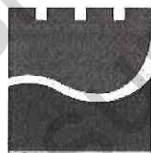


JOB NO DE16/265                      OCTOBER, 2016  
QLD DEPARTMENT OF NATURAL RESOURCES  
AND MINES  
ALTERNATIVE TREATMENT OPTIONS  
FOR SINKHOLES  
53 17 MILE ROCKS ROAD AND  
113 CLIVEDEN AVENUE  
OXLEY



**MORRISON**  
GEOTECHNIC

Job No: DE16/265  
Ref No: 21342-rev 1  
Author: Russell Howchin

17 October 2016

QLD Department of Natural Resources and Mines (NRM)  
27 O'Connell Street  
Gympie Q 4570

**ATTENTION: MR MICHAEL OVERLAND**  
Email: [michael.overland@dnrm.qld.gov.au](mailto:michael.overland@dnrm.qld.gov.au)

Dear Sir,

**RE: ALTERNATIVE TREATMENT OPTIONS FOR SINKHOLES, 53 17 MILE ROCKS ROAD AND 113 CLIVEDEN AVENUE, OXLEY**

## 1.0 INTRODUCTION

This report presents alternative treatment options for the sinkholes at 53 17 Mile Rocks Road and 113 Cliveden Avenue, Oxley (herein referred to as the "Site"). This assessment was commissioned by the QLD Department of Natural Resources and Mines (herein referred to as the "Client").

This is Revision 1 of the original report sent on the 6<sup>th</sup> October, and includes additional information in response to an email received from the Client on 12 October, 2016.

A preliminary assessment report has been produced for this Site under Job Number DE16/234, Reference 21154-rev 1, dated 11 August, 2016, and should be read in conjunction with this report. The preliminary assessment report included information regarding the existing sinkholes, underlying site geology and drainage conditions, likely activation methods of the sinkholes, and possible remediation options to reduce the potential of further sinkholes and land instability developing.

This report presents alternative treatment options to reduce the potential for further instability and sinkhole development beneath the ground surface across the Site area. Works on the NRM property do not appear to have contributed to the creation of the sinkholes.

## 2.0 METHODOLOGY

This assessment has been based on:-

- A desk study of available Geological Maps
- Borehole drilling across the hillslope adjacent to the sinkholes using a utility mounted drill rig
  - Total of 16 boreholes drilled to depths ranging between 3m and 6m
  - Quality of Material soil test results of samples collected from the boreholes
- Ground slope surface angles taken from survey data provided by the Client
- A walk-over observational assessment of the Site and surrounds by a Senior Geoscientist
- Discussions with the QLD Department of Natural Resources and Mines and Mr Warwick Willmott, eminent geologist (retired) and author of several books detailing the history and formation of the various rock formations which make up the Brisbane geology



- Review of 'Dial Before You Dig' underground services plans for the local area

The site plan showing the borehole locations, borehole record sheets and Quality of Material test results are attached as Appendices A, B and C respectively.

Global stability modelling was not carried out. The software programme, 'Infinite Slopes' was used to 'back calculate' effective strength parameters for the natural soils above the weathered rock.

### 3.0 TOPOGRAPHY

From the ground survey information provided by the Client, the ground surface adjacent to the sinkhole areas slopes downwards to the west at angles ranging between approximately 20° to 30°.

### 4.0 SUMMARY OF SUBSURFACE PROFILE

Based on the results of borehole drilling, natural, fissured, grey brown to dark grey brown silty clay soils of high plasticity and extreme reactivity is present beneath the ground surface, extending to a depth on average of approximately 1.5m to 2m, underlain by Extremely Weathered (XW) siltstone rock of Extremely Low Strength to Very Low Strength to the borehole termination depths of 3m and 6m. The XW siltstone rock is interlayered with natural silty clay soils at some locations. XW sandstone and basalt rock was present as interlayers within the natural soil and XW siltstone profile at isolated borehole locations.

The subsurface profiles are summarised in Table 1, and detailed further in the borelog sheets attached as Appendix B.

**Table 1 – Geotechnical Summary of the Subsurface Profiles**

| Borehole Location No. | Natural Soil                  | Weathered Rock             | Termination Depth (m) |
|-----------------------|-------------------------------|----------------------------|-----------------------|
|                       | Stiff to Hard Silty Clay (CH) | XW, ELS -VLS Siltstone (m) |                       |
| BH1                   | 0 – TD <sup>3</sup>           | NE                         | 6                     |
| BH2                   | 0 – TD                        | NE                         | 3                     |
| BH3                   | 0 – 1.4                       | 1.4 – 2.5 <sup>4</sup>     | 6                     |
|                       | 2.5 – 3.2                     | 3.2 – TD                   |                       |
| BH4                   | 0 – TD <sup>5</sup>           | NE                         | 3                     |
| BH5                   | 0 – 2.4 <sup>5</sup>          | 2.4 – 4.5                  | 6                     |
|                       | 4.5 – 5                       | 5 – TD                     |                       |
| BH6                   | 0 – 2.8 <sup>5</sup>          | 2.8 – TD                   | 3                     |
| BH7                   | 0 – 1.5                       | 1.5 – 3                    | 6                     |
|                       | 3 – TD                        |                            |                       |
| BH8                   | 0 – TD <sup>5</sup>           | NE                         | 6                     |
| BH9                   | 0 – 1.6 <sup>5</sup>          | 1.6 – 2.5 <sup>6</sup>     | 3                     |
|                       |                               | 2.5 – TD                   |                       |
| BH10                  | 0 – 1.5 <sup>7</sup>          | 1.5 – TD                   | 3                     |
| BH11                  | 0 – 1.8                       | 1.8 – TD                   | 6                     |
| BH12                  | 0 – 1.5 <sup>7</sup>          | 1.5 – TD                   | 6                     |
| BH13                  | 0 – 3.9                       | 3.9 – TD                   | 4.5                   |
| BH14                  | 0 – TD <sup>5</sup>           | NE                         | 4.5                   |
| BH15                  | 3.5 – 3.9                     | 0 – 3.5 <sup>8</sup>       | 6                     |
|                       | 4.8 – 5                       | 3.9 – 4.8                  |                       |
|                       |                               | 5 – TD                     |                       |
| BH16                  | 0 – TD                        | NE                         | 3                     |

**Notes:**

1) All depths below existing surface levels as at the date of drilling (5<sup>th</sup> and 6<sup>th</sup> September, 2016).

- 2) TD – Termination Depth; NE – Not Encountered
- 3) Clayey Sand encountered between 4.5m and 6m.
- 4) XW, ELS Sandstone Rock
- 5) XW Siltstone interlayers typically below 1.5m-2m
- 6) XW, ELS Basalt
- 7) Sandy Silt of Low Plasticity
- 8) XW, ELS Sandstone between 0m and 1.2m
- 9) Some minor, thin layers have not been included in this Table for ease of reading

Seepages were encountered in some of the boreholes at various depths. Standing groundwater was encountered at a depth of 5.2m in borehole BH1 immediately after borehole drilling. Groundwater is likely to be present as “springs” beneath the ground surface at various locations across the hillslope, as evidenced by silt “washout” debris at the base of the hillslope adjacent to the sinkhole areas.

Seepages may be encountered within the natural reactive clay soils, at the natural extremely reactive clay soil/weathered rock interface, and in clean rock defects, especially following rainfall events. The presence and depth to groundwater is dependent on rainfall, subsurface material and permeability, and uncontrolled surface water flows from upslope properties. Several roofwater and water tank overflow pipes were observed at the rear boundaries of the properties along Blackheath Road and 17 Mile Rocks Road. These pipes would likely discharge surface water in an uncontrolled manner over the hillslope below, increasing the potential for instability within these areas. Based on a review of the ‘Dial Before You Dig’ QUU plan (DBYD Ref No 55174335, attached as Appendix D), an underground sewer pipe runs parallel to the rear boundaries of several Blackheath Road and 17 Mile Rocks Road properties above the hillslope. A summary of properties along these roads which either discharge water in an uncontrolled manner over the hillslope, or which have sewer pipes adjacent to the rear boundaries of the properties is presented in Section 5.0 which follows.

## 5.0 SUMMARY OF SERVICES ABOVE HILLSLOPE

A summary of both above and underground services above the hillslope within the ‘Community Consultation’ area (refer to Section 9.0 of this report), and adjacent to the rear boundaries of Blackheath Road and 17 Mile Rocks Road is provided in Table 2.

Table 2 – Summary of Services Above Hillslope

| Property Address                                                                                                                                         | Service                                                                             | Property Address              | Service                                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------|--------------------------------------------------------|
| ch4p4( 6) Personal informatio                                                                                                                            | Water tank overflow                                                                 | ch4p4( 6) Personal informatio | Underground sewer and water tank overflow              |
|                                                                                                                                                          | Uncontrolled roofwater (currently being upgraded)                                   |                               | Underground sewer                                      |
|                                                                                                                                                          | Underground sewer                                                                   |                               | Underground sewer and water tank overflow              |
|                                                                                                                                                          | Underground sewer                                                                   |                               | Underground sewer                                      |
|                                                                                                                                                          | Underground sewer and uncontrolled retaining wall drainage                          |                               | Underground sewer and water tank overflow              |
|                                                                                                                                                          | Underground sewer and <i>possible uncontrolled roofwater discharge</i> <sup>1</sup> |                               | Underground sewer                                      |
|                                                                                                                                                          | Underground sewer                                                                   |                               | Underground sewer and water tank overflow              |
|                                                                                                                                                          | Underground sewer                                                                   |                               | Water tank overflow                                    |
|                                                                                                                                                          | Underground sewer                                                                   |                               |                                                        |
|                                                                                                                                                          | Underground sewer                                                                   |                               | Underground sewer and water tank overflow              |
|                                                                                                                                                          | Underground sewer                                                                   |                               | Underground sewer                                      |
|                                                                                                                                                          | Underground sewer and roofwater                                                     |                               | Underground sewer                                      |
|                                                                                                                                                          | Underground sewer                                                                   |                               | Underground sewer and uncontrolled roofwater discharge |
|                                                                                                                                                          | Underground sewer                                                                   |                               | Underground sewer                                      |
| <b>Note:</b><br>1) Couldn't properly observe from rear boundary due to steep hillslope in rear yard.<br>2) Properties directly upslope of the sinkholes. |                                                                                     |                               |                                                        |

## 6.0 LABORATORY TEST RESULTS

The Quality of Material laboratory test results are contained in Appendix C to this report and are summarised in Table 3. It is noted that the Quality of Materials test comprises both Particle Size Distribution and Atterberg Limits testing.

Table 3 – Quality of Materials (Particle Size Distribution and Atterberg Limits) Results

| Borehole No. | Depth (m) | Particle Size Distribution |          |            | Liquid Limit (%) | Plasticity Index (%) | Linear Shrinkage (%) | Material        |
|--------------|-----------|----------------------------|----------|------------|------------------|----------------------|----------------------|-----------------|
|              |           | Silt/Clay (%)              | Sand (%) | Gravel (%) |                  |                      |                      |                 |
| BH3          | 2.5 – 3   | 93                         | 7        | -          | 74               | 47                   | 17                   | Silty Clay (CH) |

|      |         |     |    |   |    |    |      |                 |
|------|---------|-----|----|---|----|----|------|-----------------|
| BH4  | 2.5 – 3 | 94  | 6  | - | 78 | 57 | 16.5 | Silty Clay (CH) |
| BH8  | 1 – 1.5 | 89  | 10 | 1 | 71 | 49 | 16.5 | Silty Clay (CH) |
| BH14 | 1.5 – 3 | 100 | -  | - | 62 | 40 | 15.5 | Silty Clay (CH) |
| BH14 | 3.5 – 4 | 99  | 1  | - | 99 | 63 | 21   | Silty Clay (CH) |
| BH16 | 0 – 1.5 | 87  | 8  | 5 | 56 | 33 | 13.5 | Silty Clay (CH) |

## 7.0 EFFECTIVE STRENGTH OF SUBSURFACE CLAY PROFILE

Sinkholes have appeared within the natural extremely reactive clay soils above the weathered rock profile at the Site.

Based on:

- the results of the Quality of Materials test results
- observation of fissured surfaces within the recovered clay samples
- observed dark grey to black colour of the clay soils typically associated with extremely reactive soils

the effective "peak" strength of the natural clays described as a friction angle is estimated at approximately  $20^{\circ}$ , based on results from modelling using computer software programme 'Infinite Slopes'. Presently, the sinkholes appear to be mostly occurring in the natural clay soils above the rock, and an effective strength friction angle of the underlying siltstone rock was not derived for this reason.

After failure, where soil movements have occurred over large horizontal and vertical distances, the "residual" soil strength may be lower than  $10^{\circ}$ , based on our knowledge of the performance of fissured clays in the Brisbane area. The resultant unstable soil mass is then more likely than before failure to undergo future failure events in the form of either landslides or sinkholes, especially after heavy rainfall events. The existing sinkholes are considered a ground failure, and associated natural clay soil friction angles are likely to be between the "peak" and "residual" strength values. The sinkholes may continue to regress up the hillslope and potentially "link" together, increasing the potential for landslip adjacent to the rear boundaries of and within the upslope Blackheath Road and 17 Mile Rocks Road properties. This may lead to costly structural damage on affected properties.

It is noted that the ground surface along the hillslope adjacent to the sinkholes slopes downwards at angles typically ranging between  $10^{\circ}$  and  $17^{\circ}$  and locally up to  $20^{\circ}$ . The ground surface slope in conjunction with groundwater seepages within the natural "springs" have probably led to the formation of the sinkholes, after the passing of many rainfall events over time and resultant soil wetting and drying cycles.

## 8.0 LIKELIHOOD OF FURTHER GROUND FAILURE AND LAND IMPACTS

It is likely that the existing sinkholes will continue to increase in size at the ground surface and below the ground surface over time where left untreated. On this basis, the likelihood of large scale landslips would also increase in time, however it is not possible to accurately determine over what timeframe future land failures would take place, and as to the 'size' of these future land disturbances.

Steep land surfaces, especially greater than  $20^{\circ}$ , in conjunction with areas of uncontrolled water flow, would be most at risk of future land disturbances.

## 9.0 METHODS TO REDUCE GEOTECHNICAL RISK

The following methods to reduce geotechnical risk and likelihood of further instability at the Site are given in order of geotechnical preference as follows:

1. Drain the hillslope and reinstate the existing surficial soils with low reactivity soils (most preferred, low risk)
2. Drain the hillslope only
3. Retain the slope using rock anchors or piles
4. Plant trees within sinkhole areas (least preferred, high risk of further instability)

Each of the methods described above are detailed further in Sections 9.1 to 9.4 inclusive which follow.

### 9.1 Drain the hillslope and reinstate the existing surficial soils

Install surface and subsurface drainage immediately behind the rear boundaries of the Blackheath Road residential properties between 17 Mile Rocks Road to the South, and Cliveden Avenue to the north, and along the rear boundaries between Nos 29 and 67 17 Mile Rocks Road, at a nominal depth of 2m or to intersect the weathered rock surface. Shallower reinstatement depths, say to 300mm could be carried out, however drainage would be required to extent to the weathered rock surface at approximately 2m beneath the ground surface of the hillslope. Excavation depths should be reduced to as little as required. Deep excavations must not be carried out over the hillslope.

Surface drainage could be transported by lined drains at regular intervals along the hillslope. Subsurface drainage, say for example by subsurface pipes wrapped in drainage gravel and suitable geotextile, would collect subsurface water flows along the crest of the hillslope. Surface and subsurface waters should discharge to the base of the hillslope, and connect to the existing stormwater network at Cliveden Avenue near the driveway entrance to the Child Care Centre. The subsurface drains would run down the slope at regular intervals in 'herringbone' type arrangement ensuring that there is some overlap.

Drainage structures must have energy dissipators, and discharge either to a Council approved stormwater system or well downslope of the hill.

Drainage outlets must be located so as not to adversely affect any adjacent property or structure.

All stormwater and drainage systems must be approved by Council.

The adjacent residential properties would require drainage upgrades to connect existing roof-water and water tank overflow into the drainage network to be installed on the NRM property, so as that water is allowed to drain in a controlled manner and discharge from the top to the base of the hillslope. Due to the age of the properties in the area, it is likely most of them were built during a time when Local Council guidelines regarding stormwater drainage were more lenient than currently in place.

The upper 1m soil profile could be reinstated during drainage installation. Earthworks would involve cutting to 1m, removal of the extremely reactive clay soils, and replacement with imported, non dispersive and low reactivity clay material, compacted to 95% Standard Maximum Dry Density at Optimum Moisture Content. "Benching" of the reinstated materials into the hillslope will help allow for compaction and improve the likelihood of slope retention. The imported clay material would have to be tested as being non dispersive and of low reactivity prior to placement.

Testing could include, but not necessarily be limited to:

- Shrink Swell Index (with an Iss value typically  $\leq 2\%$ )

- Particle Size Distribution and Atterberg Limits (with a Liquid Limit  $\leq 50\%$  and Plasticity Index  $\leq 30$ )
- Emerson Class Dispersion (with "non dispersive" test results)

Reinstatement should be carried out in small, "hit and miss" sections along the hillslope, to reduce the potential for further instability and activation of landslips which may affect the upslope and downslope properties. "Hit and miss" sections should be limited to say 20m length sections along the hillslope where possible, with the final section length to be determined by the designer or Principal Contractor. Reinstatement to a depth of say 200mm could be considered where drainage extends between the ground surface and 2m below the ground surface, or to the minimum depth required to intersect the weathered rock below the natural extremely reactive clay soils.

It is noted that removal and replacement using the existing surficial soils was given as a potential treatment measure in our preliminary report. This was based on the assumption that basalt rock was present beneath most of the ground surface based on a desktop review of local geology mapping, and the basalt rock cuttings being mixed in with the natural extremely reactive clay soils to create a material of lower reactivity and relatively impermeable seal at the ground surface. After carrying out a more detailed investigation of the subsurface profile by borehole drilling, it was generally observed that the surficial soils typically only included extremely reactive natural clay soils, with little to no weathered rock in the surface to 1.5m-2m depth profile to allow blending to achieve a low permeability seal material. On this basis, removal and replacement of the existing surficial soils is no longer considered a viable reinstatement option.

Reinstatement of the surficial soils within the sinkhole areas must be carried out at a minimum, however, extending this treatment over the entire hillslope will reduce the risk of future instability across the entire Site area.

Draining and reinstating the hillslope as described in this Section, along with planting new vegetation such as trees, will further reduce the potential of future instability events occurring.

## **9.2 Drain the hillslope only**

Methods to drain the hillslope are outlined in Section 9.1. Refer to Section 9.1 for further information.

## **9.3 Retain the slope using rock anchors or piles**

The installation of rock anchors founding within the weathered rock could be considered to retain the slope. Rock anchor design would be the responsibility of a suitably qualified and reputable structural engineer. This option would likely retain the ground immediately beneath the rear boundaries of the properties along Blackheath Road, but would not affect the existing instability of the upslope areas within the properties themselves or downslope of the retained areas.

The installation of an engineer designed retention system along the crest of the hillslope could also be considered to reduce the risk of instability within the hillslope area adjacent to the rear boundaries of the Blackheath Road and 17 Mile Rocks Road properties, noting that downslope instability may still remain.

## **9.4 Plant trees within sinkhole areas**

Reinstate the sinkhole areas using low permeability and non dispersive clay material compacted to 95% Standard Maximum Dry Density at Optimum Moisture Content. The clay material must be tested as being non dispersive and of low reactivity before placement. Refer to Section 9.1 for the minimum testing requirements.

New trees and shrubs should be planted over the reinstated ground surface.

Trees and vegetation essentially act as a "drainage system" and "remove" subsurface water from the hillslope through evapotranspiration and uptake through the root system in the soil areas adjacent to the vegetation.

Existing vegetation should not be cleared. This applies to any treatment option.

In any case, the underground service pipes at the rear boundaries of the properties listed in Table 2 should be assessed for leaks and fixed where necessary. Water tank overflow and roofwater should all be connected to the upgraded drainage system on the NRM property. This drainage upgrade should apply at a minimum to the properties along the western side of Blackheath Road between Cliveden Avenue and 17 Mile Rocks Road, and along the northern side of 17 Mile Rocks Road between Nos 29 and 67.

## 10.0 COMMUNITY CONSULTATION

At a minimum, residents of the following properties should be informed as to the existing unstable land adjacent to their houses, and potential options being investigated to treat the sinkholes and reduce the potential for future instability:

- Along the western side of Blackheath Road between Cliveden Avenue and 17 Mile Rocks Road; and
- Along the northern side of 17 Mile Rocks Road between Nos 29 and 67.

There are other areas in the Oxley and Corinda area underlain by the Corinda Formation which may be susceptible to future landslip activity, especially in the more steeply sloping areas. The areas mentioned above in the "bullet points" form a guide area only.

