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LAKESIDE DEVELOPMENT STAGES 1A, 2, 2A, 3 & 3A GEOTECHNICAL COMPLETION REPORT No.3

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	Name	Signature	Position
Prepared by	Lance Knauf	W	Engineering Geologist
Reviewed by	Ken Read	REW	Principal Geotechnical Engineer
Authorised by	Dave Morton	Complete	Principal Geotechnical Engineer



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1. INTRODUCTION

This Geotechnical Completion Report (GCR) has been prepared for Lakeside Developments 2017 Limited as part of the documentation to be submitted to Waikato District Council (WDC) to support the application of land titles for the following residential lots at 98 Scott Road, Te Kauwhata:

Stage 1A: Lot 333;

Stage 2: Lot 66;

Stage 2A: Lots 110 to 115, 150 to 156, 271 and 272;

Stage 3: Lots 11 to 14, 17 and 18;

Stage 3A: Lot 2000.

Subdivision construction was undertaken in accordance with Waikato District Council Resource Consent Conditions documents LUC0557/18 and LUC0315/18, the Regional Infrastructure Technical Specification (RITS) and the requirements of NZS 3604, NZS 4404 and NZS 4431.

This report contains our Suitability Statement and Lot Summary Report (*Appendix A*), as-built plans provided by Candor³ and specific geotechnical recommendations for building development.

Stormwater controls, roading and civil works carried out as part of the subdivision have been supervised by other parties and are therefore are outside the scope of this report.

2. DESCRIPTION OF SUBDIVISION

The original landform across Stages 1 to 6 of the Lakeside Development comprised rolling hill topography that graded gently to the northeast from RL27m (Moturiki Datum) at the western boundary to RL5m along the north-eastern boundary where a low-lying floodplain exists adjacent to Lake Waikare.

Stages 2, 2A, 3 and 3A are located on the elevated rolling topography while the margins of Stages 1, 1A, 4, 5 and 6 encroach over the low-lying floodplain/alluvial flats.

Other features of note include:

- Along the southern boundary of Stage 3A a 15 metre high natural escarpment at 24 to 28 degrees separates the elevated rolling topography of Stage 3A from the low-lying floodplain/alluvial flats to the south where Stage 6 is located. Two historic landslips were present on this escarpment, labelled Ls5a and Ls5b in previous ground investigation reports by Earthtech (See Section 3).
- The formation of a structural fill embankment in the south of Stages 3 and 6 created by previous earthworks.

The contours of the original landform are shown on Drawings 28 to 31.

The earthworks operations generally consisted of the excavation of the elevated hill topography in Stages 1, 2, 2A, 3, 3A and 4 and the placement of engineer certified fill in the low-lying areas of Stages 1, 1A, 4, 5 and 6.

As can be seen from the Cut-Fill Contour Plans (*Drawings 32 to 35*), ground levels within the subject areas have been extensively modified by subdivision earthworks incorporating cut and fill depths of up to 4.5m and 5.5m respectively.

The as-built landform (*Drawings 36 to 39*) comprises a series of near level benched building platforms that generally step down towards the east, with each step separated by a gently graded bench.

3. RELATED REPORTS

The following relevant geotechnical reports have been referenced and used as the basis for the earthworks construction at Lakeside:

- Earthtech Stage 1 Geotechnical Design Report (ref: 4036-3), dated December 2017;
- Earthtech Stage 2 Geotechnical Design Report (ref 4036-4), dated January 2017;
- Earthtech Rata Street Extension Geotechnical Design Report (ref 4036-5), dated February 2017;
- CMW Sales Precinct Geotechnical Completion Report (ref HAM2017-0102 Rev 0) dated 05 May 2018;
- CMW Earthworks Specification (ref HAM2018-0106AB Rev 1) dated 17 October 2018;
- CMW Retaining Wall Design Report (ref HAM2018-0106Al Rev 1) dated 11 March 2019;
- CMW Geotechnical Completion Report No.1, (ref HAM2018-0106AM Rev 5) dated 05 August 2019;
- CMW Geotechnical Completion Report No.2 (ref HAM2019-0062AF Rev 1) dated 21 February 2020.

4. GROUND MODEL

4.1. Soil Profile

The landform over which the lots are situated was investigated in stages over the period October 2016 to November 2017. These comprised a combination of machine and hand auger boreholes, trial pits, Cone Penetration Tests (CPTs) and Machine Boreholes. Copies of the relevant site investigation plans, cross sections and test data are attached to this report (*Appendix B*).

A summary of the main geological units beneath the site is presented in Table 1 below:

Table 1: Summary of Geological Units		
Geological Unit	Description	Typical Thickness
Topsoil	Stiff Organic SILT.	0.15m to 0.3m
A. Alluvial Flats Stage 1A: Lot 333		
Upper Holocene	Very soft to firm PEAT, SILT and CLAY, loose Silty Sand	1.0m to 6.0m
Lower Holocene	Interbedded soft to firm SILT, CLAY and Sandy SILT; Loose to medium dense Silty SAND.	4.0m to 7.5m
Whangamarino Formation	Very stiff Clayey SILT and Sandy SILT; Medium dense Silty SAND	4.0m to 8.0m

Table 1 continued: Summary of Geological Units

B: Rolling Hills

Stage 2: Lot 66; Stage 2A: Lots 110 to 115, 150 to 156, 271 and 272; Stage 3: Lots 11 to 14, 17 and 18; Stage 3A: Lot 2000.

