POWER SYSTEM OPERATING INCIDENT REPORT – TRIP OF TUGGERAH NO.1 AND 2 TRANSFORMERS AND 3A AND 3B BUSBARS ON 27 MAY 2012

PREPARED BY: Systems Capability

DATE: 13 September 2012

FINAL

Disclaimer

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Abbreviations and Symbols

Abbreviation	Term
AC	Alternating Current
CB	Circuit Breaker
DC	Direct Current
EMMS	Electricity Market Management System
EMS	Energy Management System
kV	Kilovolt
MW	Megawatt

1 Introduction

At 0918 hrs on 27 May 2012, the No. 2 330/132 kV transformer and No. 3B 330 kV busbar at Tuggerah substation in New South Wales tripped ("Incident 1").

Shortly after AusGrid reconfigured its 132 kV network to cover the contingent loss of the remaining No. 1 330/132 kV transformer, resulting in that transformer radially supplying all load from the Tuggerah, Gosford, West Gosford and Ourimbah substations.

At 1127 hrs that day the Tuggerah No. 1 330/132 kV transformer and No. 3A 330 kV busbar tripped ("Incident 2"), resulting in the loss of 141 MW of load supplied from the Tuggerah, Gosford, West Gosford and Ourimbah substations. AusGrid restored all load by 1143 hrs.

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 AusGrid and TransGrid. 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

Figures 1 and 2 below show the status of the power system immediately prior to Incident 1. The 957 Ourimbah – Eraring tee Vales Point 132 kV line was on a planned outage prior to the incident.

For clarity only equipment relevant to this incident has been included in the diagrams.