## 11.0 LIMITS OF ASSESSMENT

This Report has been prepared by Morrison Geotechnic Pty Ltd (**Morrison Geotechnic**), and may include contributions from Morrison Geotechnic's officers and employees, sub-contractors, sub-consultants or agents (**Contributors**).

This Report is for the sole benefit and use of the QLD Department of Natural Resources and Mines (**Client**) and approved parties for the sole purpose of providing an assessment of alternative treatment options for the sinkholes and future instability at 53 17 Mile Rocks Road and 113 Cliveden Avenue, Oxley (**Project**). The Report is only intended to address those issues expressly described in the scope of work in the Proposal and this Report.

This Report should not be used or relied upon for any other purpose without Morrison Geotechnic's prior written consent. Morrison Geotechnic and the Contributors do not accept any responsibility or liability in any way whatsoever for the use or reliance of this Report by anyone other than the Client or by anyone for any purpose other than that for which it has been prepared.

Except with Morrison Geotechnic's prior written consent, this Report may not be:

- (a) released to any other party, whether in whole or in part (other than to the Client's officers, employees and advisers);
- (b) used or relied upon by any other party; or
- (c) filed with any Governmental agency or other person or quoted or referred to in any public document.

Morrison Geotechnic and the Contributors do not accept any liability or responsibility whatsoever for, or in respect of, any use or reliance upon this Report by any third party. Morrison Geotechnic is not obliged to enter into discussions with any third party in respect of this Report.

The information (including technical information and information obtained through discussions) on which this report is based has been provided by the Client and third parties.

Morrison Geotechnic and the Contributors:

- (a) have relied upon and presumed the accuracy of this information;
- (b) have not verified the accuracy or reliability of this information (other than as expressly stated in this Report);
- (c) have not made any independent investigations or enquiries in respect of those matters of which it has no actual knowledge at the time of giving this Report to the Client; and
- (d) make no warranty or guarantee, expressed or implied, as to the accuracy or reliability of this information.

Morrison Geotechnic and the Contributors do not accept responsibility or liability for any incorrect assumptions related to this Report. For the avoidance of doubt, this Report:

- (a) cannot predict the ground conditions encountered at any untested location because the ground conditions surrounding a test sampling location (or between any two test sampling locations) may be different from the test samples we have obtained
- (b) is not an environmental, contamination or hazardous materials assessment;
- (c) may be invalid, incomplete or inaccurate (including errors in the scope of work, investigation methodology, observations, opinions and advice) where the information provided to Morrison Geotechnic was invalid, incomplete or inaccurate;
- (d) is limited to observations of those parts of the site that were accessible at the time of the field investigation and is not based on observations about areas of the site which were inaccessible to the investigation equipment (including steep slopes, heavily vegetated areas or service corridors); and

- (e) is not a comprehensive representation of the actual site conditions and may only show a reasonable interpretation of conditions encountered at discrete test locations along with general site observations.

No warranty or guarantee, whether express or implied, is made in respect of the geotechnical data, information, advice, opinions and recommendations present in this Report. In recognition of the limited use to be made by the Client of this Report, the Client agrees that, to the maximum extent permitted by law, Morrison Geotechnic and the Contributors shall not be liable for any losses, claims, costs, expenses, damages (whether in statute, in contract or tort for negligence or otherwise) suffered or incurred by the Client or any third party as a result of or in connection with the information, findings, opinions, estimates, recommendations and conclusions provided in the course of this Report.

If further information becomes available, or additional assumptions need to be made, Morrison Geotechnic reserves its right to amend this Report.

Please do not hesitate to contact this office if you require any further information.

Yours faithfully,

sch4p4( 6) Personal information

**R HOWCHIN**

For and on behalf of

**MORRISON GEOTECHNIC PTY LIMITED**

Encl: Appendix A – Site Plan  
Appendix B – Borehole Record Sheets  
Appendix C – Laboratory Test Results  
Appendix D – QUU plans (DBYD Ref No 55174335)  
Important Information about your Geotechnical Engineering Report

# **APPENDIX A**

## **SITE PLAN**

Published on DNRME  
Disclosure Log Act 2009



# **MORRISON GEOTECHNIC PTY LTD**

ABN: 51 009 878 899

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 D.Dragun, S.Wynne &  
 D.Vanderhor  
 Geologists: L.Bexley & R.Howchin  
 Laboratory: M.Morrison

## **LEGEND**

Bore Hole Test Location

|                   |                                                                       |             |               |
|-------------------|-----------------------------------------------------------------------|-------------|---------------|
| Map Description : | <b>BORE HOLE TEST LOCATIONS - (Approximate Only)</b>                  |             |               |
| Client :          | QLD DEPT. OF NATURAL RESOURCES & MINES                                |             |               |
| Project :         | <b>ASSESSMENT OF SUBSURFACE CONDITIONS<br/>BLACKHEATH ROAD, OXLEY</b> |             |               |
| Project No :      | DE16/265                                                              | Drawing No: | DE16/265 - 01 |
|                   |                                                                       | Scale :     | Not to Scale  |

**APPENDIX B**  
**BOREHOLE LOG SHEETS**


**Morrison Geotechnic Pty Ltd**

A.B.N. 051 009 878 899  
PO Box 3063, Darra, QLD 4076  
Phone: (07) 3279 0900 Fax: (07) 3279 0955

**Engineering Log - Borehole**
**Borehole No.: BH1**
**Page: 1 of 2**
**Job Number: DE16/265**
**Client: Qld Dept of Natural Resources & Mines**
**Project: Assessment of Subsurface Conditions**
**Location: Blackheath Road, Oxley**

**Easting:** 497095.00  
**Northing:** 6952705.00  
**RL:**  
**Total Depth:** 6.00

**Drilling Rig:** Jekyll Digga  
**Driller:** Morrison Geotechnic  
**Logged By:** R.Howchin  
**Date:** 05/09/2016

| Drilling Information    |       |     |                | Material Description |             |                     |                                                                                                           |            | Test Samples |                                  |                 |            |       |               |  |    |
|-------------------------|-------|-----|----------------|----------------------|-------------|---------------------|-----------------------------------------------------------------------------------------------------------|------------|--------------|----------------------------------|-----------------|------------|-------|---------------|--|----|
| Drill Method            | Water | RL  | Hole Depth (m) | Soil Origin          | Graphic Log | Classification Code | Description                                                                                               | Weathering | Moisture     | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |  |    |
| 100mm TC Bit with Auger |       |     |                | Natural              |             | CH                  | Sandy CLAY:<br>Hard, high plasticity, grey brown mottled orange brown, fine to medium grained sand, moist |            | M            | H                                | 4               | 0.1 -      | PP    | 420kPa        |  |    |
|                         |       |     |                |                      |             |                     |                                                                                                           | 5          |              |                                  |                 |            |       |               |  |    |
|                         |       |     |                |                      |             |                     |                                                                                                           | 5          |              |                                  |                 |            |       |               |  |    |
|                         |       |     |                |                      |             |                     |                                                                                                           | 4          |              |                                  |                 |            |       |               |  |    |
|                         |       |     |                |                      |             |                     |                                                                                                           | 5          |              |                                  |                 |            |       |               |  |    |
|                         |       |     | 0.5            |                      |             | CH                  | Sandy CLAY:<br>As above but very stiff                                                                    |            | M            | VSt                              | 4               | 0.6 -      | PP    | 320kPa        |  |    |
|                         |       |     |                |                      |             |                     |                                                                                                           | 3          |              |                                  |                 |            |       |               |  |    |
|                         |       |     |                |                      |             |                     |                                                                                                           | 3          |              |                                  |                 |            |       |               |  |    |
|                         |       |     |                |                      |             |                     |                                                                                                           | 3          |              |                                  |                 |            |       |               |  |    |
|                         |       |     |                |                      |             |                     |                                                                                                           | 3          |              |                                  |                 |            |       |               |  |    |
|                         |       |     | 1.0            |                      | 1           | CH                  | Silty CLAY:<br>Very stiff, high plasticity, grey mottled brown, with fine to medium grained sand, moist   |            | M            | VSt                              | 2               | 1.1 -      | PP    | 230kPa        |  |    |
|                         |       |     |                |                      |             |                     |                                                                                                           | 3          |              |                                  |                 |            |       |               |  |    |
|                         |       |     |                |                      |             |                     |                                                                                                           | 2          |              |                                  |                 |            |       |               |  |    |
|                         |       |     |                |                      |             |                     |                                                                                                           | 3          |              |                                  |                 |            |       |               |  |    |
|                         |       |     |                |                      |             |                     |                                                                                                           | 2          |              |                                  |                 |            |       |               |  |    |
|                         |       |     | 1.5            |                      |             | CH                  | Silty CLAY:<br>As above but stiff                                                                         |            | M            | St                               | 1               | 1.6 -      | PP    | 115kPa        |  |    |
|                         |       |     |                |                      |             |                     |                                                                                                           | 2          |              |                                  |                 |            |       |               |  |    |
|                         |       |     |                |                      |             |                     |                                                                                                           | 5          |              |                                  |                 |            |       |               |  |    |
|                         |       |     |                |                      |             |                     |                                                                                                           | 3          |              |                                  |                 |            |       |               |  |    |
|                         |       |     |                |                      |             |                     |                                                                                                           | 3          |              |                                  |                 |            |       |               |  |    |
|                         |       |     | 2.0            |                      |             |                     |                                                                                                           |            |              |                                  |                 | 5          | 2     | D             |  |    |
|                         |       |     |                |                      |             |                     |                                                                                                           |            |              |                                  |                 | 5          |       |               |  |    |
|                         |       |     |                |                      |             |                     |                                                                                                           |            |              |                                  |                 | 8          |       |               |  |    |
|                         |       |     |                |                      |             |                     |                                                                                                           |            |              |                                  |                 | 7          |       |               |  |    |
|                         |       |     |                |                      |             |                     |                                                                                                           |            |              |                                  |                 | 8          |       |               |  |    |
|                         |       |     | 2.5            |                      |             | CH                  | Silty CLAY:<br>As above but with some wet, fine to medium grained sand layers                             |            | W            | St                               | 10              | 2.6 -      | PP    | 110kPa        |  |    |
|                         |       |     |                |                      |             |                     |                                                                                                           |            |              |                                  |                 |            |       |               |  | 8  |
|                         |       |     |                |                      |             |                     |                                                                                                           |            |              |                                  |                 |            |       |               |  | 13 |
|                         |       |     |                |                      |             |                     |                                                                                                           |            |              |                                  |                 |            |       |               |  | 12 |
|                         |       |     |                |                      |             |                     |                                                                                                           |            |              |                                  |                 |            |       |               |  | 15 |
|                         |       | 3.0 |                |                      |             |                     |                                                                                                           |            |              |                                  |                 |            |       |               |  |    |

**Comments:**

Authorised by: .....

Date: .....

| Water                                                                 | Weathering                                                                                                 | Consistency                                                              | Density                                                                 | Rock Strength                                                                                                   | Tests & Results                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Water level<br>on date shown<br>Water inflow<br><br>Water outflow<br> | RS Residual soil<br>XW Extremely weathered<br>DW Distinctly weathered<br>SW Slightly weathered<br>FR Fresh | VS Very soft<br>S Soft<br>F Firm<br>St Stiff<br>VSt Very stiff<br>H Hard | VL Very loose<br>L Loose<br>MD Medium dense<br>D Dense<br>VD Very dense | ELS Extremely low<br>VLS Very low<br>LS Low<br>MS Medium High<br>HS High<br>VHS Very high<br>EHS Extremely high | U50 Undisturbed 50mm diam tube.<br>D Disturbed sample.<br>SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.<br>PP Hand penetrometer estimate of unconfined compressive strength, kPa.<br>S Vane shear value kPa<br>DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.<br>From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
|                                                                       |                                                                                                            | Moisture<br>D Dry M Moist W Wet                                          |                                                                         |                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |


**Morrison Geotechnic Pty Ltd**

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**Engineering Log - Borehole**
**Borehole No.: BH1**
**Page: 2 of 2**
**Job Number:** DE16/265

**Client:** Qld Dept of Natural Resources & Mines

**Project:** Assessment of Subsurface Conditions

**Location:** Blackheath Road, Oxley

**Easting:** 497095.00

**Drilling Rig:** Jehyco Digga

**Northing:** 6952705.00

**Driller:** Morrison Geotechnic

**RL:**
**Logged By:** R.Howchin

**Total Depth:** 6.00

**Date:** 05/09/2016

|                         |       |    |                |                      |             |                     |                                                                                                                                             |            |          |                                  |                 |            |       |               |
|-------------------------|-------|----|----------------|----------------------|-------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------|------------|----------|----------------------------------|-----------------|------------|-------|---------------|
| Drilling Information    |       |    |                | Material Description |             |                     |                                                                                                                                             |            |          | Test Samples                     |                 |            |       |               |
| Drill Method            | Water | RL | Hole Depth (m) | Soil Origin          | Graphic Log | Classification Code | Description                                                                                                                                 | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| 100mm TC Bit with Auger |       |    | 4.0            |                      |             | CH                  | Silty CLAY:<br>As above but wet, fine to medium grained sand layers                                                                         |            | W        | St                               |                 |            |       |               |
|                         |       |    | 4.5            |                      |             | SC                  | Clayey SAND:<br>Estimated Loose to medium dense, fine to medium grained, grey white mottled orange brown, medium plasticity clay fines, wet |            | W        | -L MD                            |                 |            |       |               |
|                         |       |    | 5.0            |                      |             |                     |                                                                                                                                             |            |          |                                  |                 |            |       |               |
|                         |       |    | 6.0            |                      |             |                     | 6.00m: BOREHOLE TERMINATED                                                                                                                  |            |          |                                  |                 |            |       |               |

**Comments:**

Authorised by: .....

Date: .....

| Water                                                            | Weathering                                                                                                 | Consistency                                                              | Density                                                                 | Rock Strength                                                                                              | Tests & Results                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ▼ Water level on date shown<br>► Water inflow<br>► Water outflow | RS Residual soil<br>XW Extremely weathered<br>DW Distinctly weathered<br>SW Slightly weathered<br>FR Fresh | VS Very soft<br>S Soft<br>F Firm<br>St Stiff<br>VSt Very stiff<br>H Hard | VL Very loose<br>L Loose<br>MD Medium dense<br>D Dense<br>VD Very dense | ELS Extremely low<br>VLS Very low<br>LS Low<br>MS Medium<br>HS High<br>VHS Very high<br>EHS Extremely high | U50 Undisturbed 50mm diam tube.<br>D Disturbed sample.<br>SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.<br>PP Hand penetrometer estimate of unconfined compressive strength, kPa.<br>S Vane shear value kPa<br>DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.<br>From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
|                                                                  |                                                                                                            | <b>Moisture</b><br>D Dry M Moist W Wet                                   |                                                                         |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |



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# Engineering Log - Borehole

Borehole No.: **BH2**

Page: 1 of 1

Job Number: DE16/265

Client: Qld Dept of Natural Resources & Mines

Project: Assessment of Subsurface Conditions

Location: Blackheath Road, Oxley

Easting: 497116.00

Drilling Rig: Jehyco Digga

Northing: 6952661.00

Driller: Morrison Geotechnic

RL:

Logged By: R.Howchin

Total Depth: 3.00

Date: 06/09/2016

| Drilling Information    |       |    |                | Material Description |             |                            |                                                                                                                              |            |          | Test Samples                     |                 |            |       |               |
|-------------------------|-------|----|----------------|----------------------|-------------|----------------------------|------------------------------------------------------------------------------------------------------------------------------|------------|----------|----------------------------------|-----------------|------------|-------|---------------|
| Drill Method            | Water | RL | Hole Depth (m) | Soil Origin          | Graphic Log | Classification Code        | Description                                                                                                                  | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| 250mm TC Bit with Auger |       |    | 0.35           | Natural              |             | CH                         | Silty CLAY:<br>Fissured, Very stiff, high plasticity, grey mottled orange brown, trace of fine to medium grained sand, moist |            | M        | VSt                              | 4               | 0.3 -      | PP    | 350kPa        |
|                         |       |    |                |                      |             | 4                          |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             | 4                          |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             | 1                          |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             | 2                          |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             | 1                          |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             | 1                          |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             | 2                          |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             | 2                          |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             | 2                          |                                                                                                                              |            |          |                                  |                 |            |       |               |
| 100mm TC Bit with Auger |       |    | 1.0            |                      |             | CH                         | Silty CLAY:<br>As above but light grey and orange brown                                                                      |            | M        | VSt                              | 3               | 0.6 -      | PP    | 315kPa        |
|                         |       |    |                |                      |             | 2                          |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             | 1                          |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             | 2                          |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             | 2                          |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             | 2                          |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             | 3                          |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             | 3                          |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             | 3                          |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             | 3                          |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    | 1.5            |                      |             | CH                         | Silty CLAY:<br>As above but grey brown                                                                                       |            | M        | VSt                              | 3               | 0.8 -      | D     |               |
|                         |       |    |                |                      |             | 4                          |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    | 2.0            |                      |             |                            |                                                                                                                              |            |          |                                  |                 | 2 -        | PP    | 370kPa        |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    | 2.3            |                      |             | CH                         | Silty CLAY:<br>As above but grey brown mottled orange brown, trace of fine to medium sized gravel (Ironstone)                |            | M        | VSt                              |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    | 2.5            |                      |             | CH                         | Silty CLAY:<br>As above but grey, with extremely low strength siltstone layers, no gravel                                    |            | M        | VSt                              |                 | 2.7 -      | PP    | 300kPa        |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    | 3.0            |                      |             | 3.00m: BOREHOLE TERMINATED |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |
|                         |       |    |                |                      |             |                            |                                                                                                                              |            |          |                                  |                 |            |       |               |

## Comments:

Authorised by: .....

Date: .....

| Water                     | Weathering              | Consistency         | Density         | Rock Strength      | Tests & Results                                                                                                     |
|---------------------------|-------------------------|---------------------|-----------------|--------------------|---------------------------------------------------------------------------------------------------------------------|
| Water level on date shown | RS Residual soil        | VS Very soft        | VL Very loose   | ELS Extremely low  | U50 Undisturbed 50mm diam tube.                                                                                     |
| Water inflow              | XW Extremely weathered  | S Soft              | L Loose         | LS Low             | D Disturbed sample.                                                                                                 |
| Water outflow             | DW Distinctly weathered | F Firm              | MD Medium dense | VLS Very low       | SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.  |
|                           | SW Slightly weathered   | St Stiff            | D Dense         | MS Medium High     | PP Hand penetrometer estimate of unconfined compressive strength, kPa.                                              |
|                           | FR Fresh                | VSt Very stiff      | VD Very dense   | HS High            | S Vane shear value kPa                                                                                              |
|                           |                         | H Hard              |                 | VHS Very high      | DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
|                           |                         |                     |                 | EHS Extremely high | From AS1289-1993 Methods of Testing Soils for Engineering Purposes                                                  |
|                           |                         | Moisture            |                 |                    |                                                                                                                     |
|                           |                         | D Dry M Moist W Wet |                 |                    |                                                                                                                     |


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**Engineering Log - Borehole**
**Borehole No.: BH3**
**Page: 1 of 2**
**Job Number:** DE16/265

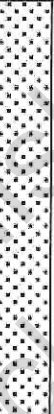
**Client:** Qld Dept of Natural Resources & Mines

**Project:** Assessment of Subsurface Conditions

**Location:** Blackheath Road, Oxley

**Easting:** 497145.00  
**Northing:** 6952606.00  
**RL:**  
**Total Depth:** 6.00

**Drilling Rig:** Jehyco Digga  
**Driller:** Morrison Geotechnic  
**Logged By:** R.Howchin  
**Date:** 05/09/2016

| Drilling Information    |       |    |                | Material Description |                                                                                     |                     |                                                                                                                           |            | Test Samples |                                  |                 |            |       |               |  |
|-------------------------|-------|----|----------------|----------------------|-------------------------------------------------------------------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------|------------|--------------|----------------------------------|-----------------|------------|-------|---------------|--|
| Drill Method            | Water | RL | Hole Depth (m) | Soil Origin          | Graphic Log                                                                         | Classification Code | Description                                                                                                               | Weathering | Moisture     | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |  |
| 100mm TC Bit with Auger |       |    | 1.0            | Natural              |   | CH                  | Silty CLAY:<br>Hard, high plasticity, grey mottled orange brown, trace of fine to medium grained sand (possibly fissured) |            | M            | H                                | 2               | 0.4<br>0.5 | PP    | 420-480kPa    |  |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                           |            |              |                                  | 3               |            |       |               |  |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                           |            |              |                                  | 2               |            |       |               |  |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                           |            |              |                                  | 3               |            |       |               |  |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                           |            |              |                                  | 3               |            |       |               |  |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                           |            |              |                                  | 4               |            |       |               |  |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                           |            |              |                                  | 3               |            |       |               |  |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                           |            |              |                                  | 4               |            |       |               |  |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                           |            |              |                                  | 4               |            |       |               |  |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                           |            |              |                                  | 7               |            |       |               |  |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                           |            |              |                                  | 8               |            |       |               |  |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                           |            |              |                                  | 8               |            |       |               |  |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                           |            |              |                                  | 10              |            |       |               |  |
|                         |       |    | 1.4            | Rock                 |  | SST                 | SANDSTONE:<br>Extremely weathered, extremely low strength, grey mottled orange brown                                      | XW         |              | ELS                              | 17              |            |       |               |  |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                           |            |              |                                  | 18              |            |       |               |  |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                           |            |              |                                  | 17              |            |       |               |  |
|                         |       |    |                | 2.0                  |                                                                                     |                     |                                                                                                                           |            |              |                                  |                 |            |       |               |  |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                           |            |              |                                  |                 |            |       |               |  |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                           |            |              |                                  |                 |            |       |               |  |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                           |            |              |                                  |                 |            |       |               |  |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                           |            |              |                                  |                 |            |       |               |  |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                           |            |              |                                  |                 |            |       |               |  |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                           |            |              |                                  |                 |            |       |               |  |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                           |            |              |                                  |                 |            |       |               |  |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                           |            |              |                                  |                 |            |       |               |  |
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**Comments:**

Authorised by: .....

