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Bureau of Meteorology

HEAD OFFICE
Bureau of Meteorology
GPO Box 1289 Melbourne VIC 3001 Australia

SPECIAL CLIMATE STATEMENT 40

A significant winter wind and storm surge event in southwest Western Australia in early June 2012

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This statement is based on preliminary data available as of 29 June 2012, which may be subject to change as a result of standard quality control procedures.

Summary

A series of low pressure systems and cold fronts crossed southwest Western Australia from 7 to 13 June 2012 resulting in significant damage in the region. Two tornadoes were observed with one affecting inner northern Perth suburbs causing extensive localised damage. Significant wind gusts that were some of the highest on record for the region caused an unprecedented number of power outages to mainly western parts of the Southwest Land Division (SWLD), and unusually high sea levels as a result of storm surges caused localised coastal and estuarine inundation.

Tornado event on 7 June

A trough off the west coast of the SWLD associated with a quasi-stationary low to the southwest of the state gradually moved eastward over land during the morning of 7 June. Severe thunderstorms developed on the trough and moved over the Lower West and neighbouring districts in the late morning and early afternoon, and a tornado was reported in the Perth metropolitan area just after midday. Another tornado was reported near York in the Central Wheat Belt at around 1230 Western Standard Time (WST).

The tornado in Perth's north affected the suburbs of Dianella and Morley, felling trees and power lines. The Fire and Emergency Services Authority (FESA) reported significant damage to approximately 20 homes in Dianella, whilst businesses were also impacted with a video store in Morley having its roof damaged and windows broken by winds estimated to be in excess of 120 km/h. Western Power reported up to 5000 homes lost power as a result of the tornado. Damage was also reported in York.

Tornadoes are a regular feature of winter weather in southwest Western Australia with an average of approximately six reported each year; however, these tornadoes are normally associated with the passage of cold fronts. In this instance, the tornadoes were not associated with a cold front, which is highly unusual in winter in southwest Western Australia.

Wind and storm surge event on 10 June

A rapidly deepening tropical low off the northwest coast of Western Australia moved south-southeastward close to the west coast during the morning on 10 June before the centre of the low crossed the Southwest district during the afternoon.

Very windy conditions were observed in the Lower West, Southwest, and South Coastal districts with numerous sites observing wind gusts in excess of 90 km/h (Table 1). The highest recorded wind gust during the event was 146 km/h at Cape Naturaliste at 1345 WST, which is the strongest wind gust observed at the site in almost 10 years of recording (daily maximum wind gust records commenced in 2003), and the 4th strongest wind gust on record in Western Australia in the May to August ("winter") period (noting higher wind gusts are common in the north in summer associated with tropical cyclones).

Widespread property damage was reported in western parts of the SWLD with a significant number of trees downed. Western Power reported that unprecedented damage occurred to the electricity supply grid southwest of a line from Geraldton to Ravensthorpe where the network of more than 90,000 kilometres of power lines was significantly affected. More than 170,000 homes lost power after 800 power lines

700 Collins Street Docklands Tel: +61 3 9669 4000 Fax: +61 3 9669 4699 www.bom.gov.au ABN 92 637 533 532

were brought down. It took several days for power to be restored to all residents in the region.

Widespread rain was reported through western parts of Western Australia as result of the cloudband associated with the low pressure system, and heavy falls were reported in the southwest Gascoyne and northern Central West districts. A number of locations registered daily totals in the 50 mm to 70 mm range (Table 2), with most of the rain occurring on the afternoon of the 9th and morning of the 10th. Several sites broke their highest June daily rainfall records as a result.

A significant storm surge was reported along the SWLD west coast on the 10th as sea levels up to approximately 0.8 m above the Highest Astronomical Tide (HAT[1]) were recorded (Table 3).

The WA Department of Transport Fremantle Fishing Boat Harbour tide gauge recorded a maximum sea level of 2.12 m, 0.76 m above the HAT, and 0.14 m above the previous highest sea level recorded by the gauge of 1.98 m on 16 May 2003. Sea level recordings at Fremantle extend back to 1897, suggesting that the sea level observed during this event in the Perth coastal region was substantially higher than any level previously recorded. Some minor inundation was reported in Fremantle, along with unusually high water levels in the Mandurah canals.

Further south, Busselton recorded a sea level of 0.83 m above the HAT, but despite the unusually high sea levels, impacts were generally minor with localised inundation reported at the Port Geographe marina near Busselton. For comparison, the passage of tropical cyclone *Alby* in April 1978 caused a storm surge 1 m above the HAT at Busselton with significant coastal inundation and resultant damage.

