

# **IMPACTS OF 2010/11 FLOODS AND RELATED WEATHER ON POWERLINK'S ELECTRICITY TRANSMISSION GRID**

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## 1 EXECUTIVE SUMMARY

The impacts of the 2010/11 floods and related weather events on Powerlink's grid were minor. Despite unprecedented record flooding across Queensland, the impact on Powerlink's high voltage transmission network was minimal, with less than 0.02% of assets sustaining material damage.

Even with some impacted assets having to be taken out of service, Powerlink was able, for the most part, to maintain sufficient high voltage supply, due to the lower than usual demand and the availability of alternate transmission pathways.

There was no loss of electricity supply attributable to Powerlink's grid in relation to impacts from the regional Queensland floods in December 2010. Loss of electricity supply attributable to Powerlink's grid in relation to the South East Queensland floods was minimal. Overall, the resulting interruptions to electricity supply from flood effects on Powerlink assets totalled less than 0.01% of Queensland's total electricity usage for the period.

The causes of the impacts on assets were varied:

- Landslips arising from torrential rainfall
- Severe riverbank erosion during floods
- Flood inundation

Powerlink managed its response to these events in accordance with its usual Corporate Emergency Response process, which incorporates the necessary interactions with other entities such as ENERGEX, Ergon Energy and State disaster co-ordination bodies.

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## 2 DOCUMENT PURPOSE

### 2.1 Introduction

Powerlink's high voltage electricity transmission grid transports power in bulk from power stations to the distribution networks (ENERGEX, Ergon Energy). The grid stretches some 1,700 km from Cairns to the Queensland border, and connects with the New South Wales transmission network as part of the national grid.

This report summarises the impacts on Powerlink's grid of the flood events and related torrential rainfall in Queensland in 2010/11. In particular, it addresses the events in South East Queensland in the week commencing 10 January 2011 and flooding in regional Queensland in December 2010. The report does not address weather events occurring post January 2011.

It identifies the impacts on various assets within the grid, and how these were addressed in order to maintain, and in a small number of cases restore, the grid's capability.

### **3 SEQ FLOODS AND RELATED WEATHER EVENTS - JANUARY 2011**

The week of 10 January 2011 started with torrential rainfall in SEQ, which led to flooding in the Brisbane River and its tributaries. The torrential rainfall led to landslips in some locations, which materially affected two Powerlink transmission line assets. The consequential flooding in the Brisbane River and tributaries affected two Powerlink substations (one only very briefly) and one Powerlink transmission line asset.

#### **3.1 Landslip - Blackbutt Range**

The landslip caused one steel tower on feeder 832 (Tarong to South Pine 275kV) to collapse (*Figure 1*), and caused temporary flexing of adjacent towers. The damage was identified on Friday 14 January following an inspection after the circuit tripped out of service the night before. The tower site was difficult to access due to the D'Aguilar Highway being temporarily closed in the Blackbutt range by landslips, and because the local access tracks were impassable due to boggy conditions.

A permanent bypass using an 'H' frame concrete pole structure (*Figure 2*) was installed by a joint Powerlink/ Ergon Energy team. Feeder 832 was returned to service on Friday 28 January.

There was no loss of high voltage supply due to alternative electricity supply paths and reduced electricity demand during the period. However, the outage of feeder 832 did require the Australian Energy Market Operator (AEMO) to introduce temporary constraint equations to ensure that the remainder of Powerlink's transmission network was operated securely throughout the repair period.

#### **3.2 Landslip - Mt England**

The landslip approached one leg of a steel transmission tower on Feeder 827 (Tarong to Mt England 275kV) (*Figure 3*). The problem was identified on Thursday 13 January by an aerial survey of Powerlink's transmission lines in SEQ.

Whilst the towers foundations remained secure, being embedded in an underground rock formation, they were further reinforced by installing a series of cable stays which were anchored into rock nearby (*Figure 4*).

Feeder 827 remained in service throughout the event.

This tower will be monitored as part of the ongoing maintenance program for this transmission line and any further remediation work undertaken as required.

### 3.3 Riverbank erosion - Karana Downs/Karalee

The large volumes of water flowing down the Brisbane River caused major erosion of the riverbank around a steel transmission pole supporting two 275kV circuits : Feeder 809 (South Pine to Rocklea) and Feeder 8818 (Blackwall to Rocklea) (*Figure 5*).

The pole had been installed in a location some 30 metres away from the original riverbank however, the flooded river reached the pole location.

