



28 August 2015

# GRANTHAM QUARRY - GEOTECHNICAL INVESTIGATIONS & EXPERT OPINION ON FORMATION OF EARTHWORKS - SUPPLEMENTARY REPORT CONCERNING LOCATION OF FAILED POWER POLE P182127

## Grantham Floods Commission of Inquiry

**Submitted to:**  
Grantham Floods Commission of Inquiry  
Level 3, Annexe  
100 George Street  
BRISBANE QLD 4000



REPORT

**Report Number.** 1532696-002-Rev1

**Distribution:**

Ms Joanne Paterson  
Director Flood Commission of Inquiry





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## **1.0 THE COMMISSION**

### **1.1 Background**

1. The Grantham Floods Commission of Inquiry (**The Commission**) has been established under the Commissions of Inquiry Act 1950 to make full and careful inquiry into the flooding of the Lockyer Creek between Helidon and Grantham on 10 January 2011, with specific reference to any natural or man-made features of the landscape which could have altered or contributed to the flooding.

### **1.2 My Previous Instructions**

2. I have previously been engaged by The Commission to prepare an expert opinion on the method of formation of the embankments surrounding the quarry to assist it in determining whether those embankments acted as a levee during the 10 January 2011 flood event.
3. I provided that opinion in the form of a report entitled "*Grantham Quarry – Geotechnical Investigations & Expert Opinion on Formation of Earthworks*", Golder reference 1532696-001-R-Rev1, dated 28 July 2015. I refer to this report in the following as the Main Report.

### **1.3 My Current Instructions**

4. I have now been instructed to prepare a Supplementary Report on a timber utility power pole (Pole 182127) designated the Broken Pole, and have been provided with further documents, as detailed in Section 3.0.
5. A copy of my letters of instruction are attached in Appendix A.
6. For the supplementary report, I have been engaged by The Commission to provide an expert opinion on the proximity of the Broken Pole to the embankments surrounding the Grantham Quarry.
7. The Commission has requested that I specifically express an opinion on the following matters:
  - a. the location of that Broken Pole and in particular, its proximity to the embankments surrounding the quarry;
  - b. the estimated AHD level of the base of the Broken Pole (that is, the AHD level at ground level for the Broken Pole); and
  - c. in the event there is an embankment or slope between the Broken Pole and the edge of the quarry pit:
    - (i) the estimated AHD level of the peak of the embankment or slope;
    - (ii) the estimated distance between the base of the Broken Pole and the base of the embankment or slope;
    - (iii) the estimated distance between the peak of the embankment or slope and the Broken Pole; and
    - (iv) the angle of the slope or embankment.



## **2.0 QUALIFICATIONS & EXPERIENCE**

8. My name is David Clark Starr and I am a Principal Geotechnical Engineer with Golder Associates Pty Ltd (Golder Associates) of 147 Coronation Drive, Milton, Brisbane, Queensland 4064.
9. I am a Geotechnical Engineer with 44 years' experience in consulting in geotechnical engineering and engineering geology.
10. My experience is detailed in a CV presented as Appendix D in the Main Report. I confirm that there has been no change in qualifications since preparation of the Main Report.

## **3.0 DOCUMENTATION & DATA PROVIDED**

11. In forming my opinion, I have relied upon the following documents:
  - a. An Energex map showing flooded assets.
  - b. Three photographs provided to the Commission by Anthony McIntosh, a Grantham resident. Each of these photographs was taken at the Grantham Quarry on 12 February 2011 and show the Broken Pole.
  - c. Google Earth kmz files showing locations of all power poles on the Quarry Site.
  - d. The findings and material contained in the Main Report.
12. The documentation and data provided by The Commission are included as Appendix A, with the Broken Pole photographs presented as Appendix B.

## **4.0 THE QUARRY SITE & GEOLOGICAL SETTING**

13. The quarry site is located approximately 4 km west of the town of Grantham, Queensland. It is enclosed within an oxbow bend in the Lockyer River, creating a "U" shaped parcel of lands bounded on three sides by the creek.
14. I note that the site is formed of Quaternary Flood Plain material comprising alluvial sands, gravel and silt, and is underlain by Marburg Formation sandstone and siltstone of Lower to Middle Jurassic age. The geological setting is described in further detail in Section 5.0 of my Main Report.

## **5.0 TOPOGRAPHY & MORPHOLOGY OF THE QUARRY SITE**

15. I have made use of topographic data available for the area of the quarry both pre-flood and post-flood in the form of contours generated from LiDAR surveys (Light Detection and Ranging). LiDAR is a remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the earth surface. These light pulses - combined with other data recorded by the airborne system - generate precise, three-dimensional information about the surface characteristics of the area being surveyed.
16. The first LiDAR survey was undertaken between 1<sup>st</sup> to 22<sup>nd</sup> August 2010 before the flood and the second from 10<sup>th</sup> February to 9<sup>th</sup> March 2011 after the flood.
17. The LiDAR data has been plotted by Golder GIS expert Travis Brousseau under my direction and presented on Figures 1 to 3, 4 to 6 and 7 to 8 in the Main Report. I have provided my interpretation of the LiDAR contours in Sections 10 and 11 of the Main Report.





