POWER SYSTEM OPERATING INCIDENT REPORT
TRIP OF 132 KV CENTRAL QUEENSLAND FEEDERS ON 8 FEBRUARY 2011

PREPARED BY: Electricity System Operations Planning and Performance

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FINAL

Disclaimer

Purpose

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Abbreviations and Symbols

Abbreviation	Term
AEMO	Australian Energy Market Operator Ltd
EST	Eastern Standard Time
kV	kilovolt
MW	megawatt
MWh	megawatt hour (also MW·h)
NEM	National Electricity Market
NER	National Electricity Rules

1 Introduction

At 2150 hrs on 8 February 2011 four 132 kV transmission lines in the central Queensland area tripped from service simultaneously. The trips occurred as a result of a lightning strike on the 7111 Callide A – Baralaba 132 kV line during an electrical storm.

All lines were returned to service by 2216 hrs on 8 February 2011. There was no loss of load as a result of this incident.

This report has been prepared under clause 4.8.15 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 Powerlink. Data from AEMO's Energy Management System has also been used in analysing the incident.

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

2 Pre-Contingent System Conditions

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

At the time of the incident an electrical storm with lightning activity was observed in the vicinity of the 7111 Callide A – Baralaba 132 kV line.

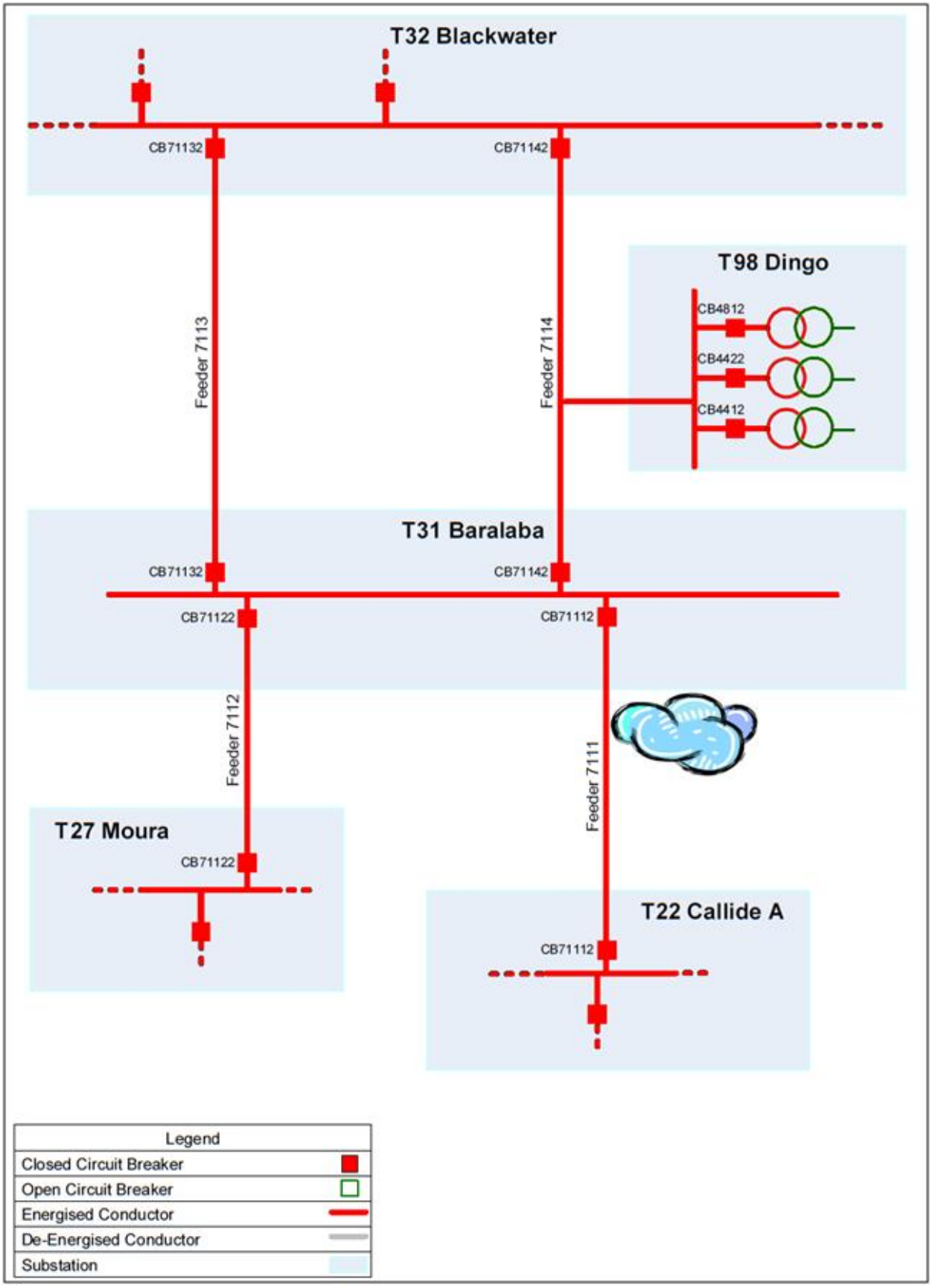

Figure 1 – Status of the power system connected to the Baralaba 132 kV substation prior to the incident

3 Summary of Events

At 2150 hrs on 8 February 2011 a high voltage fault occurred on the 7111 Callide A – Baralaba 132 kV line. The location of the fault was approximately 8 km from the Baralaba 132 kV substation. Line protection systems at Baralaba 132 kV substation operated to trip the 7111 Callide A – Baralaba 132 kV line out of service and the fault was cleared in 80 ms, within the time required by the NER[1].

