title</b>		Standby Power Electrical Systems Post-incident Review					
<b>Document ID</b>			<b>Project number</b>		253946		
<b>File path</b>		Document2					
<b>Client</b>		SA Health					
<b>Client contact</b>			<b>Client reference</b>				
Rev	Date	Revision details/status	Author	Reviewer	Verifier (if required)	Approver	
0	26 October 2016	Draft for client review	SJW/JC	JC/AJ/JWC	AJ	JT	
1	31 October 2016	Final Draft	SJW/JC	JC/AJ/JWC	AJ	JT	
2	1 November	Final	SJW/JC	JC/AJ/JWC	AJ	JT	
<b>Current revision</b>		<b>2</b>					

Approval			
<b>Author signature</b>		<b>Approver signature</b>	
<b>Name</b>	Simon Williams	<b>Name</b>	James Trezona
<b>Title</b>	Technical Director	<b>Title</b>	Project Director



# Contents

<b>1</b>	<b>Executive summary</b>	<b>1</b>
<b>2</b>	<b>Purpose and scope of review</b>	<b>3</b>
2.1	Project brief	3
2.2	Scope of investigations carried out	5
<b>3</b>	<b>The appropriateness of the architecture of the existing standby power system network</b>	<b>6</b>
3.1	Flinders Medical Centre context	6
3.2	FMC emergency power systems	8
3.3	Current hospital standards	11
3.4	Conclusion	13
<b>4</b>	<b>Standby power system network components condition, plant reliability and performance assessment</b>	<b>14</b>
<b>5</b>	<b>Events of 28 September 2016</b>	<b>15</b>
5.1	Sequence of events	15
5.2	Analysis of the failure	16
<b>6</b>	<b>Other risks identified</b>	<b>19</b>
<b>7</b>	<b>Conclusion and Recommendations</b>	<b>21</b>

## Appendices

### Appendix A

System summary

### Appendix B

Things you should know about this report

### Appendix C

FMC site diagram

## Tables

Table 1	Review of relevant standards	11
Table 2	Summary of recommendations	21
Table 3	System summary	25



# 1 Executive summary

Aurecon has been commissioned by SA Health to carry out an independent post-incident review of the performance of Flinders Medical Centre (FMC) emergency standby power systems following the state-wide electrical outages experienced on Wednesday 28 September 2016.

During this outage, FMC lost normal supply and operated on its standby power systems for over three hours. However, after one hour 45 minutes, there was a failure of one of the five generators for the site, causing loss of emergency power to a number of areas for one and a half hours, until the main power was restored to the site.

The direct cause of this loss of standby power was related to the failure of the diesel fuel system of one generator, most likely caused by human error in wrongly leaving a control switch off, but with contributing cause related to the lack of alarms to notify maintenance staff of an impending shutdown due to a low fuel situation. To restart the generator, fuel needed to be added to the day tank, but once the generator shut down, power was not available to operate the fuel pumps. Although maintenance staff attempted to improvise solutions during the event, this was hampered by overall conditions and lack of equipment for such a situation.

Recommendations to upgrade technical and administrative systems to mitigate the risk of this reoccurring have been made in the body of the report and summarized in the conclusion, and we have seen that some are already in progress.

Measures have been identified that will improve the ability of maintenance staff to respond to future emergency power loss events.

As part of this review, the overall main power system's reliability, in design, condition, maintenance and operation has also been assessed.

In Aurecon's opinion, the FMC main emergency standby power system's design meets the requirements of the relevant standards detailed in this report, and is comparable to equivalent hospitals of a similar age in Australia.

It is noted that over the last 10 years, several major projects renewed and improved the power supply infrastructure at FMC. As has been occurring over the life of the FMC, including the current Transforming Health programme, any new developments or refurbishment of elements of the infrastructure or areas of the hospital should consider opportunities to further increase system redundancy and reliability.

The emergency standby power system's network is largely in good condition, operational and reliable. Those parts of the system that have not been upgraded in the last 10 years will need to be reviewed and plans put in place to renew.

The review has identified some other improvements that, although not related to the events of 28 September 2016, would further mitigate the risk of power failures.

During the review, we also formed a view on the general performance and capability of the FMC maintenance staff. The key staff have many years of experience on the site and strong knowledge and



commitment to the hospital's operations, and are capable of reliably providing power supply to the facility.

It should be emphasised that the highlighting in this review of possible risks has been in the spirit of learning from failures to improve capability and future performance, and that overall FMC has a robust contemporary emergency electrical system.



## 2 Purpose and scope of review

### 2.1 Project brief

The following brief was provided by SA Health to Aurecon for this review:

#### **Project overview**

A comprehensive and independent post-incident review of the performance of Flinders Medical Centre (FMC) emergency standby power systems, processes and controls (both planned and actual), following the state-wide electrical outages experienced on Wednesday 28 September 2016.

#### **Project purpose**

To ensure we understand the causes of any emergency standby power electrical system failures at FMC in order to identify any improvements that can be made, and to reassure clinicians and the community that FMC has a robust contemporary emergency electrical system.

*'Learn from failures to improve capability and future performance'*

#### **Project background**

The recent total state-wide loss of power incident had a significant impact on SA Health service sites and presented associated extreme risks.

The post-incident review is structured around the SA Government Common Incident Management Framework, which identifies 10 agreed functions and responsibilities of incident management, including:

- **Command and control** – Control of the response to the emergency including incident command centre and incident management teams
- **Safety** – Ensure a safe working environment and safe systems of work
- **Communication** – Ensure effective liaison, communication and cooperation with all involved
- **Intelligence** – Continually assess the situation, identify risks and share information with all involved
- **Planning** – Develop and share plans and strategies that meet the requirements of all persons and agencies responding to the emergency (Incident Action Plan)
- **Operations** – Implement and monitor an Incident Action Plan
- **Logistics** – Ensure the effective allocation and use of available resources
- **Public information** – Ensure the public is adequately informed and warned so as to enhance community resilience
- **Investigation** – Facilitate the investigation of the emergency and review of response activities
- **Recovery** – Ensure transition from response to recovery, including the coordinated handover to the state recovery arrangements



## **Project objectives**

A robust Root Cause Analysis investigation and report of the emergency power system failures at Flinders Medical Centre that identifies:

- What actually happened
- What issues were identified
- What will we do to make it better

## **Project scope**

This review will include consideration of:

- The appropriateness of the architecture of the existing standby power system network relative to contemporary health industry best practice
- Standby power system network components condition, plant reliability and performance assessment
- Identification and description of any failure incidents identified, including photographic depiction
- The site's response to the failure incident
- Root cause analysis of any failure incident
- Identification of contributing factors to the failure incident
  - Physical
    - System and plant design including (BMS and controls)
    - Failure of plant and equipment, including ancillary systems to generator manufacturer's requirements
      - Airside including system pressure drop
      - Generator exhaust
      - Bulk fuel system including fuel quality, polishing (if provided)
    - Main emergency power distribution systems up to local distribution boards
  - Organisational
    - Availability of accurate and as installed/as built records
    - Operating systems and testing processes
    - Maintenance activities including frequency and constraints
    - Training
  - Individual factors
- Identify key single points of failure and determine mitigating/remediation strategies related to the identified causes of the failure incident
- Report any other significant risks related to standby power that may be identified by stakeholders during the investigation
- A review of the testing regime for generators
- Recommendations and, where appropriate, estimated cost of implementation for future action

## **Personnel involved**

- SA Health Infrastructure

- 
- SA Local Hospital Network (SALHN) Strategic Asset Manager
  - SALHN Risk Manager
  - Facilities Management (FM) Contractor (Spotless)
  - DPTI - Subject Matter Expert

**Project timeframe**

Priority deliverable (3 weeks)

## 2.2 Scope of investigations carried out

The investigations carried out in preparation of this report included:

- Review of documentation describing the FMC emergency power systems (documents provided by SA Health by means of portable hard disk download from the hospitals documentation system – 5 GB of data, 5000 files), and including system single line diagrams, switchboard shop drawings, generator, Automatic Transfer System (ATS) and other ancillary equipment operating and maintenance manuals, fuel system documentation, BMS, alarm and associated communications systems documentation.
- Review of maintenance records, covering the last annual service and recent monthly services, including generator, fuel systems, electrical main switchboards and ATS, and general electrical maintenance – all documents provided by SA Health.
- Interviews with SA Health staff and contractors, including Strategic Asset Manager, FM Contractor (review of report provided from earlier meeting), FMC COO.
- Site investigation of key items of plant, and areas identified from the documentation and interviews that may represent causes for the incidents, or risks to future operations. This included three separate site visits and involved physical inspection of all generators and all essential power main switchboards. Given the time available, we were not able to comprehensively audit the site to confirm accuracy of all documentation provided, or confirm all information provided from interviews. However, enough information was collected to confidently present the contents of this report. Where there may be risk or doubt, we have recommended further investigations. Site investigations were limited to visual, non-invasive inspections, without specific testing or commissioning activities.
- The investigation focused on the specific incidents identified from the 28 September events, to identify causes and strategies for mitigation and remediation. Where other risks to security of overall power supply to the FMC were identified incidental to our investigations, which were not related to the specific incident (including those raised from stakeholder interviews), these have been addressed as far as possible within the report.
- The investigation and report focuses on the overall power supply to the FMC, and does not consider in detail local application of emergency power to specific areas and equipment within the facility, and is therefore not necessarily a comprehensive coverage of all possible risks to power supply reliability at all areas of FMC.

Note that this report relies on information provided, and will necessarily be limited by the time available. Refer also to notes in Appendix B.



## 3 The appropriateness of the architecture of the existing standby power system network

### 3.1 Flinders Medical Centre context

Flinders Medical Centre (FMC), an approximately 593 bed specialist referral public teaching hospital in Adelaide, South Australia, is part of the Southern Adelaide Local Health Network, and is situated in the Adelaide foothills approximately 12 kilometres from the city centre.

Since opening in 1976, FMC has earned an international reputation as one of Australia's finest public teaching hospitals and as a centre for research excellence.

The hospital is collocated with the Flinders University School of Medicine, the Flinders Centre for Innovation in Cancer (FCIC) and the approximate 130 bed Flinders Private Hospital. (The FCIC and Flinders Private Hospital facilities are not included in this review as their power infrastructure is separate from the FMC). FMC has close links with other health providers in southern Adelaide.

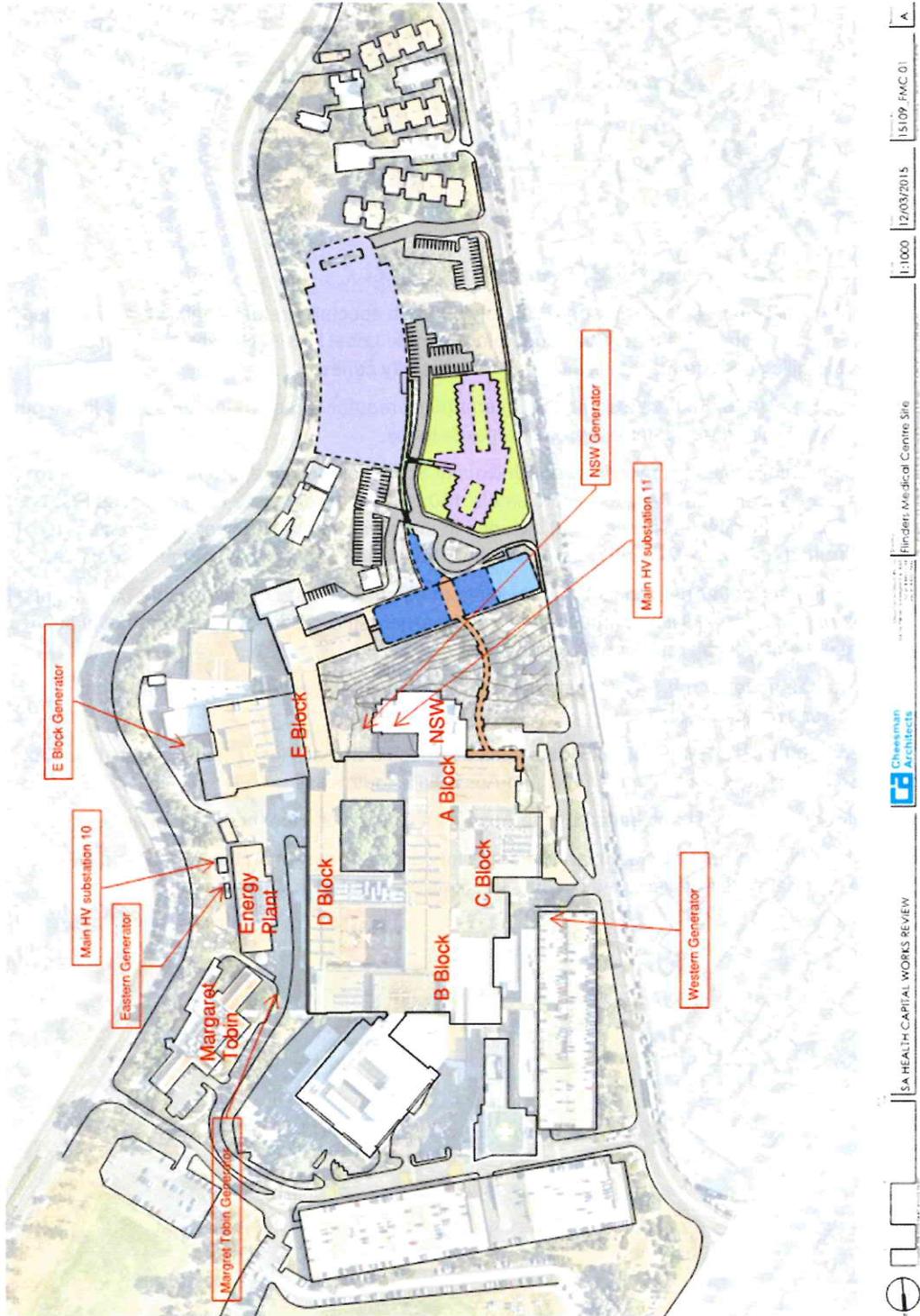
FMC is unique in South Australia (SA) in providing an extensive range of services for patients of all ages. It is one of two major trauma centres in SA. An around-the-clock emergency retrieval service brings patients to FMC by road or helicopter.

FMC is also the base for the South Australian Eye Bank and the South Australian and Northern Territory Liver Transplant Unit.

More than 3500 skilled FMC staff provide services to people across Australia, from Darwin in the Northern Territory to Mount Gambier in South Australia's south east.

Flinders Medical Centre is accredited by the Australian Council on Healthcare Standards.

Refer to the site plan below for an overview of the key areas discussed in this report, and to Appendix C for a more detailed view of what functions are located in which areas:



FMC site plan



## 3.2 FMC emergency power systems

The power infrastructure at FMC provides three main levels of power supply. Refer to diagram below for a simplified view of the system. Detailed technical drawings and reports are available for further review if required.

- Primary High Voltage (HV) – this is a dedicated SA Power Networks (SAPN) 11 kV underground feeder from Seacombe substation. This supply and associated substation within FMC were constructed in 2008/9.
- Backup HV – this is a shared SAPN 11 kV feeder from Tonsley Park substation. It has available capacity to support full operation of FMC. The incoming feeder cables were replaced in 2000, and the associated substation within FMC was constructed in 2008/9. The FMC power system is arranged to automatically switch from the primary to the backup HV supply on loss of the primary supply.
- Generators. There are 5 generators at FMC (plus one for FCIC). Generators supply essential circuits only, consequently, when operating on generator there is some impact on hospital operations:
  - “Eastern” (or “main”) generator supplies emergency power to the majority of the hospital. The essential supply is derived from Transformer 1 if it has power, or from the generator, and distributed to back up the main supply serving blocks A, B, C (except theatres), D, E (except certain critical engineering plant). Located externally adjacent to the main plant building and installed in 2008/9.
  - “Western” generator supplies emergency power to the operating theatres, Post-anaesthesia Care Unit (PACU) and associated areas in C block. Located on the roof of the car park and installed in 2010.
  - “E Block” generator supplies emergency power to certain engineering services including critical water supply plant, and has capacity and provisions in place for future backup supply to other areas. Located externally adjacent to E block and installed in 2006.
  - “New South Wing” generator supplies emergency power to this new wing (Women’s health). Located externally and installed 2008/9.
  - “Margaret Tobin” generator supplies emergency power to the mental health facility, installed outside the facility in 2005.
  - A new generator is planned as part of the current Transforming Health project to supply emergency power to the new Rehabilitation and Older Persons Mental Health facilities.

These main power sources are connected to different areas of FMC as shown on the diagram.

As a fourth level of backup, should there be a local failure of power, or general failure of all the first three levels, then local emergency provisions localised throughout the facility are also available, including:

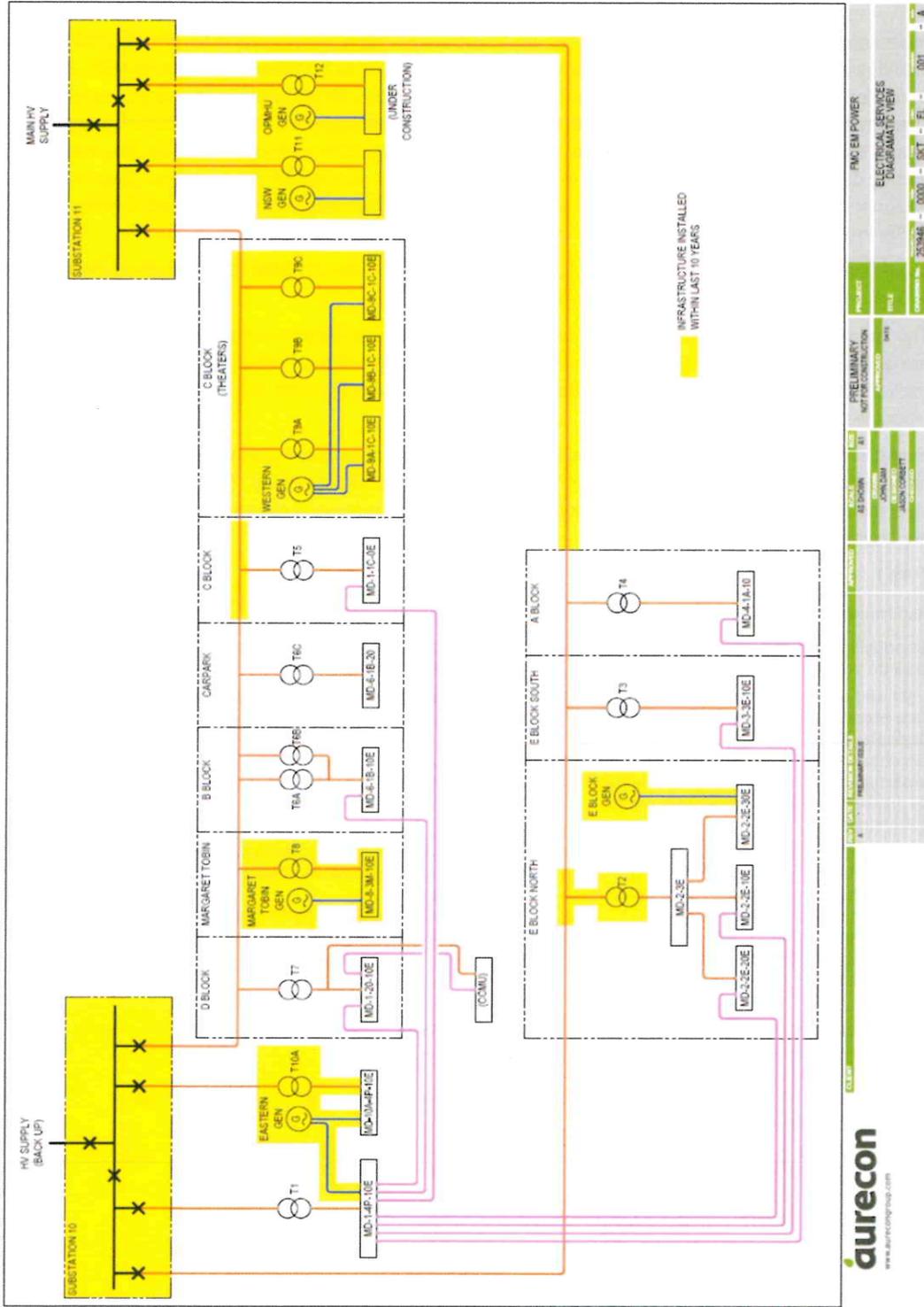
- Battery-backed emergency lighting
- Battery-backed medical equipment
- UPS systems including for the operating theatres, and areas of ED and ICU

The connection of the internal HV network to 11 substations with switchgear and transformers supplying different blocks of the facility is mainly via a flexible arrangement of ring mains as shown in the diagram below. This can be configured in a variety of ways to allow potential supply to local substations from two different HV sources or different feeder pathways. This reduces the risk of local faults or maintenance activities on the HV system affecting power supply to particular areas. It is



normally configured with supply from the primary HV network supplying approximately half of the FMC through one feeder network, and half through another.

The connection and switching between normal and essential power supplies to various areas of FMC is at essential main distribution boards (MD) at each substation.



FMC emergency power systems (simplified)

### 3.3 Current hospital standards

Australasian Health Facility Guidelines (AHFG) Part E – Building Services and Environmental Design provides a preliminary overview of engineering services issues to be taken into consideration in the design of health facilities. Technical performance specifications for engineering services are provided in additional reference documents published on the AHFG website, and includes reference to NSW Health Engineering Services Guidelines GL2016\_020 26-Aug-2016 and Western Australia Health Facility Guidelines for Engineering Services 2006. In addition, SA Health requires that planners and designers for South Australian facilities should use the Victorian Department of Health Design Guidelines as the primary reference for technical performance specification.

These standards all reference the key Australian Standard “AS/NZS 3009:1998 Electrical Installations – Emergency power supplies in hospitals”.

The key recommendations in these referenced documents with regard to emergency power systems are generally consistent and are summarised below, with an outline of the current status of the relevant facilities at FMC. (Recommendations in Table 1 below are from the Victorian Standard unless otherwise noted).

In addition, these standards provide recommendations on which specific services in the facility should be supplied with emergency power from generators, or from UPS supplies. The decisions to be made from these recommendations require consultation with end users and clinical risk assessments and are beyond the scope of this report.

Table 1 Review of relevant standards

Recommendation in referenced standards	Current FMC provisions
Standby lighting and power systems to AS 3009 shall be provided in critical care areas.	Standby lighting and power systems are provided throughout the hospital.
Light and general purpose power outlets in critical care areas shall have dedicated submains originating from the main switchboard. The switchboard and submains shall be configured to ensure continuous availability of electrical supply by means of an essential section on the switchboard.	Separate essential and non-essential submains and distribution boards are provided.
Two dedicated submains circuits shall be provided for each critical care area. At least one of the circuits shall be connected to the emergency generator supply where installed. Critical care submains cables are not required to be fire rated. Protection against mechanical damage shall be provided.	Separate essential (generator backed up) and non-essential submains and distribution boards are provided. Submains are generally fire rated, and are mechanically protected.
The following factors shall be considered when dual high voltage electrical supplies are to be used without providing emergency generators:	As follows.
Do high voltage supply feeders originate from two independent network circuits?	Yes, from Tonsley and Seacombe substations.
Are high voltage supply feeders reticulated through two separate geographical routes?	Yes, within the site (SAPN infrastructure not reviewed as part of this report).
Does the standby feeder have full capacity available all the time?	Yes.
Are the high voltage supply feeders reticulated overhead or underground?	Underground.
Is an automatic bus tie permitted by the Supply Authority?	Yes. Arrangements are in place for automatic changeover of alternate supplies, and for reconfiguration of



Recommendation in referenced standards	Current FMC provisions
	internal HV reticulation to overcome local faults.
Are either of the HV feeders likely to be interrupted due to weather conditions, vehicle crashes or vandalism?	SAPN infrastructure not reviewed as part of this report, but it would appear that the local HV supply from the SAPN substation is underground and well protected.
Emergency generators are recommended to be installed to ensure continuity of essential electrical supply in critical areas, when suitable dual supply high voltage feeders are generally not available.	Generators provided, even though suitable dual high voltage feeders are available.
Where the facility has a post disaster function or requires chilled water/cooling services for sustaining human life or critical service, this shall be achieved by providing sufficient electrical generation capacity to start and run chillers, chilled water pumps, critical air conditioning necessary for the continued operation of all critical areas and services.	Separate air conditioning plants for theatres 1 to 8, 10 and 12, PACU, procedure room and Day of Surgery Admission (DOSA) are provided and are on generator supply.
For hospitals where life-sustaining procedures are undertaken and no emergency generator is installed, a quick connection facility is recommended to be provided enabling connection of a mobile generator to the essential (emergency) section of the main switchboard	Connections for temporary generators are possible. Some provisions could be improved to make this easier to achieve – see recommendations in section 6 below.
Regardless of whether the hospital has permanent diesel generating plant installed, provision of a quick connection facility (i.e. 'power lock' connection or busbar cable connection facility) for linking the loads identified under standby power to a temporary (mobile) generator set should be considered (NSW Guideline).	Connections for temporary generators are possible. Some provisions could be improved to make this easier to achieve – see recommendations in section 6 below.
A minimum of 24 hours of fuel storage capacity at full load is required. Larger storage capacity may be provided based on justifiable clinical needs or local factors (NSW guideline).	Yes – refer to information in 5.2.1 below.
Western Australia Health Facility Guidelines for Engineering Services 2006 has, for hospitals that will continue to offer invasive surgery or emergency medical services during failure of normal utility services, options for electricity supply arrangements, including a 2 x 100% capacity normal supply and a 1 x 100% of essential supply.	FMC electrical system supply arrangement is a 2 x 100% capacity normal supply and a 1 x 100% of essential supply, with the two separate HV supplies each able to supply the whole facility, and the generator systems able to supply all the emergency circuits.



### 3.4 Conclusion

The FMC main emergency power systems' architecture in Aurecon's opinion meets the requirements of the relevant standards including AS3009, and is comparable to equivalent hospitals in Australia of a similar age.

Major teaching/emergency hospitals recently constructed have adopted some different overall architecture, with multiple parallel high voltage generator sets in an n+1 redundant arrangement, dual supplies to critical areas with local ATS and load shedding. This has some technical reliability advantages, but is only possible because of their large scale and "single build" nature e.g. Sunshine Coast University Hospital, Gold Coast University Hospital, Sydney's Royal North Shore Hospital. It would not be possible without a major rebuild of the electrical infrastructure including a hospital shutdown to change the fundamental architecture at FMC in that regard.

It is noted as described above that over the last 10 years, several major projects renewed and improved the power supply infrastructure at FMC. As has been occurring over the life of the FMC, including the current Transforming Health programme, any new developments or refurbishment of elements of the infrastructure or areas of the hospital should consider further opportunities to increase system redundancy and reliability.

Application of additional local power security measures to address local impacts from loss of power requires review and consultation of individual clinical situations, and is outside the scope of this report, but it is recommended that such reviews be carried out.



## 4 Standby power system network components condition, plant reliability and performance assessment

As indicated previously and shown on the simplified diagram in Section 3.2, key main components of the electrical infrastructure have been installed within the last 10 years, and are in very good condition, reliable and performing as required. This has been demonstrated by operational history, performance in previous events, and maintenance records. This includes the two main incoming substations, all the generators, approximately 50% of the transformers and local HV switchgear.

The other elements are of various ages, some dating back to the original 1975 construction. These have been well maintained. They include the other 50% of transformers, some of the HV local switchgear, and the older essential main distribution boards. It is noted that the replacement or refurbishment of this critical plant is complex, as works would need to be planned to avoid impacting the continuous operation of critical facilities of FMC, and should also consider the condition and capacity of downstream, local distribution systems within the facility.

The downstream distribution systems represent a limitation on the amount of emergency power that can be supplied to any particular area. As demand for essential power circuits grow as more essential equipment and services are required, this restriction will need to be addressed at the local distribution level, to allow the generator capacity to be delivered where required.

It is noted that some planning in this regard has been carried out as part of earlier projects.

**Recommendation: The electrical Master Plan for the site should be updated to include planning for the scheduled replacement or refurbishment of those parts of the infrastructure that have not been renewed in the last 10 years. This planning to consider other upgrades or plans for the FMC overall.**

A specific review of the generator systems' maintenance records, monthly and annual tests, was undertaken. From the records and from observation of the generators on site, it appears maintenance is being carried out appropriately. Annual generator tests include load bank testing by means of temporarily installed load banks. Testing of changeover mechanisms from normal to emergency power is simulated as far as possible without causing an actual loss of power to the operational hospital. Measures to improve testing mechanisms to mitigate risk of failures should be included in the Master Plan update.

During the review, we also formed a view on the general performance and capability of the FMC maintenance staff. The key staff have many years of experience on the site and strong knowledge and commitment to the hospital's operations, and are capable of reliably providing power supply to the facility. Ensuring that this capability is maintained over the long term, with suitable succession planning and investment in human resources, will be important to maintaining the reliability of FMC operations.

There are some specific details of the instrumentation and alarm systems design that impact on reliability and have contributed to the failure event of 28 September, and there are some installation details that impact on maintainability and ability to respond to emergencies. These are discussed in more detail in the review of these events in Section 5.



## 5 Events of 28 September 2016

### 5.1 Sequence of events

The sequence of key events relating to the power failure at FMC on 28 September was, as reported to us by FMC staff and from available alarm records, as follows:

- 15:43 hrs – total loss of SAPN power as a consequence of a state-wide power failure
- FMC infrastructure responded as designed – primary HV supply switched to backup supply, and when detected as unavailable, all emergency generation systems started and supplied the essential power systems. FMC operating on essential power (normal power circuits not available)
- FMC organisation mobilised and continued to take critical actions to manage the impacts of power failure on hospital operations (not subject of this report)
- FMC maintenance staff responded to site control centre and checked and monitored emergency power systems, and responded to localised issues caused by loss of the normal power supplies
- Generator maintenance contractor was contacted to come to site as a backup measure to ensure generator operation. Due to traffic issues also associated with the state-wide power failure, contractor was significantly delayed in reaching site (approximately 18:00 hrs)
- 17:30 hrs (approximately) Eastern (main) generator shut down – areas served without essential or normal power (Blocks A, B, C (except theatres), D, E (except certain critical engineering plant)). Refer to Appendix C for some details of services provided in these areas. Other generators continued to operate as normal.
- FMC maintenance staff responded to main generator to determine cause of fault and attempt to restart the generator. See further discussion in this section.
- 19:06 hrs primary HV supply restored from SAPN. Power systems returned automatically to normal supply operation and power restored to FMC. FMC maintenance staff had been communicating with SAPN Network Operations Centre, and it is understood that SAPN prioritised restoration of this supply.
- 21:00 hrs (approximately) Main generator issues resolved and generator tested and available for service (not operating as normal power available).
- 23:00 hrs (approximately) All fuel systems topped up in case of further supply failures
- Some time before 07:00 hrs on 29 September, backup HV supply restored from SAPN. Power supply systems to FMC then back to normal.

In summary,

- FMC without normal power from 15:43 to 19:06 hrs (3 hours 23 minutes) due to state-wide power failure
- Parts of FMC (Blocks A, B, C (except theatres), D, E (except certain critical engineering plant)) without normal or emergency power from approximately 17:30 to 19:06 hrs (approximately one hour 36 minutes) due to failure of main generator



## 5.2 Analysis of the failure

The direct cause of the main generator shutdown related to the fuel system.

### 5.2.1 Description of generator fuel system

The main generator fuel system consists of:

- Day tank within the packaged generator enclosure, 750 L capacity
- External underground main fuel tank (bulk tank) adjacent to generator enclosure, 6000 L capacity
- Dual fuel pumps under the day tank, which pump fuel from underground tank
- Control system for generator, which includes fuel control system. Elements of the control system are located within the generator enclosure, and other elements within the P (energy plant) building, approximately 5 minutes' walk away
- The fuel control system is set up so that the transfer pump starts when the day tank is 50% full, and remains operating until the tank is 100% full. Should the day tank fall to 40% full, a low level alarm is raised. This is approximately one hour of generator operation and would allow sufficient fuel in the day tank for continuous operation while maintenance staff respond to the alarm and ensure fuel supply to the day tank. Should the day tank reach 5% full, a day tank empty alarm is generated and the generator shuts down. This is to prevent damage to the generator that may make it difficult to restart once fuel is available. The settings of these controls reported here are based on the generator O&M manuals, and should be checked on site as part of generator maintenance. The alarms generated from the fuel control system are:
  - Day tank overfull
  - Day tank low
  - Day tank empty
  - Pump 1 failed
  - Pump 2 failed
  - Bulk tank low
  - Bulk tank empty
- These alarms are not currently connected to the site-wide BMS alarm system for the main generator (they are connected for Western, Margaret Tobin and partially for NSW generator).
- Note generator fuel consumption at full load is 326 L/hr. Actual operation is not at full load. Therefore a full day tank should operate the generator for at least two hours, estimated at three hours based on actual loads, and the bulk tank should operate the generator for 18 hours, estimated at more than 24 hours based on actual loads

### 5.2.2 Analysis of generator shut down

The cause of the generator shutdown is analysed as follows, based on events reported by FMC staff, and based on our analysis of the systems documentation and visual inspections:

1. Generator operation consumed fuel from the day tank until a sensor, as part of the control system, detected a critically low fuel level in the tank and automatically shut down the generator.
2. It was reported that the pumps did not operate to bring fuel from underground tank to the day tank because the control system Auto Off Manual switch was turned "Off". This prevents the pumps from running. This switch is available for testing and maintenance of the control system. It should always be left in "Auto" for normal operation. No other reason for failure of the fuel supply to the generator is apparent to us from information received.



3. How this switch was left in the off position is not known. Possibilities include:
  - a. At the last monthly service of the generator on 23 September, the generator maintenance contractor would have used this switch to test the operation of the fuel system. The testing was recorded in the maintenance records. The generator maintenance contractor has provided a detailed report on that maintenance, and it is their “true and best recollection of the events” that they left the switch in the auto position as per their procedures.
  - b. During the main power failure event, FMC maintenance staff checked the operation of the generator systems. It is possible that during this check the switch was left off in error. There is no evidence to indicate that this happened.
  - c. The switch is within the generator enclosure, which is locked, with keys kept at various locations. There is no apparent reason why or evidence that anyone accessed the generator enclosure at any other time between the monthly service and the event, although it is possible.
4. In any case, it could be considered that the basic cause of the failure is not necessarily this human error. Other measures should be in place to prevent this error from leading to generator shutdown, or to allow for a more rapid recovery from such a shutdown. It is also noted that there are other possible faults which, although not apparent in this case, could have occurred, with a similar impact. The fuel control system itself consists of electronic modules, cabling and sensors that could develop faults stopping the pumps from operating.
5. To mitigate the risk of fuel control system failure (whether from human error or otherwise) alarms generated from the fuel control system need to be reliable and be transmitted reliably to maintenance staff. This did not happen during these events. If alarms had been activated, maintenance staff would easily have been able to correct the switch position and no shutdown would have occurred. By reliably transmitted, we mean via the BMS critical alarm system, which raises alarms at the manned control centre as a high priority on the BMS screen, and also sends pager messages to key maintenance duty staff. It is also important that during an emergency event, the volume of alarms generated does not swamp the operators with too much information, where critical alarms can be lost.

**Recommendation: A detailed review of the fuel control and BMS systems (for all generators) be carried out and actions taken to:**

- **Ensure that the fuel alarm system is operational and properly calibrated, and ensure that the alarms are connected to the BMS. Ensure that the BMS transmits these alarms effectively to the maintenance staff.**
  - **Ensure that the BMS system during an emergency event manages the volume and priority of alarms appropriately to allow effective staff response.**
  - **If this review demonstrates risk of fuel control systems not adequately reporting alarms, consider an independent day tank level switch to be installed in each generator fuel tank, directly connected to the BMS.**
  - **Consider the feasibility of adding a “fuel system not in auto” or “fuel system fault/fail-safe watchdog” or “pre-alarm identifying that the generator is about to shut down without intervention” feature to current systems – subject to details of each individual generator system.**
6. To further mitigate these risks, although the existing administrative controls of generator maintenance and testing are of a typical standard, given the events, additional administrative controls could be implemented. It is also noted from the latest generator test report that the generator day tank was left at 50% full at the end of the last monthly maintenance.