18. Stereographic air photo images have been obtained from Department of Natural Resources and Mines. I have been provided with a series of stereo images of air photos covering the Helidon/Grantham area for the years 1982, 1988, 1992, 1997, 2001, 2009, 2010 and 2011. The 2011 photos are those used for the post-flood LiDAR imagery.
19. I have also made use of imagery of the Quarry area available on the web by using Google Earth and photomaps by Nearmap (Golder has a Nearmap license). Nearmap Ltd is an international provider of high resolution aerial imagery, and currently operates a web portal which serves up its imagery and terrain models.
20. For this report, I have utilised the Nearmap images for 2010 and 2015 to show the location of the Broken Pole before and after the flood, and have relied on the pre-flood contours shown in Figure 1A in the Main Report. For ease of reference a further copy of the relevant Nearmap Images and Figure 1A are presented in Appendix C of this report.

## **6.0 SITE INSPECTION**

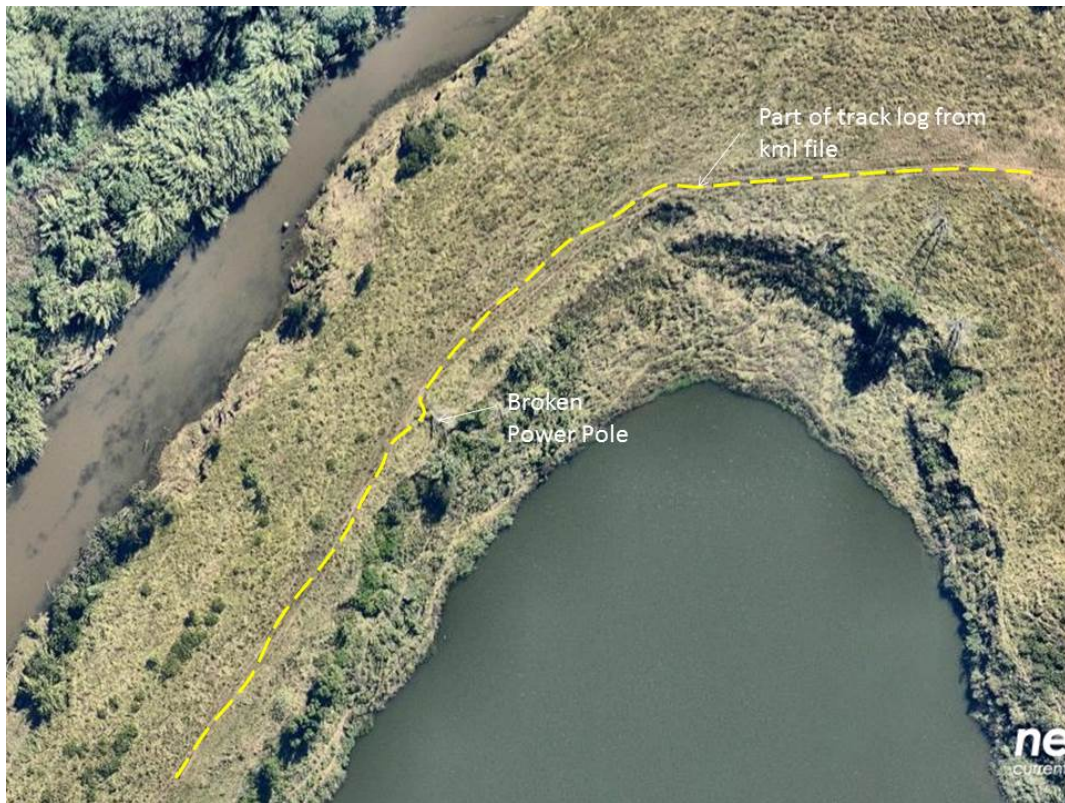
21. I undertook a walkover site inspection in the presence of John Macintosh (Water Solutions) and Tim Slack (Boral) on 1 June 2015.
22. The inspection was conducted by walking along the access track in an anticlockwise direction around the quarry. A Google Earth kmz/kml file was recorded by John Macintosh on a GPS device to show the path taken. The path file was subsequently provided to me.
23. The results of my site inspection are described in Section 7.0 of the Main Report, and site inspection photographs are presented as Appendix B in the Main Report.

## **7.0 TOPOGRAPHY ADJACENT TO THE BROKEN POLE**

24. I have undertaken a review of relevant information to determine the topography in the vicinity of the Broken Pole.
25. This review has included:
  - a. Examination of a portion of the path taken during the site inspection.
  - b. Nearmap Imagery for 2010 and 2015.
  - c. Pre-flood LiDAR contours.

