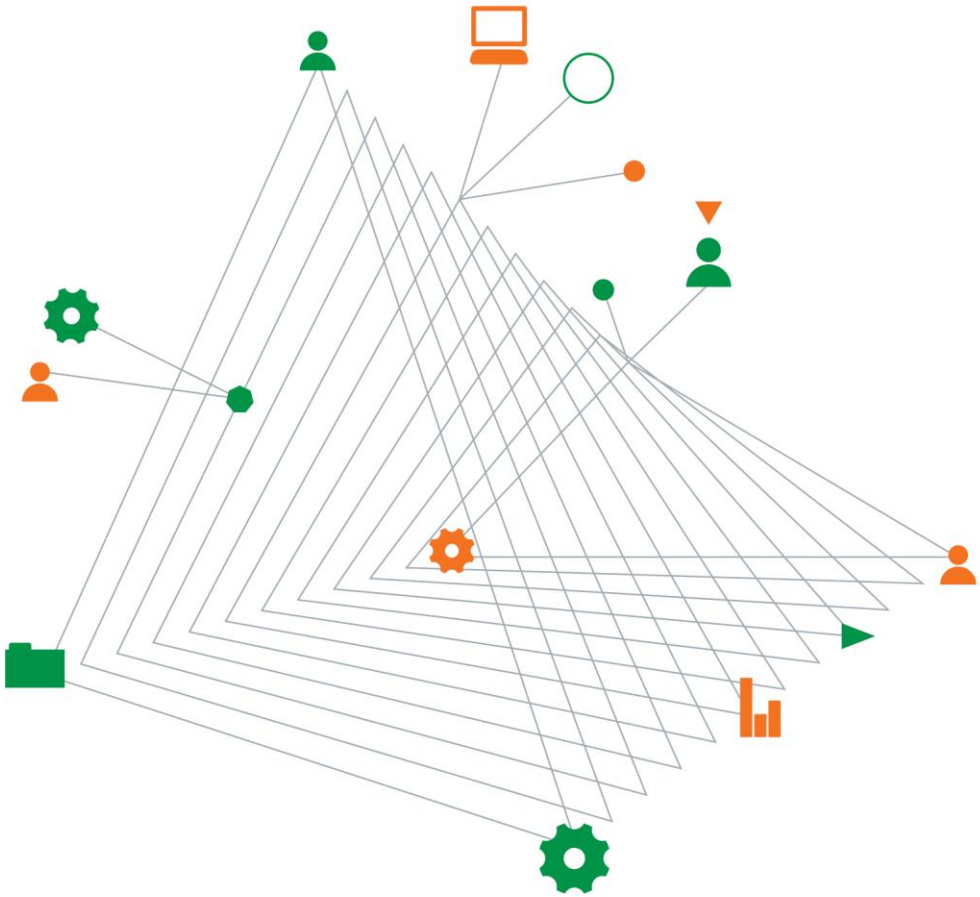
The Lakes (2012) Ltd

Lots 887, 888 & 889, Stage 2T, The Lakes

Geotechnical Completion Report



Experience
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expertise

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Lots 887, 888 & 889, Stage 2T, The Lakes

Prepared for
The Lakes (2012) Ltd

Prepared by
Coffey Geotechnics (NZ) Ltd
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Document authorisation

Our ref: GENZTAUC13086AE-AE

For and on behalf of Coffey

Robert Telford
Project Engineering Geologist

Quality information

Revision history

Revision	Description	Date	Author	Reviewer	Signatory
AE	Draft GCR	10/09/2014	R Telford	S Hargraves	S Hargraves

Distribution

Report Status	No. of copies	Format	Distributed to	Date
AE	1	PDF + Hardcopy	The Lakes (2012) Ltd	15/09/2014
AE	1	PDF + Hardcopy	Harrison Grierson Consultants Ltd	15/09/2014
AE	1	PDF + Hardcopy	Tauranga City Council	15/09/2014

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Appendices

1. Introduction and Scope

This Geotechnical Completion Report (GCR) has been prepared by Coffey Geotechnics (NZ) Ltd (Coffey) for The Lakes (2012) Limited as part of the documentation to be submitted to the Tauranga City Council following subdivision development in general accordance with the conditions of Council resource consent number RC21332. It contains a Geotechnical Suitability Statement (Appendix B), the results of site investigations and relevant quality control test data, together with as-built plans derived from Harrison Grierson Consultants Ltd (HGCL) topographical data.

This report is specific to Lots 887, 888 and 889 within Stage 2T of The Lakes subdivision as these lots were excluded from the overall GCR for this stage of the development.

2. Description of Subdivision

Stages 2Q, 2R, 2S & 2T of the Lakes subdivision (collectively referred to as 2QRST) are located to the south-east of the intersection of Takitimu Drive (State Highway 36) and Kennedy Road in Tauriko, Tauranga. Lots 887, 888 and 889 described herein are located at the southern end of the 2QRST area within Stage 2T.

The locations of the subject lots are shown on the attached plan (Figure 08). The new lots are located on flat or gently sloping ground that has been formed through excavation and controlled filling at the foot of a steep natural slope that rises to the east and south-east of the subject properties. Due to the risk of possible instability on the natural (i.e. un-modified) parts of the slope to the east and south-east of the lots, a debris barrier was constructed at the toe of the slope in the location shown on Figure 10.

With the exception of drainage materials used during the civil construction stage, all bulk fill materials used during this development were obtained from excavation on site.

3. Related Reports

Stages 2QRST of the Lakes development have been subject to several stages of geotechnical investigation and assessment which are summarised in the following documents:

1. Shrimpton & Lipinski Ltd, “Pyes Pa West Urbanisation Development, Tauranga – Geotechnical Assessment Report”, ref: 16944, dated October 2003.
2. Coffey letter, “Re Geotechnical Design – Debris Protection Bunds for Areas E, F and K, The Lakes, Pyes Pa”, ref: GEOTTAUC13086, dated 11 June 2008.
3. Coffey letter, “Re: Review of existing debris barriers for The Lakes - areas 2Q and 2T”, ref: GENZTAUC13086AE-AA, dated 1 February 2013.
4. Coffey letter, “Slope Stability Assessment for The Lakes Subdivision – Stage 2Q”, ref: GENZTAUC13086AG-AA, dated 13 March 2013.
5. Coffey letter, “Re: Design of Debris Protection Bunds – The Lakes Stages 2QRST”, ref: GENZTAUC13086AE-AB, dated 26 March 2013.
6. Coffey report, “Geotechnical Completion Report on Stage 2QRST at The Lakes Subdivision”, ref: GENZTAUC13086AE-AC (Revision 1), dated 9 June 2014.

For a full understanding of the site history and development it is recommended that these documents are read in conjunction with this report, particularly the Stage 2QRST GCR dated 9 June 2014.

4. Investigations Completed

Subsurface investigations for the 2QRST development were completed in several stages prior to and during the two phases of bulk earthworks. The majority of these investigations were located some distance from the subject lots and are therefore not discussed further in this report. Refer to the Coffey GCR dated 9 June 2014 for a complete description and summary of results.

In the vicinity of the three lots, investigations have included:

- 13 test pits (TP1 to TP13) excavated to approximately 3m depth in 2008, prior to the sub-excavation of peat and organic soils within Stage 2T;
- Two Cone Penetrometer Tests (CPT11 & CPT12) completed by Coffey in 2013 to assess subsurface conditions after the 2007-2008 earthworks and before the start of work in 2013-2014;
- Four test pits completed by Coffey (TP101 to TP104) up to 4.5m depth in November 2013;
- Three hand-auger boreholes drilled in August 2014 to up to 5m depth within the lots to confirm founding conditions beneath the sites and to assess the condition of filling placed in 2007-2008 (HA185 to HA187); and
- Ten shallow boreholes drilled in August 2014 to up to 0.8m depth within the subject lots, specifically to assess the condition of a thin layer of fill placed in 2014 (HA188 to HA197).

The test locations are shown on the appended site plans (Figures 08 to 12). Borehole and test-pit logs are attached to this report (Appendix C).

5. Overview of Geological Conditions

The original landform in the vicinity of Stage 2T consisted of a deeply incised valley which was overlooked by a steep, approximately 30m-40m high escarpment to the east and south-east. The original (i.e. pre 2007) ground contours are shown on Figure 08.

The slopes to the east and south-east of the site comprise a sequence of volcanic ashes overlying Matua Sub-Group soils and pumice sands of the Te Ranga Ignimbrite, with a surface veneer of colluvial soils on the slope face. The volcanic ash sequence on the slopes is common throughout the Tauranga area, consisting of the Hamilton Ash, Rotoehu Ash and Post-Rotoehu or ‘younger’ Ashes.

The valley floor contained ancient fluvially re-worked sediments of the Matua Sub-Group, comprising mixed and inter-bedded silts, sands and clays. At the foot of the steep slopes, the Matua Sub-Group soils were overlain by more recent sediments and colluvial material derived from the escarpment.

Beneath Lots 887, 888 and 889, the original (pre 2007) near-surface soils contained several metres of peat and highly organic silts and sands. The peat was removed to approximately 4m depth in 2008 before controlled fill was placed in the area. Subsequent investigations in 2013 however indicated that organic bearing soils still remain in places at depth in this area.

6. Earthworks Operations

6.1. Contractors & Plant

Earthworks on Lots 887, 888 and 889 have been completed in three stages in 2007-2008, 2012-2013 and 2014. Work during the 2007-2008 season was completed by Bob Hicks Earthmovers Ltd. The principal contractor for the 2012-2013 season was Higgins Group Holdings Ltd (Higgins), who sub-contracted the majority of work to Andrew Young Earthmoving Ltd. The civil construction works in 2013 and 2014 were completed by Higgins who also placed minor additional filling within the subject lots in 2014.

The main items of plant used during each of the bulk earthworks phase comprised Terex and towed motor scrapers, hydraulic excavators, bulldozers and sheepsfoot rollers.

6.2. Construction Programme

Earthworks completed in each of the three main work stages are summarised below.

6.2.1. 2007-2008

Works completed during 2007-2008 included sub-excavation of peat and organic soils to up to approximately 4m depth beneath the subject lots and replacement of the excavated material with up to 5m depth of controlled fill as shown on Figure 09. Subsoil drains were installed beneath the fill to control seepage and elevated groundwater as required.

At the end of the work season, an approximately 3m high debris protection bund was constructed between Stage 2T and the steep escarpment to the east and south east of the subject lots. The location of this bund and the 'finished' ground surface after May 2008 is shown on Figure 10. The surface was not topsoiled at the end of this work season.

6.2.2. 2012-2013

The works undertaken in the 2012-2013 season included further excavation and filling within areas to the north of the subject properties. Lots 887 to 889 were however relatively unaffected by these earthworks; the ground surface in this area being stripped of loose soil and vegetation and then covered in a 150mm layer of topsoil.

Contours of cuts and fills during this period calculated by HGCL are shown on Figure 11. These contours compare the ground surface following the 2007-08 season to the post-topsoil surface at the end of the 2012-13.

6.2.3. 2014

During the civil construction phase in 2014, up to 0.5m of fill was placed within Lots 887 to 889 by Higgins. The purpose of this late filling was to provide a more suitable gradient for stormwater drainage within this part of the subdivision.

The topsoil laid on these lots in 2012-13 was removed before the new filling was completed and then replaced over the finished ground surface at the end of work. The fill depth contours shown on Figure 11 therefore include approximately 150mm of topsoil within the subject lots. These contours were

provided by HGCL and represent the difference between the un-topsoiled ground surface surveyed in May 2008 and the finished, topsoiled surface surveyed in April 2014.

7. Quality Control

7.1. Undercut Inspections

During the initial gully cleaning and excavation in 2007-2008, general topsoil stripping and removal of the peat layer was supervised by Coffey staff.

As noted in Section 6.2.1, the finished ground surface after 2008 was not topsoiled. Clearing work at the start of the 2012-13 season therefore consisted of removing sparse vegetation and grass across the site. Minor excavation was also undertaken to sub-excavate several erosion features that had formed on the fill surface in the time between the two work seasons. The cleared surface was inspected by Coffey before any fill was placed.

Finally, in 2014 topsoil was removed from Lots 887 to 889 before the additional fill was placed in this area. Coffey inspected and approved he cleared surface before filling.

7.2. Quality Control

The placement of fill during 2007 and 2008 was overseen by Coffey. A description of the testing and supervision completed is included in the previous Stage 2QRST GCR report dated 9 June 2014. It is noted that although Nuclear Density Meter (NDM) measurements were taken within fill materials at this time, no NDM tests were actually located within Lots 887 to 889.

No specific monitoring or testing was conducted within the subject lots in 2012-2013 as work in this area did not include placement of new engineered fill. The thin layer of fill placed across the sites in 2014 was inspected and tested by Coffey in August 2014 (HA188 to HA197 inclusive).

8. Engineering Evaluation & Recommendations

8.1. Subsoil Drainage

As shown on Figure 09, a network of subsoil drains was installed below the filling near the subject lots in 2007-2008. During civil construction in March 2013 however, localised shallow groundwater levels were observed at some locations in pipe trenches within the subdivision and at levels above the drainage network, indicating the drains may not be functioning effectively. It was considered possible that the outlet to the drainage network was damaged or partially blocked during construction of SH36.

8.2. Fill Quality

Based on the results of monitoring and testing completed by Coffey during the 2007-2008 work season, it is considered that the majority of fill placed at this time generally met the requirements of ‘certified fill’ as defined by the Tauranga City Council Infrastructure Development Code (TCC IDC) and NZS 4431. However, undrained shear strength measurements from TP101 to TP104 and HA185 to HA187 inclusive indicate that parts of this fill may have lost some strength since it was placed. While most shear strengths measured were above 150kPa (and often over 200kPa), readings of between 60kPa and 100kPa were recorded at some locations. These low shear strengths are

possibly due to shallow or perched groundwater within the fill material which can result in softening, especially in cohesive soils.

The additional fill placed in 2014 also produced variable test results. The average undrained shear strength measured within this layer in boreholes HA185 to HA197 inclusive was 150kPa, although measurements as low as 100kPa were also recorded (ignoring measurements within the surficial topsoil layer).

Although placed under engineered conditions, due to the relatively low shear strengths discussed above, the fill dating from 2007-2008 and the additional fill placed in 2014 would not meet the requirements of 'certified fill' as defined by the TCC IDC or NZS 4431. However, the existing fill on this site is generally considered suitable for residential development, subject to the specific foundation design recommendations outlined in Section 8.5 below.

8.3. Static Settlement

'Static' or load induced settlements due to fill loads have been measured within or near the subject lots since February 2008, using four settlement markers installed at this time (SM05 to SM08 shown on Figure 09). The results of this monitoring programme are shown on Charts 1 & 2 in Appendix D.

The data for these points contains a large gap from March 2009 to October 2012 when work on site was placed on hold. The data also contains a number of inconsistencies due to damage to individual marker pegs or changes in survey methodology which make interpreting the long term settlement of the site somewhat difficult.

To provide a more accurate measure of the rate of settlement currently occurring at the site, three additional settlement monitoring points were installed in July 2014 (SM887 to SM889 on Figure 11). These points, along with SM5, SM6 and SM8, were measured weekly for six weeks up to 27 August 2014. Monitoring point SM7 was damaged during civil construction works in February 2013 and was abandoned.

Since July, no further discernible settlement has occurred within the tolerances of the survey method being used (approximately ±2mm). It is therefore considered that any consolidation settlements resulting from the placement of fill on these sites in 2007-2008 and 2014 is effectively complete at the time of writing.

8.3.1. Future Settlements

Notwithstanding the above, these sites may be affected by further settlement in the future, due either to consolidation settlements resulting from new building loads or additional filling, or 'creep' settlements which occur naturally over time as the underlying soils age.

Calculations completed for the overall GCR for Stage 2QRST (ref: GENZTAUC13086AE-AC) and the results of the settlement monitoring described above indicate these sites may experience on the order of 15mm to 20mm of additional consolidation settlement due to typical development loads (e.g. a single story dwelling and minor landscape filling). This consolidation would be expected to occur within 6 months of construction.

In addition to this load induced deformation, a further 15mm to 20mm of 'creep' settlement may occur over the assumed 50 year design life of the proposed dwellings. The combination of these two affects may result in up to 20mm to 30mm of differential settlement across the proposed building platforms.

Provided the foundation design recommendations outlined in Section 8.5 are followed, it is considered that the combined creep and consolidation settlements beneath a typical single storey dwelling built

on these lots should be within limits recommended by the Ministry of Business, Innovation and Employment (i.e. less than 25mm per 6m length of building).

8.4. Seismic Liquefaction

The potential for earthquake induced liquefaction of soils beneath these sites was also assessed in the overall GCR for Stage 2T (ref: GENZTAUC13086AE-AC). This report concluded that some soils beneath the subject lots may liquefy in a significant earthquake. However, due to the depth at which potentially liquefiable soils are encountered, the risk of adverse effects at the ground surface is considered to be relatively low.

In the event of a 'Serviceability Limit State' (SLS) earthquake with a return period of 1 in 25 years, liquefaction may induce vertical ground settlements of up to 10mm within Stage 2T and beneath the subject lots. Any differential settlements due to this liquefaction at the ground surface should be within the serviceability limits of a dwelling designed in accordance with the recommendations given in Section 8.5.

During an 'Ultimate Limit State' (ULS) earthquake with a return period of 1 in 500 years, liquefaction induced settlements of around 50mm may occur within Stage 2T. Provided the dwellings on the subject lots are designed in accordance with the recommendations presented below, settlement of this magnitude should not pose a significant safety risk to occupants of these buildings.

8.5. Foundation Design & Bearing Capacity

Due to the presence of variable and non-certified filling beneath the subject lots as well as risks of future settlement and earthquake induced liquefaction, it is recommended that buildings on Lots 887 to 889 be supported on pod-raft type foundations (e.g. 'rib-raft' or similar) specifically designed for an ultimate bearing capacity of 210kPa.