**Recommendation: Add to generator test procedure a checklist at the end of testing, which includes checking (independent of maintenance contractor) that all systems are back to normal positions and includes a requirement to leave the day tank full where there is a bulk tank/day tank arrangement.**



### 5.2.3 Cause of delays to restarting generator

The consequences of the generator shutdown were exacerbated by delays in being able to restart the generator. The causes of this delay were as follows:

1. To restart the generator, fuel needed to be added to the day tanks, but once the generator shut down, power was not available to operate the fuel pumps. Although maintenance staff attempted to improvise solutions during the event, this was hampered by lack of pre-prepared plans and equipment for such a situation, as well as the overall conditions they were working in (see Paragraph 2 below). A portable manual backup system would mitigate against this and a number of other possible failure scenarios related to the fuel systems.

**Recommendation: A portable manual fuel pump and portable fuel drum be made available on site to manually transfer fuel to day tanks. Emergency procedures be prepared to describe how this is to be done, including listing potential source of accessible fuel (other generator tanks, motor vehicles, offsite sources).**

2. The overall conditions in which the maintenance staff were responding to the generator shutdown event could be improved to improve their ability to effectively diagnose and rectify faults.

**Recommendation: Improvements to installation to be implemented as follows:**

- **Lighting within the generator enclosure and immediately adjacent to be emergency battery backed type.**
- **Improvements to the spatial layout within the main generator enclosure should be investigated, including allowance for the control panel door to open 180° (only 90° currently), moving the fuel pumps to a more accessible location, and ensuring clear access to the day tank for manual filling if required.**
- **Improvements to communications facilities between critical areas, including fixed phone line connections between the main control room, main generator control panel in the P (energy) Building, and the generator enclosure, and allowing link to offsite specialist advice.**
- **Where generator maintenance requires operations outdoors (not applicable to main generator but applicable to others), a shelter over the relevant area should be provided to allow safe working during wet or hot weather.**
- **Written emergency procedures to be prepared covering credible failure scenarios with step by step checklists and recommended actions.**



## 6 Other risks identified

Although not relevant to the particular events of 28 September, the following other risks to power supply reliability were identified during our review:

1. There are other scenarios where a complete generator failure may occur. Generator power should be available at all times in case a mains failure occurs. To allow for this, a connection point should be available where a temporary generator can be placed in a safe and convenient location and connected electrically in place of the failed generator. For each of the current generators, there is the possibility to do this, but for the main generator, the preferred connection location at outgoing circuits of the related generator switchboard does not allow for full power to be connected, and an alternate connection point at the generator is not easily connected.

**Recommendation: Review all generator locations for arrangements for temporary generator installation, including design of modifications as required for electrical connections and spatial requirements at installation locations, to be documented in an emergency procedure.**

2. Another single point of failure for the main generator essential power distribution is the central control system that operates the changeover contacts at each supplies essential main distribution board. Were this system to fail, the generator power would not be able to be connected to the relevant areas.

**Recommendation: Review control system for the main generator normal/essential changeover system and ensure that it has effective backup/manual or redundant operations, and suitable testing facilities. The Essential board that supplies the main generator power to blocks A, B, C (except theatres), D, E (except certain critical engineering plant) (MD-1-4P-10E) is a potential single point of failure of a significant portion of the emergency power system and, as part of the Master Plan, an update should be considered as a priority.**

3. Another potential point of failure for generators is the starting system. Although these can be repaired relatively quickly, due to the critical nature and lack of backup to the generator, dual redundant starter systems should be considered.

**Recommendation: Generator dual redundant starter systems should be considered.**

4. In carrying out this review, we note that although there is a considerable amount of documentation on the systems available on FMC's data base, due to the nature of the changes to the facilities over many years, these documents are not necessarily consistent and up to date. The single line diagrams displayed in many of the plant rooms are not necessarily current. It would assist in troubleshooting in an emergency and reviews such as this if these documents were updated – refer to Table 3 System summary in Appendix A for the relevant drawings.

**Recommendation: As part of the electrical master plan update recommended above, a complete and consistent set of single line diagrams describing the electrical**



**distribution network be prepared. Relevant diagrams to be laminated and displayed in the main substations. Labelling to all main electrical equipment be reviewed and updated in accordance with the final documents.**

5. Physical installation to some of the generators could be improved. Where possible, improvements could be carried out to reduce these risks:
  - a. The generators are located with either no or limited physical protection from the public and unauthorised access. Even though the enclosures are locked they are susceptible to vandalism and damage that could inhibit their operation. The generators have external emergency stop buttons (as required by code). With a low level of physical security there is a risk of unauthorised shutdown. Consider the addition of fencing or use of CCTV or security systems such as intruder alarms/reed switches on the generator enclosure doors and "door left open" alarm may assist in managing these risks.
  - b. The Margaret Tobin generator is located adjacent to a road with no protection against vehicle damage.
  - c. The generators are located adjacent to or below deciduous trees with a risk of foliage and branches falling onto the generator enclosure.
  - d. No fire suppression equipment positioned within the generator enclosures. It is typical to include portable appliances.

**Recommendation: Review generator installations details as noted in report and implement physical improvements where possible.**

6. Controls and switchgear for the main generator are located in the main plant building without physical segregation from other plant areas. This may result in water damage should there be a catastrophic failure of water pipework or equipment. Switches may be accidentally operated or damaged by other activities taking place in the plant room. Since the plant room is quite open, often with many operators and subcontractors in attendance, it is possible that unauthorised operations could take place. Solid wall barriers around the locations should be considered.

**Recommendation: Provide walls around critical electrical infrastructure within the main plant area to provide security and protection from catastrophic water system failures.**

## 7 Conclusion and Recommendations

From the review carried out, Aurecon concludes that

1. In Aurecon's opinion, the FMC main emergency power systems' architecture meets the requirements of the relevant standards, and is comparable to equivalent hospitals in Australia of a similar age.
2. It is noted that over the last 10 years, several major projects renewed and improved the power supply infrastructure at FMC. As has been occurring over the life of the FMC, including the current Transforming Health programme, any new developments or refurbishment of elements of the infrastructure or areas of the hospital should consider opportunities to increase system redundancy and reliability.
3. The standby power system network is largely in good condition, operational and reliable. Those parts of the system that have not been upgraded in the last 10 years will need to be reviewed and plans put in place to renew.
4. The direct cause of the loss of essential power on 28 September was related to the generator fuel system, and most likely caused by human error in wrongly leaving a switch off, but it could be considered that a contributing cause is deficiencies in alarm systems to notify the low fuel situation.
5. Other improvements can be made to improve the ability of maintenance staff to address emergency situations.
6. The review has also identified some other improvements that, although not related to the events of 28 September, would further mitigate the risk of power failures.

It should be emphasised that the emphasis in this review of possible risks has been in the spirit of learning from failures to improve capability and future performance, and that overall FMC has a robust contemporary emergency electrical system.

The recommendations of this report are summarised as follows. It is noted from interviews and site inspections, that some of these recommendations are already in the process of implementation.

Table 2 Summary of Recommendations

	Recommendation	Status	Preliminary Budget Cost
1.	The electrical master plan for the site should be updated to include planning for the scheduled replacement or refurbishment of those parts of the infrastructure that have not been renewed in the last 10 years. This planning to consider other upgrades or plans for the FMC overall.		\$100k for engineering investigations. Ultimate works cost subject to outcomes.
2.	A detailed review of the fuel control and BMS systems (for all generators) be carried out and actions taken to: <ul style="list-style-type: none"> <li>- Ensure that the fuel alarm system is operational and properly calibrated, and ensure that the alarms are connected to the</li> </ul>	In progress through maintenance.	\$20k

	Recommendation	Status	Preliminary Budget Cost
	<p>BMS. Ensure that the BMS transmits these alarms effectively to the maintenance staff.</p> <ul style="list-style-type: none"> <li>- Ensure that the BMS system during an emergency event manages the volume and priority of alarms appropriately to allow effective staff response.</li> <li>- If this review demonstrates risk of fuel control systems not adequately reporting alarms, consider an independent day tank level switch to be installed in each generator fuel tank, directly connected to the BMS.</li> <li>- Consider the feasibility of adding a "fuel system not in auto" or "fuel system fault/fail safe watchdog" or "pre-alarm identifying that the generator is about to shut down without intervention" feature to current systems – subject to details of each individual generator system.</li> </ul>		
3.	Add to generator test procedure a checklist at the end of testing which includes checking that all systems are back to normal positions and includes a requirement to leave the day tank full where there is a bulk tank/day tank arrangement.	In progress through maintenance.	-
4.	<p>Improvements to installation to be implemented as follows:</p> <ul style="list-style-type: none"> <li>- Lighting within the generator enclosure and immediately adjacent to be emergency battery-backed type.</li> <li>- Improvements to the spatial layout within the main generator enclosure should be investigated, including allowance for the control panel door to open 180° (only 90° currently); moving the fuel pumps to a more accessible location, and ensuring clear access to the day tank for manual filling if required.</li> <li>- Improvements to communications facilities between critical areas, including fixed phone line connections between the main control room, main generator control panel in the P (energy) Building, and the generator enclosure, and allowing link to offsite specialist advice.</li> <li>- Where generator maintenance requires operations outdoors (not applicable to main generator, but applicable to others), a shelter over the relevant area should be provided to allow safe work during wet or hot weather.</li> <li>- Written emergency procedures to be prepared covering credible failure scenarios with step by step checklists and recommended actions.</li> </ul>	In progress through maintenance	\$40k
5.	Review all generator locations for arrangements for temporary generator installation, including design of modifications as required for electrical connections and spatial requirements at installation locations, to be documented in an emergency procedure.		\$10k for engineering works. Ultimate works cost subject to outcomes
6.	Review control system for the main generator normal/essential changeover system and ensure that it has effective backup/manual or redundant operations, and suitable testing facilities. The Essential board that supplies the main generator power to Blocks A, B, C (except theatres), D, E (except certain critical engineering plant) (MD-1-4P-10E), is a potential single point of failure of a significant portion of the emergency power system and as part of the Master Plan update should be considered as a priority.		\$10k for engineering investigations. Ultimate works cost subject to outcomes
7.	Recommendation: Generator dual redundant starter systems should be considered.		\$50k
8.	As part of the electrical master plan update recommended above, a complete and consistent set of single line diagrams describing the	Partially addressed as	Incl. in above



	<b>Recommendation</b>	<b>Status</b>	<b>Preliminary Budget Cost</b>
	electrical distribution network be prepared. Relevant diagrams to be laminated and displayed in the main substations. Labelling to all main electrical equipment be reviewed and updated in accordance with the final documents.	part of this review	
9.	Review generator installations details as noted in report and implement physical improvements where possible.		\$20k
10.	Provide walls around critical electrical infrastructure within the main plant area to provide security and protection from catastrophic water system failures.		\$100k



# Appendix A

## System summary



**Table 3 System Summary**

The following table is provided as a useful summary of the key infrastructure and reference to the related Single Line diagrams used in the technical analysis

Substation	Transformer	Main Board	Essential Board	Drawing	Generator	Note
10 (Building P)	TF10A	MD-10A-4P-10	MD-10A-4P-10E	E010	Eastern	Supplies Plant air, vacuum plant
1 (Building P)	TF1	MD-1-4P-10	MD-1-4P-10E	E011 (and *E14 for old version)	Eastern	Supplies plant and distribution to other areas. Includes supply to generator control.
			MD-1-1A-10E (MD-4-1A-10E?)	E011 and *E05		Block A em supply – see below.
			MD-1-1B-10E (MD-6-1B-10E?)	E011 and *E04		Block B em supply – see below.
			MD-1-1C-10E	E011 and *E07		Block C em supply – see below.
			MD-1-1D-10E	E011 and *E02		Block D em supply – see below.
			MD-1-2E-20E (MD-2-2E-20E?)	E011 and *E10		Block E em supply – see below.
			MD-1-2E-10E (MD-2-2E-10E?)	E011 and *E06		Block E em supply – see below.
			MD-1-3E-10E (MD-3-3E-10E)	E011 and *E03		Block E em supply – see below
2 (E block North)	T2	MD-2-3E		E104		
			MD-2-2E-30E	E104	E building	EM only board supplying essential hydraulic and fire plant.
		MD-2-2E-10	MD-2-2E-10E	*E06	Eastern via	Note provision made for supply from E Building

Substation	Transformer	Main Board	Essential Board	Drawing	Generator	Note
					MD-1-4P-10E	generator, but not connected – see dwg 06/0044/1,2,3,4.
		MD-2-2E-20	MD-2-2E-20E	*E10	Eastern via MD-1-4P-10E	Note provision made for supply from E building generator, but not connected – see dwg 06/0044/1,2,3,4.
		MD-2-3E-40	MD-2-3E-40E			CSSD.
3 (E Block South)	T3	MD-3-3E-10	MD-3-3E-10E	*E03	Eastern via MD-1-4P-10E	Note provision made for supply from E building generator, but not connected – see dwg 06/0044/1,2,3,4.
4 (A Block)	T4	MD-4-1A-10	MD-4-1A-10E	*E05	Eastern via MD-1-4P-10E	
11 (New South Wing)	T11	MD-11-1NSW	MD-11-1NSWE	E478	New South Wing	
9 (C Block)	TF9A	MD-9A-1C-10	MD-9A-1C-10E	E006 and E521	Western	Theatres, incl. UPS system and HVAC plant for chillers.
	TF9B	MD-9B-1C-20	MD-9B-1C-20E	E007 and E520	Western	
	TF9C	MD-9C-1C-30	MD-9C-1C-30E	E008	Western	
5 (C Block)	T5	MD-5-1C-10	MD-1-1C-10E	*E07	Eastern via MD-1-4P-10E	
6 (B Block)	T6C	MD-6-1B-20	NA	*E15	NA	Car park and retail.



Substation	Transformer	Main Board	Essential Board	Drawing	Generator	Note
	T6A and B in parallel	MD-6-1B-10	MD-6-1B-10E	*E04	Eastern via MD-1-4P-10E	
8 (Margaret Tobin)	T8	MD-8-3M-10	MD-8-3M-10	BE switchcraft 05/0270/1	Margaret Tobin	Mental health.
7 (D Block)	T7	MD-7-2D-10	MD-1-20-10E	*E02	Eastern via MD-1-4P-10E	
		MD-7-2D-10A	MD-7-2D-10A?	*E02 and CW job no A6692 dwg E8	Eastern via MD-1-4P-10E and MD-7-2D-10	Critical Care Medicine Unit.
12 (OPMHU)	12	MSB-12-3V-01			OPMHU	Under construction in current development – supplies new OPMHU Rehab, Car park.
(FCIC)					FCIC	FCIC is in separate HV system and separate elec distribution

Notes

1. Switchboard naming: MD - supply from sub no – location of board, floor and block – sequence number 10, 20, 30 etc
2. Drawing number \*Exx refers to drawings in “Electrical Master Plan” prepared by Bassett Consulting Engineers, September 2000
3. Drawing number Exx refers to drawing in 2009 Infrastructure upgrade projects documentation
4. In addition, the drawings in report “Flinders Medical Centre Redevelopment Briefing” prepared by Bassett Consulting Engineers, October 2006, that describe the board locations and zoning (30018378-XE01,2,3,4,5,6, where X is floor number, should be updated
5. Green shading is relatively new (less than 10 years)



# Appendix B

## Things you should know about this report

### Conditions to apply to report:

#### Exclusive Use

- This report has been prepared by Aurecon at the request of SA Health exclusively for the use of SA Health.
- The basis of Aurecon's engagement by SA Health is that Aurecon's liability, whether under the law of contract, tort, statute, equity or otherwise, is limited as set out in the terms of the engagement.

#### Third Parties

- It is not possible to make a proper assessment of this report without a clear understanding of the terms of engagement under which the report has been prepared, including the scope of the instructions and directions given to and the assumptions made by the consultant who has prepared the report.
- The report is scoped in accordance with instructions given by or on behalf of Client. The report may not address issues which would need to be addressed with a third party if that party's particular circumstances, requirements and experience with such reports were known and may make assumptions about matters of which a third party is not aware.
- Aurecon therefore does not assume responsibility for the use of, or reliance on, the report by any third party and the use of, or reliance on, the report by any third party is at the risk of that party.

#### Existing Property: Inherent Risk

- The owner or prospective purchaser of an existing property or asset necessarily assumes the risk of there being defects inherent in the asset. An engineer's report can assist an owner or prospective purchaser in making an assessment of that risk but does not eliminate that risk.
- A report of this nature is not a certification, warranty or guarantee.

#### Limited Scope

- The limited scope of Aurecon's brief in this matter, including the limited scope of investigation requested by Client, means that the report necessarily concentrates on readily apparent major items.
- Amongst other things, Aurecon's brief expressly excludes investigation or advice in relation to the actual or potential presence of pollution, contamination or asbestos, or the actual or potential risk of any incident affecting the safety of operation.

#### Limits on Investigation and Information

- The extent of investigation required to provide a comprehensive report on the matters the subject of this report would normally be significantly greater than has been carried out to provide this report. Where site inspections have been made, they have been limited in their scope to external visual inspections. No detailed testing or inspection etc. was carried out. Except as expressly stated otherwise, the inspections Aurecon has made and the report do not cover defects that are not reasonably discoverable on a visual inspection, including defects in inaccessible places and latent defects. The inspections made have been limited to a subset of all the assets and operations and the list of assets and operations that have been inspected has been agreed with Client.
- The report is also based on information provided to Aurecon by other parties. The report is provided strictly on the basis that the information that has been provided is accurate, complete and adequate.
- Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that the Client may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the report that it has verified the information to its satisfaction.

#### Limits on Cost Indications

- Since Aurecon has no control over the cost of labour, materials, equipment or services furnished by others, or over contractors' methods of determining prices, or over competitive bidding or market conditions, any indication of costs is made on the basis of Aurecon's experience and qualifications, and represents its best judgment as an experienced and qualified professional consultant, familiar with the relevant industry, but Aurecon cannot and does not guarantee that proposals, bids or actual construction costs will not vary from cost indications given.

#### No Comment on Commercial Feasibility

- The findings, observations and conclusions expressed by Aurecon are not, and should not be considered as, an opinion concerning the commercial feasibility of the property or asset.



**Compliance with Building Codes etc.**

- Building Codes, Regulations and Standards, including with respect to fire protection measures are in a state of continuous change and may have changed since the original construction. Buildings constructed in accordance with the codes and regulations in force at the time may not comply with current codes and regulations. The report may give an indication and/or example of areas of non-compliance with current codes and regulations but it does not by any means provide a comprehensive analysis of compliance with current codes and regulations.
- The implications of current non-compliance with applicable Codes, Regulations and Standards is a matter for legal advice.

**Legal Documents etc.**

- The report may contain various remarks about and observations on legal documents and arrangements such as contracts, supply arrangements, leases, licences, permits and authorities. A consulting engineer can make remarks and observations about the technical aspects and implications of those documents and general remarks and observations of a non-legal nature about the contents of those documents. However, as a Consulting Engineer, Aurecon is not qualified, cannot express and should not be taken as in any way expressing any opinion or conclusion about the legal status, validity, enforceability, effect, completeness or effectiveness of those arrangements or documents or whether what is provided for is effectively provided for. They are matters for legal advice.

If the reader should become aware of any inaccuracy in or change to any of the facts, findings or assumptions made either in Aurecon's report or elsewhere, the reader should inform Aurecon so that it can assess its significance and review its comments and recommendations.

Nothing in this report shall be read or applied so as to purport to exclude, restrict or modify, or have the effect of excluding, restricting or modifying the application of all or any of the provisions of the Trade Practices Act 1974 or any other legislation, which by law cannot be excluded, restricted or modified.

This report, in whole or in part, may only be reproduced or published with the prior written permission of Aurecon, and this explanatory statement must accompany every copy of this report.



# Appendix C

## FMC site diagram





**Aurecon Australasia Pty Ltd**

ABN 54 005 139 873

Level 10, 55 Grenfell Street

Adelaide SA 5000

Australia

**T** +61 8 8237 9777

**F** +61 8 8237 9778

**E** [adelaide@aurecongroup.com](mailto:adelaide@aurecongroup.com)

**W** [aurecongroup.com](http://aurecongroup.com)

**Aurecon offices are located in:**

Angola, Australia, Botswana, Chile, China,  
Ethiopia, Ghana, Hong Kong, Indonesia,  
Lesotho, Libya, Malawi, Mozambique,  
Namibia, New Zealand, Nigeria,  
Philippines, Qatar, Singapore, South Africa,  
Swaziland, Tanzania, Thailand, Uganda,  
United Arab Emirates, Vietnam, Zimbabwe.





**SYSTEM  
SOLUTIONS  
ENGINEERING**

**Project:**

**PORT AUGUSTA GENERATOR FAILURE**

**Subject:**

**INVESTIGATION REPORT**

**Prepared for:**

Capital Planning and Evaluation, Infrastructure  
Finance and Corporate Services  
SA Health,  
Government of South Australia.

**Prepared by:**

System Solutions Engineering  
Level 1, 75 Fullarton Road  
Kent Town SA 5067

---

Project No: SSE3091Electrical Services Report

Date: November 2016

Revision: -Final issue 1

\\SSE-FS1\SSE\_Data\SSE\_PROJECTS\SSEJob\SSE3000 - SSE3099\SSE3091\Engineering\SPECIFICATIONS-REPORTS\Version 4\SSE 3091 Port Augusta Hospital Generator Failure report- Final Issue 2.docx  
Page 1 of 23 23/06/2016

ABN:61 007 654 971

<b>REVISIONS</b>
------------------

Revision Status	Reviewed By		Author	Date Issued
	Initials	Date		
<i>P</i>	BJM	10/11/2016	<i>Brian Westwood</i>	10/11/2016
<i>P2</i>	BJM	18/11/2016	<i>Brian Westwood</i>	15/11/2016
<i>F</i>	BJM	18/11/2016	<i>Brian Westwood</i>	18/11/2016
<i>F1</i>			<i>Brian Westwood</i>	23/11/2016
<i>F2</i>			<i>Brian Westwood</i>	29/11/2016

*Revision Status Legend - P – Preliminary; T – Tender; C – Construction; F - Final.*

**TABLE OF CONTENTS**

**REVISIONS ..... 2**

**TABLE OF CONTENTS ..... 3**

**1 EXECUTIVE SUMMARY ..... 4**

1.1 Generator description..... 4

1.2 Summary of generator failure during mains power outage ..... 4

1.3 generator failure causes ..... 4

1.4 Other issues identified ..... 4

1.5 preventative Maintenance and servicing ..... 5

1.6 recommendations ..... 5

**2 INTRODUCTION..... 6**

2.1 Project ..... 6

2.2 project purpose ..... 6

2.3 Scope ..... 6

2.4 Information sources..... 7

2.5 limitations ..... 7

**3 HISTORICAL INFORMATION ..... 8**

3.1 Generator age and origin ..... 8

3.2 generator description ..... 9

**4 GENERATOR SERVICING AND TESTING ..... 10**

4.1 Generator servicing .....10

4.2 generator testing .....11

**5 GENERATOR FAILURE EVENTS ..... 14**

5.1 Last previous power outage .....14

5.2 Generator failure events 28/09/2016.....14

**6 GENERATOR FAULTS ..... 17**

6.1 generator essential load .....17

6.2 High water temperature alarm.....17

6.3 Oil Leak .....18

6.4 Fuel line rupture .....19

6.5 Deposit build up from low loads.....19

**7 HOSPITAL OWNERSHIP AND MAINTENANCE ARRANGEMENT ..... 20**

**8 CONCLUSION ..... 21**

**9 RECOMMENDATIONS..... 23**

## **1 EXECUTIVE SUMMARY**

---

### **1.1 GENERATOR DESCRIPTION**

The Port Augusta Hospital has a backup generator that supplies power during any mains (SAPN) power interruption/outage.

The generator is a two stroke diesel generator rated at 170 KVA controlled output, with a 260 Kilowatt alternator and a 219 kilowatt Engine.

The generator was built and installed in 1972 and has done 407 hours work, at the time of our inspection.

### **1.2 SUMMARY OF GENERATOR FAILURE DURING MAINS POWER OUTAGE**

On September 28 2016 South Australia experienced a state wide loss of mains power.

The power outage in Port Augusta lasted approximately 24 hours at which time the Hospital needed to be able to rely solely on the backup generator to provide power to the Hospital essential services.

The generator started as expected, however there were a number of generator failures during the mains outage that effected the ability of the generator to continue to provide power.

Below is a summary of the generator failures that occurred.

- Generator ran for approximately 1-1/4 hours then stopped on an over temperature alarm.
- The generator was manually restarted and an oil leak was noticed in a pipe, so the generator was stopped by maintenance staff and a mechanic called to repair the oil leak. The Hospital was without power for approximately 2-1/2 hours before the generator was repaired and operating again.
- During this time two small generators were sourced that were used to keep fridges running in the pathology area and to keep the communications infrastructure operating.
- The generator then ran for approximately another 1-1/4 hours before a major fuel leak was noticed in a fuel feed hose and the generator was again shut down by maintenance staff and a mechanic called out to repair the fuel leak.
- The Hospital was without power for 3 hours until a temporary generator was sourced through SA Power Networks and connected to the Hospital.
- Repairs to the Hospital generator took 4 hours.
- The Hospital continued to run on the SA Power Networks generator until approximately 4.15pm the following day at which time the SA Power Networks loan generator stopped (Reason unknown).
- The Hospital generator started automatically and provided power for approximately ¾ of an hour, until mains power was restored to the Hospital by SA Power Networks.
- In total the Hospital was without any power at all for approximately 5-1/2 hours during the power outage (of approximately 24 hours).

### **1.3 GENERATOR FAILURE CAUSES**

A number of issues were identified that caused the failures:-

- Overheating due to the generator being under capacity for the current essential load requirements, the age of the generator and the generator never being run at full load.
- Oil Leak in split metal pipe which was an unexpected mechanical failure
- Fuel leak in split rubber hose due to the age at 44 years
- Suitability of existing back-up generator infrastructure

### **1.4 OTHER ISSUES IDENTIFIED**

A number of other maintenance related issues were identified that need to be addressed, being:-

- There is a lack of understanding of manual operation of the changeover system for the generator by maintenance staff.
- Incorrect type of batteries installed recently, namely non-vented batteries were installed however vented batteries should have been installed.

- The generator itself does not have a block heater which means that the engine was trying to supply 90% of its total capacity from a cold start and this would also cause the generator to struggle and may cause damage to the engine.
- Monthly testing is inappropriate and should be undertaken at maximum presented load for a four hour period to prove stable operation
- The generator is now 44 years old replacement parts are becoming harder to source and some may not be available at all.

### **1.5 PREVENTATIVE MAINTENANCE AND SERVICING**

Currently there is no regular preventative maintenance and the generator is only serviced once a year. The Country Health SA Emergency Generator Maintenance and Testing Procedure documentation requires preventative maintenance to be carried out in line with DPTI Technical Data Schedules E03/ E03A/ E03BA/ E03B/ E03BB.

E03B particularly applies to the Port Augusta Hospital and shows monthly and annual preventative maintenance that needs to be provided.

Fan belts and some hoses have been replaced (done on 28/10/2016) however there are still some fuel lines left to be done. These should be done as soon as possible.

### **1.6 RECOMMENDATIONS**

- Carry out regular load bank testing on the generator with a load bank large enough to fully load the generator to 110% which will clean out the engine and also identify whether the generator is capable of providing full load for a sustained length of time.
- Immediately commence preventative maintenance, as per DPTI Schedule (monthly and annual).
- Replace all remaining original hoses and pipes.
- Prepare and carry out a testing regime and testing strategy and ensure testing of the generator is done every month for 4 hours over that month and under full Hospital load with test result recorded every 15 minutes.
- Carry out a detailed audit of the current Hospital essential loads to determine the current load requirements of the Hospital.
- Due to the age of the generator, reliability and reparability risk due to age and the apparent under capacity of the generator it is recommend to replace the generator with a new generator and associated control system designed for the current load requirements and allowance for some future expansion.

## **2 INTRODUCTION**

---

### **2.1 PROJECT**

System Solutions Engineering (SSE) has been engaged by SA Health to undertake a comprehensive and independent post incident review of the performance of Port Augusta Hospital emergency stand-by power systems, processes and controls (both planned and actual), following the state wide electrical outages experienced on Wednesday 28 September 2016.

### **2.2 PROJECT PURPOSE**

To ensure that SA Health and Country Health SA understand the causes of any emergency stand-by power electrical system failures at the Port Augusta Hospital in order to identify improvements that can be made and to reassure clinicians and the community that the Port Augusta Hospital has a robust contemporary emergency electrical system.

SA Health and Country Health SA also wish to learn from these failures to improve capability and future performance of the Port Augusta Hospital's emergency stand-by power systems.

SSE has been asked to consider both load considerations as well as mechanical considerations that may have contributed to the generator failure.

### **2.3 SCOPE**

The scope of our engagement with SA Health is to visit the site to investigate the generator condition, review the generator upkeep, to assess the load on the generator and to investigate the events of the failure.

SSE are then to provide an investigation report identifying the cause(s) of the generator failure and other appropriate issues of suitability and capability of the existing emergency stand-by power systems at the Port Augusta Hospital including the following:-

- The appropriateness of the existing stand-by power
- Stand-by power system network components condition, plant reliability and performance assessment
- Identification and description of any failure incidents
- The sites response to the failure incident
- Root cause analysis of any failure incident
- Identification of contributing factors to the failure incident
- Physical e.g. System and plant design including (BMS and controls)
- Availability of accurate and as installed / as built records
- Operating systems and testing processes
- Maintenance activities including frequency and constraints
- Training
- Individual factors
- Identify key single points of failure and determine mitigating / remediation strategies related to the identified causes of the failure incident
- Report any other significant risks related to stand-by power that may be identified by stakeholders during the investigation.
- A review of the testing regime for generators
- Recommendations and where appropriate estimated cost of implementation for future action

## **2.4 INFORMATION SOURCES**

- SSE 2015 report.
- Honeywell service and maintenance reports.
- Discussion with Honeywell staff.
- Discussion with SA Health staff.
- Discussion with generator Service Contractor.
- Site inspection.
- Load readings taken by Honeywell.

## **2.5 LIMITATIONS**

Inspection was of a visual nature and no plant was dismantled as part of the inspection.

Generator loads are based on documented evidence.

At the time of our site inspection the Honeywell electrician was on sick leave which limited the amount of hands on information or testing that could be obtained.

Spot load readings of essential loads were taken by the Honeywell electrician post our inspections, on 07/11/2016 at approximately 1.30 pm to assess what might have been a typical load at a time similar to when the first outage occurred.

### 3 HISTORICAL INFORMATION

#### 3.1 GENERATOR AGE AND ORIGIN

The generator was manufactured in 1972, making it 44 years old and was originally installed in the Port Augusta Hospital Administration building which was the original Hospital at the time.

The generator was relocated to the New Hospital at the time of construction circa 1997, understood to be a cost saving measure or value management choice at the time given the low hours of operation.

In the 44 years that the generator has been installed, it has only done approximately 407 hours of work, with most of these hours in test mode only.

It has been noted that the generator does not have a block heater which keeps oil and coolant at a warm temperature which assists in starting as the engine is not absolutely cold when it starts. As well as improving starting this allows the lubricants to work immediately which reduces wear and tear and possible damage to the engine.

The generator is understood to be maintained by Honeywell as part of a Facility Management arrangement with Port Augusta Hospital Limited and assigned through the Country Health SA as an agent.

The current Honeywell Site Manager Mr Ritesh Chandra, has only been associated with the site for approximately 12 months and the Honeywell Electrician for approximately 4 years.

Honeywell currently engage a local contractor, Butlers Mechanical Services, to carry out service and maintenance on the generator.



*Engine Hour Run Meter*

**3.2 GENERATOR DESCRIPTION**

The generator is a Detroit 2 stroke diesel engine with a Stamford alternator and Detroit control panel.

The output capacities of each of the individual generator components are shown in table one below:-

<b>GENERATOR INDIVIDUAL COMPONENT OUTPUT</b>		
<b>Component</b>	<b>Kilowatts (KW)</b>	<b>Equivalent Amps (A)</b>
Engine	219 KW <small>(Actual rated output)</small>	
Alternator	260 KW <small>(Actual rated output)</small>	452 A
Control unit	170 KW <small>(Actual rated output)</small>	306 A

*Table 1: Generator individual component output*

The output from the controller is rated at 170 Kilowatts and the controller is actually protected by 315 amp fuses and as can be seen from the figures in table 1, the engine and alternator should be capable of providing considerably more than the maximum load the fuses are designed to protect against.

As a percentage of the engine output the control panel is approximately 78% of the engine Kilowatt capacity, so at approximately 300 amps of load the engine should only be producing approximately 78% of its power capacity.



*315 Amp Fuses Protecting the Output of the Generator*

The fuses in the control panel are high rupture fuses which are designed to accept an overload current for a predetermined length of time with the time being inversely proportional to the current (ie higher current shorter time before the fuse ruptures and vice versa).

## **4 GENERATOR SERVICING AND TESTING**

---

### **4.1 GENERATOR SERVICING**

There is currently no service contract in place for the servicing of the Port Augusta Hospital Generator with servicing and maintenance only carried out on an as needed basis by a local mechanical contractor, Butlers Mechanical Services, as such, there is no preventative maintenance program for the generator.

There are very few service records that were able to be provided to us. The last service records of any value were the ones that we obtained last year as part of our condition audit from the 2014 annual service.

The 2014 service records indicated a number of faults requiring rectification, mainly relating to coolant and oil leaks, most of which we believe have been addressed.

One item that was raised at the time and has not been addressed is the manual operation of the changeover system. There seems to be a lack of thorough understanding in how the manual control is meant to function or how to actually enact it and this urgently needs to be investigated and documented so that correct testing can be carried out.

The automatic function of the changeover does operate correctly and the generator starts automatically when there is a mains power loss.

Information provided indicates that the generator has one service a year.

Country Health SA have an emergency generator maintenance and testing procedure which requires maintenance in line with DPTI technical data schedules which require monthly minor and annual major services.

Being 44 years old the generator has a number of pipes, hoses and fanbelts that appear to be the original items and well past their serviceable life.

The service Mechanic changed fan belts and some hoses on 28/10/2016 however there are still some fuel lines that need to be replaced.

The recent maintenance issues have been:-

April 06 2016	Cracked elbow on oil feed replaced
Aug 16 2016	Batteries exploded and were replaced

Unfortunately the batteries have been replaced with sealed lead acid type batteries and these batteries are not suitable for use in a situation where they receive trickle charging and need to be replaced with vented batteries. The batteries also need to be in an enclosure as currently the batteries and their terminals are open and at risk of physical damage and inadvertent shorting of terminals.

The last service on the generator was carried out on September 20, 2016 (8 days before the state power outage) after which a 4 hour test was completed.

We were advised that there were no problems during the four hour test after the generator was serviced and for all intents and purpose the generator was in a serviceable condition.



*Batteries needing replacing*



*Fanbelts needing replacing*



*Fuel pipes needing replacing*

## 4.2 GENERATOR TESTING

Australian Standards AS 3009 specify that a standby generator in a Hospital is to be tested by running for a period of at least four hours, under load, and at intervals of not more than monthly (ie 4 hours a month, every month as a minimum).

Readings need to be recorded during this testing and industry standard practice is to record readings every 15 minutes. The load at which tests should be conducted is a minimum of 40% of rated capacity and manufacturers would usually suggest running at full load during testing.

Readings should be taken of the following as a minimum:-

- Voltage.
- Load Amps.
- Water temperature.
- Oil pressure.
- RPM (revs per minute).
- Oil used.
- Diesel used.

Up until May 2015, generator testing was carried out monthly by starting the generator, without any load connected, and run for approx. 10-15 minutes or so then switched off. There were no records of testing able to be provided before May 2015.

We were advised that 4 hour, on load testing commenced in May 2015 and is now considered to be the minimum requirements for generator testing by the Honeywell however this does not always happen.

Testing is usually carried out at 7pm on the designated day and apparently this time was chosen as there are concerns about the generator's capacity to provide all of the Hospitals essential load requirements.

There is no documented evidence of who, when or why this decision was made however it is believed the decision came out of concerns about the total load on the generator due to electrical loads that have been added to the essential supply over the years and that the generator appeared to be struggling at times during testing.

Testing is carried out when only the essential supply to Wards A/B/C, Accident and Emergency and Reception is being used so does not include essential loads to areas such as Theatres, Theatre Air Conditioning, Kitchen, Renal, Chemotherapy, Pharmacy and Delivery.

This essentially means that the generator is never tested under full essential load conditions and may not be able to support the full essential load requirements of the Hospital.