### **7.1 Review of path taken during site inspection**

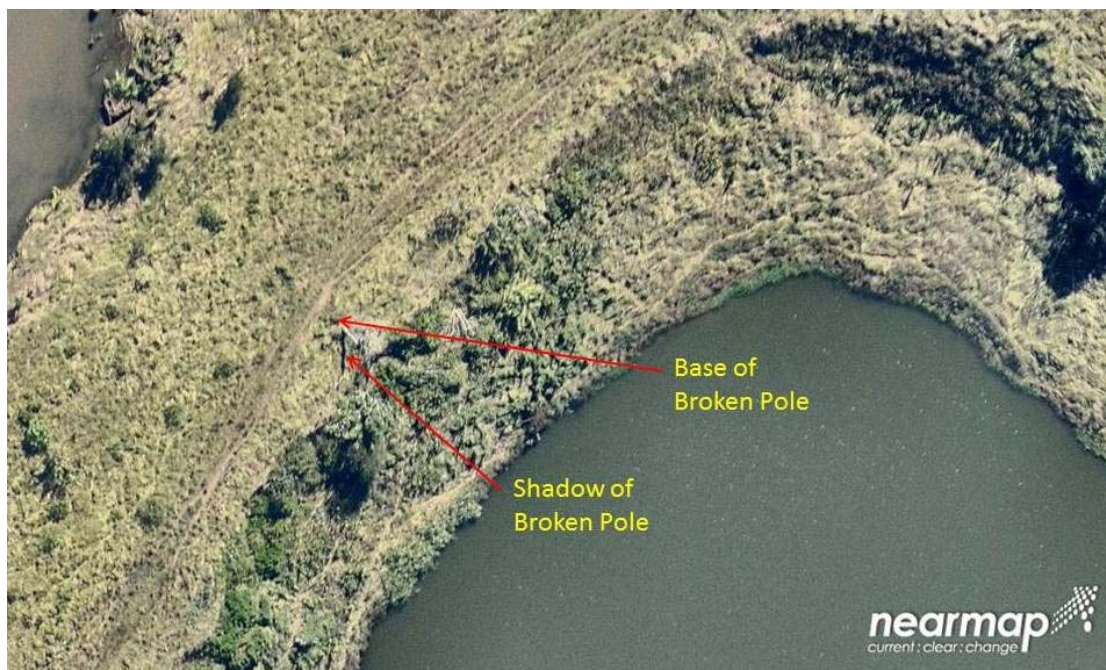
26. I can see from examining the path taken during the site inspection that I passed by the location of the Broken Pole, which is at the northern end of the western levee. The location of the Broken Pole as I observed it is shown in Plate 1 below, which is based on a kml file superimposed on the 2015 Nearmap image of the Quarry.



*Plate 1 Extract from Nearmap image dated 10 May 2015 showing path taken on 1 June 2015.*

## **7.2 Review of Nearmap imagery**

27. Plate 2 shows the Broken Pole on a Nearmap image from 10 May 2015. Although dated two weeks before my site inspection of 1 June 2015, it is consistent with my recollection of the Broken Pole location.