Date: .....

| Water                                                      | Weathering                                                                                                 | Consistency                                                              | Density                                                                 | Rock Strength                                                                                              | Tests & Results                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Water level on date shown<br>Water inflow<br>Water outflow | RS Residual soil<br>XW Extremely weathered<br>DW Distinctly weathered<br>SW Slightly weathered<br>FR Fresh | VS Very soft<br>S Soft<br>F Firm<br>St Stiff<br>VSt Very stiff<br>H Hard | VL Very loose<br>L Loose<br>MD Medium dense<br>D Dense<br>VD Very dense | ELS Extremely low<br>VLS Very low<br>LS Low<br>MS Medium<br>HS High<br>VHS Very high<br>EHS Extremely high | U50 Undisturbed 50mm diam tube.<br>D Disturbed sample.<br>SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.<br>PP Hand penetrometer estimate of unconfined compressive strength, kPa.<br>S Vane shear value kPa<br>DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.<br>From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
|                                                            |                                                                                                            | <b>Moisture</b><br>D Dry M Moist W Wet                                   |                                                                         |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |



# Morrison Geotechnic Pty Ltd

A.B.N. 051 009 878 899  
PO Box 3063, Darra, QLD 4076  
Phone: (07) 3279 0900 Fax: (07) 3279 0955

## Engineering Log - Borehole

Borehole No.: **BH3**

Page: 2 of 2

Job Number: DE16/265

Client: Qld Dept of Natural Resources & Mines

Project: Assessment of Subsurface Conditions

Location: Blackheath Road, Oxley

Easting: 497145.00

Drilling Rig: Jehyco Digga

Northing: 6952606.00

Driller: Morrison Geotechnic

RL:

Logged By: R.Howchin

Total Depth: 6.00

Date: 05/09/2016

| Drilling Information    |       |    |                | Material Description |                                                                                     |                     |                                                                    |            |          | Test Samples                     |                 |            |       |               |
|-------------------------|-------|----|----------------|----------------------|-------------------------------------------------------------------------------------|---------------------|--------------------------------------------------------------------|------------|----------|----------------------------------|-----------------|------------|-------|---------------|
| Drill Method            | Water | RL | Hole Depth (m) | Soil Origin          | Graphic Log                                                                         | Classification Code | Description                                                        | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| 100mm TC Bit with Auger |       |    | 3.2            | Residual             |    | CH                  | Silty CLAY:<br>Fissured, very stiff, high plasticity, black, moist |            | M        | Vst                              |                 |            |       |               |
|                         |       |    | 3.6            | Rock                 |    | SLT                 | SILTSTONE:<br>Extremely weathered, extremely low strength, grey    | XW         |          | ELS                              |                 |            |       |               |
|                         |       |    | 4.0            |                      |    | SLT                 | SILTSTONE:<br>As above but very low strength                       | XW         |          | VLS                              |                 |            |       |               |
|                         |       |    | 5.0            |                      |   |                     |                                                                    |            |          |                                  |                 |            |       |               |
|                         |       |    | 6.0            |                      |  |                     | 6.00m: BOREHOLE TERMINATED                                         |            |          |                                  |                 |            |       |               |

### Comments:

Authorised by: .....

Date: .....

| Water                                                      | Weathering                                                                                                 | Consistency                                                              | Density                                                                 | Rock Strength                                                                                              | Tests & Results                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Water level on date shown<br>Water inflow<br>Water outflow | RS Residual soil<br>XW Extremely weathered<br>DW Distinctly weathered<br>SW Slightly weathered<br>FR Fresh | VS Very soft<br>S Soft<br>F Firm<br>St Stiff<br>VSt Very stiff<br>H Hard | VL Very loose<br>L Loose<br>MD Medium dense<br>D Dense<br>VD Very dense | ELS Extremely low<br>VLS Very low<br>LS Low<br>MS Medium<br>HS High<br>VHS Very high<br>EHS Extremely high | U50 Undisturbed 50mm diam tube.<br>D Disturbed sample.<br>SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.<br>PP Hand penetrometer estimate of unconfined compressive strength, kPa.<br>S Vane shear value kPa<br>DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.<br>From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
|                                                            |                                                                                                            | Moisture                                                                 |                                                                         |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                            |                                                                                                            | D Dry M Moist W Wet                                                      |                                                                         |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |


**Morrison Geotechnic Pty Ltd**

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**Engineering Log - Borehole**
**Borehole No.: BH4**
**Page: 1 of 1**
**Job Number:** DE16/265

**Client:** Qld Dept of Natural Resources & Mines

**Project:** Assessment of Subsurface Conditions

**Location:** Blackheath Road, Oxley

**Easting:** 497176.00

**Drilling Rig:** Jehyco Digga

**Northing:** 6952570.00

**Driller:** Morrison Geotechnic

**RL:**
**Logged By:** R.Howchin

**Total Depth:** 3.00

**Date:** 06/09/2016

| Drilling Information    |       |    |                | Material Description |             |                                                                                                                     |                                                                                                                                        |            |          | Test Samples                     |                 |            |        |               |  |
|-------------------------|-------|----|----------------|----------------------|-------------|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|------------|----------|----------------------------------|-----------------|------------|--------|---------------|--|
| Drill Method            | Water | RL | Hole Depth (m) | Soil Origin          | Graphic Log | Classification Code                                                                                                 | Description                                                                                                                            | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests  | Sample/Result |  |
| 100mm TC Bit with Auger |       |    | 1.0            | Natural              |             | CH                                                                                                                  | Silty CLAY:<br>Hard, high plasticity, grey, with fine to medium grained sand, moist to dry                                             |            | M-D      | H                                | 6               | 0.1 -      | PP     | 600kPa        |  |
|                         |       |    |                |                      |             |                                                                                                                     |                                                                                                                                        |            |          |                                  | 5               |            |        |               |  |
|                         |       |    |                |                      |             |                                                                                                                     |                                                                                                                                        |            |          |                                  | 7               |            |        |               |  |
|                         |       |    |                |                      |             |                                                                                                                     |                                                                                                                                        |            |          |                                  | 5               |            |        |               |  |
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|                         |       |    |                |                      |             |                                                                                                                     |                                                                                                                                        |            |          |                                  | 8               |            |        |               |  |
|                         |       |    | 1.5            |                      | CH          | Silty CLAY:<br>As above but very stiff, grey with minor orange brown mottling, trace of fine to medium grained sand |                                                                                                                                        | M-D        | Vst      | 6                                | 1.1 -           | PP         | 360kPa |               |  |
|                         |       |    |                |                      |             |                                                                                                                     |                                                                                                                                        |            |          | 5                                |                 |            |        |               |  |
|                         |       |    |                |                      |             |                                                                                                                     |                                                                                                                                        |            |          | 5                                |                 |            |        |               |  |
|                         |       |    |                |                      |             |                                                                                                                     |                                                                                                                                        |            |          | 4                                |                 |            |        |               |  |
|                         |       |    | 2.0            |                      |             |                                                                                                                     |                                                                                                                                        |            |          |                                  |                 |            |        |               |  |
|                         |       |    | 2.3            |                      |             | CH                                                                                                                  | Silty CLAY:<br>As above but grey with orange brown mottling                                                                            |            | M-D      | Vst                              | 5               |            |        |               |  |
|                         |       |    |                |                      |             |                                                                                                                     |                                                                                                                                        |            |          |                                  | 4               |            |        |               |  |
|                         |       |    | 2.5            |                      |             | CH                                                                                                                  | Silty CLAY:<br>As above but increase moisture content, with fine to medium gravel layers, with extremely low strength siltstone layers |            | M        | Vst                              |                 | 2.4 -      | PP     | 230kPa        |  |
|                         |       |    |                |                      |             |                                                                                                                     |                                                                                                                                        |            |          |                                  |                 |            |        |               |  |
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|                         |       |    |                |                      |             |                                                                                                                     |                                                                                                                                        |            |          |                                  |                 |            |        |               |  |

**Comments:**

Authorised by: .....

Date: .....

| Water                                                            | Weathering                                                                                                 | Consistency                                                              | Density                                                                 | Rock Strength                                                                              | Tests & Results                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ▼ Water level on date shown<br>► Water inflow<br>► Water outflow | RS Residual soil<br>XW Extremely weathered<br>DW Distinctly weathered<br>SW Slightly weathered<br>FR Fresh | VS Very soft<br>S Soft<br>F Firm<br>St Stiff<br>VSt Very stiff<br>H Hard | VL Very loose<br>L Loose<br>MD Medium dense<br>D Dense<br>VD Very dense | ELS Extremely low<br>LS Low<br>MS Medium<br>HS High<br>VHS Very high<br>EHS Extremely high | U50 Undisturbed 50mm diam tube.<br>D Disturbed sample.<br>SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.<br>PP Hand penetrometer estimate of unconfined compressive strength, kPa.<br>S Vane shear value kPa<br>DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.<br>From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
|                                                                  |                                                                                                            | <b>Moisture</b><br>D Dry M Moist W Wet                                   |                                                                         |                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |



**Morrison Geotechnic Pty Ltd**

A.B.N. 051 009 878 899  
PO Box 3063, Darra, QLD 4076  
Phone: (07) 3279 0900 Fax: (07) 3279 0955

## Engineering Log - Borehole

Borehole No.: **BH5**

Page: 1 of 2

**Job Number:** DE16/265

**Client:** Qld Dept of Natural Resources & Mines

**Project:** Assessment of Subsurface Conditions

**Location:** Blackheath Road, Oxley

**Easting:** 497139.00

Drilling Rig: Jehyco Digga

Northings: 6952552.00

Driller: Morrison Geotechnical

RL:

Logged By: R.Howchin

Total Depth: 6.00

Date: 05/09/2016

| Drilling Information    |       |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Material Description |             |                     |             |            |          | Test Samples                     |                 |            |       |               |
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| Drill Method            | Water | RL | Hole Depth (m)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Soil Origin          | Graphic Log | Classification Code | Description | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| 100mm TC Bit with Auger |       |    | 0.65<br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br>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|                      |             |                     |             |            |          |                                  |                 |            |       |               |

## Comments:

Authorised by: .....

Date: .....

| Water                                                                                                                                                                                                | Weathering |                      | Consistency |            | Density |              | Rock Strength |                | Tests & Results |                                                                                                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------------|-------------|------------|---------|--------------|---------------|----------------|-----------------|------------------------------------------------------------------------------------------------------------------|
|  Water level<br> on date shown | RS         | Residual soil        | VS          | Very soft  | VL      | Very loose   | ELS           | Extremely low  | U50             | Undisturbed 50mm diam tube.                                                                                      |
|  Water inflow                                                                                                     | XW         | Extremely weathered  | S           | Soft       | L       | Loose        | VLS           | Very low       | D               | Disturbed sample.                                                                                                |
|  Water outflow                                                                                                    | DW         | Distinctly weathered | F           | Firm       | MD      | Medium dense | LS            | Low            | SPT             | Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.   |
|                                                                                                                                                                                                      |            |                      | St          | Stiff      |         |              | MS            | Medium         |                 | Hand penetrometer estimate of unconfined compressive strength, kPa.                                              |
|                                                                                                                                                                                                      |            |                      | VSt         | Very stiff | D       | Dense        | HS            | High           | PP              | Hand penetrometer estimate of unconfined compressive strength, kPa.                                              |
|                                                                                                                                                                                                      |            |                      | H           | Hard       | VD      | Very dense   | EHS           | Extremely high | S               | Vane shear value kPa                                                                                             |
|                                                                                                                                                                                                      | SW         | Slightly weathered   |             |            |         |              | VHS           | Very high      | DC              | Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. |
|                                                                                                                                                                                                      | FR         | Fresh                |             |            |         |              |               |                |                 | From AS1289-1993 Methods of Testing Soils for Engineering Purposes                                               |
|                                                                                                                                                                                                      |            |                      | Moisture    |            |         |              |               |                |                 |                                                                                                                  |
|                                                                                                                                                                                                      |            |                      | D Dry       | M Moist    | W Wet   |              |               |                |                 |                                                                                                                  |


**Morrison Geotechnic Pty Ltd**

A.B.N. 051 009 878 899  
PO Box 3063, Darra, QLD 4076  
Phone: (07) 3279 0900 Fax: (07) 3279 0955

**Engineering Log - Borehole**
**Borehole No.: BH5**
**Page: 2 of 2**
**Job Number:** DE16/265

**Client:** Qld Dept of Natural Resources & Mines

**Project:** Assessment of Subsurface Conditions

**Location:** Blackheath Road, Oxley

**Easting:** 497139.00

**Drilling Rig:** Jehyco Digga

**Northing:** 6952552.00

**Driller:** Morrison Geotechnic

**RL:**
**Logged By:** R.Howchin

**Total Depth:** 6.00

**Date:** 05/09/2016

| Drilling Information    |       |    |                | Material Description       |             |                     |                                                                                                                                    | Test Samples |          |                                  |                 |
|-------------------------|-------|----|----------------|----------------------------|-------------|---------------------|------------------------------------------------------------------------------------------------------------------------------------|--------------|----------|----------------------------------|-----------------|
| Drill Method            | Water | RL | Hole Depth (m) | Soil Origin                | Graphic Log | Classification Code | Description                                                                                                                        | Weathering   | Moisture | Consistency - Density - Strength | DC Test Results |
| 100mm TC Bit with Auger |       |    | 4.0            | Rock                       | SLT         | SLT                 | SILTSTONE:<br>Extremely weathered, extremely low strength, grey mottled orange brown, with extremely low strength sandstone layers | XW           |          | ELS                              |                 |
|                         |       |    | 4.5            | Residual                   | CH          | CH                  | Silty CLAY:<br>Very stiff, high plasticity, brown, trace of fine to medium grained sand, moist                                     |              | M        | VSt                              |                 |
|                         |       |    | 5.0            | Rock                       | SLT         | SLT                 | SILTSTONE:<br>Extremely weathered, extremely low to very low strength, grey, with minor sandstone layering                         | XW           |          | ELS-VLS                          |                 |
|                         |       |    | 6.0            | 6.00m: BOREHOLE TERMINATED |             |                     |                                                                                                                                    |              |          |                                  |                 |

**Comments:**

Authorised by: .....

Date: .....

| Water                                                            | Weathering                                                                                                 | Consistency                                                              | Density                                                                 | Rock Strength                                                                                              | Tests & Results                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ▼ Water level on date shown<br>► Water inflow<br>► Water outflow | RS Residual soil<br>XW Extremely weathered<br>DW Distinctly weathered<br>SW Slightly weathered<br>FR Fresh | VS Very soft<br>S Soft<br>F Firm<br>St Stiff<br>VSt Very stiff<br>H Hard | VL Very loose<br>L Loose<br>MD Medium dense<br>D Dense<br>VD Very dense | ELS Extremely low<br>VLS Very low<br>LS Low<br>MS Medium<br>HS High<br>VHS Very high<br>EHS Extremely high | U50 Undisturbed 50mm diam tube.<br>D Disturbed sample.<br>SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.<br>PP Hand penetrometer estimate of unconfined compressive strength, kPa.<br>S Vane shear value kPa<br>DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.<br>From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
|                                                                  |                                                                                                            | Moisture<br>D Dry M Moist W Wet                                          |                                                                         |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |


**Morrison Geotechnic Pty Ltd**

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**Engineering Log - Borehole**
**Borehole No.: BH6**
**Page: 1 of 1**
**Job Number:** DE16/265

**Client:** Qld Dept of Natural Resources & Mines

**Project:** Assessment of Subsurface Conditions

**Location:** Blackheath Road, Oxley

**Easting:** 497142.00  
**Northing:** 6952511.00  
**RL:**  
**Total Depth:** 3.00

**Drilling Rig:** Jehyco Digga  
**Driller:** Morrison Geotechnic  
**Logged By:** R.Howchin  
**Date:** 06/09/2016

| Drilling Information    |       |    |                | Material Description |             |                     |                                                                                                      |                                                                                                                                | Test Samples |                                  |                 |            |        |               |         |  |  |  |  |  |  |  |  |  |  |
|-------------------------|-------|----|----------------|----------------------|-------------|---------------------|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|--------------|----------------------------------|-----------------|------------|--------|---------------|---------|--|--|--|--|--|--|--|--|--|--|
| Drill Method            | Water | RL | Hole Depth (m) | Soil Origin          | Graphic Log | Classification Code | Description                                                                                          | Weathering                                                                                                                     | Moisture     | Consistency - Density - Strength | DC Test Results | Test Depth | Tests  | Sample/Result |         |  |  |  |  |  |  |  |  |  |  |
| 100mm TC Bit with Auger |       |    |                | Natural              |             | CH                  | Silty CLAY:<br>Hard, high plasticity, grey brown, trace of fine to medium grained sand, moist to dry |                                                                                                                                | M-D          | H                                | 3               | 0.1 -      | PP     | 600kPa        |         |  |  |  |  |  |  |  |  |  |  |
|                         |       |    |                |                      |             |                     |                                                                                                      |                                                                                                                                |              |                                  |                 |            |        |               | 3       |  |  |  |  |  |  |  |  |  |  |
|                         |       |    |                |                      |             |                     |                                                                                                      |                                                                                                                                |              |                                  |                 |            |        |               | 3       |  |  |  |  |  |  |  |  |  |  |
|                         |       |    |                |                      |             |                     |                                                                                                      |                                                                                                                                |              |                                  |                 |            |        |               | 3       |  |  |  |  |  |  |  |  |  |  |
|                         |       |    |                |                      |             |                     |                                                                                                      |                                                                                                                                |              |                                  |                 |            |        |               | 5       |  |  |  |  |  |  |  |  |  |  |
|                         |       |    |                |                      |             |                     |                                                                                                      |                                                                                                                                |              |                                  |                 |            |        |               | 6       |  |  |  |  |  |  |  |  |  |  |
|                         |       |    |                |                      |             |                     |                                                                                                      |                                                                                                                                |              |                                  |                 |            |        |               | 5       |  |  |  |  |  |  |  |  |  |  |
|                         |       |    |                |                      |             |                     |                                                                                                      |                                                                                                                                |              |                                  |                 |            |        |               | 4       |  |  |  |  |  |  |  |  |  |  |
|                         |       |    | 0.8            |                      |             | CH                  | Silty CLAY:<br>As above but very stiff, grey mottled red brown, moist                                | M                                                                                                                              | VSt          | 2                                | 0.9 -           | PP         | 320kPa |               |         |  |  |  |  |  |  |  |  |  |  |
|                         |       |    |                |                      |             |                     |                                                                                                      |                                                                                                                                |              | 1                                |                 |            |        |               |         |  |  |  |  |  |  |  |  |  |  |
|                         |       |    | 1.0            |                      |             |                     | CH                                                                                                   | Silty CLAY:<br>As above but grey                                                                                               |              | M                                | VSt             | 1          | 1.3 -  | PP            | 300kPa  |  |  |  |  |  |  |  |  |  |  |
|                         |       |    |                |                      |             |                     |                                                                                                      |                                                                                                                                |              |                                  |                 | 2          |        |               |         |  |  |  |  |  |  |  |  |  |  |
|                         |       |    |                |                      | 2           |                     |                                                                                                      |                                                                                                                                |              |                                  |                 |            |        |               |         |  |  |  |  |  |  |  |  |  |  |
|                         |       |    |                |                      | 3           |                     |                                                                                                      |                                                                                                                                |              |                                  |                 |            |        |               |         |  |  |  |  |  |  |  |  |  |  |
|                         |       |    | 1.5            |                      |             | CH                  | Silty CLAY:<br>As above but dark grey and grey white, some extremely low strength, siltstone layers  |                                                                                                                                | M            | VSt                              | 3               | 1.6 -      | PP     | 460kPa        |         |  |  |  |  |  |  |  |  |  |  |
|                         |       |    |                |                      |             |                     |                                                                                                      |                                                                                                                                |              |                                  | 3               |            |        |               |         |  |  |  |  |  |  |  |  |  |  |
|                         |       |    |                |                      |             |                     |                                                                                                      |                                                                                                                                |              |                                  | 3               |            |        |               |         |  |  |  |  |  |  |  |  |  |  |
|                         |       |    | 2.0            |                      |             |                     |                                                                                                      |                                                                                                                                |              |                                  |                 |            |        |               |         |  |  |  |  |  |  |  |  |  |  |
|                         |       |    |                |                      |             |                     |                                                                                                      |                                                                                                                                |              |                                  |                 |            |        |               |         |  |  |  |  |  |  |  |  |  |  |
|                         |       |    |                |                      |             |                     |                                                                                                      |                                                                                                                                |              |                                  |                 |            |        |               |         |  |  |  |  |  |  |  |  |  |  |
|                         |       |    | 2.3            |                      | Rock        |                     | CH                                                                                                   | Silty CLAY:<br>As above but grey                                                                                               |              | M                                | VSt             |            | 2.4 -  | PP            | >600kPa |  |  |  |  |  |  |  |  |  |  |
|                         |       |    |                |                      |             |                     |                                                                                                      |                                                                                                                                |              |                                  |                 |            |        |               |         |  |  |  |  |  |  |  |  |  |  |
|                         |       |    |                |                      |             |                     |                                                                                                      |                                                                                                                                |              |                                  |                 |            |        |               |         |  |  |  |  |  |  |  |  |  |  |
|                         |       |    | 2.8            |                      |             |                     | SLT                                                                                                  | SILTSTONE:<br>Extremely weathered, extremely low strength, grey and orange brown, with extremely low strength sandstone layers | XW           |                                  | ELS             |            |        |               |         |  |  |  |  |  |  |  |  |  |  |
|                         |       |    | 3.0            |                      |             |                     |                                                                                                      | 3.00m: BOREHOLE TERMINATED                                                                                                     |              |                                  |                 |            |        |               |         |  |  |  |  |  |  |  |  |  |  |

**Comments:**

Authorised by: .....

