



Department of Consumer
and Employment Protection
Government of Western Australia

EnergySafety

ELECTRICAL INCIDENT REPORT

POWER LINE FAULT AND WILDFIRE NEAR CHATCUP ROAD TOODYAY WESTERN AUSTRALIA ON 3 FEBRUARY 2007

7 February 2007

Report prepared by:

EnergySafety WA

EIS 2007-115

Toodyay Fire Report.doc

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1 INTRODUCTION

A wildfire occurred near Toodyay on 3 February 2007 and the Fire and Emergency Service Authority (FESA) advised EnergySafety on 4 February 2007 that the wildfire originated directly beneath a Western Power three phase 22 kV overhead power line. An investigation has been conducted and this report summarises EnergySafety's findings.

EnergySafety's investigation has found that at approximately 1400 hours on 3 February 2007 conductors clashed on a Western Power 22 kV overhead power line north of Toodyay approximately midway between poles number 97 and number 98. A short circuit fault ensued, as evidenced from the burn marks and metal globules on the conductors, and there is a high probability that this resulted in molten metal falling to ground, igniting dry stubble under the power line.

This investigation could not have been completed without the cooperation and assistance of FESA, Western Power and the WA Police Service.

1.1 Time and Date of Occurrence

Approximately 1400 hours on Saturday 3 February 2007.

1.2 Notification of Incident

EnergySafety was notified of the incident by Mr Brynn Weir an investigation officer of the Western Australian Fire and Emergency Service Authority (FESA) at 1025 hours on 4 February 2007 (FESA incident number 2006068250). Mr Michael Bunko, EnergySafety's Chief Electrical Inspector advised the Director of Energy Safety, Mr Albert Koenig. He also arranged for an investigation to commence in liaison with FESA and Western Power later that day at Toodyay.

1.3 Investigating Inspectors

The following EnergySafety WA personnel carried out the onsite investigation:

- Mr Todd Bell, Senior Electrical Inspector; and
- Mr Norman McKendry, Senior Electrical Engineer.

Mr Bell initially inspected the wildfire scene on 4 February 2007 and both Mr Bell and Mr McKendry visited the site again on 5 February 2007.

2 SUMMARY

In consideration of prevailing weather conditions around 1400 hours on 3 February 2007 and all the technical evidence available, a short circuit fault resulted from conductors clashing on a Western Power 22kV overhead power line north of Toodyay. The power line is the Northam to Bolgart 22kV Feeder and the fault occurred midspan between poles number 97 and number 98.

The span length between poles number 97 and number 98 is 182 metres. The crossarms used for this span are longer than standard and this configuration is commonly referred to by Western Power as an anti-swan (i.e. large bird) construction. This longer crossarm is utilised to provide greater separation between the phase conductors and the underslung earth conductor.

Notwithstanding the use of this type of construction, it is concluded that the red phase conductor and the underslung earth conductor made direct contact with each other in the strong gusting wind and high ambient air temperature.

The evidence indicates the ensuing short circuit fault resulted in hot metal particles igniting dry stubble under the power line.

The clashing of conductors as described above raises the question of a deficiency, since conductor separation should have been sufficient to avoid such a fault. However, the type of construction used on this power line has traditionally performed satisfactorily within the Western Power network (and is different to that of power lines where previous clashing has occurred, resulting in serious wildfires).

It is clear that significant further engineering investigation will be required by Western Power, in conjunction with EnergySafety, to deal with the above question and to assess whether this was an isolated problem, or whether it is an indication of a more systemic problem, and the type and extent of corrective action required.

3 ORIGIN OF THE WILDFIRE

The FESA investigator estimated that the wildfire's point of ignition was on the ground in a paddock southwest of the Bindi Bindi -Toodyay Road between Church Gully and Chatcup Roads approximately 12 kilometres North of Toodyay.

An inspection of the ignition point indicated that a large area of grass paddock had burnt out adjacent to the Western Power 22 kV overhead power line. The wildfire had continued in a South Easterly direction, which is consistent with the wildfire being driven forward from the point of ignition by wind coming from the North West.

The power line (Northam 535.0 Feeder) originates at Western Power's Northam substation and extends via Toodyay to Bolgart.

