# St Vincent's Foundation Pty Ltd

## Eastern Creek, Rainbow Beach Project, Ocean Drive, Bonny Hills

## Geotechnical Assessment

Report No. RGS20337.1-AD

1 December 2015

REGIONAL
GEOTECHNICAL SOLUTIONS

REGIONAL
GEOTECHNICAL SOLUTIONS

Manning-Great Lakes

Port Macquarie

Coffs Harbour

RGS20337.1-AD

1 December 2015

St Vincent's Foundation Pty Ltd c-/
King Campbell Pty Ltd
PO Box 243
PORT MACQUARIE NSW 2444

**Attention: Scott Marchant**

Dear Scott,

**RE: Eastern Creek, Rainbow Beach Project, Ocean Drive, Bonny Hills**

**Geotechnical Assessment**

As requested, Regional Geotechnical Solutions Pty Ltd (RGS) has undertaken a geotechnical assessment of the upper soil profiles in the vicinity of Eastern Creek at the Rainbow Beach Project, Lot 1 DP1193553, Ocean Drive, Bonny Hills.

Surface and subsurface conditions encountered at the site are discusses in the attached report.

If you have any questions regarding this project, or require any additional consultations, please contact the undersigned.

For and on behalf of

**Regional Geotechnical Solutions Pty Ltd**

**Tim Morris**

Senior Engineering Geologist

**Regional Geotechnical Solutions Pty Ltd**
ABN 51141848820

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Port Macquarie NSW 2444
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Web: www.regionalgeotech.com.au

**Table of Contents**



**Figures**



**Appendices**

# 1 INTRODUCTION

As requested, Regional Geotechnical Solutions Pty Ltd (RGS) has undertaken an assessment of the soil profiles in the vicinity of Eastern Creek at the Rainbow Beach Project, Lot 1 DP1193553, Ocean Drive, Bonny Hill's.

The purpose of the work described herein was to assess the origin of the soils present in the upper soil profile along three nominated transect lines. The presence of alluvial or colluvial soils can be a factor in the determination of the ecological communities present at the site.

The work was commissioned by Greg Isaac of the St Vincent's Foundation on 6 October 2015.

# 2 FIELD WORK

Field work for the assessment was undertaken on 21 and 26 October 2015 and was based on the supplied pdf file titled "Propose Soil Sampling Locations". Fieldwork included:

- Observation of site and surrounding features relevant to the geotechnical conditions of the site;
- Ten test pits excavated by hand tools along the nominated transect lines. Excavations were restricted to use of hand tools due to the thick vegetation and wet ground conditions present;
- Test pits were logged and sampled by a Senior Engineering Geologist.

Engineering logs of the test pits are presented in Appendix A. The locations of the test pits are shown on Figure 1. They were obtained on site by measurement relative to existing site features. Coordinates of each location were recorded by hand held GPS and are shown on the logs. RL's of each test location obtained by survey are shown on Figure 1

# 3 SITE CONDITIONS

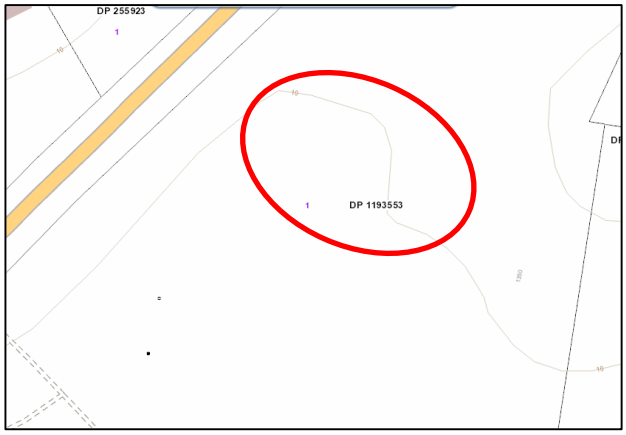
## 3.1 Surface conditions

The area of the assessment is located in gently to moderately undulating topography to the east or Ocean Drive. There were three sampling transects located on the south to south east facing lower slopes of an undulating rise that was up to about 30m AHD in elevation. The surface elevations along each transect range from approximately 14m AHD on the slopes of the rise and graded down to 6.5m AHD at the toe of the slope onto an alluvial flood plain.

Slope angles on the rise slopes are up to approximately 10°, grading down to near level on the alluvial floodplain. The slopes present are concave in plan with an indistinct drainage line present in the vicinity of Transect 1, draining towards the south east.

Images of the site taken from the NSW Department of Property Information website that illustrate features of the subject area are presented below.


*Lot 1 DP1193553 – Satellite image. Subject area is partially cleared with thick vegetation present on the slopes at the interface between the residual hills and alluvial plain.*




*Lot 1 DP1193553 -Topographic map. Subject area is located on the lower slopes of a low rise.*

Vegetation along the length of the three transects ranged from open cleared pasture to the north, grading into low trees with a thick understorey on the lower slope that then graded out onto a mostly cleared alluvial flood plain. Where trees were present they typically comprised paperbark and casuarina with a saw grass understorey. The alluvial flood plain was poorly drained with surface water present at the time of investigation.

A selection of images of the subject are presented below.

*Transect 3A - Open cleared pasture at north of transect line on the middle rise slopes. Thick vegetation present on the lower rise slope.*

*Transect 2B – Thick regrowth vegetation present on lower rise slope with grass understorey.*

*Transect 3B – Thick paperbark vegetation with saw grass understorey at toe of slope.*

*Transect 1A – Open cleared floodplain at toe of slope. Water pooling at surface at time of investigation*

### 3.2 Subsurface conditions

Reference to the Laurieton Coastal Quaternary Geology 1:25,000 Sheet (Troedson et al 2008) indicates the subject area of is located near the interface between a Quaternary alluvial and colluvial fan (Qavf) to the south and residual soils to the north. An excerpt of the Sheet is reproduced in Plate 3.