Date: .....

| Water                                                            | Weathering                                                                                                 | Consistency                                                              | Density                                                                 | Rock Strength                                                                                              | Tests & Results                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ▼ Water level on date shown<br>► Water inflow<br>► Water outflow | RS Residual soil<br>XW Extremely weathered<br>DW Distinctly weathered<br>SW Slightly weathered<br>FR Fresh | VS Very soft<br>S Soft<br>F Firm<br>St Stiff<br>VSt Very stiff<br>H Hard | VL Very loose<br>L Loose<br>MD Medium dense<br>D Dense<br>VD Very dense | ELS Extremely low<br>VLS Very low<br>LS Low<br>MS Medium<br>HS High<br>VHS Very high<br>EHS Extremely high | U50 Undisturbed 50mm diam tube.<br>D Disturbed sample.<br>SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.<br>PP Hand penetrometer estimate of unconfined compressive strength, kPa.<br>S Vane shear value kPa<br>DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.<br>From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
|                                                                  |                                                                                                            | <b>Moisture</b><br>D Dry M Moist W Wet                                   |                                                                         |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |


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**Engineering Log - Borehole**
**Borehole No.: BH7**
**Page: 1 of 2**
**Job Number:** DE16/265

**Client:** Qld Dept of Natural Resources & Mines

**Project:** Assessment of Subsurface Conditions

**Location:** Blackheath Road, Oxley

**Easting:** 497187.00

**Drilling Rig:** Jehyco Digga

**Northing:** 6952507.00

**Driller:** Morrison Geotechnic

**RL:**
**Logged By:** R.Howchin

**Total Depth:** 6.00

**Date:** 05/09/2016

| Drilling Information    |       |      |                                                                                     | Material Description |                                                                                                             |                     |                                                                                                     |            |          | Test Samples                     |                 |            |       |               |
|-------------------------|-------|------|-------------------------------------------------------------------------------------|----------------------|-------------------------------------------------------------------------------------------------------------|---------------------|-----------------------------------------------------------------------------------------------------|------------|----------|----------------------------------|-----------------|------------|-------|---------------|
| Drill Method            | Water | RL   | Hole Depth (m)                                                                      | Soil Origin          | Graphic Log                                                                                                 | Classification Code | Description                                                                                         | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| 100mm TC Bit with Auger |       |      | 1.0                                                                                 | Natural              |                           | CH                  | Silty CLAY:<br>Very stiff, high plasticity, grey brown, trace of fine to medium grained sand, moist |            | M        | H                                | 4               | 0.35       | PP    | >600kPa       |
|                         | 4     |      |                                                                                     |                      |                                                                                                             |                     |                                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 3     |      |                                                                                     |                      |                                                                                                             |                     |                                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 4     |      |                                                                                     |                      |                                                                                                             |                     |                                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 4     |      |                                                                                     |                      |                                                                                                             |                     |                                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 7     |      |                                                                                     |                      |                                                                                                             |                     |                                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 6     |      |                                                                                     |                      |                                                                                                             |                     |                                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 4     |      |                                                                                     |                      |                                                                                                             |                     |                                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 4     |      |                                                                                     |                      |                                                                                                             |                     |                                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 5     |      |                                                                                     |                      |                                                                                                             |                     |                                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 6     |      |                                                                                     |                      |                                                                                                             |                     |                                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 7     |      |                                                                                     |                      |                                                                                                             |                     |                                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 7     |      |                                                                                     |                      |                                                                                                             |                     |                                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 6     |      |                                                                                     |                      |                                                                                                             |                     |                                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 6     |      |                                                                                     |                      |                                                                                                             |                     |                                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 1.5   | Rock |  | SLT                  | SILTSTONE:<br>Extremely weathered, extremely low strength, grey mottled orange brown, with sandstone layers | XW                  |                                                                                                     | ELS        | 7        |                                  |                 |            |       |               |
|                         |       |      |                                                                                     |                      |                                                                                                             |                     |                                                                                                     |            | 6        |                                  |                 |            |       |               |
|                         |       |      |                                                                                     |                      |                                                                                                             |                     |                                                                                                     |            | 6        |                                  |                 |            |       |               |
|                         | 2.0   |      |                                                                                     |                      |                                                                                                             |                     |                                                                                                     |            |          |                                  |                 |            |       |               |
|                         |       |      |                                                                                     |                      |                                                                                                             |                     |                                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 2.5   |      |  | SLT                  | SILTSTONE:<br>As above but orange brown mottled grey brown                                                  | XW                  |                                                                                                     | ELS        |          |                                  |                 |            |       |               |
|                         |       |      |                                                                                     |                      |                                                                                                             |                     |                                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 3.0   |      |                                                                                     |                      |                                                                                                             |                     |                                                                                                     |            |          |                                  |                 |            |       |               |
|                         |       |      |                                                                                     |                      |                                                                                                             |                     |                                                                                                     |            |          |                                  |                 |            |       |               |

**Comments:**

Authorised by: .....

Date: .....

| Water                                                            | Weathering                                                                                                 | Consistency                                                              | Density                                                                 | Rock Strength                                                                                              | Tests & Results                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ▼ Water level on date shown<br>▲ Water inflow<br>▲ Water outflow | RS Residual soil<br>XW Extremely weathered<br>DW Distinctly weathered<br>SW Slightly weathered<br>FR Fresh | VS Very soft<br>S Soft<br>F Firm<br>St Stiff<br>VSt Very stiff<br>H Hard | VL Very loose<br>L Loose<br>MD Medium dense<br>D Dense<br>VD Very dense | ELS Extremely low<br>VLS Very low<br>LS Low<br>MS Medium<br>HS High<br>VHS Very high<br>EHS Extremely high | U50 Undisturbed 50mm diam tube.<br>D Disturbed sample.<br>SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.<br>PP Hand penetrometer estimate of unconfined compressive strength, kPa.<br>S Vane shear value kPa<br>DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.<br>From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
|                                                                  |                                                                                                            | Moisture<br>D Dry M Moist W Wet                                          |                                                                         |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |


**Morrison Geotechnic Pty Ltd**

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**Engineering Log - Borehole**
**Borehole No.: BH7**
**Page: 2 of 2**
**Job Number:** DE16/265

**Client:** Qld Dept of Natural Resources & Mines

**Project:** Assessment of Subsurface Conditions

**Location:** Blackheath Road, Oxley

**Easting:** 497187.00

**Drilling Rig:** Jehyco Digga

**Northing:** 6952507.00

**Driller:** Morrison Geotechnic

**RL:**
**Logged By:** R.Howchin

**Total Depth:** 6.00

**Date:** 05/09/2016

| Drilling Information    |       |    |                | Material Description |             |                                                             |                                                                                                                |            |          | Test Samples                     |                 |            |       |               |        |
|-------------------------|-------|----|----------------|----------------------|-------------|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|------------|----------|----------------------------------|-----------------|------------|-------|---------------|--------|
| Drill Method            | Water | RL | Hole Depth (m) | Soil Origin          | Graphic Log | Classification Code                                         | Description                                                                                                    | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |        |
| 100mm TC Bit with Auger |       |    | 3              | Residual             |             | CH                                                          | Silty CLAY:<br>Very stiff, high plasticity, orange brown mottled grey brown, trace of fine grained sand, moist |            | M        | Vst                              |                 | 3.2 -      | PP    | 300kPa        |        |
|                         |       |    | 3.5            |                      | CH          | Silty CLAY:<br>As above but grey                            |                                                                                                                | M          | Vst      |                                  |                 |            |       |               |        |
|                         |       |    | 4.0            |                      |             |                                                             |                                                                                                                |            |          |                                  |                 |            |       |               |        |
|                         |       |    | 5.0            |                      |             |                                                             |                                                                                                                |            |          |                                  |                 |            | 4.8 - | PP            | 330kPa |
|                         |       |    | 5.5            |                      | CH          | Silty CLAY:<br>As above but grey brown mottled orange brown |                                                                                                                | M          | Vst      |                                  |                 |            |       |               |        |
|                         |       |    | 6.0            |                      |             |                                                             | 6.00m: BOREHOLE TERMINATED                                                                                     |            |          |                                  |                 |            |       |               |        |

**Comments:**

Authorised by: .....

Date: .....

| Water                                                            | Weathering                                                                                                 | Consistency                                                              | Density                                                                 | Rock Strength                                                                                              | Tests & Results                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ▼ Water level on date shown<br>► Water inflow<br>► Water outflow | RS Residual soil<br>XW Extremely weathered<br>DW Distinctly weathered<br>SW Slightly weathered<br>FR Fresh | VS Very soft<br>S Soft<br>F Firm<br>St Stiff<br>VSt Very stiff<br>H Hard | VL Very loose<br>L Loose<br>MD Medium dense<br>D Dense<br>VD Very dense | ELS Extremely low<br>VLS Very low<br>LS Low<br>MS Medium<br>HS High<br>VHS Very high<br>EHS Extremely high | U50 Undisturbed 50mm diam tube.<br>D Disturbed sample.<br>SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.<br>PP Hand penetrometer estimate of unconfined compressive strength, kPa.<br>S Vane shear value kPa<br>DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.<br>From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
|                                                                  |                                                                                                            | <b>Moisture</b><br>D Dry M Moist W Wet                                   |                                                                         |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |



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## Engineering Log - Borehole

**Borehole No.: BH8**

Page: 1 of 2

Job Number: DE16/265

**Client:** Qld Dept of Natural Resources & Mines

**Project:** Assessment of Subsurface Conditions

**Location:** Blackheath Road, Oxley

Easting: 497141.00

Drilling Rig: Jehyco Digga

Northings: 6952447.00

Driller: Morrison Geotechnic

RL:

Logged By: R.Howchin

Total Depth: 6.00

Date: 05/09/2016

[illegible]

|              |                              |                   |                         |                    |            |                |                 |                      |                   |                                     |                                                                                                                     |
|--------------|------------------------------|-------------------|-------------------------|--------------------|------------|----------------|-----------------|----------------------|-------------------|-------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Comments:    |                              |                   |                         |                    |            |                |                 |                      |                   | Authorised by: .....<br>Date: ..... |                                                                                                                     |
| <b>Water</b> |                              | <b>Weathering</b> |                         | <b>Consistency</b> |            | <b>Density</b> |                 | <b>Rock Strength</b> |                   | <b>Tests &amp; Results</b>          |                                                                                                                     |
| ▼            | Water level<br>on date shown | RS                | Residual<br>soil        | VS                 | Very soft  | VL             | Very loose      | ELS                  | Extremely<br>low  | U50                                 | Undisturbed 50mm diam tube.                                                                                         |
| —            |                              | XW                | Extremely<br>weathered  | S                  | Soft       | L              | Loose           |                      |                   | D                                   | Disturbed sample.                                                                                                   |
| ▶            | Water inflow                 | DW                | Distinctly<br>weathered | F                  | Firm       | MD             | Medium<br>dense | VLS                  | Very low          | SPT                                 | Standard Penetration Test, N = number of blows to drive 50mm sampler<br>300mm with a 63.6kg hammer falling 762mm.   |
|              |                              |                   |                         | VSt                | Stiff      |                |                 | LS                   | Low               |                                     |                                                                                                                     |
| ▶            | Water outflow                | SW                | Slightly<br>weathered   | H                  | Very stiff | D              | Dense           | MS                   | Medium            | PP                                  | Hand penetrometer estimate of unconfined compressive strength, kPa.                                                 |
|              |                              |                   |                         |                    | Hard       | VD             | Very dense      | HS                   | High              | S                                   | Vane shear value kPa                                                                                                |
|              |                              | FR                | Fresh                   | <b>Moisture</b>    |            |                |                 | VHS                  | Very high         | DC                                  | Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg<br>taper cone fitted to rods of smaller section. |
|              |                              |                   |                         | D                  | Dry        | M              | Moist           | EHS                  | Extremely<br>high |                                     | From AS1289-1993 Methods of Testing Soils for Engineering Purposes                                                  |
|              |                              |                   |                         | W                  | Wet        |                |                 |                      |                   |                                     |                                                                                                                     |



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## Engineering Log - Borehole

Borehole No.: **BH8**

Page: 2 of 2

Job Number: DE16/265

Client: Qld Dept of Natural Resources & Mines

Project: Assessment of Subsurface Conditions

Location: Blackheath Road, Oxley

Easting: 497141.00

Drilling Rig: Jeyhco Digga

Northing: 6952447.00

Driller: Morrison Geotechnic

RL:

Logged By: R.Howchin

Total Depth: 6.00

Date: 05/09/2016

| Drilling Information    |       |    |                | Material Description |             |                     |                                                                                                                 |            |          | Test Samples                     |                 |            |   |       |               |
|-------------------------|-------|----|----------------|----------------------|-------------|---------------------|-----------------------------------------------------------------------------------------------------------------|------------|----------|----------------------------------|-----------------|------------|---|-------|---------------|
| Drill Method            | Water | RL | Hole Depth (m) | Soil Origin          | Graphic Log | Classification Code | Description                                                                                                     | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | D | Tests | Sample/Result |
| 100mm TC Bit with Auger |       |    | 4.0            |                      |             | CH                  | Silty CLAY:<br>As above but very stiff, grey mottled orange brown, some extremely low strength siltstone layers |            | M        | Vst                              |                 |            |   |       |               |
|                         |       |    | 5.0            |                      |             |                     |                                                                                                                 |            |          |                                  |                 |            |   |       |               |
|                         |       |    | 6.0            |                      |             |                     |                                                                                                                 |            |          |                                  |                 |            |   |       |               |
|                         |       |    |                |                      |             |                     |                                                                                                                 |            |          |                                  |                 |            |   |       |               |
|                         |       |    |                |                      |             |                     |                                                                                                                 |            |          |                                  |                 |            |   |       |               |
|                         |       |    |                |                      |             |                     |                                                                                                                 |            |          |                                  |                 |            |   |       |               |
|                         |       |    |                |                      |             |                     |                                                                                                                 |            |          |                                  |                 |            |   |       |               |
|                         |       |    |                |                      |             |                     |                                                                                                                 |            |          |                                  |                 |            |   |       |               |
|                         |       |    |                |                      |             |                     |                                                                                                                 |            |          |                                  |                 |            |   |       |               |
|                         |       |    |                |                      |             |                     |                                                                                                                 |            |          |                                  |                 |            |   |       |               |
|                         |       |    |                |                      |             |                     | 6.00m: BOREHOLE TERMINATED                                                                                      |            |          |                                  |                 |            |   |       |               |

### Comments:

Authorised by: .....

Date: .....

| Water                                                                                              | Weathering                                                                                                 | Consistency                                                              | Density                                                                 | Rock Strength                                                                                              | Tests & Results                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div> <div>Water level on date shown</div> <div>Water inflow</div> <div>Water outflow</div> </div> | RS Residual soil<br>XW Extremely weathered<br>DW Distinctly weathered<br>SW Slightly weathered<br>FR Fresh | VS Very soft<br>S Soft<br>F Firm<br>St Stiff<br>VSt Very stiff<br>H Hard | VL Very loose<br>L Loose<br>MD Medium dense<br>D Dense<br>VD Very dense | ELS Extremely low<br>VLS Very low<br>LS Low<br>MS Medium<br>HS High<br>VHS Very high<br>EHS Extremely high | U50 Undisturbed 50mm diam tube.<br>D Disturbed sample.<br>SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.<br>PP Hand penetrometer estimate of unconfined compressive strength, kPa.<br>S Vane shear value kPa.<br>DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.<br>From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
|                                                                                                    |                                                                                                            | Moisture<br>D Dry M Moist W Wet                                          |                                                                         |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |


**Morrison Geotechnic Pty Ltd**

A.B.N. 051 009 878 899  
PO Box 3063, Darra, QLD 4076  
Phone: (07) 3279 0900 Fax: (07) 3279 0955

**Engineering Log - Borehole**
**Borehole No.: BH9**
**Page: 1 of 1**
**Job Number:** DE16/265

**Client:** Qld Dept of Natural Resources & Mines

**Project:** Assessment of Subsurface Conditions

**Location:** Blackheath Road, Oxley

**Easting:** 497182.00

**Drilling Rig:** Jehyco Digga

**Northing:** 6952445.00

**Driller:** Morrison Geotechnic

**RL:**
**Logged By:** R.Howchin

**Total Depth:** 3.00

**Date:** 06/09/2016

| Drilling Information    |       |    |                | Material Description |             |                     |                                                                                                                        |                                                                             |          | Test Samples                     |                 |            |       |               |   |
|-------------------------|-------|----|----------------|----------------------|-------------|---------------------|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|----------|----------------------------------|-----------------|------------|-------|---------------|---|
| Drill Method            | Water | RL | Hole Depth (m) | Soil Origin          | Graphic Log | Classification Code | Description                                                                                                            | Weathering                                                                  | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |   |
| 100mm TC Bit with Auger |       |    |                | Natural              |             | CH                  | Silty CLAY:<br>Hard, high plasticity, dark grey mottled red brown, moist                                               |                                                                             | M        | H                                | 3               | 0.4        | PP    | >600kPa       |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               | 4 |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               | 3 |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               | 4 |
|                         |       |    | 0.5            |                      |             | CH                  | Silty CLAY:<br>As above but with extremely low strength siltstone layers                                               |                                                                             | M        | H                                | 4               |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               | 6 |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               | 7 |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               | 7 |
|                         |       |    | 1.0            |                      |             |                     |                                                                                                                        |                                                                             |          |                                  | 6               |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  | 4               |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  | 7               |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  | 6               |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          | 5                                |                 |            |       |               |   |
|                         |       |    | 1.6            |                      |             |                     |                                                                                                                        |                                                                             |          |                                  | 3               |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  | 4               |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  | 4               |            |       |               |   |
|                         |       |    |                | Rock                 |             | BAS                 | BASALT:<br>Extremely weathered, extremely low strength, orange brown with grey extremely low strength siltstone layers | XW                                                                          |          | ELS                              | 9               |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       | 10            |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       | 14            |   |
|                         |       |    | 1.9            |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    | 2.0            |                      |             |                     | BAS                                                                                                                    | BASALT:<br>As above but orange brown mottled red brown, no siltstone layers | XW       |                                  | ELS             |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
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|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
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|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
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|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
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|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
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|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
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|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
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|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |
|                         |       |    |                |                      |             |                     |                                                                                                                        |                                                                             |          |                                  |                 |            |       |               |   |

**Comments:**

Authorised by: .....

