

POWER SYSTEM OPERATING INCIDENT REPORT – TRIPS OF HUMMOCKS - WATERLOO AND KADINA EAST 132 KV TRANSMISSION LINES ON 15 FEBRUARY 2013

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FINAL

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Abbreviations and Symbols

Abbreviation	Term
CB	Circuit Breaker
EMMS	Electricity Market Management System
EMS	Energy Management System
kV	Kilovolt
MW	Megawatt
NEM	National Electricity Market
NOS	Network Outage Scheduler
VT	Voltage Transformer

Contents

Disclaimer	2
Abbreviations and Symbols	3
Incident summary	5
1 Introduction	6
2 Pre-Contingent System Conditions	6
3 Summary of Events.....	7
4 Immediate Actions Taken.....	10
5 Follow-up Actions.....	11
6 Power System Security Assessment.....	11
7 Conclusions.....	12
8 Recommendations	12

Incident summary

Date and time of incident	15 February 2013 at 2041 hrs
Region of incident	South Australia
Affected regions	South Australia
Event type	TL – Loss of transmission elements and load interruption
Primary cause	ENVI & LN – Environment and Lightning
Impact	Not Significant
Associated reports	Nil

1 Introduction

At 2041 hrs on 15 February 2013, the Hummocks – Waterloo 132 kV Transmission Line tripped and Hummocks - Kadina East 132 kV Transmission Line also tripped. The tripping of the Hummocks - Kadina East 132 kV Transmission Line, disconnected supply to approximately 14 MW of load at Kadina East. Wattle Point Wind Farm tripped from 56 MW on the operation of the Wattle Point Tripping Scheme¹. The Hummocks - Waterloo 132 kV Transmission Line was successfully auto reclosed. There were reports of lightning in the vicinity during this period.

The Wattle Point Wind Farm was restored at approximately 2152 hrs on 15 February 2013. The Hummocks - Kadina East 132 kV Transmission Line returned to service at approximately 2341 hrs on 15 February 2013. Supplies to the load disconnected in the incident were restored at 2348 hrs on 15 February 2013.

This report has been prepared under clause 4.8.15 (c) of the National Electricity Rules (NER) to assess the adequacy of the provision and response of facilities and services and the appropriateness of actions taken to restore or maintain power system security.

This report is largely based upon information provided by ElectraNet. Data from AEMO's Energy Management System (EMS) and Electricity Market Management System (EMMS) has also been used in analysing the incident.

All references to time in this report are to National Electricity Market time (Australian Eastern Standard Time).