Geological Unit	Description	Typical Thickness
Brown Ash (Hamilton/Kauroa Ash)	Stiff to very stiff CLAY and Silty CLAY	0.0m to 3.7m
Gully floor Alluvium	Soft CLAY, SILT, organics and loose Silty SAND	0.0m to 3.3m
Whangamarino Silts and Clays	Stiff to very stiff CLAY, SILT, Silty CLAY, Clayey SILT, Sandy SILT; pumiceous.	1.0 to 4.0m
Whangamarino Sands	Medium dense to very dense pumiceous SAND and Silty SAND	0.5m to 2.0m
Whangamarino Lignite	Hard LIGNITE	0.5m to 3.0m

Ground conditions encountered during earthworks generally agreed with those described above. Of particular note is that within the soils of the Whangamarino formation, there is rapid lateral and vertical variation in composition and grain size between silty sands, sandy silts, clayey silts and silty clays.

4.2. Groundwater

Based on the investigation data and observations, the regional groundwater table across the Alluvial Flats was approximately 0.5 to 1.0m below the existing ground level. This is expected to rise close to ground level during winter conditions (RL5.0m).

Investigation data suggested perched groundwater conditions in the shallow Whangamarino sands across the rolling hills. This was confirmed where localised seepages were observed at a number of levels and often associated with lignite horizons in the Whangamarino soils during construction.

In Stage 1, a piezometer installed in BH2-02 at 10m to 15m depth recorded sub-artesian groundwater at 0.1m below original ground level (approx. 10.5m RL) measured between November 2017 and January 2018.

5. DESCRIPTION OF EARTHWORKS

5.1. Plant

The main items of plant used by the contractor, Ross Reid Contractors Limited during bulk earthworks included:

- Motor scrapers
- Moxy dump trucks
- Excavators
- Bulldozers
- Pad foot rollers

5.2. Construction Programme

Earthworks operations for the subject lots generally involved downcutting the more elevated hill topography of Stages 3 and 3A and placing engineer certified fill within lower-lying areas across Stage 2A and the former Stage 1A floodplain.

The chronology of the main earthworks operations is as follows:

- An early earthworks package was undertaken during the 2017/18 season across the Sales Precinct within Stages 2 and 3 and nearby areas.
- During the 2018/19 season, bulk earthworks were carried out across Stages 1 to 3A and 6 but were not completed at that time.
- Bulk earthworks were continued in the 2019/20 season across Stages 1A, 2, 2A, 3, 4, 5 and 6.

The main earthworks activities that were carried out are summarised as follows:

- Topsoil stripping across all bulk cut and fill earthworks surfaces;
- Over-excavating soft and compressible Upper Holocene Alluvium from beneath the Stages 1 and 1A floodplain fill embankment to depths of up to 6m to expose a stiff to very stiff subgrade. In the location of Road 201 at the northern boundary of Stage 1A soft to firm subgrade materials were encountered below the Upper Holocene Alluvium. Following the placement of a gravel starter layer settlement monitoring pins were installed and filling continued. Monitoring of the settlement pins is continuing. Undercut depths have been accounted for on the cut/fill plan (*Drawings 32 to 35*);
- Constructing a 0.3m thick granular starter fill layer with 2 layers of Bidim A14 geotextile to deal with abundant groundwater seepage in the base of the Stage 1 and 1A undercut;
- Subsoil drains were installed at the locations shown on **Drawings 36 to 39** to intercept groundwater seepages from beneath the proposed gully and valley floor fills of Stage 1A and perched layers within Stage 2A and were discharged into open drains within the low-lying floodplain towards the north and east;
- Over-excavation of landslide Ls5a and Ls5b debris and benching into the undisturbed natural escarpment to the south of Stage 3A and the fill embankment of Stages 3 and 6.
- Bulk cut to fill earthworks were then undertaken and completed to the levels presented on **Drawings 32 to 35** to 17 March 2020.
- Unsuitable firm natural soils were identified at and near finished level across Lots 110 to 112. These soils were undercut to a maximum depth of 1.5m below finished level prior to being backfilled with suitably compacted imported sand material.

5.3. Outstanding Works

At the time of this report preparation bulk earthworks within Lot 2000 (Stage 3A) were still being undertaken. The scope of these outstanding works is as follows and their locations are shown on *Drawing 38*;

- Excavation of 12,000m³ of cut material to reach design level in the western portion of the Lot.
- A temporary 45 to 60 degree cut batter has been formed along the western side of the lot, which is to be cut back to its design gradient of 1(V):3(H) in the future.
- Up to 1.6m of engineered fill is yet to be placed along the southern edge of the lot.
- Up to 3.6m of engineered fill to a design gradient of 1(V):3(H) is yet to be placed across Stage 6
 located immediately to the southeast to buttress the existing steep natural escarpment along the
 southern boundary of Stage 3A.