On Tuesday 11 January, when the flood waters approached the required safety clearance below the lowest conductor, the line was taken out of service. As the electricity demand could be met without this line, the line was left out of service for the remainder of the flood event. The pole was visually monitored, and when the flood waters receded, a survey of the river floor and bank profile was undertaken, as input to an engineering assessment of the stability of the pole.

That assessment determined that the pole was sound, enabling the line to be returned to service (both transmission feeders were energised on Tuesday 18 January, however feeder 809 was not loaded until Friday 28 January due to system conditions, until feeder 832 was in-turn returned to service). As a precautionary measure against potential future erosion of the river bank, large boulders were placed on the river bank adjacent to the base of the pole.

### 3.4 Flood inundation - Rocklea substation (H016)

Powerlink's Rocklea substation is located in an area which was affected by flooding of the Brisbane River in Rocklea near Oxley Creek. Flood waters inundated the substation yard to a depth of about one metre, which in itself was not a material problem. However, there was some water ingress (about 0.5 m) into the control building which houses the protection and control systems (*Figure 6 & Figure 7*).

On Wednesday 12 January, as the flood waters were rising, and prior to the above-mentioned water ingress, Powerlink implemented contingency plans to protect most of the protection and control equipment and associated systems from flood damage, and to reconfigure the substation such that power would pass directly through Rocklea substation and onto Tennyson substation. Since that work required technicians to be in the substation with flood waters in the yard, the substation had to be de-energised for safety reasons for the duration of the work, with the consequence that there was no power flow to Tennyson substation for about 3 hours. This required a temporary interruption of electricity supply to some ENERGEX customers in the south-west suburbs and West End of initially about 66 MW, reducing to about 38MW after about 90 minutes.

Following the reconfiguration, there was adequate power flow to Tennyson substation to meet the ENERGEX demand. Tennyson substation remained above the flood level (*Figure 8*).

Once the flood waters receded, the substation was inspected, any water-affected components were cleaned and checked, the protection and control equipment and associated systems were reinstalled and checked, and the substation was returned to its original configuration.

The transmission lines supplied by Rocklea substation were progressively energised and/or returned to their original configuration from Tuesday 18 January.

### **3.5 Flood water proximity – Lines Supplying Bundamba substation (T162)**

On Wednesday 12 January, the rising flood waters were approaching the required safety clearance below 110kV transmission lines supplying power to Powerlink's Bundamba substation. For safety reasons, these transmission lines were de-energised, interrupting electricity supply to Bundamba substation, resulting to a loss of supply of 8 MW to ENERGEX customers in the surrounding area for almost 24 hours .

On Thursday 13 January, when the flood waters were receding and it was clear that clearance distances were satisfactory, the transmission line was re-energised and Bundamba substation was restored to service.

### **3.6 Loss of auxiliary power supply - various substations**

The auxiliary power supply to Powerlink substations, which is needed to operate protection and control equipment, and the air-conditioning for that equipment, is supplied from two alternative sources - the primary supply being the local ENERGEX distribution lines and the secondary supply being Powerlink's diesel generator at each substation.

In several locations, the ENERGEX local distribution lines went out of service due to the floods. This meant that the auxiliary power supply in the Powerlink substations had to be supplied via backup diesel generator sets in those substations.

Powerlink then had to manage the resupply of diesel fuel to those substations, and in some cases where road access had been cut by flood waters, this required the use of helicopters.

These arrangements operated successfully until the local ENERGEX distribution supply was restored.

### **3.7 Impact on reliability of bulk power supply**

Despite the impacts on transmission assets outlined in sections 3.1 through 3.6 above, Powerlink was generally able to provide adequate transmission supply to meet the (lower than usual) ENERGEX demand throughout South-East Queensland during the flood event.

The only exceptions were during the outage of the Bundamba substation (8 MW for about 24 hours), and during the approximately 3 hour re-configuration of Rocklea substation (66 MW). The resulting interruptions to electricity supply from flood effects on Powerlink assets was minimal, and totalled less than 0.01% of Queensland's total electricity usage for the period.

## **4 FLOODS IN REGIONAL QUEENSLAND - DECEMBER 2010**

The December 2010 flooding occurred in a number of regions where Powerlink has assets, most notably in Central Queensland and in South West Queensland. In those areas, Ergon Energy is Powerlink's maintenance service provider. Ergon Energy monitored locations where floodwaters were near Powerlink assets, particularly in relation to safe clearances between transmission lines and rising floodwaters.

There was only one circumstance in which Ergon Energy had to take action. Floodwaters from the Fitzroy River near Rockhampton inundated the base of a number of towers. From time to time, Ergon Energy crews removed debris from around the base of these towers, but it was not necessary to take these towers out of service as they could continue to operate safely. There was no damage to Powerlink assets, and no loss of customer supply attributable to Powerlink assets during the December 2010 floods in regional Queensland.