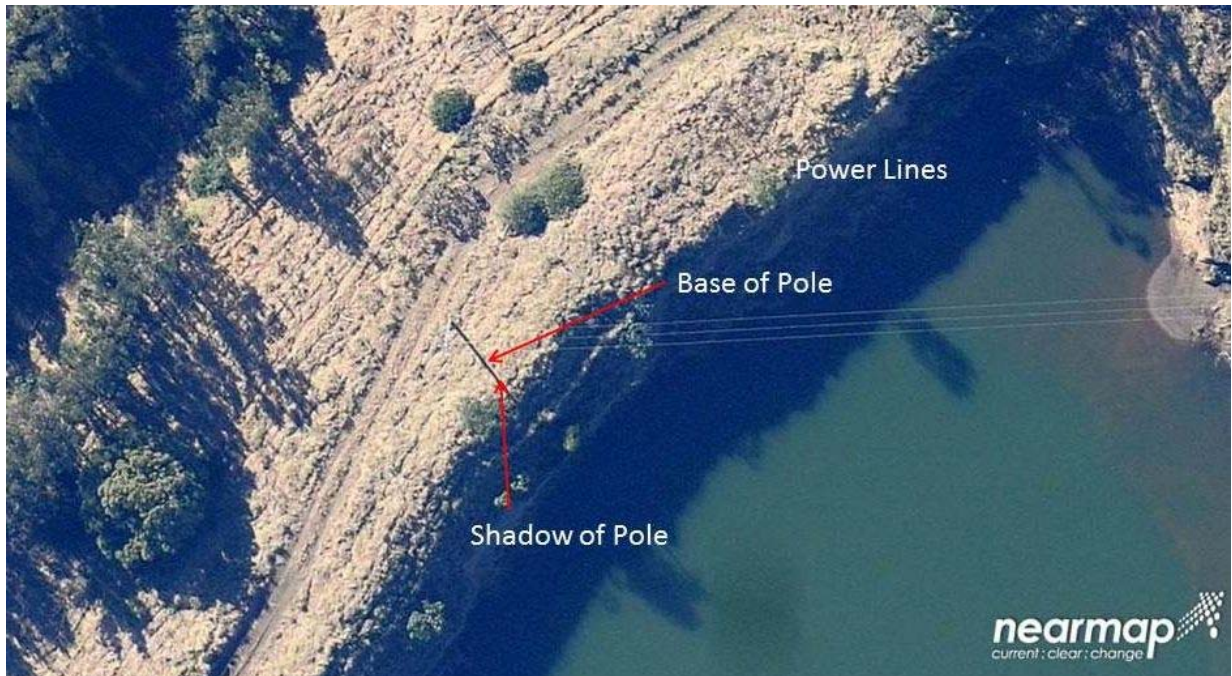


*Plate 2: Power Pole P182127 (the Broken Pole) on 10 May 2015*





28. Furthermore, I have also reviewed the same portion of the Quarry based on a pre-flood Nearmap image dated 17 July 2010, and note that it shows the Broken Pole in the same location (see Plate 3).



*Plate 3: Power Pole P182127 (the Broken Pole) on 17 July 2010*

29. The annotations on both Plates 2 and 3 indicate the base of the power pole and the shadow cast by the pole, depending on the location of the sun at the time the image was taken. I note that on 17 July 2010 (Plate 3), the shadow is almost in exact alignment with the pole, making it difficult to recognise the base location easily. However, I can see a slight bend in the shadow, where it passes over the adjacent section of bund, hence aiding identification of the base.
30. The Eastern Bund is labelled on Plates 4 and 5, and is also shown in cross sections in the Main Report as Plates 1 and 2.

### **7.3 Review of LiDAR contours**

31. I have also reviewed the pre-flood LiDAR contours which are shown in Figure 1A included in my Main Report. Plate 4 is an extract from Figure 1A which shows pre-flood colour coded heights of fill.
32. For clarity I have shown the location of the pole on an extract of the contour plan without colour coding (Plate 5).

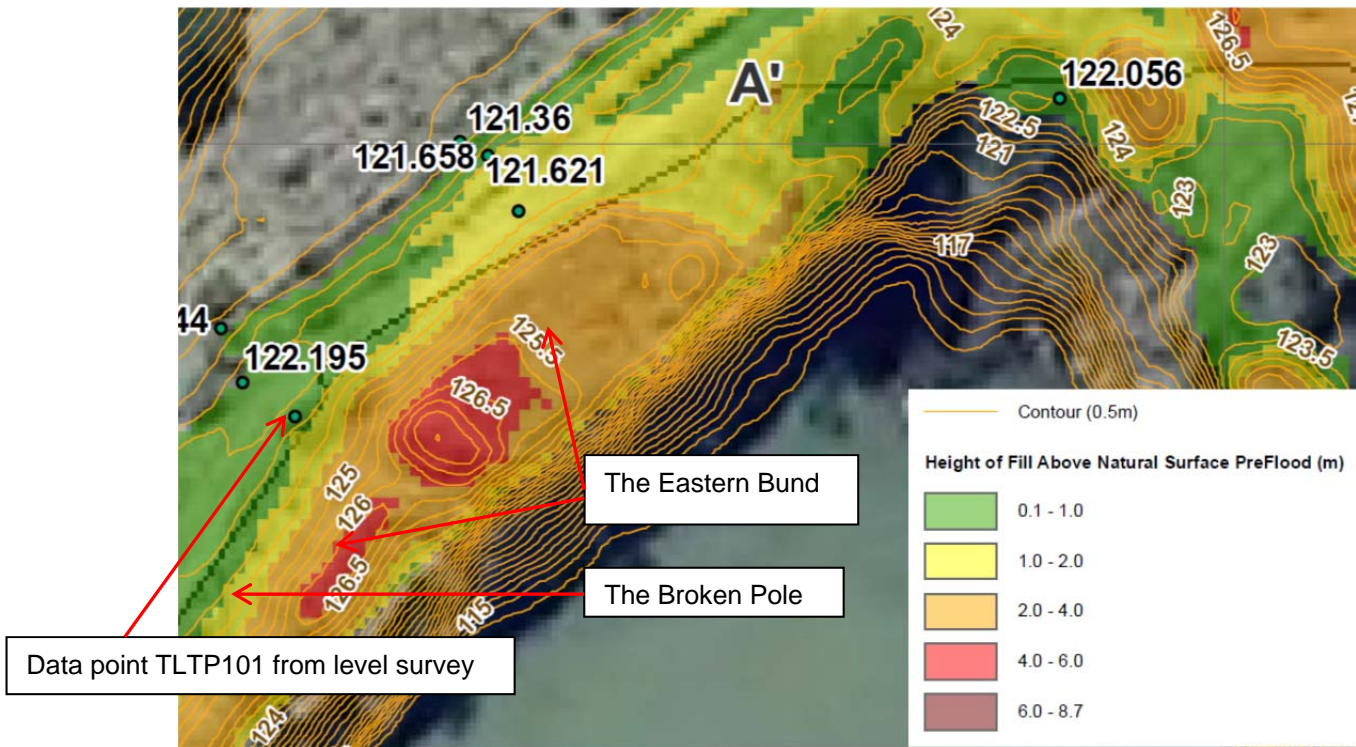


Plate 4: Extract from pre-flood 2010 LiDAR contour plan showing fill heights adjacent to Broken Pole