Further to this, our understanding from discussion with both Honeywell and CHSA Staff is that testing cannot be conducted when Theatre is in use, when Renal or Chemotherapy is in use and if X-Ray need to be used.

Testing must be stopped if any of these services are required to be used when testing is occurring. This appears to be dictated by Doctors/ Surgeons that perform procedures in the Hospital.

Currently there are services operating on all but one night a week (Tuesday), which is when testing is usually carried out, and we understand that this will change soon with Renal operating all nights during the week which means that finding a period of time to conduct monthly 4 hour testing will become more difficult.

Between January 2016 and September 2016 testing was not able to be carried out on the following months:-

- January, due to Hospital operational reasons
- May, cancelled 3 times during month due to Hospital operational reasons
- June, cancelled 2 times during month due to Hospital operational reasons
- July, cancelled once and completed partial test of 3.5 hours on 26<sup>th</sup> then stopped due to Hospital operational reasons
- August, testing did not occur due to batteries exploding when attempting testing on the 16<sup>th</sup>

4 hour testing was completed in the following months:-

- February
- March
- April
- September

While writing this report the October test became due. The test was conducted and the generator ran for 4 hours with the peak load being 110 Kilowatts.

Readings were taken on these months however the number of recordings and the items recorded vary month to month and on one month (July) there was only one recorded entry on the test sheets at the very beginning of the test.

1. Recording of readings needs considerable improvement for this site.
2. Agreement on set testing times also needs to be negotiated at this site.

Generator testing should be carried out with the full Hospital essential load on the generator to ensure that the generator has the real capacity to run the full load including start up as would be required when a generator comes on line during a power outage. Without full load testing it can never be guaranteed that the generator is able to support the Hospitals essential load requirements in an emergency.

If the generator cannot support the full Hospital essential load requirements then either items need to be removed from the essential supply or the generator needs to be upgraded to meet current capacity demands.

The first step in assessing the requirement for reducing load, or increasing generator size, should be a detailed study of the current Hospital essential power loads against the Australian standards for essential power in Hospitals (AS 3009) to determine whether there are loads that are not true essential loads but are currently connected to the Generator and should be removed from the generator supply.

Below is a table showing the loads that have been recorded during monthly testing since May 2015:-

<b>PORT AUGUSTA HOPITAL GENERATOR MONTHLY TEST LOADS</b>		
Month	Max load Kilowatts (KW)	Max load Amps (A) (on any phase)
May 2015	120 KW	245 A
June 2015	115 KW	250 A
July 2015	105 KW	200 A
August 2015	140 KW	260 A
September 2015	101KW	205 A
October 2015	110 KW	210A
February 2016	125 KW	230 A
March 2016	110 KW	200 A
April 2016	90 KW	160 A
July 2016	85 KW	180 A
August 2016	100 KW	180 A
September 2016	75 KW	145 A
October 2016	88 KW	145 A

*Table 2: Monthly Generator Test Loads*

Based on the engine rating of 219 kilowatts we can see that monthly testing does not come close to the maximum motor load.

Below is a table of highest and lowest recorded generator loads as a percentage of the engine capacity:-

<b>MONTHLY TEST LOADS AS A PERCENTAGE OF ENGINE CAPACITY</b>		
Month	Load Kilowatts (KW)	% of ENGINE CAPACITY
August 2015	140 KW	64%
September 2016	75 KW	34%

*Table 3: Maximum and Minimum Load Readings as % of Engine Capacity*

Throughout the life of the generator it has mainly had minimal or no load connected and only some (7-8) months in the last years of moderate load.

Due to this low loading the engine is likely to have carbon build up and possibly engine bore glazing which could lead to some loss of power in the engine as well as overheating when needing to provide full load.

When diesel engines are only lightly loaded, as part of their maintenance regime, they should be run on a resistive load bank at full load at least annually for a number of hours to work the engine and burn off deposits that settle in the motor due to low loading. It is also prudent to run generators to allow a turnover of fuel.

## **5 GENERATOR FAILURE EVENTS**

---

### **5.1 LAST PREVIOUS POWER OUTAGE**

The last power outage prior to the September 2016 main power outage event was on 06/07/2015. The outage happened at approximately 10am and only lasted for a couple of minutes. It was noted by the Honeywell maintenance staff that the generator appeared to be "struggling" apparently due to high load, albeit no readings were taken or observed.

### **5.2 GENERATOR FAILURE EVENTS 28/09/2016**

On September 28, 2016, at approximately 11.30am, a mains power loss occurred, which required the Port Augusta Hospital Generator to provide essential power to the Hospital.

The Hospital generator had one failure which caused the generator to stop and two mechanical faults that required shutting down the generator and repairs being carried out on the day. Below is a description of the events that occurred.

1. The Hospital generator started and provided backup power to the site as would be expected when mains power was lost.
2. The Honeywell's maintenance staff claims that at some time after the generator started running they went into the generator plant room and were concerned to hear the generator appearing to be working extremely hard and to see the amp gauge on the control panel indicating the load on the generator as being just below 300 amps.
3. The Honeywell advised us that they contacted the CHSA to advise of their concerns that they thought the generator might be overloaded.

Honeywell was not able to give us an idea as to what approximate time this would have been and it is difficult without this time line to know if there was an opportunity to disconnect any load before the generator stopped. During the time between the automatic starting of the generator and the failure of the generator, the Honeywell Electrician had been attending to manually restarting Hospital plant and equipment that needs to be restarted after any power loss.

At approximately 12.45 pm (approximately 1-1/4 hours after auto starting) the generator stopped. According to the Honeywell electrician there was no indication of any problem until he noticed the lights go out and at that point he realized the generator had stopped.

The Honeywell Electrician went to the plant room and noticed that the generator was stopped and showing a high water temperature alarm. The electrician restarted the generator and after the generator had been running for a short while he noticed an oil leak at the front of the generator engine. He then shut the generator down and notified the Honeywell Facility Manager of the issue.

The Honeywell Facility Manger then advised the CHSA that the generator needed to be repaired and the Hospital would be without any power until the generator was repaired.

As there was no way of knowing how long the generator was going to be out of service, CHSA staff tried to access a hire generator to be installed, however there were no local generators available.

Honeywell did manage to obtain two small generators that were used to keep drug fridges and the communications infrastructure operating during the times of total power outages during the day.

Eventually SA Power Networks (SAPN) were contacted and they arranged to have a generator shipped up from Adelaide however it was going to be around 7pm before the generator arrived on site and approximately 7.30 when it was connected to the transformer and provided power to the Hospital.

In the meantime Butler Mechanical Services were called and attended site at approximately 1.15 pm and identified a leak in an oil pipe at the front of the motor.

It took approximately 2 hours from the time of the generator failure to the completion of the replacement of the oil pipe and the Hospital generator was back on line at approximately 3.15 pm.

Once the generator was running the Honeywell electrician again busied himself with manual restarting of plant etc around the Hospital.

The Hospital generator had then been running for approximately 1-1/4 hours as the electrician walked back past the generator enclosure when he noticed a mist coming out through the radiator grille. Initially he thought it may have been coolant that was leaking and went in and turned the generator off. This was at approximately 4.30 pm.

CHSA was again notified that the generator was once again in need of repair and had been turned off.

Butler Mechanical Services were again called out and identified that it was actually a rubber diesel feed line at the front of the engine that had split and that it was diesel that was being sprayed out through the radiator.

From the turning off of the generator until the generator was repaired took approximately 4 hours with repairs to the generator finished at approximately 8.30 pm. SAPN had already delivered and connected a generator by 7.30 pm.

The SAPN generator had been connected to the consumer's mains at the Hospital transformer so, to the Hospital's electrical infrastructure it appeared as if the Hospital had mains power restored again and the SAPN loan generator was trying to supply load to both the essential and nonessential Hospital loads.

The Honeywell Electrician said that the SAPN generator was having difficulty delivering the Hospital power demand as it was trying to supply the whole Hospital and was not large enough, so the Honeywell electrician started turning off all non-essential loads until the Hospital was more or less just requiring the minimum amount of essential power (as would be similar to when the Hospital generator is tested).

The Hospital then continued to run on the SAPN generator until approximately 4.15 pm the following day.

According to the Honeywell Facility Manager, the SAPN generator stopped at about 4.15 pm on Thursday 29/09/2016 due to a fault on the generator (nature of fault unknown).

At this time the Hospital generator started and ran without fault for a short period until SAPN had reconnected the mains power supply back to the Hospital at approximately 5.00 pm on Thursday 29/09/2016.

Once the mains power was restored to the Hospital the Hospital generator automatically shut down as it would do normally once mains power had been restored from a power loss.

The generator then had its usual monthly test in October 18th 2016 however the test lasted 3.25 hours (not the full 4 hours) and the load was only 88 Kilowatts.

<b>PORT AUGUSTA HOSPITAL GENERATOR FAILURE TIME LINE</b>		
<b>Time/date</b>	<b>Event</b>	<b>Comments</b>
<b>28/09/2016</b>		
11.15 am.	Mains power failed and generator started	
	Honeywell Maintenance Manager noticed generator working hard and load was approximately 300 amps on the amp gauge of the generator control panel.	
12.45pm	Generator stopped and had high water temperature alarm. Generator restarted. Oil leak noticed and generator manually stopped. Service mechanic called to repair generator. CHSA staff start process of procuring a second generator as a backup.	Generator had been operating for 1-1/4 hours when it stopped.
1.15 pm	Butlers Mechanical Services attended site to repair oil leak.	
3.15 pm	Repairs completed and generator back on line.	Generator had been out of service and the Hospital was without power for 2.5 hours until the generator was operating again.
4.30 pm	Fuel line ruptured and generator was turned off so repairs to the fuel line could be carried out.	The Hospital generator ran for approximately 1-1/4 hours before a major leak was noticed and the generator shut down.
7.30pm	SAPN generator connected to Hospital transformer	Generator had been out of service and the Hospital without power for 3 hours before the SAPN generator was connected.
8.30 pm	Hospital generator repaired but left off line with the Hospital continuing to run on the SAPN generator.	
<b>29/08/2016</b>		
11.55 am	Mains power was restored to the town but the Hospital continued to run on SAPN generator so as not to interrupt Hospital operations.	
4.15 pm	SAPN generator failed. Hospital generator started.	
5.00 pm	Mains power restored to Hospital. Hospital generator automatically stopped when mains power was restored.	

*Table 4: Generator Failure Event Time Line*

Based on the recorded events of the day there appear to be three events that caused the Hospital generator to stop or be tuned off by maintenance staff, being:-

- Over temperature which shut the generator down.
- Oil leak with generator shut down by maintenance staff.
- Fuel line rupture with generator shut down by maintenance staff.

## 6 GENERATOR FAULTS

### 6.1 GENERATOR ESSENTIAL LOAD

SSE advised Honeywell that we needed to assess the load that would have been placed on the generator during the power loss and that a method needed to be developed which would as close as possible simulate the essential load requirements at the time of the power outage.

This would enable a determination to be made as to whether the generator was actually overloaded or not. This test was carried out on 07/11/2016 at approximately 1.30pm.

The readings obtained by taking measurements with just the essential loads connected are:-

<b>*ESSENTIAL LOAD READINGS TAKEN 07/11/2016</b>			
RED Phase Amps	White Phase Amps	Blue phase Amps	Total Kilowatts (KW)
390 Amps	325 Amps	300 Amps	198 KW

\*This is a simulated load to try and replicate the actual load on the day of the outage. The load may have been higher but there is no data to support this.

As the engine is rated at 219 Kilowatts and the load is approximately 198 kilowatts we can conclude that the engine was working very hard, however a standby diesel generator should be able to provide 100% of its capacity continually and can actually provide an overload for one hour in twelve.

198 Kilowatts is approximately 90% of the engine capacity of 219 kilowatts, so theoretically, if the engine is in good condition, the generator should be able to provide this load with room for more load still available.

### 6.2 HIGH WATER TEMPERATURE ALARM

After the generator had been running for about 1-1/4 hours the generator stopped.

When the Honeywell Site Electrician went to the generator plant room he noticed a high water temperature alarm activated.

The maximum temperature for the day was approximately 25 degrees so the generator was not operating in high ambient conditions that may have contributed to an overheating problem.

The generator was able to be restarted almost immediately after it stopped, which would indicate that the stoppage was controls based, at a predetermined setting rather than a seizure of the engine caused by overheating.

Other factors that could cause an overheating problem are:-

- Low coolant level
- Stuck or inoperative thermostat
- Damaged water pump
- Blockage in coolant pathways
- Blocked radiator (internal)
- Blocked radiator fins shroud etc.(external)
- Faulty water temperature switch
- Faulty water temperature sender unit
- Fan belt slippage
- Low oil pressure
- Overloading

There is no evidence of there being overheating issues with the generator in the past or during monthly testing including testing in October 2016 (after the failure event) with temperature recordings showing constant water temperatures of 180 degrees F or approximately 80 degrees C which appears to be the correct operating temperature for the engine.

However it must be noted that the generator is never run at or near full capacity as it did on 28<sup>th</sup> September 2016.

Low oil pressure would have brought up a low oil pressure alarm so we can discount this as a cause as there was no low oil pressure alarm activated.

As there is no record of event (not having computerized controller) the cause of the high temperature alarm is hard to determine. Further investigation would be required to positively identify the cause of the overheating shutdown.

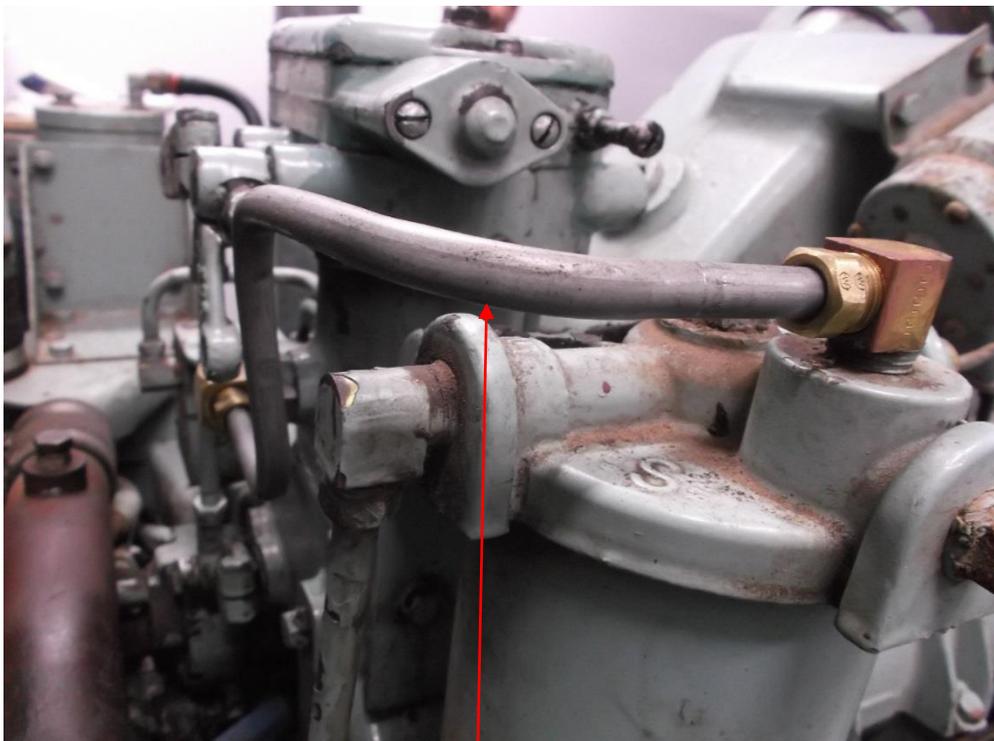
### **6.3 OIL LEAK**

The Honeywell Site Electrician informed us that he restarted the generator after the over temperature shutdown and subsequently noticed an oil leak at the front of the generator engine. The Electrician then shut the generator down and informed his immediate Manager (Honeywell) of the issue.

Our understanding from discussion with Butler Mechanical Services is that a split occurred in a metal oil feed line at the front of the motor.

Butler Mechanical services said that they found a thread at a connector had been stripped at some stage when this pipe had been removed and reinstalled. This meant that the fitting was loose and that through vibration etc a rupture developed at a weak point in the pipe (a bend in the pipe).

Butler Mechanical services manufactured a new pipe and installed it to the generator which took approximately 2-1/2 hours.



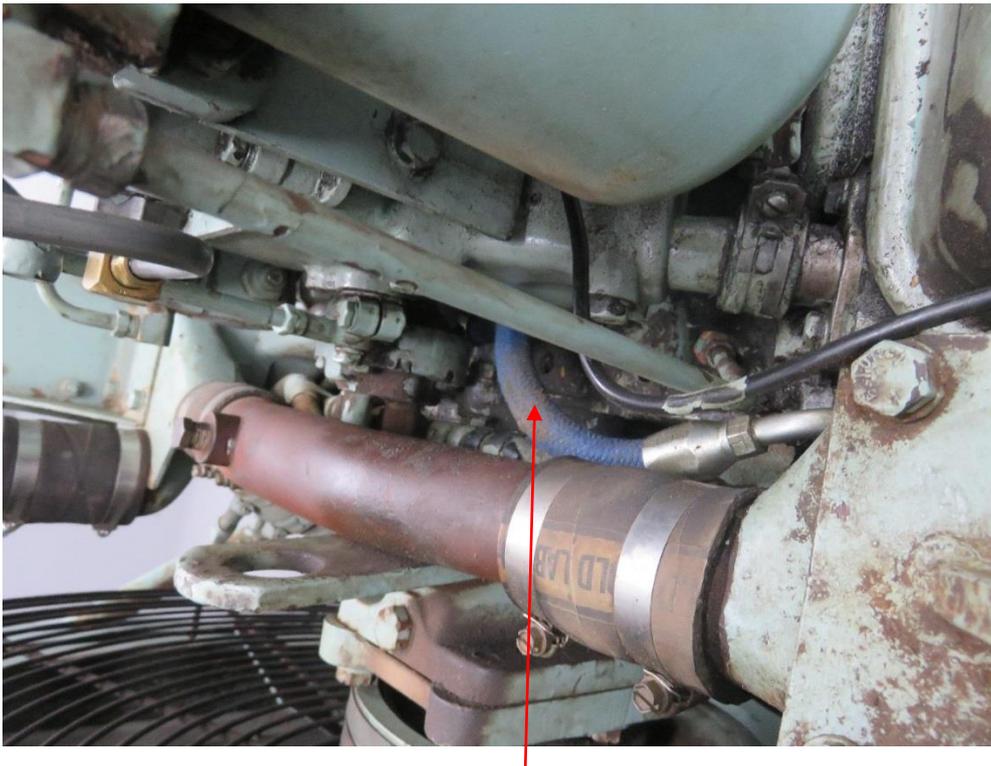
*Oil pipe that was replaced by Butler Mechanical Services*

#### **6.4 FUEL LINE RUPTURE**

Approximately 1-1/4 hours after the generator was put back into service after the oil leak was repaired, another leak developed which turned out to be a rubber diesel fuel line that ruptured at the front of the generator engine.

The generator was immediately shut down and Butler Mechanical Services were called out to repair the ruptured fuel line which took approximately 4 hours.

We believe that the ruptured fuel line was the original fuel line making it 44 years old and over time had become brittle and reached a point where it failed and ruptured.



*Fuel pipe replaced by Butler Mechanical Services*

#### **6.5 DEPOSIT BUILD UP FROM LOW LOADS**

With the testing regime of running the generator without load for a very short period of time the generator never achieves proper operating temperature, proper running in to seat rings etc and poor/incomplete fuel burning in the cylinders results in particle build up which affects the engine performance.

This poor engine performance could result in overheating when the engine is being run at high output as the engine is not able to provide full power.

The best way to ensure that the engine is in good operating condition is to run it at full load regularly.

This can be achieved by providing a suitable load from the facility or if the load is not consistent then a load bank can be connected to a generator to provide a stable load to keep the engine in good condition.

## **7 HOSPITAL OWNERSHIP AND MAINTENANCE ARRANGEMENT**

---

Our understanding is that the Hospital is not owned by CHSA or SA Health but rather, leased from the Lessor Port Augusta Hospital Limited and that they have engaged Honeywell for the maintenance and repair contract for the main new Hospital. We also understand that Port Augusta Hospital Limited has assigned the administration of the Honeywell contract to CHSA as their Agent.

CHSA administer a number of other buildings on the site as well.

The Honeywell Maintenance Agreement has been negotiated directly between the Building Owner and Honeywell so CHSA or SA Health have no influence on the contract or the contract conditions but are responsible for its administration.

## **8 CONCLUSION**

---

The Port Augusta Hospital generator is approximately 44 years old however over the life of the generator it has only run for a total of 407 hours at the time of our investigation.

The Hospital is not owned by CHSA or SA Health but is leased and there is a maintenance arrangement between the Facility Owner and Honeywell for maintenance of the New Hospital, administered by CHSA and SA Health under assignment from the Owner Port Augusta Hospital Limited.

This means that there are two Facility Managers looking after different sections of the complete Hospital facility and this creates complications regarding replacement of obsolete equipment.

Up until May 2015 the generator was only ever tested by starting the generator and running it without load for 10-15 minutes once a month.

In June 2015 testing was changed to be four hour testing once a month and on load, in line with Australian Standards AS 3009 requirements.

Testing is done generally on a Tuesday night and starting anywhere from 7pm to 8.30 pm.

Testing is carried out at night for two reasons, being:-

- Not to interfere with Hospital operations. Due to this requirement testing does not get carried out regularly every month as it should. As an example testing was only completed in 4 out of 9 months between Jan 2016 and Sept 2016.
- To limit the load on the generator due to concerns about the generator being overloaded with the current essential load requirements due to the continual addition of loads to the generator supply over the years since the designed load when it was installed 44 years ago.

The last recorded outage was on 06/07/2015 and was only for a couple of minutes. This information was not part of Honeywell records but was obtained from the SA Health Hospital facility manager. Honeywell reported the generator appeared to be struggling due to high load.

However as the events were of such short duration we cannot say whether the generator may have stabilized once it had the opportunity to get up to operating conditions. There were no records of any earlier outages available

On Wednesday 28<sup>th</sup> September 2016 a power outage occurred causing the Hospital to rely on their backup generator to provide essential power to the Hospital.

After operating for approximately 1-1/4 hours the generator stopped due to a high water temperature alarm.

After restarting the generator an oil leak from an oil feed pipe at the front of the engine was noticed and the generator was shut down by maintenance staff. The generator was repaired and put back into service.

The generator then ran for approximately 1-1/4 hours when a second leak was noticed and the generator was shut down again.

The second leak appeared as mist coming out of the radiator so initial thoughts were that it was a coolant leak however after further investigation it turned out to be a rubber diesel fuel supply hose that had ruptured.

The oil leak and the fuel leak are purely maintenance related issues with the oil leak being caused by one of two possibilities being:-

- Poor installation practice
- Age of pipe past serviceable life

The fuel hose rupture would most definitely be attributed to the age of the hose as the hose would have become brittle over a lifespan of 44 years and failure was inevitable for a rubber fuel hose of this age at some time.

The two events, oil leak and fuel leak, which resulted in the generator being manually shut down are quite straight forward to understand however the issue of the overheating is not quite so simple.

We do not know if the generator would have overheated a second time had it run for a longer period of time however under test conditions it ran for 3.5 hours without overheating issues after the events of September 28/29 in its October monthly test however only under a low load.

Findings seem to show that the generator was not overloaded at the time of the power failure and that the main causes of failure appear to be age and maintenance related issues.

Essentially the Port Augusta Hospital has an old generator (44 years old) that is

- Never tested under full essential load conditions,
- Has only recently (last 12 months) been tested for 4 hours per month as per Australian Standards recommendations,
- Does not have a preventative maintenance program,
- Is only serviced once a year
- Has perishable items such as hoses, fanbelts etc that may still be the originals from 44 years ago and the main generator outages were caused by mechanical faults needing repair.

## 9 RECOMMENDATIONS

---

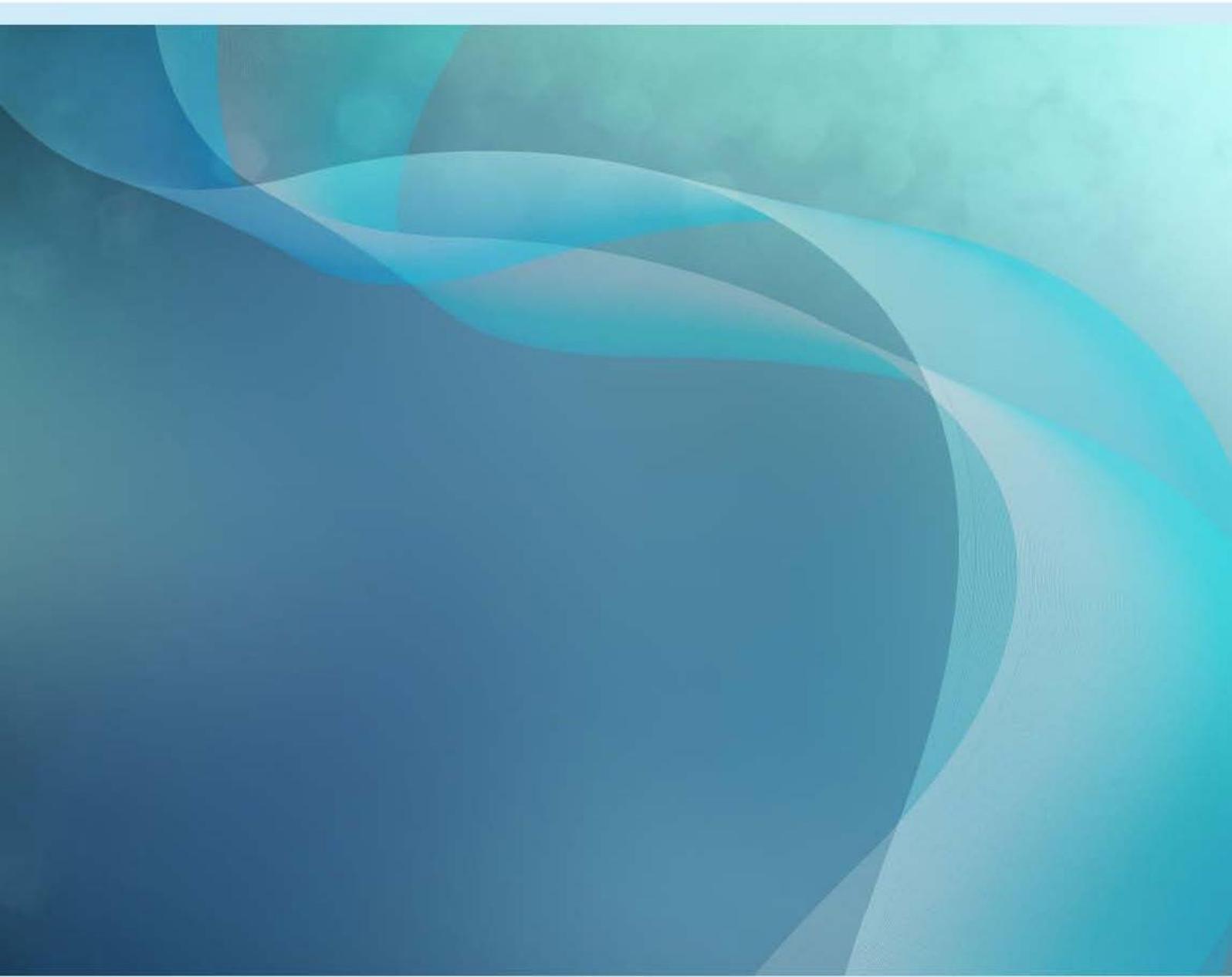
Recommendations for the Port Augusta Hospital Essential power supply are:-

- Conduct an assessment of the current essential loads and determine if there are loads that should not be on essential power.
- Remove any loads that do not need to be on essential power.
- From the above assessment determine the existing generator load requirements and provide a new generator to meet those loads.
- A monthly testing regime needs to be developed that will allow the generator to be tested at full essential load capacity and to ensure that 4 hour monthly testing can be done every month.
- Regular annual testing at 100% on a load bank needs to be scheduled into a maintenance schedule.
- Monthly and annual maintenance servicing needs to be scheduled for the generator to DPTI or CHSA schedule requirements.
- Replacement of all original pipes and hoses not yet done.
- Accurate records need to be provided as to what is done for each service.
- Monthly test results need to be accurately recorded.
- If the existing generator is capable of providing the current essential power requirements then the generator needs a major inspection and overhaul all items that may need to be replaced due to age and condition. This includes checking compression, oil pressure, coolant pumping and all other critical components and may actually require providing a temporary generator while the Hospital generator receives a major inspection and possible re build.
  - A ball park figure to do this would be \$50,000.00 plus crantage and transport to Detroit workshop probably another \$10,000.00 then a temporary generator would need to be hired and installed which could run into \$10's of thousands of dollars depending on how long the engine was out of service. For the money that would be spent checking and rebuilding the existing engine it would be recommended to replace the generator with a new generator.
- Renegotiate the maintenance contract at the end of the current contract and have DPTI through AGFMA take on the maintenance contract.



**Australian Government**  
**Bureau of Meteorology**

# Severe thunderstorm and tornado outbreak South Australia 28 September 2016



© Commonwealth of Australia 2015

This work is copyright. Apart from any use as permitted under the Copyright Act 1968, no part may be reproduced without prior written permission from the Bureau of Meteorology. Requests and inquiries concerning reproduction and rights should be addressed to the Production Manager, Communication Section, Bureau of Meteorology, GPO Box 1289, Melbourne 3001. Information regarding requests for reproduction of material from the Bureau website can be found at [www.bom.gov.au/other/copyright.shtml](http://www.bom.gov.au/other/copyright.shtml)

Published by the Bureau of Meteorology

## Table of Contents

1	Executive Summary .....	1
2	Introduction.....	2
3	Meteorology.....	3
3.1	Antecedent Conditions .....	3
3.2	Synoptic Scale Development.....	5
3.3	Mesoscale Thunderstorm Development .....	7
3.4	Radar and Satellite Evidence .....	12
3.5	Thunderstorm Timeline - 28 September .....	18
4	Tornado Damage Assessment .....	22
4.1	Blyth Tornado – Rated F2 Strength .....	23
4.2	Wild Dog Creek Tornado – Rated F2 Strength .....	28
4.3	Wilmington Tornado – Rated F2 Strength .....	31
4.4	South Mintaro Tornado – Rated F1 Strength.....	37
5	Impact on Power Transmission Network.....	39
6	Warnings Timeline.....	43
7	Summary .....	44
8	References.....	45
9	Appendices .....	46

## List of Tables

<i>Table 1: Fujita Scale (converted from mph to km/h with rounding)</i> .....	23
<i>Table 2: Blyth tornado description of damage, estimated wind speeds and corresponding rating</i> .....	24
<i>Table 3: Wild Dog Creek tornado description of damage, estimated wind speeds and corresponding rating.</i> .....	29
<i>Table 4: Wilmington tornado description of damage, estimated wind speeds and corresponding rating.</i> .....	33
<i>Table 5: South Mintaro tornado description of damage, estimated wind speeds and corresponding rating.</i> .....	38
<i>Table 6: Summary of Severe Thunderstorm Warnings issued.</i> .....	43

## List of Figures

<i>Figure 1: Sea surface temperature (SST) deciles for the Timor Sea and the Indian Ocean south of Java for winter 2016 (1 June to 31 August).</i> .....	3
<b>Figure 2:</b> <i>Rainfall deciles for Australia for winter 2016 (1 June to 31 August).</i> .....	4
<i>Figure 3: Root zone soil moisture variation from average (top 1 metre) for 27 September 2016.</i> .....	5
<i>Figure 4: Synoptic mean sea level pressure charts for 28 September 2016. from top left to bottom right - 3:30 am (CST), 9:30 am (CST), 3:30 pm (CST) and 9:30 pm (CST).</i> .....	6
<i>Figure 5: Surface dewpoint temperature observation analysis at 2:30 pm CST 28 September, showing the high moisture levels ahead of the front.</i> .....	8
<i>Figure 6: CAPE (red contours) and LI (shaded) analysis 2:30 pm CST, showing the highly unstable environment ahead of the front.</i> .....	9
<i>Figure 7: Aerological diagram for Adelaide Airport at 2:30 pm CST, modified with temperature and dewpoint temperature observations from Port Pirie Automatic Weather Station (AWS).</i> .....	10
<i>Figure 8: Hodograph based on the upper winds from Adelaide Airport at 2:30 pm CST and surface wind observations from Clare AWS. The looping shape of the wind shear profile (black line) indicates extreme low level SRH, which is favourable for tornado formation. The storm motion vector (red arrow) is northwest at 82 km/h.</i> .....	12
<b>Figure 9:</b> <i>Buckland Park Radar reflectivity scans at 0.5°, 03:31 pm (left) and 1.8°, 03:32 pm (right) of the supercell thunderstorm responsible for the Blyth tornado. Numbers indicate severe thunderstorm radar signatures; (1) bounded weak echo region (BEWR), (2) hook echo, (3) elevated core with extreme maximum reflectivity (74.5 dBZ at 1250 m), (4) echo</i>	

<i>top displacement, and (5) tight low level reflectivity gradient in the updraft/downdraft boundary. ....</i>	14
<i>Figure 10: Idealised radial velocity signature of a mesocyclone where blue is inbound and yellow outbound. ....</i>	15
<i>Figure 11: Buckland Park Doppler Radar 0.5° velocity scan at 03:31 pm of the supercell thunderstorm responsible for the Blyth tornado. The peak rotational velocity is 32 m/s (circled in black) at 1400m AGL. ....</i>	16
<i>Figure 12: Multilayered Himawari-8 satellite image from 03:40 pm showing various severe thunderstorm signatures. The subset shows the supercell responsible for the Blyth tornado with the overshooting top (blue circle), enhanced-v including the back sheared anvil (red line) and warm wake (yellow circle). ....</i>	17
<i>Figure 13: 24 hours of lightning data for 28 September provided by Global Position and Tracking Systems (GPATS). In real time lightning data can be used to assess relative severity of thunderstorms, with greater lightning frequency indicating a stronger updraft. Timing of strikes prior to midnight; Red 0 to 6 hours, Yellow 6 to 12 hours, Green 12 to 18 hours, Blue 18 to 24 hours. ....</i>	18
<i>Figure 14: 4-5 cm hailstones at Blyth. Credit Zack Zweck (left) and Tanya Penna (right). ....</i>	20
<i>Figure 15: The locations of the four assessed tornado paths overlaid with transmission network and damaged towers. ....</i>	22
<i>Figure 16: Approximate Blyth tornado path with damage markers, transmission network (blue) and damaged towers (red). ....</i>	24
<i>Figure 17: Blyth tornado damage marker 1. ....</i>	25
<i>Figure 18: Blyth tornado damage marker 2. ....</i>	
<i>Figure 19: Blyth tornado damage marker 3. ....</i>	25
<i>Figure 20: Blyth tornado damage marker 4. ....</i>	
<i>Figure 21: Blyth tornado damage marker 4. ....</i>	26
<i>Figure 22: Blyth tornado damage marker 5. ....</i>	
<i>Figure 23: Blyth tornado damage marker 5. ....</i>	26
<i>Figure 24: Blyth tornado damage marker 6. ....</i>	
<i>Figure 25: Still frame from video footage of the Blyth tornado. Credit Michael Jaeschke. ....</i>	27
<i>Figure 26: Still frame from video footage of the Blyth tornado. Credit Jace Bourne. ....</i>	27
<i>Figure 27: Still frame from video footage of the Blyth tornado crossing Blyth between 3:40 pm and 3:45 pm. Credit Michael Mathew. ....</i>	28
<i>Figure 28: Approximate Wild Dog Creek tornado path with damage markers, transmission network (blue) and damaged towers (red). ....</i>	29
<i>Figure 29: Wild Dog Creek tornado damage marker 1. ....</i>	30
<i>Figure 30: Wild Dog Creek tornado damage marker 1. ....</i>	

<i>Figure 31: Wild Dog Creek tornado damage marker 2.</i>	<i>Figure 32: Wild Dog Creek tornado damage marker 2.</i>	30
<i>Figure 33 Wild Dog Creek tornado damage marker 3.</i>	<i>Figure 34 Wild Dog Creek tornado damage marker 3.</i>	31
<i>Figure 35: Wild Dog Creek tornado damage marker 4.</i>	<i>Figure 36: Wild Dog Creek tornado damage marker 4.</i>	31
<i>Figure 37: Approximate Wilmington tornado path with damage markers, transmission network (blue) and damaged towers (red).</i>		32
<i>Figure 38: Wilmington tornado damage marker 1.</i>	<i>Figure 39: Wilmington tornado damage marker 1.</i>	33
<i>Figure 40: Wilmington tornado damage marker 2.</i>	<i>Figure 41: Wilmington tornado damage marker 3.</i>	34
<i>Figure 42: Wilmington tornado damage marker 4.</i>	<i>Figure 43: Wilmington tornado damage marker 4.</i>	34
<i>Figure 44: Wilmington tornado damage marker 5.</i>	<i>Figure 45: Wilmington tornado damage marker 6.</i>	35
<i>Figure 46: Wilmington tornado damage marker 7.</i>	<i>Figure 47: Wilmington tornado damage marker 8.</i>	35
<i>Figure 48: Tornadic damage to trees along Spring Creek, nearby damage marker 4, indicates the approximate width of the Wilmington tornado.</i>		36
<i>Figure 49: Still frame from video footage of Wilmington tornado. Credit Sharee and Locky McCallum.</i>		36
<i>Figure 50: Approximate South Mintaro tornado path with damage markers.</i>		37
<i>Figure 51: South Mintaro tornado damage marker 1.</i>	<i>Figure 52: South Mintaro tornado damage marker 1.</i>	38
<i>Figure 53: South Mintaro tornado damage marker 2.</i>	<i>Figure 54: South Mintaro tornado damage marker 3.</i>	38
<i>Figure 55: Damaged towers on the Davenport – Brinkworth transmission line</i>		40
<i>Figure 56: Idealised Wilmington supercell thunderstorm, depicting the position of the tornado(T), forward flank downdraft (FFD) and how they impacted the Davenport – Belalie/Davenport - Mt Lock and Davenport - Brinkworth Transmission Lines respectively. Also shown is the rear flank downdraft (RFD) and updraft region (UD).</i>		41
<i>Figure 57: Buckland Doppler Radar 1.3° (left) and 1.8° (right) velocity scans at 03:32 pm of the supercell thunderstorm responsible for the Blyth tornado. Peak rotational velocities are 27.2 m/s and 28.2 m/s respectively (circled in black).</i>		46
<i>Figure 58: Buckland Doppler Radar 2.4° (left) and 3.1° (right) velocity scans at 03:33 pm of the supercell thunderstorm responsible for the Blyth tornado. Peak rotational velocities are 30.7 m/s and 26.7 m/s respectively (circled in black).</i>		47

---

<i>Figure 59: Severe Thunderstorm Warning issued at 10:10 am</i> .....	48
<i>Figure 60: Severe Thunderstorm Warning issued at 12:26 pm</i> .....	49
<b>Figure 61: Severe Thunderstorm Warning issued at 02:10 pm</b> .....	50
<i>Figure 62: Severe Thunderstorm Warning issued at 03:23 pm</i> .....	51
<b>Figure 63: Severe Thunderstorm warning issued at 05:22 pm</b> .....	52
<b>Figure 64: Severe Thunderstorm warning issued at 06:42 pm</b> .....	53
<i>Figure 65: Severe Thunderstorm warning issued at 07:46 pm</i> .....	54



# 1 Executive Summary

One of the most significant severe thunderstorm outbreaks in recent decades impacted central and eastern districts of South Australia during the afternoon and evening on 28 September 2016. Multiple supercell thunderstorms produced damaging to destructive wind gusts, including at least seven tornadoes, very large hailstones and locally intense rainfall. These supercell thunderstorms and tornadoes impacted the South Australian power network, contributing to a state-wide power outage.