The implications of these outstanding works are outlined in subsequent sections of this report.

6. GEOTECHNICAL QUALITY CONTROL

6.1. Construction Observations

Site observations were undertaken on a part time basis by CMW field staff during bulk earthworks to assess compliance with NZS 4431, the project specification and any other specific design recommendations.

Site visits were carried out to observe and confirm compliance relating to:

- Adequate topsoil stripping and underfill subsoil drainage;
- Removal of existing uncontrolled fill and/or unsuitable soft natural soils;
- Placement and compaction of engineered fill;
- Drilling hand auger boreholes across the as-built landform to verify soil shear strength and consistency.

The results of our observations and associated correspondence with the developer and earthworks contractor show that the works appear to have generally been carried out in accordance with the relevant codes, specifications and standards and our on-site recommendations.

6.2. Compaction Control

Prior to the earthworks being undertaken potential borrow materials were subjected to laboratory testing to determine the solid density and compaction properties for each of the soil types present.

During works blending of materials was undertaken to maximise the use of available soils.

Samples of the 'blended' fill were obtained and also subjected to laboratory testing to determine the solid density and compaction properties.

Copies of the laboratory compaction testing results are presented in *Appendix C*.

Regular earthfill compaction compliance testing comprising hand shear vane testing, and the determination of the placed fill dry density and air voids by the use of a Nuclear Density Meter, was carried out with respect to NZS 4431:1989, RITS and the CMW Subdivision Earthworks Specification.

A copy of the earthworks specification is presented in **Appendix D**.

The compaction control criteria adopted for all engineered fills on this site were as follows:

Air voids percentage average value* less than

8 %

Air voids percentage maximum single value

10 %

Undrained shear strength average value* not less than

120 kPa

Undrained shear strength minimum single value

100 kPa

Shear strength was measured by hand-held shear vane calibrated using NZGS 2001 method.

During the 2018/19 and 2019/20 seasons a total of 598 compliance tests (incl 114 retests) have been carried out on a certified fill volume of 601,603m³ placed to 17 March 2020. This equates to one fill test per 1243m³ of fill. The specification required 1 test every 1000m³ to 1500m³.

The locations of the respective earthfill quality control tests are presented on the attached **Drawings 40 to 44**.

^{*}The average value is determined over any ten consecutive tests

6.3. Earthfill Suitability

Results of the earthfill quality control testing since issue of GCRs Nos. 1 and 2 are provided in *Appendix E*.

Control tests carried out on the fill showed that on some occasions the required compaction standards were not being achieved, generally due to being too wet or too dry of optimum soil moisture content or inadequate compaction effort.

Results of test failures were relayed to the contractor with instructions to rework or replace the affected areas of fill until compliance with the appropriate standards was achieved.

No geotechnical testing was carried out on the starter layer. Through visual observation of the fill placement and proof rolling we are confident the starter layer has been adequately compacted.

Where imported sand was used to backfill the undercut of Lots 110 to 112 the volume placed did not trigger NDM density testing therefore dynamic cone penetrometer tests were relied upon. In this case a minimum DCP blow count of 5 per 100mm penetration was adopted.

Based on the appended earthfill quality control test results the fill areas across the subject lots are considered to have been constructed in accordance with NZS4431:1989, the RITS and site-specific compaction control criteria.

6.4. Post Construction Investigations

Post-construction hand auger boreholes with in-situ shear vane and dynamic cone penetrometer tests were undertaken within the Lots mentioned above to confirm geotechnical ultimate bearing capacities for building foundations. Borehole locations are presented on *Drawings 36 to 39*.

Copies of our borehole logs with detailed descriptions and depths of strata encountered in the post construction hand augers are provided in *Appendix F*.

6.5. Contractors Work

CMW's site presence during earthworks construction for this project included periodic observations of specific elements of work as described herein.

As we were not on site at all times during construction, we have relied on the Contractor's diligence and our construction observations to ensure that the works have been carried out in accordance with:

- a) The approved Contract drawings and design details;
- b) The approved Contract specifications;
- c) Authorised Variations during the execution of the works;
- d) The conditions of Resource, Earthworks and Building Consents where applicable;
- e) The relevant Geotechnical Investigation reports, recommendations and site instructions,

and that all as-built information and other details provided to the Client and/or CMW Geosciences are accurate and correct in all respects.

7. GEOTECHNICAL EVALUATION AND RECOMMENDATIONS

7.1. Liquefaction

The liquefaction risk for the residential development has previously been assessed in the Earthtech Stage 1 and Stage 2 Investigation and Design reports (ref. 4036-3 & 4036-4). The liquefaction risk is low.