The Swan River at Perth (Barrack Street) recorded a high tide of equal to or greater than 1.6 m between 1359 and 1615 WST, with a peak of 1.71 m at approximately 1500 WST. Previous experience suggests inundation of Riverside Drive, next to the Swan River in the Perth CBD, occurs when the tide reaches 1.6 m or greater, and reports confirmed that the river foreshore and nearby Riverside Drive were inundated during the afternoon.

Wind and storm surge event on 11 June

A cold front moved through the SWLD on 11 June, following the low on 10 June, and brought further severe wind gusts and another notable storm surge event to west coast parts of the region.

Severe wind gusts were reported at a few sites with the passage of the front in the morning in the Southwest and Lower West districts (Table 4).

Unusually high sea levels also occurred near the SWLD west coast during this event. Although sea levels were generally lower than on the 10th, it appears that most sites again exceeded the HAT (Table 5). Water levels in the Swan River at Perth (Barrack Street) again reached and exceeded 1.6 m between 1009 and 1506 WST, with another peak of 1.71 m at approximately 1300 WST. Despite a similar peak river height to the previous day, this event persisted for several hours longer forcing Riverside Drive to be closed due to inundation.

[1] Highest Astronomical Tide is the highest sea level that can be expected to occur under average meteorological conditions and under any combination of astronomical conditions.

Wind and storm surge event of 12 and 13 June

A rapidly developing cold front and deep low pressure system moved through the SWLD during the afternoon and evening of 12 June, and through central and eastern parts of southern Western Australia on 13 June. Thunderstorms, moderate to heavy rainfall, and severe wind gusts were reported in the SWLD, particularly in the Southwest and neighbouring districts.

The highest wind gust reported during this event was 113 km/h at both Rottnest Island and Cape Leeuwin in the evening as the cold front moved through, whilst there was a secondary burst of extreme winds near the west coast in the early morning of the 13th (Table 6). Widespread rainfall was reported through the SWLD, with heavy falls in the 40 mm to 60 mm range reported in the Southwest and Lower West districts (Table 7).

The impact of the severe winds saw trees uprooted and houses suffer roof damage whilst Western Power reported that 17,000 homes were left without power with 30 power lines brought down. This was additional to the 10,000 homes that were yet to have their power reconnected after the event on 10 June.

A third notable storm surge was reported during this event though at most sites the surge was weaker than the previous two events (Table 8). On this occasion, the Swan River at Perth (Barrack Street) equalled or exceeded 1.6 m for only a short period between 0322 and 0347 WST, with a peak of 1.61 m, suggesting little if any local inundation of the foreshore occurred in this instance.

Accumulated Rainfall

Rainfall as a result of the series of low pressure systems and cold fronts that crossed southwest Western Australia from 7 to 13 June 2012 was widespread across western, central and southern parts of Western Australia (Figure 1). Daily falls were significant, but generally not extreme though a number of sites did register June daily rainfall records (Table 2). The highest daily total was 73.2 mm at Tamala, near Shark Bay in the southwest Gascoyne, on 10 June, whilst the highest seven-day rainfall total, recorded from 8 to 14 June, was 136.6 mm at Margaret River in the Southwest district.

Contacts for further information

Glenn Cook, WA Climate Services Centre (08 9263 2237)
Andrew Burton, WA Severe Weather Section (08 9263 2282)

Site Number	Station Name	District	Maximum wind gust (km/h)	Maximum wind gust direction	Time of gust (WST)
009519	Cape Naturaliste	Southwest	146	SW	1345
009937	Busselton Jetty	Southwest	135	WSW	1415
009193	Rottnest Island	Lower West	119	WNW	1334
009977	Mandurah	Lower West	119	W	1404
009256	Garden Island	Lower West	117	W	1356
010916	Katanning	Great Southern	117	NW	1610
009965	Bunbury	Southwest	111	WSW	1434
009538	Dwellingup Forestry	Lower West	107	W	1434
009603	Busselton Aero	Southwest	106	SW	1420
009172	Jandakot Aero	Lower West	106	WNW	1353
009999	Albany Airport	South Coastal	98	WNW	1752
009240	Bickley	Lower West	98	WNW	1357
009204	Gooseberry Hill	Lower West	96	W	1412
009215	Swanbourne	Lower West	96	WNW	1348
009053	Pearce RAAF	Lower West	94	NW	1328
509169	Champion Lakes	Lower West	94	NW	1414
009998	North Walpole	Southwest	93	W	1658

Table 1. Observed wind gusts on 10 June in Western Australia greater than 90 km/h. Only the highest daily wind gust for each site is included in this table.