Figure 1 - Status of Tuggerah 330 kV substation immediately prior to Incident 1

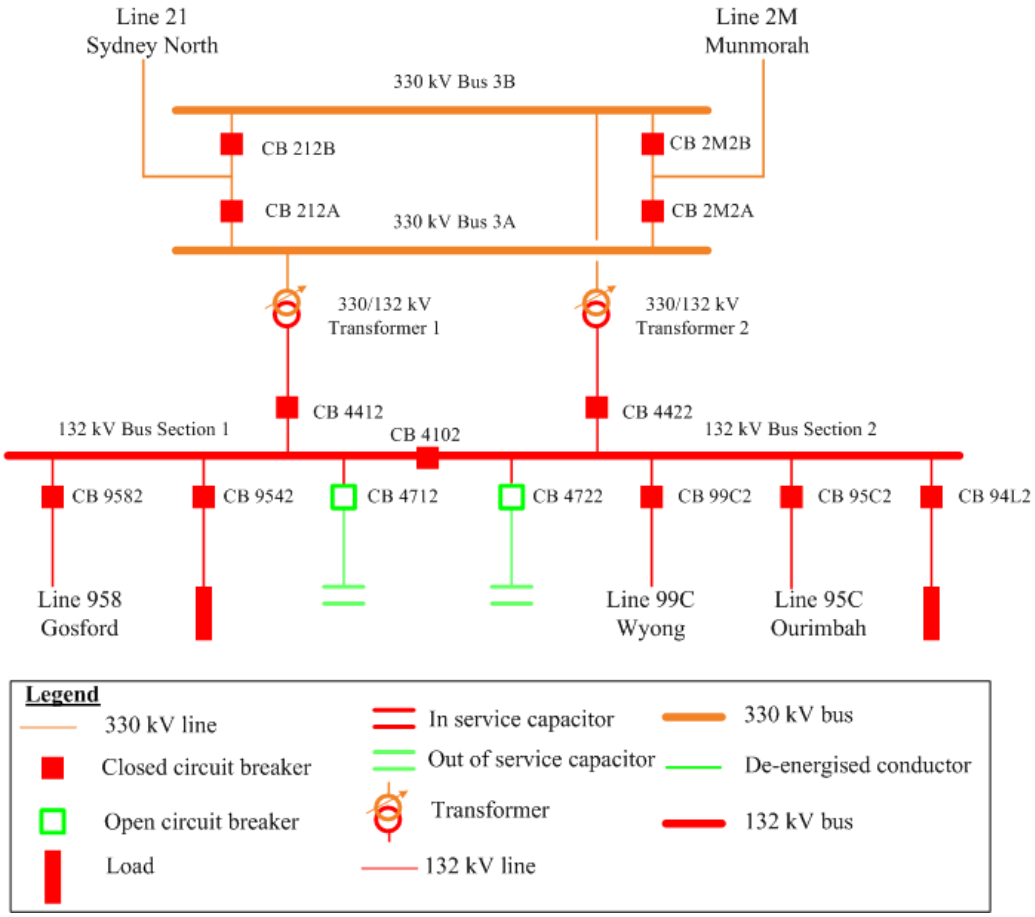
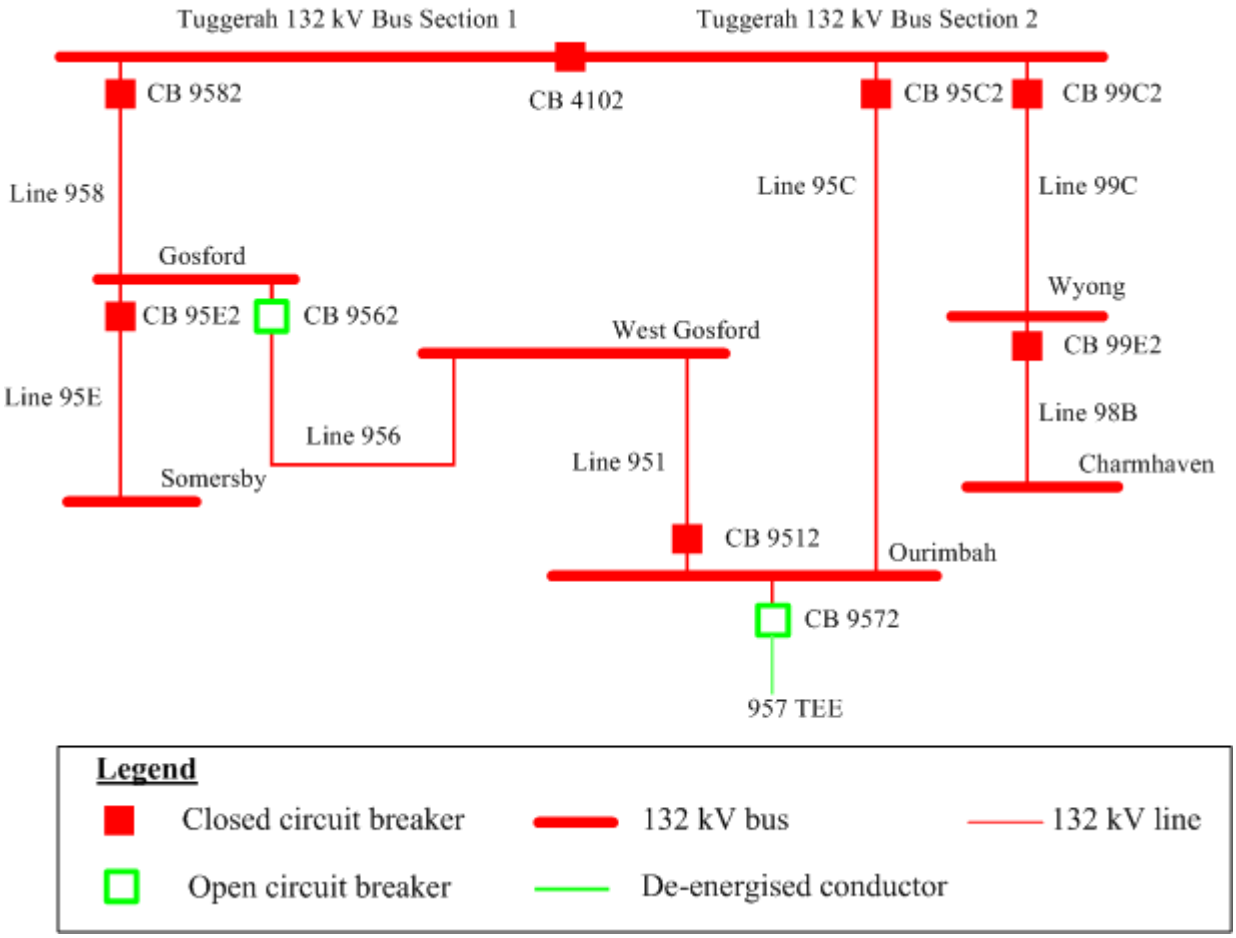


Figure 2 - Status of the Central Coast 132 kV network immediately prior to Incident 1



3 Summary of Events

At 0918 hrs on 27 May 2012 the Tuggerah No. 2 330/132 kV transformer and No. 3B 330 kV busbar tripped[1] following operation of circuit breakers 212B, 2M2B and 4422.