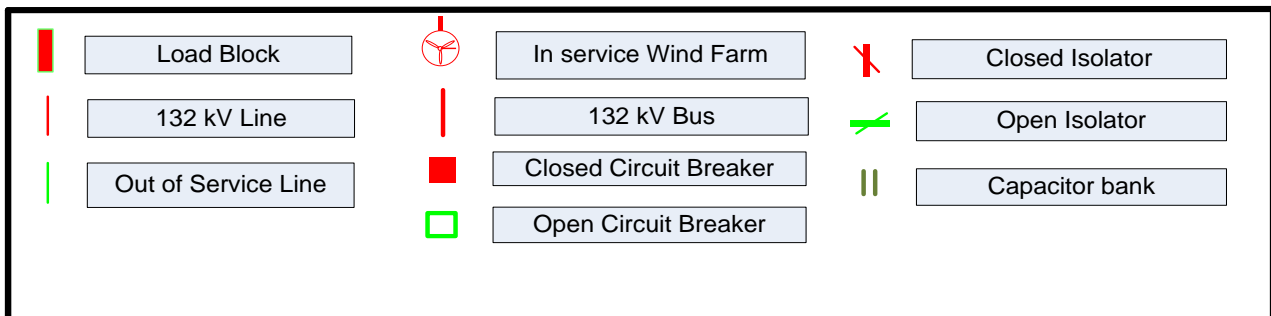
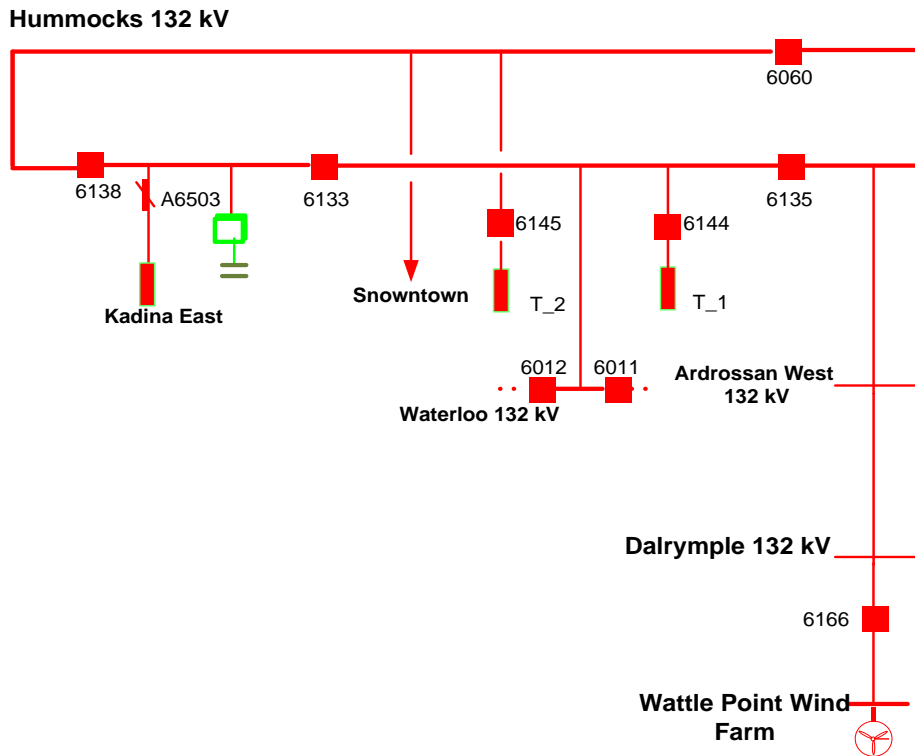
2 Pre-Contingent System Conditions

Prior to the incident, there were reports of lightning in the vicinity.

The status of the power system prior to the incident is shown in Figure 1. For clarity only equipment relevant to this incident has been included in the diagram.

¹ The scheme provide high speed tripping of Wattle Point Wind Farm should a fault occur on either the Hummocks – Waterloo or the Hummocks – Snowtown – Bungama 132 kV Transmission Lines and Wattle Point is generating more than 60 MW at the time to prevent voltage instability on the Yorke Peninsula and Mid-North regions.

Figure 1 - Status of the power system prior to the incident



3 Summary of Events

At 2041 hrs on 15 February 2013, the Hummocks – Waterloo 132 kV Transmission Line tripped and successfully auto closed. Simultaneously, the Wattle Point Tripping Scheme operated, tripping Wattle Point Wind Farm from 56 MW. Several hundred milliseconds later, a section of the 132 kV Ring Busbar at Hummocks Substation and the Hummocks - Kadina East 132 kV Transmission Line tripped, the latter event interrupting supply to approximately 14 MW of load.

A summary of the events leading up to the incident is shown in Table 1.