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## **5 EMERGENCY MANAGEMENT PROCESS**

Powerlink managed this event using its normal emergency management process, which embeds interaction with emergency authorities (SDCC, EMQ, etc) and the distribution entities (ENERGEX & Ergon Energy). Powerlink's communications with ENERGEX and Ergon Energy enabled them to appropriately plan for, manage and communicate downstream impacts on customers' electricity supplies.

For the SEQ floods, Powerlink's Corporate Emergency Management Team was initially convened on Tuesday 11 January, and was stood down on Friday 21 January.

The process, including interactions with ENERGEX and disaster authorities, worked effectively as expected. Regular updates on the impacts on Powerlink assets and the progress of the restoration work were provided to Government stakeholders and SDCC. Given the very small impacts on Powerlink assets, this event was readily managed by the normal emergency process.

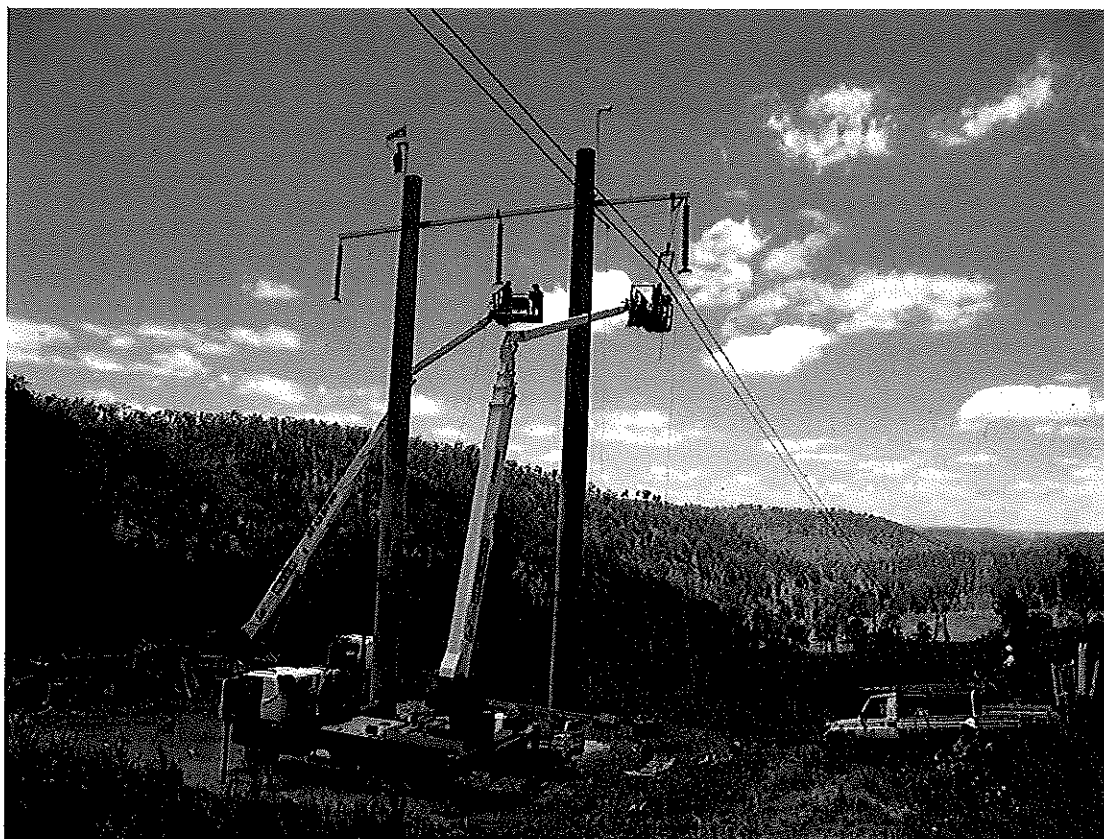
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## **6 APPENDICES**