7.2. Slope Stability

Following bulk earthworks, the landform encompassed by this report (excluding Lot 2000) comprises a series of terraced building platforms. Terraces between platforms are generally in the order of 0.5m in height formed at gradients of 1 vertical (v) to 3 horizontal (h) with global gradients across the site in the order of 1(v):20(h).

Based on these landform gradients and the scope of earthworks undertaken, including underfill drainage, conditioning and compaction of engineered fills, we consider that the site provides an adequate factor of safety with regards to slope stability for residential building construction.

Any variations to this conclusion are set out below.

7.2.1. Stage 1A - Lot 333

The northern edge of Stage 1A comprises a 4m high fill embankment constructed at a gradient of 1(V):3(H) from very stiff to hard silt and clay engineered fill and founded on competent subgrade materials at depth.

Lot 333 within Stage 1A is set back 50m from the crest of the fill embankment.

Based on these conditions, we consider there is a low risk of any deep-seated land instability affecting the Lot 333 building platform.

7.2.2. Stage 3A - Lot 2000

Western Cut Batter

The steep cut batter gradients within the western part of Lot 2000 are unlikely to meet required slope stability factors of safety and are at risk of generating shallow soil failures in the short to medium term.

A temporary building exclusion zone is defined on **Drawings 36 and 38** based on a nominal 5m setback from the toe of the batter until it is cut back to its final design gradient. This exclusion zone equates to a projection line gradient of 1(V):2(H) from the crest of the batter.

Following completion of outstanding works outlined in Section 5.3 the exclusion zone is to be reassessed by a suitably qualified geotechnical engineer.

Southern Escarpment

Section 7 of the Earthtech Stage 1 Geotechnical Design Report identifies historic 'landslides Ls5a and LS5b' over the steep natural slope immediately to the south of Lot 2000. At Section B (Ls5b on **Drawing 38**) proposed earthworks involve placing up to 6m of engineered fill against the lower part of that slope, cutting 1.5m from the top of the slope and regrading of the slope to an angle of 1(V):3(H) gradient. The proposed slope crest will be some 12 metres away from the lot boundary. Following those works Earthtech considered that the slope would have an 'adequate' factor of safety. We concur with that assessment.

At the time of writing this report, the slip debris from those slips had been removed and engineered fill had been placed in Stage 6 to the extent illustrated on *Drawings 34 and 38* and therefore steep slopes remain immediately to the south of Lot 2000.

Specific slope stability analyses were therefore carried out on these steep slopes to determine what effect, if any, they would have on building development within the Lot 2000.

Results are presented in *Appendix G*, which show that unacceptable slope stability factors of safety exist directly over the steep slope although do not extend into the lot. Therefore based on the attached analyses and landform presented by Candor 3 (05/02/20) there is a low risk of deep-seated instability affecting structures located within Lot 2000.

A temporary building exclusion zone is defined on *Drawings 36 and 38* to prevent any future building construction until earthworks are completed in the south eastern corner of the lot.

Following completion of outstanding works outlined in Section 5.3 the exclusion zone is to be reassessed by a suitably qualified geotechnical engineer.

Should the works be carried out as per the proposed design then a building restriction line will not be required.

At the location of Section C (*Drawing 34 and 38*) up to 7m of uncontrolled fill has been placed on the slope with a face angle of up to 38 degrees to the horizontal. This is not expected to have the required factors of safety. No development should occur downslope of this are without remedial work of this slope. Options include regrading of the slope, construction of a retaining wall or protection barrier, or allowing for a suitable runout zone.

7.3. Fill Induced Settlement

Fill induced settlements within the over-consolidated stiff to very stiff and dense Whangamarino soils beneath the engineered fills are expected to be negligible.

Where softer and compressible upper Holocene and Whangamarino Formation soils have been encountered beneath the areas covered in this report have been undercut and removed with the new structural fill being placed directly over the stiff to very stiff Whangamarino silts and clays.

As the specified degree of compaction has been achieved internal settlement of the fill is also expected to be negligible.

7.4. Post Construction Ground Profile

7.4.1. Post Construction Hand Auger Frequency

Based on anticipated ground conditions at and near design subgrade level (stiff to very stiff cohesive, medium dense granular natural soils and very stiff engineered fill materials), our post construction hand auger frequency was determined as follows:

- Where Lots sizes are less than 450m² one post construction hand auger was carried out for every second Lot. This was usually on a shared lot boundary.
- Where Lot sizes are greater than 450m² one post construction hand auger was carried out near the centre of the Lot.
- In Lot 2000 four post construction hand augers were carried out across the current surface.

7.4.2. Lignite

In the geotechnical interpretative reports prepared for the subdivision, various recommendations were made regarding undercutting lignite deposits where exposed at design subgrade level to depths of between 1.0m and 1.5m. During the earthworks consenting process, 1.5m was recommended.

These recommendations were based on the lignite being weak and compressible, thereby posing a low bearing capacity risk and unacceptable settlements for standard NZS3604 based foundations, together with possible shrinkage on drying and possible acid soil conditions.