Table 1: Summary of events

Time	Events
15-Feb-13, 20:41:01	Hummocks – Waterloo 132 kV line tripped and a section of the 132 kV Ring Busbar at Hummocks Substation tripped (CBs 6133 and 6135 open at Hummocks Substation, CBs 6011 and 6012 open at Waterloo Substation).
15-Feb-13, 20:41:01	CB 6144 open at Hummocks Substation, de-energising T_1 at Hummocks. The local load was supplied by T_2.
15-Feb-13, 20:41:01	CB 6166 open at Dalrymple Substation (Wattle Point Tripping Scheme operated)

Time	Events
15-Feb-13, 20:41:01	CB 6138 at Hummocks open disconnecting the Hummocks- Kadina East 132kV Transmission Line (Supply interrupted to approximately 14 MW of load). The trip was caused by mal-operation of Kadina East Set 2 protection at Hummocks substation.
15-Feb-13, 20:41:07	Hummocks – Waterloo 132 kV Transmission Line auto reclosed and the affected section of the 132 kV Ring Busbar energised at Hummocks Substation (CB 6135 at Hummocks and CBs 6011 and 6012 at Waterloo reclosed. CB 6133 at Hummocks remained open).
15-Feb-13, 20:44	CB 6144 closed at Hummocks Substation
15-Feb-13, 21:34	Isolator A6503 opened and the section of the 132kV Ring Busbar at Hummocks Substation restored (CBs 6133 and 6138 closed). Hummocks – Kadina East 132 kV Transmission Line isolated for fault checking.
15-Feb-13, 21:52:41	CB 6166 closed at Dalrymple Substation to restore Wattle Point Wind Farm
15-Feb-13, 22:20	Market Notice No.41528 issued informing of the non-credible contingency event.
15-Feb-13, 22:33	ElectraNet reported that no fault was found on the Hummocks – Kadina East 132 kV Transmission Line and that the line could be re-energised
15-Feb-13, 23:35	CBs 6138 and 6133 at Hummocks were opened to initiate restoration of the Hummocks – Kadina East 132 kV Transmission Line
15-Feb-13, 23:40	Isolator A6503 at Hummocks closed
15-Feb-13, 23:41	The Hummocks - Kadina East 132 kV Transmission Line was restored (CB 6138 closed, but CB 6133 failed to close). NOS entry for CB 6133 was submitted at 2341 hrs.
16-Feb-13, 06:40	Electricity Market Notice No 41532 issued updating the Market Notice 41528
16-Feb-13, 16:33:57	CB 6133 at Hummocks Substation closed successfully
19-Feb-13, 11:22	Market Notice No. 41567 issued informing the reclassification of the Non-credible contingency event as credible event.

The status of the power system immediately after the incident is shown in Figures 2 and 3.

Figure 2- Status of the power system immediately after the incident prior to reclosing