Site Number	Station	District	Rainfall (mm)	Years of record (years)	Remarks
006045	Tamala	Gascoyne	73.2	79	*Wettest June day in 25 years*
008200	Eradu	Central West	62.2	70	*Wettest June day on record*
006105	Shark Bay Airport	Gascoyne	60.6	12	*Wettest June day on record*
008141	Willigulli North	Central West	56.4	81	*Wettest June day in 30 years*
008240	Coolangatta	Central West	54.4	61	*Wettest June day on record*
008116	Sandsprings	Central West	52.0	89	*Wettest June day in 24 years*
008075	Lynton	Central West	50.3	85	*Wettest June day in 30 years*
008290	North Island	Central West	50.2	11	*Wettest June day on record*

Table 2. Highest daily rainfall totals in WA in the 24 hours to 9am on 10 June.

Location	Residual tide (storm surge) (m)	Time of highest residual tide (WST)	Tide peak (m)	HAT (m)	Height above HAT (m)
Geraldton	0.78	1020	1.64	1.22	0.42
Jurien Bay	0.70	1100	1.74	n/a	n/a
Hillarys	1.00	1342	1.97	1.29	0.68
Fremantle	1.14	1410	2.12	1.36	0.76
Perth (Barrack Street)	0.78	1500	1.71	n/a	n/a
Cape Bouvard	0.80	1400	n/a	n/a	n/a
Harvey Estuary	0.70	2300	n/a	n/a	n/a
Peel Inlet	0.60	2330	n/a	n/a	n/a
Bunbury	1.21	1455	2.00	1.23	0.77
Busselton	1.28	1425	2.27	1.44	0.83

Table 3. Storm surge recorded by the Western Australian Department of Transport and Bureau of Meteorology on 10 June. The residual tide or storm surge is the greatest departure of the sea level from the astronomical predicted tide. HAT is the Highest Astronomical Tide. Data for some sites were not available (n/a).

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Site Number	Station Name	District	Maximum wind gust (km/h)	Maximum wind gust direction (°C)	Time of gust (WST)
009518	Cape Leeuwin	Southwest	117	W	0925
009519	Cape Naturaliste	Southwest	113	W	0925
009937	Busselton Jetty	Southwest	91	W	0901 1013
009172	Jandakot Aerodrome	Lower West	91	WNW	0954

Table 4. Observed wind gusts on 11 June in Western Australia greater than 90 km/h. Only the highest daily wind gust for each site is included in this table.

Location	Residual tide (storm surge) (m)	Time of highest residual tide (WST)	Tide peak (m)	HAT (m)	Height above HAT (m)
Geraldton	0.45	0145	1.24	1.22	0.02
Jurien Bay	0.60	1135	1.60	n/a	n/a
Hillarys	0.81	1144	1.76	1.29	0.47
Fremantle	0.83	0950	1.82	1.36	0.46
Perth (Barrack Street)	0.80	1230	1.71	n/a	n/a
Cape Bouvard	0.68	1300	n/a	n/a	n/a
Harvey Estuary	0.69	1100	n/a	n/a	n/a
Peel Inlet	0.67	1230	n/a	n/a	n/a
Bunbury	0.89	1105	1.72	1.23	0.49
Busselton	0.98	0700	1.99	1.44	0.55

Table 5. Storm surge recorded by the Western Australian Department of Transport and Bureau of Meteorology on 11 June. The residual tide or storm surge is the greatest departure of the sea level from the astronomical predicted tide. Height above HAT is the Highest Astronomical Tide. Data for some sites were not available (n/a).

Site Number	Station Name	District	Maximum wind gust (km/h)	Maximum wind gust direction	Date Time (WST)
009193	Rottnest Island	Lower West	113	W	12 2118
009518	Cape Leeuwin	Southwest	113	W	12 2250
009519	Cape Naturaliste	Southwest	109	WSW	12 2203
009215	Swanbourne	Lower West	107	WNW	12 2131
009214	Ocean Reef	Lower West	107	NW	12 2033
012009	Norseman Aerodrome	Goldfields	106	WSW	13 0655
009937	Busselton Jetty	Southwest	102	WNW	12 2224
009193	Rottnest Island	Lower West	100	W	13 0106
009977	Mandurah	Lower West	98	NW	12 2006
009256	Garden Island	Lower West	98	W	13 0133
009518	Cape Leeuwin	Southwest	98	SW	13 0323
009240	Bickley	Lower West	96	W	12 2144
009519	Cape Naturaliste	Southwest	96	W	13 0011
009172	Jandakot Aerodrome	Lower West	94	WNW	12 2138
011003	Eucla	Eucla	94	WNW	13 1232
009256	Garden Island	Lower West	93	W	12 2245
009746	Witchcliffe	Southwest	93	SSW	13 0103

Table 6. Observed wind gusts on 12 and 13 June in Western Australia greater than 90 km/h. Only the highest daily wind gust for each site is included in this table.