The severity of the thunderstorms was aided by an intense and powerful mid-latitude cyclone (low pressure system), which intensified over the Great Australian Bight on 28 September and directly impacted the state on 29 September.

The severe thunderstorm and tornado outbreak described in this report was the initial phase in a week of severe weather in South Australia. This followed a tumultuous winter and spring where wetter and windier than average conditions had already stretched the State Emergency Service which had already turned out to more jobs than the previous year. Winds on 29 September reached storm force over coastal waters, generating damaging wave action and a significant storm surge in Spencer Gulf. Persistent heavy rain over the Mount Lofty and Flinders Ranges led to flooding impacts, including widespread riverine flooding which continued through to 2 October. A series of fronts associated with a second low pressure system brought further bursts of severe winds and moderate to heavy rain during 2-4 October, which led to renewed flooding.

The impacts arising from the range of weather hazards experienced during the period 28 September to 5 October 2016 will be documented in three reports.

This report focusses on the severe thunderstorm and tornado outbreak on 28 September. The meteorology is described at various scales, from the broad scale antecedent conditions to the synoptic and mesoscale development of supercell thunderstorms and tornadoes. An assessment of ground damage, track length and strength is provided for four of the seven tornadoes, including the impact on power network infrastructure.

Two additional reports are in preparation. These reports will cover the significant storm surge on 29 September 2016 and the widespread floods, which were the most significant in South Australia since November 2005. The flood report will include performance assessments of rain and flood forecasts including forecast and warning systems. The role of the meteorologist embedded within emergency services will also be examined.

The Bureau's engagement with emergency services has been reinforced since 2015 when South Australia's fire and emergency sector secured the services of an embedded meteorologist under contract from the Bureau of Meteorology. The embedded meteorologist rapidly developed a trusted relationship with the Country Fire Service during the Sampson Flat and Pinery Fires, with the State Emergency Service deeply engaged throughout the wet and windy winter and spring in the lead up to this event. Initial indications of a significant weather system with potential severe wind and rain impacts were provided to the State Emergency Service on Friday 22 September. Escalating confidence in the historical significance of the approaching weather system on Monday 26 September provided the SES a firm platform for pre-emptive activation strategies.

## 2 Introduction

One of the most significant severe thunderstorm outbreaks in recent decades impacted central and eastern districts of South Australia during the afternoon and evening on 28 September 2016. Multiple supercell thunderstorms produced damaging to destructive wind gusts, including at least seven tornadoes, very large hailstones and locally intense rainfall. These supercell thunderstorms and tornadoes impacted the South Australian power network, contributing to a state-wide power outage.

The severity of the thunderstorms was aided by an intense and powerful mid-latitude cyclone (low pressure system), which intensified over the Great Australian Bight on 28 September and directly impacted the state on 29 September.

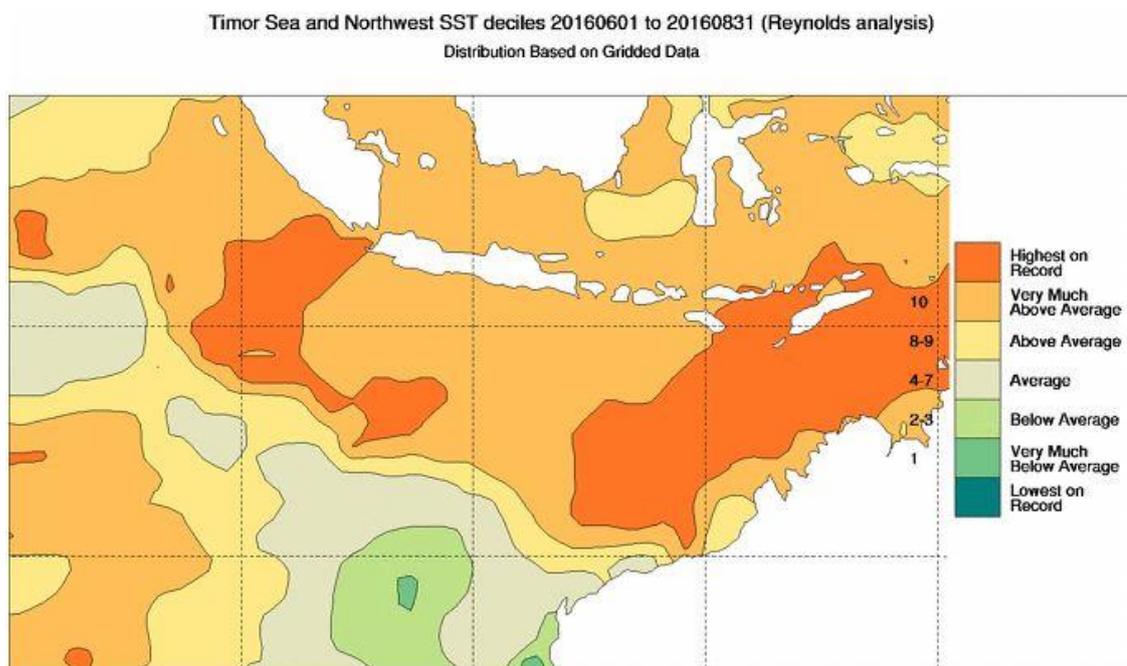
This report focusses on the severe thunderstorm and tornado outbreak on 28 September. The meteorology is described at several scales, from the broad scale antecedent conditions to the synoptic and mesoscale development of the supercell thunderstorms and tornadoes. Weather radar and satellite data have been analysed and integrated with information gathered from an inspection of damage by skilled meteorologists on 6 October. An assessment of damage characteristics, track length and strength is provided for four of the seven tornadoes, including the impact on power network infrastructure. Warnings provided on 28 September are described.

### 3 Meteorology

#### 3.1 Antecedent Conditions

Early in 2016 a weak negative Indian Ocean Dipole (IOD) became established across the Indian Ocean, with a subsequent rapid strengthening during the early part of winter to be at its lowest value on record during July. The negative IOD weakened slightly during August and September but still remained strongly negative. Negative IOD events result from an intensification of westerly winds along the equator, which allows warmer waters to concentrate near Australia. This can be seen in Figure 1, which shows very much above average to highest on record sea surface temperatures (SST) for the Timor Sea and the Indian Ocean south of Java for winter 2016.

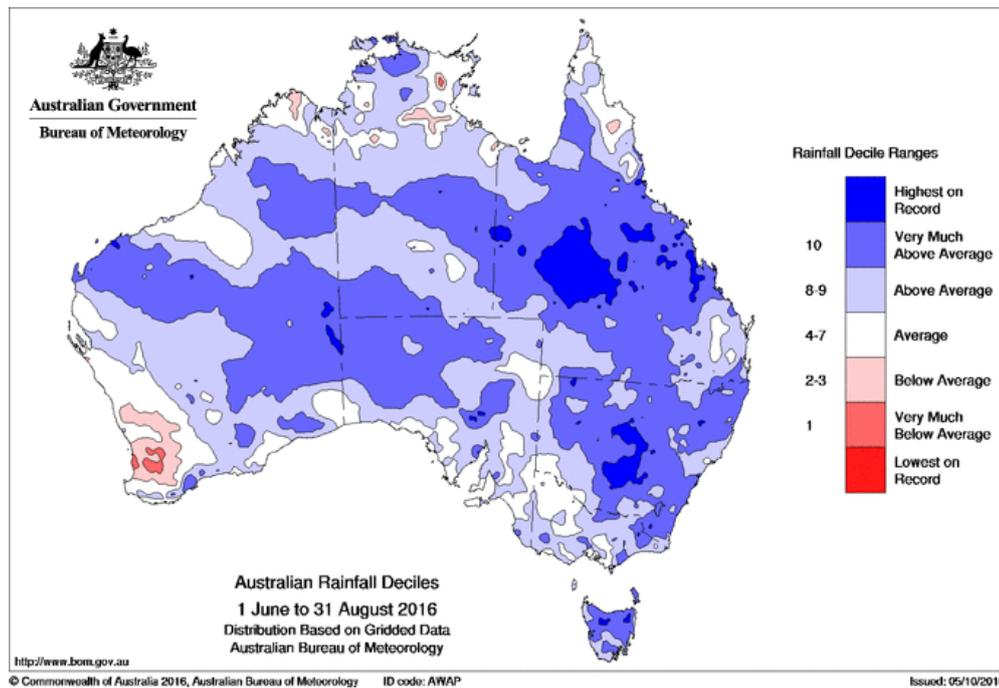
Negative IOD events typically result in above average winter–spring rainfall over parts of southern Australia as the warmer waters off northwest Australia provide increased available moisture to weather systems crossing the country.



**Figure 1:** Sea surface temperature (SST) deciles for the Timor Sea and the Indian Ocean south of Java for winter 2016 (1 June to 31 August).

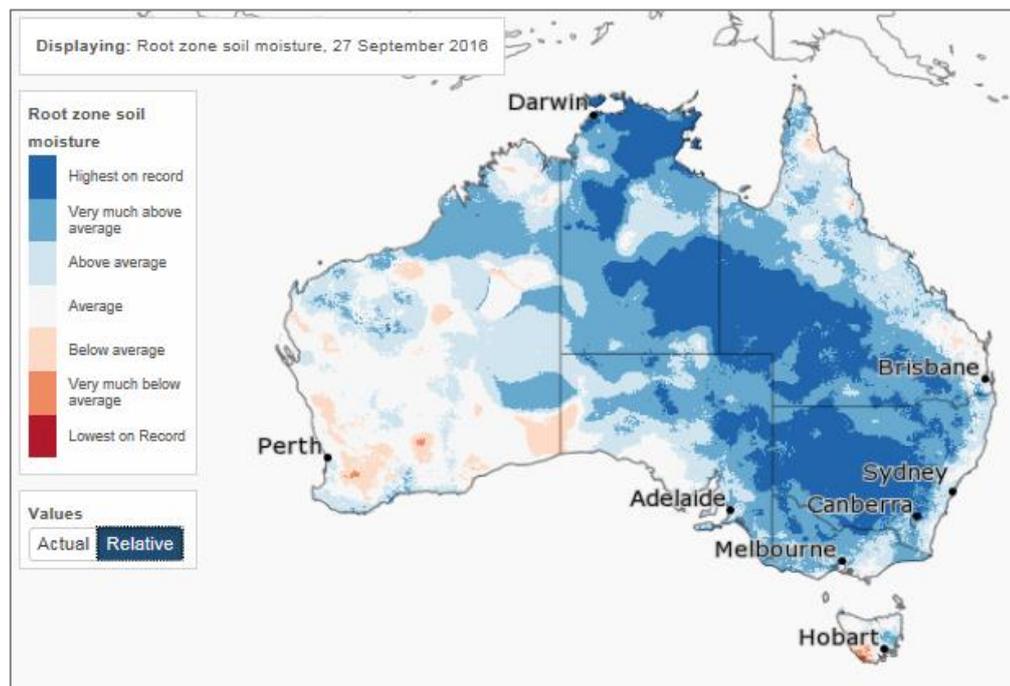
During winter 2016, the above average SST northwest of Australia provided increased moisture flow across the continent, which resulted in numerous rain bearing northwest cloud bands. The

interaction of this northern moisture with many mid-latitude frontal systems resulted in winter 2016 being the second wettest winter on record for Australia (see Figure 2).



*Figure 2: Rainfall deciles for Australia for winter 2016 (1 June to 31 August).*

The abnormally high rainfall in the preceding months produced root zone soil moisture values (top 1 metre) which were highest on record for much of September. This can be seen in Figure 3, which shows a large portion of the Northern Territory, inland Queensland, inland New South Wales and northeast inland South Australia had highest on record zone soil moisture the day prior to the event.



**Figure 3:** Root zone soil moisture variation from average (top 1 metre) for 27 September 2016.

Madden-Julian Oscillation (MJO) phase 5 is associated with enhanced westerly wind flows across the north of the continent and is often associated with increased cloudiness and rainfall through the tropical parts of the country.

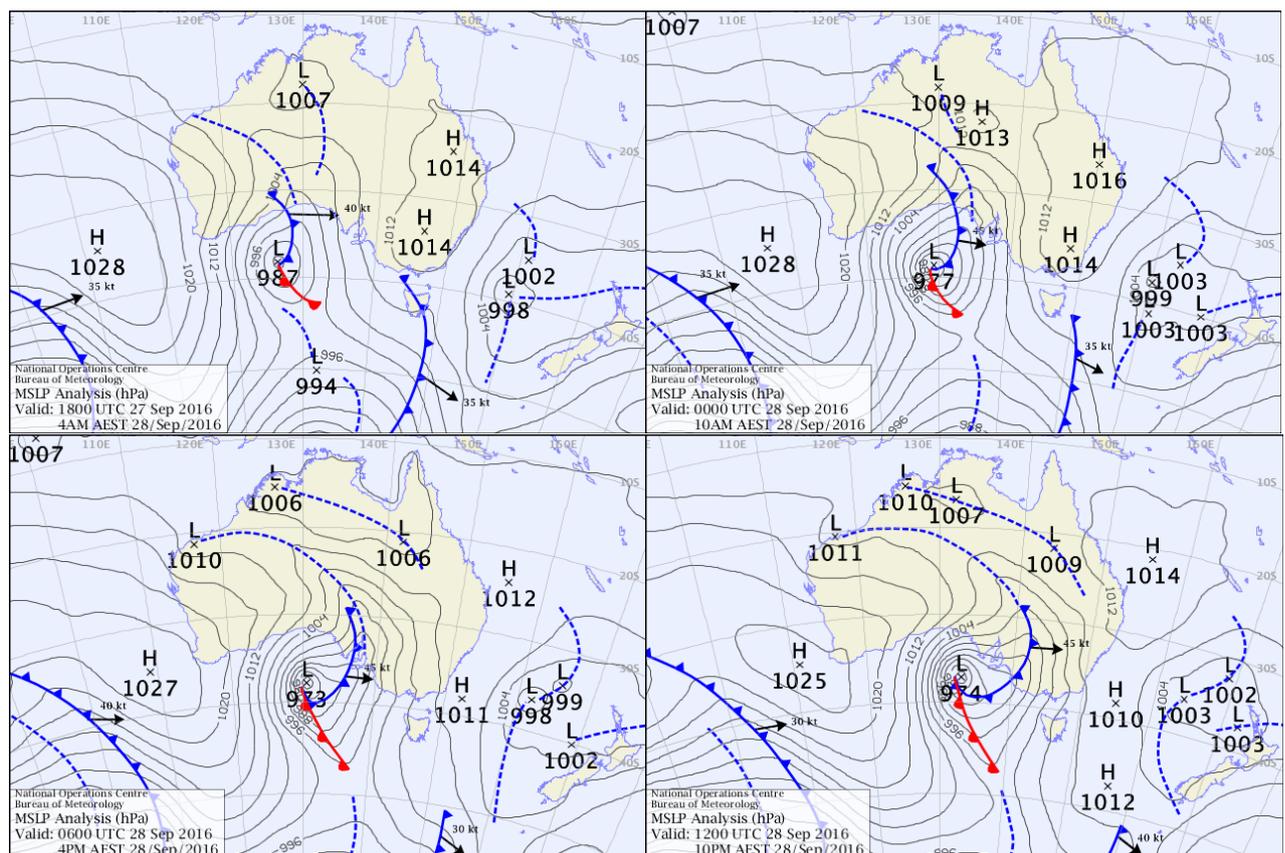
In the week prior and during this event, the MJO was active in phase 5. This is likely to have reinforced the effects of the negative IOD, contributing to the high moisture flow across the north and centre of Australia towards South Australia.

### 3.2 Synoptic Scale Development

In the days prior to 28 September, a highly dynamic Rossby wave pattern resulted in the polar jet stream developing a strong meridional pattern. An upper ridge developed over the southern Indian Ocean and an upper level trough amplified over the Southern Ocean and southern Western Australia. In response to the amplifying upper level trough a surface low pressure system developed south of Albany, Western Australia on 27 September.

During the morning on 28 September the upper trough became negatively tilted near the Western Australia and South Australia border, and began to 'cut off' from the polar jet to the south as a breaking Rossby wave. The cut off upper trough resulted in a transfer of vorticity to the surface, with subsequent explosive cyclogenesis of the surface low pressure system. The central pressure fell 23 hPa in 24 hours to be 973 hPa south of the Bight by 4 pm CST on 28 September.

The low pressure system also generated a north-south oriented cold front, which entered the west of South Australia early on 28 September. The cold front tracked east at about 85 km/h to be near Woomera to Port Augusta to Kangaroo Island by 4 pm, then Moomba to Broken Hill to Mount Gambier by 10 pm (see Figure 4).



**Figure 4:** Synoptic mean sea level pressure charts for 28 September 2016. from top left to bottom right - 3:30 am (CST), 9:30 am (CST), 3:30 pm (CST) and 9:30 pm (CST).

### 3.3 Mesoscale Thunderstorm Development

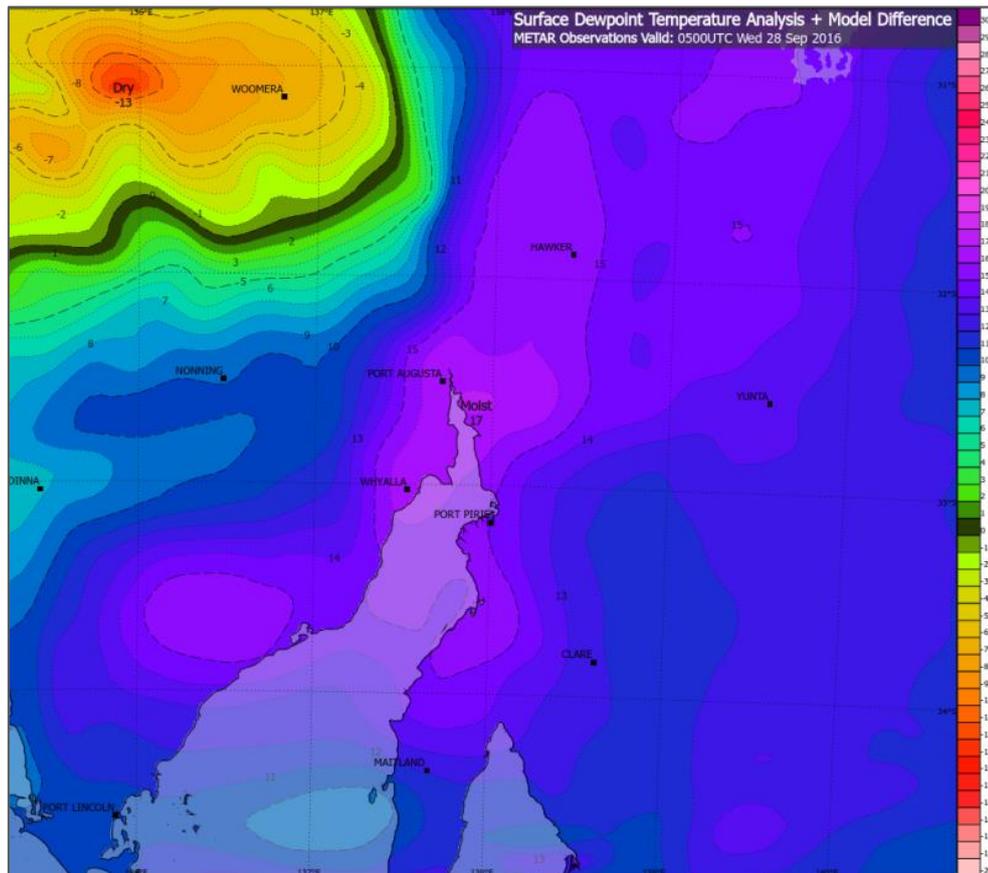
The four key ingredients for severe thunderstorm development are moisture, instability, lift and wind shear. During the afternoon on 28 September these ingredients combined on and ahead of the front.

#### **Moisture:**

In the days preceding 28 September, rain across central Australia reinforced the already wet surface and soil conditions over inland areas. The resulting high humidity air over the Simpson Desert was advected south into central and eastern districts of South Australia by strong northerly pre-frontal winds.

In the early hours on 28 September, middle level thunderstorms developed over the North West Pastoral and Eyre Peninsula and moved southeast across central and eastern districts as a thundery rain band during the late morning and early afternoon. This increased moisture levels over central parts of South Australia where thunderstorms later developed. For example, the surface dew point at Whyalla increased from 6°C at 9 am CST to around 17°C by early afternoon (see Figure 5).

The increased moisture led to low cloud bases, with lifting condensation levels (LCL) of around 400 to 800 m above ground level. Such low LCL increase the potential for tornado development. Precipitable water (PW) values were around 30 mm, significantly higher than the long term September average of 14 mm. Elevated PW values increase the potential for thunderstorms to produce heavy rainfall conducive to flash flooding.



*Figure 5: Surface dewpoint temperature observation analysis at 2:30 pm CST 28 September, showing the high moisture levels ahead of the front.*

### **Instability:**

Clear skies following the thundery rain band led to strong surface heating. The combination of warm moist surface conditions beneath a relatively cold upper atmosphere associated with the upper trough, resulted in a highly unstable atmosphere. In the region ahead of the front, convective available potential energy (CAPE) values were around 1800 J/kg, with surface to 500 hPa lifted indices (LI) as low as -8°C (see Figures 6 and 7). Such large values of CAPE combined with the relatively low freezing level increased the potential for large hail.

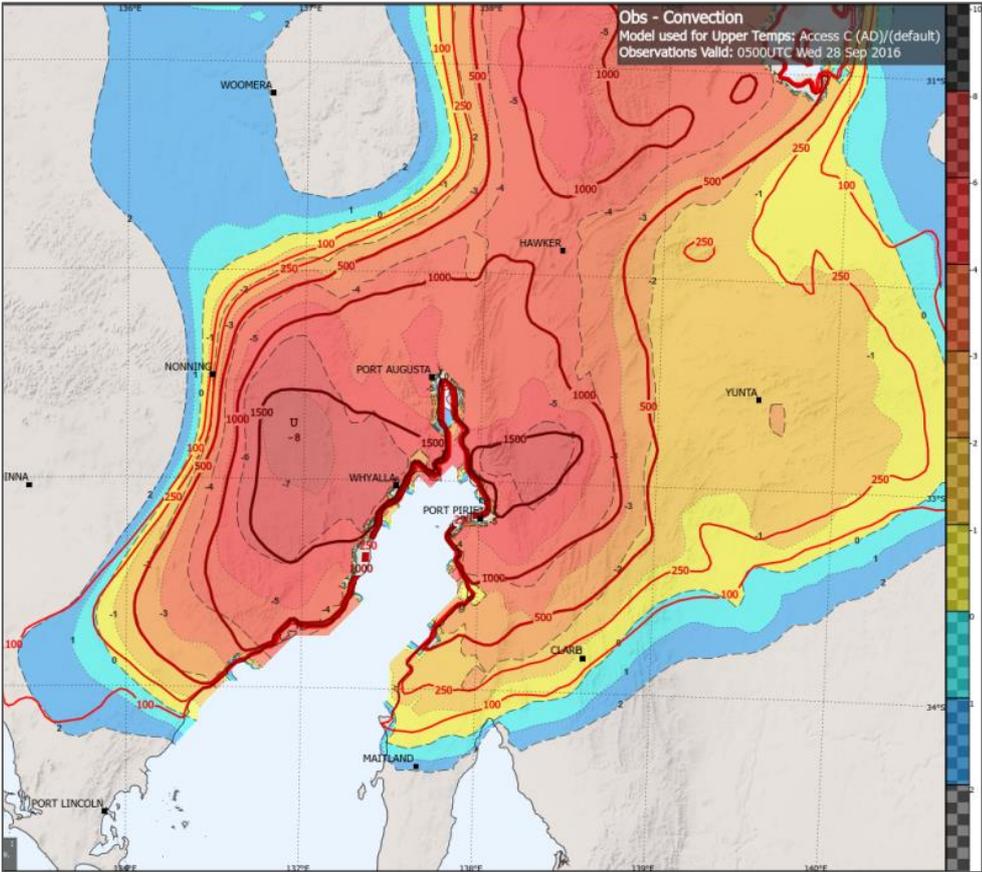


Figure 6: CAPE (red contours) and LI (shaded) analysis 2:30 pm CST, showing the highly unstable environment ahead of the front.

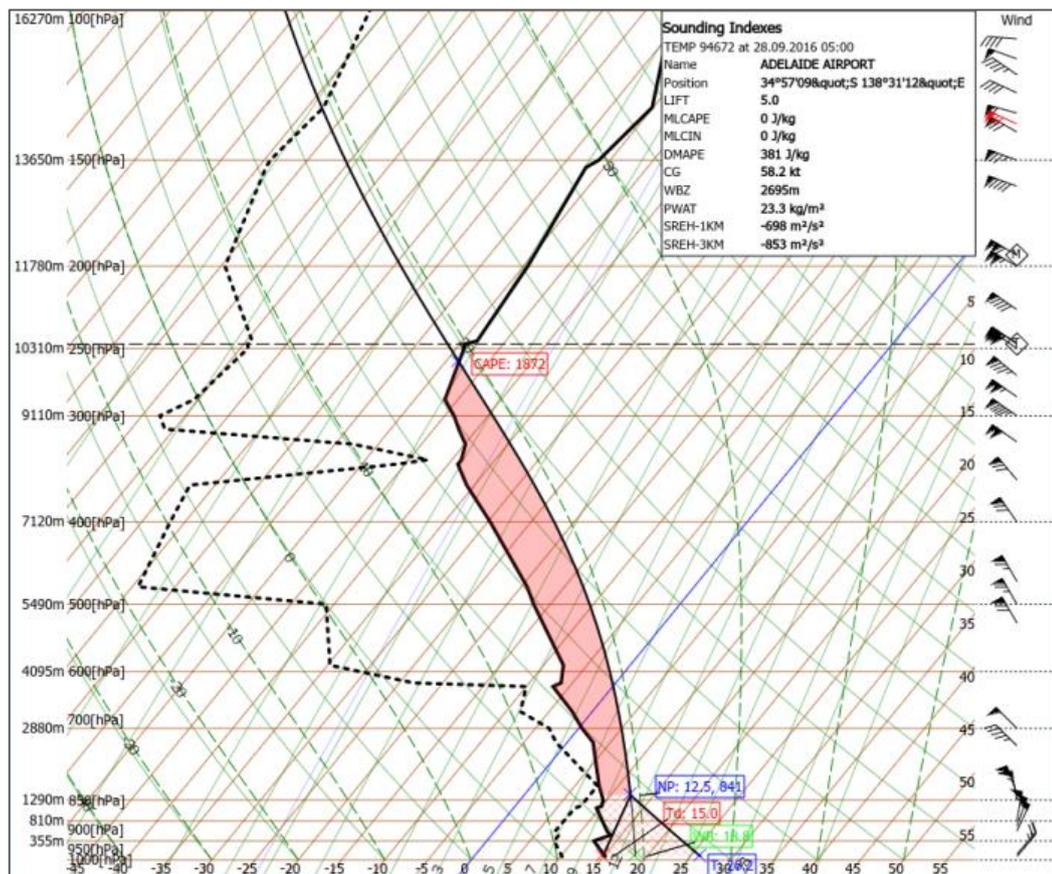


Figure 7: Aerological diagram for Adelaide Airport at 2:30 pm CST, modified with temperature and dewpoint temperature observations from Port Pirie Automatic Weather Station (AWS).

### Lift:

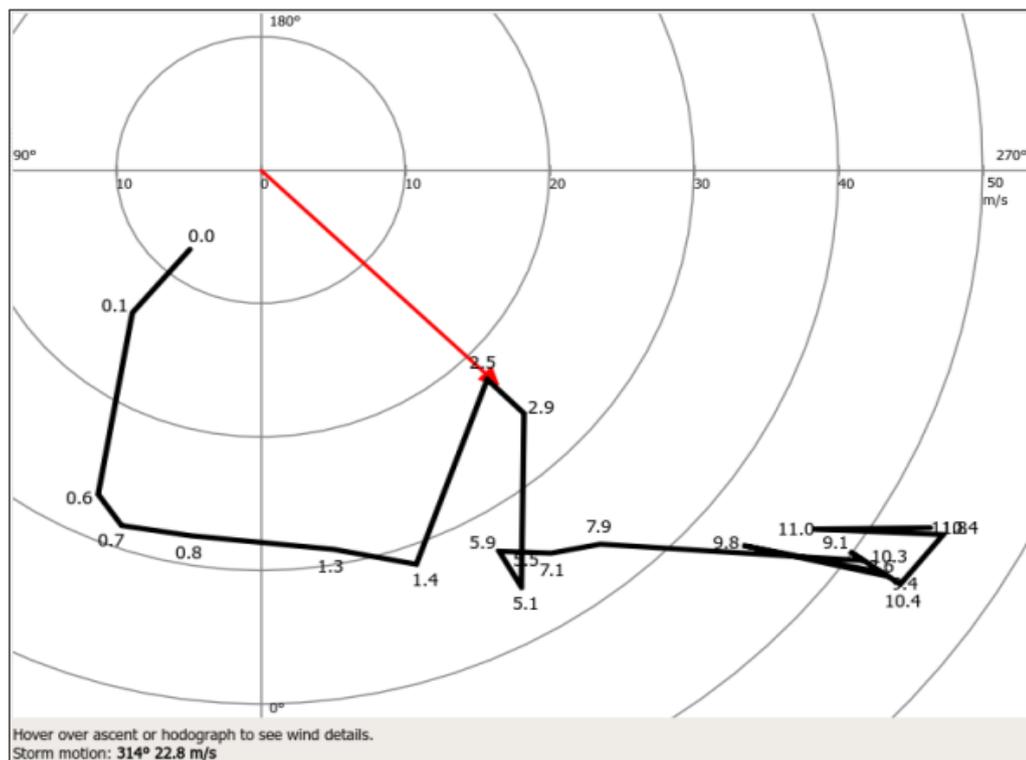
The main lifting mechanism was the exceptionally strong convergence along the cold front, produced by strong to gale force northeast winds immediately ahead of the front which shifted westerly at similar speeds behind the front. Density related uplift was enhanced by the large difference in mixing ratio (4-5 g/kg) across the frontal boundary. The strong surface heating immediately ahead of the cold front and local topography across the region of thunderstorm development would have also contributed to the lifting mechanism.

### **Wind shear:**

The vertical structure of wind in the thunderstorm environment is a critical element for thunderstorm organisation, particularly the development of supercell thunderstorms. Supercell thunderstorms are defined by the presence of a deep rotating updraft (mesocyclone) within the thunderstorm. Supercell thunderstorms are far more likely to produce severe weather phenomena including tornadoes than ordinary thunderstorms.

Deep layer (0-6 km) bulk wind shear values in excess of 35-40 knots are commonly associated with supercells. Bulk wind shear values on 28 September were 40-50 knots. The steering flow indicated thunderstorm motion from the northwest to the southeast.

Helicity describes low level wind speed and directional shear and is a key predictor for the development of supercell thunderstorms and tornadoes. The upper air wind profile at Adelaide Airport at 2:30 pm CST and the surface wind observations at Clare AWS were used to calculate storm relative helicity (SRH). SRH from 0 to 3 km was approximately  $-850 \text{ m}^2/\text{s}^2$  and from 0 to 1 km was approximately  $-700 \text{ m}^2/\text{s}^2$ . These values are extreme considering 0 to 1 km values as low as  $\pm 100 \text{ m}^2/\text{s}^2$  indicate an increased likelihood of supercells and tornadoes. These extreme SRH values can be inferred from the 'looping' hodograph shown in Figure 8.