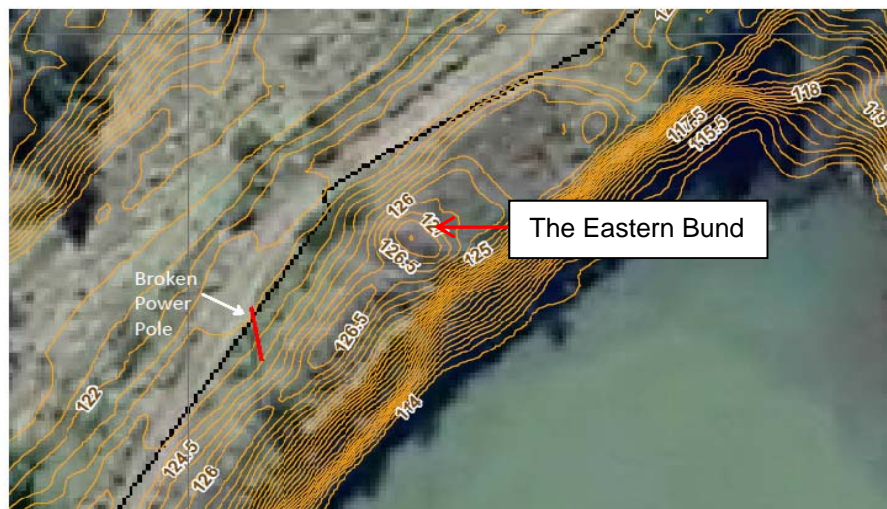
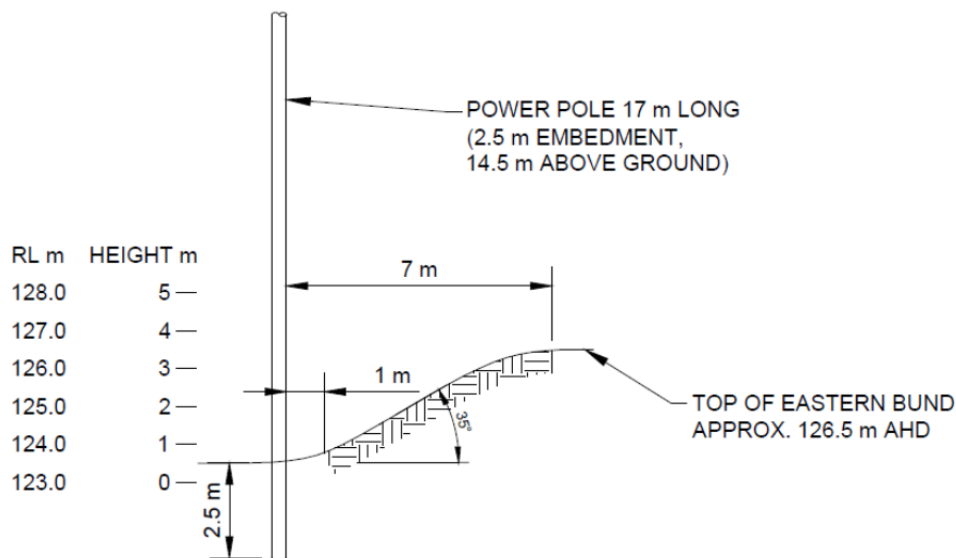


Plate 5: Extract from pre-flood 2010 LiDAR contour plan showing the Broken Pole location and contours.

33. I note from Plates 4 and 5 that the pre-flood LiDAR contours indicate that the Broken Pole was at the toe of the northern section of the eastern bund, on the western side.



34. A photograph of the Broken Pole immediately after the flood is presented on the front cover of this report, based on image DSCF7666 provided by Anthony McIntosh taken on 12 February 2011. In my opinion, the bare surface in the foreground indicates where the eastern bund has been eroded by the flood. This photograph assists in determining that the Broken Pole was adjacent to the eastern bund.
35. In reviewing the contour plans, I have identified a data point designated TLTP101 (Track Level near Test Pit 101), which is close to the base of the Broken Pole. This point is identified on Plate 4, and was surveyed as part of the geotechnical investigations. This data point has an RL of 122.849 AHD. (The survey data are tabulated on a figure in the front of Appendix D in my Main Report).
36. Based on the AHD contour values I have drawn a simplified cross section of the eastern bund adjacent to the Broken Pole. This is presented as Plate 6.
37. Based on Plate 6, I can make the following inferences:
- a The base of the Broken Pole pre-flood had an RL of between about 122.5 and 123.5 m AHD (depending on exact location of the pole in relation to the toe of the eastern bund).
  - b I estimate that the level of the top section of bank adjacent to the Broken Pole immediately to the east was about 126.5 AHD.
  - c The embankment adjacent to the Broken Pole had a side slope of about 35 degrees on the western side of the eastern bund at this location.
  - d The horizontal distance from the Broken Pole to the top of the bund is about 7 m.