As earthworks have progressed, the Lignite has been observed as being hard, dry and of low compressibility. For all lots considered in this report, lignite was at least 500mm below design subgrade level.

From a geotechnical perspective, we have adopted a minimum of 500mm of soil cover to any hard lignite material present beneath design subgrade level subject to that material meeting bearing capacity requirements.

With respect to possible acid soil conditions no foundations will be in contact with the lignite and all services will be in gravel filled trenches. We therefore consider any risk posed by possible acid soil conditions to be low.

7.4.3. Sensitive Soils

Sensitive soils of the Whangamarino Formation exposed at finish level across Stages 2A and 3A cut areas have been found to be susceptible to significant shear strength loss upon repetitive vehicle and plant movements.

If not carefully managed the soils across these lots may become damaged beyond repair and require remedial works. To avoid disturbance, we recommend a 150mm of sand or hardfill be placed over the natural surface which is expected to provide suitable protection to the underlying subsoils.

7.5. Foundation Bearing Capacity

7.5.1. General Conditions

Post construction hand auger borehole results undertaken following earthworks, combined with the earthfill compaction test results indicate that for all lots covered by this report, a Geotechnical Ultimate Bearing Capacity of 300kPa should be available for the construction of shallow foundations (strip footings or pad foundations) and structures designed in accordance with NZS3604.

Should isolated lenses of soft or loose soils be encountered during construction, they must be overexcavated and replaced with suitably compacted granular fill or footings widened or deepened accordingly necessitating the involvement of a Chartered Professional Engineer.

7.5.2. Lot 2000

At the time of writing this report, the location, foundation details and types of any proposed buildings in this lot were yet to be confirmed.

Based on the post construction hand auger boreholes carried out in Lot 2000, it is expected that a Geotechnical Ultimate Bearing Capacity of 300kPa should be available for the construction of shallow foundation (strip footings or pad foundations)

Preliminary calculations indicate that strip footings up to 1m wide and pad foundations up to 1.25m square can be adopted (with appropriately factored uniformly applied design bearing pressures) giving estimated settlements less than 25mm.

This requires to be reassessed when building locations, foundation types and loads are known.

7.5.3. Geotechnical Strength Reduction Factor

As required by section B1/VM4 of the New Zealand Building Code Handbook, a strength reduction factor of 0.5 and 0.8 must 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.

7.6. Lot 3000 Road Subgrade Bulk Fill

Structural fill placed beneath roads with the area covered by this report has been placed and tested as part of the bulk earthworks in line with the project specification.

7.7. Cut and Fill Restrictions

Level to very gently sloping building platforms have been formed during bulk earthworks therefore only minor site preparation works, comprising stripping of topsoil from with the building footprint, is expected prior to building construction.

If any earthworks are proposed they shall be subject to the normal topsoil stripping, fill conditioning and appropriate compaction of any fill in accordance with the requirements of NZS 4431, RITS and subject to engineer inspection and certification at the time.

7.8. Respread Topsoil

Topsoil has been placed across the lots following the post construction hand augers. Survey data provided by Candor³ indicates that the topsoil depths across these lots range from approximately 0.15m to 0.40m.

7.9. Suitability Statement

A copy of our Statement of Professional Opinion as to the Suitability of Land for Building Consent, in the form of the Regional Infrastructure Technical Specification Schedule 2A, is provided in *Appendix* **A**.

A summary of Geotechnical Data for individual lots, in the form of a lot summary spreadsheet is also provided in *Appendix A*.