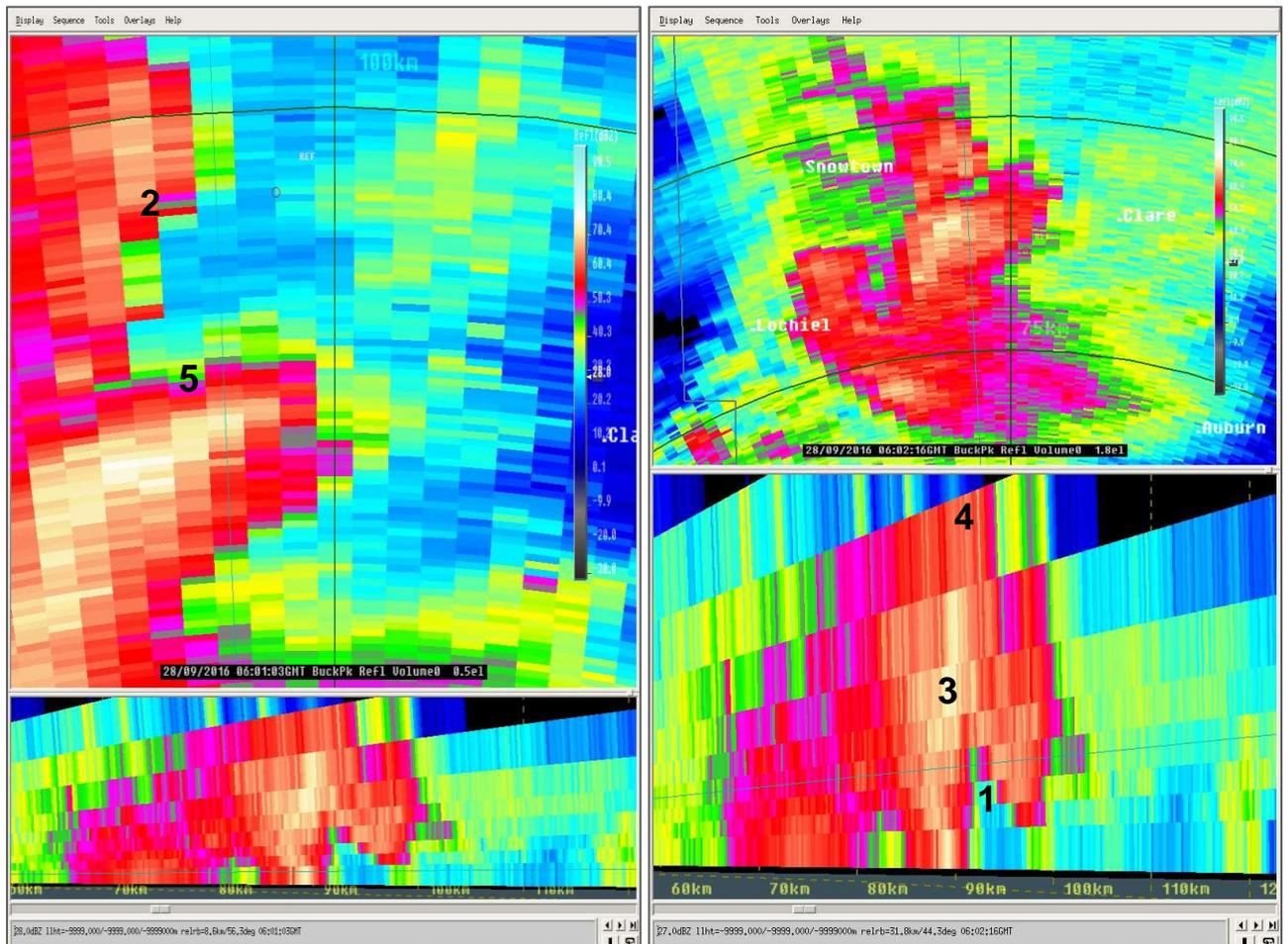
**Figure 8:** Hodograph based on the upper winds from Adelaide Airport at 2:30 pm CST and surface wind observations from Clare AWS. The looping shape of the wind shear profile (black line) indicates extreme low level SRH, which is favourable for tornado formation. The storm motion vector (red arrow) is northwest at 82 km/h.

### 3.4 Radar and Satellite Evidence

Radar data is a critical tool used by operational forecasters to determine the real-time location, severity and track of thunderstorms. Volumetric reflectivity and velocity are primary data types used to identify severe thunderstorm signatures. On 28 September the Buckland Park Doppler Radar was used to monitor supercell thunderstorms. As the thunderstorms moved into northern Yorke Peninsula and the Mid North, the proximity to the radar enabled a detailed analysis of severity. Unfortunately the lack of radar coverage over Eyre Peninsula and the Flinders district precluded a detailed radar analysis of the thunderstorms over these areas.

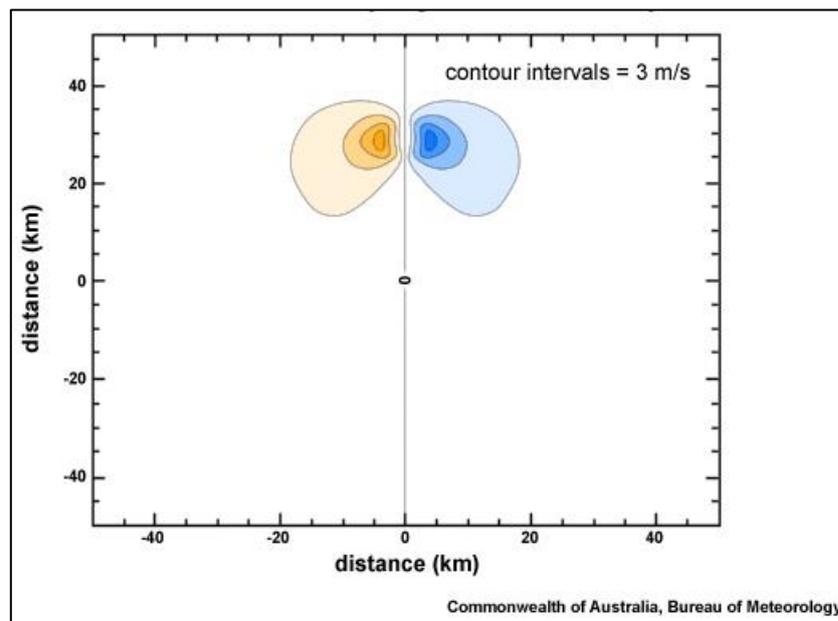
Figure 9 shows radar reflectivity scans at 0.5° (left) and 1.8° (right) of the supercell thunderstorm responsible for the Blyth tornado (see Tornado Damage Assessment). The scans were taken

between 03:31 pm and 03:32 pm, which is around the approximate start time of the tornado. The top and bottom panels show the plan position indicator (PPI) and the range height indicator (RHI) views respectively. Severe thunderstorm radar signatures evident include: (1) Bounded weak echo region (BEWR) - local minimum in radar reflectivity as updraft carries precipitation aloft. (2) Hook echo – heavy precipitation wrapping around the low level mesocyclone creating a hooked shaped pendant. (3) Elevated core with extreme maximum reflectivity (74.5 dBZ at 1250 m) – heaviest precipitation and hail held aloft by strong updraft. (4) Echo top displacement – storm top displaced from the core to be above the BEWR where the strongest updraft is located. (5) Tight low level reflectivity gradient – strong updraft and downdraft.



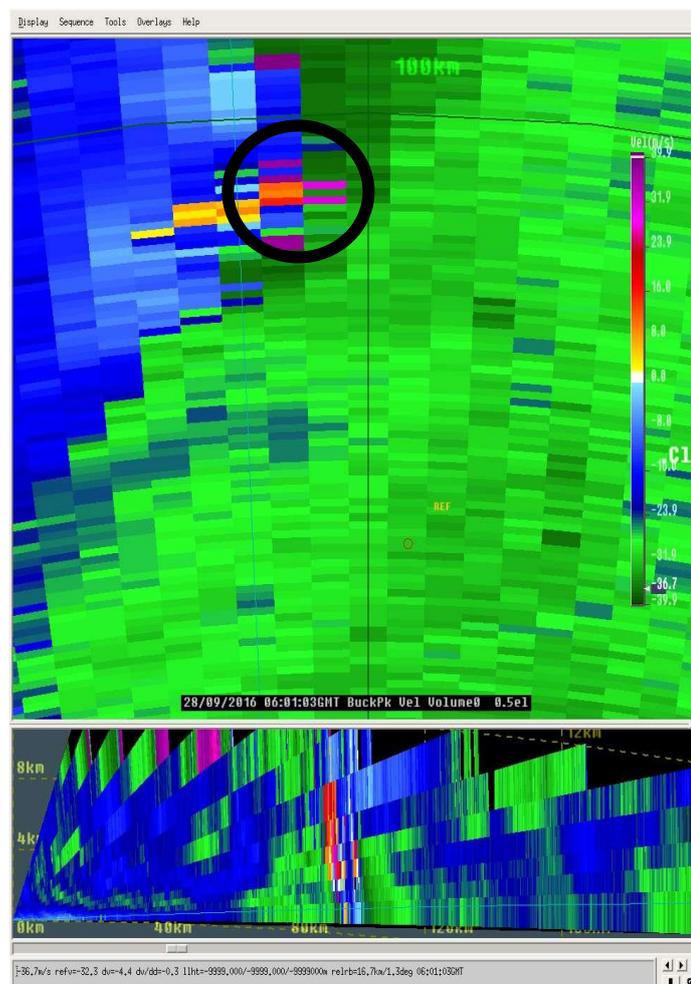
**Figure 9:** Buckland Park Radar reflectivity scans at 0.5°, 03:31 pm (left) and 1.8°, 03:32 pm (right) of the supercell thunderstorm responsible for the Blyth tornado. Numbers indicate severe thunderstorm radar signatures; (1) bounded weak echo region (BEWR), (2) hook echo, (3) elevated core with extreme maximum reflectivity (74.5 dBZ at 1250 m), (4) echo top displacement, and (5) tight low level reflectivity gradient in the updraft/downdraft boundary.

To identify and diagnose the strength of the Blyth supercell mesocyclone on radar, we analysed the velocity data through the vertical extent of the thunderstorm. An idealised radial velocity signature of a mesocyclone is shown in Figure 10. The rotational velocity strength is obtained by adding the magnitudes of the maximum inbound and outbound velocities, then dividing by 2. It should be noted that some inbound velocities analysed were aliased.



*Figure 10: Idealised radial velocity signature of a mesocyclone where blue is inbound and yellow outbound.*

Figure 11 shows the 0.5° velocity scan also taken at 03:32 pm. The low level mesocyclone (circled in black) shows a peak rotational velocity of 32 m/s (62 knots) in the vicinity of the hook echo at approximately 1400 m AGL. According to Smith, B et al (2015)<sup>[1]</sup> a peak 0.5° rotational velocity of 60 – 65 knots gives a 55 % – 60 % conditional probability of an EF2+ occurrence. This is consistent with the damage assessed rating (see Tornado Damage Assessment).

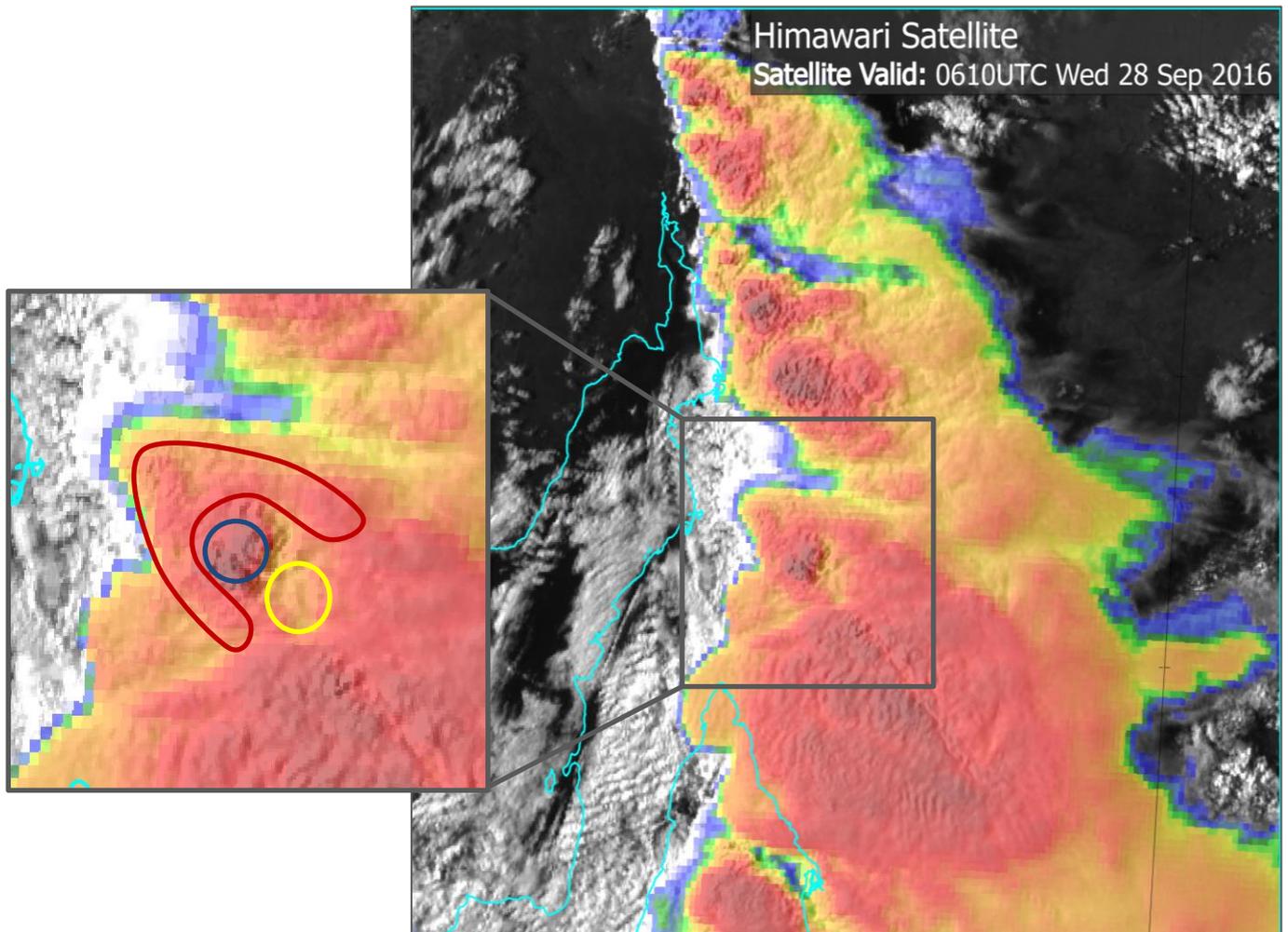


*Figure 11: Buckland Park Doppler Radar 0.5° velocity scan at 03:31 pm of the supercell thunderstorm responsible for the Blyth tornado. The peak rotational velocity is 32 m/s (circled in black) at 1400m AGL.*

Figures 51 and 52 in Appendix A show the velocity scans for the 1.3° (approx. 2800 m) - 3.1° (approx. 5600 m) scans taken between 03:31 pm and 03:03 pm at a range of around 100 km. The average peak rotational velocity of these 4 scans of the mesocyclone through the 2800 m in depth is 28.2 m/s (54 knots), correlating to a very strong mid-level mesocyclone.

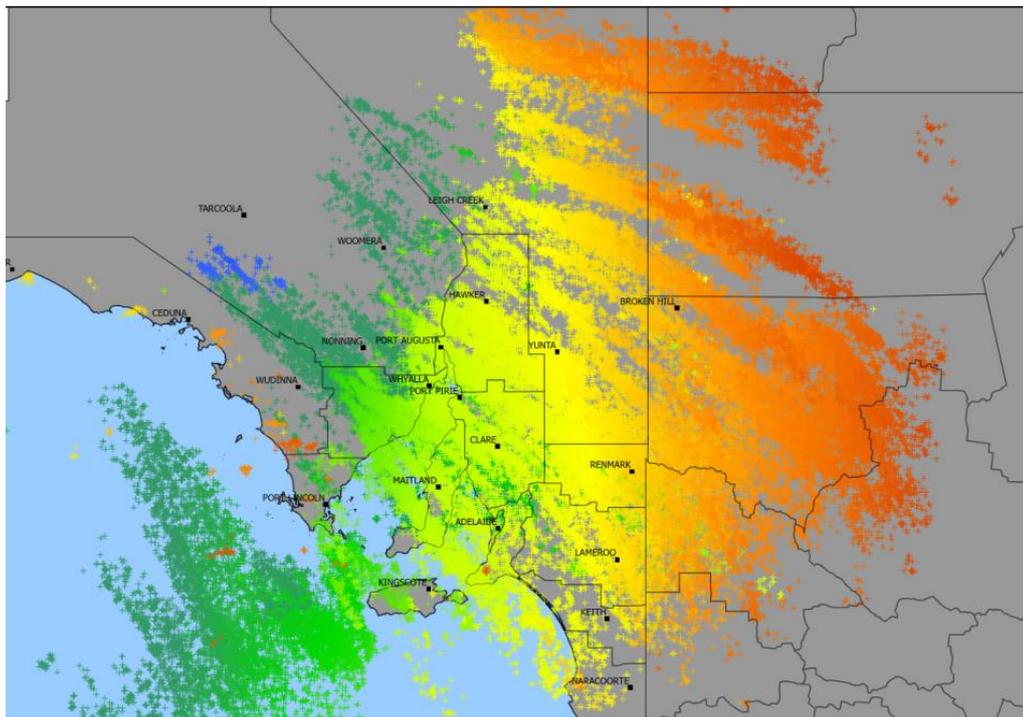
In areas of poor or no radar coverage satellite data is the primary tool used by operational forecasters to determine the real-time location, severity and track of thunderstorms. Images from the Japanese weather satellite Himawari-8 were utilised on September 28.

Figure 12 shows a multilayered Himawari-8 satellite image from 03:40 pm. This product uses high resolution visible imagery, blended with enhanced infrared (IR) imagery. The IR enhancement applies temperature colour ranges to the cold end of the scale, highlighting deep convection. Several severe thunderstorm satellite signatures are evident on the supercells responsible for the tornadoes (refer Tornado Damage Assessment). These signatures include, overshooting tops (strong updraft causing cloud to protrude above the equilibrium level of the anvil), back sheared anvils (strong updraft causing the anvil to spread upwind) enhanced-v (cold anvil spreading around the overshooting top) warm wake (depressed area downwind of the overshooting top).



**Figure 12:** Multilayered Himawari-8 satellite image from 03:40 pm showing various severe thunderstorm signatures. The subset shows the supercell responsible for the Blyth tornado with the overshooting top (blue circle), enhanced-v including the back sheared anvil (red line) and warm wake (yellow circle).

Complimenting radar and satellite imagery, lightning data provided by Global Position and Tracking Systems (GPATS) is a tool that can be used operationally to track and identify the relative severity of thunderstorms. Figure 13 shows the daily lightning data for 28 September.



**Figure 13:** 24 hours of lightning data for 28 September provided by Global Position and Tracking Systems (GPATS). In real time lightning data can be used to assess relative severity of thunderstorms, with greater lightning frequency indicating a stronger updraft. Timing of strikes prior to midnight; Red 0 to 6 hours, Yellow 6 to 12 hours, Green 12 to 18 hours, Blue 18 to 24 hours.

### 3.5 Thunderstorm Timeline - 28 September

*Times are shown in Central Standard Time (CST)*

#### **11:30 am – 01:00 pm:**

Thunderstorms began to develop along the frontal boundary, with the first thunderstorm cell forming near Yardea on the northern Eyre Peninsula at 11:35 am. The cells continued to develop along the frontal line tracking to the southeast ahead of the eastward progressing frontal boundary.

By 01:00 pm thunderstorms could be observed on radar along the length of the frontal boundary from Woomera in the north to Port Lincoln in the south. Two cells over Eastern Eyre Peninsula were beginning to show supercell characteristics.

**01:00 pm - 02:00 pm:**

These supercell thunderstorms impacted various townships across Eastern Eyre Peninsula including Kimba, Cleve, Arno Bay and Cowell before moving into Spencer Gulf shortly after 02:00 pm. There were reports of large hail (up to 5 cm at Cleve), heavy rainfall with local flash flooding and damaging winds. The highest wind gust at Cleve AWS was 87 km/h at 01:36 pm.

**01:30 pm – 03:00 pm:**

Thunderstorms also impacted Whyalla, Port Augusta and Woomera further north along the front with recorded AWS gusts of 83 km/h, 87 km/h and 96 km/h respectively.

**02:30 pm – 03:00 pm:**

Supercell thunderstorms began to impact the eastern coastline of Spencer Gulf. A wind gust of 96 km/h was recorded at Port Pirie AWS to at 02:56 pm.

- Approximately 02:50 pm there were reports (including photographic confirmation) of a tornado near Port Broughton, this was consistent with radar evidence.

**03:00 pm – 03:30 pm:**

The line of thunderstorms along and ahead of the front now stretches from west of Hawker in the north to the Fleurieu Peninsula in the south. Supercell thunderstorms along the line now begin to impact the Mid North and Flinders district. At Snowtown and Blyth large hail of 4-6 cm was reported (Figure 14). A wind gust of 104 km/h occurred at Snowtown AWS at 03:28 pm.



*Figure 14: 4-5 cm hailstones at Blyth. Credit Zack Zweck (left) and Tanya Penna (right).*

**03:30 pm – 04:30 pm:**

During this period 6 further tornadoes are believed to have occurred, with 4 confirmed by a damage assessment conducted on 6 October, and the remaining 2 deduced from damage reports and radar evidence.

- Approximately 03:30 pm damage consistent with a tornado occurred at Crystal Brook in the Mid North. The most significant damage appears to have occurred in the vicinity of Crystal Brook Oval where there was structural damage to sheds and sporting facilities.
- Approximately 03:35 pm a tornado starts to the northwest of Blyth in the Mid North before ending at approximately 03:50 pm to the southeast of the town (refer Tornado Damage Assessment). Damage to the Brinkworth – Templers West transmission line occurred with this tornado (see Impact on Power Transmission Network).
- Approximately 03:35 pm a tornado begins near Survey Road south of Melrose in the Flinders district. The tornado tracks approximately 23 km to the southeast before ending at approximately 04:00 pm (refer Tornado Damage Assessment).
- Approximately 03:45 pm a tornado begins near Wilmington in the Flinders district. The tornado tracks approximately 30 km to the southeast before ending at approximately 04:05 pm (refer Tornado Damage Assessment). Damage to the Davenport – Belalie and

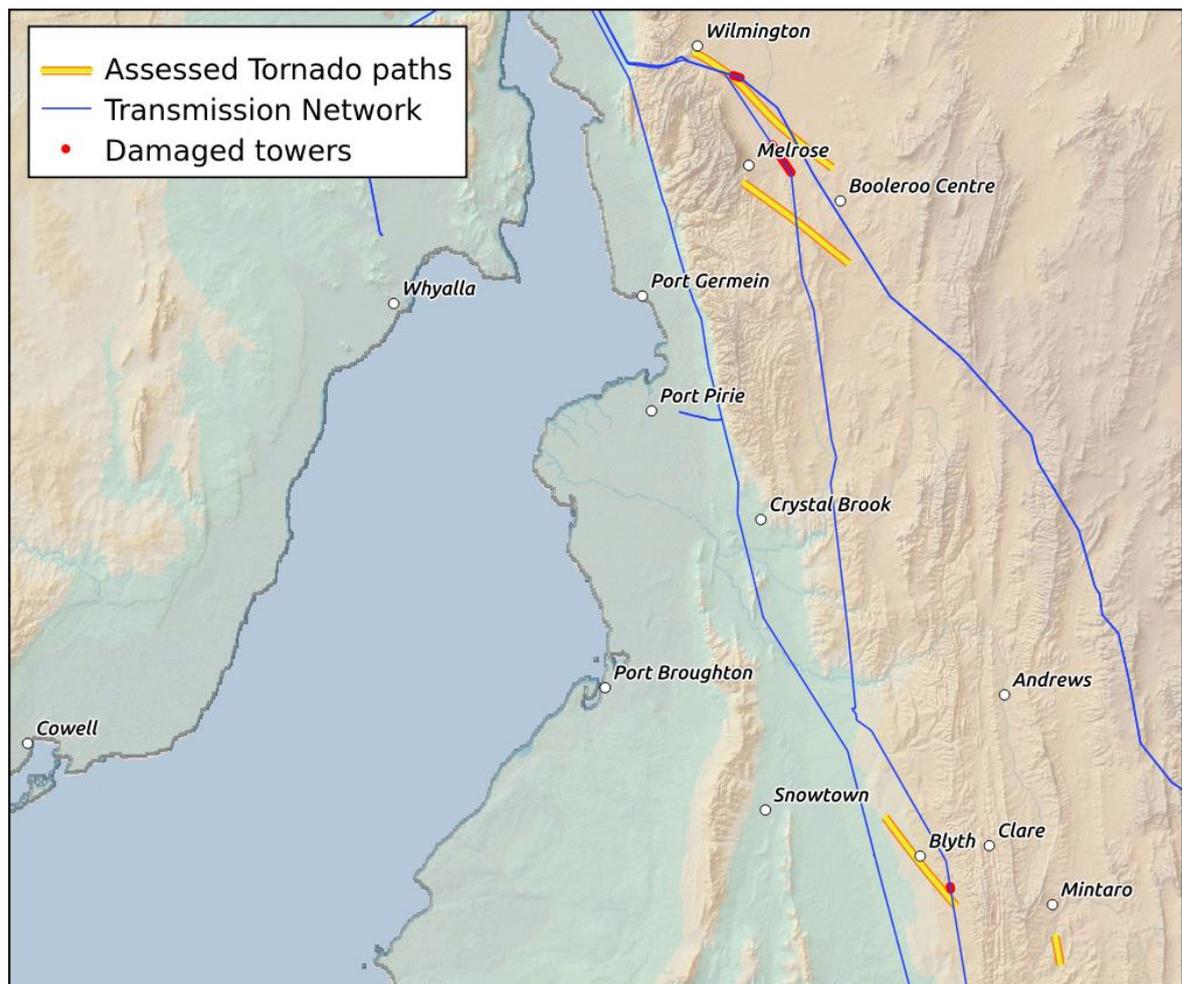
Davenport – Mt Lock transmission lines occurred with this tornado/supercell thunderstorm (see Impact on Power Transmission Network).

- Approximately 04:00 pm a tornado begins south of Mintaro in the Mid North. The tornado tracks approximately 5 km before ending at approximately 04:05 pm (refer Tornado Damage Assessment).
- Approximately 04:00 pm damage consistent with a tornado occurred at Andrews north of Clare in the Mid North; this is consistent with radar evidence.

**04:30 pm – 11:00 pm:**

Thunderstorms began to merge into a squall line during the evening as the front moved through the eastern districts, stretching from the Murraylands in the south to the northern border. A wind gust of 113 km/h was recorded at Yunta at 05:50 pm as a thunderstorm on the front impacted the town. Thunderstorms eventually exited the State late in the evening.

## 4 Tornado Damage Assessment



*Figure 15: The locations of the four assessed tornado paths overlaid with transmission network and damaged towers..*

A damage assessment was performed on 6 October across the Mid North and Flinders districts, with four of the seven identified areas of tornadic damage investigated (Figure 15). During the assessment, photographic evidence of the damage was captured and has been used to estimate the path and intensity of the tornadoes. All wind speed ranges given are estimates only (not measurements) based on the Enhanced Fujita (EF<sup>\*</sup>)/Fujita (F) Scale of tornado damage. Damage was assigned an upper and lower bound of probable wind speeds using the damage indicators (DI) and degrees of damage (DOD) (McDonald & Mehta 2004)<sup>[2]</sup> given in the EF Scale. These were then converted to a rating in the F Scale (table 1), which is the standard tornado rating system used by the Bureau of Meteorology.

Without a thorough engineering analysis of tornado damage in any event, the actual wind speeds needed to cause that damage are unknown. It should also be noted that the EF Scale of tornado damage is based on human-built structures and vegetation in North America. Differences in construction standards and vegetation types increases the uncertainty of wind speed estimates given.

<b>Fujita Scale</b>	
<b>Rating</b>	<b>Estimated 3 Second Wind Gust Speed (km/h)</b>
F0	72 – 126
F1	127 – 189
F2	190 – 260
F3	261 – 337
F4	338 – 421
F5	422 – 510

*Table 1: Fujita Scale (converted from mph to km/h with rounding)*

*Note the four rated tornadoes have been assessed in chronological order.*

#### 4.1 Blyth Tornado – Rated F2 Strength

Tornadic damage has been identified along an approximately 19 km long track, beginning northwest of Blyth in the Mid North and tracking to the southeast through farms, native vegetation, residential properties and community buildings in the township itself before ending to the south of Kybunga. Damage was not formally assessed to the southeast of Blyth; however damage to the Brinkworth – Templers West transmission, video footage and ground reports suggest it was ongoing south of Kybunga. The tower on the transmission line (Figure 24) has collapsed towards the northwest; this damage and the timing of the fault (see Impact on Power Transmission Network) are consistent with the path of the tornado (Figure 16). Based on radar evidence the tornado is estimated to have started at approximately 03:35 pm and finished at approximately 03:50 pm. This tornado has been rated at F2 strength, based on the damage indicators in table 2. The upper bound of wind speeds for damage marker 6 reach the low end of the F3 scale, but a lack of supportive evidence of this wind speed from other damage indicators excludes a rating beyond F2.

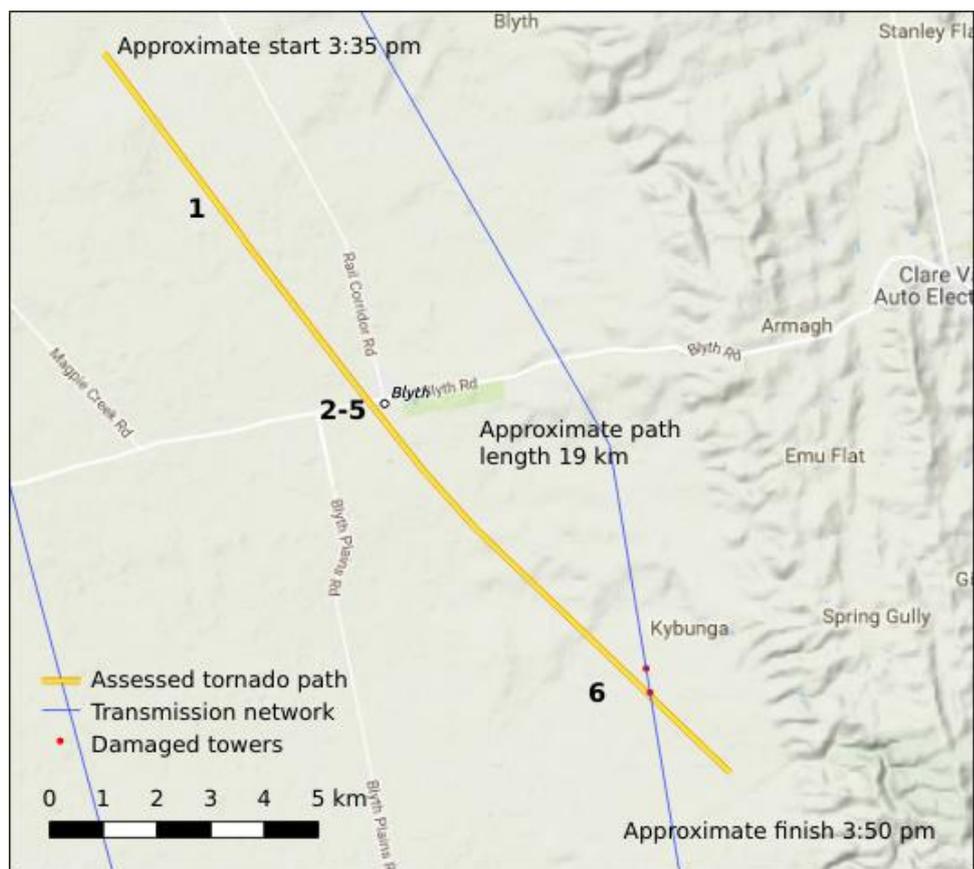


Figure 16: Approximate Blyth tornado path with damage markers, transmission network (blue) and damaged towers (red).

Damage Marker	Damage Description	Estimated Wind Speed (km/h)	Rating
1	A patch of native scrub (hardwood) showed large branches broken.	98 – 142	F0/F1
2	Church hall full loss of roof.	167 – 229	F1/F2
3	Large pine trees uprooted (softwood).	117 – 182	F0/F1
4	Loss of significant roof covering material (>20%) to multiple houses.	130 – 187	F1
5	Light object missile generated (wood beam thrown 200+ metres, piercing metal shed wall)	190 – 259	F2
6	Collapsed metal truss transmission line towers.	187 – 266	F2/F3

Table 2: Blyth tornado description of damage, estimated wind speeds and corresponding rating



**Figure 17:** *Blyth tornado damage marker 1.*



**Figure 18:** *Blyth tornado damage marker 2.*



**Figure 19:** *Blyth tornado damage marker 3.*



**Figure 20:** *Blyth tornado damage marker 4.*



*Figure 21: Blyth tornado damage marker 4.*



*Figure 22: Blyth tornado damage marker 5.*



*Figure 23: Blyth tornado damage marker 5.*



*Figure 24: Blyth tornado damage marker 6.*



*Figure 25: Still frame from video footage of the Blyth tornado. Credit Michael Jaeschke.*



*Figure 26: Still frame from video footage of the Blyth tornado. Credit Jace Bourne.*



*Figure 27: Still frame from video footage of the Blyth tornado crossing Blyth between 3:40 pm and 3:45 pm. Credit Michael Mathew.*

## 4.2 Wild Dog Creek Tornado – Rated F2 Strength

Tornadic damage has been identified along an approximately 23 km long track, beginning near Survey Road south of Melrose in the Flinders district. The tornado tracked to the southeast across the Horrocks Highway near Wild Dog Creek, continuing through farms and native vegetation before ending near the Appila road approximately 10 km south of Booleroo Centre. The precise start and end locations were not identified via the damage survey on 6 October, but have been estimated with a moderate level of confidence based on video footage, anecdotal evidence from local residents and radar information. Based on radar evidence the tornado is estimated to have started at approximately 03:35 pm and finished at 04:00 pm. This tornado has been rated at F2 strength, based on the damage indicators in table 3.

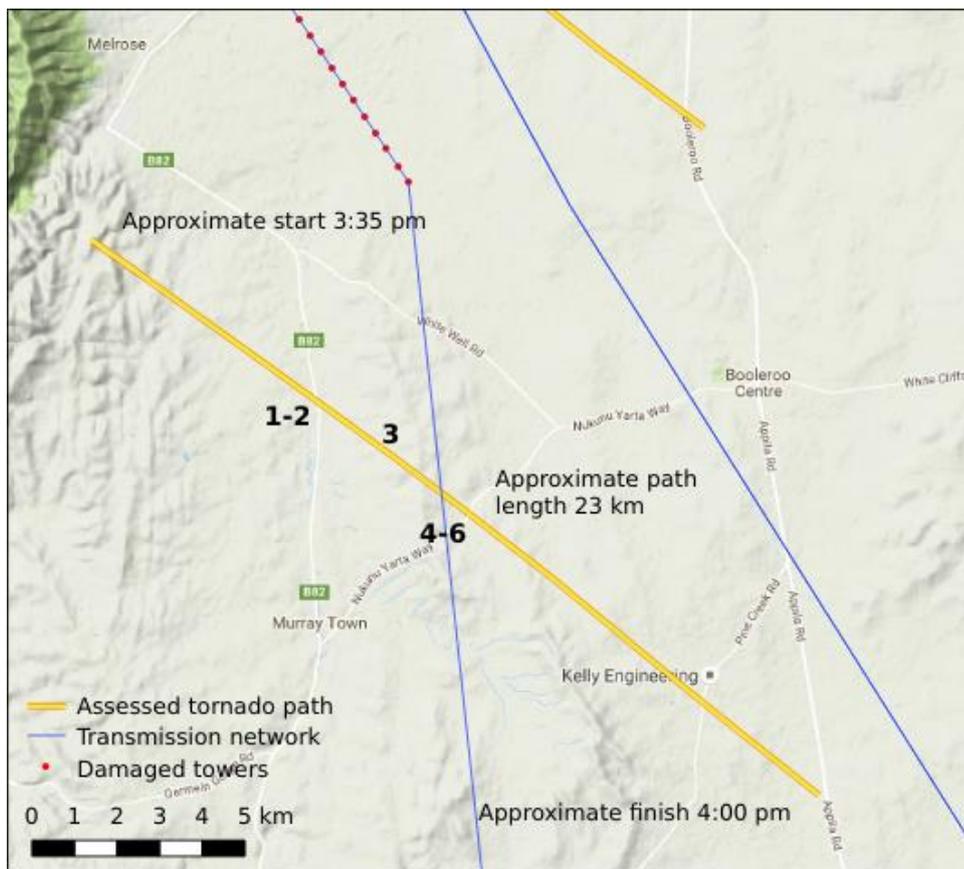


Figure 28: Approximate Wild Dog Creek tornado path with damage markers, transmission network (blue) and damaged towers (red).

Damage Marker	Damage Description	Estimated Wind Speed (km/h)	Rating
1-2	A patch of native scrub (hardwood) showed large branches broken.	98 – 142	F0/F1
3	Damage to metal shed, buckling of roof purlins.	153 – 222	F1/F2
4	Large field bins (1 ton+) thrown approximately 300 metres, rolling a further 300+ metres.	190 – 259	F2

Table 3: Wild Dog Creek tornado description of damage, estimated wind speeds and corresponding rating.