### **6.1 Attachments - photographs**



**Figure 1 - Landslip damages tower on feeder 832**

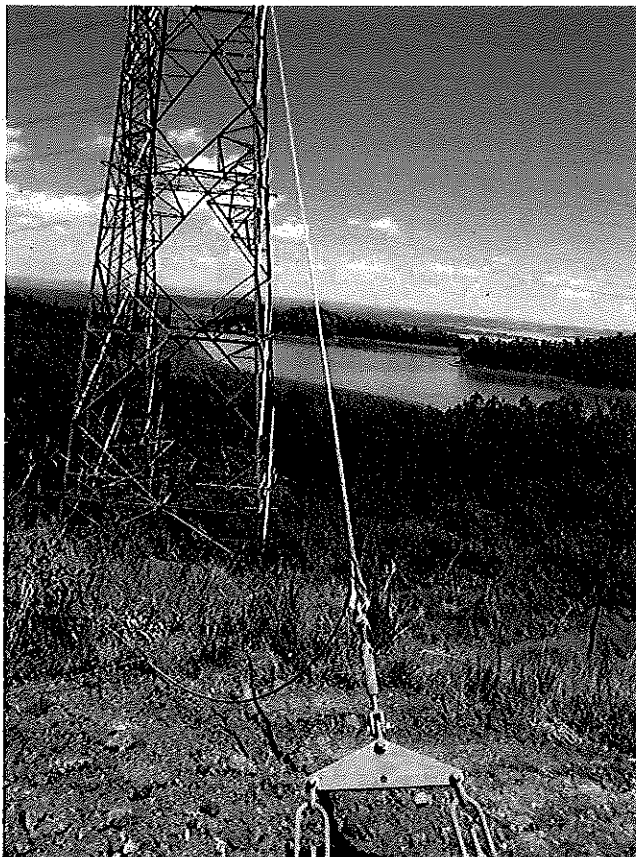


**Figure 2 - Permanent tower replacement using H frame concrete pole structure**





**Figure 3 - Landslip near tower at Mt England**



**Figure 4 - Tower secured with cable stays**



**Figure 5 - Major erosion of the riverbank near Karalee pole**



**Figure 6 - Rocklea substation**



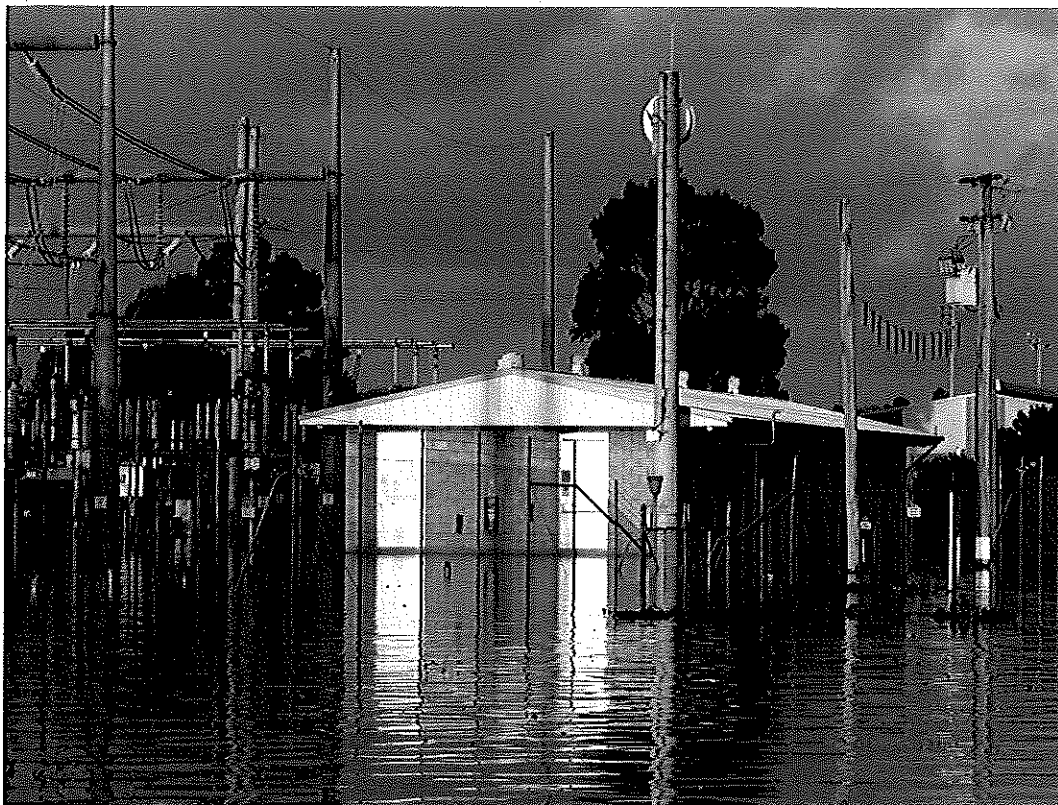


Figure 7 - Rocklea substation inundation



Figure 6 - Tennyson substation