Alternatively, dwellings may be supported on specifically designed suspended timber foundations. In this case, the foundation bearing capacity should be confirmed by a Chartered Professional Engineer (CPEng) at the design stage.

Regardless of foundation option selected, the design will also need to consider the effects of future differential settlement on these sites (see Sections 8.3.1 and 8.6) and may need to allow for re-levelling of the dwelling in the event of excessive deformation.

Due to the variable nature of the underlying fill materials, it is essential that all foundation excavations are inspected by a TCC Category 1 or Category 2 Geo-professional during construction. These inspections should include undrained shear strength measurements at regular intervals within the excavation. Any materials with an undrained shear strength of less than 110kPa or any other unsuitable materials encountered should be sub-excavated and replaced with appropriately compacted clean fill.

Foundations within a 45 degree zone of influence from pipe inverts or service trenches will require engineering design input in accordance with the specifications in the TCC Infrastructure Development Code.

8.5.1. Strength Reduction Factor

As required by Section B1/VM4 of the New Zealand Building Code Handbook, a strength reduction factor of 0.50 or 0.80 should be applied to all recommended geotechnical ultimate soil capacities in

conjunction with their use in factored design load cases for static and earthquake overload conditions respectively.

8.6. Future Cut, Fill & Retaining Wall Design

The subject lots are situated on gently sloping land and may therefore be subject to minor cuts and fills as part of the development of individual lots. To reduce the risk of adverse effects due to excessive load induced settlement, it is recommended that the depth of fill placed on these lots be restricted to 300mm or less above existing ground level (including topsoil or raised gardens, etc). Fills of more than 300mm depth will require specific geotechnical input. Possible options for reducing development loads and therefore mitigating effects due to future load induced settlements are presented in an advisory document by Coffey (ref: GENZTAUC13086AE-AD dated 15 June 2014).

Any retaining walls with a total retained height of more than 0.5m (including tiered walls on subject or neighbouring properties) or those supporting a building or accessway/parking area should be designed by a Chartered Professional Engineer giving consideration to toe slope gradients and crest surcharge slopes. Consideration must also be given to existing retaining walls on the subject or neighbouring properties. Filling within the zone of influence of any existing retaining wall will need specific engineering input to ensure the stability of the existing wall is not adversely affected.

It is generally advised that unsupported cut and fill batters should be graded no steeper than 1 vertical to 2.5 horizontal. Fills above an existing retaining wall on the subject or neighbouring property should not encroach within a distance equal to the height of the wall without geotechnical review. Excavation below an existing retaining wall should not encroach within a distance equal to twice the height of the wall without geotechnical advice.

8.7. Re-Spread Topsoil

Topsoil was re-spread across the site at the completion of earthworks development. Topsoil depths were checked across the subdivision by the drilling of boreholes following final landscaping works. The results of this investigation, which are indicative only and subject to variation at other locations, show that topsoil depths on the subject lots vary from 0.1 to 0.2 metres (average 0.15 metres).

Building development or future earthworks will require over-excavation of these re-spread topsoil materials to expose the fill subgrade, followed by the placement and compaction of further subfloor filling as required to achieve design grades.

8.8. Service Trenches

It should be noted that the backfilling and compaction of stormwater and sewer trenches on this subdivision were not inspected or tested by Coffey and these should accordingly be classified as uncertified filling for geotechnical purposes. Trench backfilling was inspected by HGCL as part of their supervision during civil construction.

As is normal on all subdivisions, building developments involving foundations within a 45 degree zone of influence from all service pipe inverts will require specific design by a Chartered Professional Engineer with a view to piling foundation loads to below that zone (as specified in the TCC Infrastructure Development Code).

8.9. Contractor’s Work

This report has relied on the Contractor’s diligence and construction observations to ensure that the works have been carried out in accordance with:

(i) The approved Contract drawings and design details,

(ii) The approved Contract specifications,

(iii) Authorised Variations to (i) and (ii) during the execution of the works,

(iv) The conditions of Resource and Earthworks Consents where applicable,

(v) The relevant Geotechnical Investigation reports, recommendations and site instructions,

and that all as-built information and other details provided to the Client and/or Coffey Geotechnics (NZ) Limited are accurate and correct in all respects.

8.10. Suitability Statement

A copy of our suitability statement, in the form of the Tauranga City Council forms G2 and G2a are appended.

9. Summary of Recommendations

Based on the information contained in this report, it is considered that the geotechnical aspects of the works with Lots 887,888 and 889 have been completed in general accordance with accepted engineering practice and standards. From a geotechnical perspective, development on the new lots may therefore proceed, subject to the following recommendations:

1. All buildings on the new lots should be supported on either raft type foundations designed for an Ultimate Bearing Capacity of 210kPa or on suspended timber foundations specifically designed for a bearing capacity to be determined by a Chartered Professional Engineer (CPEng) at design stage.

2. All foundation excavations must be inspected and tested by a TCC Category 1 or 2 Geo-professional. Testing should include undrained shear strength measurements at regular intervals within the excavation. Any soils within the top 0.5m with undrained shear strengths of less than 110kPa or other unsuitable materials encountered must be sub-excavated and replaced with compacted clean fill.

3. Building development or future earthworks on the new lots will require over-excavation of the existing topsoil materials to expose the earthfill subgrade, followed by the placement and compaction of further subfloor filling as required to achieve design grades and bearing in mind the restrictions given in (3) above.

4. The placement of more than 300mm thickness of additional fill on any lot (above existing ground level and including topsoil) should be subject to geotechnical review due to the risk of inducing further settlement on the subject or neighbouring properties as outlined in Section 8.6. The recommended 300mm limit is measured from existing ground level to finished ground level including topsoil.

5. All retaining walls with a total height of more than 0.5m (including tiered walls) or those supporting slopes or building/vehicle loads must be specifically designed by a Chartered Professional Engineer giving consideration to toe slope gradients, crest surcharge slopes and fill surcharge effects. The design of any retaining wall or the placement of filling on any lot should also consider possible adverse effects on pre-existing retaining walls on the subject or neighbouring properties as discussed in Section 8.6.

6. Building developments involving foundations within a 45 degree zone of influence from all service pipe inverts will require specific design by a Chartered Professional Engineer with a view to piling foundation loads to below that zone (as specified in the TCC Infrastructure Development Code).
7. It is recommended that a consent notice be placed on these properties specifically including the requirement for Cat 2 geotechnical inspection and testing of foundation excavations given in (2) and restrictions on additional fill thicknesses given in (3) above.

10. Limitations

This report has been prepared solely for the use of the client, The Lakes (2012) Limited, their professional advisers and the relevant Territorial Authorities in relation to the specific project described herein. No liability is accepted in respect of its use for any other purpose or by any other person or entity. All future owners of this property should seek professional geotechnical advice to satisfy themselves as to its ongoing suitability for their intended use.

The opinions, recommendations and comments given in this report result from the application of normal methods of site investigation. As the post construction factual evidence has been obtained solely from boreholes and test pits, which by their nature only provide information about a relatively small volume of subsoils, there may be special conditions pertaining to this site which have not been disclosed by the investigation and which have not been taken into account in the report.

For and on behalf of Coffey

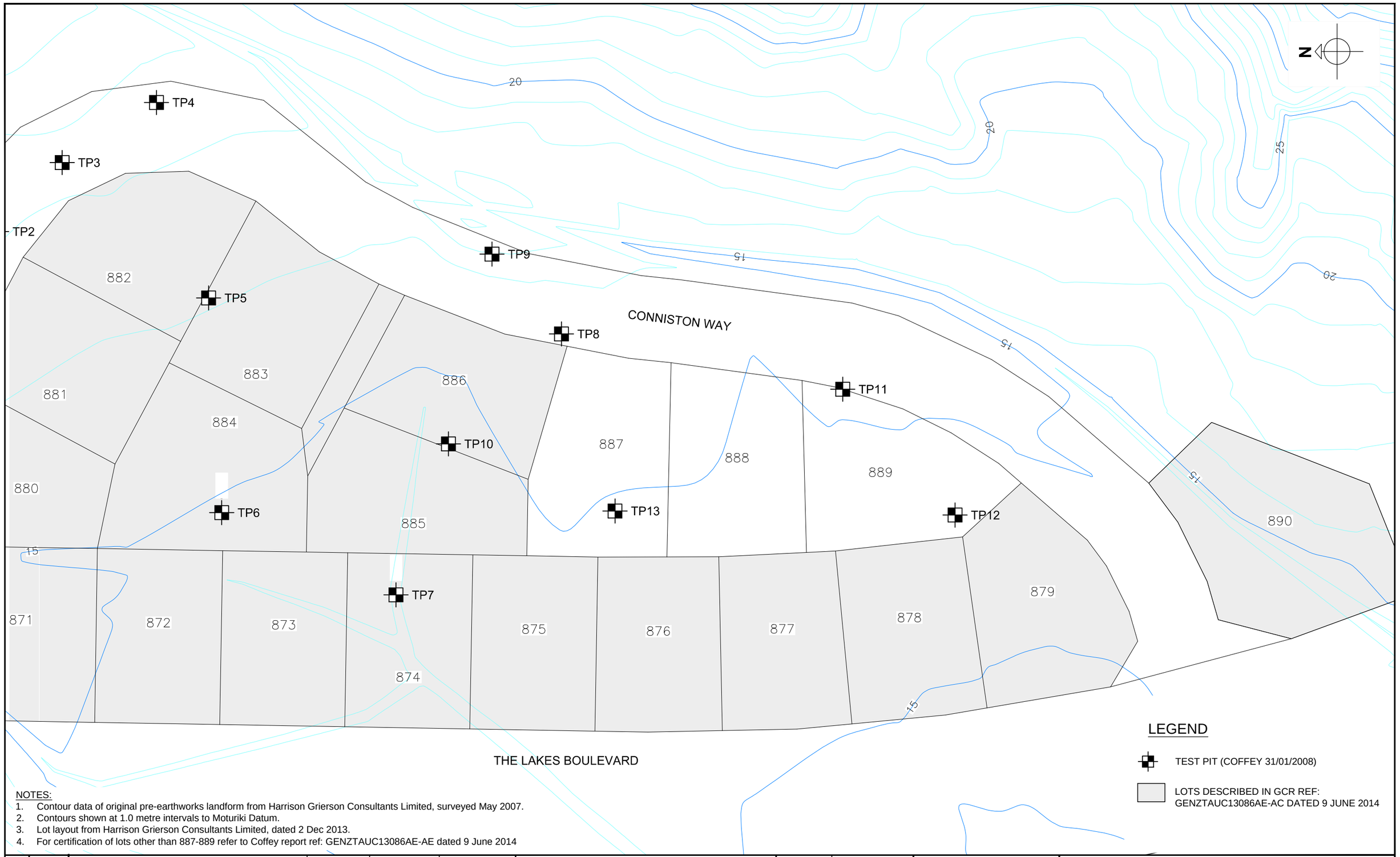
Prepared by:

R.B. TELFORD
Project Engineering Geologist

Reviewed and Authorised by:

S.V. HARGRAVES
Principal Engineering Geologist
TCC Category 1 Geo-Professional

Appendix A - Figures



LEGEND

TEST PIT (COFFEY 31/01/2008)

LOTS DESCRIBED IN GCR REF: GENZTAUC13086AE-AC DATED 9 JUNE 2014

NOTES:

1. Contour data of original pre-earthworks landform from Harrison Grierson Consultants Limited, surveyed May 2007.
2. Contours shown at 1.0 metre intervals to Moturiki Datum.
3. Lot layout from Harrison Grierson Consultants Limited, dated 2 Dec 2013.
4. For certification of lots other than 887-889 refer to Coffey report ref: GENZTAUC13086AE-AE dated 9 June 2014

revision	rev	description	drawn	approved	date

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Horizontal Scale (metres)

0 10.0 20.0 30.0
Vertical Scale (metres)

drawn	AIP
approved	RBT
date	09/09/2014
scale	1:500
original size	A3

coffey

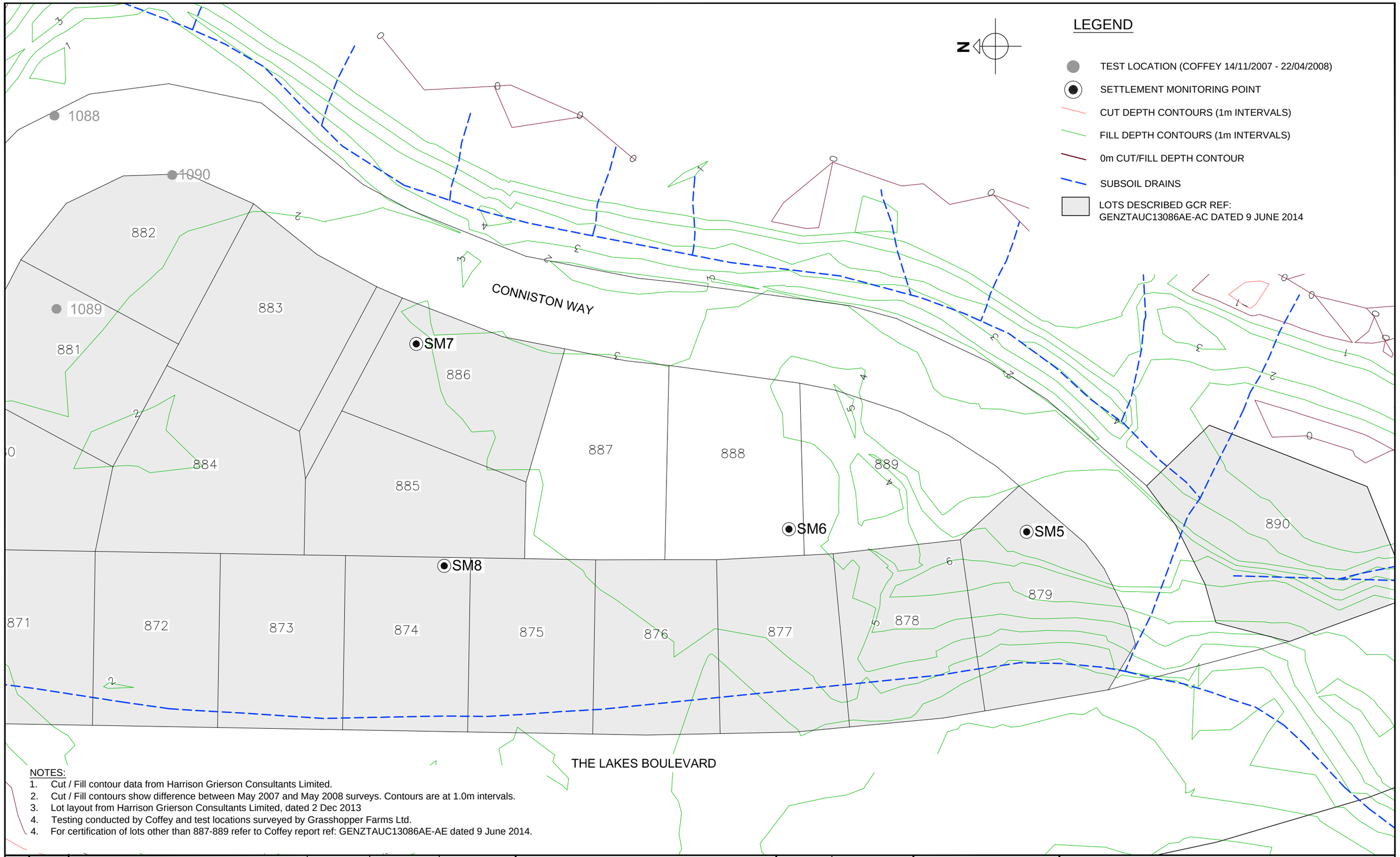
client: THE LAKES (2012) LIMITED

project: THE LAKES SUBDIVISION
STAGE 2T - LOTS 887, 888 & 889
GEOTECHNICAL COMPLETION REPORT

title: PRE DEVELOPMENT CONTOUR PLAN

project no: GENZTAUC13086AE | figure no: 08 | rev: 1

20/08/2014 F:\1.GENZ\1.GEOTECHNICS PROJECTS\13086AE THE LAKES STAGE 2 QRST\DRAWINGS\CGL DRAWINGS\WORKING\LOTS 887-889 GCR\13086AE LOTS 887-889 GCR FIG 8 ORIGINAL CONTOUR PLAN.DWG



NOTES:

1. Cut / Fill contour data from Harrison Grierson Consultants Limited.
2. Cut / Fill contours show difference between May 2007 and May 2008 surveys. Contours are at 1.0m intervals.
3. Lot layout from Harrison Grierson Consultants Limited, dated 2 Dec 2013
4. Testing conducted by Coffey and test locations surveyed by Grasshopper Farms Ltd.
4. For certification of lots other than 887-889 refer to Coffey report ref: GENZTAUC13086AE-AE dated 9 June 2014.