**Figure 29:** Wild Dog Creek tornado damage marker 1



**Figure 30:** Wild Dog Creek tornado damage marker 1.



**Figure 31:** Wild Dog Creek tornado damage marker 2.



**Figure 32:** Wild Dog Creek tornado damage marker 2.



*Figure 33 Wild Dog Creek tornado damage marker 3.*



*Figure 34 Wild Dog Creek tornado damage marker 3.*



*Figure 35: Wild Dog Creek tornado damage marker 4.*

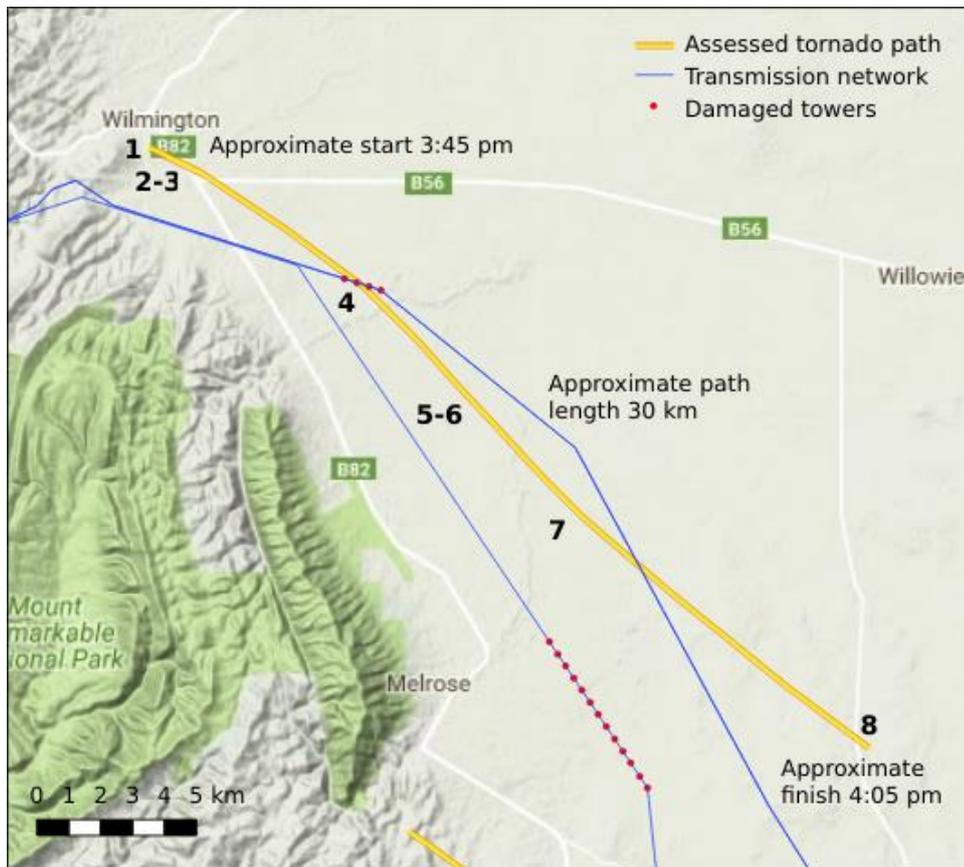


*Figure 36: Wild Dog Creek tornado damage marker 4.*

### 4.3 Wilmington Tornado – Rated F2 Strength

Tornadic damage was evident along an approximately 30 km long track, starting in southern parts of Wilmington and tracking to the southeast, through the Wilmington caravan park, across farms and native vegetation and ending approximately 6 km north of Booleroo near Booleroo road. The extent of damage further east of Booleroo is unknown, but a lessening of damage near the end of the analysed track is suggestive of the tornado weakening below tornadic strength. Based on radar

evidence the tornado is estimated to have started at approximately 03:45 pm and finished at 04:05 pm. This tornado has been rated at F2 strength, based on the damage indicators in table 4. The upper bound of wind speeds for damage markers 4, 5 and 6 reached the low end of the F3 scale, but a lack of supportive evidence of this wind speed from other damage indicators excludes a rating beyond F2. The wind speed estimates for this storm do however indicate that this was the strongest assessed tornado on the day and was likely at the upper end of F2. Damage to a section of trees along Spring Creek (Figure 48), nearby damage marker 4, gives a visual guide on the approximate width of the tornado at that point.



*Figure 37: Approximate Wilmington tornado path with damage markers, transmission network (blue) and damaged towers (red).*

Damage Marker	Damage Description	Estimated Wind Speed (km/h)	Rating
1	Large metal shed column anchorage failure.	154 – 217	F1/F2
2	A patch of native scrub (hardwood) showed large branches broken.	98 – 142	F0/F1
3	Caravan overturned.	127 – 188	F1
4	Collapsed metal truss transmission line towers.	187 – 266	F2/F3
5-6	Large gum trees (hardwood) with only stubs of largest branches remaining.	198 – 269	F2/F3
7	Total collapse of metal farm shed.	151 – 211	F1/F2
8	A patch of native scrub (hardwood) showed large branches broken.	98 – 142	F0/F1

*Table 4: Wilmington tornado description of damage, estimated wind speeds and corresponding rating.*



*Figure 38: Wilmington tornado damage marker 1.*



*Figure 39: Wilmington tornado damage marker 1.*



*Figure 40: Wilmington tornado damage marker 2.*



*Figure 41: Wilmington tornado damage marker 3.*



*Figure 42: Wilmington tornado damage marker 4.*



*Figure 43: Wilmington tornado damage marker 4.*



*Figure 44: Wilmington tornado damage marker 5.*



*Figure 45: Wilmington tornado damage marker 6.*



*Figure 46: Wilmington tornado damage marker 7.*



*Figure 47: Wilmington tornado damage marker 8.*



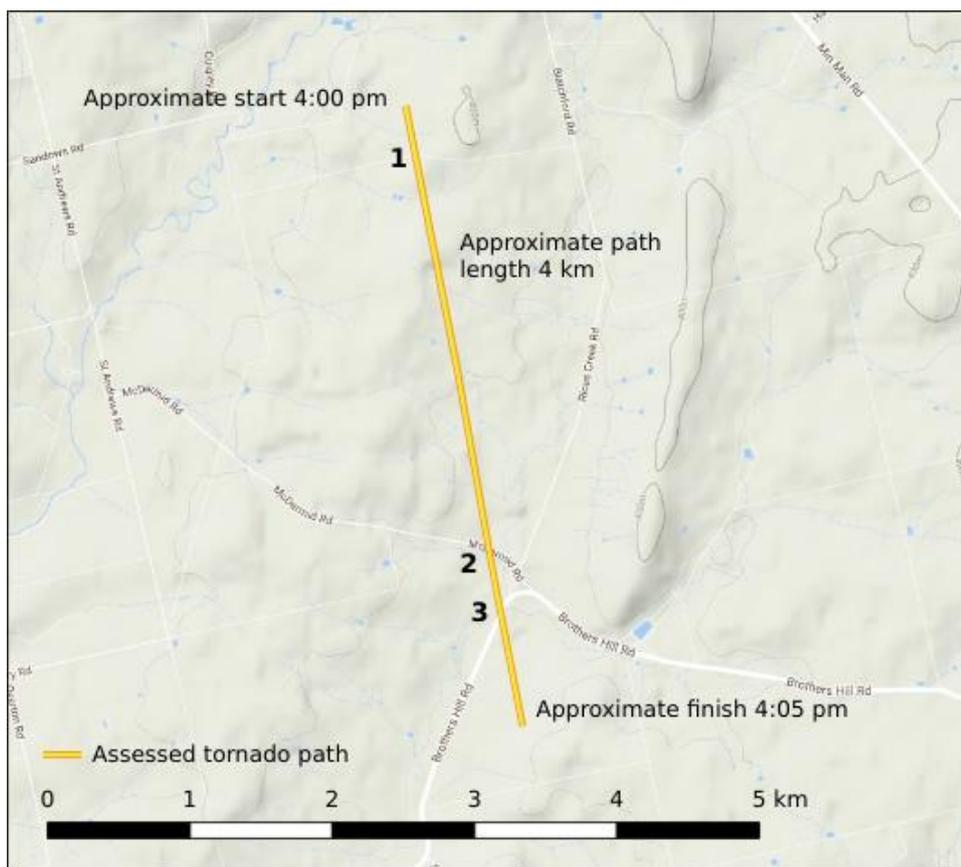
*Figure 48: Tornadic damage to trees along Spring Creek, nearby damage marker 4, indicates the approximate width of the Wilmington tornado.*



*Figure 49: Still frame from video footage of Wilmington tornado. Credit Sharee and Locky McCallum.*

#### 4.4 South Mintaro Tornado – Rated F1 Strength

Tornadic damage was evident along an approximately 4 km long track, starting approximately 5 km south of Mintaro in the Mid North and tracking to the south, through farms and native vegetation, before ending approximately near Brothers Hill road (Auburn-Manoora road). Based on radar evidence the tornado is estimated to have started at approximately 04:00 pm and finished at 04:05 pm. This tornado has been rated at F1 strength, based on the damage indicators in table 5. The upper bound of wind speeds for damage marker 3 reached the bottom threshold of the F2 scale, but the expected winds remain well within the F1 range.



*Figure 50: Approximate South Mintaro tornado path with damage markers.*

Damage Marker	Damage Description	Estimated Wind Speed (km/h)	Rating
1	A patch of native scrub (hardwood) showed large branches broken.	98 – 142	F0/F1
2	A patch of native scrub (hardwood) showed large branches broken.	98 – 142	F0/F1
3	Uprooted gum trees (hardwood).	122 – 190	F0/F1/F2

*Table 5: South Mintaro tornado description of damage, estimated wind speeds and corresponding rating.*



*Figure 51: South Mintaro tornado damage marker 1.*



*Figure 52: South Mintaro tornado damage marker 1.*



*Figure 53: South Mintaro tornado damage marker 2.*



*Figure 54: South Mintaro tornado damage marker 3.*

## 5 Impact on Power Transmission Network

On Wednesday 28 September 2016, at 03:48 pm electricity supply was lost across the state of South Australia (Black System Event) (AEMO<sup>1</sup>)<sup>[3], [4]</sup>. The loss of supply corresponded with a widespread outbreak of supercell thunderstorms with an exceptional number of tornadoes. An analysis of meteorological data including satellite, radar, surface and upper air observations as well as on ground damage assessments has been performed, with the aim of determining the impact of the severe weather on the network.

Five faults led to the Black System Event, with four of these occurring on three transmission lines (Brinkworth - Templars West, Davenport - Belalie and Davenport - Mt Lock) (AEMO)<sup>[3], [4]</sup>. A damage assessment on 6 October has identified that these faults were caused by the impact of supercell thunderstorms and tornadoes. Along with the faults reported by AEMO, it is likely that severe weather also led to damage on the Davenport - Brinkworth transmission line, shortly after the state-wide blackout had occurred.

### Brinkworth - Templars West Transmission Line

*Refer damage assessment for tornado track map and assessment.*

Radar evidence indicates a supercell thunderstorm in the vicinity of the two damaged transmission towers on the Brinkworth - Templars West transmission line between 03:40 pm and 03:50 pm. On the ground damage surveys and video evidence confirm the presence of the F2 Blyth tornado, with estimated peak wind gusts of 190 – 260 km/h. The timing and location of the tornado is consistent with the faults on this line at 03:47:33 pm CST (AEMO)<sup>[3], [4]</sup>.

### Davenport – Belalie/Davenport - Mt Lock Transmission Lines

*Refer damage assessment for tornado track map and assessment.*

The Davenport – Belalie/Davenport - Mt Lock transmission lines are both on the same double circuit towers (AEMO)<sup>[3], [4]</sup>. Radar evidence indicates a supercell thunderstorm in the vicinity of the five damaged transmission towers between 03:45 pm and 03:55 pm. On the ground damage surveys as well as video evidence confirm the presence of the F2 Wilmington tornado, with estimated peak wind gusts of 190 – 260 km/h. The five damaged power transmission poles were in the direct path of the surveyed tornado track (see Figure 56). The timing and location of the tornado is consistent with the faults on these lines between 03:47:59 pm CST and 03:48:14 pm CST (AEMO)<sup>[3], [4]</sup>.

---

<sup>1</sup> AEMO reports state times in AEST, half an hour ahead of CST.

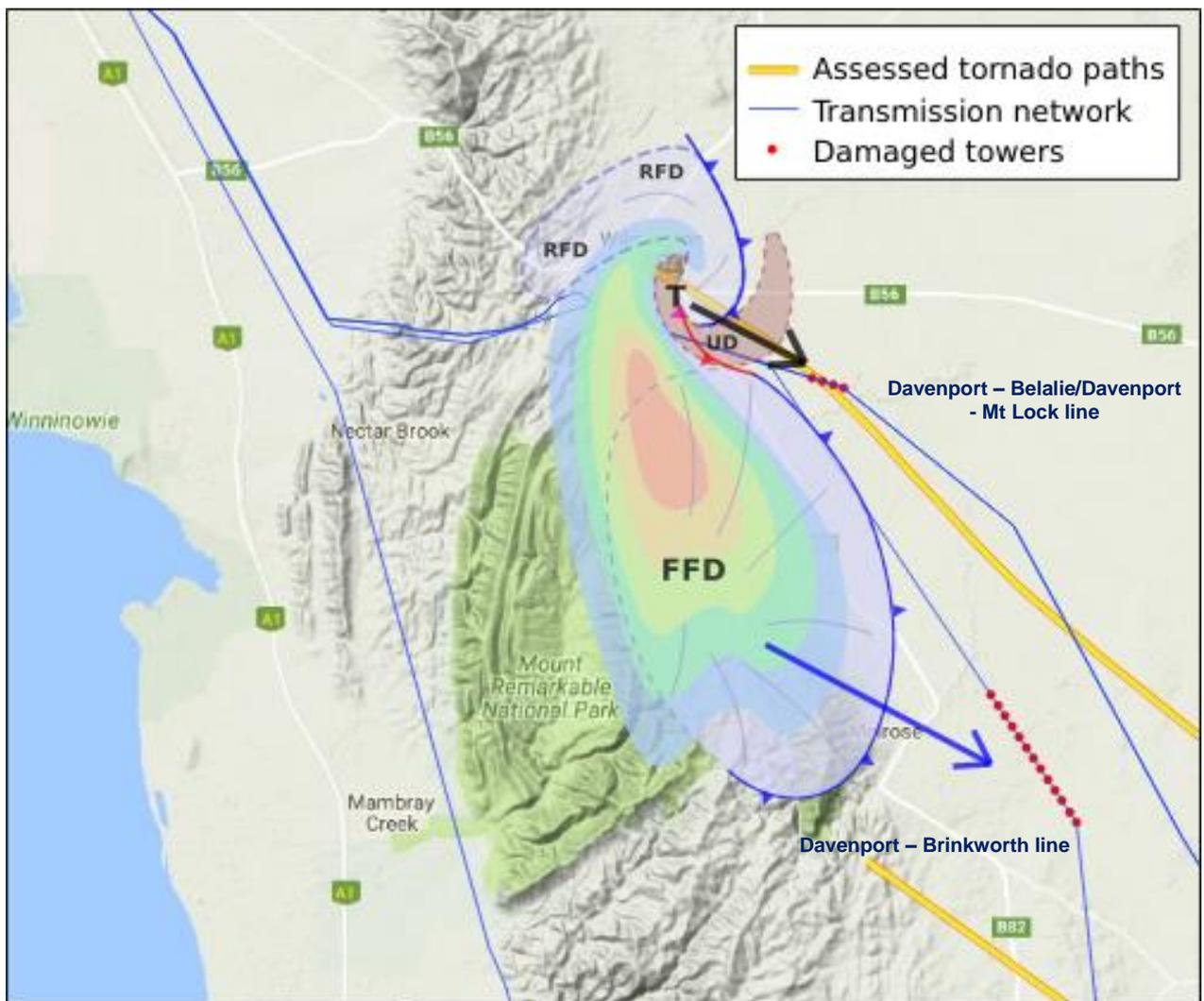
## Davenport - Brinkworth Transmission Line

The Davenport - Brinkworth transmission line was also impacted by the supercell thunderstorm that produced the Wilmington tornado and damaged the Davenport - Belalie and Davenport - Mt Lock transmission lines. The preliminary AEMO report <sup>[3]</sup> suggests this damage occurred after the state-wide blackout. A total of 14 towers were damaged and these were located well to the south of the Wilmington tornado damage path. In the vicinity of the towers there was little evidence of significant damage to vegetation or structures, indicating that these towers were not directly impacted by a tornado. Figure 55 shows the damaged towers on the transmission line and was taken on Girdham Rd looking northwest with towers collapsed towards the northeast.



*Figure 55: Damaged towers on the Davenport - Brinkworth transmission line*

Radar evidence suggests that supercell thunderstorms were oriented with the tornado and rear flank downdraft to the north/northwest and the forward flank downdraft to the south/southeast. Based on the position and collapse orientation of the damaged towers compared to the radar and tornado track, it is theorised that the 14 towers were impacted by the forward flank downdraft, a broad region of mostly straight-line thunderstorm outflow (see Figure 56). The timing of this impact is likely to have been within minutes after the state-wide black out.



*Figure 56: Idealised Wilmington supercell thunderstorm, depicting the position of the tornado (T), forward flank downdraft (FFD) and how they impacted the Davenport – Belalie/Davenport - Mt Lock and Davenport - Brinkworth Transmission Lines respectively. Also shown is the rear flank downdraft (RFD) and updraft region (UD).*

### Port Lincoln – Yadnarie Transmission Line

The preliminary AEMO <sup>[3]</sup> report indicates a single tower was damaged on the Port Lincoln – Yadnarie transmission line, likely after the state-wide blackout. Unfortunately a damage assessment could not be performed in this region. Without the timing of this failure and a damage

assessment it is difficult to suggest a direct weather related cause. It is possible however to suppose that the period of damaging to destructive broad scale winds over much of Eyre Peninsula due to the deep low pressure system to the south early on 29 September, may have contributed to the damage that occurred.

## 6 Warnings Timeline

In the days prior to the 28 September varying sources of numerical weather prediction (NWP) guidance were analysed and the potential for a significant thunderstorm outbreak was recognised. Continually updated advice was conveyed to emergency services via the regular verbal briefings and outlook products provided to emergency services by the contracted embedded meteorologist. The publicly available warning service (Table 6) provided by the Bureau of Meteorology aims to give detailed short lead time and frequently updated warnings of severe thunderstorms.

All severe thunderstorm warnings issued by the Bureau of Meteorology on 28 September have been included in Figures 53 – 59 in Appendix B. A summary of warnings is available in Table 6.

The first official severe thunderstorm warning was issued at 10:10 am for damaging wind gusts over western districts. An upgraded warning was issued at 12:26 pm for destructive wind gusts, large hail and heavy rainfall over western and central districts. As the thunderstorms tracked to the south and east further updates to warnings were issued for the same phenomena at 02:10 pm, 03:23 pm and 05:22 pm. Thunderstorm warnings were then downgraded to damaging wind gusts only as the system tracked east, these were issued at 06:42 pm and 07:46 pm. The severe thunderstorm warning was cancelled at 10:56 pm.

Time (CST)	Severe Phenomena	Districts Warned
10:10 am	Damaging wind.	Lower Eyre Peninsula, Eastern Eyre Peninsula and parts of the West Coast and North West Pastoral.
12:26 pm	Destructive wind, Heavy rainfall and Large Hailstones.	Eastern Eyre Peninsula, Flinders and parts of the Yorke Peninsula, Mid North, North West Pastoral and North East Pastoral.
02:10 pm	Destructive wind, Heavy rainfall and Large Hailstones.	Eastern Eyre Peninsula, Yorke Peninsula, Flinders and parts of the Mid North, North West Pastoral and North East Pastoral.
03:23 pm	Destructive wind, Heavy rainfall and Large Hailstones.	Adelaide Metropolitan, Mount Lofty Ranges, Yorke Peninsula, Flinders, Mid North and parts of the Eastern Eyre Peninsula, Murraylands, North West Pastoral and North East Pastoral.
05:22 pm	Destructive wind, Heavy rainfall and Large Hailstones.	Flinders, Riverland and parts of the Mid North and North East Pastoral.
06:42 pm	Damaging wind.	Parts of the Riverland and North East Pastoral.
07:46 pm	Damaging wind.	Parts of the Riverland and North East Pastoral.
10:56 pm	Cancelled.	Nil.

**Table 6:** Summary of Severe Thunderstorm Warnings issued.

## 7 Summary

A severe thunderstorm and tornado outbreak impacted central and eastern districts of South Australia on 28 September 2016. Multiple supercell thunderstorms produced damaging to destructive winds, very large hailstones, locally intense rainfall and at least seven tornadoes.

Diagnosis of the initiation and evolution of supercell thunderstorms was achieved utilising numerical model guidance, radar, weather satellite and weather station data.

Damage inspection by skilled meteorologists has been used to deduct track length and strength of four tornadoes. Anecdotal damage reports are consistent with at least three additional tornadoes. Overlaying the different data types and integrating the meteorological data with maps of power network infrastructure assisted analysis.

On this occasion critical infrastructure was damaged by an extreme weather event. This report has described the environment and accompanying phenomena, utilising the best available technologies and expertise within the Bureau of Meteorology.

Additional data may have provided even more beneficial insights. Collaborative investigations with partner agencies would be encouraged by the Bureau of Meteorology. Additional information could be sourced from joined-up infrastructure inspections and additional remote sensing, such as high resolution satellite tasking or aerial reconnaissance. There are also opportunities for sharing of private automated weather station network data.

The climatological return period for destructive severe thunderstorms has not been considered in this report. Sophisticated climatological studies into the frequency of high impact are now possible utilising reanalysis data. The Bureau has recently commenced generating highly accurate numerical model simulations of the atmosphere for the last 25 years. At hourly (or better) time steps the 1.5 km grid resolution will enable users to resolve regional patterns, with an understanding of local topography, coastal influences and shifts over time driven by climate change. Studies can consider the risk profiles for different categories of fire weather, drought, wind characteristics, flood and severe thunderstorms, amongst a wide range of phenomena.

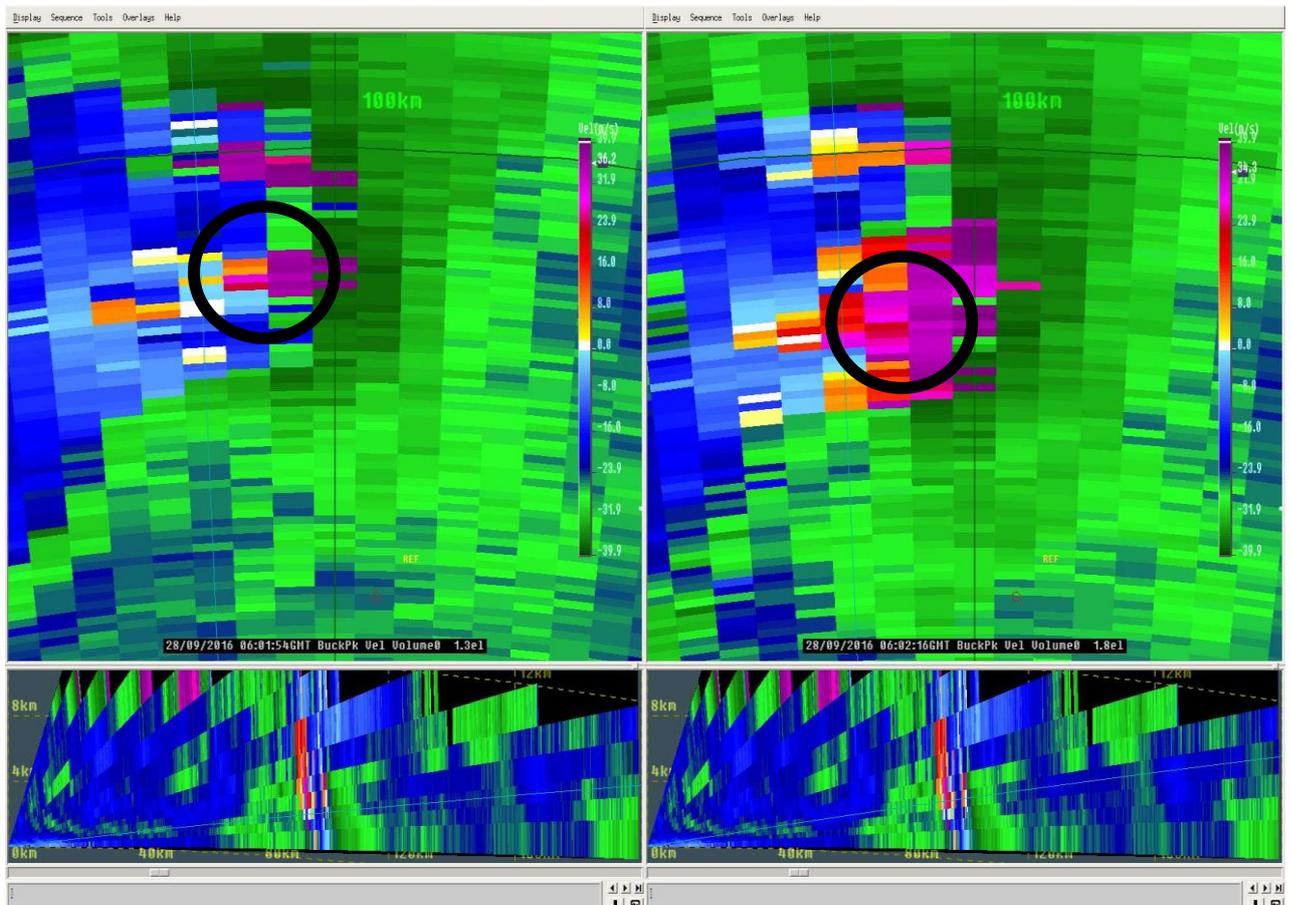
## 8 References

---

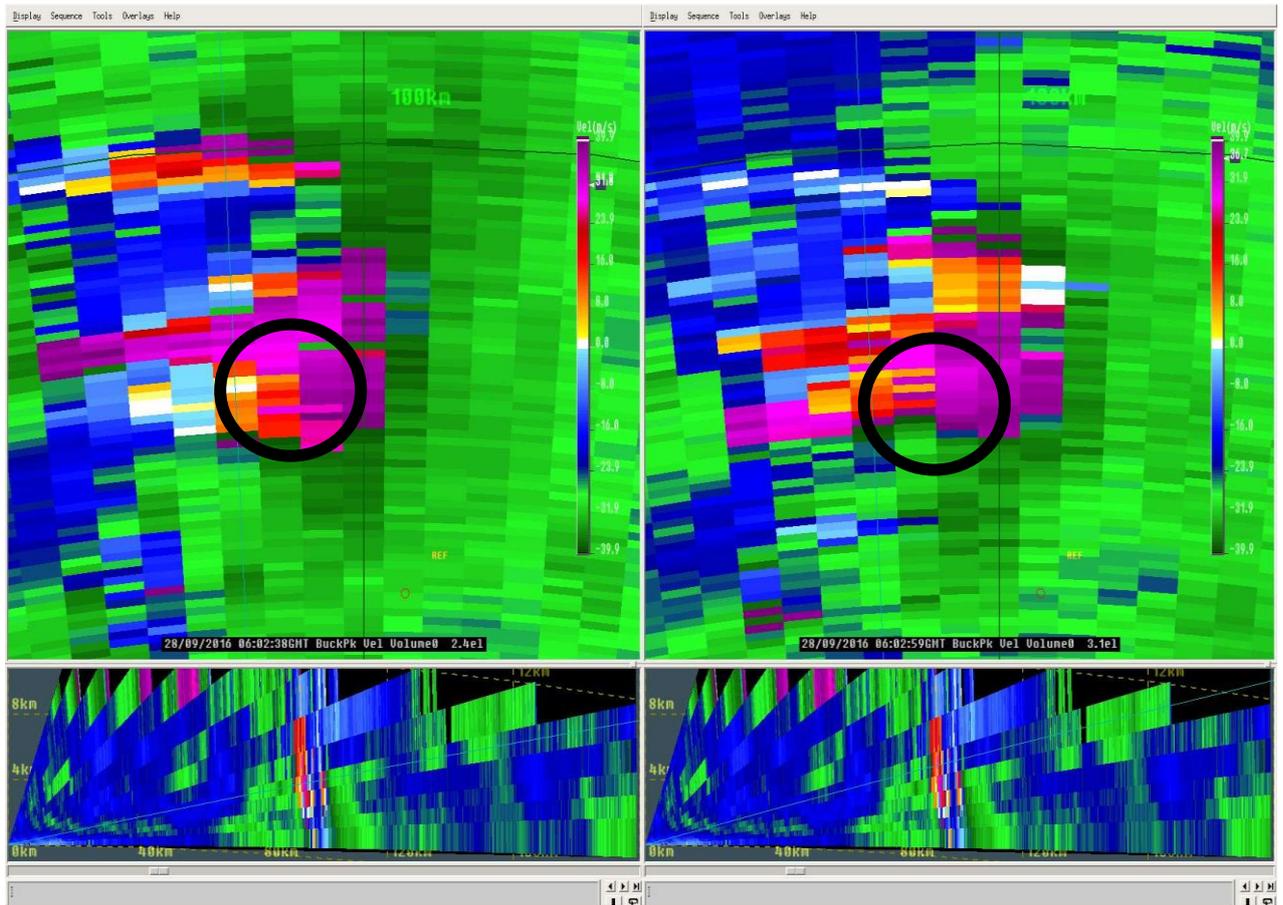
1. Smith, B et al (2015). Diagnosing the Conditional Probability of Tornado Damage Rating Using Environmental and Radar Attributes. NOAA/NWS/NCEP/Storm Prediction Center, Norman, Oklahoma.
2. McDonald, J; Mehta K, (2004). A recommendation for an Enhanced Fujita scale (EF-Scale). Lubbock, Texas: Wind Science and Engineering Research Center, Texas Tech University.
3. Australian Energy Market Operator Ltd., (2016). Preliminary Report – Black System Event in South Australia on 28 September 2016. [Online] Available at: <https://www.aemo.com.au/Media-Centre>.
4. Australian Energy Market Operator Ltd., (2016). Updated Report – Black System Event in South Australia on 28 September 2016. [Online] Available at: <https://www.aemo.com.au/Media-Centre>.

## 9 Appendices

### Appendix A – Supporting Radar Evidence



**Figure 57:** Buckland Doppler Radar 1.3° (left) and 1.8° (right) velocity scans at 03:32 pm of the supercell thunderstorm responsible for the Blyth tornado. Peak rotational velocities are 27.2 m/s and 28.2 m/s respectively (circled in black).



*Figure 58: Buckland Doppler Radar 2.4° (left) and 3.1° (right) velocity scans at 03:33 pm of the supercell thunderstorm responsible for the Blyth tornado. Peak rotational velocities are 30.7 m/s and 26.7 m/s respectively (circled in black).*

## Appendix B – Warnings

IDS65502

Australian Government Bureau of Meteorology  
South Australia Regional Office

**TOP PRIORITY FOR IMMEDIATE BROADCAST**

### **SEVERE THUNDERSTORM WARNING**

for **DAMAGING WIND**

For people in the  
Lower Eyre Peninsula,  
Eastern Eyre Peninsula and parts of the  
West Coast and  
North West Pastoral districts.

Issued at 10:10 am Wednesday, 28 September 2016.

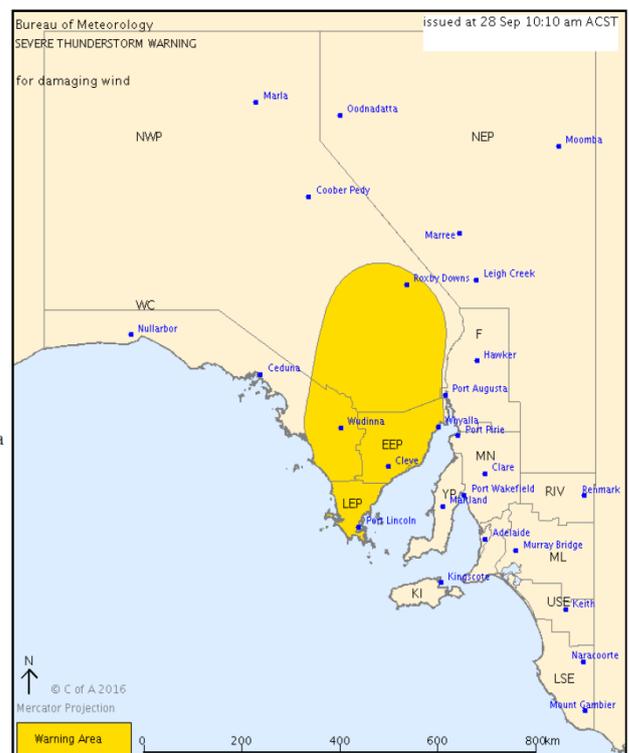
Severe thunderstorms are likely to produce damaging wind gusts in excess of 90 km/h in the warning area over the next several hours. Locations which may be affected include Port Lincoln, Whyalla, Roxby Downs, Elliston, Cleve and Woomera.

The State Emergency Service advises that people should:

- \* Secure or put away loose items around your property.
- \* Move cars under cover or away from trees.
- \* Keep clear of fallen power lines.
- \* Stay indoors, away from windows, while storms are nearby.

The next warning is due to be issued by 1:10 pm.

Warnings are also available through TV and Radio broadcasts, the Bureau's website at [www.bom.gov.au](http://www.bom.gov.au) or call 1300 659 215. The Bureau and State Emergency Service would appreciate warnings being broadcast regularly.



*Figure 59: Severe Thunderstorm Warning issued at 10:10 am*

IDS65502

Australian Government Bureau of Meteorology  
South Australia Regional Office

**TOP PRIORITY FOR IMMEDIATE BROADCAST**

**SEVERE THUNDERSTORM WARNING**

**for DESTRUCTIVE WIND, HEAVY RAINFALL and LARGE HAILSTONES**

For people in the Eastern Eyre Peninsula, Flinders and parts of the Yorke Peninsula, Mid North, North West Pastoral and North East Pastoral districts.

Issued at 12:26 pm Wednesday, 28 September 2016.

Severe thunderstorms are likely to produce destructive wind gusts up to 140 km/h, heavy rainfall that may lead to flash flooding and large hailstones in the warning area over the next several hours. Locations which may be affected include Whyalla, Port Augusta, Hawker, Port Pirie, Clare, Roxby Downs and Leigh Creek.

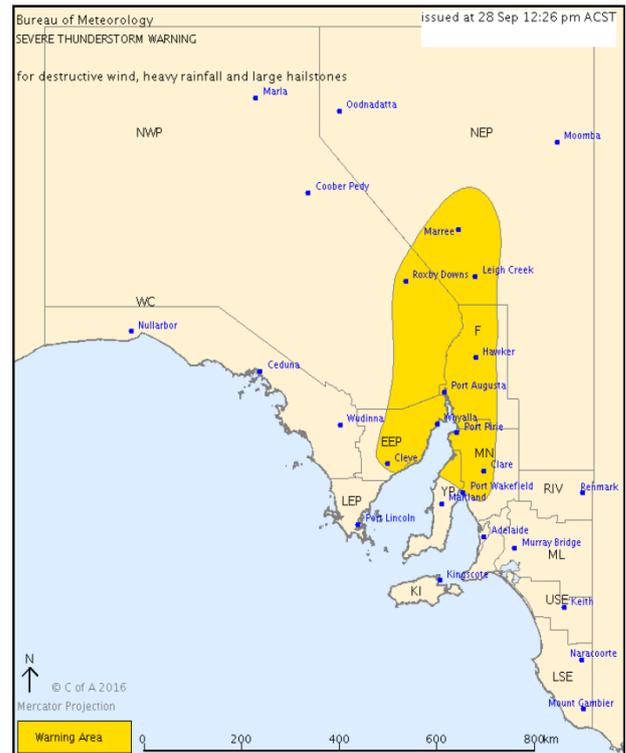
Severe thunderstorms are no longer occurring in the West Coast and Lower Eyre Peninsula districts and the warning for these districts is CANCELLED.

The State Emergency Service advises that people should:

- \* Secure or put away loose items around your property.
- \* Move cars under cover or away from trees.
- \* Keep clear of fallen power lines.
- \* Don't drive, ride or walk through flood water.
- \* Keep clear of creeks and storm drains.
- \* Stay indoors, away from windows, while storms are nearby.

The next warning is due to be issued by 3:30 pm.

Warnings are also available through TV and Radio broadcasts, the Bureau's website at [www.bom.gov.au](http://www.bom.gov.au) or call 1300 659 215. The Bureau and State Emergency Service would appreciate warnings being broadcast regularly.