Figure 3 shows the status of the power system immediately after Incident 1.

At 0933 hrs AusGrid opened the 99C Tuggerah – Wyong 132 kV line (refer to AEMO Market Notice No.38913) and the 95E Gosford – Somersby 132 kV line at Gosford end only, to avoid overloading the Central Coast 132 kV network for a contingent loss of the remaining Tuggerah No.1 330/132 kV transformer. This resulted in the Tuggerah, Gosford, West Gosford and Ourimbah loads being radially supplied via the Tuggerah No. 1 330/132 kV transformer.

Figure 4 shows the status of the power system after this network reconfiguration.

At 1127 hrs that day the Tuggerah No. 1 330/132 kV transformer and No. 3A 330 kV busbar tripped following operation of circuit breakers 212A, 2M2A and 4412[1]. This off-loaded the 21 Sydney North – Tuggerah and 2M Tuggerah – Munmorah 330 kV lines and resulted in the loss of 141 MW of load supplied from the Tuggerah, Gosford, West Gosford and Ourimbah substations.

Figure 5 shows the status of the power system immediately after Incident 2.

At 1134 hrs AusGrid commenced restoration of the interrupted load, which was completed at 1143 hrs by closing the 99C Tuggerah – Wyong 132 kV line.

[1] Owing to Tuggerah substation design, the trip of a 330/132 kV transformer also trips the associated 330 kV busbar.