Date: .....

| Water                                                      | Weathering                                                                                                 | Consistency                                                              | Density                                                                 | Rock Strength                                                                                              | Tests & Results                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Water level on date shown<br>Water inflow<br>Water outflow | RS Residual soil<br>XW Extremely weathered<br>DW Distinctly weathered<br>SW Slightly weathered<br>FR Fresh | VS Very soft<br>S Soft<br>F Firm<br>St Stiff<br>VSt Very stiff<br>H Hard | VL Very loose<br>L Loose<br>MD Medium dense<br>D Dense<br>VD Very dense | ELS Extremely low<br>VLS Very low<br>LS Low<br>MS Medium<br>HS High<br>VHS Very high<br>EHS Extremely high | U50 Undisturbed 50mm diam tube.<br>D Disturbed sample.<br>SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.<br>PP Hand penetrometer estimate of unconfined compressive strength, kPa.<br>S Vane shear value kPa<br>DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.<br>From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
|                                                            |                                                                                                            | <b>Moisture</b><br>D Dry M Moist W Wet                                   |                                                                         |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |


**Morrison Geotechnic Pty Ltd**

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**Engineering Log - Borehole**
**Borehole No.: BH10**
**Page: 1 of 1**
**Job Number:** DE16/265

**Client:** Qld Dept of Natural Resources & Mines

**Project:** Assessment of Subsurface Conditions

**Location:** Blackheath Road, Oxley

**Easting:** 497107.00

**Drilling Rig:** Jehyco Digga

**Northing:** 6952384.00

**Driller:** Morrison Geotechnic

**RL:**
**Logged By:** R.Howchin

**Total Depth:** 3.00

**Date:** 06/09/2016

| Drilling Information    |       |     |                | Material Description |                                                                                     |                                                                                                           |                                                                                     |            |          | Test Samples                     |                 |            |       |               |
|-------------------------|-------|-----|----------------|----------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------------|----------|----------------------------------|-----------------|------------|-------|---------------|
| Drill Method            | Water | RL  | Hole Depth (m) | Soil Origin          | Graphic Log                                                                         | Classification Code                                                                                       | Description                                                                         | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| 100mm TC Bit with Auger |       |     | 0.5            | Natural              |   | ML                                                                                                        | Sandy SILT:<br>Hard, low plasticity, grey brown, fine to medium grained sand, moist |            | M        | H                                | 4               | 0.2 -      | PP    | 460kPa        |
|                         | 8     |     |                |                      |                                                                                     |                                                                                                           |                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 4     |     |                |                      |                                                                                     |                                                                                                           |                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 3     |     |                |                      |                                                                                     |                                                                                                           |                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 4     |     |                |                      |                                                                                     |                                                                                                           |                                                                                     |            |          |                                  |                 |            |       |               |
|                         |       |     | 1.0            |                      |    | ML                                                                                                        | Sandy SILT:<br>As above but grey white and brown                                    |            | M        | H                                | 3               | 0.6 -      | PP    | >600kPa       |
|                         | 6     |     |                |                      |                                                                                     |                                                                                                           |                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 5     |     |                |                      |                                                                                     |                                                                                                           |                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 6     |     |                |                      |                                                                                     |                                                                                                           |                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 8     |     |                |                      |                                                                                     |                                                                                                           |                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 6     |     |                |                      |                                                                                     |                                                                                                           |                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 6     |     |                |                      |                                                                                     |                                                                                                           |                                                                                     |            |          |                                  |                 |            |       |               |
|                         | 8     |     |                |                      |                                                                                     |                                                                                                           |                                                                                     |            |          |                                  |                 |            |       |               |
|                         |       |     | 1.3            |                      |  | ML                                                                                                        | Sandy SILT:<br>As above but with orange brown, extremely weathered basalt layers    |            | M        | H                                | 7               |            |       |               |
|                         | 7     |     |                |                      |                                                                                     |                                                                                                           |                                                                                     |            |          |                                  |                 |            |       |               |
|                         |       |     | 1.5            | Rock                 |  | SLT                                                                                                       | SILTSTONE:<br>Extremely weathered, extremely low strength, grey                     | XW         |          | ELS                              | 10              |            |       |               |
|                         | 10    |     |                |                      |                                                                                     |                                                                                                           |                                                                                     |            |          |                                  |                 |            |       |               |
|                         |       |     |                |                      |                                                                                     |                                                                                                           |                                                                                     |            |          |                                  |                 |            |       |               |
|                         |       |     | 2.0            |                      |  |                                                                                                           |                                                                                     |            |          |                                  |                 |            |       |               |
|                         |       |     |                |                      |                                                                                     |                                                                                                           |                                                                                     |            |          |                                  |                 |            |       |               |
|                         |       |     |                |                      |                                                                                     |                                                                                                           |                                                                                     |            |          |                                  |                 |            |       |               |
|                         |       |     |                |                      |                                                                                     |                                                                                                           |                                                                                     |            |          |                                  |                 |            |       |               |
|                         |       | 2.2 |                |                      | SLT                                                                                 | SILTSTONE:<br>As above but very low strength, grey mottled orange brown, with basalt and sandstone layers | XW                                                                                  |            | VLS      |                                  |                 |            |       |               |
|                         |       | 2.4 |                |                      | SLT                                                                                 | SILTSTONE:<br>As above but extremely low strength                                                         | XW                                                                                  |            | ELS      |                                  |                 |            |       |               |
|                         |       | 2.6 |                |                      | SLT                                                                                 | SILTSTONE:<br>As above but very low strength                                                              | XW                                                                                  |            | VLS      |                                  |                 |            |       |               |
|                         |       | 3.0 |                |                      |                                                                                     | 3.00m: BOREHOLE TERMINATED                                                                                |                                                                                     |            |          |                                  |                 |            |       |               |

**Comments:**

Authorised by: .....

Date: .....

| Water                                                      | Weathering                                                                                                 | Consistency                                                              | Density                                                                 | Rock Strength                                                                                              | Tests & Results                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Water level on date shown<br>Water inflow<br>Water outflow | RS Residual soil<br>XW Extremely weathered<br>DW Distinctly weathered<br>SW Slightly weathered<br>FR Fresh | VS Very soft<br>S Soft<br>F Firm<br>St Stiff<br>VSt Very stiff<br>H Hard | VL Very loose<br>L Loose<br>MD Medium dense<br>D Dense<br>VD Very dense | ELS Extremely low<br>VLS Very low<br>LS Low<br>MS Medium<br>HS High<br>VHS Very high<br>EHS Extremely high | U50 Undisturbed 50mm diam tube.<br>D Disturbed sample.<br>SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.<br>PP Hand penetrometer estimate of unconfined compressive strength, kPa.<br>S Vane shear value kPa<br>DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.<br>From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
|                                                            |                                                                                                            | <b>Moisture</b><br>D Dry M Moist W Wet                                   |                                                                         |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |


**Morrison Geotechnic Pty Ltd**

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**Engineering Log - Borehole**
**Borehole No.: BH11**
**Page: 1 of 2**
**Job Number:** DE16/265

**Client:** Qld Dept of Natural Resources & Mines

**Project:** Assessment of Subsurface Conditions

**Location:** Blackheath Road, Oxley

**Easting:** 497165.00

**Drilling Rig:** Jehyco Digga

**Northing:** 6952368.00

**Driller:** Morrison Geotechnic

**RL:**
**Logged By:** R.Howchin

**Total Depth:** 6.00

**Date:** 05/09/2016

| Drilling Information    |       |     |                | Material Description |             |                     |                                                                                                                      |            |          | Test Samples                     |                 |            |       |               |   |
|-------------------------|-------|-----|----------------|----------------------|-------------|---------------------|----------------------------------------------------------------------------------------------------------------------|------------|----------|----------------------------------|-----------------|------------|-------|---------------|---|
| Drill Method            | Water | RL  | Hole Depth (m) | Soil Origin          | Graphic Log | Classification Code | Description                                                                                                          | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |   |
| 100mm TC Bit with Auger |       |     |                | Natural              |             | CH                  | Silty CLAY:<br>Hard, high plasticity, dark red brown mottled grey, trace of fine to medium grained sand, moist       |            | M        | H                                | 5               | 0.1 –      | PP    | >600kPa       |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  | 4               |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  | 4               |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  | 3               |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  | 2               |            |       |               |   |
|                         |       |     | 0.5            |                      |             | CH                  | Silty CLAY:<br>As above but grey mottled orange brown, increased moisture content                                    |            | M        | H                                | 3               | 0.6 –      | PP    | 430kPa        |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               | 2 |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               | 3 |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               | 4 |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               | 5 |
|                         |       |     | 1.0            |                      |             | CH                  | Silty CLAY:<br>As above but dark grey, decrease in moisture content                                                  |            | M        | H                                | 6               | 1.1 –      | PP    | >600kPa       |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               | 7 |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               | 7 |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               | 6 |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               | 7 |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  | 8               |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  | 6               |            |       |               |   |
|                         |       | 1.8 |                | Rock                 |             | SLT                 | SILTSTONE:<br>Extremely weathered, extremely low strength, grey mottled orange brown, some clay and sandstone layers | XW         |          | ELS                              |                 |            |       |               |   |
|                         |       | 2.0 |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
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|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
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|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
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|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |
|                         |       |     |                |                      |             |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |   |

**Comments:**

Authorised by: .....

Date: .....

| Water                                                      | Weathering                                                                                                 | Consistency                                                              | Density                                                                 | Rock Strength                                                                                              | Tests & Results                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Water level on date shown<br>Water inflow<br>Water outflow | RS Residual soil<br>XW Extremely weathered<br>DW Distinctly weathered<br>SW Slightly weathered<br>FR Fresh | VS Very soft<br>S Soft<br>F Firm<br>St Stiff<br>VSt Very stiff<br>H Hard | VL Very loose<br>L Loose<br>MD Medium dense<br>D Dense<br>VD Very dense | ELS Extremely low<br>VLS Very low<br>LS Low<br>MS Medium<br>HS High<br>VHS Very high<br>EHS Extremely high | U50 Undisturbed 50mm diam tube.<br>D Disturbed sample.<br>SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.<br>PP Hand penetrometer estimate of unconfined compressive strength, kPa.<br>S Vane shear value kPa<br>DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.<br>From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
|                                                            |                                                                                                            | Moisture<br>D Dry M Moist W Wet                                          |                                                                         |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |


**Morrison Geotechnic Pty Ltd**

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**Engineering Log - Borehole**
**Borehole No.: BH11**
**Page: 2 of 2**
**Job Number:** DE16/265

**Client:** Qld Dept of Natural Resources & Mines

**Project:** Assessment of Subsurface Conditions

**Location:** Blackheath Road, Oxley

**Easting:** 497165.00

**Drilling Rig:** Jehyco Digga

**Northing:** 6952368.00

**Driller:** Morrison Geotechnic

**RL:**
**Logged By:** R.Howchin

**Total Depth:** 6.00

**Date:** 05/09/2016

| Drilling Information       |       |    |                | Material Description |                                                                                     |                     |                                                                                                                      |            |          | Test Samples                     |                 |            |       |               |
|----------------------------|-------|----|----------------|----------------------|-------------------------------------------------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------|------------|----------|----------------------------------|-----------------|------------|-------|---------------|
| Drill Method               | Water | RL | Hole Depth (m) | Soil Origin          | Graphic Log                                                                         | Classification Code | Description                                                                                                          | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| 100mm TC Bit with Auger    |       |    | 4.0            | Rock                 |   | SLT                 | SILTSTONE:<br>Extremely weathered, extremely low strength, grey mottled orange brown, some clay and sandstone layers | XW         |          | ELS                              |                 |            |       |               |
|                            |       |    | 4.5            |                      |                                                                                     | SLT                 | SILTSTONE:<br>As above but grey mottled orange brown and red brown, no sandstone layers                              | XW         |          | ELS                              | 4.5             |            |       |               |
|                            |       |    | 5.0            |                      |  |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |
|                            |       |    | 6.0            |                      |                                                                                     |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |
| 6.00m: BOREHOLE TERMINATED |       |    |                |                      |                                                                                     |                     |                                                                                                                      |            |          |                                  |                 |            |       |               |

**Comments:**

Authorised by: .....

Date: .....

| Water                                                      | Weathering                                                                                                 | Consistency                                                              | Density                                                                 | Rock Strength                                                                                              | Tests & Results                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Water level on date shown<br>Water inflow<br>Water outflow | RS Residual soil<br>XW Extremely weathered<br>DW Distinctly weathered<br>SW Slightly weathered<br>FR Fresh | VS Very soft<br>S Soft<br>F Firm<br>St Stiff<br>VSt Very stiff<br>H Hard | VL Very loose<br>L Loose<br>MD Medium dense<br>D Dense<br>VD Very dense | ELS Extremely low<br>VLS Very low<br>LS Low<br>MS Medium<br>HS High<br>VHS Very high<br>EHS Extremely high | U50 Undisturbed 50mm diam tube.<br>D Disturbed sample.<br>SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.<br>PP Hand penetrometer estimate of unconfined compressive strength, kPa.<br>S Vane shear value kPa<br>DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.<br>From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
|                                                            |                                                                                                            | Moisture<br>D Dry M Moist W Wet                                          |                                                                         |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |


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**Engineering Log - Borehole**
**Borehole No.: BH12**
**Page: 1 of 2**
**Job Number:** DE16/265

**Client:** Qld Dept of Natural Resources & Mines

**Project:** Assessment of Subsurface Conditions

**Location:** Blackheath Road, Oxley

**Easting:** 497057.00  
**Northing:** 6952362.00  
**RL:**  
**Total Depth:** 6.00

**Drilling Rig:** Jekyll Digga  
**Driller:** Morrison Geotechnic  
**Logged By:** R.Howchin  
**Date:** 05/09/2016

| Drilling Information    |       |    |                | Material Description |                                                                                     |                     |                                                                                                                                      |            |          | Test Samples                     |                 |            |       |               |  |                                                                                   |    |
|-------------------------|-------|----|----------------|----------------------|-------------------------------------------------------------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------|------------|----------|----------------------------------|-----------------|------------|-------|---------------|--|-----------------------------------------------------------------------------------|----|
| Drill Method            | Water | RL | Hole Depth (m) | Soil Origin          | Graphic Log                                                                         | Classification Code | Description                                                                                                                          | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |  |                                                                                   |    |
| 100mm TC Bit with Auger |       |    | 0.5            | Natural              |    | ML                  | Sandy SILT:<br>Hard, low plasticity, dark red brown, fine to medium grained sand, trace of fine to medium sized gravel, moist to dry |            | M-D      | H                                | 3               |            |       |               |  |                                                                                   |    |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                                      |            |          |                                  | 4               |            |       |               |  |                                                                                   |    |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                                      |            |          |                                  | 5               |            |       |               |  |                                                                                   |    |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                                      |            |          |                                  | 4               |            |       |               |  |                                                                                   |    |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                                      |            |          |                                  | 6               |            |       |               |  |                                                                                   |    |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                                      |            |          |                                  | 1.0             |            |       |               |  |  | ML |
|                         |       |    | 5              |                      |                                                                                     |                     |                                                                                                                                      |            |          |                                  |                 |            |       |               |  |                                                                                   |    |
|                         |       |    | 7              |                      |                                                                                     |                     |                                                                                                                                      |            |          |                                  |                 |            |       |               |  |                                                                                   |    |
|                         |       |    | 6              |                      |                                                                                     |                     |                                                                                                                                      |            |          |                                  |                 |            |       |               |  |                                                                                   |    |
|                         |       |    | 6              |                      |                                                                                     |                     |                                                                                                                                      |            |          |                                  |                 |            |       |               |  |                                                                                   |    |
|                         |       |    | 8              |                      |                                                                                     |                     |                                                                                                                                      |            |          |                                  |                 |            |       |               |  |                                                                                   |    |
|                         |       |    | 1.5            | Rock                 |   | SLT                 | SILTSTONE:<br>Extremely weathered, very low strength, grey                                                                           | XW         |          | VLS                              | 7               |            |       |               |  |                                                                                   |    |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                                      |            |          |                                  | 7               |            |       |               |  |                                                                                   |    |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                                      |            |          |                                  | 10              |            |       |               |  |                                                                                   |    |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                                      |            |          |                                  | 10              |            |       |               |  |                                                                                   |    |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                                      |            |          |                                  | 14              |            |       |               |  |                                                                                   |    |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                                      |            |          |                                  | 19              |            |       |               |  |                                                                                   |    |
|                         |       |    | 2.0            |                      |  |                     |                                                                                                                                      |            |          |                                  |                 |            |       |               |  |                                                                                   |    |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                                      |            |          |                                  |                 |            |       |               |  |                                                                                   |    |
|                         |       |    | 2.8            |                      |  | SLT                 | SILTSTONE:<br>As above but grey mottled orange brown                                                                                 | XW         |          | VLS                              |                 |            |       |               |  |                                                                                   |    |
|                         |       |    |                |                      |                                                                                     |                     |                                                                                                                                      |            |          |                                  |                 |            |       |               |  |                                                                                   |    |
|                         |       |    | 3.0            |                      |                                                                                     |                     |                                                                                                                                      |            |          |                                  |                 |            |       |               |  |                                                                                   |    |

**Comments:**

Authorised by: .....

Date: .....

| Water                                                            | Weathering                                                                                                 | Consistency                                                              | Density                                                                 | Rock Strength                                                                                              | Tests & Results                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ▼ Water level on date shown<br>► Water inflow<br>► Water outflow | RS Residual soil<br>XW Extremely weathered<br>DW Distinctly weathered<br>SW Slightly weathered<br>FR Fresh | VS Very soft<br>S Soft<br>F Firm<br>St Stiff<br>VSt Very stiff<br>H Hard | VL Very loose<br>L Loose<br>MD Medium dense<br>D Dense<br>VD Very dense | ELS Extremely low<br>VLS Very low<br>LS Low<br>MS Medium<br>HS High<br>VHS Very high<br>EHS Extremely high | U50 Undisturbed 50mm diam tube.<br>D Disturbed sample.<br>SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.<br>PP Hand penetrometer estimate of unconfined compressive strength, kPa.<br>S Vane shear value kPa<br>DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.<br>From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
|                                                                  |                                                                                                            | <b>Moisture</b><br>D Dry M Moist W Wet                                   |                                                                         |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |


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**Engineering Log - Borehole**
**Borehole No.: BH12**
**Page: 2 of 2**
**Job Number:** DE16/265

**Client:** Qld Dept of Natural Resources & Mines

**Project:** Assessment of Subsurface Conditions

**Location:** Blackheath Road, Oxley

**Easting:** 497057.00

**Drilling Rig:** Jehyco Digga

**Northing:** 6952362.00

**Driller:** Morrison Geotechnic

**RL:**
**Logged By:** R.Howchin

**Total Depth:** 6.00

**Date:** 05/09/2016

| Drilling Information    |       |    |                | Material Description |             |                     |                                                                    |            | Test Samples |                                  |                 |            |       |               |
|-------------------------|-------|----|----------------|----------------------|-------------|---------------------|--------------------------------------------------------------------|------------|--------------|----------------------------------|-----------------|------------|-------|---------------|
| Drill Method            | Water | RL | Hole Depth (m) | Soil Origin          | Graphic Log | Classification Code | Description                                                        | Weathering | Moisture     | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| 100mm TC Bit with Auger |       |    |                |                      |             | SLT                 | SILTSTONE:<br>As above but grey mottled orange brown               | XW         |              | VLS                              |                 |            |       |               |
|                         |       |    | 3.5            |                      |             | SLT                 | SILTSTONE:<br>As above but grey mottled orange brown and red brown | XW         |              | VLS                              |                 |            |       |               |
|                         |       |    | 4.0            |                      |             |                     |                                                                    |            |              |                                  |                 |            |       |               |
|                         |       |    | 4.5            |                      |             | SLT                 | SILTSTONE:<br>As above but grey                                    | XW         |              | VLS                              |                 |            |       |               |
|                         |       |    | 5.0            |                      |             |                     |                                                                    |            |              |                                  |                 |            |       |               |
|                         |       |    | 6.0            |                      |             |                     | 6.00m: BOREHOLE TERMINATED                                         |            |              |                                  |                 |            |       |               |

**Comments:**

Authorised by: .....