*Plate 6: Cross section through the section of eastern bund adjacent to the Broken Pole*





## **8.0 CONCLUSIONS ABOUT THE BROKEN POWER POLE**

38. From the discussions above, I draw the following conclusions about the Broken Pole:

- a. The location of the Broken Pole is the same as shown in the 2010 aerial photograph (which is presented as Plate 3), and there was a slope located to the east of the Broken Pole on the eastern bund along the western side to the quarry;
- b. The surface level of the base of the Broken Pole was between 122.5m AHD and 123.5m AHD;
- c. The peak of the slope to the south east of the Broken Pole (on the Western embankment) was approximately 126.5m AHD;
- d. The distance between the base of the Broken Pole and the base of the embankment to the south east was between 1m to 2m;
- e. The horizontal distance from the Broken Pole to the top of the embankment to the south east of the Broken Pole was between 7m to 8m; and
- f. The embankment to the east of the Broken Pole had a slope which, on the side of the Broken Pole, was at an angle of 35 degrees.

**GOLDER ASSOCIATES PTY LTD**

David Starr  
Principal Geotechnical Engineer  
BSc MSc FIEAust CPEng RPEQ 5836

DCS/dcs/mm

A.B.N. 64 006 107 857

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# **APPENDIX A**

## **Instructions and Documentation & Data Provided**

# Grantham Floods Commission of Inquiry

Reference number: DOC/15/127323

Mr David Starr  
Golder Associates Pty Ltd  
By email: dstarr@golder.com.au

Dear Mr Starr

## **GRANTHAM FLOODS COMMISSION OF INQUIRY – GEOTECHNICAL OPINION CONCERNING LOCATION OF FAILED POWER POLE**

We refer to our letter of instructions dated 10 July 2015 in which we requested that you provide an expert opinion concerning the formation of embankments surrounding the Grantham quarry. We note that this opinion is to be contained in the form of an expert report, which will be delivered to the Commission shortly (**First Report**).

### **Additional opinion sought**

In addition to the First Report, we now request your opinion concerning the proximity of a broken timber utility power pole (pole 182127) (the **Broken Pole**) to the embankments surrounding the Grantham quarry. That is, we ask that you express your opinion as to the following matters:

1. the location of that Broken Pole and in particular, its proximity to the embankments surrounding the quarry;
2. the estimated AHD level of the base of the Broken Pole (that is, the AHD level at ground level for the Broken Pole); and
3. in the event there is an embankment or slope between the Broken Pole and the edge of the quarry pit:
  - (a) the estimated AHD level of the peak of the embankment or slope;
  - (b) the estimated distance between the base of the Broken Pole and the base of the embankment or slope;

(c) the estimated distance between the peak of the embankment or slope and the Broken Pole; and

(d) the angle of the slope or embankment.

To assist you in forming your opinion, we **attach** a copy of an aerial map that has been provided by Energex to the Commission which indicates the general proximity of the Broken Pole on the line of power poles surrounding the quarry.

### **Form of additional opinion**

We request that you provide your opinion on the above matters in the form of a supplementary expert report addressed to the Commission and signed by you.

That report must include the following information:

1. your qualifications;
2. all material facts and assumptions, whether written or oral, on which your report is based;
3. references to any literature or other material relied upon by you to prepare your report;
4. for any site inspection, examination or experiment conducted, initiated or relied upon by you to prepare your report:
  - (a) a description of what was done;
  - (b) whether that inspection, examination or experiment was done by you or under your supervision;
  - (c) the names and qualifications or any other person involved; and
  - (d) the result;
5. if there is a range of opinion on the matters dealt with in the report, a summary of the range of opinion, and the reason why you adopted a particular opinion;
6. a summary of the conclusions reached by you;
7. a statement about whether access to any readily ascertainable additional facts would assist you in reaching a more reliable conclusion.

To the extent that the above matters have been addressed in your First Report, the Commission is content for you to include appropriate references to those matters in the supplementary report together with confirmation that those matters have not changed since your First Report was prepared.

Finally, we request that your supplementary report include suitable drawings, maps and photographs to explain your opinion.

We look forward to receiving your supplementary report in due course.

# Grantham Floods Commission of Inquiry

Reference number: *TF/15/14981*

Mr David Starr  
Golder Associates Pty Ltd  
dstarr@golder.com.au

Dear Mr Starr

## **GRANTHAM FLOODS COMMISSION OF INQUIRY – GEOTECHNICAL OPINION CONCERNING LOCATION OF FAILED POWER POLE**

We refer to our letter of instructions dated 27 July 2015 in which we requested that you provide an expert opinion concerning the location of the broken power pole (the **Broken Pole**).

Further to those instructions, we now attach copies of three photographs which were provided to the Commission by Anthony McIntosh, a Grantham resident. Each of these photographs were taken at the Grantham Quarry on 12 February 2011 and show the Broken Pole.

We ask that you consider these photographs in forming your opinion concerning the location of the broken power pole.