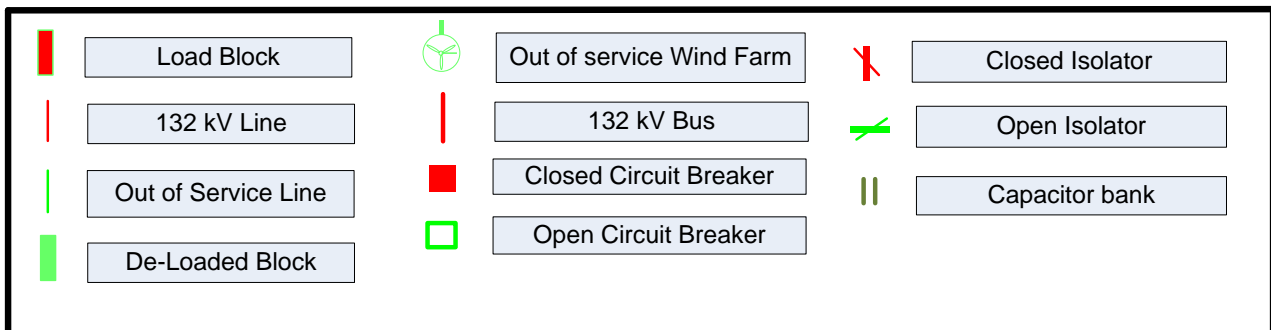
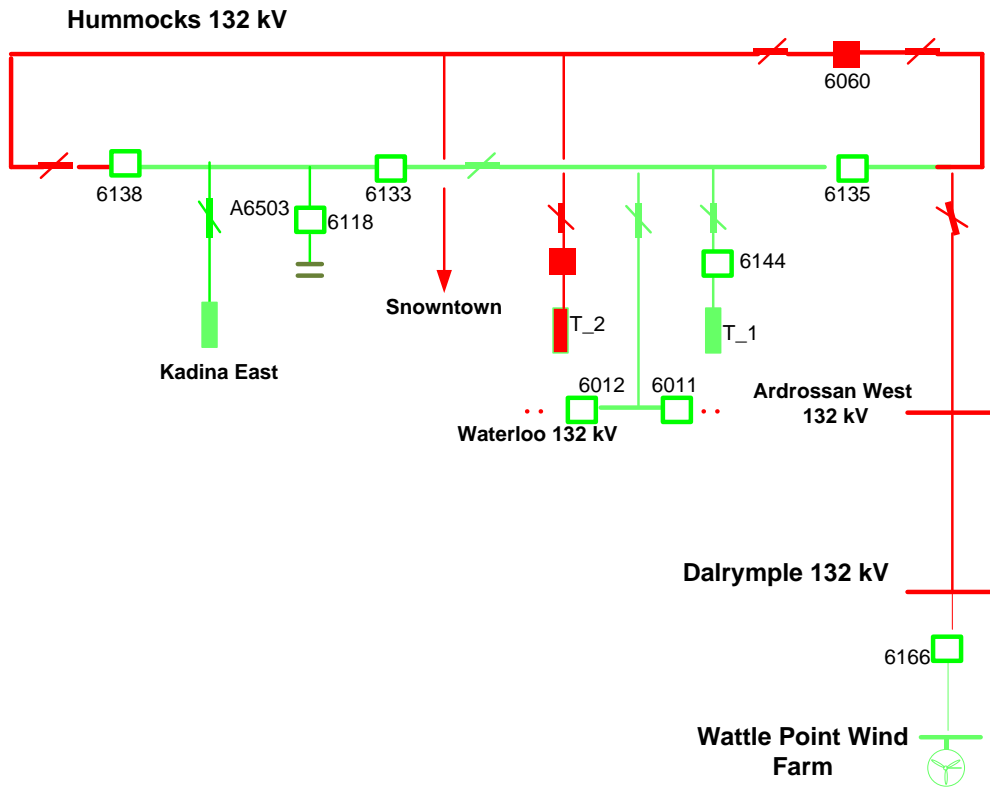
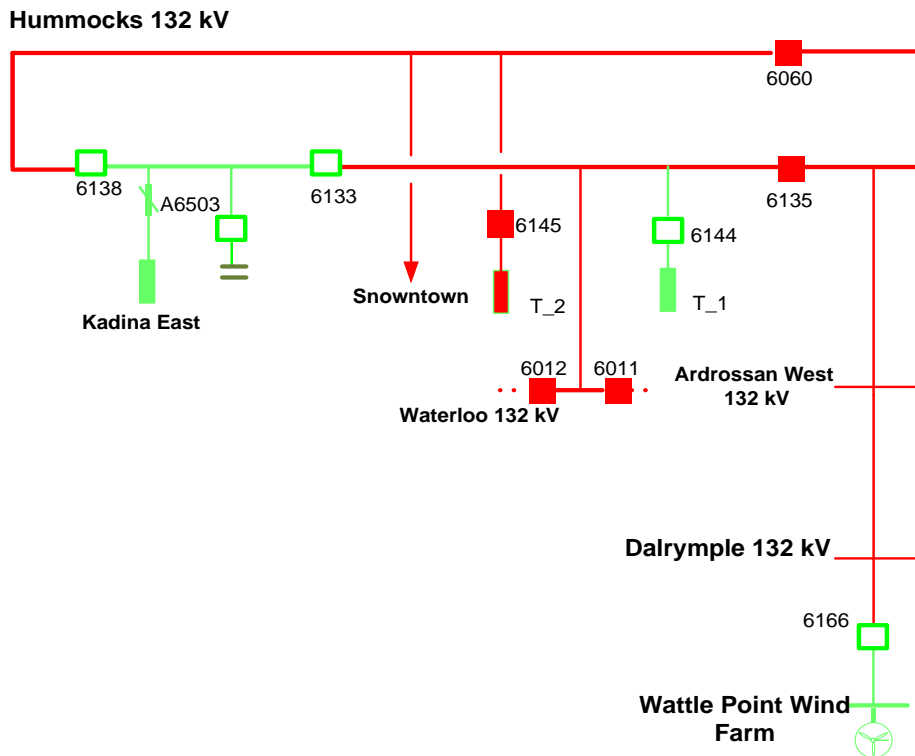