Site Number	Station	District	Rainfall (mm)	Years of record (years)	Remarks
009585	Nannup	Southwest	67.6	106	*Wettest June day in 54 years*
009510	Bridgetown	Southwest	57.6	99	*Wettest June day in 24 years*
009746	Witchcliffe	Southwest	46.8	14	*Wettest June day in 9 years*
009030	Mundaring	Lower West	43.0	103	*Wettest June day in 4 years*
009538	Dwellingup Forestry	Lower West	42.8	79	*Wettest June day in 7 years*

Table 7. Highest daily rainfall totals in WA in the 24 hours to 9am on 13 June.

Location	Residual tide (storm surge) (m)	Date and Time of highest residual tide (WST)	Tide peak (m)	HAT (m)	Height above HAT (m)
Geraldton	0.54	12 2225	1.27	1.22	0.05
Jurien Bay	0.63	12 2250	1.56	n/a	n/a
Hillarys	0.78	13 0231	1.72	1.29	0.43
Fremantle	0.81	12 2140	1.63	1.36	0.27
Perth (Barrack Street)	0.75	13 0330	1.61	n/a	n/a
Cape Bouvard	0.62	12 2300	n/a	n/a	n/a
Harvey Estuary	0.70	12 2200	n/a	n/a	n/a
Peel Inlet	0.70	12 2130	n/a	n/a	n/a
Bunbury	0.97	12 2010	1.60	1.23	0.37
Busselton	0.83	12 1920	1.65	1.44	0.21

Table 8. Storm surge recorded by the Western Australian Department of Transport on 12 and 13 June. The residual tide or storm surge is the greatest departure of the sea level from the astronomical predicted tide. HAT is the Highest Astronomical Tide. Data for some sites were not available (n/a).

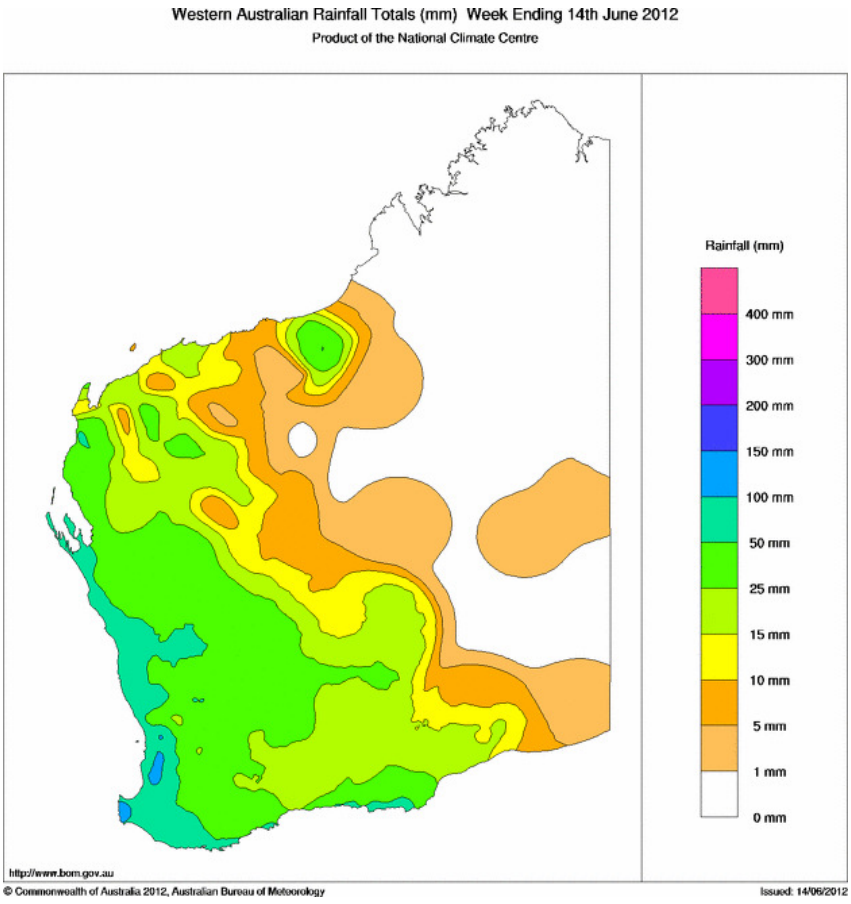

Figure 1. Accumulated seven day rainfall for the period 8 June to 14 June