Yours sincerely



Joanne Paterson  
**Director**  
**Grantham Floods Commission of Inquiry**

31 July 2015

Yours sincerely

Joanne Paterson  
**Director**  
**Grantham Floods Commission of Inquiry**

/ /2015

# Attachment RAB-1

FLOODED ASSETS  
GRANTHAM



Scale 1:5,000

0 62.5 125 250 Meters

HELIDON

GRANTHAM

11kV Feeder HDN1  
BANANA 6/1/3.75 ACSR/GZ  
Cable Count = 3

11kV Feeder HDN1  
BANANA 6/1/3.75 ACSR/GZ  
Cable Count = 3

11kV Feeder HDN1  
BANANA 6/1/3.75 ACSR/GZ  
Cable Count = 3

P182128  
15.5m Wooden Pole (grey ironbark)  
Spec is 15.5/12KN

P182127  
17m Wooden Pole (spotted Gum)  
Spec is 17/20KN

P182126  
15.5m Wooden Pole (spotted Gum)  
Spec is 15.5/12KN

11kV Feeder HDN1  
7/080 COPPER (7/14) 11kV  
Cable Count = 3

SP4685-A  
14m Wooden Pole (ironbark)

11kV Feeder HDN1  
7/080 COPPER (7/14) 11kV  
Cable Count = 3

P21319-B  
10.7m Wooden Pole (grey ironbark)

GARPENDALE

Lot 103  
CH31505

Lot 2  
RP142070



# Power Pole Locations - Grantham Quarry

**Legend**

- ▲ 06-01-2015 15:41:25 Track
- 10 m



Google earth

© 2015 Google  
Image © 2015 CNES / Astrium

200 m



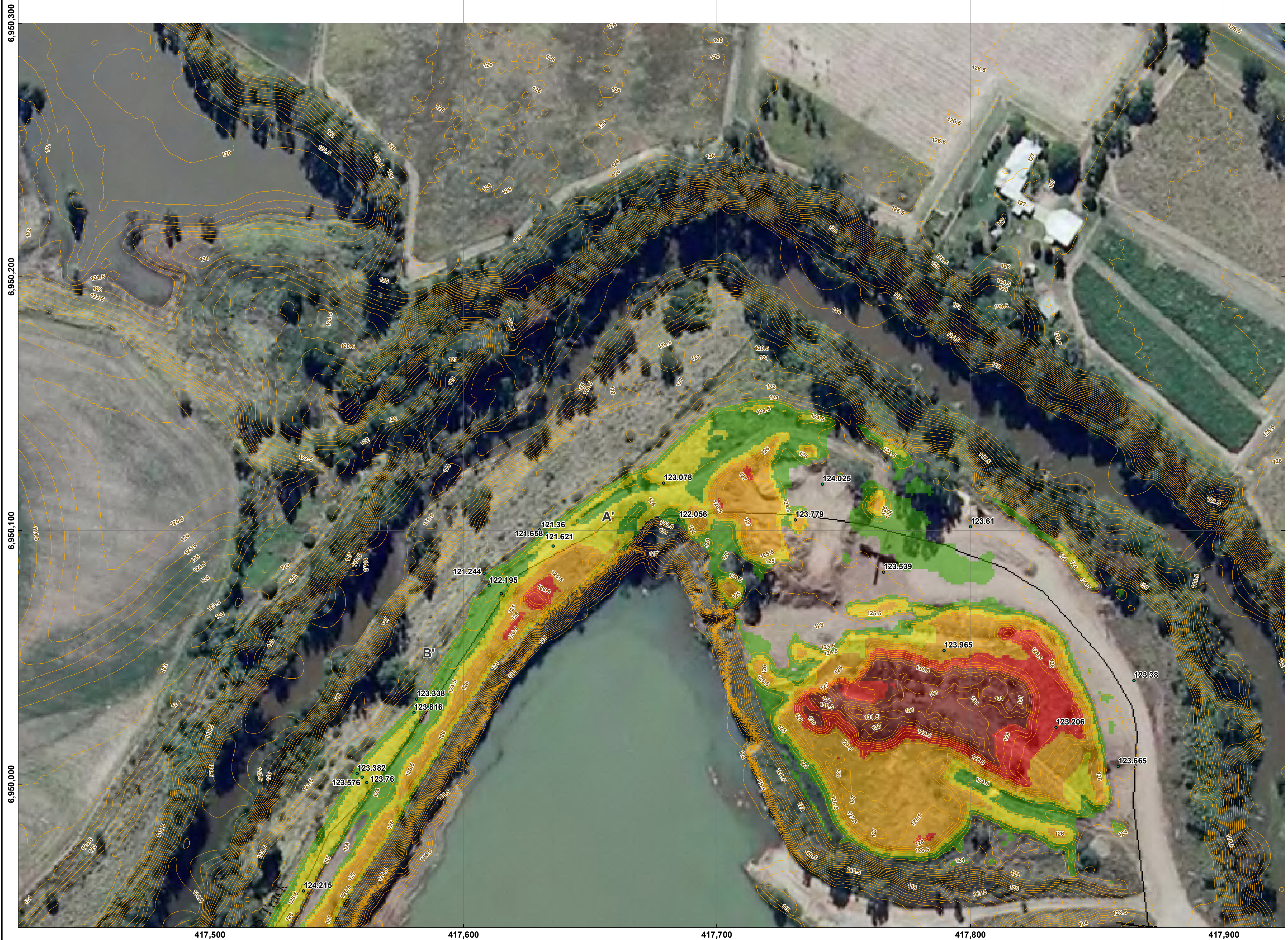
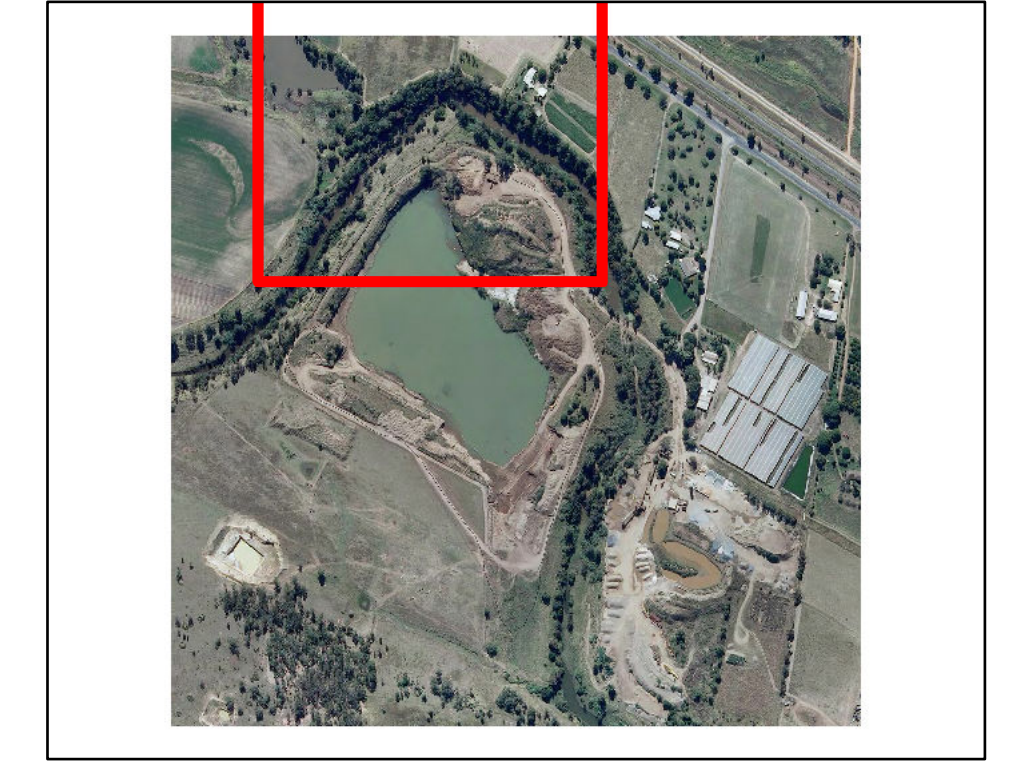
417,500 417,600 417,700 417,800 417,900