Date: .....

| Water                                                      | Weathering                                                                                                 | Consistency                                                              | Density                                                                 | Rock Strength                                                                                              | Tests & Results                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Water level on date shown<br>Water inflow<br>Water outflow | RS Residual soil<br>XW Extremely weathered<br>DW Distinctly weathered<br>SW Slightly weathered<br>FR Fresh | VS Very soft<br>S Soft<br>F Firm<br>St Stiff<br>VSt Very stiff<br>H Hard | VL Very loose<br>L Loose<br>MD Medium dense<br>D Dense<br>VD Very dense | ELS Extremely low<br>VLS Very low<br>LS Low<br>MS Medium<br>HS High<br>VHS Very high<br>EHS Extremely high | U50 Undisturbed 50mm diam tube.<br>D Disturbed sample.<br>SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.<br>PP Hand penetrometer estimate of unconfined compressive strength, kPa.<br>S Vane shear value kPa<br>DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.<br>From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
|                                                            |                                                                                                            | <b>Moisture</b><br>D Dry M Moist W Wet                                   |                                                                         |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |


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**Engineering Log - Borehole**
**Borehole No.: BH13**
**Page: 1 of 2**
**Job Number:** DE16/265

**Client:** Qld Dept of Natural Resources & Mines

**Project:** Assessment of Subsurface Conditions

**Location:** Blackheath Road, Oxley

**Easting:** 497134.00

**Drilling Rig:** Jehyco Digga

**Northing:** 6952310.00

**Driller:** Morrison Geotechnic

**RL:**
**Logged By:** R.Howchin

**Total Depth:** 4.50

**Date:** 06/09/2016

| Drilling Information    |       |    |                | Material Description |             |                     |                                                                                                                     |            | Test Samples |                                  |                 |            |       |               |
|-------------------------|-------|----|----------------|----------------------|-------------|---------------------|---------------------------------------------------------------------------------------------------------------------|------------|--------------|----------------------------------|-----------------|------------|-------|---------------|
| Drill Method            | Water | RL | Hole Depth (m) | Soil Origin          | Graphic Log | Classification Code | Description                                                                                                         | Weathering | Moisture     | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| 100mm TC Bit with Auger |       |    |                | Natural              |             | SM                  | Silty SAND:<br>Loose, fine to medium grained, dark orange brown, trace of fine to medium sized gravel, moist to wet |            | M-W          | L                                | 2               |            |       |               |
|                         |       |    | 0.25           |                      |             | CH                  | Silty CLAY:<br>Stiff to very stiff, high plasticity, grey mottled orange brown, moist                               |            | M            | St-Vst                           | 2               | 0.3 -      | PP    | 200kPa        |
|                         |       |    | 0.5            |                      |             | CH                  | Silty CLAY:<br>As above but stiff                                                                                   |            | M            | St                               | 2               | 0.7 -      | PP    | 175kPa        |
|                         |       |    | 1.0            |                      |             |                     |                                                                                                                     |            |              |                                  | 2               |            |       |               |
|                         |       |    | 1.5            |                      |             | CH                  | Silty CLAY:<br>As above but very stiff, grey with some orange brown mottling                                        |            | M            | Vst                              | 9               | 1.6 -      | PP    | 220kPa        |
|                         |       |    | 2.0            |                      |             | CH                  | Silty CLAY:<br>As above but decreased moisture content                                                              |            | M            | Vst                              |                 | 2.3 -      | PP    | 300kPa        |
|                         |       |    | 3.0            |                      |             |                     |                                                                                                                     |            |              |                                  |                 |            |       |               |

**Comments:**

Authorised by: .....

Date: .....

| Water                                                            | Weathering                                                                                                 | Consistency                                                              | Density                                                                 | Rock Strength                                                                                              | Tests & Results                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ▼ Water level on date shown<br>▲ Water inflow<br>▲ Water outflow | RS Residual soil<br>XW Extremely weathered<br>DW Distinctly weathered<br>SW Slightly weathered<br>FR Fresh | VS Very soft<br>S Soft<br>F Firm<br>St Stiff<br>VSt Very stiff<br>H Hard | VL Very loose<br>L Loose<br>MD Medium dense<br>D Dense<br>VD Very dense | ELS Extremely low<br>VLS Very low<br>LS Low<br>MS Medium<br>HS High<br>VHS Very high<br>EHS Extremely high | U50 Undisturbed 50mm diam tube.<br>D Disturbed sample.<br>SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.<br>PP Hand penetrometer estimate of unconfined compressive strength, kPa.<br>S Vane shear value kPa<br>DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.<br>From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
|                                                                  |                                                                                                            | Moisture<br>D Dry M Moist W Wet                                          |                                                                         |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |



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# Engineering Log - Borehole

Borehole No.: **BH13**

Page: 2 of 2

Job Number: DE16/265

Client: Qld Dept of Natural Resources & Mines

Project: Assessment of Subsurface Conditions

Location: Blackheath Road, Oxley

Easting: 497134.00

Drilling Rig: Jehyco Digga

Northing: 6952310.00

Driller: Morrison Geotechnic

RL:

Logged By: R.Howchin

Total Depth: 4.50

Date: 06/09/2016

| Drilling Information    |       |    |                | Material Description |                                                                                    |                            |                                                                                                        |            | Test Samples |                                  |                 |            |       |               |
|-------------------------|-------|----|----------------|----------------------|------------------------------------------------------------------------------------|----------------------------|--------------------------------------------------------------------------------------------------------|------------|--------------|----------------------------------|-----------------|------------|-------|---------------|
| Drill Method            | Water | RL | Hole Depth (m) | Soil Origin          | Graphic Log                                                                        | Classification Code        | Description                                                                                            | Weathering | Moisture     | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| 100mm TC Bit with Auger |       |    | 3.9            |                      |   | CH                         | Silty CLAY:<br>As above but decreased moisture content                                                 |            | M            | Vst                              |                 |            |       |               |
|                         |       |    | 4.0            | Rock                 |  | SLT                        | SILTSTONE:<br>Extremely weathered, extremely low strength, grey mottled orange brown, with clay layers | XW         |              | ELS                              |                 |            |       |               |
|                         |       |    | 4.5            |                      |                                                                                    |                            |                                                                                                        |            |              |                                  |                 |            |       |               |
|                         |       |    | 5.0            |                      |                                                                                    | 4.50m: BOREHOLE TERMINATED |                                                                                                        |            |              |                                  |                 |            |       |               |
|                         |       |    | 6.0            |                      |                                                                                    |                            |                                                                                                        |            |              |                                  |                 |            |       |               |

## Comments:

Authorised by: .....

Date: .....

| Water                                                                                 | Weathering                                                                                                 | Consistency                                                              | Density                                                                 | Rock Strength                                                                                              | Tests & Results                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div>Water level on date shown</div> <div>Water inflow</div> <div>Water outflow</div> | RS Residual soil<br>XW Extremely weathered<br>DW Distinctly weathered<br>SW Slightly weathered<br>FR Fresh | VS Very soft<br>S Soft<br>F Firm<br>St Stiff<br>VSt Very stiff<br>H Hard | VL Very loose<br>L Loose<br>MD Medium dense<br>D Dense<br>VD Very dense | ELS Extremely low<br>VLS Very low<br>LS Low<br>MS Medium<br>HS High<br>VHS Very high<br>EHS Extremely high | U50 Undisturbed 50mm diam tube.<br>D Disturbed sample.<br>SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.<br>PP Hand penetrometer estimate of unconfined compressive strength, kPa.<br>S Vane shear value kPa<br>DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.<br>From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
|                                                                                       |                                                                                                            | Moisture<br>D Dry M Moist W Wet                                          |                                                                         |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |


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**Engineering Log - Borehole**
**Borehole No.: BH14**
**Page: 1 of 2**
**Job Number:** DE16/265

**Client:** Qld Dept of Natural Resources & Mines

**Project:** Assessment of Subsurface Conditions

**Location:** Blackheath Road, Oxley

**Easting:** 497061.00  
**Northing:** 6952315.00  
**RL:**  
**Total Depth:** 4.50

**Drilling Rig:** Jehyco Digga  
**Driller:** Morrison Geotechnic  
**Logged By:** R.Howchin  
**Date:** 06/09/2016

| Drilling Information    |       |    |                | Material Description |             |                     |                                                                                                           |            | Test Samples |                                  |                 |            |       |               |  |  |
|-------------------------|-------|----|----------------|----------------------|-------------|---------------------|-----------------------------------------------------------------------------------------------------------|------------|--------------|----------------------------------|-----------------|------------|-------|---------------|--|--|
| Drill Method            | Water | RL | Hole Depth (m) | Soil Origin          | Graphic Log | Classification Code | Description                                                                                               | Weathering | Moisture     | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |  |  |
| 100mm TC Bit with Auger |       |    | 0.5            | Natural              |             | CH                  | Silty CLAY:<br>Hard, high plasticity, grey brown, moist                                                   |            | M            | H                                | 3               | 0.1 -      | PP    | 440kPa        |  |  |
|                         |       |    |                |                      |             | 3                   |                                                                                                           |            |              |                                  |                 |            |       |               |  |  |
|                         |       |    |                |                      |             | 3                   |                                                                                                           |            |              |                                  |                 |            |       |               |  |  |
|                         |       |    |                |                      |             | 3                   |                                                                                                           |            |              |                                  |                 |            |       |               |  |  |
|                         |       |    |                |                      |             | 3                   |                                                                                                           |            |              |                                  |                 |            |       |               |  |  |
|                         |       |    | 0.55           |                      |             | CH                  | Silty CLAY:<br>As above but grey mottled orange brown, with fine to medium grained sand, with silt layers |            | M            | H                                | 3               | 0.55 -     | PP    | >600kPa       |  |  |
|                         |       |    |                |                      |             | 5                   |                                                                                                           |            |              |                                  |                 |            |       |               |  |  |
|                         |       |    |                |                      |             | 6                   |                                                                                                           |            |              |                                  |                 |            |       |               |  |  |
|                         |       |    |                |                      |             | 5                   |                                                                                                           |            |              |                                  |                 |            |       |               |  |  |
|                         |       |    |                |                      |             | 5                   |                                                                                                           |            |              |                                  |                 |            |       |               |  |  |
|                         |       |    | 1.0            | 1                    |             | MH                  | Sandy SILT:<br>Very stiff, grey mottled red brown and orange brown, fine to medium grained sand, moist    |            | M            | VSL                              | 4               | 1.1 -      | PP    | 320kPa        |  |  |
|                         |       |    |                |                      |             | 5                   |                                                                                                           |            |              |                                  |                 |            |       |               |  |  |
|                         |       |    |                |                      |             | 7                   |                                                                                                           |            |              |                                  |                 |            |       |               |  |  |
|                         |       |    | 1.35           |                      |             | CH                  | Silty CLAY:<br>Hard, high plasticity, grey mottled orange brown, moist                                    |            | M            | H                                | 13              | 1.35 -     | PP    | 450kPa        |  |  |
|                         |       |    |                |                      |             | 10                  |                                                                                                           |            |              |                                  |                 |            |       |               |  |  |
|                         |       |    |                |                      |             | 15                  |                                                                                                           |            |              |                                  |                 |            |       |               |  |  |
|                         |       |    |                |                      |             | 9                   |                                                                                                           |            |              |                                  |                 |            |       |               |  |  |
|                         |       |    |                |                      |             |                     |                                                                                                           |            |              |                                  |                 |            |       |               |  |  |
|                         |       |    | 2.8            |                      |             | CH                  | Silty CLAY:<br>As above but grey, with some extremely low strength siltstone layers                       |            | M            | H                                |                 | D          |       | 430kPa        |  |  |
|                         |       |    |                |                      |             |                     |                                                                                                           |            |              |                                  |                 |            |       |               |  |  |
|                         |       |    |                |                      |             |                     |                                                                                                           |            |              |                                  |                 |            |       |               |  |  |
|                         |       |    |                |                      |             |                     |                                                                                                           |            |              |                                  |                 |            |       |               |  |  |
|                         |       |    |                |                      |             |                     |                                                                                                           |            |              |                                  |                 |            |       |               |  |  |
|                         |       |    | 3.0            |                      |             |                     |                                                                                                           |            |              |                                  |                 |            |       |               |  |  |

**Comments:**

Authorised by: .....

Date: .....

| Water                                                      | Weathering                                                                                                 | Consistency                                                              | Density                                                                 | Rock Strength                                                                                              | Tests & Results                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Water level on date shown<br>Water inflow<br>Water outflow | RS Residual soil<br>XW Extremely weathered<br>DW Distinctly weathered<br>SW Slightly weathered<br>FR Fresh | VS Very soft<br>S Soft<br>F Firm<br>St Stiff<br>VSt Very stiff<br>H Hard | VL Very loose<br>L Loose<br>MD Medium dense<br>D Dense<br>VD Very dense | ELS Extremely low<br>VLS Very low<br>LS Low<br>MS Medium<br>HS High<br>VHS Very high<br>EHS Extremely high | U50 Undisturbed 50mm diam tube.<br>D Disturbed sample.<br>SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.<br>PP Hand penetrometer estimate of unconfined compressive strength, kPa.<br>S Vane shear value kPa<br>DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.<br>From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
|                                                            |                                                                                                            | <b>Moisture</b><br>D Dry M Moist W Wet                                   |                                                                         |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |


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**Engineering Log - Borehole**
**Borehole No.: BH14**
**Page: 2 of 2**
**Job Number:** DE16/265

**Client:** Qld Dept of Natural Resources & Mines

**Project:** Assessment of Subsurface Conditions

**Location:** Blackheath Road, Oxley

**Easting:** 497061.00

**Drilling Rig:** Jehyco Digga

**Northing:** 6952315.00

**Driller:** Morrison Geotechnic

**RL:**
**Logged By:** R.Howchin

**Total Depth:** 4.50

**Date:** 06/09/2016

| Drilling Information    |       |    |                | Material Description |             |                            |                                                                                     |            | Test Samples |                                  |                 |            |         |               |
|-------------------------|-------|----|----------------|----------------------|-------------|----------------------------|-------------------------------------------------------------------------------------|------------|--------------|----------------------------------|-----------------|------------|---------|---------------|
| Drill Method            | Water | RL | Hole Depth (m) | Soil Origin          | Graphic Log | Classification Code        | Description                                                                         | Weathering | Moisture     | Consistency - Density - Strength | DC Test Results | Test Depth | Tests   | Sample/Result |
| 100mm TC Bit with Auger |       |    | 3.5            |                      |             | CH                         | Silty CLAY:<br>As above but grey, with some extremely low strength siltstone layers |            | M            | H                                |                 |            |         |               |
|                         |       |    | 4.0            |                      |             | CH                         | Silty CLAY:<br>As above but dark grey and black                                     |            | M            | H                                |                 | 3.5        |         |               |
|                         |       |    | 4.1            |                      |             | CH                         | Silty CLAY:<br>As above but grey                                                    |            | M            | H                                |                 | 3.8        | D<br>PP | >600kPa       |
|                         |       |    | 4.5            |                      |             |                            |                                                                                     |            |              |                                  |                 |            |         |               |
|                         |       |    | 5.0            |                      |             | 4.50m: BOREHOLE TERMINATED |                                                                                     |            |              |                                  |                 |            |         |               |
|                         |       |    | 6.0            |                      |             |                            |                                                                                     |            |              |                                  |                 |            |         |               |

**Comments:**

Authorised by: .....

Date: .....

| Water                                                      | Weathering                                                                                                 | Consistency                                                              | Density                                                                 | Rock Strength                                                                                              | Tests & Results                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Water level on date shown<br>Water inflow<br>Water outflow | RS Residual soil<br>XW Extremely weathered<br>DW Distinctly weathered<br>SW Slightly weathered<br>FR Fresh | VS Very soft<br>S Soft<br>F Firm<br>St Stiff<br>VSt Very stiff<br>H Hard | VL Very loose<br>L Loose<br>MD Medium dense<br>D Dense<br>VD Very dense | ELS Extremely low<br>VLS Very low<br>LS Low<br>MS Medium<br>HS High<br>VHS Very high<br>EHS Extremely high | U50 Undisturbed 50mm diam tube.<br>D Disturbed sample.<br>SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.<br>PP Hand penetrometer estimate of unconfined compressive strength, kPa.<br>S Vane shear value kPa<br>DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.<br>From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
|                                                            |                                                                                                            | <b>Moisture</b><br>D Dry M Moist W Wet                                   |                                                                         |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |


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**Engineering Log - Borehole**
**Borehole No.: BH15**
**Page: 1 of 2**
**Job Number:** DE16/265

**Client:** Qld Dept of Natural Resources & Mines

**Project:** Assessment of Subsurface Conditions

**Location:** Blackheath Road, Oxley

**Easting:** 496989.00

**Drilling Rig:** Jehyco Digga

**Northing:** 6952337.00

**Driller:** Morrison Geotechnic

**RL:**
**Logged By:** R.Howchin

**Total Depth:** 6.00

**Date:** 05/09/2016

| Drilling Information    |       |    |                | Material Description |                                                                                     |                     |                                                                                                                                       |            |          | Test Samples                     |                 |            |       |               |
|-------------------------|-------|----|----------------|----------------------|-------------------------------------------------------------------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------|------------|----------|----------------------------------|-----------------|------------|-------|---------------|
| Drill Method            | Water | RL | Hole Depth (m) | Soil Origin          | Graphic Log                                                                         | Classification Code | Description                                                                                                                           | Weathering | Moisture | Consistency - Density - Strength | DC Test Results | Test Depth | Tests | Sample/Result |
| 100mm TC Bit with Auger |       |    | 1.0            | Rock                 |   | SST                 | SANDSTONE:<br>Extremely weathered, extremely low strength, grey white, with grey extremely low strength siltstone layers              | XW         |          | ELS                              | 5               | 1.5        | D     |               |
|                         |       |    | 1.2            |                      |  | SLT                 | SILTSTONE:<br>Extremely weathered, extremely low strength, red brown mottled grey white, with extremely low strength sandstone layers | XW         |          | ELS                              | 7               |            |       |               |
|                         |       |    | 1.5            |                      |  | SLT                 | SILTSTONE:<br>As above but grey, no sandstone layers                                                                                  | XW         |          | ELS                              | 11              |            |       |               |
|                         |       |    | 2.0            |                      |  |                     |                                                                                                                                       |            |          |                                  | 16              |            |       |               |
|                         |       |    | 3.0            |                      |  |                     |                                                                                                                                       |            |          |                                  | 25              |            |       |               |

**Comments:**

Authorised by: .....

Date: .....

| Water                                                      | Weathering                                                                                                 | Consistency                                                              | Density                                                                 | Rock Strength                                                                                              | Tests & Results                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Water level on date shown<br>Water inflow<br>Water outflow | RS Residual soil<br>XW Extremely weathered<br>DW Distinctly weathered<br>SW Slightly weathered<br>FR Fresh | VS Very soft<br>S Soft<br>F Firm<br>St Stiff<br>VSt Very stiff<br>H Hard | VL Very loose<br>L Loose<br>MD Medium dense<br>D Dense<br>VD Very dense | ELS Extremely low<br>VLS Very low<br>LS Low<br>MS Medium<br>HS High<br>VHS Very high<br>EHS Extremely high | U50 Undisturbed 50mm diam tube.<br>D Disturbed sample.<br>SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.<br>PP Hand penetrometer estimate of unconfined compressive strength, kPa.<br>S Vane shear value kPa<br>DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.<br>From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
|                                                            |                                                                                                            | <b>Moisture</b><br>D Dry M Moist W Wet                                   |                                                                         |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |


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**Engineering Log - Borehole**
**Borehole No.: BH15**
**Page: 2 of 2**
**Job Number:** DE16/265

**Client:** Qld Dept of Natural Resources & Mines

**Project:** Assessment of Subsurface Conditions

**Location:** Blackheath Road, Oxley

**Easting:** 496989.00  
**Northing:** 6952337.00  
**RL:**  
**Total Depth:** 6.00

**Drilling Rig:** Jehyco Digga  
**Driller:** Morrison Geotechnic  
**Logged By:** R.Howchin  
**Date:** 05/09/2016

| Drilling Information    |       |    |                | Material Description |             |                     |                                                                                             | Test Samples |          |                                  |                    |
|-------------------------|-------|----|----------------|----------------------|-------------|---------------------|---------------------------------------------------------------------------------------------|--------------|----------|----------------------------------|--------------------|
| Drill Method            | Water | RL | Hole Depth (m) | Soil Origin          | Graphic Log | Classification Code | Description                                                                                 | Weathering   | Moisture | Consistency - Density - Strength | DC Test Results    |
| 100mm TC Bit with Auger |       |    | 3.5            | Residual             |             | CH                  | Silty CLAY:<br>Hard, high plasticity, dark grey, moist                                      |              | M        | H                                | 3.6 - PP - >600kPa |
|                         |       |    | 4.0            | Rock                 |             | SLT                 | SILTSTONE:<br>Extremely weathered, very low strength, dark grey                             | XW           |          | VLS                              |                    |
|                         |       |    | 4.8            | Residual             |             | CH                  | Silty CLAY:<br>Hard, high plasticity, dark grey, moist                                      |              | M        | H                                | 4.9 - PP - >600kPa |
|                         |       |    | 5.0            | Rock                 |             | SLT                 | SILTSTONE:<br>Extremely weathered, extremely low strength, dark grey                        | XW           |          | ELS                              |                    |
|                         |       |    | 5.5            |                      |             | SLT                 | SILTSTONE:<br>As above but very low strength, grey, with very low strength sandstone layers | XW           |          | VLS                              |                    |
|                         |       |    | 6.0            |                      |             |                     | <b>6.00m: BOREHOLE TERMINATED</b>                                                           |              |          |                                  |                    |

**Comments:**

Authorised by: .....