4 INVESTIGATION ANALYSIS

4.1 Examination of the 22 kV Overhead Power Line

The Western Power Northam to Bolgart (535.0) overhead 22 kV feeder specifications are:

- Phase conductors (x3): Steel cored aluminium
- Underslung earth conductor: Galvanised steel wire (rusted)
- Pole material: Wood
- Pole lengths (#97 and #98): 11 metres
- Pole height above ground: 9.5 metres
- Span length (poles #97 to #98): 182 metres
- Crossarm material: Wood
- Crossarm length: 2.8 metres
- Direction of power line: North South orientation

The span length between poles number 97 and number 98 is 182 metres. The crossarms used for this span are longer than standard and this configuration is commonly referred to by Western Power as an anti-swan (i.e. large bird) construction. This longer crossarm is utilised to provide greater separation between the phase conductors and the underslung earth conductor.

Inspection of the power line found evidence of damage to the overhead power line conductors between poles number 97 and number 98 on the Northam to Bolgart 22 kV Feeder (535.0). The damage consisted of electric arc burn marks on the outer steel cored aluminium conductor (red phase) and on the underslung earth conductor near and at the point where it was subsequently broken. This was immediately below the damage to the red phase conductor.

Pole number 97 was damaged by the wildfire on the 3 February 2007, causing it to fall towards the ground. The damaged power line was still live when discovered and the conductors remained suspended above ground by the crossarm. There was no evidence of a pole top fire, the pole base was burnt from the fire further suggesting it did not contribute to the point of ignition.

Western Power staff became aware of the damaged pole and replaced the pole on 4 February 2007.

Western Power also recorded an intermittent fault on the power line on 3 February 2007 at approximately 1400 hours. This fault coincides with the commencement of the wildfire.

4.2 Weather Conditions and Topography

The weather at Northam for 3 February 2007 was recorded as follows:

NW wind at 44 kph
Relative Humidity 8%
Ambient air temperature was approximately 46°C

The sky was clear and there was no evidence of lightning in the area.

The ground between poles number 97 and number 98 is formed in the shape of a valley. The ground, before the wildfire was covered with dry stubble from a crop.

4.3 Other Sources of Ignition - Eliminated

Consideration was given to various possibilities of other sources of ignition at the power line, such as an electrically caused pole-top fire, a high tensile physical failure of the steel earth wire which may have caused it to flick up into the phase conductor above, or wind-borne material (such as twigs) striking and snagging on the power line, however, all the evidence led to the conclusion that the source of ignition was the clashing of the conductors.

For example, the earth conductor exhibited damage at the break point that is consistent with electrical arcing between it and another conductor and there was evidence of multiple burn marks on the phase conductor.

4.4 The Effect of a Short Circuit on an Overhead High Voltage Power Line

When a live bare high voltage conductor and earth conductor come together they cause an arc to develop across the air gap between them or at the point of actual contact. In both cases a significant amount of electric energy passes between the two conductors and a large quantity of heat is produced in the metal at the point where the arc is formed. This heat causes melting of the metal resulting in welding of the conductors and the formation of molten metal globules that would disperse away from the arc and fall to the ground whilst still hot.