**Figure 60:** Severe Thunderstorm Warning issued at 12:26 pm

IDS65502

Australian Government Bureau of Meteorology  
South Australia Regional Office

TOP PRIORITY FOR IMMEDIATE BROADCAST

**SEVERE THUNDERSTORM WARNING**

for DESTRUCTIVE WIND, HEAVY RAINFALL and LARGE HAILSTONES

For people in the Eastern Eyre Peninsula, Yorke Peninsula, Flinders and parts of the Mid North, North West Pastoral and North East Pastoral districts.

Issued at 2:10 pm Wednesday, 28 September 2016.

Severe thunderstorms are likely to produce destructive wind gusts to 140 km/h, heavy rainfall that may lead to flash flooding and large hailstones in the warning area over the next several hours. Locations which may be affected include Whyalla, Port Pirie, Clare, Maitland, Roxby Downs and Leigh Creek.

A thunderstorm produced large hailstones at Cleve, a gust to 87 km/h and 14 mm in 15 minutes earlier this afternoon.

The State Emergency Service advises that people should:

- \* Secure or put away loose items around your property.
- \* Move cars under cover or away from trees.
- \* Keep clear of fallen power lines.
- \* Don't drive, ride or walk through flood water.
- \* Keep clear of creeks and storm drains.
- \* Stay indoors, away from windows, while storms are nearby.

The next warning is due to be issued by 5:10 pm.

Warnings are also available through TV and Radio broadcasts, the Bureau's website at [www.bom.gov.au](http://www.bom.gov.au) or call 1300 659 215. The Bureau and State Emergency Service would appreciate warnings being broadcast regularly.

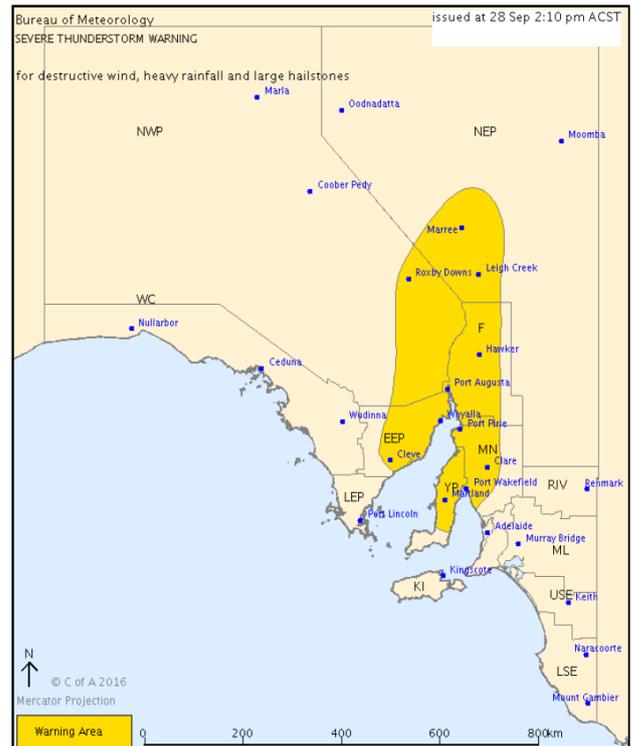


Figure 61: Severe Thunderstorm Warning issued at 02:10 pm

IDS6592

Australian Government Bureau of Meteorology  
South Australia Regional Office

**TOP PRIORITY FOR IMMEDIATE BROADCAST**

**SEVERE THUNDERSTORM WARNING**

for **DESTRUCTIVE WIND, HEAVY RAINFALL and LARGE HAILSTONES**

For people in the Adelaide Metropolitan, Mount Lofty Ranges, Yorke Peninsula, Flinders, Mid North and parts of the Eastern Eyre Peninsula, Murraylands, North West Pastoral and North East Pastoral districts.

Issued at 3:23 pm Wednesday, 28 September 2016.

Severe thunderstorms are likely to produce destructive wind gusts to 140 km/h, heavy rainfall that may lead to flash flooding and large hailstones in the warning area over the next several hours. Locations which may be affected include Whyalla, Clare, Maitland, Hawker and Leigh Creek.

Severe thunderstorms with heavy rainfall that may lead to flash flooding and damaging wind gusts of 90-100 km/h are expected in the Adelaide Metropolitan and Mount Lofty Ranges districts. Large hailstones are not expected in these districts.

A thunderstorm produced large hailstones at Cleve, a gust to 87 km/h and 14 mm in 15 minutes earlier this afternoon.

The State Emergency Service advises that people should:

- \* Secure or put away loose items around your property.
- \* Move cars under cover or away from trees.
- \* Keep clear of fallen power lines.
- \* Don't drive, ride or walk through flood water.
- \* Keep clear of creeks and storm drains.
- \* Stay indoors, away from windows, while storms are nearby.

The next warning is due to be issued by 6:25 pm.

If severe thunderstorms develop in the Adelaide Region, a more detailed Severe Thunderstorm Warning will be issued to people in this area.

Warnings are also available through TV and Radio broadcasts, the Bureau's website at [www.bom.gov.au](http://www.bom.gov.au) or call 1300 659 215. The Bureau and State Emergency Service would appreciate warnings being broadcast regularly.

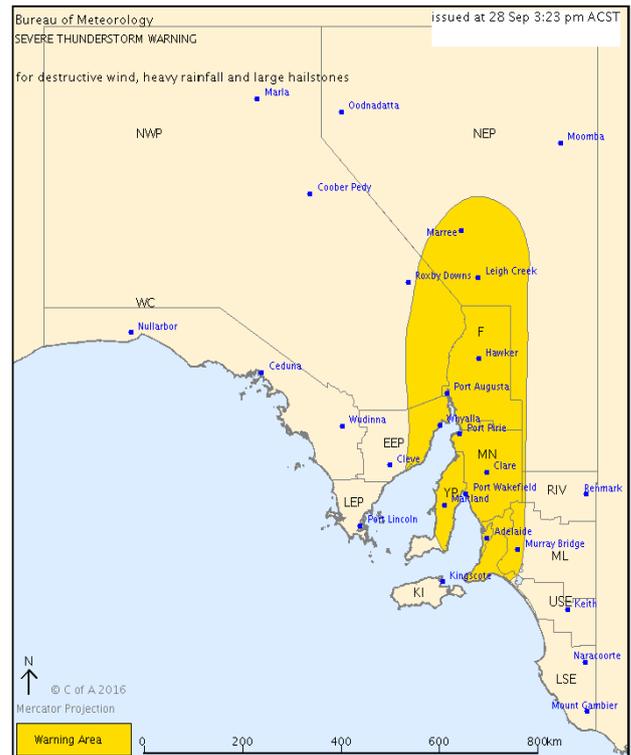


Figure 62: Severe Thunderstorm Warning issued at 03:23 pm

ID865902

Australian Government Bureau of Meteorology  
South Australia Regional Office

TOP PRIORITY FOR IMMEDIATE BROADCAST

**SEVERE THUNDERSTORM WARNING**

for DESTRUCTIVE WIND, HEAVY RAINFALL and LARGE HAILSTONES

For people in the  
Flinders,  
Riverland and parts of the  
Mid North and  
North East Pastoral districts.

Issued at 5:22 pm Wednesday, 28 September 2016.

Severe thunderstorms are likely to produce destructive wind gusts to 140 km/h, heavy rainfall that may lead to flash flooding and large hailstones in the warning area over the next several hours. Locations which may be affected include Leigh Creek, Hawker, Waikerie, Arkaroola, Peterborough and Olary.

Severe thunderstorms are no longer occurring in the Adelaide Metropolitan, Mount Lofty Ranges, Eastern Eyre Peninsula, Yorke Peninsula, Murraylands and North West Pastoral districts and the warning for these districts is CANCELLED.

A thunderstorm produced large hailstones at Cleve, a gust to 87 km/h and 14 mm in 15 minutes earlier this afternoon. Snowtown recorded a wind gust to 104 km/h and Clare recorded 26 mm in 1 hour this afternoon.

The State Emergency Service advises that people should:

- \* Secure or put away loose items around your property.
- \* Move cars under cover or away from trees.
- \* Keep clear of fallen power lines.
- \* Don't drive, ride or walk through flood water.
- \* Keep clear of creeks and storm drains.
- \* Stay indoors, away from windows, while storms are nearby.

The next warning is due to be issued by 8:25 pm.

Warnings are also available through TV and Radio broadcasts, the Bureau's website at [www.bom.gov.au](http://www.bom.gov.au) or call 1300 659 215. The Bureau and State Emergency Service would appreciate warnings being broadcast regularly.

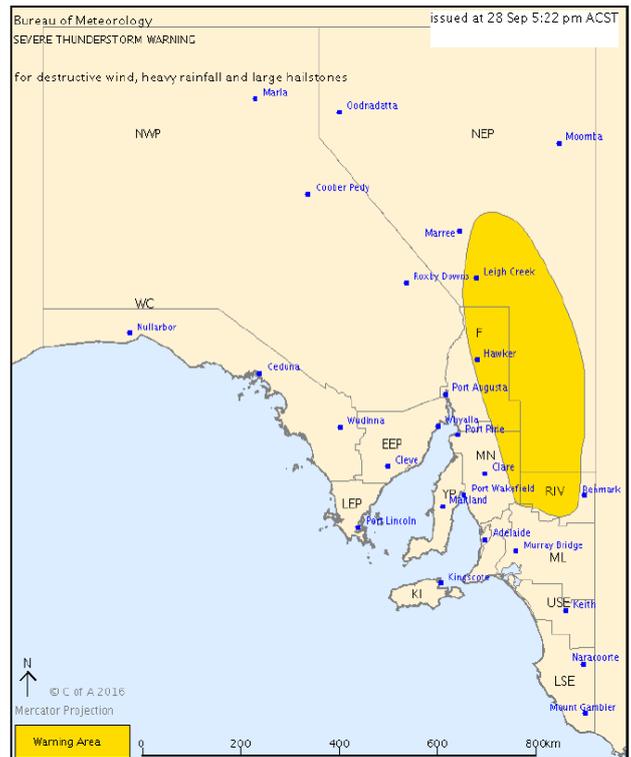


Figure 63: Severe Thunderstorm warning issued at 05:22 pm

DS66502

Australian Government Bureau of Meteorology  
South Australia Regional Office

TOP PRIORITY FOR IMMEDIATE BROADCAST

**SEVERE THUNDERSTORM WARNING**

for DAMAGING WIND

For people in parts of the  
Riverland and  
North East Pastoral districts.

Issued at 6:42 pm Wednesday, 28 September 2016.

Severe thunderstorms are likely to produce damaging wind gusts in excess of 90 km/h in the warning area over the next several hours. Locations which may be affected include Renmark, Arkaroola, Olary and Dangali Conservation Park.

Severe thunderstorms are no longer occurring in the Flinders and Mid North districts and the warning for these districts is CANCELLED.

Snowtown recorded a wind gust to 104 km/h in a thunderstorm this afternoon and Clare recorded 26mm in 1 hour this afternoon.

The State Emergency Service advises that people should:

- \* Secure or put away loose items around your property.
- \* Move cars under cover or away from trees.
- \* Keep clear of fallen power lines.
- \* Stay indoors, away from windows, while storms are nearby.

The next warning is due to be issued by 9:45 pm.

Warnings are also available through TV and Radio broadcasts, the Bureau's website at [www.bom.gov.au](http://www.bom.gov.au) or call 1300 659 215. The Bureau and State Emergency Service would appreciate warnings being broadcast regularly.

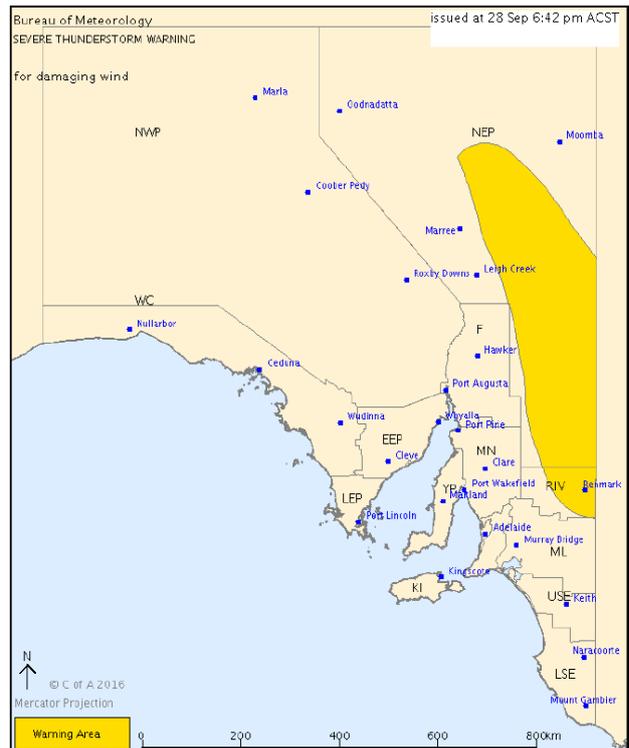


Figure 64: Severe Thunderstorm warning issued at 06:42 pm

IDS65502  
 Australian Government Bureau of Meteorology  
 South Australia Regional Office

TOP PRIORITY FOR IMMEDIATE BROADCAST

**SEVERE THUNDERSTORM WARNING**

for DAMAGING WIND

For people in parts of the  
 Riverland and  
 North East Pastoral districts.

Issued at 7:46 pm Wednesday, 28 September 2016.

Severe thunderstorms are likely to produce damaging wind gusts in excess of 90 km/h in the warning area over the next several hours. Locations which may be affected include Renmark, Moomba, Arkaroola and Olary.

Snowtown recorded a wind gust to 104 km/h in a thunderstorm this afternoon and Clare recorded 26mm in 1 hour this afternoon.

The State Emergency Service advises that people should:

- \* Secure or put away loose items around your property.
- \* Move cars under cover or away from trees.
- \* Keep clear of fallen power lines.
- \* Stay indoors, away from windows, while storms are nearby.

The next warning is due to be issued by 10:50 pm.

Warnings are also available through TV and Radio broadcasts, the Bureau's website at [www.bom.gov.au](http://www.bom.gov.au) or call 1300 659 215. The Bureau and State Emergency Service would appreciate warnings being broadcast regularly.

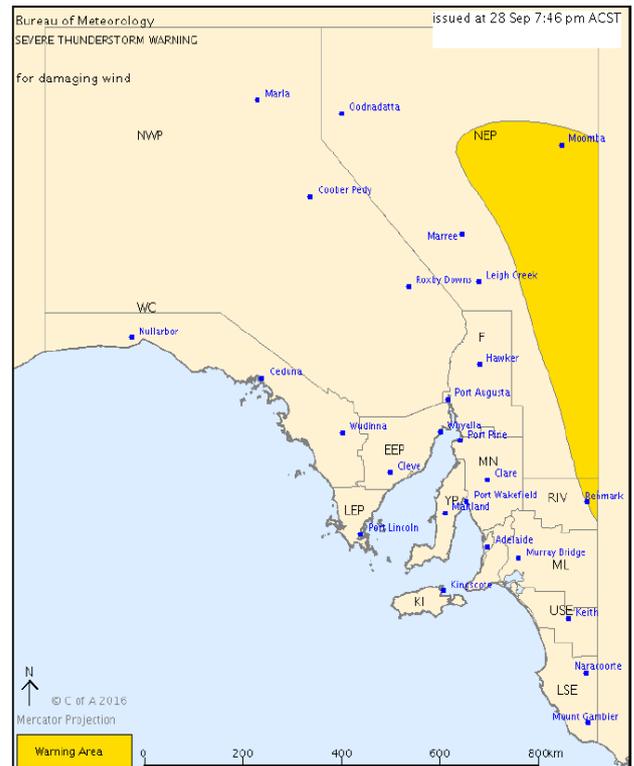


Figure 65: Severe Thunderstorm warning issued at 07:46 pm

Submission to: Independent Review of the Extreme Weather Event South Australia  
28 September – 5 October 2016

Authors: Dennis Mulroney and Peter Schar

Both authors were members of South Australia Police and involved in emergency management activities before the introduction of the Emergency Management Act 2004 and State Emergency Management Plan and then subsequently actively engaged in all aspects of the introduction and application of the Act and Plan through to their retirement in August 2015. Both were principle collaborators in the development and introduction of changes to emergency management policy such as the 10 responsibilities of the Control Agency, Traffic Management at Emergencies, Evacuation and State Emergency Centre & Zone Emergency Centre Operations Manuals. They have closely examined most inquiries/reports/reviews/debriefs on significant incidents across Australia on behalf of SAPOL and were key contributors to the development and introduction of Crisis Information Management System to the Police Operation Centre and State Emergency Centre environments. They also developed and facilitated a range of emergency management training and exercises. Dennis Mulroney was also recently engaged by the State Emergency Service to facilitate the multi-agency and State Emergency Centre debriefs for the extreme weather event, the subject of this submission.

This submission makes suggestions to improve the adequacy, content and structure of the State Emergency Management Plan (SEMP, December 2016 version) in relation to the State's prevention, preparedness, response and recovery arrangements (3<sup>rd</sup> objective of the Review) for it to meet the new requirements of the Emergency Management Act 2004. It also includes suggestions to improve the on-going maintenance of the SEMP and related plans, for audit and assurance arrangements, and multi-agency emergency management training.

The authors have not had the benefit of viewing the submission that would have been presented to the State Emergency Management Committee (SEMC) describing the reasons for the various changes to the SEMP at the time the plan was presented for adoption. The discussion and suggestions offered below are based on their work experience and knowledge of SA's legislative framework and emergency management arrangements.

Amendments to the Emergency Management Act 2004 brought about by the Emergency Management (Miscellaneous) Amendment Act 2016, has placed new requirements on the content of the SEMP. It must now contain vide Section 5A(1):

***'detail strategies for dealing with emergencies in the State, including strategies—***

- (a) for the prevention of emergencies; and*
- (b) relating to preparedness for emergencies; and*
- (c) for the containment of emergencies; and*
- (d) for the co-ordination of response and recovery operations; and*
- (e) for the orderly and efficient deployment of resources and services in connection with response and recovery operations.*

In addition, the SEMP must meet the Act's objectives and guiding principles - section 2(1):

- (a) *to establish an emergency management framework for the State that—*
  - (i) *promotes prompt and effective decision-making associated with emergencies; and*
  - (ii) *makes provision for comprehensive and integrated planning in relation to emergencies; and*
- (b) *to promote community resilience and reduce community vulnerability in the event of an emergency.*

The SEMP December 2016 update does not reflect the new requirements of the Act and is deficient in many respects including: content that does not align with the Act; lack of clear, specific and directive strategies; and conflicts in roles, terminology and definitions. Also, in some areas there has been fundamental changes to the emergency management arrangements some of which conflict with lessons learnt over the past decade.

The revised SEMP is comprised primarily of general statements. There is a significant risk to the State if agencies interpret the general statements in different ways. This risk is compounded by the current responsibility stated within the SEMP for each agency to independently manage emergency management training within their own organisations, rather than, work together to have a central provider delivering training in a multi-agency environment. Multi-agency training delivered at field and strategic management levels, provides a consistent understanding of the emergency management arrangements across all agencies and additionally, participants gain an understanding of other agencies capabilities and develop working relationship with persons they may encounter at emergencies.

SEMC requires a workable and effective SEMP that contains detailed requirements for the necessary structures, roles and responsibilities required to plan for, mitigate and manage emergencies when they occur. It is only through agencies applying the requirements of the SEMP that the Act's objects and guiding principles and, in particular, section 2(a)(i) *promotes prompt and effective decision making associated with emergencies* can be achieved.

The Emergency Management Act 2004 provides a common sense, practical and relatively simple approach to achieving the desired emergency management outcomes. However, how this is achieved is dependent upon the quality of the SEMP. For example, in relation to response operations, *Section 19-Coordinating Agency* and *Section 20-Control agency* affords an effective basis to achieve the objects of the Act by providing a simple mechanism to determine which agency is to be in-charge and responsible for the resolution of an emergency. These Sections removed a considerable amount of confusion that had often occurred at emergencies when trying to determine who is in-charge of response operations. This simplicity is relatively unique and rarely seen in emergency management legislation around the world.

This paper also includes suggestions as to the detailed strategies that need to be articulated comprehensively in the SEMP for it to meet the requirements of the Act. It also proposes a total restructure of the content of Part 2-Arrangements. The following is an outline of the issues the authors have identified within the SEMP.

## **PART ONE - OVERVIEW**

The 'Overview' does not follow a hierarchical and logical order and there are key players missing from the overview. For example, the topic 'Legislative and Administrative Framework' should logically go first. There is no mention that the Premier is responsible for the administration of the Act and is supported by a sub-committee of Cabinet, the Emergency Management Council. Also, while 'Zone Emergency Support Team' is mentioned, there is no mention of the most important persons for response operations – the Incident Controller and their strategic management level manager.

Additionally, the diagram representing an 'Overview of Arrangements' does not correctly reflect the arrangements as per the Act and the SEMP. It is also in conflict with the diagrams in Part 2, Figures 3A and 3B. The administrative arrangements for the SEMP are quite different and separate to the response and recovery arrangements. Two separate diagrams are required, one showing the Administrative and Planning Arrangements and the other Response and Recovery Arrangements.

There is no mention that a key part of the Act is having one agency overall responsible for response operations – the control agency, and all other person and agencies involved are subject to their control. Also, that the control agency has ten specific responsibilities they must address in resolving an emergency.

While there is a list of nominated control agencies for a range of emergency types, there is no mention of what happens for emergencies when there is no predetermined control agency, (for example, mining and industrial accidents, and widespread and extended outage of electricity, gas, water or sewage) and the responsibilities of the Coordinating Agency in determining the leadership agency when it is unclear as to who is in-charge.

**It is suggested** that a summary of the key response operational arrangements be included in this Part. A possible example is as follows:

*The key response operations arrangements described in the Act and this Plan are summarised as follows:*

- *The provision of the Act and this Plan in relation to an emergency apply at all times*
- *For every emergency there is to be a single control agency responsible for response operations including relief and recovery operation*
- *The nominated Control Agency for different types of emergencies are listed in the table at Part 3.19.2 of this Plan*
- *When it is unclear which agency is the Control Agency for an emergency the Coordinating Agency (South Australia Police) is required to make a determination as to which agency will be the control agency*

- *The Control Agency is required to address the ‘ten responsibilities of the control agency’*
- *The person designated by the control agency to lead field operations is to be known as the incident controller*
- *The incident controller is subject to the command of their manager or the designated state controller*
- *Other persons and agencies that attend an emergency (support agencies) are subject to the control (not command) of the control agency unless by formal agreement*
- *Support agencies are accountable for undertaking their legislative responsibilities or agreed tasks in support of the control agency*
- *Coordinating agency role is primarily an assurance one. It is required to ensure there is a control agency for every emergency and is undertaking the ten responsibilities of the control agency*
- *Upon a declaration of an identified major incident, major emergency or disaster the State Coordinator is responsible for the management and coordination of response and recovery operations, the latter in conjunction with an Assistant State Coordinator (Recovery)*
- *Upon a declaration the control agency remains responsible for resolving the emergency subject to directions, if any, of the State Coordinator or Assistant State Coordinator.*

## **PART TWO - ARRANGEMENTS**

The recent changes to the Act (requirements for detailed strategies; objectives and guiding principles) mean that this Part of the SEMP must be more prescriptive and dictate what must be in place, not just provide general statements about what already exists.

### **State Emergency Centre (SEC) Arrangements**

The concept of the SEC was developed following the devastating 1980 Ash Wednesday Bushfire. This was South Australia’s first major bushfire/disaster for many years and the first since significant advances in communications capabilities. At the time, there were limited arrangements in place to allow agency leaders and government to collaborate to support the resolution of a significant emergency and provide relief and recovery efforts to affected communities. It led to the development of the State Disaster Act 1980 and a State Disaster Plan that was based around the operations of a SEC.

SEC support to the State’s emergency management arrangements is restricted by the physical environment in that it can only house a limited number of players. Thus the creation of the Functional Services ‘communication trees’ of liaising with like/related parties.

One of the roles of the SEC is to be able to quickly communicate and with the right person/s from over 120 agencies that can be involved in the resolutions of a significant emergency or can provide advice or expert opinion. It is not physically possible or practical for all these organisations to be represented in the SEC.

That is why Functional Services were originally created with a lead agency given responsibility for organising the arrangements with their Participating Agencies. It appears this capability has not been maintained across all areas.

The SEMP has made changes to the functionality and naming conventions of the State Emergency Centre (SEC) that are confusing and likely to significantly reduce effectiveness.

The SEMP (at 3.20 and 3.23), in moving away from the single concept of Functional Services to having a combination of Support Agencies and Functional Support Groups within the SEC arrangements creates significant naming convention issues throughout the plan. One example is the confusion created by failing to clearly differentiate the role of a support agency supporting the Control Agency to that of an agency managing a Functional Support Group.

The concept of an agency or person performing two or more roles is common. For example, St John Ambulance has the following roles:

- Support Agency for emergencies they are called upon to attend and undertake specific tasks
- Participating Agency as part of Ambulance and First Aid Functional Service where they provide advice on their resource capability and availability, call-out their resources when called upon or provide other information and advice when requested.

SAPOL has the following roles:

- Coordinating Agency for all emergencies
- Control Agency for a range of emergency types
- Support Agency for all other emergencies
- Participating Agency and lead agency for three Functional Services – Communications, Police and Public Information.

An agency keeping these roles separated assists in ensuring all aspects of the various roles are undertaken and reduces misunderstandings.

**It is suggested** the new concept of having a combination of Support Agencies and Functional Support Groups within the SEC be cancelled and only Functional Support Groups be retained.

The SEMP describes the 'Role of Functional Support Groups' (at 3.2) when it is actually describing the role and responsibilities of the lead agency of a Functional Support Group. This needs to be amended to ensure clarity.

The authors suggest that Functional Support Groups do not exist outside of the SEC environment contrary to the thoughts of others. In over ten years of examining Zone Emergency Centres (now to be known as Zone Emergency Support Teams-ZEST) operations we have not experienced an occasion where an agency acts as a lead agency of a Functional Support Group. Instead Participating Agencies of Functional Support Groups deal directly with the Zone on a needs basis as a supporting agency.

**It is suggested** that the SEMP states clearly that Functional Support Groups do not exist outside of the SEC environment. This would assist in simplifying the emergency management arrangements.

The SEMP has removed the previous (and limited) role statement of the SEC and replaced it with a summary of 'functions' that is different and less comprehensive than the *Key Principles and Limitations* contained in the SEC Operations Manual. In 2014 after extensive discussions, lessons gained through activations of the SEC for emergencies and exercises, and gaining an understanding of what should be the role of the SEC, changes were made in the operations of the centre and the contents of the SEC Operations Manual. This included a revised role statement.

An example of the issues created by the change in expression from 'role' to 'function' is the inclusion in this version of the SEMP of an SEC function to: *"exercise the powers and functions of the State Coordinator in a declared emergency"*. No person or body can exercise the powers and functions of the State Coordinator unless there has been a delegation made under Section 18 of the EM Act (i.e. specifically to the SEC). If it was intended that the SEC exercise these powers and functions then the Plan should detail the existence, and limitations, of the delegation made by the State Coordinator so that they can be incorporated into the SEC Operations Manual.

**It is suggested** that the role statement contained in the SEC Operations Manual (see below) replaces the one in the SEMP (at 3.7).

*The SEC supports the State Coordinator by bringing together agencies and persons to engage in operations within the SEC which may include:*

- *Control Agency*
- *Functional Support Groups*
- *Recovery representatives*
- *Subject experts (e.g. Bureau of Meteorology)*
- *Other relevant organisations and interested parties.*

*The role of the State Emergency Centre (SEC) is to:*

- *Support the State Coordinator in the execution of his/her responsibilities for managing and coordinating response and recovery operations in accordance with the Emergency Management Act 2004 and SEMP and;*
- *Support agencies engaged in response and recovery operations that are beyond the capability of day-to-day resources.*

*The SEC supports this role by engaging participating agencies in the following activities:*

- *Coordinating the analysis and sharing of information about an emergency or potentially disastrous situation with the State Coordinator, Control Agency, Functional Support Groups, support agencies and the State Recovery Office*
- *Coordinating and prioritising the allocation of State resources to support agency response and recovery planning and/or operations*
- *Facilitating collaborations between the State Coordinator and Chief Executives of government departments and other agencies*
- *Coordinating liaison with the State Government and with Australian Government emergency management authorities*
- *Supporting the State Coordinator in the preparation of any requests for Australian Government assistance, declarations, appointments or delegations as required*
- *Supporting the formal transition from response activities to recovery operations.”*

**It is suggested** that it is more appropriate for the SEC role statement to be contained in the SEMP, and repeated in the Manual, rather than the other way round, as it provides the high level strategic direction and guidance for SEC operations and the Manual’s content and development.

The SEMP (at 3.8 and 3.9) describes two centres - State Control Centre (Control or Supporting Agency) and State Command Centre (Functional Support Group) as part of the SEC arrangements. These titles are no longer required as they are the State Command Centre of the respective agencies. In any case to use of the terms ‘control’ and ‘command’ in these titles is inappropriate as lead agencies of Functional Support Groups collaborate with their Participating Agencies, they do not have command or control authority over them.

**It is suggested** that the titles - State Control Centre (Control or Supporting Agency) and State Command Centre (Functional Support Group) be deleted from the SEMP and just the term ‘State Command Centre’ used.

The position of SEC Coordinator does not need to be described in the SEMP (at 3.17) as it is not a position identified in the Emergency Management Act 2004 or one having particular authorities. SEC Coordinators are Officers of Police allocated responsibility for the role by the Deputy Commissioner of Police under SAPOL plans and, their roles and responsibilities are comprehensively described in the SEC Operations Manual. It is just one of a number of positions created under the Manual to ensure effective operations of the SEC. The removal of the position from the SEMP will have no impact on the overall arrangements.

**It is suggested** that the position of SEC Coordinator be removed from the SEMP.

Further to the responsibility statement for the SEC Coordinator in the SEMP - it copies a recent amendment to the SEC Operations Manual which changed from *“The responsibilities of the SEC Coordinator include the following: ...”* (followed by 3 dot points) to *“The position of SEC Coordinator represents the State Coordinator in their absence. The State Coordinator, when present, will lead the operations of the SEC. The Responsibilities of the SEC Coordinator (in the absence of the State Coordinator) include...”* (followed by the same three dot points). Some, but not all, other references to SEC Coordinator later in the document e.g. in the Operations section now refers to the ‘absence’ of the State Coordinator’.

The change that makes the State Coordinator responsible for ‘leading’ the SEC is considered significant. The authors suggest that taking direct leadership responsibility for the centre is contrary to the principles of strategic command, places a number of additional complex demands on the State Coordinator that should be delegated to the SEC Coordinator so that they remain free for the strategic thinking, high level briefings and discussions that must take place when managing responsibilities at that level. The State Coordinator, due to their day to day responsibilities, would have limited opportunities for training and exercising in the SEC, acquire a comprehensive grasp of the operations of the centre, nor the time to exercise them properly. Some issues discussed at the SEC debrief conducted on 16 November demonstrated how a lack of knowledge or adherence to plans can affect the operations of the centre.

The SEC infrastructure provides two distinct parts to provide effective support to agency operations. One is the Functional Support Groups room where representatives share information and problem solve at a strategic operational level. The second is a ‘coordination’ area consisting of a conference room and private office for the State Coordinator’s use to fulfill their executive level strategic responsibilities e.g. Government and State level problem solving.

The State Coordinator is responsible for choosing which level (i.e. general operational or strategic) should be activated and should remain free of direct involvement in the operational level to be able to fulfill the executive level responsibilities when required.

**It is suggested** that any SEMP provisions regarding the SEC should provide a clear statement ensuring that the State Coordinator role does not include a responsibility for ‘leading’ the SEC.

As most nominated Control Agencies are also lead agencies of a Functional Support Groups it is important that during activations of the SEC they keep the two roles separate, as far as practicable, to ensure the sharing of information and collaboration with their Participating Agencies occurs. This is achieved by reporting and providing briefings separately as the Control Agency and for the Functional Support Group. The separation of responsibilities, and the awareness of others, would be significantly enhanced if the Control Agency was given a booth or office in the SEC that was separate to their Functional booth.

If there are no or minimal differences in the two roles it becomes questionable if the Functional Support Group is still relevant. The authors are not aware of a comprehensive review been undertaken of responsibilities and composition of each Functional Support Groups. For example, should the SES Functional Support Group become the Rescue Functional Support Group and their Participating Agencies include links with private sector rescue agencies particularly those involved in the mining sector. Likewise, should the Police Functional Support Group become the Policing and Investigations Functional Support Group and their Participating Agencies include the various investigation arms of Federal and State Governments, statutory bodies with an investigation arm and subject experts across a wide range of disciplines.

On the other hand, the Logistics Functional Support Group responsibilities, as described in the SEMP, indicate that its capability has been reduced essentially to catering issues. Logistics is no longer about the distribution of Government supplies, as they no longer exist. What agencies require is assistance with procurement of resources beyond day-to-day supplies during emergencies. The authors suggest the most appropriate lead agency would be the component of State Government responsible for the contracting or procurement of resources and supplies to the State Government. It is suggested this group be re-organised to become the Procurement Functional Support Group and have as its Participating Agencies the various procurement units of the State Government.

It is noted that 'Mapping' has been added as a Functional Support Group. It is disappointing that its responsibilities are limited to providing support only to 'public information' and there is only one state government department that is a Participating Agency. This is strange as spatial information can support the information needs of many aspects of the resolution of an emergency. State and local government have extensive resources in this field and it is an area that the private sector, with its extensive resources, is likely to volunteer to assist extensively.

**It is suggested** that a comprehensive review be undertaken of the types of Functional Support Groups required to support the State Coordinator and the broader emergency management arrangements together with the responsibilities and composition of the agencies involved.

### **Control Agency**

The SEMP contains following three paragraphs under the Control Agency heading (at 3.19):

*If two agencies are jointly responding to an incident through agency based mutual aid arrangements, the State Coordinator is able to consult with either or both agencies in seeking information upon which to base decisions.*

*During an emergency that involves mutual aid/joint response arrangements by the Country Fire Service (CFS), Metropolitan Fire Service (MFS) and/or State Emergency Service (SES), the State Coordinator may utilise the authority given in section 20(1)(b) of the Act to determine the control agency for the purposes of seeking advice, prior to making a declaration.*

*The MFS/CFS Joint Principles of Incident Management will be used to assist with those agencies providing advice to the State Coordinator.*

The above statements contain an element that is technically incorrect at law. Section 20 relates to the 'Coordinating Agency' and not the 'State Coordinator'. They are different entities although the Commissioner of Police could make this decision as the Coordinating Agency if ever in that position. In practice, if a decision is required as to who is the control agency for an emergency it would be a field decision made by the senior police officer present who would be unlikely have access to or knowledge of the document.

Their determination would be based upon which agency present at the emergency is best placed to undertake the role of control agency. Hopefully, CFS & MFS leaders present would be able to work it out without the need to refer a decision to the Coordinating Agency. Therefore, the authors question the need for these statements to remain in the SEMP.

**It is recommended** that the above three paragraphs be removed from the SEMP. If this information must be known by the Coordinating Agency, then it belongs in a Practice Guide to support training and not in the SEMP.

The next paragraph (see below) is also not appropriate.

*Where multiple agencies are attending an emergency, the use of incident management sectorisation will enable those agencies with the appropriate skills to take charge of operations within their area of expertise. These areas include inland water oil spills and the rescue of persons trapped within accident scenes whereby the control agency will maintain overall control, but the specialist support agency will ensure the appropriate response within their area of expertise.*

The outcome is not achieved by just 'sectorisation' but by appropriate 'delegation' by the Incident Controller. This aspect is discussed below in the 'Incident Management' section.

**It is suggested** the above paragraph be removed from the SEMP.

**It is suggested** that the SEMP glossary definition of 'Sectorisation' also be removed. It has the potential to create further confusion with its references to a 'division', something not articulated anywhere else in the plans.