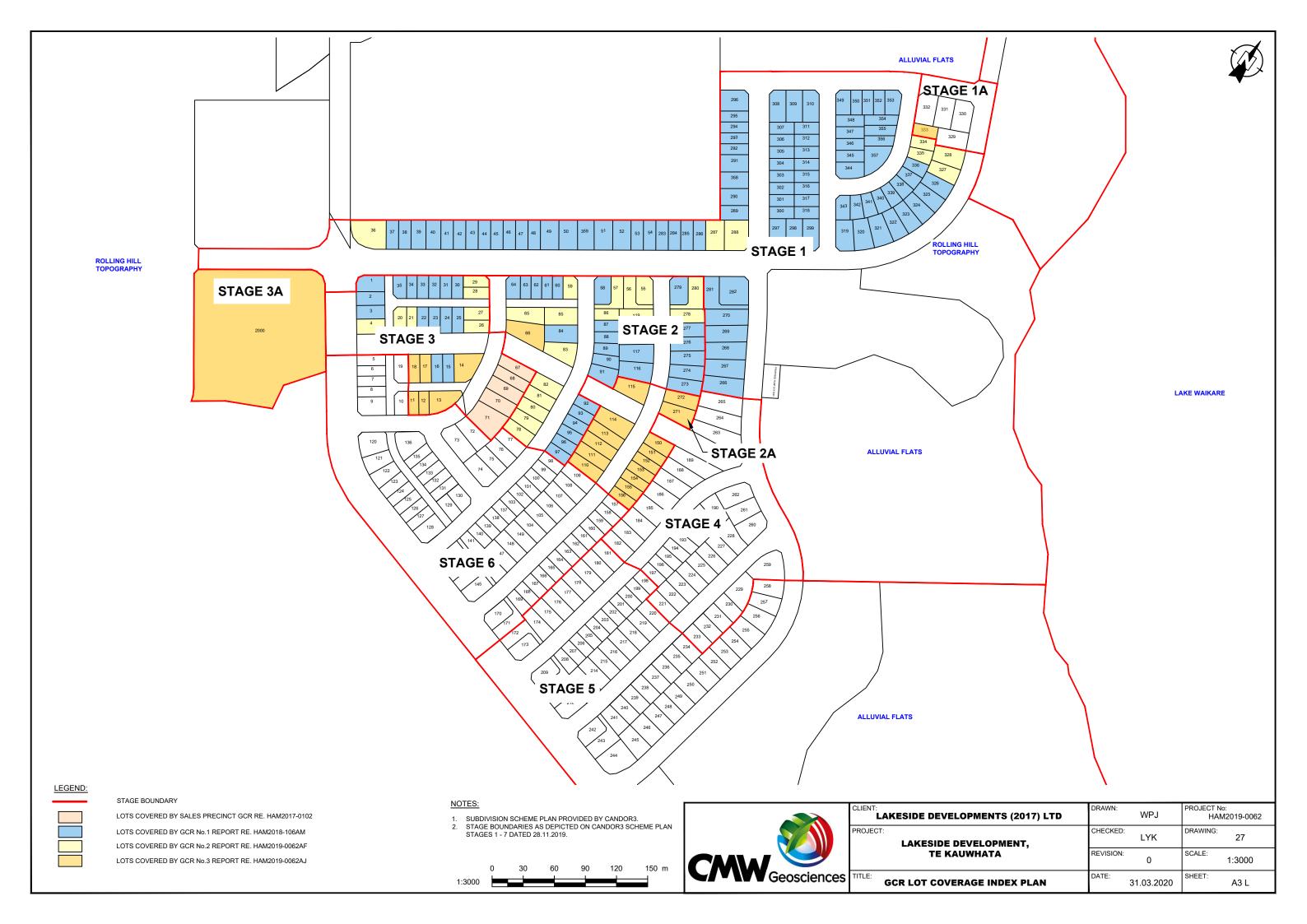
8. LIMITATION

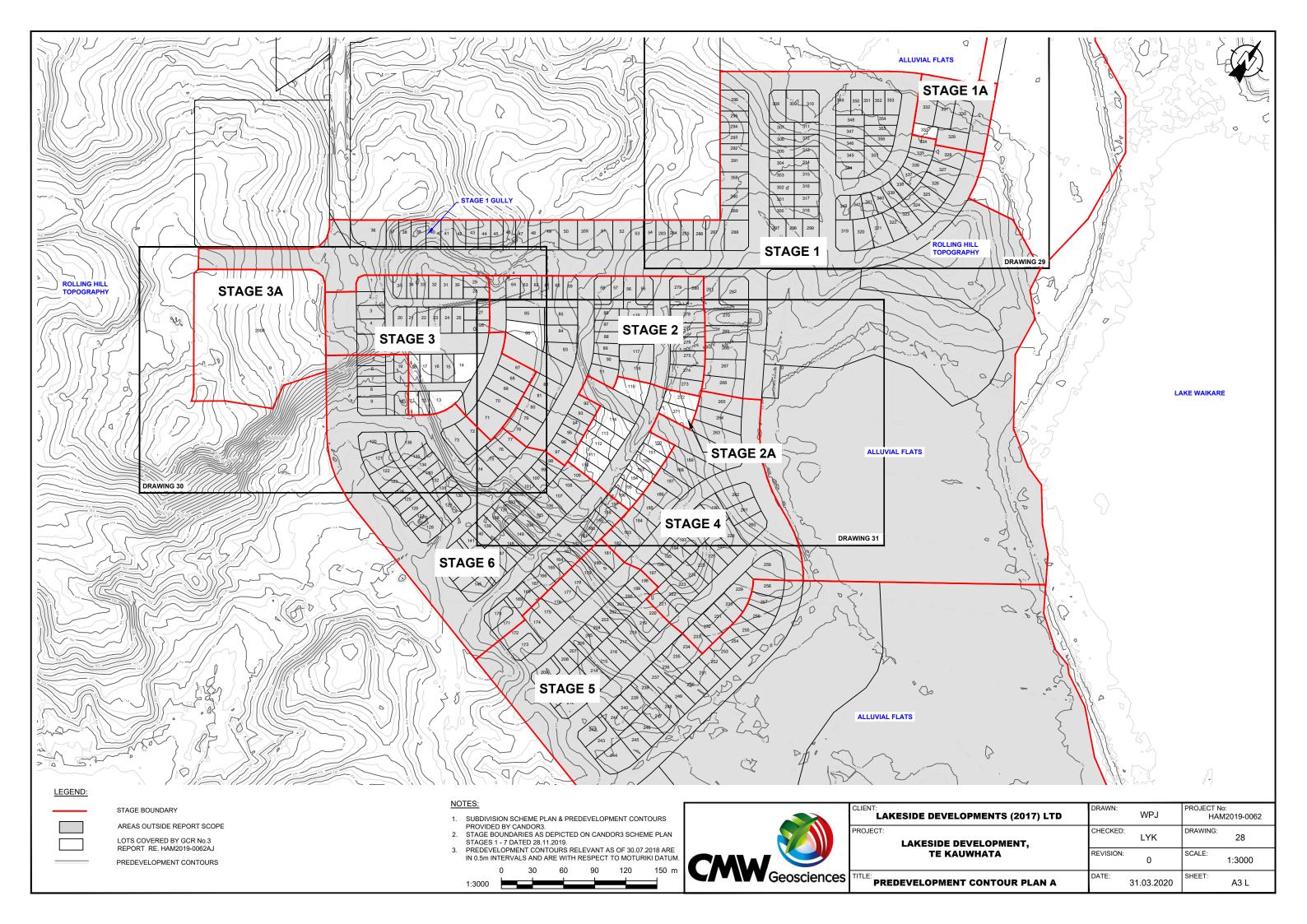
This report has been prepared for use by our Lakeside Developments 2017 Limited, their consultants and Waikato District Council. Liability for its use is limited to the scope of work for which it was prepared as it may not contain sufficient information for other parties or for other purposes.