revision	rev	description	drawn	approved	date

0 10.0 20.0 30.0
Horizontal Scale (metres)
0 10.0 20.0 30.0
Vertical Scale (metres)

drawn	AIP
approved	RBT
date	09/09/2014
scale	1:500
original size	A3

coffey

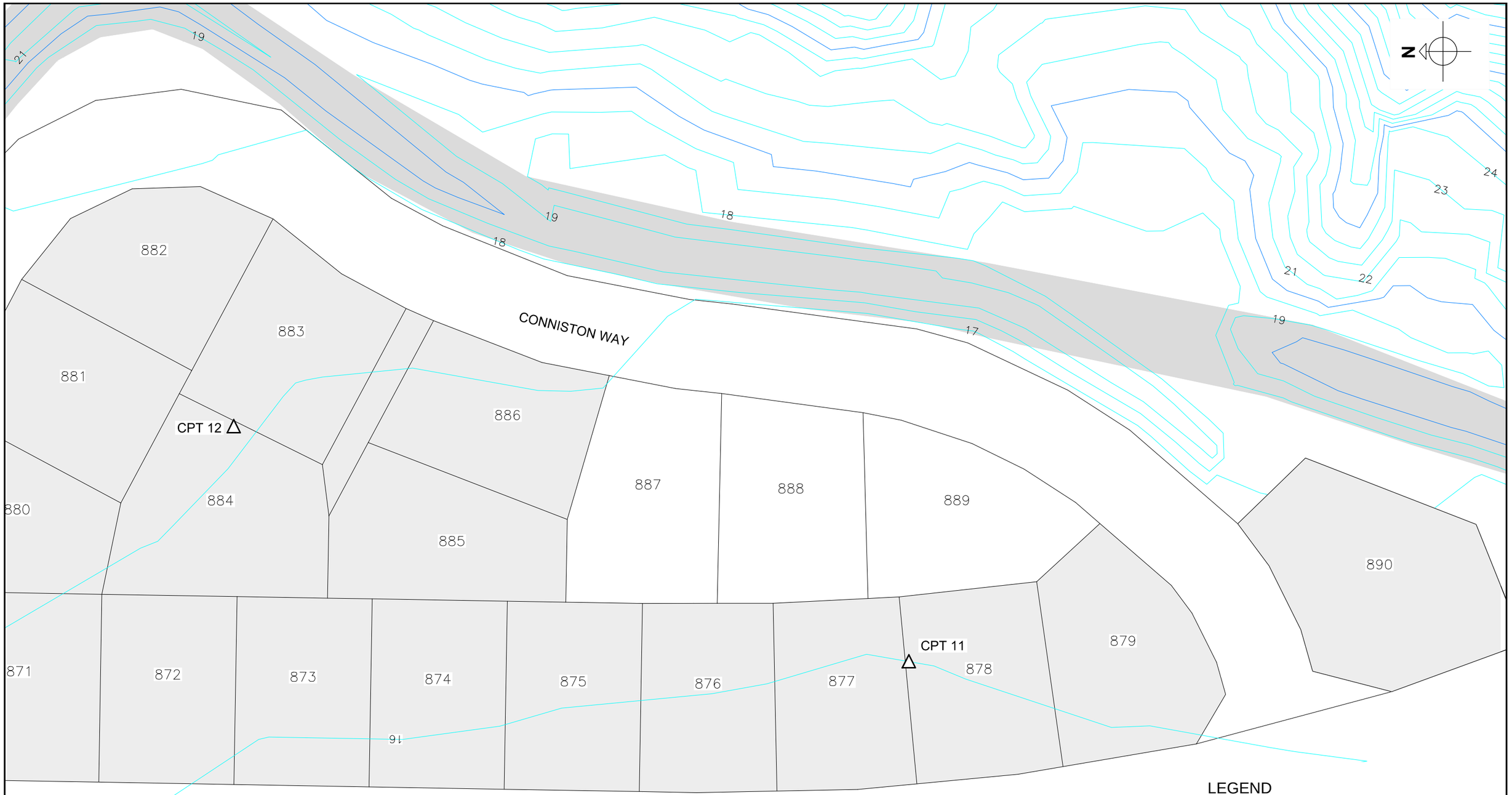
client: THE LAKES (2012) LIMITED

project: THE LAKES SUBDIVISION
STAGE 2T - LOTS 887, 888 & 889
GEOTECHNICAL COMPLETION REPORT

title: 2007-2008 CUT/FILL PLAN

project no: GENZTAUC13086AE | figure no: 09 | rev: 1

20/08/2014 F:\1.GENZ\1.GEOTECHNICS PROJECTS\13086AE THE LAKES STAGE 2 QRST\DRAWINGS\CGL DRAWINGS\WORKING\LOTS 887-889 GCR\13086AE LOT 887-889 GCR FIG 9 CUT-FILL PLAN.DWG



LEGEND

- CONE PENETRATION TEST (COFFEY 28/11/2013)
- DEBRIS BUND
- LOTS DESCRIBED IN GCR REF: GENZTAUC13086AE-EC DATED 9 JUNE 2014

NOTES:

1. As-built contour data from Harrison Grierson Consultants Limited, surveyed May 2008.
2. Contours are of May 2008 landform surveyed at end of 2007-2008 earthworks season. Contours are shown at 1.0-metre intervals to Moturiki Datum.
3. Lot layout from Harrison Grierson Consultants Limited, dated 2 Dec 2013 .
4. For certification of lots other than 887-889 refer to Coffey report ref: GENZTAUC13086AE-AE dated 9 June 2014.

revision	rev	description	drawn	approved	date

0 10.0 20.0 30.0
Horizontal Scale (metres)
0 10.0 20.0 30.0
Vertical Scale (metres)

drawn	AIP
approved	RBT
date	09/09/2014
scale	1:500
original size	A3

coffey

client: THE LAKES (2012) LIMITED

project: THE LAKES SUBDIVISION
STAGE 2T - LOTS 887, 888 & 889
GEOTECHNICAL COMPLETION REPORT

title: 2007-2008 AS-BUILT PLAN

project no: GENZTAUC13086AE | figure no: 10 | rev: 1

20/08/2014 F:\1.GENZ\1.GEOTECHNICS PROJECTS\13086AE THE LAKES STAGE 2 QRST\DRAWINGS\CGL DRAWINGS\WORKING\LOTS 887-889 GCR\13086AE LOT 887-889 GCR FIG 10 AS-BUILT PLAN.DWG

NOTES:
1. Cut / Fill contour data from Harrison Grierson Consultants Limited.
2. Cut / Fill contours show difference between May 2008 and April 2014 surveys. Contours are at 0.2m intervals.
3. Lot layout from Harrison Grierson Consultants Limited, dated 2 Dec 2013.
4. For certification of lots other than 887-889 refer to Coffey report ref: GENZTAUC13086AE-AE dated 9 June 2014.

revision	rev	description	drawn	approved	date

0 10.0 20.0 30.0
Horizontal Scale (metres)
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Vertical Scale (metres)

drawn	AIP
approved	RBT
date	09/09/2014
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coffey

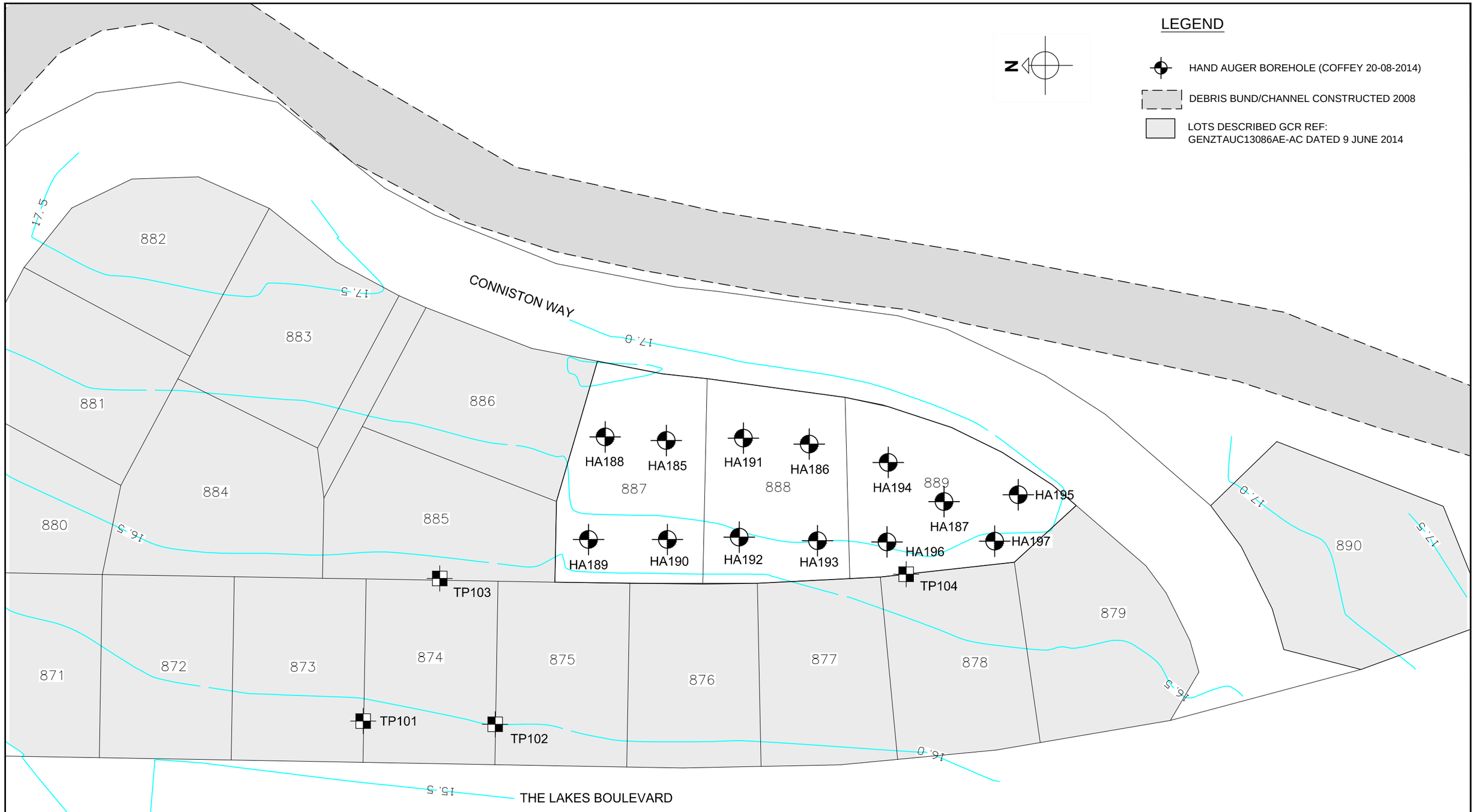
client: THE LAKES (2012) LIMITED

project: THE LAKES SUBDIVISION
STAGE 2T - LOTS 887, 888 & 889
GEOTECHNICAL COMPLETION REPORT

title: 2012-2013 CUT/FILL PLAN

project no: GENZTAUC13086AE | figure no: 11 | rev: 1

20/08/2014 F:\1.GENZ\1.GEOTECHNICS PROJECTS\13086AE THE LAKES STAGE 2 QRST\DRAWINGS\CGL DRAWINGS\WORKING\LOTS 887-889 GCR\13086AE LOTS 887-889 GCR FIG 11 CUT-FILL PLAN.DWG



NOTES:

1. As-built contour data from Harrison Grierson Consultants Limited, surveyed 1 April 2014.
2. Contours are finished ground level and are shown at 0.5-metre intervals to Moturiki Datum.
3. Lot layout from Harrison Grierson Consultants Limited dated 2 Dec 2013.
4. For certification of lots other than 887-889 refer to Coffey report ref: GENZTAUC13086AE-AE dated 9 June 2014.

revision	rev	description	drawn	approved	date

0 10.0 20.0 30.0
Horizontal Scale (metres)
0 10.0 20.0 30.0
Vertical Scale (metres)

drawn	AIP
approved	RBT
date	09/09/2014
scale	1:500
original size	A3

coffey

client: THE LAKES (2012) LIMITED

project: THE LAKES SUBDIVISION
STAGE 2T - LOTS 887, 888 & 889
GEOTECHNICAL COMPLETION REPORT

title: 2014 AS-BUILT PLAN

project no: GENZTAUC13086AE | figure no: 12 | rev: 1

20/08/2014 F:\1.GENZ\1.GEOTECHNICS PROJECTS\13086AE THE LAKES STAGE 2 QRST\DRAWINGS\CGL DRAWINGS\WORKING\LOTS 887-889 GCR\13086AE LOTS 887-889 GCR FING 12 AS-BUILT PLAN.DWG

Appendix B - Geotechnical Suitability Statement

STATEMENT OF PROFESSIONAL OPINION AS TO THE GEOTECHNICAL SUITABILITY OF LAND FOR BUILDING

NAME OF SUBDIVISION	Lots 887, 888 & 889 only Within Stage 2T of The Lakes Subdivision
COUNCIL FILE NUMBER RC No:	RC21332
ENGINEER RESPONSIBLE FOR DEVELOPMENT	Sally V. Hargraves
QUALIFICATIONS:	BSc, PhD, Category 1 Geoprofessional

I, Sally Victoria Hargraves of Coffey Geotechnics Ltd, 141 Cameron Road, Tauranga, hereby confirm that:

1) I am a professional person, appropriately qualified with experience in geomechanics to ascertain the suitability of the land for building development and was retained as the Soils Engineer to the above development.
2) An appropriate level of site investigation and construction supervision has been carried out under my direction and is described in my development evaluation report dated 15 September 2014
3) In my professional opinion, not to be construed as a guarantee, I consider that;
   a) The areas shown in my report dated 15 September 2014 of each new allotment are suitable for the erection thereon of the building types appropriate to the zoning of the land, provided that reference is made to my Geotechnical Completion Report Ref. GENZTAUC13086AE-AE, dated 15 September 2014.
   b) Although the earth fills shown on the attached plans ref Figure 09 & Figure 11 were not placed in accordance with the requirements of the Infrastructure Development Code, the filling is generally considered suitable for development subject to the limitations outlined in my Geotechnical Completion Report Ref. GENZTAUC13086AE-AE, dated 15 September 2014.
   c) The completed works give due regard to all land slope considerations.
   d) The filled ground is suitable for the erection thereon of residential buildings requiring specific design subject to the recommendations presented in my Geotechnical Completion Report Ref. GENZTAUC13086AE-AE, dated 15 September 2014.
4) This professional opinion is furnished to the Council and the owner for their purposes alone, on the express condition that it will not be relied upon by any other person and does not remove the necessity for the normal inspection of foundation conditions at the time of erection for any dwelling.

Signed  Date: 15 September 2014

DP No:	DP463737	Property Address	99 Kennedy Road, Pyes Pa	RC No:	21332

Lot No:	Area (m^2)	Subsurface data						Foundations		Building Restriction Line	S/W Specific Design	S/W Soakage	S/W Reticulate	Designated Building Platform	Minimum Building Platform	Compressible Soils	On-Site Effluent Disposal	Consent Notice	Comments
		Shear Strength (kPa) at 0.5m depth	Subdivision Filling Y/N	Subdivision Filling Depth (m)	Natural Topography Unworked Y/N	Natural Topography Earthworked Y/N	Natural Topography Earthworked Depth (m)	Conventional Shallow Foundation to NZS 3604:2011 Y/N/NA	Specific Design Y/N/NA										
887	544	85 - >200	Y	4	N	N	-	N	Y	N	N	N	Y	N	N	Y	N	Y	Raft type foundations specifically designed for Ultimate Bearing Capacity = 210kPa or suspended timber foundations specifically designed for bearing capacity to be confirmed by CPEng at design stage. All foundation excavations to be inspected and tested by Cat 1 or Cat 2 Geo-Professional. Any soils encountered with undrained shear strength < 110kPa or other unsuitable soils identified are to be sub-excavated and replaced with well compacted clean fill. Placement of more than 300mm of additional fill on any site should be subject to specific geotechnical review.
888	514	150 - >200	Y	4.5	N	N	-	N	Y	N	N	N	Y	N	N	Y	N	Y	
889	521	100 - >200	Y	5.5	N	N	-	N	Y	N	N	N	Y	N	N	Y	N	Y	

Appendix C - Investigation Data

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Engineering Log - Hand Auger

		Borehole ID.	***HA185***
		sheet:	1 of 1
		project no.	***GENZTAUC13086AE***
client:	***The Lakes 2012 Ltd***	date started:	***20 Aug 2014***
principal:		date completed:	***20 Aug 2014***
project:	***The Lakes Stage 2 QRST***	logged by:	***AIP***
location:	***Lot 887***	checked by:	***RBT***

position: E: 368133; N: 800144 (BOPC2000) surface elevation: Not Specified angle from horizontal: 90° DCP id.:

drill model: hole diameter : 50 mm vane id.: 764 / SL588

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	vane shear (kPa) ⊕ remoulded ⊙ peak 50 100 150 200	DCP (blows/ 100 mm) 2 4 6 8 10	structure and additional observations
HA N					0.0			**ORGANIC SILT**: non plastic, black/dark brown, with some rootlets, moist.	M				**TOPSOIL FILL**
									M	VSt			**FILL**
								Sandy SILT: low to medium plasticity, brown mottled orange, with inclusion of cream sand, moist, very stiff.			⊕ ⊙		VS 110/ 25 kPa
											⊕ ⊙		VS 139/ 35 kPa
					0.5			- Becoming dark brown. Occasional inclusions of orange mottled pink Silt.	M		⊕ ⊙		VS 209/ 41 kPa
									W	H			
								SAND: medium to coarse grained, white/pale grey, pumiceous, moist.			⊕ ⊙		VS 215/ >54 kPa
								- Inclusions of white non-plastic pumiceous SILT.					
					1.0					VSt	⊕ ⊙		VS 144/ 20 kPa
								Sandy SILT: low to medium plasticity, pale brown mottled cream, wet, very stiff to hard. - Organic staining.					
											⊕ ⊙		VS 113/ 35 kPa
					1.5			- Becoming dark brown. Organic staining.					
								Sandy SILT: non plastic to low plasticity, pale grey, moist, very stiff. - Trace organic sand.	M		⊕ ⊙		VS 152/ 44 kPa
					2.0						⊕ ⊙		VS 148/ 36 kPa
								Sandy SILT: low to medium plasticity, pale brown, loosing sample due to suction, moist, very stiff.	M				
									M				
								Silty SAND: fine to coarse grained, pale brown mottled orange, moist.			⊕ ⊙		VS 187/ 46 kPa
					2.5								
											⊕ ⊙		VS 140/ 41 kPa
					3.0								
											⊕ ⊙		VS 215/ >66 kPa
					3.5								
								Sandy SILT: low to medium plasticity, pale brown, moist, hard.	M	H			
									M		⊕ ⊙		VS 215/ >54 kPa
								- Yellow/Orange silty SAND with some fine gravels.					
					4.0			**Sandy SILT**: low plasticity, pale grey, moist, very stiff to hard.			⊕ ⊙		VS 198/ 38 kPa
										VSt to H			
					4.5			Hand Auger HA185 terminated at 4.6 m Refusal			⊕ ⊙		VS 215/ >87 kPa
					5.0								

method		**support**		**samples & field tests**	
AD	auger drilling*	M	mud	B	bulk disturbed sample
AS	auger screwing*	C	casing	D	disturbed sample
HA	hand auger	N	nil	E	environmental sample
W	washbore	**penetration**		SS	split spoon sample
HA	hand auger	1 2 3	no resistance ranging to refusal	U##	undisturbed sample ##mm diameter
		water		HP	hand penetrometer (kPa)
*	bit shown by suffix		10-Oct-12 water level on date shown	N	standard penetration test (SPT)
e.g.	AD/T		water inflow	N*	SPT - sample recovered
B	blank bit		water outflow	Nc	SPT with solid cone
T	TC bit			VS	vane shear; peak/remouded (kPa)
V	V bit			R	refusal
				HB	hammer bouncing

classification symbol & soil description based on Unified Classification System

moisture

D	dry
M	moist
W	wet
S	saturated
Wp	plastic limit
Wl	liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey

Engineering Log - Hand Auger

Borehole ID.	***HA186***
sheet:	1 of 1
project no.	***GENZTAUC13086AE***
client:	***The Lakes 2012 Ltd***
date started:	***20 Aug 2014***
principal:	
date completed:	***20 Aug 2014***
project:	***The Lakes Stage 2 QRST***
logged by:	***DBC***
location:	***Lot 888***
checked by:	***RBT***

position: E: 368132; N: 800124 (BOPC2000) surface elevation: Not Specified angle from horizontal: 90° DCP id.:

drill model: hole diameter : 50 mm vane id.: 4523 / 4583-19

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	vane shear ⊕ remoulded ⊙ peak (kPa) 50 100 150 200	DCP (blows/ 100 mm) 2 4 6 8 10	structure and additional observations
HA N		20/08/14			0.5			**Clayey ORGANIC SILT**: low plasticity, black, moist to wet.	M to W				**TOPSOIL FILL**
								SILT: non plastic to low plasticity, orange brown streaked cream, with minor sand and some clay, moist to wet, stiff.	M to W	St	⊕		VS 54/ 10 kPa **FILL**
								Clayey SILT: low to medium plasticity, brown orange streaked orange brown, moist, hard.	M	H	⊙		VS 200 kPa
					1.0			**SILT**: non plastic, brown streaked cream, with minor sand and minor clay, moist to wet, very stiff.	M to W	VSt	⊕ ⊙		VS 198/ 30 kPa
								Sandy SILT: non plastic, orange brown streaked cream, with some clay, moist, hard.	M	H	⊙		VS 200 kPa
					1.5			**Clayey SILT**: low to medium plasticity, brown streaked brown orange, moist, hard.	M	H	⊙		VS 200 kPa
								SILT: non plastic, orange brown streaked cream, with minor sand and minor clay, moist, very stiff to hard.	M	VSt to H	⊙		VS 200 kPa
					2.0			- with a <200mm lense of cream mottled reddish brown clayey silt at 1.9m			⊕ ⊙		VS 189/ 28 kPa
					2.5						⊙		VS 200 kPa
								- becoming organic stained brown grey from 2.7m			⊙		VS 200 kPa
					3.0			- becoming orange brown streaked cream from 2.8m	W				
								Silty SAND: fine to medium grained, dark grey, groundwater encountered at 2.9m, wet.	M	VSt	⊕ ⊙		VS 164/ 44 kPa
					3.5			**SILT**: non plastic, orange brown streaked cream, with some clay and some topsoil inclusions, moist, very stiff. - topsoil inclusions absent from 3.2m			⊕ ⊙		VS 119/ 41 kPa
								Sandy Clayey SILT: low to medium plasticity, orange brown, with minor well cemented silt clasts, moist.	M				
					4.0			**Clayey SILT**: low to medium plasticity, orange brown, with some sand and minor well cemented silt clasts, moist, stiff to hard.	M	St	⊕ ⊙		VS 65/ 23 kPa
										VSt to H	⊕ ⊙		VS 152/ 49 kPa
					4.5						⊙		VS 200 kPa
					5.0			- with some topsoil inclusions from 5.2m					
								Hand Auger HA186 terminated at 5.2 m Target depth					

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method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore
- HA hand auger

* bit shown by suffix
e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration
1 2 3 — no resistance ranging to refusal

water
- 10-Oct-12 water level on date shown
- water inflow
- water outflow

samples & field tests
- B bulk disturbed sample
- D disturbed sample
- E environmental sample
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remouded (kPa)
- R refusal
- HB hammer bouncing

classification symbol & soil description
based on Unified Classification System

moisture
- D dry
- M moist
- W wet
- S saturated
- Wp plastic limit
- Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey

Engineering Log - Hand Auger

		Borehole ID.	***HA187***
		sheet:	1 of 1
		project no.	***GENZTAUC13086AE***
client:	***The Lakes 2012 Ltd***	date started:	***20 Aug 2014***
principal:		date completed:	***20 Aug 2014***
project:	***The Lakes Stage 2 QRST***	logged by:	***DBC***
location:	***Lot 889***	checked by:	***RBT***

position: E: 368124; N: 800106 (BOPC2000) surface elevation: Not Specified angle from horizontal: 90° DCP id.:

drill model: hole diameter : 50 mm vane id.: 4523 / 4583-19

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	vane shear ⊕ remoulded ⊙ peak (kPa) 50 100 150 200	DCP (blows/ 100 mm) 2 4 6 8 10	structure and additional observations
HA N		▶			0.0			**Clayey ORGANIC SILT**: low plasticity, black, wet.	W				**TOPSOIL FILL**
								SILT: non plastic to low plasticity, orange brown streaked cream, with some sand and some clay, moist to wet, very stiff to hard. - with some topsoil inlcusions from 0.4m. Slight groundwater seepage encountered between 0m to 0.8m - topsoil inclusions absent from 0.5m	M to W	VSt to H	⊕ ⊙		VS 140/ 12 kPa **FILL**
					0.5						⊕ ⊙		VS 137/ 18 kPa
											⊙		VS 200 kPa
											VS UTP		VS UTP
					1.0						VS UTP		VS UTP
											VS UTP		VS UTP
					1.5						⊕ ⊙		VS 193/ 33 kPa
					2.0			- becoming cream mottled brown from 1.9m - becoming orange brown mottled cream from 2.1m			⊕ ⊙		VS 176/ 12 kPa
											⊙		VS 200 kPa
					2.5						⊙		VS 200 kPa
					3.0			- with some topsoil inclusions from 3.1m - topsoil inclusions absent from 3.2m			⊙		VS 200 kPa
					3.5						⊙		VS 200 kPa
					4.0			- with a <100mm lense of dark brown clayey silt at 4.0m			⊕ ⊙		VS 156/ 28 kPa
											⊙		VS 200 kPa
					4.5						⊙		VS 200 kPa
					5.0			- with a gravel inclusion at 4.9m					
								Hand Auger HA187 terminated at 5.2 m Target depth					

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method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore
- HA hand auger

* bit shown by suffix e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration
1 2 3 — no resistance ranging to refusal

water
- 10-Oct-12 water level on date shown
- water inflow
- water outflow

samples & field tests
- B bulk disturbed sample
- D disturbed sample
- E environmental sample
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remouded (kPa)
- R refusal
- HB hammer bouncing

classification symbol & soil description
based on Unified Classification System

moisture
- D dry
- M moist
- W wet
- S saturated
- Wp plastic limit
- Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey

Engineering Log - Hand Auger

Borehole ID.	***HA188***
sheet:	1 of 1
project no.	***GENZTAUC13086AE***
client:	***The Lakes 2012 Ltd***
date started:	***20 Aug 2014***
principal:	
date completed:	***20 Aug 2014***
project:	***The Lakes Stage 2 QRST***
logged by:	***AIP***
location:	***Lot 887***
checked by:	***RBT***

position: E: 368133; N: 800152 (BOPC2000) surface elevation: Not Specified angle from horizontal: 90° DCP id.:

drill model: hole diameter : 50 mm vane id.: 764 / SL588

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	vane shear (kPa) ⊕ remoulded ⊙ peak (50 100 150 200)	DCP (blows/ 100 mm) (2 4 6 8 10)	structure and additional observations
HA N		Not Encountered			0.5			**ORGANIC SILT**: non plastic, dark brown, some rootlets, wet.	W				**TOPSOIL FILL**
								Sandy SILT: non plastic to low plasticity, brown mottled cream, some fine gravel, dry to moist, stiff to hard.	D - M	H			**FILL** VS 215/ >87 kPa
								Inclusions of coarse orange sand	M	St to VSt			VS 198/ 33 kPa VS 119/ 44 kPa VS 84/ 27 kPa
					1.0			**Sandy SILT**: non plastic to low plasticity, pale brown, minor fine gravels, moist, stiff to very stiff.					VS 122/ 33 kPa
								Hand Auger HA188 terminated at 1.0 m Target depth					
					1.5								
					2.0								
					2.5								
					3.0								
					3.5								
					4.0								
					4.5								
					5.0								

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method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore
- HA hand auger

* bit shown by suffix e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration

1 2 3 no resistance ranging to refusal

water

10-Oct-12 water level on date shown
water inflow
water outflow

samples & field tests
- B bulk disturbed sample
- D disturbed sample
- E environmental sample
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remouded (kPa)
- R refusal
- HB hammer bouncing

classification symbol & soil description
based on Unified Classification System

moisture
- D dry
- M moist
- W wet
- S saturated
- Wp plastic limit
- Wl liquid limit

consistency / relative density
- VS very soft
- S soft
- F firm
- St stiff
- VSt very stiff
- H hard
- Fb friable
- VL very loose
- L loose
- MD medium dense
- D dense
- VD very dense

coffey

Engineering Log - Hand Auger

Borehole ID.	***HA189***
sheet:	1 of 1
project no.	***GENZTAUC13086AE***
client:	***The Lakes 2012 Ltd***
date started:	***20 Aug 2014***
principal:	
date completed:	***20 Aug 2014***
project:	***The Lakes Stage 2 QRST***
logged by:	***AIP***
location:	***Lot 887***
checked by:	***RBT***

position: E: 368119; N: 800154 (BOPC2000) surface elevation: Not Specified angle from horizontal: 90° DCP id.:

drill model: hole diameter : 50 mm vane id.: 764 / SL588

drilling information | **material substance**

method & support	penetration (1 2 3)	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	vane shear (remoulded / peak) (kPa) 50 100 150 200	DCP (blows/ 100 mm) 2 4 6 8 10	structure and additional observations
HA, N		▶			0.0			**ORGANIC SILT**: non plastic, dark brown/black, some rootlets, moist.	M				**TOPSOIL FILL**
								Sandy SILT: non plastic, orange/brown, some fine pumiceous gravels, moist, stiff.	M	St			**FILL**
					0.5			Inclusions of orange medium plasticity clayey SILT			⊕ ⊙		VS 90/ 31 kPa
								Sandy SILT: non plastic, cream, limonite staining, wet, stiff.	W		⊕ ⊙		VS 87/ 44 kPa
								Becoming medium plasticity					VS 99/ 46 kPa
								Hand Auger HA189 terminated at 0.8 m Target depth					
					1.0								
					1.5								
					2.0								
					2.5								
					3.0								
					3.5								
					4.0								
					4.5								
					5.0								

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method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore
- HA hand auger

* bit shown by suffix, e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration

1 2 3 — no resistance ranging to refusal

water

10-Oct-12 water level on date shown
water inflow
water outflow

samples & field tests
- B bulk disturbed sample
- D disturbed sample
- E environmental sample
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remouded (kPa)
- R refusal
- HB hammer bouncing

classification symbol & soil description
based on Unified Classification System

moisture
- D dry
- M moist
- W wet
- S saturated
- Wp plastic limit
- Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey

Engineering Log - Hand Auger

Borehole ID.	***HA190***
sheet:	1 of 1
project no.	***GENZTAUC13086AE***
client: ***The Lakes 2012 Ltd***	date started: ***20 Aug 2014***
principal:	date completed: ***20 Aug 2014***
project: ***The Lakes Stage 2 QRST***	logged by: ***DBC***
location: ***Lot 887***	checked by: ***RBT***

position: E: 368119; N: 800143 (BOPC2000) surface elevation: Not Specified angle from horizontal: 90° DCP id.:

drill model: hole diameter : 50 mm vane id.: 4523 / 4583-19

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	vane shear (kPa) ⊕ remoulded ⊙ peak (50 100 150 200)	DCP (blows/ 100 mm) (2 4 6 8 10)	structure and additional observations
HA N		20/08/14 ▼			0.0			**Clayey ORGANIC SILT**: low plasticity, black, moist to wet.	M to W				**TOPSOIL FILL**
								SILT: non plastic, cream streaked brown orange, with minor sand and some clay, moist.	M				**FILL**
									M to W	VSt	⊕ ⊙		VS 119/ 15 kPa
											⊕ ⊙		VS 164/ 10 kPa
					0.5			**Clayey SILT**: low plasticity, brown mottled brown orange, moist to wet, very stiff.	M	St	⊕ ⊙		VS 99/ 4 kPa
								- slight groundwater seepage encountered at 0.2m		H	VS UTP		VS UTP
								- with some topsoil inclusions from 0.4m					
					1.0			**SILT**: non plastic to low plasticity, orange brown streaked cream, with minor sand and some clay, moist, stiff to hard.					
								- topsoil inclusions absent from 0.5m					
					1.5			Hand Auger HA190 terminated at 0.8 m Target depth					
					2.0								
					2.5								
					3.0								
					3.5								
					4.0								
					4.5								
					5.0								

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method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore
- HA hand auger

* bit shown by suffix, e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration

1 2 3 no resistance ranging to refusal

water

10-Oct-12 water level on date shown
water inflow
water outflow

samples & field tests
- B bulk disturbed sample
- D disturbed sample
- E environmental sample
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remouded (kPa)
- R refusal
- HB hammer bouncing

classification symbol & soil description
based on Unified Classification System

moisture
- D dry
- M moist
- W wet
- S saturated
- Wp plastic limit
- Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey

Engineering Log - Hand Auger

Borehole ID.	***HA191***
sheet:	1 of 1
project no.	***GENZTAUC13086AE***
client: ***The Lakes 2012 Ltd***	date started: ***20 Aug 2014***
principal:	date completed: ***20 Aug 2014***
project: ***The Lakes Stage 2 QRST***	logged by: ***AIP***
location: ***Lot 888***	checked by: ***RBT***

position: E: 368133; N: 800133 (BOPC2000) surface elevation: Not Specified angle from horizontal: 90° DCP id.:

drill model: hole diameter : 50 mm vane id.: 764 / SL588

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	vane shear ⊕ remoulded ⊙ peak (kPa) 50 100 150 200	DCP (blows/ 100 mm) 2 4 6 8 10	structure and additional observations
HA N		Not Encountered			0.5			**ORGANIC SILT**: non plastic, dark brown, some rootlets, moist.	M	St to VSt	⊕		**TOPSOIL FILL**
								Clayey SILT: low to medium plasticity, pale brown, some fine to medium sand, moist to wet, stiff to very stiff.	M to W		⊕ ⊙		**FILL** VS 193/ 44 kPa
											⊕		VS 215/ 82 kPa
								Occasional inclusions pink and white pumiceous sand	M		⊕ ⊙		VS 215/ 46 kPa
					1.0			**SILT**: non plastic, pale yellow/cream, pumiceous, moist, stiff to very stiff. Becoming sandy. Sand is fine to coarse.			⊕ ⊙		VS 137/ 46 kPa
								Hand Auger HA191 terminated at 0.8 m Target depth					
					1.5								
					2.0								
					2.5								
					3.0								
					3.5								
					4.0								
					4.5								
					5.0								

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method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore
- HA hand auger

* bit shown by suffix e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration

1 2 3 no resistance ranging to refusal

water

10-Oct-12 water level on date shown
water inflow
water outflow

samples & field tests
- B bulk disturbed sample
- D disturbed sample
- E environmental sample
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remouded (kPa)
- R refusal
- HB hammer bouncing

classification symbol & soil description
based on Unified Classification System

moisture
- D dry
- M moist
- W wet
- S saturated
- Wp plastic limit
- Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey

Engineering Log - Hand Auger

Borehole ID.	***HA192***
sheet:	1 of 1
project no.	***GENZTAUC13086AE***
client: ***The Lakes 2012 Ltd***	date started: ***20 Aug 2014***
principal:	date completed: ***20 Aug 2014***
project: ***The Lakes Stage 2 QRST***	logged by: ***DBC***
location: ***Lot 888***	checked by: ***RBT***

position: E: 368119; N: 800134 (BOPC2000) surface elevation: Not Specified angle from horizontal: 90° DCP id.:

drill model: hole diameter : 50 mm vane id.: 4523 / 4583-19

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	vane shear ⊕ remoulded ⊙ peak (kPa) 50 100 150 200	DCP (blows/ 100 mm) 2 4 6 8 10	structure and additional observations
HA N		20/08/14 ▼			0.0			**Clayey ORGANIC SILT**: low plasticity, black, moist to wet.	M to W	H			**TOPSOIL FILL**
									M to W				**FILL**
								SILT: non plastic to low plasticity, brown orange streaked cream, with minor sand and some clay, moist to wet, hard.	M	VSt			VS 200 kPa
					0.5			- slight groundwater seepage encountered at 0.2m					VS 198/ 28 kPa
								Clayey SILT: medium plasticity, brown streaked brown orange, with trace rootlets, moist, very stiff.	M	VSt to H			VS 137/ 20 kPa
					1.0			**SILT**: non plastic, cream streaked brown orange, with minor sand, moist, very stiff to hard.					VS 200 kPa
								- becoming brown mottled brown orange with minor sand and minor clay from 0.7m					
					1.5			Hand Auger HA192 terminated at 0.8 m Target depth					
					2.0								
					2.5								
					3.0								
					3.5								
					4.0								
					4.5								
					5.0								

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method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore
- HA hand auger

* bit shown by suffix, e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration

1 2 3 no resistance ranging to refusal

water

10-Oct-12 water level on date shown
water inflow
water outflow

samples & field tests
- B bulk disturbed sample
- D disturbed sample
- E environmental sample
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remouded (kPa)
- R refusal
- HB hammer bouncing

classification symbol & soil description
based on Unified Classification System

moisture
- D dry
- M moist
- W wet
- S saturated
- Wp plastic limit
- Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey

Engineering Log - Hand Auger

Borehole ID.	***HA193***
sheet:	1 of 1
project no.	***GENZTAUC13086AE***
client: ***The Lakes 2012 Ltd***	date started: ***20 Aug 2014***
principal:	date completed: ***20 Aug 2014***
project: ***The Lakes Stage 2 QRST***	logged by: ***DBC***
location: ***Lot 888***	checked by: ***RBT***

position: E: 368119; N: 800123 (BOPC2000) surface elevation: Not Specified angle from horizontal: 90° DCP id.:

drill model: hole diameter : 50 mm vane id.: 4523 / 4583-19

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	vane shear ⊕ remoulded ⊙ peak (kPa) 50 100 150 200	DCP (blows/ 100 mm) 2 4 6 8 10	structure and additional observations
HA N		Not Encountered			0.5			**Clayey ORGANIC SILT**: low plasticity, black, moist to wet.	M to W				**TOPSOIL FILL**
								SILT: non plastic, brown orange mottled cream, with minor sand and some clay, moist, very stiff to hard.	M	VSt	⊕ ⊙		**FILL** VS 160/ 23 kPa
											⊕ ⊙		VS 156/ 33 kPa
								- becoming brown orange streaked pale grey flecked black from 0.6m		H	⊙		VS 200 kPa
								Hand Auger HA193 terminated at 0.8 m Target depth			⊙		VS 200 kPa
					1.0								
					1.5								
					2.0								
					2.5								
					3.0								
					3.5								
					4.0								
					4.5								
					5.0								

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method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore
- HA hand auger

* bit shown by suffix, e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration

1 2 3 — no resistance ranging to refusal

water

10-Oct-12 water level on date shown
water inflow
water outflow

samples & field tests
- B bulk disturbed sample
- D disturbed sample
- E environmental sample
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remouded (kPa)
- R refusal
- HB hammer bouncing

classification symbol & soil description
based on Unified Classification System

moisture
- D dry
- M moist
- W wet
- S saturated
- Wp plastic limit
- Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey

Engineering Log - Hand Auger

Borehole ID.	***HA194***
sheet:	1 of 1
project no.	***GENZTAUC13086AE***
client:	***The Lakes 2012 Ltd***
date started:	***20 Aug 2014***
principal:	
date completed:	***20 Aug 2014***
project:	***The Lakes Stage 2 QRST***
logged by:	***AIP***
location:	***Lot 889***
checked by:	***RBT***

position: E: 368130; N: 800113 (BOPC2000) surface elevation: Not Specified angle from horizontal: 90° DCP id.:

drill model: hole diameter : 50 mm vane id.: 764 / SL588

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	vane shear (kPa) ⊕ remoulded ⊙ peak (50 100 150 200)	DCP (blows/ 100 mm) (2 4 6 8 10)	structure and additional observations
HA N		20/08/14 ▽			0.5			**ORGANIC SILT**: non plastic, dark brown/black, some rootlets, wet.	W				**TOPSOIL FILL**
								Clayey SILT: low to medium plasticity, pale brown, moist, very stiff.	M	VSt			**FILL** VS 137/ 38 kPa
								Sandy SILT: non plastic, pale grey mottled orange, occasional white pumice clasts, moist, hard.		H			VS 200 kPa
					1.0			- becoming orange and clayey. Low to medium plasticity					VS 200 kPa
								- inclusions of pale grey pumiceous sand					VS 200 kPa
					1.5			Hand Auger HA194 terminated at 0.8 m Target depth					
					2.0								
					2.5								
					3.0								
					3.5								
					4.0								
					4.5								
					5.0								

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method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore
- HA hand auger

* bit shown by suffix
e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration
1 2 3 — no resistance ranging to refusal

water
- 10-Oct-12 water level on date shown
- water inflow
- water outflow

samples & field tests
- B bulk disturbed sample
- D disturbed sample
- E environmental sample
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remouded (kPa)
- R refusal
- HB hammer bouncing

classification symbol & soil description
based on Unified Classification System

moisture
- D dry
- M moist
- W wet
- S saturated
- Wp plastic limit
- Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey

Engineering Log - Hand Auger

		Borehole ID.	***HA195***
		sheet:	1 of 1
		project no.	***GENZTAUC13086AE***
client:	***The Lakes 2012 Ltd***	date started:	***20 Aug 2014***
principal:		date completed:	***20 Aug 2014***
project:	***The Lakes Stage 2 QRST***	logged by:	***AIP***
location:	***Lot 889***	checked by:	***RBT***

position: E: 368125; N: 800096 (BOPC2000) surface elevation: Not Specified angle from horizontal: 90° DCP id.:

drill model: hole diameter : 50 mm vane id.: 764 / SL588

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	vane shear ⊕ remoulded ⊙ peak (kPa) 50 100 150 200	DCP (blows/ 100 mm) 2 4 6 8 10	structure and additional observations
HA N		Not Encountered			0.5			**ORGANIC SILT**: non plastic, dark brown, minor rootlets, moist.	M	VSt to H	⊕ ⊙		**TOPSOIL FILL** VS 200 kPa
								Clayey SILT: low to medium plasticity, pale brown, some fine to medium sand, moist, very stiff to hard. - inclusion of white pumiceous sand. - becoming orange/brown. Trace dark brown organic silt.			⊙		**FILL** VS 187/ 27 kPa VS 200 kPa
					1.0			Hand Auger HA195 terminated at 0.8 m Target depth			⊙		VS 200 kPa
					1.5								
					2.0								
					2.5								
					3.0								
					3.5								
					4.0								
					4.5								
					5.0								

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method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore
- HA hand auger

* bit shown by suffix, e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration

1 2 3 no resistance ranging to refusal

water

10-Oct-12 water level on date shown
water inflow
water outflow

samples & field tests
- B bulk disturbed sample
- D disturbed sample
- E environmental sample
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remouded (kPa)
- R refusal
- HB hammer bouncing

classification symbol & soil description
based on Unified Classification System

moisture
- D dry
- M moist
- W wet
- S saturated
- Wp plastic limit
- Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey

Engineering Log - Hand Auger

Borehole ID.	***HA196***
sheet:	1 of 1
project no.	***GENZTAUC13086AE***
client:	***The Lakes 2012 Ltd***
date started:	***20 Aug 2014***
principal:	
date completed:	***20 Aug 2014***
project:	***The Lakes Stage 2 QRST***
logged by:	***DBC***
location:	***Lot 889***
checked by:	***RBT***

position: E: 368119; N: 800113 (BOPC2000) surface elevation: Not Specified angle from horizontal: 90° DCP id.:

drill model: hole diameter : 50 mm vane id.: 4523 / 4583-19

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	vane shear ⊕ remoulded ⊙ peak (kPa) 50 100 150 200	DCP (blows/ 100 mm) 2 4 6 8 10	structure and additional observations
HA N		20/08/14			0.5			**Clayey ORGANIC SILT**: low plasticity, black, moist to wet.	M to W				**TOPSOIL FILL**
								Clayey SILT: low to medium plasticity, brown orange mottled cream, with minor sand, moist to wet, firm to hard. - perched groundwater encountered at 0.3m - with some topsoil inclusions from 0.4m - becoming brown orange mottled cream flecked black from 0.5m. Topsoil inclusions absent	W	F	⊕		VS 41/ 10 kPa
										VSt	⊕ ⊙		**FILL** VS 119/ 40 kPa
									M to W				
									M	H	VS UTP		VS UTP
									M	VSt	⊕ ⊙		VS 119/ 25 kPa
					1.0			**SILT**: non plastic, brown orange streaked cream, with some sand and some clay, moist, very stiff.					
								Hand Auger HA196 terminated at 0.8 m Target depth					
					1.5								
					2.0								
					2.5								
					3.0								
					3.5								
					4.0								
					4.5								
					5.0								

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method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore
- HA hand auger

* bit shown by suffix e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration

1 2 3 no resistance ranging to refusal

water

10-Oct-12 water level on date shown
water inflow
water outflow

samples & field tests
- B bulk disturbed sample
- D disturbed sample
- E environmental sample
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remouded (kPa)
- R refusal
- HB hammer bouncing

classification symbol & soil description based on Unified Classification System

moisture
- D dry
- M moist
- W wet
- S saturated
- Wp plastic limit
- Wl liquid limit

consistency / relative density
- VS very soft
- S soft
- F firm
- St stiff
- VSt very stiff
- H hard
- Fb friable
- VL very loose
- L loose
- MD medium dense
- D dense
- VD very dense

coffey

Engineering Log - Hand Auger

Borehole ID.	***HA197***
sheet:	1 of 1
project no.	***GENZTAUC13086AE***
client:	***The Lakes 2012 Ltd***
date started:	***20 Aug 2014***
principal:	
date completed:	***20 Aug 2014***
project:	***The Lakes Stage 2 QRST***
logged by:	***DBC***
location:	***Lot 889***
checked by:	***RBT***

position: E: 368119; N: 800099 (BOPC2000) surface elevation: Not Specified angle from horizontal: 90° DCP id.:

drill model: hole diameter : 50 mm vane id.: 4523 / 4583-19

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	vane shear ⊕ remoulded ⊙ peak (kPa) 50 100 150 200	DCP (blows/ 100 mm) 2 4 6 8 10	structure and additional observations
HA N		Not Encountered			0.5			**Clayey ORGANIC SILT**: low plasticity, black, moist to wet.	M to W				**TOPSOIL FILL**
								Clayey SILT: low to medium plasticity, brown orange mottled cream, with minor sand, moist to wet, stiff to hard.	M to W	St			**FILL** VS 99/ 18 kPa
								- becoming slightly plastic from 0.2m	M	H			VS 200 kPa
								- becoming brown orange mottled brown from 0.4m					VS 200 kPa
								- becoming moderately plastic and brown orange streaked cream from 0.6m	M	H			VS 200 kPa
					1.0			**SILT**: non plastic, brown orange streaked cream, with minor sand and some clay, moist, hard.					
								Hand Auger HA197 terminated at 0.8 m Target depth					
					1.5								
					2.0								
					2.5								
					3.0								
					3.5								
					4.0								
					4.5								
					5.0								

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method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore
- HA hand auger

* bit shown by suffix, e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration

1 2 3 — no resistance ranging to refusal

water

10-Oct-12 water level on date shown
water inflow
water outflow

samples & field tests
- B bulk disturbed sample
- D disturbed sample
- E environmental sample
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remouded (kPa)
- R refusal
- HB hammer bouncing

classification symbol & soil description
based on Unified Classification System

moisture
- D dry
- M moist
- W wet
- S saturated
- Wp plastic limit
- Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey geotechnics

Engineering Log - Trial Pit

Trial Pit No. **TP101**

Sheet 1 of 1

Project No: **GENZTAUC13086AE**

Client: ***The Lakes (2012)***

Date started: ***27.11.2013***

Principal:

Date completed: ***27.11.2013***

Project: ***The Lakes Stage 2qrst***

Logged by: ***KMJ***

Trial pit location: ***Boundary of Lots 873 & 874***

Checked by: ***RBT***

Equipment type:

Pit Orientation:

Easting: 368093.26 m

R.L. Surface: 16

Excavation dimensions: 4m long 1m wide

Vane No: DR4523

Northing: 800185.07 m

Datum: x/y=EBOPC2000, RL=Moturiki

excavation information | **material substance**

stratigraphy	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	Material Description (Soil name; plasticity or grading, colour, secondary components. Moisture, sensitivity, strength. Structure, bedding, cementation, defects. Origin, additional observations. Rock name, grain size & type, colour, fabric, inclusions & minor components. Weathering, moisture, strength, defects.)	moisture condition	consistency/ density index	vane shear (remoulded /peak) kPa (25 50 75 100 125 150 175)	structure and additional observations
FILL						OL	SILT, no plasticity, black, rootlets, organic odor (TOPSOIL).	M	VSt		
						ML	Sandy SILT, no plasticity, brown, sand is fine to medium grained, occasional pockets/layers of organic staining.				
			15	1			- fine to medium grained gravel, sub-angular - becoming grey, organic odor				
						ML	SILT, low plasticity, yellow brown, minor fine grained gravel.		St-Vst		
ALLUVIAL DEPOSITS						ML	SILT, low plasticity, white with black & orange specks; pumiceous.				
			14	2			- becoming yellow brown - pumiceous silt pockets - large gravel inclusion & tree trunks from 2.3 to 2.4m				
						ML	Sandy SILT/Silty SAND, no plasticity, grey-white/pale grey; sand is fine grained, organic odor.	M-W			
			13	3		ML	Sandy SILT, pale green-brown/green-grey, with abundant rootlets; sand is fine grained.		S-F		
	26/11/2013 ▼					ML	- abundant tree trunks	W			
						SP	Clayey SILT, medium plasticity, blue-grey, sensitive, organic odor.				
			12	4		ML	SAND, fine to medium grained, blue-grey, with clay inclusion				
							SILT, low plasticity, brown, with fine to medium grained grey gravel, trace rootlets and fine grained blue sand.				
			11	5			EOBH @ 4.4m, maximum reach of excavator. Test pit TP101 terminated at 4.4 metres.				
			10	6							

Sketch

classification symbols and soil description
based on New Zealand Geotechnical Society Inc 2005

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
Bs	bulk sample
E	environmental sample
R	refusal

vane shear (kPa)

●	remoulded
×	peak
>>×	peak greater than 200kPa
UTP	unable to penetrate

water

▼	10/1/98 water level on date shown
►	waterinflow
◄	wateroutflow

moisture

D	dry
M	moist
W	wet
S	saturated

consistency/ density index

VS	very soft	VL	very loose
S	soft	L	loose
F	firm	MD	medium dense
St	stiff	D	dense
VSt	very stiff	VD	very dense
H	hard		

TRIAL PIT FIELD_LOG&SHEAR_VEIN_RECORDS.GPJ COFFEY.GDT 21.1.14

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Engineering Log - Trial Pit

Trial Pit No. **TP102**

Sheet 1 of 1

Project No: **GENZTAUC13086AE**

Client: ***The Lakes (2012)***

Date started: ***27.11.2013***

Principal:

Date completed: ***27.11.2013***

Project: ***The Lakes Stage 2qrst***

Logged by: ***KMJ***

Trial pit location: ***Boundary of Lots 874 & 875***

Checked by: ***RBT***

Equipment type:

Pit Orientation:

Easting: 368092.67 m

R.L. Surface: 16

Excavation dimensions: 4m long 1m wide

Vane No: DR4523

Northing: 800166.76 m

Datum: x/y=EBOPC2000, RL=Moturiki

excavation information | **material substance**

stratigraphy	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	Material Description (Soil name; plasticity or grading, colour, secondary components. Moisture, sensitivity, strength. Structure, bedding, cementation, defects. Origin, additional observations. Rock name, grain size & type, colour, fabric, inclusions & minor components. Weathering, moisture, strength, defects.)	moisture condition	consistency/ density index	vane shear (remoulded /peak) kPa	structure and additional observations
FILL	None Observed		15	1		OL	SILT, no plasticity, black, rootlets, organic odor (TOPSOIL).	M	St		
						ML	SILT, low plasticity, brown, with white & black specks, trace fine sand.				
							- white pumiceous silt pockets				
							- becoming orange-brown - occasional pockets/layers of organic silts with organic odor				
			14	2			- increasing plasticity				
ALLUVIAL DEPOSITS						ML	SILT, medium plasticity, interbedded brown, grey & light brown.				
							- tree trunks & rootlets				
			13	3		SP	Silty SAND, fine grained, grey.			UPT UPT	
			12	4		ML	Clayey SILT/Clayey SAND, medium plasticity, blue-grey, sensitive, organic odor, sand is fine grained.				
			11	5			EOBH @ 4.2m, target depth. Test pit TP102 terminated at 4.2 metres.				
			10	6							

vane shear (kPa): 25 50 75 100 125 150 175

Sketch

classification symbols and soil description
based on New Zealand Geotechnical Society Inc 2005

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
Bs	bulk sample
E	environmental sample
R	refusal

vane shear (kPa)

●	remoulded
×	peak
>>×	peak greater than 200kPa
UTP	unable to penetrate

water

▼	10/1/98 water level on date shown
►	waterinflow
◄	wateroutflow

moisture

D	dry
M	moist
W	wet
S	saturated

consistency/ density index

VS	very soft	VL	very loose
S	soft	L	loose
F	firm	MD	medium dense
St	stiff	D	dense
VSt	very stiff	VD	very dense
H	hard		

TRIAL PIT FIELD_LOG&SHEAR_VEIN_RECORDS.GPJ COFFEY.GDT 21.1.14

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Engineering Log - Trial Pit

Trial Pit No. **TP103**

Sheet 1 of 1

Project No: **GENZTAUC13086AE**

Client: ***The Lakes (2012)***

Date started: ***27.11.2013***

Principal:

Date completed: ***27.11.2013***

Project: ***The Lakes Stage 2qrst***

Logged by: ***KMJ***

Trial pit location: ***Boundary of Lots 874 & 885***

Checked by: ***RBT***

Equipment type:

Pit Orientation:

Easting: 368113.82 m

R.L. Surface: 16.5

Excavation dimensions: 4m long 1m wide

Vane No: DR4523

Northing: 800175.79 m

Datum: x/y=EBOPC2000, RL=Moturiki

excavation information | **material substance**

stratigraphy	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	Material Description (Soil name; plasticity or grading, colour, secondary components. Moisture, sensitivity, strength. Structure, bedding, cementation, defects. Origin, additional observations. Rock name, grain size & type, colour, fabric, inclusions & minor components. Weathering, moisture, strength, defects.)	moisture condition	consistency/ density index	vane shear (remoulded /peak) kPa (25 50 75 100 125 150 175)	structure and additional observations
FILL	None Observed		16	0		OL	SILT, no plasticity, black, rootlets, organic odor (TOPSOIL).	M	St-Vst		
						ML	Sandy SILT, low plasticity, brown, with white specks, with fine gravel & fine to medium grained sand. - silt pockets, white, with black specks.				
			15	1			- becoming orange-brown with black specks - grey inclusion				
							- grey silt lenses & occasional organic pockets				
				2			- decreasing sand content				
			14			ML	SILT, low plasticity, orange-brown, white inclusion & black specks. - becoming pale orange-brown				
							- tree trunks				
AD				3		ML	Sandy SILT, low plasticity, grey, trace clay & fine sand. - abundant tree trunks from 2.9 to 3.5m				
			13			ML	Clayey SILT, medium plasticity, blue-grey, sensitive, organic odor.				
				4			EOBH @ 3.5m, target depth AD = ALLUVIAL DEPOSITS Test pit TP103 terminated at 3.5 metres.				
			12								
				5							
			11								
				6							

Sketch

classification symbols and soil description
based on New Zealand Geotechnical Society Inc 2005

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
Bs	bulk sample
E	environmental sample
R	refusal

vane shear (kPa)

●	remoulded
×	peak
>>×	peak greater than 200kPa
UTP	unable to penetrate

water

▼	10/1/98 water level on date shown
►	waterinflow
◄	wateroutflow

moisture

D	dry
M	moist
W	wet
S	saturated

consistency/ density index

VS	very soft	VL	very loose
S	soft	L	loose
F	firm	MD	medium dense
St	stiff	D	dense
VSt	very stiff	VD	very dense
H	hard		

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Engineering Log - Trial Pit

Trial Pit No. **TP104**

Sheet 1 of 1

Project No: **GENZTAUC13086AE**

Client: ***The Lakes (2012)***

Date started: ***27.11.2013***

Principal:

Date completed: ***27.11.2013***

Project: ***The Lakes Stage 2qrst***

Logged by: ***KMJ***

Trial pit location: ***Boundary of Lots878 & 889***

Checked by: ***RBT***

Equipment type:

Pit Orientation:

Easting: 368114.25 m

R.L. Surface: 16.5

Excavation dimensions: 4m long 1m wide

Vane No: DR4523

Northing: 800111.63 m

Datum: x/y=EBOPC2000, RL=Moturiki

excavation information | **material substance**

stratigraphy	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	Material Description (Soil name; plasticity or grading, colour, secondary components. Moisture, sensitivity, strength. Structure, bedding, cementation, defects. Origin, additional observations. Rock name, grain size & type, colour, fabric, inclusions & minor components. Weathering, moisture, strength, defects.)	moisture condition	consistency/ density index	vane shear (remoulded /peak) kPa	structure and additional observations
FILL	None Observed		16	0		OL	SILT, no plasticity, black, rootlets, organic odor (TOPSOIL).	M	St-Vst		
						ML	SILT, no plasticity, brown, black specks & rootlets.				
				1			- organic inclusion				
			15				- dark brown inclusion				
				2			- increasing sand content				
			14				- becoming pale yellow-brown, black specks, with fine grained sand - pale grey silt pockets				
			13	3		ML	SILT, low plasticity, grey-white, with black specks, pumiceous.				
				4			EOBH @ 3.5m target depth. Test pit TP104 terminated at 3.5 metres.				
			12								
				5							
			11								
				6							

vane shear (remoulded /peak) kPa: 25, 50, 75, 100, 125, 150, 175

Sketch

classification symbols and soil description
based on New Zealand Geotechnical Society Inc 2005

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
Bs	bulk sample
E	environmental sample
R	refusal

vane shear (kPa)

●	remoulded
×	peak
>>×	peak greater than 200kPa
UTP	unable to penetrate

water

▼	10/1/98 water level on date shown
►	waterinflow
◄	wateroutflow

moisture

D	dry
M	moist
W	wet
S	saturated

consistency/ density index

VS	very soft	VL	very loose
S	soft	L	loose
F	firm	MD	medium dense
St	stiff	D	dense
VSt	very stiff	VD	very dense
H	hard		

TRIAL PIT FIELD_LOG&SHEAR_VEIN_RECORDS.GPJ COFFEY.GDT 21.1.14

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Engineering Log - Trial Pit

Trial Pit No.	**TP01**		
Sheet	1 of 1		
Project No:	**GENZTAUC13086AE**		
Client:	**The Lakes (2012)**	Date started:	**31.1.2008**
Principal:		Date completed:	**31.1.2008**
Project:	**The Lakes Stage 2qrst**	Logged by:	**GW**
Trial pit location:	**Driveway North of Lot 881**	Checked by:	**RBT**

Equipment type: | Pit Orientation: | Easting: 368143.83 m | R.L. Surface: m

Excavation dimensions: m long m wide | Vane No: not specified | Northing: 800242.63 m | Datum: x/y: WGOPC2000; RL: Moturiki

excavation information | **material substance**

stratigraphy	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	Material Description (Soil name; plasticity or grading, colour, secondary components. Moisture, sensitivity, strength. Structure, bedding, cementation, defects. Origin, additional observations. Rock name, grain size & type, colour, fabric, inclusions & minor components. Weathering, moisture, strength, defects.)	moisture condition	consistency/ density index	vane shear (remoulded /peak) kPa (25 50 75 100 125 150 175)	structure and additional observations
Colluvium				1		ML	Sandy SILT, no plasticity, orange-brown, mottled light brown,black specks; sand is fine to medium grained.	M			
Sedimentary Deposits	31/01/2008 ▼			2 3 4 5		SP	SAND, fine to medium grained, creamy speckled grey/green - water seeping from side of test pit	W			
				6			EOBH @ 5.5m, target depth Test pit TP01 terminated at 5.5 metres.				

Sketch

classification symbols and soil description
based on New Zealand Geotechnical Society Inc 2005

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
Bs	bulk sample
E	environmental sample
R	refusal

vane shear (kPa)

●	remoulded
×	peak
>>×	peak greater than 200kPa
UTP	unable to penetrate

water

▼	10/1/98 water level on date shown
►	waterinflow
◄	wateroutflow

moisture

D	dry
M	moist
W	wet
S	saturated

consistency/ density index

VS	very soft	VL	very loose
S	soft	L	loose
F	firm	MD	medium dense
St	stiff	D	dense
VSt	very stiff	VD	very dense
H	hard		

TRIAL PIT 13086AE GCRHAND AUGERS.GPJ COFFEY.GDT 14.4.14

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Engineering Log - Trial Pit

Trial Pit No. **TP02**

Sheet 1 of 1

Project No: **GENZTAUC13086AE**

Client: ***The Lakes (2012)***

Date started: ***31.1.2008***

Principal:

Date completed: ***31.1.2008***

Project: ***The Lakes Stage 2qrst***

Logged by: ***GW***

Trial pit location: ***Driveway North of Lot 881 & 882***

Checked by: ***RBT***

Equipment type:

Pit Orientation:

Easting: 368163.68 m

R.L. Surface: m

Excavation dimensions: m long m wide

Vane No: not specified

Northing: 800235.13 m

Datum: x/y: WGOPC2000; RL: Moturiki

excavation information | **material substance**

stratigraphy	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	Material Description (Soil name; plasticity or grading, colour, secondary components. Moisture, sensitivity, strength. Structure, bedding, cementation, defects. Origin, additional observations. Rock name, grain size & type, colour, fabric, inclusions & minor components. Weathering, moisture, strength, defects.)	moisture condition	consistency/ density index	vane shear (remoulded /peak) kPa (25 50 75 100 125 150 175)	structure and additional observations
Colluvium / Sedimentary Deposits	groundwater not encountered			1		ML	Sandy SILT, no plasticity, creamy black, speckled light brown; sand is fine to medium grained.	M	F	●× ●×	
				2		SP	SAND, fine to medium grained, black speckled light grey.			●×	
						SP	SAND, fine to medium grained, creamy speckled dark brown.		H	>>×	
				3		SP	SAND, fine to medium grained, creamy speckled pale green.			>>×	
				4			EOBH @ 3.0m, target depth. Test pit TP02 terminated at 3 metres.				
				5							
				6							

Sketch

classification symbols and soil description
based on New Zealand Geotechnical Society Inc 2005

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
Bs	bulk sample
E	environmental sample
R	refusal

vane shear (kPa)

●	remoulded
×	peak
>>×	peak greater than 200kPa
UTP	unable to penetrate

water

▼	10/1/98 water level on date shown
►	waterinflow
◄	wateroutflow

moisture

D	dry
M	moist
W	wet
S	saturated

consistency/ density index

VS	very soft	VL	very loose
S	soft	L	loose
F	firm	MD	medium dense
St	stiff	D	dense
VSt	very stiff	VD	very dense
H	hard		

TRIAL PIT 13086AE GCRHAND AUGERS.GPJ COFFEY.GDT 14.4.14

Form GEO 5.5 Rev.6

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Engineering Log - Trial Pit

Trial Pit No.	**TP03**		
Sheet	1 of 1		
Project No:	**GENZTAUC13086AE**		
Client:	**The Lakes (2012)**	Date started:	**31.1.2008**
Principal:		Date completed:	**31.1.2008**
Project:	**The Lakes Stage 2qrst**	Logged by:	**GW**
Trial pit location:	**Driveway North-East of Lot 852**	Checked by:	**RBT**

Equipment type: | Pit Orientation: | Easting: 368170.85 m | R.L. Surface: m

Excavation dimensions: m long m wide | Vane No: not specified | Northing: 800224.14 m | Datum: x/y: WGOPC2000; RL: Moturiki

excavation information | **material substance**

stratigraphy	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	Material Description (Soil name; plasticity or grading, colour, secondary components. Moisture, sensitivity, strength. Structure, bedding, cementation, defects. Origin, additional observations. Rock name, grain size & type, colour, fabric, inclusions & minor components. Weathering, moisture, strength, defects.)	moisture condition	consistency/ density index	vane shear (remoulded /peak) kPa (25 50 75 100 125 150 175)	structure and additional observations
Colluvium	groundwater not encountered			1		ML	Sandy SILT, no plasticity, creamy black, speckled light brown; sand is fine to medium grained.	M	F	● ×	
									St-H	>>×	
Sedimentary Deposits						SP	SAND, fine to medium grained, black, speckled light grey.			● ×	
				2		ML	Sandy SILT, no plasticity, creamy streaked pale green.			● ×	
				3							
							EOBH @ 3.0m, target depth Test pit TP03 terminated at 3 metres.				
				4							
				5							
				6							

Sketch

classification symbols and soil description
based on New Zealand Geotechnical Society Inc 2005

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
Bs	bulk sample
E	environmental sample
R	refusal

vane shear (kPa)

●	remoulded
×	peak
>>×	peak greater than 200kPa
UTP	unable to penetrate

water

▼	10/1/98 water level on date shown
►	waterinflow
◄	wateroutflow

moisture

D	dry
M	moist
W	wet
S	saturated

consistency/ density index

VS	very soft	VL	very loose
S	soft	L	loose
F	firm	MD	medium dense
St	stiff	D	dense
VSt	very stiff	VD	very dense
H	hard		

TRIAL PIT 13086AE GCRHAND AUGERS.GPJ COFFEY.GDT 14.4.14

Form GEO 5.5 Rev.6

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Engineering Log - Trial Pit

Trial Pit No. **TP04**

Sheet 1 of 1

Project No: **GENZTAUC13086AE**

Client: ***The Lakes (2012)***

Date started: ***31.1.2008***

Principal:

Date completed: ***31.1.2008***

Project: ***The Lakes Stage 2qrst***

Logged by: ***GW***

Trial pit location: ***Driveway East of Lot 852***

Checked by: ***RBT***

Equipment type:

Pit Orientation:

Easting: 368173.85 m

R.L. Surface: m

Excavation dimensions: m long m wide

Vane No: not specified

Northing: 800224.14 m

Datum: x/y: WGCPC2000; RL: Moturiki

excavation information | **material substance**

stratigraphy	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	Material Description (Soil name; plasticity or grading, colour, secondary components. Moisture, sensitivity, strength. Structure, bedding, cementation, defects. Origin, additional observations. Rock name, grain size & type, colour, fabric, inclusions & minor components. Weathering, moisture, strength, defects.)	moisture condition	consistency/ density index	vane shear (remoulded /peak) kPa (25 50 75 100 125 150 175)	structure and additional observations
Colluvium	groundwater not encountered			0		SP	SAND, fine to medium grained, black creamy speckled light grey.	M			
Sedimentary Deposits				1		SM	Silty SAND, fine to medium grained, black speckled, creamy, with wood inclusions. - becoming creamy pale green				
				2		SP	SAND, fine to medium grained, creamy speckled green.				
				3			EOBH @ 3.0m, targt depth. Test pit TP04 terminated at 3 metres.				
				4							
				5							
				6							

Sketch

classification symbols and soil description
based on New Zealand Geotechnical Society Inc 2005

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
Bs	bulk sample
E	environmental sample
R	refusal

vane shear (kPa)

●	remoulded
×	peak
>>×	peak greater than 200kPa
UTP	unable to penetrate

water

▼	10/1/98 water level on date shown
►	waterinflow
◄	wateroutflow

moisture

D	dry
M	moist
W	wet
S	saturated

consistency/ density index

VS	very soft	VL	very loose
S	soft	L	loose
F	firm	MD	medium dense
St	stiff	D	dense
VSt	very stiff	VD	very dense
H	hard		

TRIAL PIT 13086AE GCRHAND AUGERS.GPJ COFFEY.GDT 14.4.14

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Engineering Log - Trial Pit

Trial Pit No. **TP05**

Sheet 1 of 1

Project No: **GENZTAUC13086AE**

Client: ***The Lakes (2012)***

Date started: ***31.1.2008***

Principal:

Date completed: ***31.1.2008***

Project: ***The Lakes Stage 2qrst***

Logged by: ***GW***

Trial pit location: ***Boundary of Lot 882 & Lot 883***

Checked by: ***RBT***

Equipment type:

Pit Orientation:

Easting: 368154.51 m

R.L. Surface: m

Excavation dimensions: m long m wide

Vane No: not specified

Northing: 800205.31 m

Datum: x/y: WGOPC2000; RL: Moturiki

excavation information | **material substance**

stratigraphy	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	Material Description: Soil name; plasticity or grading, colour, secondary components. Moisture, sensitivity, strength. Structure, bedding, cementation, defects. Origin, additional observations. Rock name, grain size & type, colour, fabric, inclusions & minor components. Weathering, moisture, strength, defects.	moisture condition	consistency/ density index	vane shear (remoulded /peak) kPa 25 50 75 100 125 150 175	structure and additional observations
C P Sedimentary Deposits	groundwater not encountered			1		SP	SAND, fine to medium grained, black creamy speckled grey.	M			
						OL	PEAT, Organic SILT, dark brown, moist.				
				2		SP	SAND, fine to medium grained, black creamy speckled light brown, with trace silt.				
				3		SP	SAND, fine to medium grained, creamy speckled pale green.				
				4			EOBH @ 3.0m, target depth P=Peat C=Colluvium Test pit TP05 terminated at 3 metres.				
				5							
				6							

Sketch

classification symbols and soil description
based on New Zealand Geotechnical Society Inc 2005

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
Bs	bulk sample
E	environmental sample
R	refusal

vane shear (kPa)

●	remoulded
×	peak
>>×	peak greater than 200kPa
UTP	unable to penetrate

water

▼	10/1/98 water level on date shown
►	waterinflow
◄	wateroutflow

moisture

D	dry
M	moist
W	wet
S	saturated

consistency/ density index

VS	very soft	VL	very loose
S	soft	L	loose
F	firm	MD	medium dense
St	stiff	D	dense
VSt	very stiff	VD	very dense
H	hard		

TRIAL PIT 13086AE GCRHAND AUGERS.GPJ COFFEY.GDT 14.4.14

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Engineering Log - Trial Pit

Trial Pit No.	**TP06**		
Sheet	1 of 1		
Project No:	**GENZTAUC13086AE**		
Client:	**The Lakes (2012)**	Date started:	**31.1.2008**
Principal:		Date completed:	**31.1.2008**
Project:	**The Lakes Stage 2qrst**	Logged by:	**GW**
Trial pit location:	**Lot 884**	Checked by:	**RBT**

Equipment type: | Pit Orientation: | Easting: 368117.99 m | R.L. Surface: m

Excavation dimensions: m long m wide | Vane No: not specified | Northing: 800200.15 m | Datum: x/y: WGOPC2000; RL: Moturiki

excavation information | **material substance**

stratigraphy	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	Material Description (Soil name; plasticity or grading, colour, secondary components. Moisture, sensitivity, strength. Structure, bedding, cementation, defects. Origin, additional observations. Rock name, grain size & type, colour, fabric, inclusions & minor components. Weathering, moisture, strength, defects.)	moisture condition	consistency/ density index	vane shear (remoulded /peak) kPa (25 50 75 100 125 150 175)	structure and additional observations
C	groundwater not encountered			0		SP	SAND, fine to medium grained, black creamy speckled grey.	M			
Sedimentary Deposits				1		ML	SILT, no plasticity, light grey, creamy, with abundant wood.				
				2							
				3		SP	SAND, fine to medium grained, black creamy speckled pale green/grey, with some wood.				
						SP	SAND, fine to medium grained, creamy speckled green.				
				4			EOBH @ 3.3m, target depth C=Colluvium Test pit TP06 terminated at 3.3 metres.				
				5							
				6							

Sketch

classification symbols and soil description
based on New Zealand Geotechnical Society Inc 2005

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
Bs	bulk sample
E	environmental sample
R	refusal

vane shear (kPa)

●	remoulded
×	peak
>>×	peak greater than 200kPa
UTP	unable to penetrate

water

▼	10/1/98 water level on date shown
►	waterinflow
◄	wateroutflow

moisture

D	dry
M	moist
W	wet
S	saturated

consistency/ density index

VS	very soft	VL	very loose
S	soft	L	loose
F	firm	MD	medium dense
St	stiff	D	dense
VSt	very stiff	VD	very dense
H	hard		

coffey

Engineering Log - Trial Pit

Trial Pit No. **TP07**

Sheet 1 of 1

Project No: **GENZTAUC13086AE**

Client: ***The Lakes (2012)***

Date started: ***31.1.2008***

Principal:

Date completed: ***31.1.2008***

Project: ***The Lakes Stage 2qrst***

Logged by: ***GW***

Trial pit location: ***Lot 874***

Checked by: ***RBT***

Equipment type:

Pit Orientation:

Easting: 368118.16 m

R.L. Surface: m

Excavation dimensions: m long m wide

Vane No: not specified

Northing: 800179.32 m

Datum: x/y: WGOPC2000; RL: Moturiki

excavation information | **material substance**

stratigraphy	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	Material Description (Soil name; plasticity or grading, colour, secondary components. Moisture, sensitivity, strength. Structure, bedding, cementation, defects. Origin, additional observations. Rock name, grain size & type, colour, fabric, inclusions & minor components. Weathering, moisture, strength, defects.)	moisture condition	consistency/ density index	vane shear (remoulded /peak) kPa (25 50 75 100 125 150 175)	structure and additional observations
C						SP	SAND, fine to medium grained, black creamy speckled grey.	M			
Sedimentary Deposits	31/01/2008 ▼			1		SM	Silty SAND, fine to medium grained, black creamy speckled grey/brown, with abundant wood inclusions.				
				2			- water seeping in site				
				3		SM	Silty SAND, fine to medium grained, creamy speckled green.				
				4			EOBH @ 3.0m, target depth C=Colluvium Test pit TP07 terminated at 3 metres.				
				5							
				6							

Sketch

classification symbols and soil description
based on New Zealand Geotechnical Society Inc 2005

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
Bs	bulk sample
E	environmental sample
R	refusal

vane shear (kPa)

●	remoulded
×	peak
>>×	peak greater than 200kPa
UTP	unable to penetrate

water

▼	10/1/98 water level on date shown
►	waterinflow
◄	wateroutflow

moisture

D	dry
M	moist
W	wet
S	saturated

consistency/ density index

VS	very soft	VL	very loose
S	soft	L	loose
F	firm	MD	medium dense
St	stiff	D	dense
VSt	very stiff	VD	very dense
H	hard		

coffey

Engineering Log - Trial Pit

Trial Pit No. **TP08**

Sheet 1 of 1

Project No: **GENZTAUC13086AE**

Client: ***The Lakes (2012)***

Date started: ***31.1.2008***

Principal:

Date completed: ***31.1.2008***

Project: ***The Lakes Stage 2qrst***

Logged by: ***GW***

Trial pit location: ***Driveway South-East of Lot 886***

Checked by: ***RBT***

Equipment type:

Pit Orientation:

Easting: 368147.94 m

R.L. Surface: m

Excavation dimensions: m long m wide

Vane No: not specified

Northing: 800157.58 m

Datum: x/y: WGOPC2000; RL: Moturiki

excavation information | **material substance**

stratigraphy	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	Material Description: Soil name; plasticity or grading, colour, secondary components. Moisture, sensitivity, strength. Structure, bedding, cementation, defects. Origin, additional observations. Rock name, grain size & type, colour, fabric, inclusions & minor components. Weathering, moisture, strength, defects.	moisture condition	consistency/ density index	vane shear (remoulded /peak) kPa (25 50 75 100 125 150 175)	structure and additional observations
Colluvium				1		SP	SAND, fine to medium grained, black cream speckled grey, with trace silt.	M			
Peat				2		OL	PEAT, Organic SILT, no plasticity, fibrous, black, with abundant organic inclusions.				
							- water seeping in from the side of test pit				
SD				3		SP	SAND, fine to medium grained, black, creamy speckled grey/brown.				
				4			EOBH @ 3.0m, target depth SD=Sedimentary Deposits Test pit TP08 terminated at 3 metres.				
				5							
				6							

Sketch

classification symbols and soil description
based on New Zealand Geotechnical Society Inc 2005

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
Bs	bulk sample
E	environmental sample
R	refusal

vane shear (kPa)

●	remoulded
×	peak
>>×	peak greater than 200kPa
UTP	unable to penetrate

water

▼	10/1/98 water level on date shown
►	waterinflow
◄	wateroutflow

moisture

D	dry
M	moist
W	wet
S	saturated

consistency/ density index

VS	very soft	VL	very loose
S	soft	L	loose
F	firm	MD	medium dense
St	stiff	D	dense
VSt	very stiff	VD	very dense
H	hard		

coffey

Engineering Log - Trial Pit

Trial Pit No.	**TP09**		
Sheet	1 of 1		
Project No:	**GENZTAUC13086AE**		
Client:	**The Lakes (2012)**	Date started:	**31.1.2008**
Principal:		Date completed:	**31.1.2008**
Project:	**The Lakes Stage 2qrst**	Logged by:	**GW**
Trial pit location:	**Driveway East of Lot 886**	Checked by:	**RBT**

Equipment type: | Pit Orientation: | Easting: 368159.11 m | R.L. Surface: m

Excavation dimensions: m long m wide | Vane No: not specified | Northing: 800167.7 m | Datum: x/y: WGOPC2000; RL: Moturiki

excavation information | **material substance**

stratigraphy	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	Material Description (Soil name; plasticity or grading, colour, secondary components. Moisture, sensitivity, strength. Structure, bedding, cementation, defects. Origin, additional observations. Rock name, grain size & type, colour, fabric, inclusions & minor components. Weathering, moisture, strength, defects.)	moisture condition	consistency/ density index	vane shear (remoulded /peak) kPa (25 50 75 100 125 150 175)	structure and additional observations
Colluvium				0		SP	SAND, fine to medium grained, black creamy speckled light brown/grey, trace silt.	M			
Peat				1		OL	PEAT, Organic Sandy SILT, no plasticity, dark brown/black with abundant rootlets & wood.				
	▼ 31/01/2008			2			- water seeping out of wall	W			
SD				3		SP	SAND, fine to medium grained, creamy speckled pale green.				
							EOBH @ 3.3m, target depth SD=Sedimentary Deposits Test pit TP09 terminated at 3.3 metres.				
				4							
				5							
				6							

Sketch

classification symbols and soil description
based on New Zealand Geotechnical Society Inc 2005

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
Bs	bulk sample
E	environmental sample
R	refusal

vane shear (kPa)

●	remoulded
×	peak
>>×	peak greater than 200kPa
UTP	unable to penetrate

water

▼	10/1/98 water level on date shown
►	waterinflow
◄	wateroutflow

moisture

D	dry
M	moist
W	wet
S	saturated

consistency/ density index

VS	very soft	VL	very loose
S	soft	L	loose
F	firm	MD	medium dense
St	stiff	D	dense
VSt	very stiff	VD	very dense
H	hard		

coffey

Engineering Log - Trial Pit

Trial Pit No. **TP10**

Sheet 1 of 1

Project No: **GENZTAUC13086AE**

Client: ***The Lakes (2012)***

Date started: ***31.1.2008***

Principal:

Date completed: ***31.1.2008***

Project: ***The Lakes Stage 2qrst***

Logged by: ***GW***

Trial pit location: ***Boundary of Lot 885 & Lot 886***

Checked by: ***RBT***

Equipment type:

Pit Orientation:

Easting: 368140.74 m

R.L. Surface: m

Excavation dimensions: m long m wide

Vane No: not specified

Northing: 800171.77 m

Datum: x/y: WGOPC2000; RL: Moturiki

excavation information | **material substance**

stratigraphy	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	Material Description: Soil name; plasticity or grading, colour, secondary components. Moisture, sensitivity, strength. Structure, bedding, cementation, defects. Origin, additional observations. Rock name, grain size & type, colour, fabric, inclusions & minor components. Weathering, moisture, strength, defects.	moisture condition	consistency/ density index	vane shear (remoulded /peak) kPa (25 50 75 100 125 150 175)	structure and additional observations
Colluvium				1		SP	SAND, fine to medium grained, black speckled light brown/grey, with trace silt.	M			
SD				2		SP	SAND, fine to medium grained, black speckled creamy grey.				
				3			EOBH @ 2.5m, target depth SD=Sedimentary Deposits Test pit TP10 terminated at 2.5 metres.				
				4							
				5							
				6							

Sketch

classification symbols and soil description
based on New Zealand Geotechnical Society Inc 2005

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
Bs	bulk sample
E	environmental sample
R	refusal

vane shear (kPa)

●	remoulded
×	peak
>>×	peak greater than 200kPa
UTP	unable to penetrate

water

▼	10/1/98 water level on date shown
►	waterinflow
◄	wateroutflow

moisture

D	dry
M	moist
W	wet
S	saturated

consistency/ density index

VS	very soft	VL	very loose
S	soft	L	loose
F	firm	MD	medium dense
St	stiff	D	dense
VSt	very stiff	VD	very dense
H	hard		

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coffey

Engineering Log - Trial Pit

Trial Pit No. **TP11**

Sheet 1 of 1

Project No: **GENZTAUC13086AE**

Client: ***The Lakes (2012)***

Date started: ***31.1.2008***

Principal:

Date completed: ***31.1.2008***

Project: ***The Lakes Stage 2qrst***

Logged by: ***GW***

Trial pit location: ***Eastern Boundary of Lot 889***

Checked by: ***RBT***

Equipment type:

Pit Orientation:

Easting: 368139.76 m

R.L. Surface: m

Excavation dimensions: m long m wide

Vane No: not specified

Northing: 800117.39 m

Datum: x/y: WGOPC2000; RL: Moturiki

excavation information | **material substance**

stratigraphy	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	Material Description (Soil name; plasticity or grading, colour, secondary components. Moisture, sensitivity, strength. Structure, bedding, cementation, defects. Origin, additional observations. Rock name, grain size & type, colour, fabric, inclusions & minor components. Weathering, moisture, strength, defects.)	moisture condition	consistency/ density index	vane shear (remoulded /peak) kPa	structure and additional observations
C						SP	SAND, fine to medium grained,creamy speckled grey.	M			
SD				1		SM	Silty SAND, fine to medium grained, black creamy speckled light brown, with abundant wood.				
				2			- becoming dark brown & fibrous				
						SP	SAND, fine to medium grained, black creamy speckled light brown/grey.	W			
	▼ 31/01/2008			3			- water seeping in				
						SM	Silty SAND, fine to medium grained, creamy speckled pale green.				
				4			EOBH @ 3.3m, target depth C=Colluvium SD=Sedimentary Deposits Test pit TP11 terminated at 3.3 metres.				
				5							
				6							

vane shear (remoulded /peak) kPa: 25 50 75 100 125 150 175

Sketch

classification symbols and soil description
based on New Zealand Geotechnical Society Inc 2005

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
Bs	bulk sample
E	environmental sample
R	refusal

vane shear (kPa)

●	remoulded
×	peak
>>×	peak greater than 200kPa
UTP	unable to penetrate

water

▼	10/1/98 water level on date shown
►	waterinflow
◄	wateroutflow

moisture

D	dry
M	moist
W	wet
S	saturated

consistency/ density index

VS	very soft	VL	very loose
S	soft	L	loose
F	firm	MD	medium dense
St	stiff	D	dense
VSt	very stiff	VD	very dense
H	hard		

Engineering Log - Trial Pit

Trial Pit No. **TP12**

Sheet 1 of 1

Project No: **GENZTAUC13086AE**

Client: ***The Lakes (2012)***

Date started: ***31.1.2008***

Principal:

Date completed: ***31.1.2008***

Project: ***The Lakes Stage 2qrst***

Logged by: ***GW***

Trial pit location: ***South-West Corner of Lot 889***

Checked by: ***RBT***

Equipment type:

Pit Orientation:

Easting: 368121.6 m

R.L. Surface: m

Excavation dimensions: m long m wide

Vane No: not specified

Northing: 800100.91 m

Datum: x/y: WGOPC2000; RL: Moturiki

excavation information | **material substance**

stratigraphy	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	Material Description (Soil name; plasticity or grading, colour, secondary components. Moisture, sensitivity, strength. Structure, bedding, cementation, defects. Origin, additional observations. Rock name, grain size & type, colour, fabric, inclusions & minor components. Weathering, moisture, strength, defects.)	moisture condition	consistency/ density index	vane shear (remoulded /peak) kPa	structure and additional observations
Colluvium				0		SP	SAND, fine to medium grained, creamy black.	M			
SD				1		ML	SILT, no plasticity, light brown. creamy, with abundant wood & trace fine sand.				
	31/01/2008			2			- water seeping into test pit	W			
				3		SM	Silty SAND, fine to medium grained, creamy speckled pale green.				
				4			EOBH @ 3.3m, target depth. Test pit TP12 terminated at 3.3 metres.				
				5							
				6							

vane shear (remoulded /peak) kPa: 25, 50, 75, 100, 125, 150, 175

Sketch

classification symbols and soil description
based on New Zealand Geotechnical Society Inc 2005

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
Bs	bulk sample
E	environmental sample
R	refusal

vane shear (kPa)

●	remoulded
×	peak
>>×	peak greater than 200kPa
UTP	unable to penetrate

water

▼	10/1/98 water level on date shown
►	waterinflow
◄	wateroutflow

moisture

D	dry
M	moist
W	wet
S	saturated

consistency/ density index

VS	very soft	VL	very loose
S	soft	L	loose
F	firm	MD	medium dense
St	stiff	D	dense
VSt	very stiff	VD	very dense
H	hard		

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Engineering Log - Trial Pit

Trial Pit No.	**TP13**		
Sheet	1 of 1		
Project No:	**GENZTAUC13086AE**		
Client:	***The Lakes (2012)***	Date started:	***31.1.2008***
Principal:		Date completed:	***31.1.2008***
Project:	***The Lakes Stage 2qrst***	Logged by:	***GW***
Trial pit location:	***Lot 887***	Checked by:	***RBT***

Equipment type: | Pit Orientation: | Easting: 368136.69 m | R.L. Surface: m

Excavation dimensions: m long m wide | Vane No: not specified | Northing: 800145.84 m | Datum: x/y: WGOPC2000; RL: Moturiki

excavation information | **material substance**

stratigraphy	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	Material Description (Soil name; plasticity or grading, colour, secondary components. Moisture, sensitivity, strength. Structure, bedding, cementation, defects. Origin, additional observations. Rock name, grain size & type, colour, fabric, inclusions & minor components. Weathering, moisture, strength, defects.)	moisture condition	consistency/ density index	vane shear (remoulded /peak) kPa	structure and additional observations
Colluvium				1		SM	Silty SAND, fine to medium grained, black creamy speckled light brown.	M			
SD	31/01/2008 ▼			2		SP	SAND, fine to medium grained, black speckled grey. - water seeping into test pit	W			
						SM	Silty SAND, fine to medium grained, creamy speckled pale green.				
				3			EOBH @ 2.5m, target depth SD=Sedimentary Deposits Test pit TP13 terminated at 2.5 metres.				
				4							
				5							
				6							

Sketch

classification symbols and soil description
based on New Zealand Geotechnical Society Inc 2005

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
Bs	bulk sample
E	environmental sample
R	refusal

vane shear (kPa)

●	remoulded
×	peak
>>×	peak greater than 200kPa
UTP	unable to penetrate

water

▼	10/1/98 water level on date shown
►	waterinflow
◄	wateroutflow

moisture

D	dry
M	moist
W	wet
S	saturated

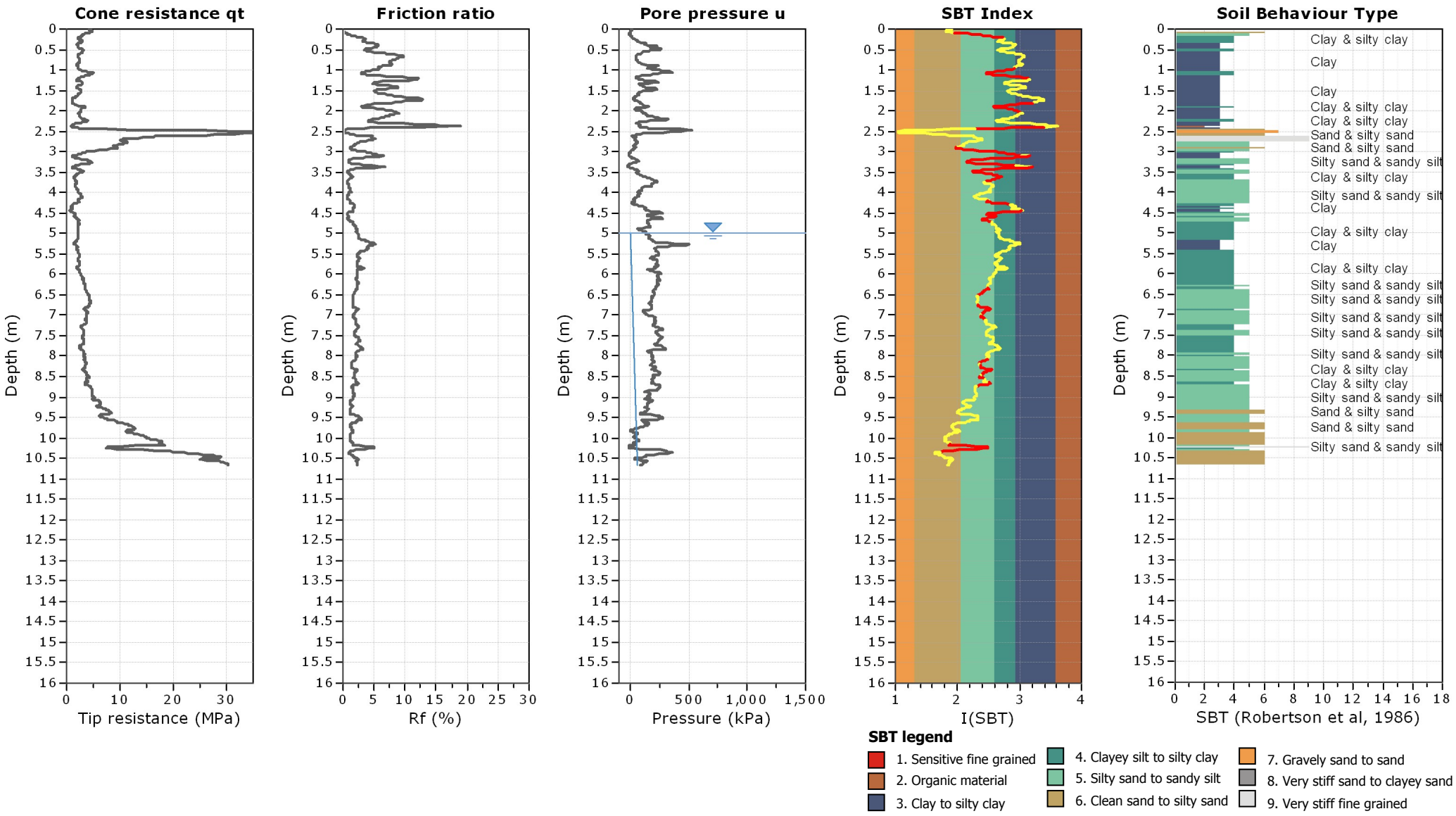
consistency/ density index

VS	very soft	VL	very loose
S	soft	L	loose
F	firm	MD	medium dense
St	stiff	D	dense
VSt	very stiff	VD	very dense
H	hard		