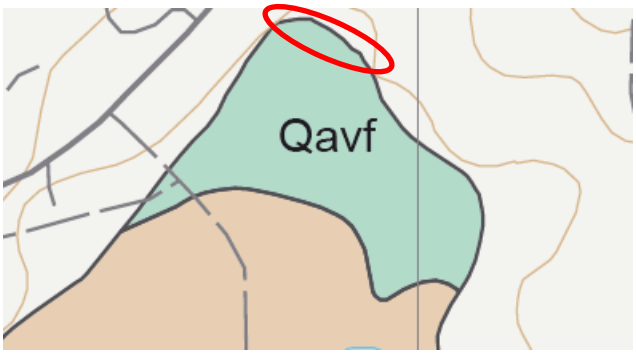



*Plate 3: Excerpt from the 1:25,000 Laurieton Coastal Quaternary Geology Sheet. Approximate location of the ssessment area outlined in red and is situated at the transition from residual slopes to a Qauternary alluvial floodplain.*

Reference to the Grants Head 1:25,000 Acid Sulfate Soils Risk Map (DLWC 2000) indicates the subject area is situated at the interface between residual soils and an alluvial floodplain.

The Quaternary sediments are underlain by undifferentiated rocks of the Watonga Formation which can include slate, chert, mudstone and the intrusive Karikeree Meta-dolerite.

The investigations encountered a variable soil profile as summarised in Tables 1 and 2.

**Table 1: Summary of Geotechnical Units**

| Geotechnical Unit | Material | Material Description |
|---|---|---|
| UNIT 1A | TOPSOIL (ORGANIC) | Organic Silty CLAY, dark brown/ grey/ black with high organic content, grass and tree roots. |
| UNIT 1B | TOPSOIL | Sandy SILT to Sandy CLAY, brown/ grey, trace Gravel, fine to coarse ironstone, with grass and tree roots. |
| UNIT 2 | ALLUVIAL (FLOODPLAIN) | CLAY, medium plasticity, pale grey / blue with brown mottling grading to pale brown with grey mottling, Some Sand, fine to coarse, firm to stiff, moisture content greater than plastic limit. |
| UNIT 3 | TRANSFERRAL | Sandy SILT to Sandy Silty CLAY, low plasticity, grey/ brown, trace orange mottling, Sand fine to coarse, trace Gravel, fine to coarse. Inferred colluvial / residual soils with poorly sorted composition that have been reworked by surface water flow. |
| UNIT 4 | RESIDUAL | Sandy CLAY, medium plasticity, brown with orange mottling, trace to some ironstone Gravel, fine to medium ironstone, very stiff / friable. |

The geotechnical units summarised above were defined taking into consideration the following:

- Alluvium: The general term for detrital deposits made by rivers or streams or found on alluvial fans, floodplains etc. – *Collins Geology Dictionary*
- Colluvium: Unconsolidated material at the bottom of a cliff or slope, generally moved by gravity alone. It lacks stratification and is usually unsorted – *Collins Geology Dictionary*
- Residual: Weathered insitu soils derived from pre-existing rocks – *Collins Dictionary*
- Transferral Soil Landscapes: Deposits of mostly eroded parent materials washed from areas directly upslope. Stream channels are often discontinuous and slopes are generally concave. – *Soil Landscapes of the Wingham and Camden Haven 1:100,000 Sheet – Draft Notes, (Eddie, M.W. 2015)*
- Based on previous experience, the presence of grey/blue mottling is indicative of saturation of the soil profile for extended periods, such as during inundation of a floodplain.

**Table 3: Summary of Subsurface Conditions**

| Investigation | Depth to Base of Material Layer (m) | | | | | |
|---|---|---|---|---|---|---|
| | Unit 1A Topsoil (Organic) | Unit 1B Topsoil | Unit 2 Alluvial (Floodplain) | Unit 3 Transferral | Unit 4 Residual | Groundwater |
| 1A | 0.2 | -- | ≥ 0.4 | -- | -- | >0.05 |
| 1B | 0.08 | -- | ≥ 0.4 | -- | -- | >0.08 |
| 1C | -- | 0.15 | -- | ≥ 0.4 | -- | -- |
| 1D | -- | >0.25* | -- | -- | -- | -- |
| 1E | -- | 0.1 | -- | ≥ 0.25* | -- | -- |
| 2A | -- | 0.15 | -- | -- | ≥ 0.45 | -- |
| 2B | -- | 0.3 | -- | -- | ≥ 0.4 | -- |
| 2C | 0.1 | -- | ≥ 0.45 | -- | -- | -- |
| 3A | -- | 0.15 | -- | -- | ≥ 0.25 | -- |
| 3B | 0.25 | >0.35 | ≥ 0.5 | -- | -- | >0.35 |

** Hand tool refusal*

Selected images of excavated profiles that illustrate the subsurface profiles encountered are presented below.

*TP1B – Organic topsoil (Unit 1A) overlying grey/blue saturated alluvial floodplain clays (Unit 2).*

*TP1C – Topsoil (Unit 1B) grading into transferral soils (Unit 3) with trace coarse ironstone gravel present.*

| | |
|---|---|
|  |  |
| *TP2C – Organic topsoil (Unit 1A) overlying mottled alluvial floodplain soils (Unit 2).* | *TP2A – Topsoil (Unit 1B) overlying orange/brown residual clay (Unit 4) soils.* |

Groundwater was encountered at the depths shown in Table 2. It should be noted that fluctuations in groundwater levels can occur as a result of seasonal variations, temperature, rainfall and other similar factors, the influence of which may not have been apparent at the time of the assessment.

## 4 DISCUSSION

Test pits were excavated using hand tools along three transects to assess the extent of alluvial soils in the subject area. The published Coastal Quaternary mapping indicates alluvial and colluvial soils may be present near the toe of the residual slope.

The subsurface profiles encountered comprised soils of the following origins:

- Unit 2 - Alluvial floodplain deposits encountered at the toe of the slope below approximately RL 7.75m and characterised by an organic rich topsoil horizon overlying mottled clay soils with a shallow water table. The presence of alluvial soils is consistent with the location of the subject area on an alluvial floodplain.
- Unit 3 – Transferral soils comprising a mixture of clays, silts, sands and gravels that were poorly sorted and are considered to comprise colluvial and, or, residual soils that have been reworked by alluvial processes and are situated in an indistinct drainage line;
- Unit 4 – Residual clay soils present on the residual slopes.