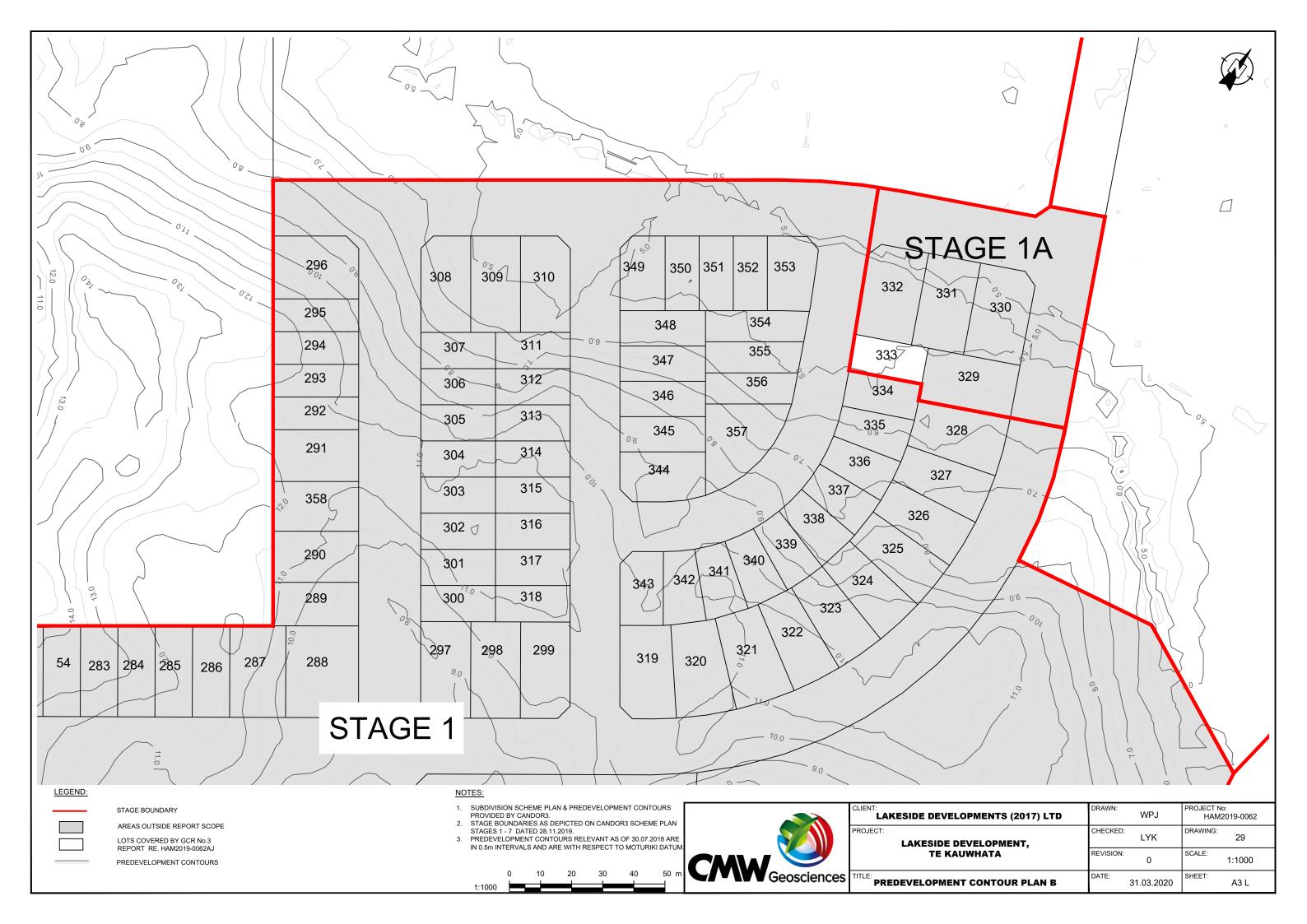
Although regular site visits have been undertaken for observation, for providing guidance and instruction for testing purposed, the geotechnical services scope did not include full time site presence. To this end, our appended suitability statement also relies on the Contractors' work practices and assumes that when we have not been present to observe the work, it has been completed to high standard and in accordance with the drawings, instructions and consent conditions provided to them.