Figure 3 - Status of the power system immediately after the Hummocks – Waterloo 132 kV line auto closed



	Load Block		Out of service Wind Farm		Closed Isolator
	132 kV Line		132 kV Bus		Open Isolator
	Out of Service Line		Closed Circuit Breaker		Capacitor bank
	De-Loaded Block		Open Circuit Breaker		De-energised 132 kV Bus

4 Immediate Actions Taken

At 2053 hrs on 15 February 2013, ElectraNet informed AEMO that the cause of this incident was unknown at that point and there was lightning in the area.

At 2134 hrs on 15 February 2013, the affected section of the 132kV Ring Busbar at Hummocks Substation was restored (CBs 6133 and 6138 closed) and the Hummocks - Kadina East 132kV Transmission Line was de-energised by opening the 132 kV isolator A6503 at Hummocks Substation for fault check.

At 2152 hrs on 15 February 2013, Wattle Point Wind Farm was restored.

At 2220 hrs on 15 February 2013, AEMO issued Electricity Market Notice No 41528 advising the Non-credible contingency event.

At 2233 hrs on 15 February 2013, ElectraNet confirmed that the protection mal-operation caused the Hummocks – Kadina East 132 kV Transmission Line de-energised and line crews were immediately requested to go to site for switching.

At 2335 hrs on 15 February 2013, switching to restore the Hummocks – Kadina East 132 kV Transmission Line was initiated (CBs 6133 and 6138 opened at Hummocks Substation).

At 2340 hrs on 15 February 2013, Isolator A6503 closed at Hummocks Substation.

At 2341 hrs on 15 February 2013, the Hummocks – Kadina East 132 kV Transmission Line was restored with CB 6138 closed, but CB 6133 failed being closed at Hummocks Substation. NOS entry was submitted to investigate issue with CB 6133.

At 2348 hrs on 15 February 2013, supply to the Kadina East load was restored.

5 Follow-up Actions

At 2233 hrs on 15 February 2013, ElectraNet informed AEMO the near-coincident trips of the Hummocks - Waterloo and Hummocks - Kadina East 132 kV Transmission Line were suspected to be a protection mal operation and ElectraNet were investigating.

At 0640 hrs on 16 February 2013, AEMO issued Electricity Market Notice No. 41532 updating the Market Notice No. 41528.

At 1633 hrs on 16 February 2013, CB 6133 was closed at Hummocks Substation. The CB 6133 has a history of not closing according to ElectraNet report (ElectraNet is planning the replacement of this CB by mid April 2013).

At 1121 hrs on 18 February 2013, AEMO requested ElectraNet to provide information of whether the condition that caused the non-credible contingency event of near-simultaneous tripping of the Hummocks -Waterloo 132 kV Transmission Line and the Hummocks - Kadina East 132 kV Transmission Line has been resolved.

At 1122 hrs on 19 February 2013, based on advice from ElectraNet AEMO issued Electricity Market Notice No.41567 declaring the simultaneous trip of the Hummocks - Waterloo 132 kV Transmission Line and the Hummocks - Kadina East 132 kV Transmission Line re-classified as a credible contingency event from 1130 hrs on 19 February 2013 until further notice. The cause of the protection mal operation that resulted in the trip of the Hummocks - Kadina East 132 kV Transmission Line was still under investigation.