The inferred extent of the Unit 2 soils based in the investigation is shown on Figure 1.

## 5 LIMITATIONS

The findings presented in the report and used as the basis for recommendations presented herein were obtained using normal, industry accepted geotechnical design practises and standards. To our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances, however, can it be considered that these findings represent the actual state of the site at all points. If site conditions encountered during construction vary significantly from those discussed in this report, Regional Geotechnical Solutions Pty Ltd should be contacted for further advice.

This report alone should not be used by contractors as the basis for preparation of tender documents or project estimates. Contractors using this report as a basis for preparation of tender documents should avail themselves of all relevant background information regarding the site before deciding on selection of construction materials and equipment.

If you have any questions regarding this project, or require any additional consultations, please contact the undersigned.

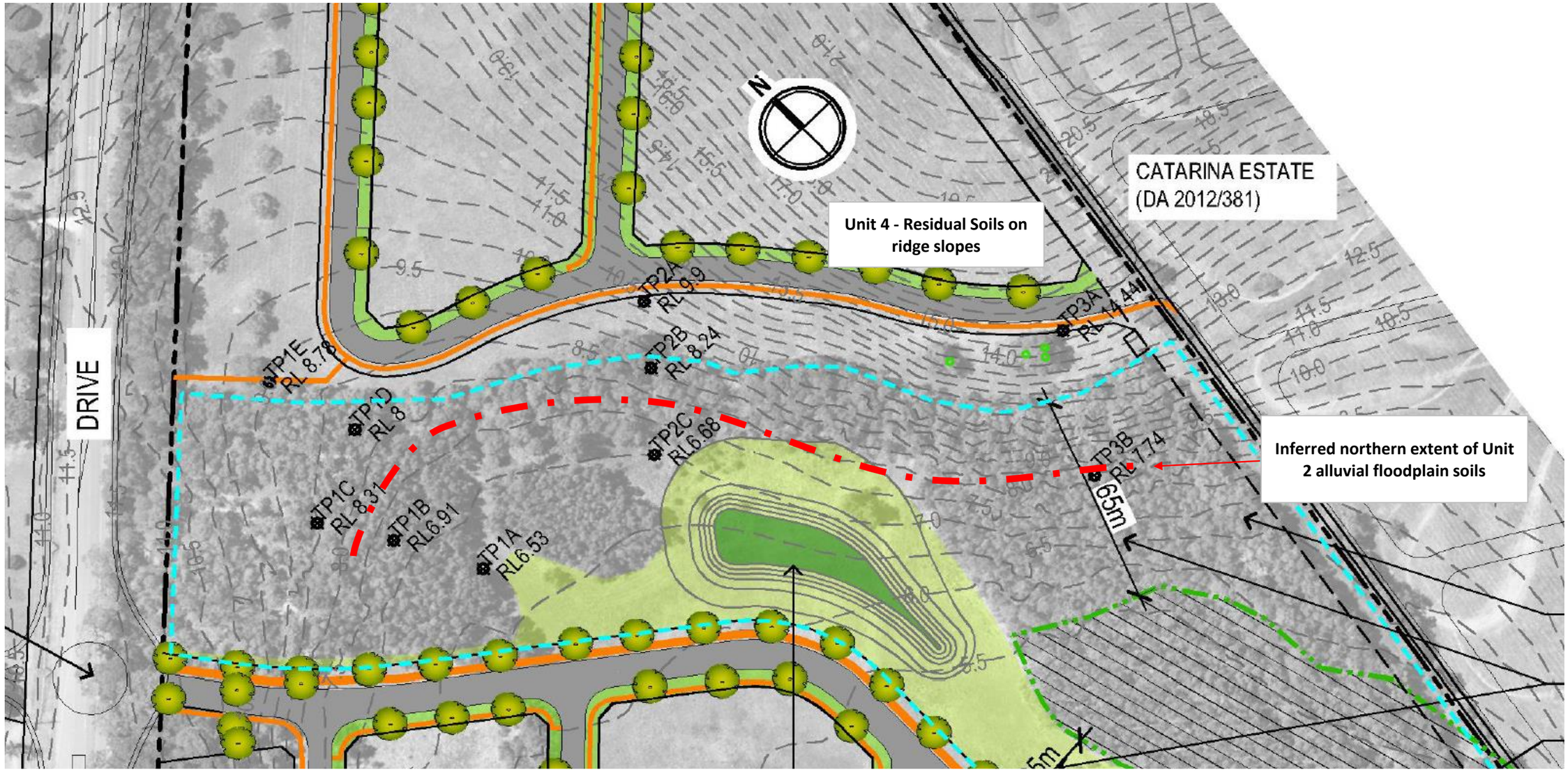
For and on behalf of

**Regional Geotechnical Solutions Pty Ltd**

**Tim Morris**

Senior Engineering Geologist

# Figure




Based on supplied drawing titled "5709_VMP Base for Freehand Drawings"

**Legend**

Test Pit Location

REGIONAL GEOTECHNICAL SOLUTIONS

| | | | |
|---|---|---|---|
| **Client** | KING & CAMPBELL | Job No. | RGS20337.1 |
| **Project:** | EASTERN CREEK, ST VINCENTS DEVELOPMENT | Drawn By: | TLM |
| | OCEAN DRIVE, LAKE CATHIE | Date: | 1-Dec-15 |
| **Title:** | INVESTIGATION LOCATION PLAN | Drawing No. | **Figure 1** |