Figure 3 - Status of Tuggerah 330 kV substation immediately after Incident 1

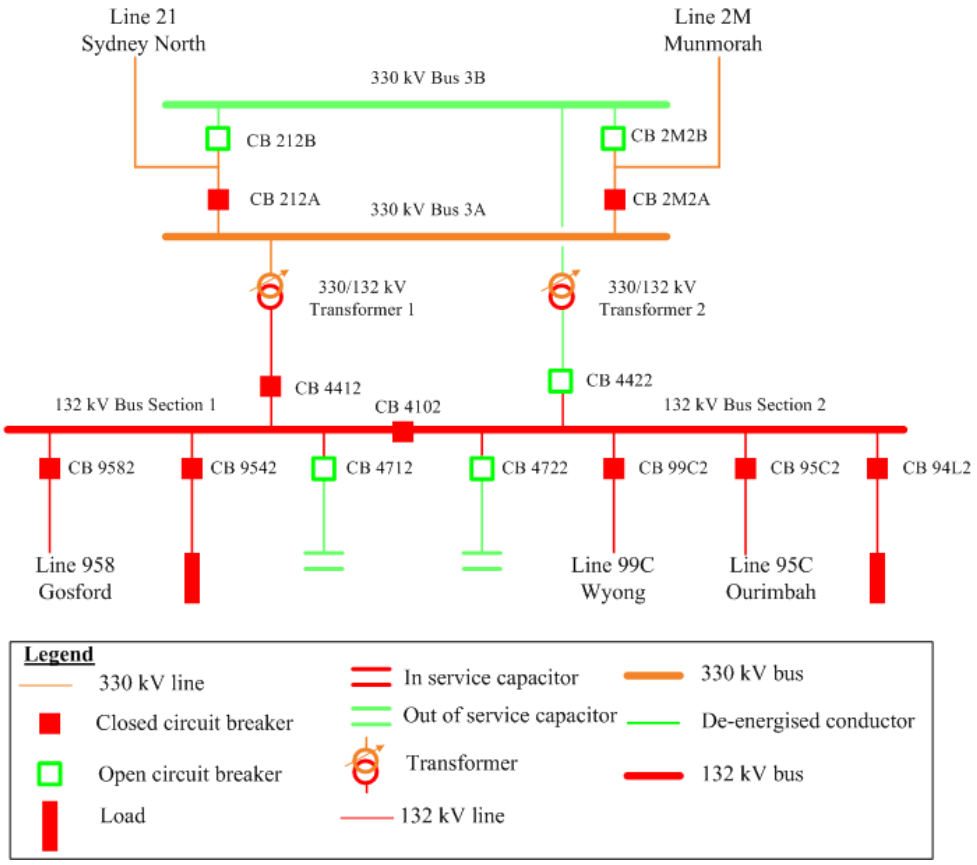


Figure 4 - Status of Tuggerah 330 kV substation after network re-configuration

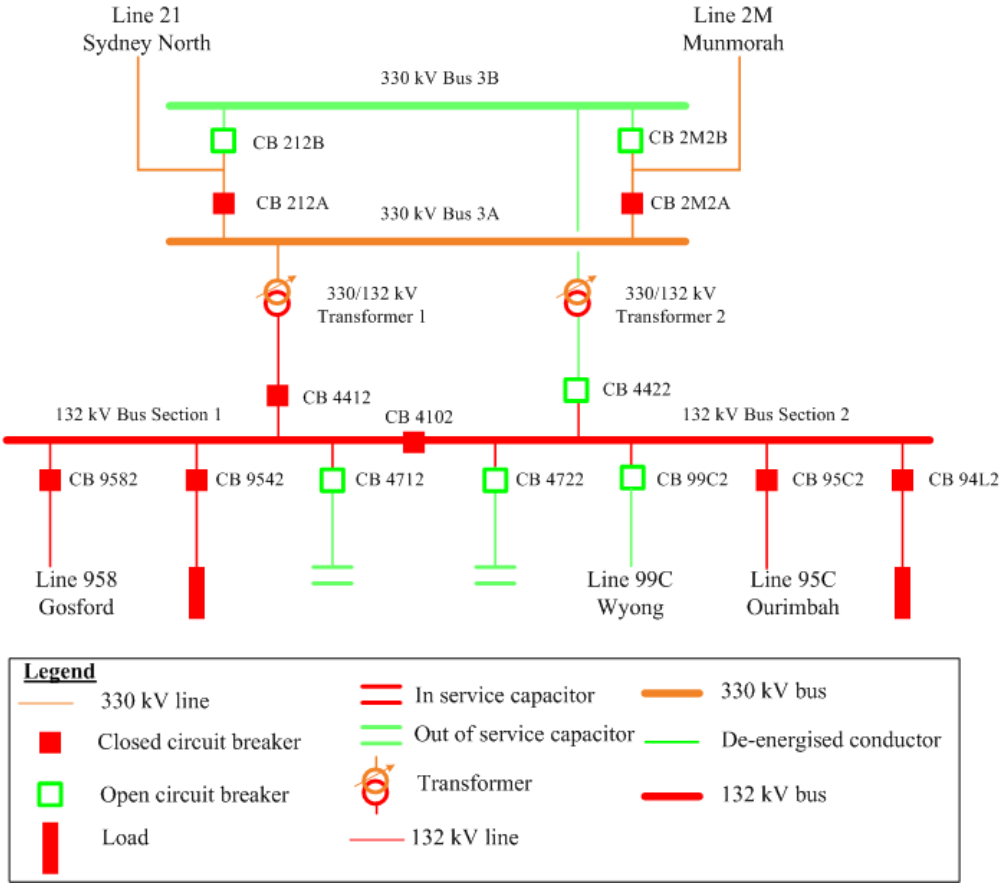
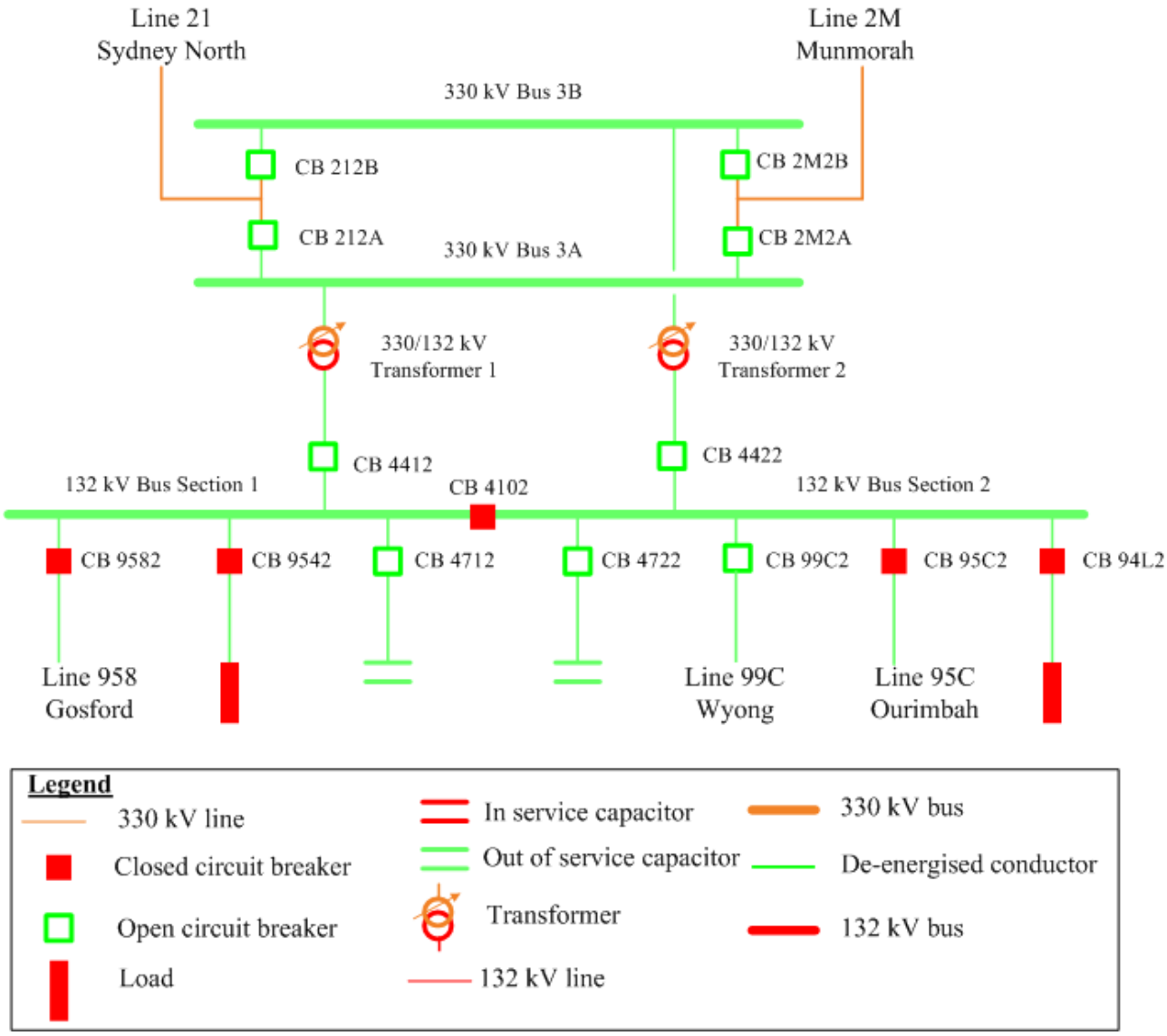