An inspection of the line by Powerlink revealed that the fault was caused by a lightning strike.

Coincident with the trip of the 7111 Callide A – Baralaba 132 kV line the following line trips also occurred due to protection system operation:

- 7112 Moura – Baralaba 132 kV line tripped at the Moura end only
- 7113 Baralaba – Blackwater 132 kV line tripped at both ends
- 7114 Baralaba – Blackwater Tee Dingo 132 kV line tripped at the Baralaba end only

All tripped network elements were returned to service by 2216 hrs on 8 February 2011.

There was no loss of load as a result of this incident.

Following examination by Powerlink of its protection relay data, all tripped network elements were restored by 2216 hrs on 8 February 2011. The sequence of power system restoration was:

- At 2206 hrs the 7111 Callide A – Baralaba 132 kV line was returned to service
- At 2210 hrs the 7113 Baralaba – Blackwater 132 kV line was returned to service
- At 2211 hrs the 7114 Baralaba – Blackwater Tee Dingo 132 line was reconnected at the Baralaba end
- At 2216 hrs the 7112 Moura – Baralaba 132 kV line was reconnected at Moura

At 2228 hrs AEMO issued Electricity Market Notice No.34455 advising the occurrence of this incident as a non-credible contingency event.

AEMO did not need to invoke a constraint set for this incident.

The status of the power system immediately following the incident is shown in Figure 2.

[1] Refer Schedule S5.1a.8 in the NER.