GRANTHAM FLOOD COMMISSION OF INQUIRY

GRANTHAM QUARRY

PRE FLOOD CONTOURS AND INTERPRETED HEIGHT OF FILL PLAN NORTH



LEGEND

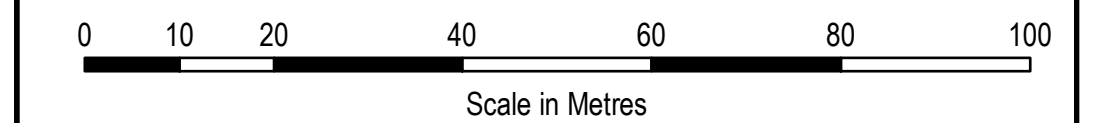
- Data Point
- A A' Section Line
- Contour (0.5m)

Height of Fill Above Natural Surface PreFlood (m)

- 0.1 - 1.0
- 1.0 - 2.0
- 2.0 - 4.0
- 4.0 - 6.0
- 6.0 - 8.7

NOTES

1. Fill heights determined from modelling of H2 surface (natural alluvium) based on observations at data points.
2. LIDAR data provided by GFCI.



SCALE (at A1) 1:800  
DATUM GDA94, PROJECTION MGA Zone 56

PROJECT: 1532696  
DATE: 28 JUL 2015  
DRAWN: TB  
CHECKED: DS

FIGURE 1A



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# **APPENDIX B**

## **Broken Pole Photographs**

















# **APPENDIX C**

## **Selected Nearmap Images**

Notes: Nearmap Image

Date: Sat, 17 Jul 2010





Notes: Nearmap Image

Date: Sun, 10 May 2015



At Golder Associates we strive to be the most respected global company providing consulting, design, and construction services in earth, environment, and related areas of energy. Employee owned since our formation in 1960, our focus, unique culture and operating environment offer opportunities and the freedom to excel, which attracts the leading specialists in our fields. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America, and South America.

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