Figure 5 - Status of Tuggerah 330 kV substation immediately after Incident 2



4 Immediate Actions Taken

At 1250 hrs, AEMO issued Electricity Market Notice No.38913 to notify the market of this incident. AEMO were not required to invoke a network constraint equation in central dispatch following either incident, hence there was no market impact.

At 1527 hrs TransGrid loaded the 21 Sydney North – Tuggerah and 2M Tuggerah – Munmorah 330 kV lines by closing circuit breakers 212A and 2M2A.

At 1531 hrs TransGrid returned the Tuggerah No.1 330/132 kV transformer to service. TransGrid returned Tuggerah No.2 330/132 kV transformer at 1533 hrs by closing circuit breakers 4422, 212B and 2M2B.

5 Follow-up Actions

TransGrid found that the Tuggerah No. 1 and 2 330/132 kV transformer protection multi-trip relays had operated respectively in Incident 2 and 1. TransGrid did not find any other protection flagging, nor any fault recorder operations or high voltage faults on the system.

Following further investigations TransGrid found that an insulation failure on the Tuggerah No. 1 Auxiliary Transformer 415 V AC circuit breaker resulted in AC voltage being superimposed on the

DC system. The superimposed voltage caused the mal-operation of the Tuggerah 330/132 kV transformer protection multi-trip relays on both occasions.

TransGrid has since replaced the faulty 415 V AC circuit breaker.

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 provision and response of facilities and services were adequate to maintain power system security.

7 Conclusions

The Tuggerah No. 1 and 2 330/132 kV transformers tripped following the mal-operation of the transformer protection multi-trip relays as a result of an insulation failure on the Tuggerah No. 1 Auxiliary Transformer 415 V AC circuit breaker.

AEMO is satisfied that AusGrid and TransGrid have carried out the appropriate work to mitigate the risk of a similar incident occurring in the future.

8 Recommendations

There are no recommendations arising from this incident.