Coffey
96 Cameron Road, Tauranga
3110
New Zealand

CPT: CPT-11
Total depth: 10.67 m, Date: 28/11/2012
Surface Elevation: 16.00 m
Coords: X:0.00, Y:0.00
Cone Type: 50 MPa Piezocone
Cone Operator: Ground Investigation

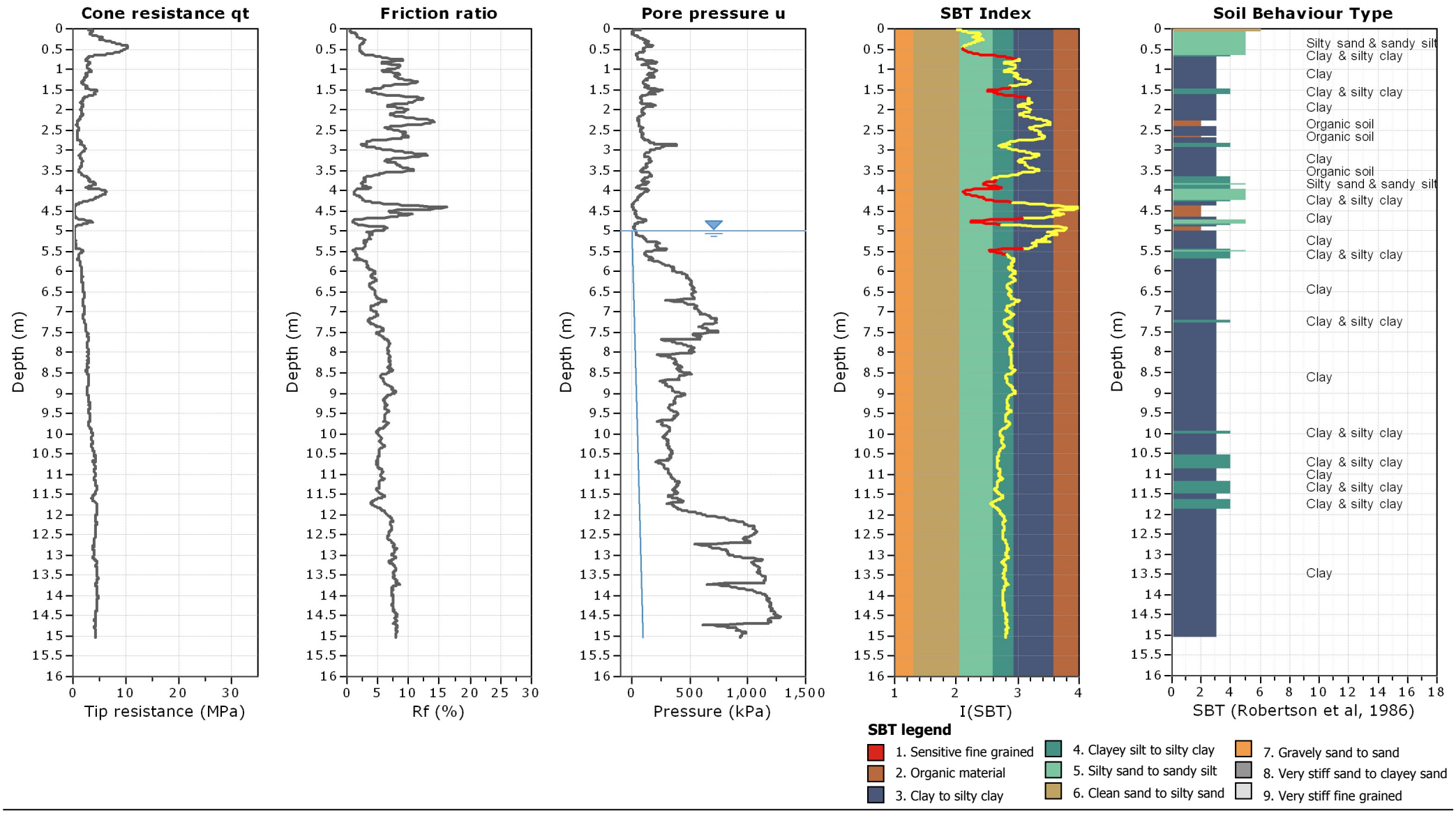
Project: **GENZTAUC13086AE - THE LAKES STAGE 2QRST EARTHWORKS**
Location: **TAURANGA**



Coffey
96 Cameron Road, Tauranga
3110
New Zealand

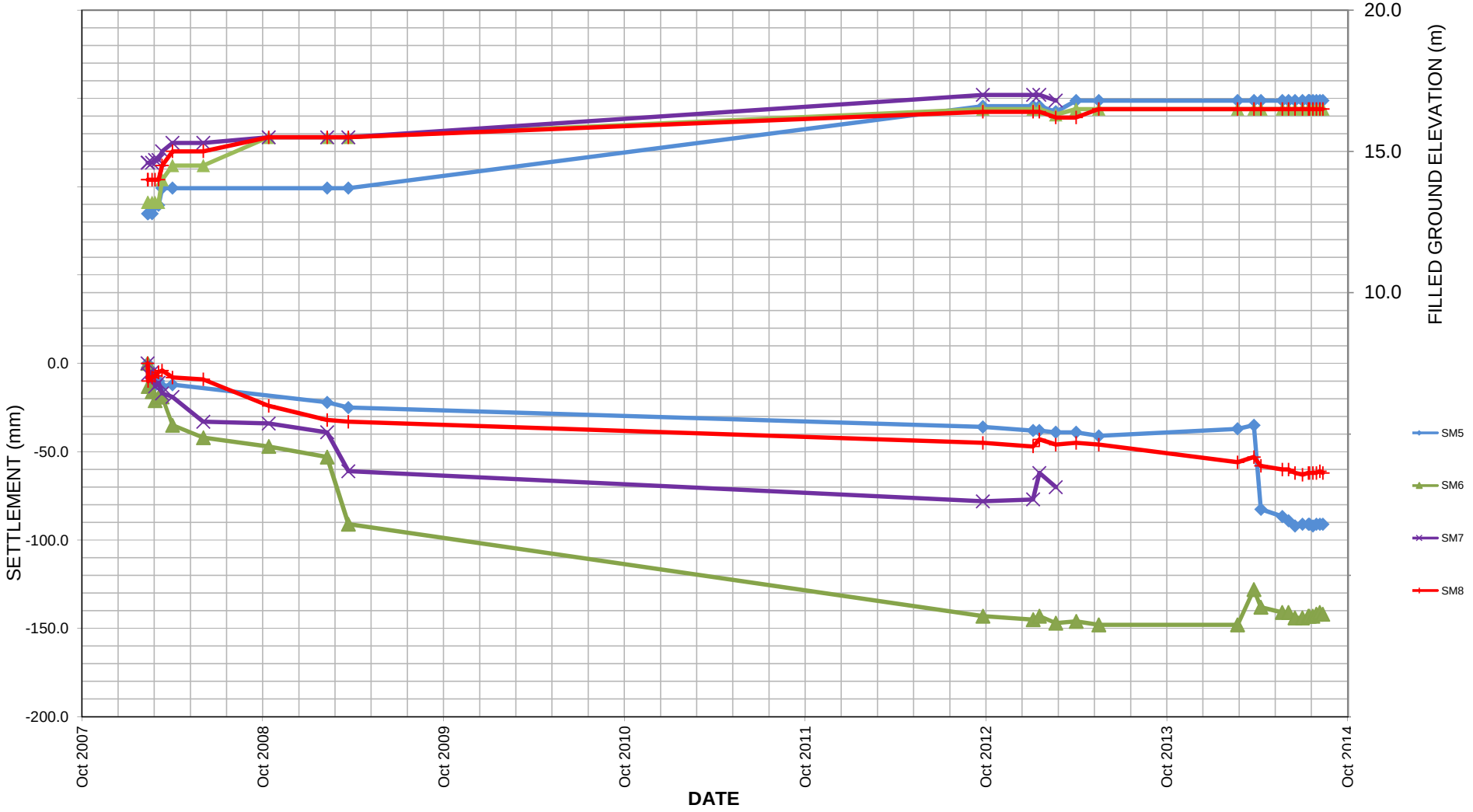
Project: **GENZTAUC13086AE - THE LAKES STAGE 2QRST EARTHWORKS**
Location: **TAURANGA**

CPT: CPT-12
Total depth: 15.02 m, Date: 28/11/2012
Surface Elevation: 17.00 m
Coords: X:0.00, Y:0.00
Cone Type: 50 MPa Piezocone
Cone Operator: Ground Investigation

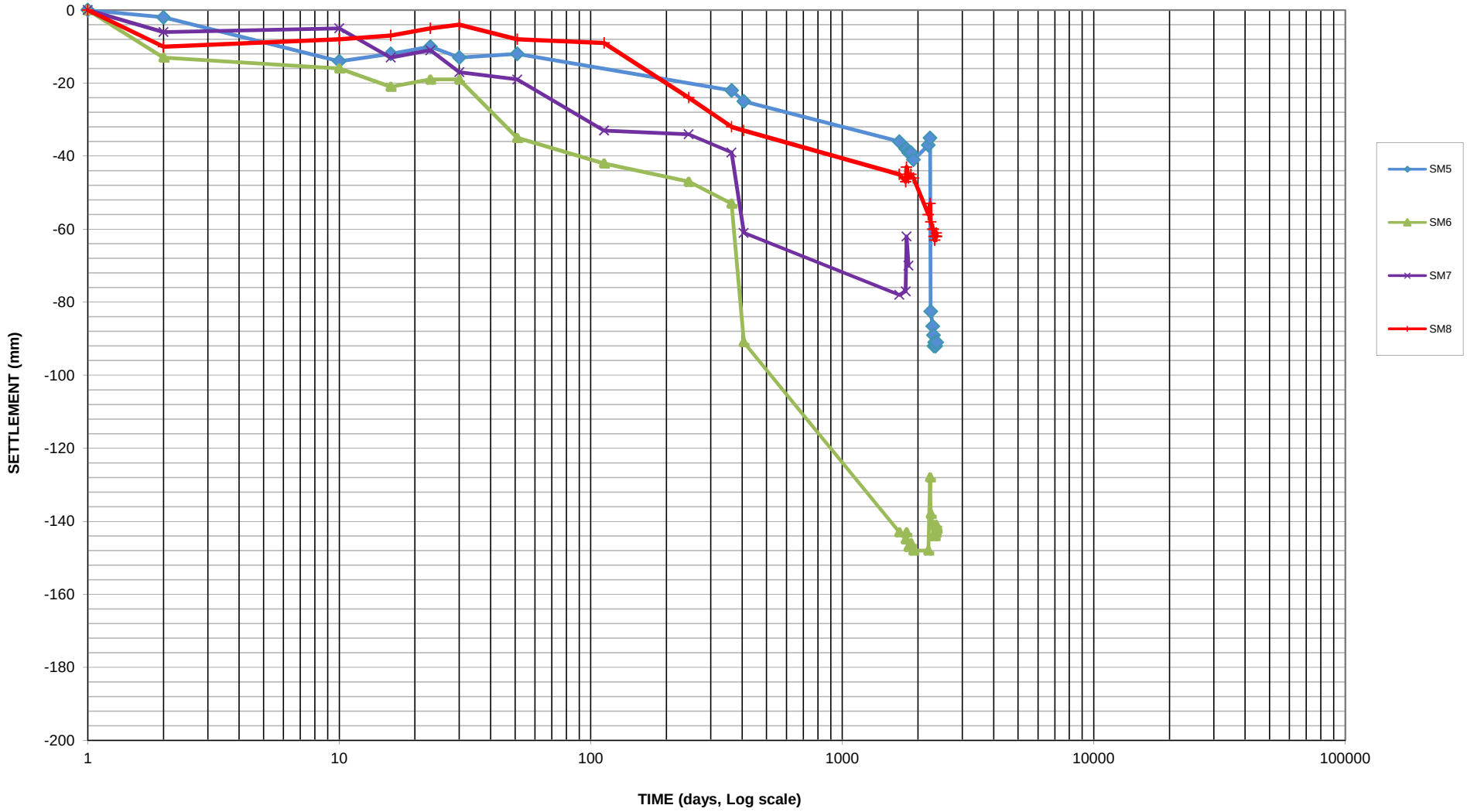


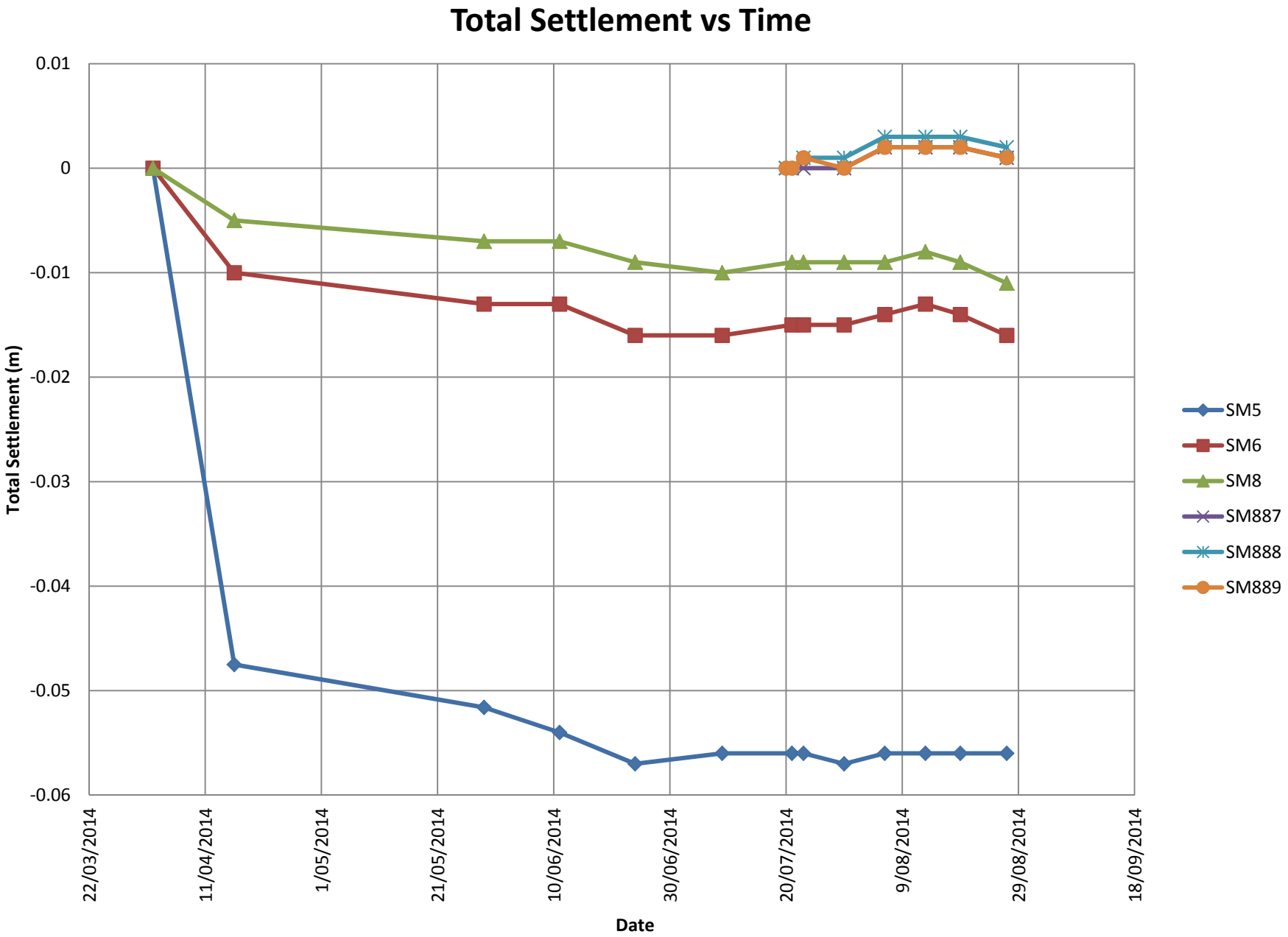
Appendix D - Settlement Monitoring Data

SETTLEMENT & FILLED GROUND ELEVATION VS DATE
FEBRUARY 2008 - SEPTEMBER 2014



SETTLEMENT VS TIME (Log Scale)




Total Settlement vs Time
0.01
0
-0.01
-0.02
-0.03
-0.04
-0.05
-0.06
Total Settlement (m)
22/03/2014
11/04/2014
1/05/2014
21/05/2014
10/06/2014
30/06/2014
20/07/2014
9/08/2014
29/08/2014
18/09/2014
Date
SM5
SM6
SM8
SM887
SM888
SM889

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