5 CONCLUSIONS

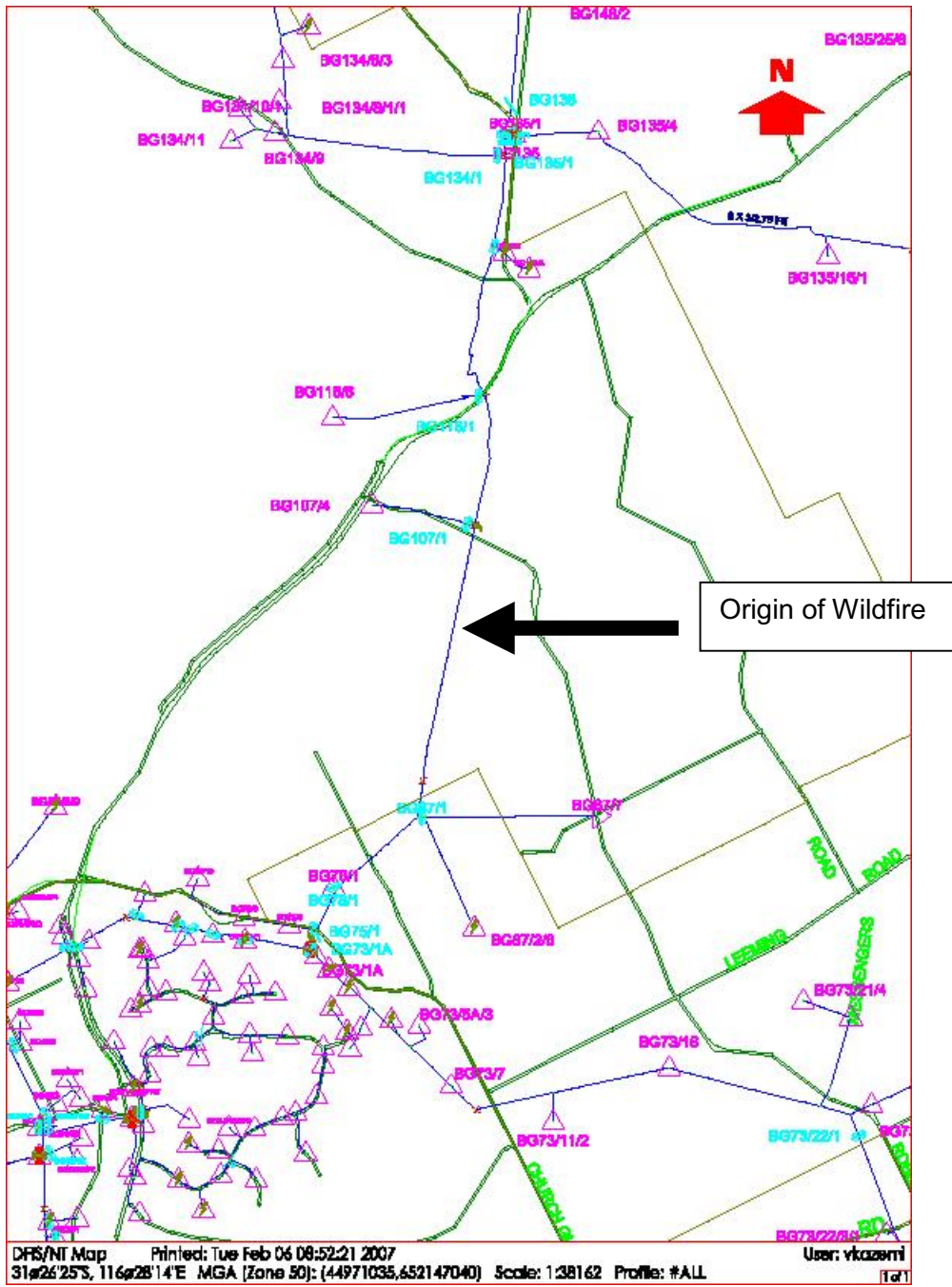
There are a number of inter-related events, circumstances and factors that coincided on the day of the wildfire. Taking all evidence into account the conclusion is reached that:

- There are no suspicious circumstances relating to the origin of the fire.
- The wildfire incident originated at midspan between poles number 97 and number 98 on the Northam to Bolgart 22kV overhead power line (Feeder 535.0), North of Toodyay and South East of Bindi Bindi – Toodyay Road between Church Gully Road and Chatcup Roads.
- The wildfire resulted from the ignition of the dry stubble on the ground due to hot metal globules falling from a 22 kV conductor clashing with an underslung earth conductor on the Western Power Northam to Bolgart overhead power line (Feeder 535.0), between poles number 97 and number 98.
- The clashing of conductors as described above raises the question of a deficiency, since conductor separation should have been sufficient to avoid such a fault. However, the type of construction used on this power line has traditionally performed satisfactorily within the Western Power network (and is different to that of power lines where previous clashing has occurred, resulting in serious wildfires).
- It is clear that significant further engineering investigation will be required by Western Power, in conjunction with EnergySafety, to deal with the above question and to assess whether this was an isolated problem, or whether it is an indication of a more systemic problem, and the type and extent of corrective action required.

APPENDIX A: LOCATION MAP



APPENDIX B: NETWORK DIAGRAM



APPENDIX C: PHOTOGRAPHS

Photograph No 1: - Origin of wildfire

Photograph taken at Culham Farm, Toodyay on 3 February 2007 by Senior Electrical Inspector Todd Bell, EnergySafety.



Photograph No 2: - Pole 98 - Broken earth conductor

Photograph taken at Culham Farm, Toodyay on 3 February 2007 by Senior Electrical Inspector Todd Bell, EnergySafety.



Photograph No 3: - Contact marks and metal globules on the red phase conductor

Photograph taken at Culham Farm, Toodyay on 3 February 2007 by Senior Electrical Inspector Todd Bell, EnergySafety.



Photograph No 4: - Pole 97 - Damaged by fire

Photograph taken at Culham Farm, Toodyay on 3 February 2007 by Senior Electrical Inspector Todd Bell, EnergySafety.



Photograph No 5: - Contact marks and metal globules on the broken earth conductor

Photograph taken at Culham Farm, Toodyay on 3 February 2007 by Senior Electrical Inspector Todd Bell, EnergySafety.