This section also requires statements like the following:

*The responsibilities of the control agency apply at field and strategic management levels. The successful resolution of an emergency requires all ten responsibilities to be considered and addressed appropriately. At any point of time the individual responsibilities may vary in priority, relevance and the resources allocated to them and, this may also vary between management levels.*

*The nominated Control Agencies are required to develop internal policies and incident management arrangements that allow the agency to effectively command or manage its own personnel and resources involved in the resolution of an emergency, as well as controlling the Support Agencies involved.*

*Upon a declaration of an identified major incident, major emergency or disaster the Control Agency remains responsible for resolving the emergency subject to directions, if any, of the State Coordinator or an Assistant State Coordinator.*

*The Control Agency is responsible for recovery operations unless the executive officer (or their delegate) of another agency has formally agreed to accept that responsibility or in the case of a declared emergency, an Assistant State Coordinator (Recovery) has been appointed and has formally agreed to accept that responsibility.*

## **Support Agency**

The SEMP (at 3.20) had not previously defined the responsibilities of Support Agencies. However, those described in the Plan are more aligned to the responsibilities of a lead agency of a Functional Support Group than to a Support Agency assisting the Control Agency.

This section would require statements, amongst others, like the following:

- *Support the control agency*
- *Follow reasonable directions of the control agency*
- *Command their own resources unless otherwise agreed*
- *Regularly report to the control agency.*

**It is suggested** the responsibilities of Support Agency be re-defined.

## **COORDINATING AGENCY**

The SEMP (at 3.21) does not accurately reflect the legislative requirements of Section 19 and 20 of the Act. Also, the additional coordination requirements placed upon the Coordinating Agency by the SEMC following the lessons gained from the 2009 Victorian Black Saturday Bushfires Royal Commission need to be clearly delineated from the Act requirements to improve training and understanding.

**It is suggested** the current information be replaced with the following:

*'The Coordinating Agency has the following functions in relation to an emergency (refer s19 & s20(1)(b) of the Act):*

- *When it is unclear as to which agency at an emergency should be in control, make a determination*
- *Consult with the control agency*
- *Take action to facilitate the exercise by the control agency of functions or powers in relation to the emergency*
- *Determine whether other agencies should be notified of the emergency or called to the scene of the emergency or otherwise asked to take action in relation to the emergency*

- *To advise the State Coordinator in accordance with any requirements of the State Coordinator’.*

*The Coordinating Agency has been assigned additional functions by SEMC. They are to actively seek information from the Control Agency and Supporting Agencies to ensure that the Control Agency is meeting its ten responsibilities as described in this Plan. This includes ensuring:*

- *That effective command and control arrangements are in place and clear*
- *That the threat is clearly understood and being actioned accordingly*
- *There are incident management objectives and priorities*
- *Agencies are working together in a collaborative manner*
- *That public warnings are actually disseminated and appropriate (this is a Control Agency responsibility but the Coordination Agency is required to check this is occurring).*

*Coordinating Agency responsibilities are undertaken irrespective of any declaration that may be made by the State Coordinator or Governor and are in addition to any Control Agency or Support Agency responsibilities undertaken in relation to an emergency by that agency.*

*Coordinating Agency responsibilities apply at field and strategic management levels. The manner in which the Coordinating Agency links with the leadership of the Control Agency and Supporting Agencies prior to and following the declaration of an identified major incident, major emergency or disaster is illustrated in Figures 3A and 3B. (Note: SAPOL is on both sides of the diagram – always as the Coordinating Agency and either a Control Agency or Support Agency depending on the type of emergency.)*

*The Coordinating Agency role is essentially an assurance role and different and separate to the coordination of resources which is primarily the responsibility of the Control Agency.*

Figures 3A and 3B are technically not correct when including the various centres into the diagrams as not all centres are included, for example, the SEC; Agency State and Regional Commanders do not necessarily have to be in their respective command centres for coordination to occur and ZEST support can occur at both Zone and field levels. Coordination responsibilities can be achieved through electronic conferencing conducted anywhere. The purpose of the diagrams is to show the leadership arrangements and links and this is more clearly displayed if no centres are included.

**It is suggested** Figures 3A and 3B are amended by the deletion of State Command Centres, Regional Command Centres, Zest Support and IMT.

## **Local Police Coordination**

The content in this section is not required as the role and responsibilities listed are the same responsibilities the local police commander or nominee has within their Coordinating Agency role but stated in a slightly different manner. Their removal will have no impact on the State's emergency management arrangements and will reduce confusion within policing and simplify training.

What this section needs to state are the additional responsibilities SEMC through the SEMP wishes to place upon the local police commander that do not already exist as part of their Coordinating Agency's responsibilities. In determining the additional responsibilities, it is essential they do not conflict with the requirements of Section 20(3).

That is when police are a Support Agency they, including the local police commander, are subject to the control of the Control Agency. The local police commander's emergency management activities must be at the direct request of the Control Agency. They cannot act independently of them otherwise they usurp the authority of the Control Agency and can cause control confusion. (Note: a related discussion regarding ZEST on page 22)

The SEMP must clearly identify that the coordination of resources is the responsibility of the Control Agency and they can request any agency, including the local police commander, to support them in this role and is achieved by making specific requests.

**It is suggested** that the content under the heading of 'local police coordination' be deleted.

It is also suggested that further discussions should occur to determine what would be the additional responsibilities, if any, of the local police commander outside of their role as part of the Coordinating Agency before anything is included in the Plan.

## **Incident Management (at 3.24)**

This is the first time the specific topic of incident management has been included in the SEMP and needs to be commended. However, what has been included lacks detail and substance. To ensure that agencies can work together effectively and efficiently, the SEMP must describe a common incident management framework that sets minimum standards for incident management irrespective of the industry incident management model an agency employs. The aim is to have everyone behaving and thinking in a similar manner during response operations at all management levels irrespective of the role they are undertaking.

The introduction paragraph suggests that all agencies must adopt a sophisticated incident management system. This is mainly applicable to nominated control agencies.

**It is suggested** that the introduction is amended to reflect the following:

*Effective working relationships between the nominated control agency and supporting agencies at an emergency is critical. Agencies involved in response operations for the resolution of an emergency are expected to employ incident management arrangements to manage their own people and resources.*

*Nominated control agencies are required to employ a sophisticated incident management system that provides not only a means to manage their own people and resources but also to control other agencies that provide support at field, regional/zone (if applicable) and state management levels.*

*It does not matter which incident management model a nominated control agency employs, for example, AIIMS, ICCS Plus or Gold/Silver/Bronze. However, they are required to adjust or expand the particular industry model to meet the legislative and administrative framework of South Australia including the specific requirements of the SEMP.*

*Individual agencies are responsible for the management/command of their own people and resources. A control agency does not command the members of a support agency unless by formal agreement (for example, a multi-agency Urban Search and Rescue team). A control agency controls a support agency by delegating tasks to that agency via its leader. How that task is achieved is up to that agency.*

Nominated control agencies cannot solely rely on their industry incident management system as their incident management model. These models are prepared in a generic manner for broad use. Individual agencies need to amend them to meet the specific requirements of their jurisdiction. For example, SAPOL employs the police ICCS Plus model. However, it was required to make a number of amendments and expansions to this model so it would be relevant to South Australia's legislative framework which includes the requirements of EM Act and the SEMP. These changes are reflected in SAPOL's ICCS General Order and ICCS Practice Guide.

The various industry incident management systems apply principles of incident management or principles of command of control in their operations. They form the basis of performance standards expected of people and agencies, however there are differences between systems. It is appropriate for the SEMP to identify the key principles they expect nominated control agencies to apply.

**It is suggested** that the following be incorporated into the SEMP as the essential principles of command and control which agency incident management models must adopt to achieve a common methodology of incident management across agencies.

- Appropriate leadership – there are clear arrangements to ensure leaders with the appropriate authority and capability take charge at all management level in-line with the complexity and risks of the emergency.

- Take charge – about actively taking responsibility, exercising initiative and applying leadership. It includes being proactive and responsive to changing or developing circumstances.
- Safety – operational safety is to be applied at all times. Acting safely involves the continuous assessment and control of risk as circumstances change.
- Functional management – involves managing multiple responsibilities, tasks or resources by grouping them into manageable, related activity type. (Nominated control agencies have agreed to align functional management with the ten responsibilities of the control agency as described in the SEMP.)
- Delegation – is normally necessary to achieve resolution of an emergency. Responsibility for undertaking a task can be delegated but not the accountability for it being carried out.
- Span of control or management – relates to the number of groups, individuals or tasks that can be successfully managed by one person and operates as a way to avoid overwhelming any one individual with too much responsibility.
- Collaboration – consulting with others and joint problem solving is normally superior to individual efforts and the soliciting of experience, knowledge, ideas and opinions of others support improved outcomes, including unity of effort and team work.
- Decision making – in responding to an emergency decisions need to be timely and based on an appreciation of the circumstances. Decisions are often required to be made in an environment of pressure and uncertainty, lack of information and before comprehensive awareness can be achieved.
- Incident action plan – the resolution of an emergency requires a defined plan that clearly states the mission and describes the strategies and tactics to be employed. The plan needs to be concise and clear to facilitate its implementation.
- Priority of action – activities need to be undertaken in order of priority and monitored. As circumstances change, the order of activities needs to be re-assessed and where necessary, amended.
- Flexibility- involves being responsive to changes that occur during the evolution of an emergency. It requires awareness and foresight so as to be sufficiently agile and flexible to changing situations, needs, priorities and opportunities.
- Unity of Command – a hierarchy where a person receives orders and reports to the one person – their direct leader. Dual command is a perpetual source of conflict.
- Communications – all communications during an emergency should be clear, succinct and timely and as far as possible in plain language.

- Strategic oversight – involves commanders ensuring they are not constantly engaged in the detail of activities being managed under their leadership by regularly taking time out to reflect on their decisions, observe the conduct and tempo of operations and, think through key issues to maintain a strategic level of focus on their overall responsibilities.
- Continuation of mission – unless there is a change in circumstances which requires an alteration to the incident action plan, the objectives, strategies and directions of the strategic controller and incident controller are to remain when a changeover (such as a shift change) occurs.

These principles are not limited to key position holders but need to be continuously considered by leaders at every level during response operations. For example, someone managing a group is a leader who has to consider these principles and apply them to their situation. It applies equally to an individual who has been delegated a task.

The field and strategic command structures within an agency are absent or not clear in some industry incident management systems. It is therefore appropriate for the SEMP to define minimum expectations. For example, the SEMP identifies that the resolution of emergencies may involve three distinct levels of management – field management; strategic management at regional/zone, state and chief executive levels; and executive management as depicted in Figures 3A and 3B of the SEMP.

The authors provide the following as an outline of some of the issues that would need to be addressed to standardise arrangements.

#### *Appointment of field leader*

The Act requires an agency to be in control of the resolution of an emergency at all times (the Control Agency), and also provides rules as to how agency leadership is to occur if the nominated control agency is not present. The Act and SEMP does not describe how an agency will appoint the incident controller or other field leaders to represent them – each agency is required to develop their own policies.

As successful resolution of emergencies is intrinsically linked to field leadership, it is essential that an agency's policies describe the appointment process from the time of first arrival plus an assurance process. There can be no delay in the appointment of the field leader.

As the initial response leaders to an emergency are generally low in experience as well as position/rank within their agency, an agency's policy would need to include the requirement for the field leader to assess the scale and complexity of the incident and their ability to effectively manage the situation, and if necessary, arrange for a more suitable person to assume that role. Also, if there is no strategic leader in place and the field leader believes there would be benefits in having strategic management support, it is appropriate for them to request their manager or other suitable person to nominate as the strategic leader and provide that support.

### *Role of field leader*

The field leader is accountable and responsible for management of their agency's resources involved in resolution of the emergency in the field.

If the emergency involves a multi-agency response and the organisation is the Control Agency, the field leader is also the incident controller and responsibilities include the control and coordination of the support agencies involved in the field operations. They are also accountable and responsible for ensuring that the responsibilities of the Control Agency, as per the SEMP, are undertaken as they relate to field operations. These responsibilities are in addition to those contained within the industry incident management model adopted by their agency.

The field leader of a support agency is also accountable and responsible for ensuring the responsibilities of the control agency, as applicable to the context of being a support agency, are undertaken as they relate to field operations.

If the field leader is also the Incident Controller, they are subject to audit by the police forward commander who has a legislative coordination responsibilities that basically relate to ensuring that the incident controller is adequately addressing the responsibilities of the control agency.

Agency's policies would need to articulate that the incident controller is responsible for regularly bringing together the field leaders of the support agencies for the purpose of:

- Providing briefings on the current and likely future situation
- Reporting on the status of activities being undertaken
- Collaborating on the appreciation process and development of a joint incident action plan
- Delegating tasks
- Sharing relevant information.

The frequency of liaison would depend on the size and complexity of the situation. To support effective liaison, where practicable, the co-locate of the various agency leaders and their support resources is to be encouraged.

Policies would also need to be clear that the field leader, after undertaking an initial assessment, must establish and remain at the nominated command location to enable ongoing liaison to occur.

### *Role of strategic leader*

Depending on the complexity and risks associated with an emergency, the position of strategic leader (to whom the field leader reports) may need to be established. The strategic leader becomes accountable and responsible for the overall strategic command, control and coordination of the emergency and is accountable for its outcomes.

Due to the incident despatch arrangements of agencies, the supervisor/manager of the field leader is often not aware of the occurrence of an emergency and there needs to be clear policies as to how and when they are advised of an emergency. Once advised, the supervisor/manager becomes the strategic leader of the emergency until it is resolved or the responsibility is transferred to another person.

The responsibilities of the strategic leader are to provide guidance, support and if necessary, direction to the field leader and includes the approval of their plan/s, assessment of the field leader's performance and the taking of corrective action. Activities would include the following:

- Providing strategic directions and guidance in the development of plans, the setting of limitations and field plan approval
- Advising the field leader of surrounding events and issues that may impact upon the development of plans
- Not getting involved in field operational and tactical issues – how the plan is executed is the responsibility of the field leader
- When necessary, building a strategic management level support team to undertake tasks that can be performed away from the field, for example, organising the attendance of specialist personnel or other resources, organising the personnel for a change of shift or undertaking particular public information activities
- Regularly communicating with their field leader and reviewing available information to assess the performance of the field leader in relation to their application of the principles of command and control (see above) and the addressing of the ten responsibilities of the control agency as it applies to their organisation, and taking corrective action
- Assessing the scale and complexity of the incident and the ability of the field leader to effectively manage the situation, and if necessary, undertake the field leader role or arrange a suitable person to assume the role.

The appointment of a strategic leader and any change of field leader, if occurs, must be immediately communicated to the key people involved and recorded. If the strategic leader becomes the field leader, they must immediately arrange for a more senior person to undertake the role of strategic leader.

When the emergency involves a multi-agency response and the organisation is the control agency, the responsibility of the strategic leader extends to the strategic control and coordination of support agencies at the strategic management level.

There is a perception in the emergency management community that according to AIIMS the incident controller is in overall control and is subject to only limited strategic management level supervision and direction. This is based on the following within AIIMS that states the incident controller is: *“overall responsibility for the management of all activities undertaken to control the incident”*. This statement relates to field management and the role of the strategic leader as described above supports this position. There are legislative responsibilities upon chief executives and chief officers of government agencies to supervise when they delegate responsibilities, for example, the responsibilities attached to incident controller or field leader role.

### *Strategic leader command and control centre*

For many less significant emergencies a strategic leader may only need to provide guidance and limited directions to the field leader. In these circumstances conversations by means of radio or mobile phone may suffice. However, for complex emergencies the strategic leader may need to build a strategic management level command and control structure for purposes including:

- Discharging their responsibility of providing direction, guidance and support to their field leader(s)
- Undertaking tasks requested by their field leader(s)
- Liaising with equivalent strategic commanders of the other agencies involved
- Reporting to chief executive or chief officer and if operating, the State Emergency Centre.

Also, when two or more significant emergencies occur simultaneously the workload at the strategic management level can increase immensely. Not only is there a requirement to spread scarce resources over more than one incident but maintaining appropriate information management and sharing arrangements between various leaders is critical. The situation may activate the State level emergency management arrangements that add an additional level of complexity. There is also the issue of maintaining normal day-to-day business.

An agency would require policies and procedures for strategic management level command and control centre/s (ie: centre operations manual) that includes how the centre is activated, its operations, information management and sharing arrangements, and describes the role and responsibilities of key centre personnel. There would also need to be a regular testing and evaluation protocols.

### *Leadership for multiple emergencies*

An agency needs to plan for multi emergencies and have clear policies as to the leadership arrangements for different combinations of concurrent significant emergencies: The following provides an example:

- When two or more significant emergencies occur within the same region, a field leader be assigned to each incident and the region manager (or nominee) becomes the (region) strategic leader operating from a regional centre.
- When single significant emergencies occur within multiple regions, the field leader is to be the region manager (or other nominee) and the (state) strategic leader to be a senior manager of the agency operating from a state centre.
- When multiple emergencies occur within multiple regions, a field leader to be assigned to each incident and the region managers (or other nominees) to be the region strategic leader reporting to the state strategic leader.

- When the same significant emergency occurs or crosses two or more regional boundaries the state strategic commander to determine who would be the field leader or how field leadership would be divided.

#### *Multi-agency command and control arrangements*

Multi-agency command and control arrangements can vary depending upon the type of emergency and the resources involved. Normally, agencies operate as independent units being responsible for the command/management of their own personnel and other resources. The focus of their activities is controlled by the control agency.

On occasions agencies may come together and form a single command and control structure, for example, some search and rescue operations. In these cases, the field personnel forgo their agency's command arrangements and operate as a joint team under the command of the incident controller.

At other times a combination of the two types of multi-agency arrangements can also occur. For example, fire and rescue agencies may agree to work jointly together as a single team while other agencies like police and ambulance services operate as independent units.

The SEMP should describe the different types of multi-agency command and control structures that may be employed and in what circumstances they are used and if conflicts occur, a resolution process.

#### *Other Issues*

**It is suggested** the SEMP also needs to incorporate more detail to ensure a consistent response when considering other issues such as the following:

- Standards for delegating tasks to a support agency and reporting back arrangements
- Define an Incident Management Team (IMT) and its composition
- Considerations for selecting a venue for a field command and control centre
- Support agencies communication linkage to the Incident Controller and IMT
- Management of an Incident Controller by the Control Agency's State and/or Regional Controller
- Arrangements for dealing with 2 or more geographically separated significant emergencies within the one Zone
- Arrangements for dealing with an emergency involving 2 or more Zones.

#### **Zone Emergency Support Team (ZEST) Arrangements (3.10)**

The authors noted the Plan has changed the title of Zone Emergency Centre (ZEC) to ZEST and made some insignificant changes to its role statement. In June 2009 the ZEC role statement was significantly changed from its original one in an attempt to overcome the significant problem of ZECs undermining the role and responsibilities of the Control Agency in an emergency.

Although the ZEC Operations Manual template was updated at the time to align with the revised role of ZECs and various training undertaken, there continued to be misunderstandings and conflicts between ZECs and the Control Agency including the following:

- ZECs activated without a request or knowledge of the Control Agency
- ZECs undertaking activities not assigned to it by the Control Agency
- Inability of Support Agencies and Control Agency to provide ZECs with appropriate level of representation that can speak for and on behalf of their organisation
- Agency representation in ZECs is not consistent across Zones
- Continued perception that ZECs can act independent and/or superior to the Control Agency
- Police strategic level commanders using ZECs as a source of incident situation information, independent of the Control Agency.

The minimal changes made to the role statement are deemed unlikely to have sufficient impact to change or eliminate these issues.

Within policing the activities of ZEC's has been seen as necessary and successful however Emergency Services have been less inclined to support them. Police commanders at field and strategic level are highly motivated to actively coordinate and resolve emergencies. This motivation is derived from the Police Act 1998, Section 5—Purpose of police which contains the following:

- *(d) assist the public in emergency situations; and*
- *(e) co-ordinate and manage responses to emergencies; and*

Failing to fully recognise the primacy of the Emergency Management Act 2004, and therefore the responsibilities of the Control Agency, police commanders have often overstepped their coordination role and ended up trying to conduct operations, parallel to or independently of the Control Agency.

The Act has specifically given the Control Agency the overall responsibility to collaborate with Support Agencies and control response operations in their entirety. The establishment of a ZEC has tended to undermine the authority of the Control Agency.

Close engagement in the training, exercising and reviewing of ZEC's has led the authors to question the relevance or need for ZESTs. The following discussion has been provided to support that view.

Prior to the introduction of the Emergency Management Act 2004 there were no specific laws governing multi-agency control or coordination arrangements at emergencies that were not a declared disaster. This included the operations of Divisional Emergency Operations Centres (re-named Zone Emergency Centres). The State Disaster Act 1980 made no reference to these Centres and the State Disaster Plan briefly mentioned that they were part of the State's arrangements but provided no guidance as to their function or operations.

The then Police Functional Service Plan stated that to facilitate effective control and coordination at emergencies that ZECs are to replicate the State Emergency Centre (SEC) arrangements that were based around Functional Services but at a Zone level. The Divisional Coordinator (re-named Zone Coordinator) was to operate from the ZEC and the agencies involved in resolving the emergency were subject to their control. This arrangement was only supported by legislation during a declaration as this was the only time the State Disaster Act 1980 and State Disaster Plan had legal affect. ZECs were often activated for non-declared emergencies and attempted to undertake a control and coordination role.

The introduction of the Emergency Management Act 2004 significantly changed the emergency management legislative framework in South Australia. Amongst other things, it introduced the concept of a Control Agency and gave them overall responsible for the resolution of an emergency. The Act states:

*'all other persons and agencies involved in response operations in relation to an emergency are, in carrying out those operations, subject to the control of the control agency'* (refer to Section 19(3) of the Act).

The legislative change meant that the original role of ZECs and its management by Zone Coordinators under the State Disaster Act 1980 was no longer applicable under the new Act.

The failure to recognise the full implications of the change in emergency management arrangements, due to the new Act and Plan, has meant that an inappropriate model was adapted for use under the new arrangements and it is now clear that it is no longer required or desirable. (Note: a related discussion regarding the position of Local Police Coordinator on page 13)

The Control Agency and/or the Coordinating Agency can at any time bring together or communicate with the local or regional leaders of the support agencies involved in an emergency (including local government representation) and this does not require the activation of a ZEC.

As per our comments on the role of the field leader above (page 16):

*"The incident controller is responsible for regularly bringing together the field leaders of the support agencies for the purpose of:*

- *Providing briefings on the current and likely future situation*
- *Reporting on the status of activities being undertaken*
- *Collaborating on the appreciation process and development of a joint incident action plan*
- *Delegating tasks*
- *Sharing relevant information."*

This '*regularly bringing together*' (meetings) can be conducted in person, by teleconference or a combination of both, when necessary, to collaborate on defined and particular issues. This could include when notified of a potential emergency to ensure all agencies are aware of the situation and are prepared. However, during response and relief operations it is to come together for a meeting with a defined agenda and then return to their duties.

The Plan must ensure that Control Agencies address this responsibility properly as it is a methodology that will ensure a more effective and efficient coordination of local resources than having a 'satellite' group to support with resources and information.

It is reasonable to assume that continuing with a ZEST or ZEC type model of semi-independent coordination of resources will continue to cause control conflict and undermine the activities of the Control Agency.

During the 2015 Sampson Flat bushfire that was declared a major emergency, Support Agencies (including local government representatives), were engaged with the Control Agency at the One Tree Hill incident management team (IMT) location or were in contact with the CFS Regional office. There was no request for the activation of a ZEC.

Feedback from CFS Regional Managers advises that ZECs have worked for significant bushfires when they are co-located with the IMT. In these circumstances, it is not technically operating as a ZEC but the expected direct collaboration of the Control Agency with Support Agencies.

Traditionally ZECs have been seen as a means of engaging with local government during the resolution of emergencies. However, not all Councils are represented in ZECs and it has generally been an ineffective method of engaging with them.

In recent years, the Councils in which an emergency has occurred have liaised directly with the Control Agency. The 2014 Eden Valley and 2015 Sampson Flat bushfires are recent examples of successful collaboration between local government and the Control Agency without the use of ZEC arrangements. This is the appropriate arrangement and needs to be encouraged as standard practice.

The need for ZECs/ZEST to continue as part of the State's emergency management arrangements has been replaced by other arrangements that align with the responsibilities of the Control Agency and the Act.

**It is suggested** that ZEST are deleted from the State's Emergency Management Arrangement as they were formed under another legislative framework and are no longer relevant or appropriate under the current legislation.

The collaboration of regional/Zone management level leaders prior to and during significant emergencies that require a multi-agency response is an essential activity. The Control Agency is responsible for its organisation and the Coordinating Agency for ensuring it occurs. It does not require a ZEST for this activity to occur.

The deletion of ZEST will not impact upon multi-agency arrangements as the 'responsibilities of the Control Agency' (refer SEMP Part 2 paragraph 3.19.3) places specific obligations upon the Control Agency to collaborate with Support Agencies.

## **Other deficiencies of the SEMP**

The following are just a few examples of where there are misunderstanding of the arrangements, lack of direct strategies mentioned, poor use of terminology or there is content that is not relevant. The sections dealing with recovery operations were only cursorily explored as part of this submission. It appears this content also experiences the same problems.

**It is suggested** that a major review of the SEMP content is warranted.

### *Investigations (3.25)*

This section is poorly written and there is no 'investigating agency' under the plan. The control agency is responsible for investigations (refer 3.19.3). They may delegate one or more tasks of investigations to a support agency, for example, the police. However, there may have been a workplace injury during response operations that may need to be investigated by the control agency as well as by Workplace SA.

There are various agencies involved in investigations and have different responsibilities depending upon their legislative authority and the nature of the incident. It is the responsibility of the control agency to ensure that appropriate investigation bodies are notified and provided the appropriate assistance to undertake their task.

**It is suggested** that the SEMP must be amended to articulate this responsibility clearly.

### *Emergency Management Training (5.3.1)*

This section provides limited detail strategies as to how emergency management training is to be undertaken within and across agencies. The resolution of significant emergencies requires various agencies to collaborate and work together to achieve a successful outcome. It is essential that agency leaders who will undertake key roles during emergencies train together in a multi-agency environment.

### *Emergency Management Exercises (5.3.2)*

This section provides limited detailed strategies as to how emergency management exercising is to be undertaken within and across agencies. The Plan needs to state, at a minimum, the extent of the membership of CEWT, the minimum requirements for exercises by agencies and their reporting of lessons gained from the activity.

### *Response (6.1, 6.3 to 6.6.1 and 6.8)*

The 'Response Principles' are incomplete. This section also attempts to explain response operations for the resolution of emergencies using 'RABORD' – Reporting / Action / Build Up / Operation / Rundown / Debrief. It does not achieve this purpose. RABORD is used to assist in the structure of operational plans. The SEMP is not such a plan and it is inappropriate for it to be used in this way.

### Debriefs (6.9)

Debrief requirements for agencies after the State Emergency Centre has been activated are not clear. The debriefs conducted for the extreme weather event that was held in the SEC clearly demonstrated that most participants were not able to differentiate between a Control Agency led multi-agency debrief of response operations and the requirements of a SEC operational debrief.

Current SEMP requirement (quoted below) does not ensure that the various levels of operations debrief in a structured way (e.g. all agency field operations debrief should be completed prior to the agency state level debrief to ensure all relevant issues are addressed).

*“Upon completion of any incident, each agency is to conduct an internal debrief. Within three weeks of the completion of the response to an incident involving the use of the SEC or a ZEST, a formal debrief will be convened by the control agency to ensure that any lessons learned are captured...”*

The time frame and hierarchy of review and reporting needs to be included to ensure all levels of incident and emergency management are thoroughly informed / reviewed / assessed upon completion of an incident.

It is suggested that a chart or matrix such as the example below (under the Response heading) be considered for inclusion in this part of the SEMP, supported by detailed reporting requirements in SEMP Part 3 – Annex F. The detail should also include a requirement that multi-agency debriefs should not be held in the SEC due to the confusion of context that it regularly creates.

SEMP incident debrief reporting time frames							
Field	Agency	SEC	Multi-Agency	Advisory Groups	SEMC	EMC	
	Progressive Reporting to the relevant authority						Review SEMC and SCC debriefs
							State Crisis Centre - within 2 weeks of the SEC
							Committee review - first meeting post Advisory Groups
							Recovery Multi-Agency - interim as required, final within 3 weeks of completion of operations
							SRAG & Recovery - first meeting post Multi-Agency State Level debrief
							Control Agency led Multi-Agency State level - within 2 weeks of the SEC debrief
							Control Agency led SEC with activated agencies, interested parties and operations staff - within 2 weeks of the Agency level debrief
							Individual Control Agency & Support Agencies at strategic Level - within 2 weeks of completion of Field level debriefs
							Individual groups - Functional Support Group Leaders, Capability Units, ZEST's, Agency Field or Regional centres - within 2 weeks of completion of operations

## *Glossary (8.)*

A key principle of any incident management model is the use of common terminology and definitions. Terms used throughout the SEMP document and its sub-plans must align with their definitions within the Glossary so there is no misunderstanding as to what is meant. Extreme care is required in the construction of statements.

An example where this is poor is under the heading 'SUPPORT AGENCY' where it states:

*Where a control agency is not the control agency for a particular emergency, they will be referred to as a support agency. A support agency will support the nominated control agency and is subject to direction by the nominated control agency.*

This statement can be inferred in different ways. One way is that only nominated Control Agencies, when they are not acting in that role for a particular emergency, can be deemed to be Support Agencies.

It is suggested that this can be overcome by the statement being re-written as:

*Agencies involved in response operations, including nominated control agency when not the control agency for a particular emergency, are a support agency and subject to the control of the control agency for that emergency.*

Within the SEMP the term 'control' is used on occasions when the appropriate term is 'command' and the opposite is also the case. While the Act does not define command, it is clear that control relates to controlling other agencies. These terms are clearly defined within the Glossary and align with the definitions contained in the Emergency Management Australia Glossary that is considered an Australian standard for emergency management terminology.

Additionally, there are examples within the Plan where the language is not consistent with the Act and likely to lead to misunderstandings or confusion.

**It is suggested** that the SEMP be carefully reviewed to ensure that terms and words used are in accordance with the definitions contained in the Glossary and language used is consistent with the Act.

### *Re-organisation of SEMP content in Part 2-Arrangements.*

**The authors suggest** that the order and structure of this Part be changed to better reflect the requirements of section 5A of the Emergency Management Act 2004, and to improve the flow and logical order of the document.

Below is a suggested format with brief outlines of the content allocated to each heading as an example:

### **Introduction**

This section to summarise information that the plan is: prepared, kept under review, maintained by SEMC, provision requirements of EM Act Section 5A, i.e. detailed strategies for dealing with emergencies in South Australia.

### **Aim**

Simple statement of what this plan intends to do, based on EM Act Section 2 (1) Objects of the Act to “*promote prompt and effective decision-making*”, “*comprehensive and integrated planning*” and “*promote community resilience and reduce community vulnerability*”.

### **Application**

Simply describe the role of the plan

EM responsibilities: State Govt, Local Govt, Business, Non-Govt, Individuals

Response: outline role of Control Agency, Coordinating Agency, Recovery etc

### **Limitations**

Not applicable in industrial disputes etc

### **Authorities**

Outline those elements that have authority within this plan (not the components of the plan) e.g. provide reference to specific areas of Acts etc and simply state what is prescribed or controls actions

The EM Act

- SEMC role
- Function powers of State Coordinator
- Coordinating Agency
- Control Agency
- Declarations
- Powers of Authorized officers

The Role of EMC

Role of Australian Government

- EMA
- Assistance
- National Plans or Policy Principles

### **Structures**

Outline the various structures required by the Act and this plan (i.e. the those created to ensure “*comprehensive and integrated planning*”)

Examples include:

EMC, SEMC, State Advisory Groups, Recovery, Agency Chief Exec’s, State Recovery Coordinator, EM Zone committee’s and Functional Support Groups

## **Prevention**

- Hazard Leader role and allocation
- SA Emergency Risk Management requirements and responsibilities
- Community Resilience requirements
- Business Continuity requirements (for organisational resilience)
- National Plans that direct framework – NSDR, NCTC, Health etc

## **Preparedness**

- Planning for each role an agency might be required to undertake: e.g. Hazard leader, Response agency, Recovery etc. include requirement for plans to use RABORD format and a rigorous assurance process
- Facilities required to support activities expressed as a need to have a facility capable of housing xyz to ensure role can be effectively supported: State Crisis Centre, State Emergency Centre, State Operations Centre's, Functional Support Group Operations Centres, Incident Management Teams, Zone Emergency Support Teams, Field Operations etc
- Positions: e.g. Zone Coordinator requirement
- Public Information requirements for community resilience
- Policies: reference to the need for Annex's such as Traffic Management at Emergencies, Evacuation etc

## **Response**

Dictate the emergency response arrangements. Must include the principles, legislated positions, other appointments, incident management details e.g. 10 responsibilities and functional management outlined as follows:

- Principles of command & control (AIIMS, ICCS Plus and other industry models)
- Response principles/elements: Control Agency primacy and functional management of operations
- Coordinating Agency role: how it is applicable at all times and how to apply at all management levels
- State Coordinator: how powers practically applied e.g. declarations, appointing Assistant State Coordinator's, activating SEC etc (The existing RABORD content does not belong in this plan. It is operational info that belongs in the operations manual. The SEC Coordinator role is also an item for the ops manual, not this plan as it solely applies to the role of the centre)
- Public Information during event
- Control Agency (responsibilities of State Controller and matrix of which agency for which emergency)
- Support Agency (describe supplementary role responsibilities)
- Investigations (include others with responsibility e.g. Workplace, Coroner, ATSB etc)
- Authorized Officers (who and how applicable)

- Relief Operations (describe what is required – currently no mention at all)
- Transition to Recovery (detail triggers, process and responsibilities)

### **Recovery**

Describe how to take over from relief and/or just response operations  
 How ongoing is to be managed (including mandating requirements for Public Information and other agency involvement)  
 Detail who, how and when of Appointments required for on-going recovery  
 Reporting and Debriefing after response operations completed

### **Debriefs**

Prescribe pyramid structure to ensure components are reporting to responsible authority before that authority reports upwards

### **Training**

Detail requirements including CEWT membership and role, who and how must exercise, etc

### **Administration**

Prescribe who is responsible for this plan and how it is managed

### **Glossary**

### **Acronyms**

### **Annexes**

List those in existence that detail requirements laid out in the plan above.

## **PART 3-GUIDELINES AND FRAMEWORKS**

The concept of SEMC having ‘noted guidelines and frameworks’ and expecting them to be applied within the emergency management arrangements is flawed.

**It is suggested** that to comply with the Act SEMC needs to approve guidelines and frameworks and also needs to insure the content is integrated into the SEMP as detailed strategies.

## **PART 4 - PLANS**

Control agency plans have been added to the planning framework. The requirements and description of control agency plans is not detailed or directive.

The ‘plan approval process’ described is not sufficiently rigorous to be an assurance process. Assurance requires independent scrutiny and verifications by person/s with detailed understanding of the subject and the broad emergency management arrangements, together with a report stating whether the plan meets or does not meet the criteria and standards for that type of plan.

**The authors propose the following key recommendations for consideration:**

**Key Recommendation 1**

The SEMP undergo a comprehensive review and takes into consideration the improvements and deficiencies identified in this submission.

**Key Recommendation 2**

A SEMP Practice Guide be prepared that explains in more detail the operations of each part of the emergency management arranges, and collates the collective wisdom and lessons gained from experience, to form an underpinning text for practice and training.

**Key Recommendation 3**

The plan assurance methodology described in Part 4 includes an independent review/audit of the proposed changes. The person conducting the audit would be required to endorse the proposed changes as:

- Not conflicting with other aspects of the SEMP, annexures, and associated plans and manuals
- Words align with the definitions contained in the Act or SEMP Glossary
- Correct naming conventions used
- Changes required to other SEMP documents – annexures, and associated plans and manuals are identified and incorporated into the update approval submission.

**Key Recommendation 4**

An ‘Office of Emergency Management’ be created to support SEMC to develop and maintain arrangements to ensure the resources of the State can be applied effectively in responding to and resolving declared emergencies and disasters. This Office to work collaboratively with the emergency management units of Department of Premier and Cabinet and SAFECOM, and the State Recovery Office.

In various jurisdictions, this role is performed by an appointed Disaster Management Coordinator or Inspector General (or similar term) and support by a small team.

Responsibilities of this office would include:

- Maintaining the State Emergency Management Plan and its sub-plans
- Keeping under review the State Emergency Management Plan Practice Guide – a document to inform how to apply the aspects of the SEMP
- Reviewing significant emergencies to inform training needs and improvements to the emergency management arrangements
- Coordinating, developing, presenting and reviewing multi-agency training
- Oversee the emergency management exercise program
- Audit nominated control agencies’ multi-agency incident management arrangements
- Audit agencies’ internal emergency management plans and training packages to ensure alignment with the SEMP.