# Appendix A

## Results of Field Investigations

# ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

**TEST PIT NO:** TP1A

**CLIENT:** King & Campbell

**PAGE:** 1 OF 1

**PROJECT NAME:** St Vincents Development, Rainbow Beach

**JOB NO:** RGS20337.1

**LOGGED BY:** TLM/JM

**LOCATION:** E484876 N6507657

**DATE:** 21/10/15

**EQUIPMENT TYPE:** Hand Tools

**SURFACE RL:**

**TEST PIT LENGTH:** 0.3 m **WIDTH:** 0.3 m

**DATUM:** AHD

| Drilling and Sampling | | | | | Material description and profile information | | | | | Field Test | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| METHOD | WATER | SAMPLES | RL (m) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components | MOISTURE CONDITION | CONSISTENCY DENSITY | Test Type | Result | Structure and additional observations |
| HAND TOOLS | ▶ | | | | | OL | **TOPSOIL:** Organic Silty CLAY, medium plasticity, dark grey, with grass roots | $M < w_L$ | S | | | TOPSOIL |
| | | | | | | | 0.20m | | | | | |
| | | | | | | CH | **CLAY:** High plasticity, pale grey with pale brown mottling, trace Sand, fine to coarse grained Gravel, fine grained ironstone, subrounded, orange/brown, trace pinhole fabric | $M > w_P$ | F - St | | | ALLUVIAL |
| | | | | | | | 0.40m | | | | | |
| | | | | | | | Hole Terminated at 0.40 m | | | | | |
| | | | | 0.5 | | | | | | | | |

**LEGEND:**

**Water**

- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

**Strata Changes**

- Gradational or transitional strata
- Definitive or distict strata change

**Notes, Samples and Tests**

| | |
|---|---|
| $U_{50}$ | 50mm Diameter tube sample |
| CBR | Bulk sample for CBR testing |
| E | Environmental sample (Glass jar, sealed and chilled on site) |
| ASS | Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled) |
| B | Bulk Sample |

**Field Tests**

| | |
|---|---|
| PID | Photoionisation detector reading (ppm) |
| DCP(x-y) | Dynamic penetrometer test (test depth interval shown) |
| HP | Hand Penetrometer test (UCS kPa) |

**Consistency**

| | | UCS (kPa) |
|---|---|---|
| VS | Very Soft | <25 |
| S | Soft | 25 - 50 |
| F | Firm | 50 - 100 |
| St | Stiff | 100 - 200 |
| VSt | Very Stiff | 200 - 400 |
| H | Hard | >400 |
| Fb | Friable | |

**Density**

| | | |
|---|---|---|
| V | Very Loose | Density Index <15% |
| L | Loose | Density Index 15 - 35% |
| MD | Medium Dense | Density Index 35 - 65% |
| D | Dense | Density Index 65 - 85% |
| VD | Very Dense | Density Index 85 - 100% |

**Moisture Condition**

| | |
|---|---|
| D | Dry |
| M | Moist |
| W | Wet |
| $W_p$ | Plastic Limit |
| $W_L$ | Liquid Limit |

RG LIB 1.03.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS20337.1 TP LOGS.GPJ <<DrawingFile>> 20/11/2015 09:36 8.30.004 Datgel Lab and In Situ Tool

# ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

**CLIENT:** King & Campbell
**PROJECT NAME:** St Vincents Development, Rainbow Beach
**LOCATION:** E484868 N6507673

**TEST PIT NO:** TP1B
**PAGE:** 1 OF 1
**JOB NO:** RGS20337.1
**LOGGED BY:** TLM/JM
**DATE:** 21/10/15

**EQUIPMENT TYPE:** Hand Tools
**TEST PIT LENGTH:** 0.3 m **WIDTH:** 0.3 m
**SURFACE RL:**
**DATUM:** AHD

| Drilling and Sampling | | | | | Material description and profile information | | | | | Field Test | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| METHOD | WATER | SAMPLES | RL (m) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components | MOISTURE CONDITION | CONSISTENCY DENSITY | Test Type | Result | Structure and additional observations |
| HAND TOOLS | ▶ | | | | | OL | **TOPSOIL:** Organic Clayey SILT, dark brown, with tree and grass roots | M - W | Fb | | | TOPSOIL |
| | | | | | | | 0.08m | | | | | |
| | | | | | | CL | **Silty CLAY:** Medium plasticity, dark brown/dark grey, some Sand fine to coarse grained, trace Gravel, fine grained, subrounded, ironstone | M > $w_P$ | F - Fb | | | ALLUVIAL |
| | | | | | | | 0.30m | | | HP | 150 | |
| | | | | | | CH | **CLAY:** High plasticity, blue/grey trace orange/brown mottling | M > $w_P$ | St | | | |
| | | | | | | | 0.40m | | | | | |
| | | | | 0.5 | | | Hole Terminated at 0.40 m | | | | | |

**LEGEND:**

**Water**
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

**Strata Changes**
- Gradational or transitional strata
- Definitive or distict strata change

**Notes, Samples and Tests**

| | |
|---|---|
| $U_{50}$ | 50mm Diameter tube sample |
| CBR | Bulk sample for CBR testing |
| E | Environmental sample (Glass jar, sealed and chilled on site) |
| ASS | Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled) |
| B | Bulk Sample |

**Field Tests**

| | |
|---|---|
| PID | Photoionisation detector reading (ppm) |
| DCP(x-y) | Dynamic penetrometer test (test depth interval shown) |
| HP | Hand Penetrometer test (UCS kPa) |

| Consistency | | UCS (kPa) |
|---|---|---|
| VS | Very Soft | <25 |
| S | Soft | 25 - 50 |
| F | Firm | 50 - 100 |
| St | Stiff | 100 - 200 |
| VSt | Very Stiff | 200 - 400 |
| H | Hard | >400 |
| Fb | Friable | |

| Density | | |
|---|---|---|
| V | Very Loose | Density Index <15% |
| L | Loose | Density Index 15 - 35% |
| MD | Medium Dense | Density Index 35 - 65% |
| D | Dense | Density Index 65 - 85% |
| VD | Very Dense | Density Index 85 - 100% |

| Moisture Condition | |
|---|---|
| D | Dry |
| M | Moist |
| W | Wet |
| $W_p$ | Plastic Limit |
| $W_L$ | Liquid Limit |

RG LIB 1.03.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS20337.1 TP LOGS.GPJ <<DrawingFile>> 20/11/2015 09:36 8.30.004 Datgel Lab and In Situ Tool

# ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

**CLIENT:** King & Campbell
**PROJECT NAME:** St Vincents Development, Rainbow Beach
**LOCATION:** E484849 N6507695

**TEST PIT NO:** TP1C
**PAGE:** 1 OF 1
**JOB NO:** RGS20337.1
**LOGGED BY:** TLM/JM
**DATE:** 21/10/15

**EQUIPMENT TYPE:** Hand Tools
**TEST PIT LENGTH:** 0.3 m **WIDTH:** 0.3 m
**SURFACE RL:**
**DATUM:** AHD

| Drilling and Sampling | | | | | Material description and profile information | | | | | Field Test | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| METHOD | WATER | SAMPLES | RL (m) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components | MOISTURE CONDITION | CONSISTENCY DENSITY | Test Type | Result | Structure and additional observations |
| HAND TOOLS | Not Encountered | | | | | MH | **TOPSOIL:** Sandy SILT, brown, some Clay, tree roots | M | Fb | | | TOPSOIL |
| | | | | | | | 0.15m | | | HP | 200 | COLLUVIAL/ALLUVIAL - INFERRED DRAINAGE LINE |
| | | | | | | CL | **Sandy Silty CLAY:** Low plasticity, grey/brown, Sand fine to coarse grained, Quartz trace of Gravel, fine to coarse, subangular/subrounded, iron altered Sandstone? | M < $w_P$ | St - Fb | | | |
| | | | | | | | 0.40m | | | | | |
| | | | | | | | Hole Terminated at 0.40 m | | | | | |
| | | | | 0.5 | | | | | | | | |

**LEGEND:**

**Water**
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

**Strata Changes**
- Gradational or transitional strata
- Definitive or distict strata change

**Notes, Samples and Tests**

| | |
|---|---|
| $U_{50}$ | 50mm Diameter tube sample |
| CBR | Bulk sample for CBR testing |
| E | Environmental sample (Glass jar, sealed and chilled on site) |
| ASS | Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled) |
| B | Bulk Sample |

**Field Tests**

| | |
|---|---|
| PID | Photoionisation detector reading (ppm) |
| DCP(x-y) | Dynamic penetrometer test (test depth interval shown) |
| HP | Hand Penetrometer test (UCS kPa) |

| Consistency | | UCS (kPa) |
|---|---|---|
| VS | Very Soft | <25 |
| S | Soft | 25 - 50 |
| F | Firm | 50 - 100 |
| St | Stiff | 100 - 200 |
| VSt | Very Stiff | 200 - 400 |
| H | Hard | >400 |
| Fb | Friable | |

| Density | | |
|---|---|---|
| V | Very Loose | Density Index <15% |
| L | Loose | Density Index 15 - 35% |
| MD | Medium Dense | Density Index 35 - 65% |
| D | Dense | Density Index 65 - 85% |
| VD | Very Dense | Density Index 85 - 100% |

| Moisture Condition | |
|---|---|
| D | Dry |
| M | Moist |
| W | Wet |
| $W_p$ | Plastic Limit |
| $W_L$ | Liquid Limit |

RG LIB 1.03.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS20337.1 TP LOGS.GPJ <<DrawingFile>> 20/11/2015 09:36 8.30.004 Datgel Lab and In Situ Tool

# ENGINEERING LOG - TEST PIT

**TEST PIT NO:** TP1D

**CLIENT:** King & Campbell

**PAGE:** 1 OF 1

**PROJECT NAME:** St Vincents Development, Rainbow Beach

**JOB NO:** RGS20337.1

**LOGGED BY:** TLM/JM

**LOCATION:** E484887 N6507698

**DATE:** 21/10/15

**EQUIPMENT TYPE:** Hand Tools

**SURFACE RL:**

**TEST PIT LENGTH:** 0.3 m **WIDTH:** 0.3 m

**DATUM:** AHD

| Drilling and Sampling | | | | | Material description and profile information | | | | | Field Test | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| METHOD | WATER | SAMPLES | RL (m) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components | MOISTURE CONDITION | CONSISTENCY DENSITY | Test Type | Result | Structure and additional observations |
| HAND TOOLS | Not Encountered | | | | | MH | **TOPSOIL:** Sandy SILT, grey, Sand fine to coarse grained, some Clay with grass and tree roots, trace Gravel fine to coarse grained, subangular | M | H / Fb | | | TOPSOIL GRADING TO COLLUVIAL |
| | | | | 0.5 | | | 0.25m<br>Hole Terminated at 0.25 m<br>Refusal on Coarse Gravel | | | | | |

**LEGEND:**

**Water**

- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

**Strata Changes**

- Gradational or transitional strata
- Definitive or distict strata change

**Notes, Samples and Tests**

| | |
|---|---|
| $U_{50}$ | 50mm Diameter tube sample |
| CBR | Bulk sample for CBR testing |
| E | Environmental sample (Glass jar, sealed and chilled on site) |
| ASS | Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled) |
| B | Bulk Sample |

**Field Tests**

| | |
|---|---|
| PID | Photoionisation detector reading (ppm) |
| DCP(x-y) | Dynamic penetrometer test (test depth interval shown) |
| HP | Hand Penetrometer test (UCS kPa) |

| Consistency | | UCS (kPa) |
|---|---|---|
| VS | Very Soft | <25 |
| S | Soft | 25 - 50 |
| F | Firm | 50 - 100 |
| St | Stiff | 100 - 200 |
| VSt | Very Stiff | 200 - 400 |
| H | Hard | >400 |
| Fb | Friable | |

| Density | | |
|---|---|---|
| V | Very Loose | Density Index <15% |
| L | Loose | Density Index 15 - 35% |
| MD | Medium Dense | Density Index 35 - 65% |
| D | Dense | Density Index 65 - 85% |
| VD | Very Dense | Density Index 85 - 100% |

| Moisture Condition | |
|---|---|
| D | Dry |
| M | Moist |
| W | Wet |
| $W_p$ | Plastic Limit |
| $W_L$ | Liquid Limit |

RG LIB 1.03.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS20337.1 TP LOGS.GPJ <<DrawingFile>> 20/11/2015 09:36 8.30.004 Datgel Lab and In Situ Tool