Date: .....

| Water                                                      | Weathering                                                                                                 | Consistency                                                              | Density                                                                 | Rock Strength                                                                                              | Tests & Results                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Water level on date shown<br>Water inflow<br>Water outflow | RS Residual soil<br>XW Extremely weathered<br>DW Distinctly weathered<br>SW Slightly weathered<br>FR Fresh | VS Very soft<br>S Soft<br>F Firm<br>St Stiff<br>VSt Very stiff<br>H Hard | VL Very loose<br>L Loose<br>MD Medium dense<br>D Dense<br>VD Very dense | ELS Extremely low<br>VLS Very low<br>LS Low<br>MS Medium<br>HS High<br>VHS Very high<br>EHS Extremely high | U50 Undisturbed 50mm diam tube.<br>D Disturbed sample.<br>SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.<br>PP Hand penetrometer estimate of unconfined compressive strength, kPa.<br>S Vane shear value kPa<br>DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.<br>From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
|                                                            |                                                                                                            | Moisture<br>D Dry M Moist W Wet                                          |                                                                         |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |


**Morrison Geotechnic Pty Ltd**

A.B.N. 051 009 878 899  
PO Box 3063, Darra, QLD 4076  
Phone: (07) 3279 0900 Fax: (07) 3279 0955

**Engineering Log - Borehole**
**Borehole No.: BH16**
**Page: 1 of 1**
**Job Number:** DE16/265

**Easting:** 496782.00  
**Northing:** 6952279.00  
**RL:**  
**Total Depth:** 3.00

**Drilling Rig:** Jehyco Digga  
**Driller:** Morrison Geotechnic  
**Logged By:** R.Howchin  
**Date:** 06/09/2016

**Client:** Qld Dept of Natural Resources & Mines  
**Project:** Assessment of Subsurface Conditions

**Location:** Blackheath Road, Oxley

| Drilling Information    |       |    |                | Material Description |             |                     |                                                                                                                 | Test Samples |          |                       |          |
|-------------------------|-------|----|----------------|----------------------|-------------|---------------------|-----------------------------------------------------------------------------------------------------------------|--------------|----------|-----------------------|----------|
| Drill Method            | Water | RL | Hole Depth (m) | Soil Origin          | Graphic Log | Classification Code | Description                                                                                                     | Weathering   | Moisture | Consistency - Density | Strength |
| 100mm TC Bit with Auger |       |    |                | Natural              |             | CH                  | Silty CLAY:<br>Hard, high plasticity, dark grey mottled orange brown, moist                                     |              | M        | H                     | 5        |
|                         |       |    |                |                      |             |                     |                                                                                                                 |              |          |                       |          |
|                         |       |    |                |                      |             |                     |                                                                                                                 |              |          |                       |          |
|                         |       |    |                |                      |             |                     |                                                                                                                 |              |          |                       |          |
|                         |       |    |                |                      |             |                     |                                                                                                                 |              |          |                       |          |
|                         |       |    |                |                      |             |                     |                                                                                                                 |              |          |                       |          |
|                         |       |    |                |                      |             |                     |                                                                                                                 |              |          |                       |          |
|                         |       |    |                |                      |             |                     |                                                                                                                 |              |          |                       |          |
|                         |       |    |                |                      |             |                     |                                                                                                                 |              |          |                       |          |
|                         |       |    |                |                      |             |                     |                                                                                                                 |              |          |                       |          |
|                         |       |    |                |                      |             |                     |                                                                                                                 |              |          |                       |          |
|                         |       |    |                |                      |             |                     |                                                                                                                 |              |          |                       |          |
|                         |       |    |                |                      |             |                     |                                                                                                                 |              |          |                       |          |
|                         |       |    |                |                      |             |                     |                                                                                                                 |              |          |                       |          |
|                         |       |    |                |                      |             |                     |                                                                                                                 |              |          |                       |          |
|                         |       |    |                |                      |             |                     |                                                                                                                 |              |          |                       |          |
|                         |       |    |                |                      |             |                     |                                                                                                                 |              |          |                       |          |
|                         |       |    |                |                      |             |                     |                                                                                                                 |              |          |                       |          |
|                         |       |    |                |                      |             |                     |                                                                                                                 |              |          |                       |          |
|                         |       |    |                |                      |             |                     |                                                                                                                 |              |          |                       |          |
|                         |       |    |                |                      |             |                     |                                                                                                                 |              |          |                       |          |
|                         |       |    | 1.0            |                      |             |                     |                                                                                                                 |              |          |                       |          |
|                         |       |    | 1.5            |                      |             | CH                  | Silty CLAY:<br>As above but grey mottled orange brown and red brown, with fine to medium sized gravel in layers |              | M        | H                     | 5        |
|                         |       |    | 2.0            |                      |             |                     |                                                                                                                 |              |          |                       | 6        |
|                         |       |    | 2.2            |                      |             | CH                  | Silty CLAY:<br>As above but grey mottled orange brown, red brown and black, no gravel layers                    |              | M        | H                     |          |
|                         |       |    | 2.5            |                      |             | CH                  | Silty CLAY:<br>As above but grey mottled orange brown and red brown                                             |              | M        | H                     |          |
|                         |       |    | 3.0            |                      |             |                     | 3.00m: BOREHOLE TERMINATED                                                                                      |              |          |                       |          |

**Comments:**

Authorised by: .....

Date: .....

| Water                                                      | Weathering                                                                                                 | Consistency                                                              | Density                                                                 | Rock Strength                                                                              | Tests & Results                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Water level on date shown<br>Water inflow<br>Water outflow | RS Residual soil<br>XW Extremely weathered<br>DW Distinctly weathered<br>SW Slightly weathered<br>FR Fresh | VS Very soft<br>S Soft<br>F Firm<br>St Stiff<br>VSt Very stiff<br>H Hard | VL Very loose<br>L Loose<br>MD Medium dense<br>D Dense<br>VD Very dense | ELS Extremely low<br>LS Low<br>MS Medium<br>HS High<br>VHS Very high<br>EHS Extremely high | U50 Undisturbed 50mm diam tube.<br>D Disturbed sample.<br>SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.<br>PP Hand penetrometer estimate of unconfined compressive strength, kPa.<br>S Vane shear value kPa<br>DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.<br>From AS1289-1993 Methods of Testing Soils for Engineering Purposes |
|                                                            |                                                                                                            | <b>Moisture</b><br>D Dry M Moist W Wet                                   |                                                                         |                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

**APPENDIX C**  
**LABORATORY TEST RESULTS**

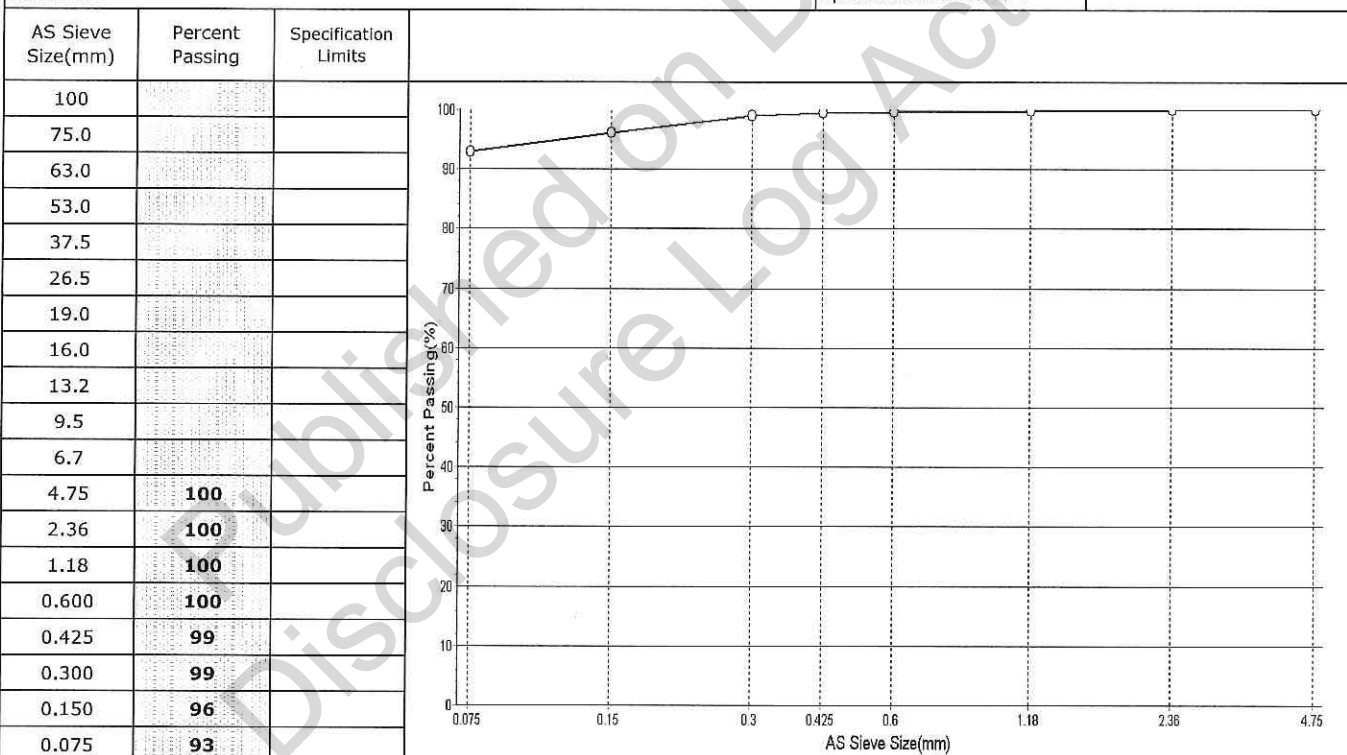
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 ABN 51 009 878 899  
 www.morrisongeo.com.au

## Quality of Materials Report

|                  |                                                                 |                    |                     |
|------------------|-----------------------------------------------------------------|--------------------|---------------------|
| Client :         | <b>DEPARTMENT OF NATURAL RESOURCES &amp; MINES</b>              | Report Number:     | <b>DE16/265 - 1</b> |
| Address :        | <b>27 O'CONNELL STREET, GYMPIE, QLD, 4570</b>                   | Report Date :      | <b>16/09/2016</b>   |
| Project Name :   | <b>ASSESSMENT OF SUBSURFACE CONDITIONS - EXISTING SINKHOLES</b> | Order Number :     | -                   |
| Project Number : | <b>DE16/265</b>                                                 | Test Method :      | <b>AS1289.3.6.1</b> |
| Location:        | <b>BLACKHEATH ROAD , OXLEY</b>                                  | <b>Page 1 of 1</b> |                     |

|                   |                 |                                                                    |   |
|-------------------|-----------------|--------------------------------------------------------------------|---|
| Sample Number :   | 218422          | <b>SAMPLE LOCATION</b><br><b>BH3</b><br><b>Depth 2.50m - 3.00m</b> |   |
| Sampling Method : | -               |                                                                    |   |
| Sampled By :      | Russell Howchin | Test Number :                                                      | - |
| Date Sampled :    | 06/09/2016      | Lot Number :                                                       | - |
| Date Tested :     | 07/09/2016      | Specification Number :                                             |   |
| Material Type :   | -               |                                                                    |   |
| Material Source : | Insitu          |                                                                    |   |
| Remarks :         | -               |                                                                    |   |



| Test Method            |                     | Results   |                      |                                     |
|------------------------|---------------------|-----------|----------------------|-------------------------------------|
| Liquid Limit (%) :     | <b>AS1289.3.1.1</b> | <b>74</b> | Shrinkage Comments : | <b>Cracking - NO, Curling - YES</b> |
| Plastic Limit (%) :    | <b>AS1289.3.2.1</b> | <b>27</b> | Mould Length (mm) :  | <b>254.7</b>                        |
| Plasticity Index (%) : | <b>AS1289.3.3.1</b> | <b>47</b> | Sample History       | <b>Oven Dried</b>                   |
| Linear Shrinkage (%) : | <b>AS1289.3.4.1</b> | <b>17</b> |                      |                                     |
| Soil Description :     |                     |           |                      |                                     |



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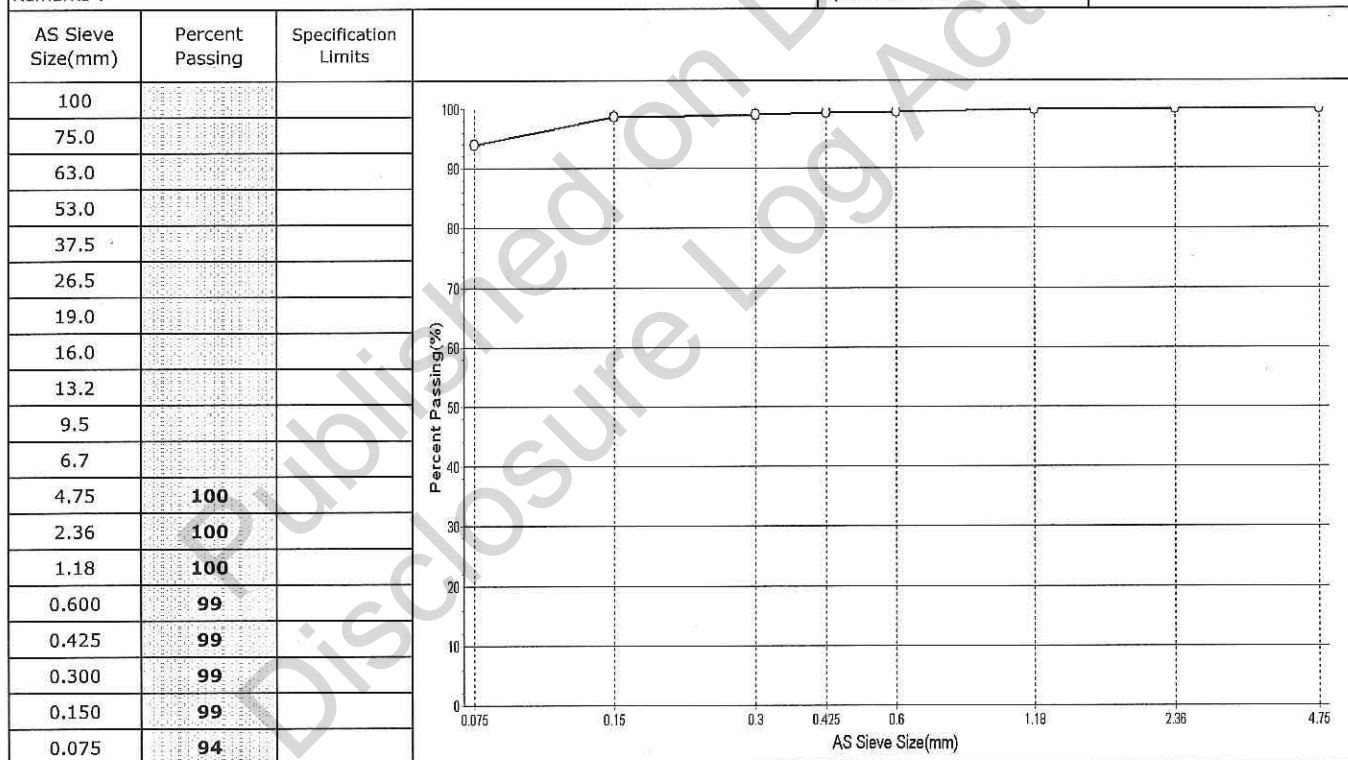
Document Code RF145-6

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## Quality of Materials Report

|                  |                                                                 |                    |                     |
|------------------|-----------------------------------------------------------------|--------------------|---------------------|
| Client :         | <b>DEPARTMENT OF NATURAL RESOURCES &amp; MINES</b>              | Report Number:     | <b>DE16/265 - 2</b> |
| Address :        | <b>27 O'CONNELL STREET, GYMPIE, QLD, 4570</b>                   | Report Date :      | <b>16/09/2016</b>   |
| Project Name :   | <b>ASSESSMENT OF SUBSURFACE CONDITIONS - EXISTING SINKHOLES</b> | Order Number :     | -                   |
| Project Number : | <b>DE16/265</b>                                                 | Test Method :      | <b>AS1289.3.6.1</b> |
| Location:        | <b>BLACKHEATH ROAD , OXLEY</b>                                  | <b>Page 1 of 1</b> |                     |

|                   |                 |                            |   |
|-------------------|-----------------|----------------------------|---|
| Sample Number :   | 218423          | SAMPLE LOCATION            |   |
| Sampling Method : | -               | <b>BH4</b>                 |   |
| Sampled By :      | Russell Howchin | <b>Depth 2.50m - 3.00m</b> |   |
| Date Sampled :    | 06/09/2016      | Test Number :              | - |
| Date Tested :     | 07/09/2016      | Lot Number :               | - |
| Material Type :   | -               | Specification Number :     |   |
| Material Source : | Insitu          |                            |   |
| Remarks :         | -               |                            |   |



|                        |                     |             |                      |                                     |
|------------------------|---------------------|-------------|----------------------|-------------------------------------|
|                        | Test Method         | Results     |                      |                                     |
| Liquid Limit (%) :     | <b>AS1289.3.1.1</b> | <b>78</b>   | Shrinkage Comments : | <b>Cracking - NO, Curling - YES</b> |
| Plastic Limit (%) :    | <b>AS1289.3.2.1</b> | <b>21</b>   | Mould Length (mm) :  | <b>250.0</b>                        |
| Plasticity Index (%) : | <b>AS1289.3.3.1</b> | <b>57</b>   | Sample History       | <b>Oven Dried</b>                   |
| Linear Shrinkage (%) : | <b>AS1289.3.4.1</b> | <b>16.5</b> |                      |                                     |
| Soil Description :     |                     |             |                      |                                     |



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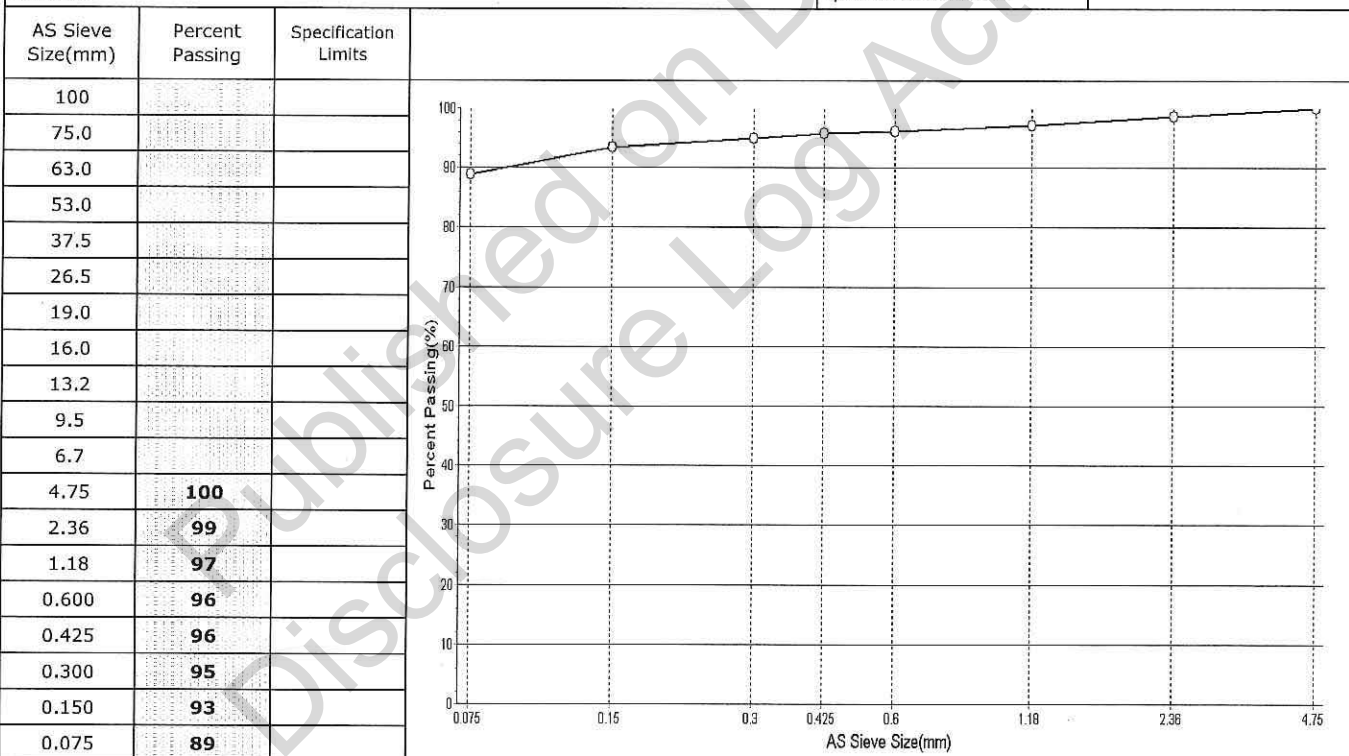
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|------------------|----------------------------------------------------------|----------------|--------------|
| Client :         | DEPARTMENT OF NATURAL RESOURCES & MINES                  | Report Number: | DE16/265 - 3 |
| Address :        | 27 O'CONNELL STREET, GYMPIE, QLD, 4570                   | Report Date :  | 16/09/2016   |
| Project Name :   | ASSESSMENT OF SUBSURFACE CONDITIONS - EXISTING SINKHOLES | Order Number : | -            |
| Project Number : | DE16/265                                                 | Test Method :  | AS1289.3.6.1 |
| Location:        | BLACKHEATH ROAD , OXLEY                                  | Page 1 of 1    |              |

|                   |                 |                        |   |
|-------------------|-----------------|------------------------|---|
| Sample Number :   | 218424          | SAMPLE LOCATION        |   |
| Sampling Method : | -               | BH8                    |   |
| Sampled By :      | Russell Howchin | Depth 1.00m - 1.50m    |   |
| Date Sampled :    | 06/09/2016      | Test Number :          | - |
| Date Tested :     | 07/09/2016      | Lot Number :           | - |
| Material Type :   | -               | Specification Number : | - |
| Material Source : | Insitu          |                        |   |
| Remarks :         | -               |                        |   |



| Test Method            |              | Results |                                                   |
|------------------------|--------------|---------|---------------------------------------------------|
| Liquid Limit (%) :     | AS1289.3.1.1 | 71      | Shrinkage Comments : Cracking - NO, Curling - YES |
| Plastic Limit (%) :    | AS1289.3.2.1 | 22      | Mould Length (mm) : 250.2                         |
| Plasticity Index (%) : | AS1289.3.3.1 | 49      | Sample History : Oven Dried                       |
| Linear Shrinkage (%) : | AS1289.3.4.1 | 16.5    |                                                   |
| Soil Description :     |              |         |                                                   |