At 1358 hrs on 19 February 2013, ElectraNet informed by email that ElectraNet preliminary findings indicated that the Hummocks – Kadina East Transmission Line tripped due to loss of voltage transformer (VT) supply that occurred when the Hummocks –Waterloo 132 kV Transmission Line tripped. Based on this information it would be appropriate to reclassify this non-credible contingency event as a credible contingency event.

At 1607 hrs on 18 March 2013, ElectraNet provided AEMO the event investigation report that has informed the cause of this incident and the resolution to prevent a re-occurrence. Protection configuration and setting changes are required and completion of the Hummocks – Kadina East 132 kV Transmission Line protection scheme changes was expected by 22 March 2013

At 1603 hrs on 8 April 2013, ElectraNet informed AEMO that:

- ElectraNet intends to complete the necessary protection configuration/setting changes to prevent simultaneous tripping of the Hummocks-Kadina East and the Hummocks-Waterloo 132kV Lines by 3 May 2013
- ElectraNet intends to complete the necessary protection configuration/setting changes to the Wattle Point Tripping Scheme (to ensure the scheme operates at 60MW and above) by 3 May 2013.

6 Power System Security Assessment

The power system voltages and frequencies remained within the normal operating bands and the power system remained in a secure operating state throughout the incident.

The reclassification declared at 1122 hrs on 19 February 2013 should have been issued when the Hummocks - Kadina East 132 kV Transmission Line was returned to service at approximately 2350 hrs on 15 February 2013 when the reason for the simultaneous tripping was not known.

The delay in the reclassification did not impose any risk to the power system.

The reclassification of the simultaneous trip of Hummocks - Waterloo 132 kV Transmission Line and the Kadina East 132 kV Transmission Line as a credible contingency event will remain in place until ElectraNet resolve the problem.

7 Conclusions

The Hummocks – Waterloo 132 kV Transmission Line tripped during a period when lightning was in the vicinity of the line. The line protection operated correctly, clearing the fault and auto reclosing the line.

The trip of the section of the 132 kV Ring Busbar at Hummocks Substation that de-energised the Hummocks – Kadina East 132 kV Transmission Line was caused by operation of the set Y Hummocks – Kadina East 132 kV Transmission Line protection at Hummocks following the Hummocks – Waterloo 132 kV Transmission Line fault, due to incorrect logic implemented in a voltage changeover scheme.

The Hummocks – Kadina East 132 kV Transmission Line was restored at 2341 hrs on 15 February 2013. The trip of the Hummocks – Kadina East 132 kV Transmission Line resulted in the interruption to supply of load.

The Wattle Point Tripping Scheme did not operate in accordance with the design criterion relating to the Wattle Point Wind Farm output threshold of 60 MW because of the protection configuration/setting problem.

The 132 kV Ring Busbar at Hummocks Substation remained opened until 1605 hrs on 16 February 2013 due to CB 6133 failing to close. The CB has a closing problem according to ElectraNet and is scheduled to be replaced by mid April 2013.

AEMO is satisfied that ElectraNet provided information in a timely manner and is carrying out the appropriate work to mitigate the risk of a similar incident occurring in the future.

AEMO correctly applied the criteria published in section 12 of its Power System Security Guidelines in assessing that the circumstances of this incident did warrant reclassifying similar incidents as a credible contingency event. However there was some delay in declaring this reclassification. This delay did not affect the security of the power system.

8 Recommendations

AEMO to ensure reclassifications occur in the appropriate time.

ElectraNet to inform AEMO on completion of the necessary protection configuration/setting changes to prevent simultaneous tripping of the Hummocks-Kadina East and the Hummocks-Waterloo 132kV Lines. This is expected by 3 May 2013

ElectraNet to inform AEMO on completion of the necessary protection configuration/setting changes to the Wattle Point Tripping Scheme (to ensure the scheme operates at 60MW and above). This is expected by 3 May 2013.