# ENGINEERING LOG - TEST PIT

**TEST PIT NO:** TP1E

**CLIENT:** King & Campbell

**PAGE:** 1 OF 1

**PROJECT NAME:** St Vincents Development, Rainbow Beach

**JOB NO:** RGS20337.1

**LOGGED BY:** TLM/JM

**LOCATION:** E484893 N6507728

**DATE:** 21/10/15

**EQUIPMENT TYPE:** Hand Tools

**SURFACE RL:**

**TEST PIT LENGTH:** 0.3 m **WIDTH:** 0.3 m

**DATUM:** AHD

| Drilling and Sampling | | | | | Material description and profile information | | | | | Field Test | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| METHOD | WATER | SAMPLES | RL (m) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components | MOISTURE CONDITION | CONSISTENCY DENSITY | Test Type | Result | Structure and additional observations |
| HAND TOOLS | Not Encountered | | | | | ML | **TOPSOIL:** Sandy SILT, grey/brown, Sand fine to coarse grained, grass and tree roots | M | Fb | | | TOPSOIL |
| | | | | | | | 0.10m | | | | | |
| | | | | | | MH | **Sandy SILT:** Brown/grey, trace orange mottling, some Clay, trace Gravel, fine to medium grained, subangular/subrounded, ironstone, red | | H / Fb | | | ALLUVIAL/COLLUVIAL |
| | | | | | | | 0.25m | | | | | |
| | | | | 0.5 | | | Hole Terminated at 0.25 m<br>Practical Refusal | | | | | |

**LEGEND:**

**Water**

- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

**Strata Changes**

- Gradational or transitional strata
- Definitive or distict strata change

**Notes, Samples and Tests**

| | |
|---|---|
| $U_{50}$ | 50mm Diameter tube sample |
| CBR | Bulk sample for CBR testing |
| E | Environmental sample (Glass jar, sealed and chilled on site) |
| ASS | Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled) |
| B | Bulk Sample |

**Field Tests**

| | |
|---|---|
| PID | Photoionisation detector reading (ppm) |
| DCP(x-y) | Dynamic penetrometer test (test depth interval shown) |
| HP | Hand Penetrometer test (UCS kPa) |

| Consistency | | UCS (kPa) |
|---|---|---|
| VS | Very Soft | <25 |
| S | Soft | 25 - 50 |
| F | Firm | 50 - 100 |
| St | Stiff | 100 - 200 |
| VSt | Very Stiff | 200 - 400 |
| H | Hard | >400 |
| Fb | Friable | |

| Density | | |
|---|---|---|
| V | Very Loose | Density Index <15% |
| L | Loose | Density Index 15 - 35% |
| MD | Medium Dense | Density Index 35 - 65% |
| D | Dense | Density Index 65 - 85% |
| VD | Very Dense | Density Index 85 - 100% |

| Moisture Condition | |
|---|---|
| D | Dry |
| M | Moist |
| W | Wet |
| $W_p$ | Plastic Limit |
| $W_L$ | Liquid Limit |

RG LIB 1.03.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS20337.1 TP LOGS.GPJ <<DrawingFile>> 20/11/2015 09:36 8.30.004 Datgel Lab and In Situ Tool

# ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

**CLIENT:** King & Campbell
**PROJECT NAME:** St Vincents Development, Rainbow Beach
**LOCATION:** E484969 N6507668

**TEST PIT NO:** TP2A
**PAGE:** 1 OF 1
**JOB NO:** RGS20337.1
**LOGGED BY:** TLM/JM
**DATE:** 21/10/15

**EQUIPMENT TYPE:** Hand Tools
**TEST PIT LENGTH:** 0.3 m **WIDTH:** 0.3 m
**SURFACE RL:**
**DATUM:** AHD

| Drilling and Sampling | | | | | Material description and profile information | | | | | Field Test | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| METHOD | WATER | SAMPLES | RL (m) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components | MOISTURE CONDITION | CONSISTENCY DENSITY | Test Type | Result | Structure and additional observations |
| HAND TOOLS | Not Encountered | | | | | MH | **TOPSOIL:** Sandy Clay SILT, dark brown/brown, Sand fine to coarse grained, trace Charcoal | M | Fb | | | TOPSOIL/COLLUVIAL |
| | | | | | | | 0.15m | | | | | |
| | | | | | | CH | **Sandy CLAY:** Medium plasticity, brown, with orange mottling, trace Gravel find to medium grained, subangular/subrounded, ironstone | M < $w_P$ | Fb - VSt | | | RESIDUAL SOIL |
| | | | | | | | 0.45m | | | | | |
| | | | | 0.5 | | | Hole Terminated at 0.45 m | | | | | |

**LEGEND:**

**Water**
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

**Strata Changes**
- Gradational or transitional strata
- Definitive or distict strata change

**Notes, Samples and Tests**

| | |
|---|---|
| $U_{50}$ | 50mm Diameter tube sample |
| CBR | Bulk sample for CBR testing |
| E | Environmental sample (Glass jar, sealed and chilled on site) |
| ASS | Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled) |
| B | Bulk Sample |

**Field Tests**

| | |
|---|---|
| PID | Photoionisation detector reading (ppm) |
| DCP(x-y) | Dynamic penetrometer test (test depth interval shown) |
| HP | Hand Penetrometer test (UCS kPa) |

| Consistency | | UCS (kPa) |
|---|---|---|
| VS | Very Soft | <25 |
| S | Soft | 25 - 50 |
| F | Firm | 50 - 100 |
| St | Stiff | 100 - 200 |
| VSt | Very Stiff | 200 - 400 |
| H | Hard | >400 |
| Fb | Friable | |

| Density | | |
|---|---|---|
| V | Very Loose | Density Index <15% |
| L | Loose | Density Index 15 - 35% |
| MD | Medium Dense | Density Index 35 - 65% |
| D | Dense | Density Index 65 - 85% |
| VD | Very Dense | Density Index 85 - 100% |

| Moisture Condition | |
|---|---|
| D | Dry |
| M | Moist |
| W | Wet |
| $W_p$ | Plastic Limit |
| $W_L$ | Liquid Limit |

RG LIB 1.03.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS20337.1 TP LOGS.GPJ <<DrawingFile>> 20/11/2015 09:36 8.30.004 Datgel Lab and In Situ Tool

# ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

**CLIENT:** King & Campbell
**PROJECT NAME:** St Vincents Development, Rainbow Beach
**LOCATION:** E484956 N6507649

**TEST PIT NO:** TP2B
**PAGE:** 1 OF 1
**JOB NO:** RGS20337.1
**LOGGED BY:** TLM/JM
**DATE:** 21/10/15

**EQUIPMENT TYPE:** Hand Tools
**TEST PIT LENGTH:** 0.3 m **WIDTH:** 0.3 m
**SURFACE RL:**
**DATUM:** AHD

| Drilling and Sampling | | | | | Material description and profile information | | | | | Field Test | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| METHOD | WATER | SAMPLES | RL (m) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components | MOISTURE CONDITION | CONSISTENCY DENSITY | Test Type | Result | Structure and additional observations |
| HAND TOOLS | Not Encountered | | | | | MH | **TOPSOIL:** Sandy Clayey SILT, brown, Sand fine to coarse grained, trace Gravel, fine to coarse grained, subangular/subrounded, ironstone | M | Fb | | | TOPSOIL/COLLUVIAL |
| | | | | | | CH | 0.30m<br>**Sandy CLAY:** Medium plasticity, brown with orange mottling, Sand fine to coarse grained, some Gravel m fine grained, subrounded/subangular, ironstone | M < $w_P$ | Fb - VSt | | | RESIDUAL SOIL |
| | | | | 0.5 | | | 0.40m<br>Hole Terminated at 0.40 m | | | | | |

**LEGEND:**

**Water**
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

**Strata Changes**
- Gradational or transitional strata
- Definitive or distict strata change

**Notes, Samples and Tests**

| | |
|---|---|
| $U_{50}$ | 50mm Diameter tube sample |
| CBR | Bulk sample for CBR testing |
| E | Environmental sample (Glass jar, sealed and chilled on site) |
| ASS | Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled) |
| B | Bulk Sample |

**Field Tests**

| | |
|---|---|
| PID | Photoionisation detector reading (ppm) |
| DCP(x-y) | Dynamic penetrometer test (test depth interval shown) |
| HP | Hand Penetrometer test (UCS kPa) |

**Consistency**

| | | UCS (kPa) |
|---|---|---|
| VS | Very Soft | <25 |
| S | Soft | 25 - 50 |
| F | Firm | 50 - 100 |
| St | Stiff | 100 - 200 |
| VSt | Very Stiff | 200 - 400 |
| H | Hard | >400 |
| Fb | Friable | |

**Density**

| | | |
|---|---|---|
| V | Very Loose | Density Index <15% |
| L | Loose | Density Index 15 - 35% |
| MD | Medium Dense | Density Index 35 - 65% |
| D | Dense | Density Index 65 - 85% |
| VD | Very Dense | Density Index 85 - 100% |

**Moisture Condition**

| | |
|---|---|
| D | Dry |
| M | Moist |
| W | Wet |
| $W_p$ | Plastic Limit |
| $W_L$ | Liquid Limit |

RG LIB 1.03.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS20337.1 TP LOGS.GPJ <<DrawingFile>> 20/11/2015 09:36 8.30.004 Datgel Lab and In Situ Tool

# ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

**CLIENT:** King & Campbell
**PROJECT NAME:** St Vincents Development, Rainbow Beach
**LOCATION:** E484944 N6507646

**TEST PIT NO:** TP2C
**PAGE:** 1 OF 1
**JOB NO:** RGS20337.1
**LOGGED BY:** TLM/JM
**DATE:** 21/10/15

**EQUIPMENT TYPE:** Hand Tools
**TEST PIT LENGTH:** 0.3 m **WIDTH:** 0.3 m
**SURFACE RL:**
**DATUM:** AHD

| Drilling and Sampling | | | | | Material description and profile information | | | | | Field Test | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| METHOD | WATER | SAMPLES | RL (m) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components | MOISTURE CONDITION | CONSISTENCY DENSITY | Test Type | Result | Structure and additional observations |
| HAND TOOLS | Not Encountered | | | | | OH | **TOPSOIL:** Clayey organic SILT, dark brown, some Sand fine to medium grained, with grass roots | M | Fb | | | TOPSOIL |
| | | | | | | MH | 0.10m<br>**Sandy Clayey SILT:** Grey/brown, Sand fine o medium grained, grass roots, trace charcoal | M | Fb | | | ALLUVIAL |
| | | | | | | CH | 0.20m<br>**Sandy CLAY:** Medium plasticity, pale brown with trace orange mottling, Sand fine to coarse grained, trace Gravel fine grained, ironstone, subrounded, quartz and charcoal | $M > w_P$ | St | | | |
| | | | | 0.5 | | | 0.45m<br>Hole Terminated at 0.45 m | | | | | |

RG LIB 1.03.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS20337.1 TP LOGS.GPJ <<DrawingFile>> 20/11/2015 09:36 8.30.004 Datgel Lab and In Situ Tool

**LEGEND:**

**Water**
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

**Strata Changes**
- Gradational or transitional strata
- Definitive or distict strata change

**Notes, Samples and Tests**

| | |
|---|---|
| $U_{50}$ | 50mm Diameter tube sample |
| CBR | Bulk sample for CBR testing |
| E | Environmental sample (Glass jar, sealed and chilled on site) |
| ASS | Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled) |
| B | Bulk Sample |

**Field Tests**

| | |
|---|---|
| PID | Photoionisation detector reading (ppm) |
| DCP(x-y) | Dynamic penetrometer test (test depth interval shown) |
| HP | Hand Penetrometer test (UCS kPa) |

**Consistency**

| | | UCS (kPa) |
|---|---|---|
| VS | Very Soft | <25 |
| S | Soft | 25 - 50 |
| F | Firm | 50 - 100 |
| St | Stiff | 100 - 200 |
| VSt | Very Stiff | 200 - 400 |
| H | Hard | >400 |
| Fb | Friable | |

**Density**

| | | |
|---|---|---|
| V | Very Loose | Density Index <15% |
| L | Loose | Density Index 15 - 35% |
| MD | Medium Dense | Density Index 35 - 65% |
| D | Dense | Density Index 65 - 85% |
| VD | Very Dense | Density Index 85 - 100% |

**Moisture Condition**

| | |
|---|---|
| D | Dry |
| M | Moist |
| W | Wet |
| $W_p$ | Plastic Limit |
| $W_L$ | Liquid Limit |