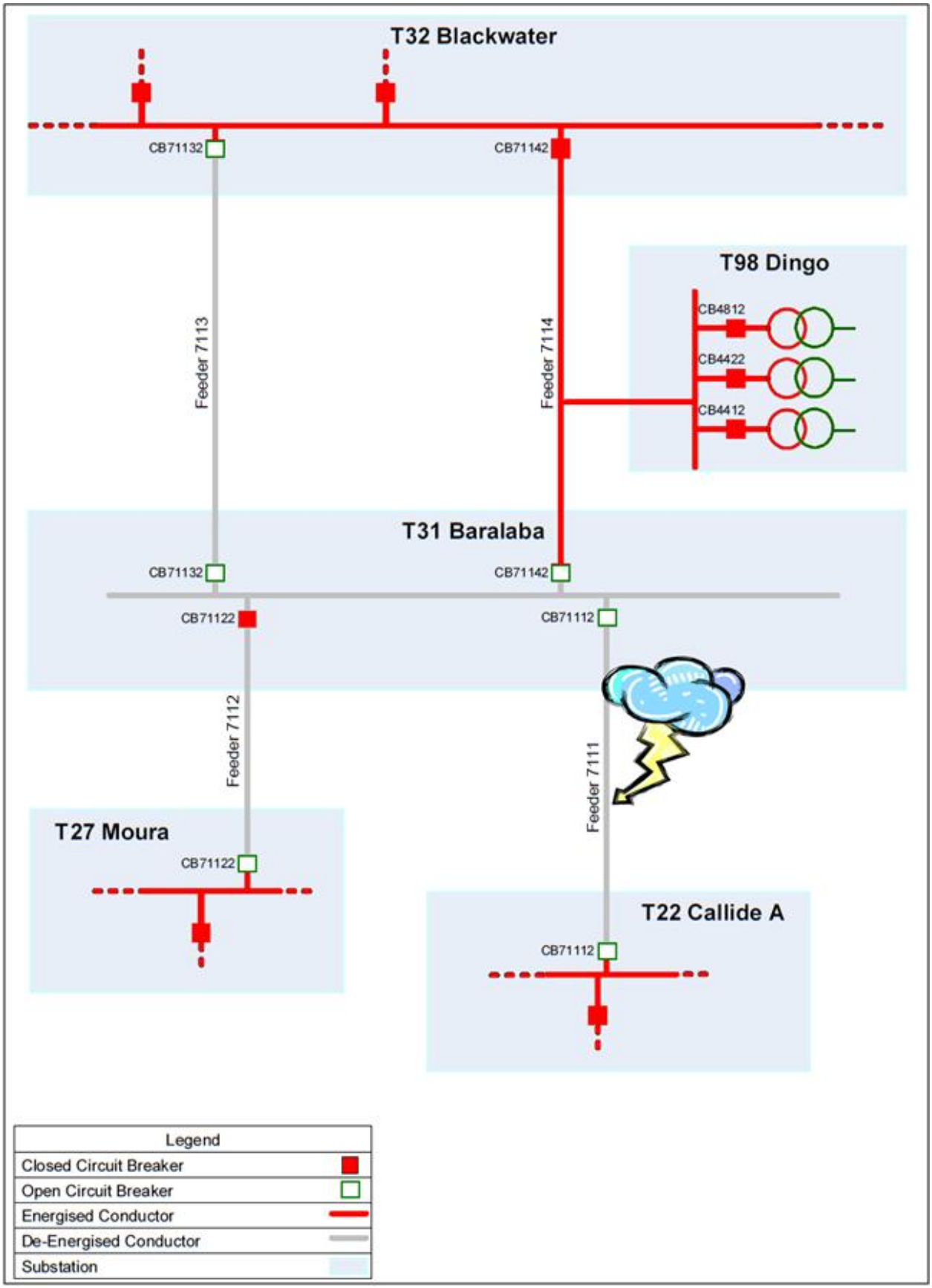

Figure 2 - Status of the power system connected to the Baralaba 132 kV substation immediately after the incident

4 Power System Security Assessment

Coincident with the trip of 7111 Callide A – Baralaba 132 kV line, the protection system for 7112 Moura – Baralaba 132 kV line operated to open circuit breaker 71122 at the Moura end only. The operation of this protection system was unexpected. The 7112 line distance protection relay at the Moura 132 kV substation detected the fault on 7111 Callide A – Baralaba 132 kV line in protection zone 2 and, contrary to intended design, operated to open circuit breaker 71122 before the fault was cleared by 7111 line protection system.

Also coincident with the trip of 7111 Callide A – Baralaba 132 kV line, the protection system for 7113 Baralaba – Blackwater 132 kV line operated to open circuit breakers at both ends and de-energise the line. The operation of these protection systems was unexpected. The 7113 line distance protection relay at the Baralaba 132 kV substation detected the fault on 7111 Callide A – Baralaba 132 kV line and, contrary to intended design, operated to open circuit breaker 71132 at the Baralaba end. The relay also sent a permissive intertrip signal to the 7113 line protection system at the Blackwater 132 kV substation.

The 7113 line distance protection relay at the Blackwater 132 kV substation detected the fault on 7111 Callide A – Baralaba 132 kV line in its zone 2 area of protection. Because it had also received a permissive intertrip signal from the Baralaba end, the 7113 line distance protection relay operated to open circuit breaker 71132 at the Blackwater 132 kV substation.

Again, coincident with the trip of 7111 Callide A – Baralaba 132 kV line, the protection system for the Baralaba – Blackwater Tee Dingo 132 kV line operated to open circuit breaker 71142 at the Baralaba 132 kV substation. The operation of this protection system was unexpected. The 7114 line distance protection relay at the Baralaba 132 kV substation detected the fault on the 7111 Callide A – Baralaba 132 kV line and, contrary to its intended design, operated to open circuit breaker 71142 at the Baralaba end. The relay also sent a permissive intertrip signal to the 7114 line protection system at the Blackwater 132 kV substation.

Although the 7114 line distance protection relay at the Blackwater 132 kV substation detected the fault in its zone 2 area of protection it did not operate. This is because the fault had been cleared before the permissive intertrip signal had been received from the 7114 line protection system at the Baralaba 132 kV substation.

Immediately following the fault local voltages dipped to 15 kV on the faulted phases during the 60 ms period before the fault was cleared.

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

5 Follow-up Actions

A subsequent Powerlink investigation revealed that the unexpected operation of the protection systems associated with the 7112, 7113 and 7114 132 kV transmission lines was due to issues with the recently replaced protection equipment at the Baralaba and Moura 132 kV substations.

Powerlink have since resolved these issues, and at 0834 hrs on 23 February 2011 AEMO issued Electricity Market Notice No.34616 cancelling the classification of the loss of the 7111 Callide A – Baralaba and 7113 Baralaba – Blackwater 132 kV lines as a credible contingency event, effective from 0830 hrs.

Powerlink have also completed precautionary checks of other recently replaced equipment of the same type. The issue was not found elsewhere.

6 Conclusions

At 2150 hrs on 8 February 2011 a lightning strike resulted in the trip of the 7111 Callide A – Baralaba 132 kV line following correct operation of its distance protection system to clear the high voltage fault. However the other four 132 kV transmission lines connected to the Baralaba 132 kV substation also tripped due to unexpected protection system operation.

Powerlink investigated the reason for the unexpected protection system operations and have rectified the issue. Powerlink completed precautionary checks on other similar protection systems to avoid similar issues.

All the 132 kV lines were returned to service by 2216 hrs on 8 February 2011 and there was no loss of load during the incident.

7 Recommendations

There are no recommendations arising from this incident.