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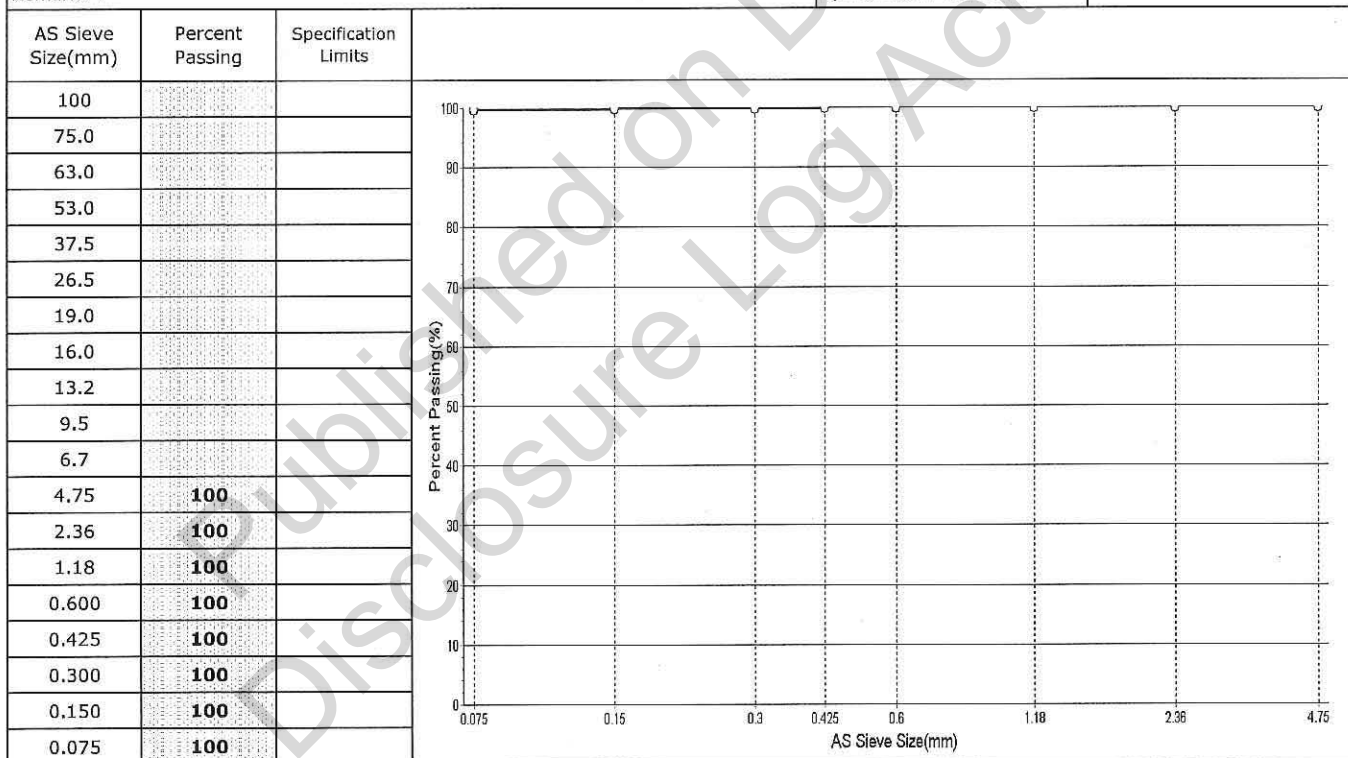
Document Code RF145-6

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## Quality of Materials Report

|                  |                                                          |                |              |
|------------------|----------------------------------------------------------|----------------|--------------|
| Client :         | DEPARTMENT OF NATURAL RESOURCES & MINES                  | Report Number: | DE16/265 - 4 |
| Address :        | 27 O'CONNELL STREET, GYMPIE, QLD, 4570                   | Report Date :  | 16/09/2016   |
| Project Name :   | ASSESSMENT OF SUBSURFACE CONDITIONS - EXISTING SINKHOLES | Order Number : | -            |
| Project Number : | DE16/265                                                 | Test Method :  | AS1289.3.6.1 |
| Location:        | BLACKHEATH ROAD , OXLEY                                  | Page 1 of 1    |              |

|                   |                 |                        |   |
|-------------------|-----------------|------------------------|---|
| Sample Number :   | 218425          | SAMPLE LOCATION        |   |
| Sampling Method : | -               | BH14                   |   |
| Sampled By :      | Russell Howchin | Depth 1.50m - 3.00m    |   |
| Date Sampled :    | 06/09/2016      | Test Number :          | - |
| Date Tested :     | 07/09/2016      | Lot Number :           | - |
| Material Type :   | -               | Specification Number : |   |
| Material Source : | Insitu          |                        |   |
| Remarks :         | -               |                        |   |



| Test Method            | Results      | Shrinkage Comments : | Cracking And Curling Occurred |
|------------------------|--------------|----------------------|-------------------------------|
| Liquid Limit (%) :     | AS1289.3.1.1 | 62                   |                               |
| Plastic Limit (%) :    | AS1289.3.2.1 | 22                   |                               |
| Plasticity Index (%) : | AS1289.3.3.1 | 40                   |                               |
| Linear Shrinkage (%) : | AS1289.3.4.1 | 15.5                 |                               |
| Soil Description :     |              |                      |                               |

|                                                                                                                                          |  |                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------------------------------------------------------------------------------------------------------------------------------------------|
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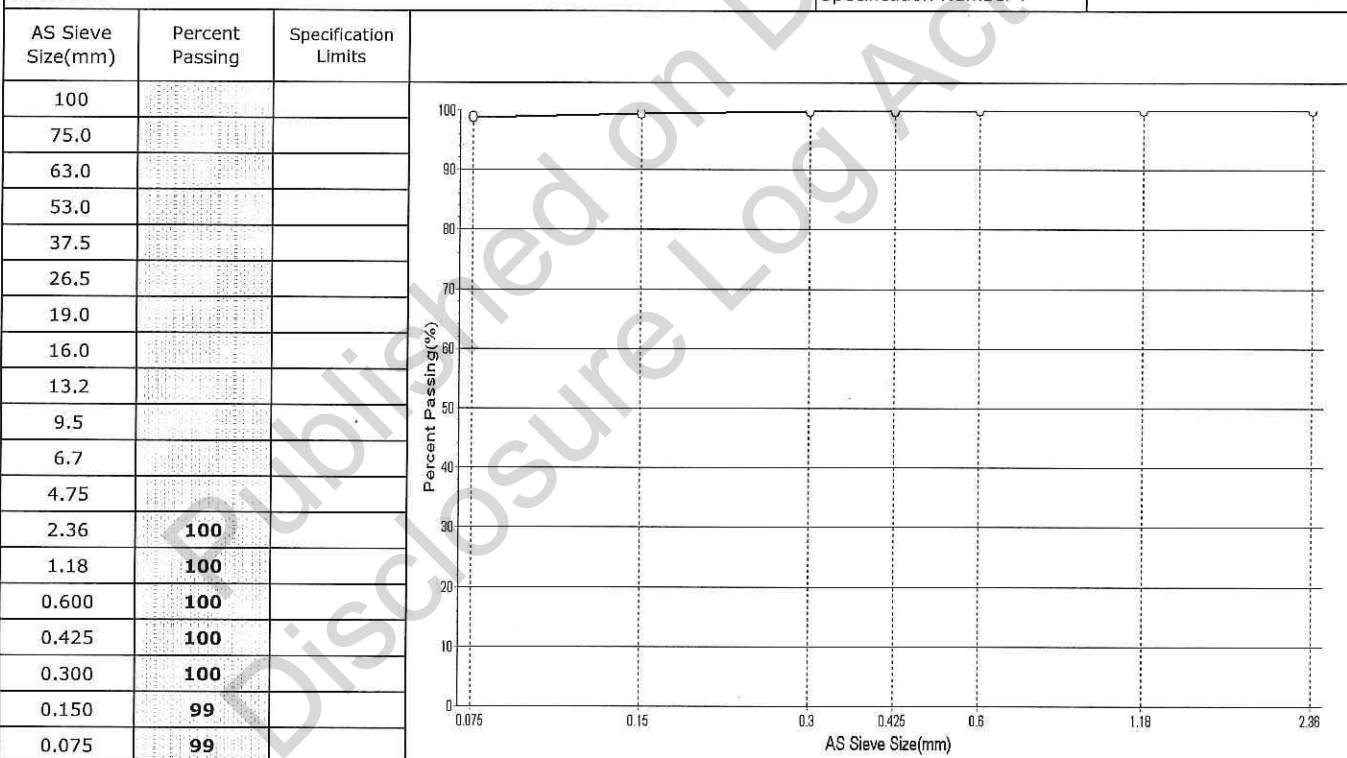
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|------------------|----------------------------------------------------------|----------------|--------------|
| Client :         | DEPARTMENT OF NATURAL RESOURCES & MINES                  | Report Number: | DE16/265 - 5 |
| Address :        | 27 O'CONNELL STREET, GYMPIE, QLD, 4570                   | Report Date :  | 16/09/2016   |
| Project Name :   | ASSESSMENT OF SUBSURFACE CONDITIONS - EXISTING SINKHOLES | Order Number : | -            |
| Project Number : | DE16/265                                                 | Test Method :  | AS1289.3.6.1 |
| Location:        | BLACKHEATH ROAD , OXLEY                                  | Page 1 of 1    |              |

|                   |                 |                        |   |
|-------------------|-----------------|------------------------|---|
| Sample Number :   | 218426          | SAMPLE LOCATION        |   |
| Sampling Method : | -               | BH14                   |   |
| Sampled By :      | Russell Howchin | Depth 3.50m - 4.00m    |   |
| Date Sampled :    | 06/09/2016      | Test Number :          | - |
| Date Tested :     | 07/09/2016      | Lot Number :           | - |
| Material Type :   | -               | Specification Number : |   |
| Material Source : | In situ         |                        |   |
| Remarks :         | -               |                        |   |



| Test Method            |              | Results |                                                    |
|------------------------|--------------|---------|----------------------------------------------------|
| Liquid Limit (%) :     | AS1289.3.1.1 | 99      | Shrinkage Comments : Cracking And Curling Occurred |
| Plastic Limit (%) :    | AS1289.3.2.1 | 36      | Mould Length (mm) : 250.1                          |
| Plasticity Index (%) : | AS1289.3.3.1 | 63      | Sample History : Oven Dried                        |
| Linear Shrinkage (%) : | AS1289.3.4.1 | 21      |                                                    |
| Soil Description :     |              |         |                                                    |



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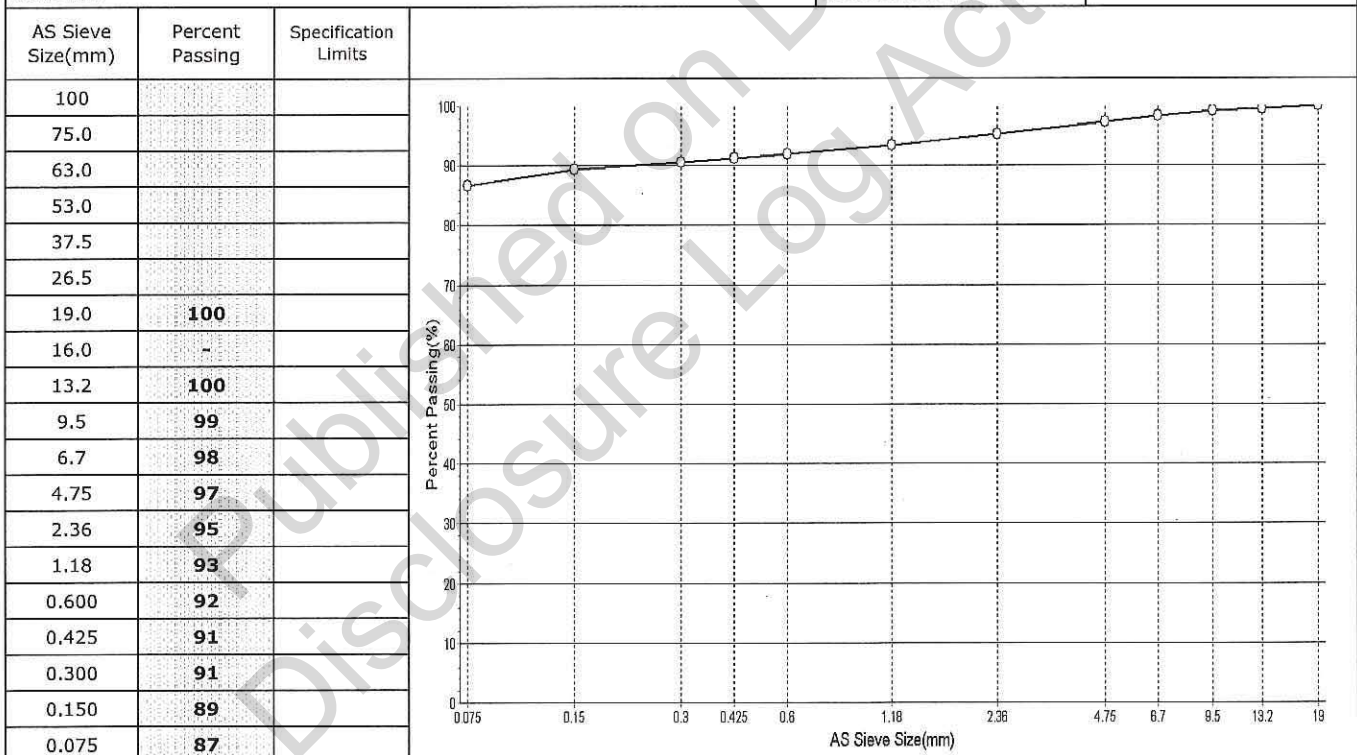
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|                  |                                                          |                |              |
|------------------|----------------------------------------------------------|----------------|--------------|
| Client :         | DEPARTMENT OF NATURAL RESOURCES & MINES                  | Report Number: | DE16/265 - 6 |
| Address :        | 27 O'CONNELL STREET, GYMPIE, QLD, 4570                   | Report Date :  | 16/09/2016   |
| Project Name :   | ASSESSMENT OF SUBSURFACE CONDITIONS - EXISTING SINKHOLES | Order Number : | -            |
| Project Number : | DE16/265                                                 | Test Method :  | AS1289.3.6.1 |
| Location:        | BLACKHEATH ROAD, OXLEY                                   | Page 1 of 1    |              |

|                   |                 |                        |   |
|-------------------|-----------------|------------------------|---|
| Sample Number :   | 218427          | SAMPLE LOCATION        |   |
| Sampling Method : | -               | BH16                   |   |
| Sampled By :      | Russell Howchin | Depth 0.00m - 1.50m    |   |
| Date Sampled :    | 06/09/2016      | Test Number :          | - |
| Date Tested :     | 07/09/2016      | Lot Number :           | - |
| Material Type :   | -               | Specification Number : |   |
| Material Source : | Insitu          |                        |   |
| Remarks :         | -               |                        |   |



|                        |  | Test Method  | Results |                      |                              |
|------------------------|--|--------------|---------|----------------------|------------------------------|
| Liquid Limit (%) :     |  | AS1289.3.1.1 | 56      | Shrinkage Comments : | Cracking - NO, Curling - YES |
| Plastic Limit (%) :    |  | AS1289.3.2.1 | 23      | Mould Length (mm) :  | 250.1                        |
| Plasticity Index (%) : |  | AS1289.3.3.1 | 33      | Sample History       | Oven Dried                   |
| Linear Shrinkage (%) : |  | AS1289.3.4.1 | 13.5    |                      |                              |
| Soil Description :     |  |              |         |                      |                              |



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# APPENDIX D

## QUU PLAN

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# Queensland Urban Utilities - Water & Sewer Infrastructure



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|                                                                               |                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                       |                                                                                                                                                                                   |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>DBYD - Queensland Urban Utilities<br/>Water &amp; Sewer Infrastructure</p> | <p>DBYD Reference No: 55174335</p> <p>Date DBYD Ref Received: 24/08/2016 2:05:00 PM<br/>Date DBYD Job to Commence: 27/08/2016 12:00:00 AM<br/>Date DBYD Map Produced: 24/08/2016<br/>This Map is valid for 30 days</p> <p>Produced By: Queensland Urban Utilities </p> | <p><b>Sewer</b></p> <ul style="list-style-type: none"> <li>● Infrastructure</li> <li>◆ Major Infrastructure</li> <li>— Network Pipelines</li> <li>— Recycled Water Pipelines</li> <li>▨ Network Structures</li> </ul> | <p><b>Water</b></p> <ul style="list-style-type: none"> <li>● Infrastructure</li> <li>◆ Major Infrastructure</li> <li>— Network Pipelines</li> <li>▨ Network Structures</li> </ul> |  | <p>The plans are indicative and approximate only and provided without warranty or any kind, expressed or implied, relating to accuracy, completeness, correctness, currency or fitness for purpose.</p> <p>QAU takes no responsibility and accepts no liability for any loss, damage, costs or liability that may be incurred by any person acting in reliance on the information provided on this plan.</p> <p>This plan should be used as a guide only. Any dimensions should be confirmed on site by the relevant authority.</p> <p>Based on or contains data provided by the State of Queensland Department of Natural Resources and Mines (DNRM), in consideration of the State permitting the use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, fitness for purpose) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws, © State of Queensland Department of Natural Resources and Mines (2015)</p> <p>For further information, please call Queensland Urban Utilities on 13 26 37 (7am-7pm weekdays). Faults and emergencies 13 23 04 (24/7). <a href="http://www.urbanutilities.com.au">www.urbanutilities.com.au</a> ABN 88 073 325 011</p> |
|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

# Important Information about Your Geotechnical Engineering Report

*Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.*

*While you cannot eliminate all such risks, you can manage them. The following information is provided to help.*

## Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you — should apply the report for any purpose or project except the one originally contemplated.*

## Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

## A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,

- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

## Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

## Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

## A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

### **A Geotechnical Engineering Report Is Subject to Misinterpretation**

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

### **Do Not Redraw the Engineer's Logs**

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

### **Give Contractors a Complete Report and Guidance**

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.*

### **Read Responsibility Provisions Closely**

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that

have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

### **Geoenvironmental Concerns Are Not Covered**

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

### **Obtain Professional Assistance To Deal with Mold**

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

### **Rely, on Your ASFE-Member Geotechnical Engineer for Additional Assistance**

Membership in ASFE/THE BEST PEOPLE ON EARTH exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.



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