# ENGINEERING LOG - TEST PIT

**TEST PIT NO:** TP3A

**CLIENT:** King & Campbell

**PAGE:** 1 OF 1

**PROJECT NAME:** St Vincents Development, Rainbow Beach

**JOB NO:** RGS20337.1

**LOGGED BY:** TLM/JM

**LOCATION:** E485053 N6507563

**DATE:** 21/10/15

**EQUIPMENT TYPE:** Hand Tools

**SURFACE RL:**

**TEST PIT LENGTH:** 0.3 m **WIDTH:** 0.3 m

**DATUM:** AHD

| Drilling and Sampling | | | | | Material description and profile information | | | | | Field Test | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| METHOD | WATER | SAMPLES | RL (m) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components | MOISTURE CONDITION | CONSISTENCY DENSITY | Test Type | Result | Structure and additional observations |
| HAND TOOLS | Not Encountered | | | | | MH | **TOPSOIL:** Sandy SILT, brown, some Clay, low plasticity, grass and tree roots | M | Fb | | | TOPSOIL/COLLUVIAL |
| | | | | | | CH | 0.15m<br>**Sandy CLAY:** Medium plasticity, brown with orange mottling, Sand fine to coarse grained, some Gravel, fine to medium grained, subangular/subrounded, mixed ironstone and lithic fragments | M < $w_P$ | H - Fb | | | RESIDUAL SOIL |
| | | | | 0.5 | | | 0.25m<br>Hole Terminated at 0.25 m<br>Practical Refusal | | | | | |

**LEGEND:**

**Water**

- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

**Strata Changes**

- Gradational or transitional strata
- Definitive or distict strata change

**Notes, Samples and Tests**

| | |
|---|---|
| $U_{50}$ | 50mm Diameter tube sample |
| CBR | Bulk sample for CBR testing |
| E | Environmental sample (Glass jar, sealed and chilled on site) |
| ASS | Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled) |
| B | Bulk Sample |

**Field Tests**

| | |
|---|---|
| PID | Photoionisation detector reading (ppm) |
| DCP(x-y) | Dynamic penetrometer test (test depth interval shown) |
| HP | Hand Penetrometer test (UCS kPa) |

| Consistency | | UCS (kPa) |
|---|---|---|
| VS | Very Soft | <25 |
| S | Soft | 25 - 50 |
| F | Firm | 50 - 100 |
| St | Stiff | 100 - 200 |
| VSt | Very Stiff | 200 - 400 |
| H | Hard | >400 |
| Fb | Friable | |

| Density | | |
|---|---|---|
| V | Very Loose | Density Index <15% |
| L | Loose | Density Index 15 - 35% |
| MD | Medium Dense | Density Index 35 - 65% |
| D | Dense | Density Index 65 - 85% |
| VD | Very Dense | Density Index 85 - 100% |

| Moisture Condition | |
|---|---|
| D | Dry |
| M | Moist |
| W | Wet |
| $W_p$ | Plastic Limit |
| $W_L$ | Liquid Limit |

RG LIB 1.03.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS20337.1 TP LOGS.GPJ <<DrawingFile>> 20/11/2015 09:36 8.30.004 Datgel Lab and In Situ Tool

# ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

**CLIENT:** King & Campbell
**PROJECT NAME:** St Vincents Development, Rainbow Beach
**LOCATION:** E485021 N6507544

**TEST PIT NO:** TP3B
**PAGE:** 1 OF 1
**JOB NO:** RGS20337.1
**LOGGED BY:** TLM/JM
**DATE:** 21/10/15

**EQUIPMENT TYPE:** Hand Tools
**TEST PIT LENGTH:** 0.3 m **WIDTH:** 0.3 m
**SURFACE RL:**
**DATUM:** AHD

| Drilling and Sampling | | | | | Material description and profile information | | | | | Field Test | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| METHOD | WATER | SAMPLES | RL (m) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components | MOISTURE CONDITION | CONSISTENCY DENSITY | Test Type | Result | Structure and additional observations |
| HAND TOOLS | | | | | | OL | **TOPSOIL:** Organic SILT, dark brown, some Clay, grass and tree roots | M | Fb | | | TOPSOIL |
| | | | | | | | 0.20m | | | | | |
| | ▶ | | | | | CH | **CLAY:** Medium to high plasticity, pale grey, grading to pale brown with G/B mottling, some Sand fine to coarse grained quartz | M > $w_P$ | F | | | ALLUVIAL<br>0.35: water inflow |
| | | | | 0.5 | | | 0.50m | | | | | |
| | | | | | | | Hole Terminated at 0.50 m | | | | | |

**LEGEND:**

**Water**
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

**Strata Changes**
- Gradational or transitional strata
- Definitive or distict strata change

**Notes, Samples and Tests**

| | |
|---|---|
| $U_{50}$ | 50mm Diameter tube sample |
| CBR | Bulk sample for CBR testing |
| E | Environmental sample (Glass jar, sealed and chilled on site) |
| ASS | Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled) |
| B | Bulk Sample |

**Field Tests**

| | |
|---|---|
| PID | Photoionisation detector reading (ppm) |
| DCP(x-y) | Dynamic penetrometer test (test depth interval shown) |
| HP | Hand Penetrometer test (UCS kPa) |

**Consistency**

| | | UCS (kPa) |
|---|---|---|
| VS | Very Soft | <25 |
| S | Soft | 25 - 50 |
| F | Firm | 50 - 100 |
| St | Stiff | 100 - 200 |
| VSt | Very Stiff | 200 - 400 |
| H | Hard | >400 |
| Fb | Friable | |

**Density**

| | | |
|---|---|---|
| V | Very Loose | Density Index <15% |
| L | Loose | Density Index 15 - 35% |
| MD | Medium Dense | Density Index 35 - 65% |
| D | Dense | Density Index 65 - 85% |
| VD | Very Dense | Density Index 85 - 100% |

**Moisture Condition**

| | |
|---|---|
| D | Dry |
| M | Moist |
| W | Wet |
| $W_p$ | Plastic Limit |
| $W_L$ | Liquid Limit |

RG LIB 1.03.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS20337.1 TP LOGS.GPJ <<DrawingFile>> 20/11/2015 09:36 8.30.004 Datgel Lab and In Situ Tool