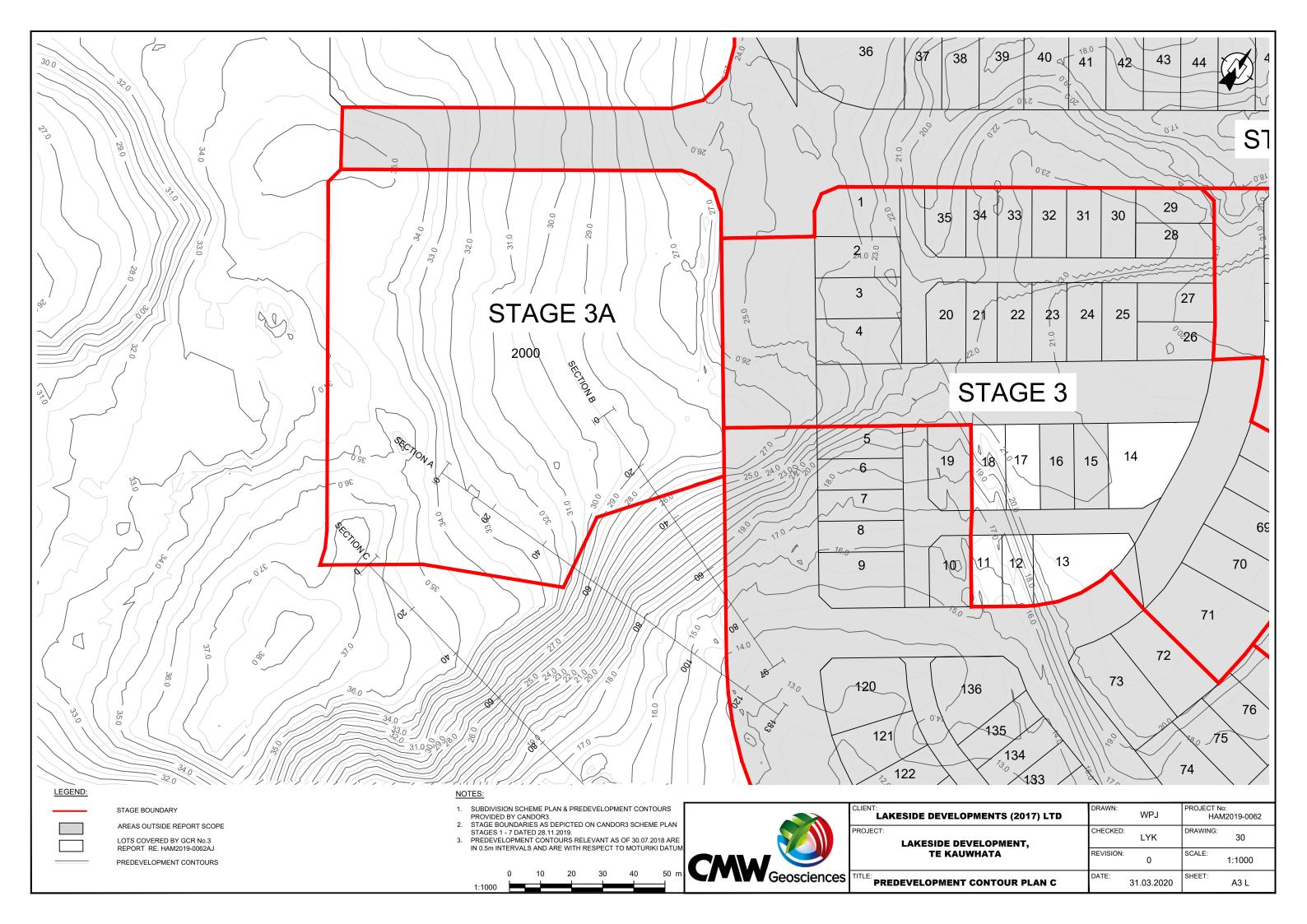
There may be special conditions pertaining to this site which have not been disclosed by the investigation and which have not been taken into account in the report. If variations in the subsoils occur from those described or assumed to exist then the matter should be referred back to CMW immediately.

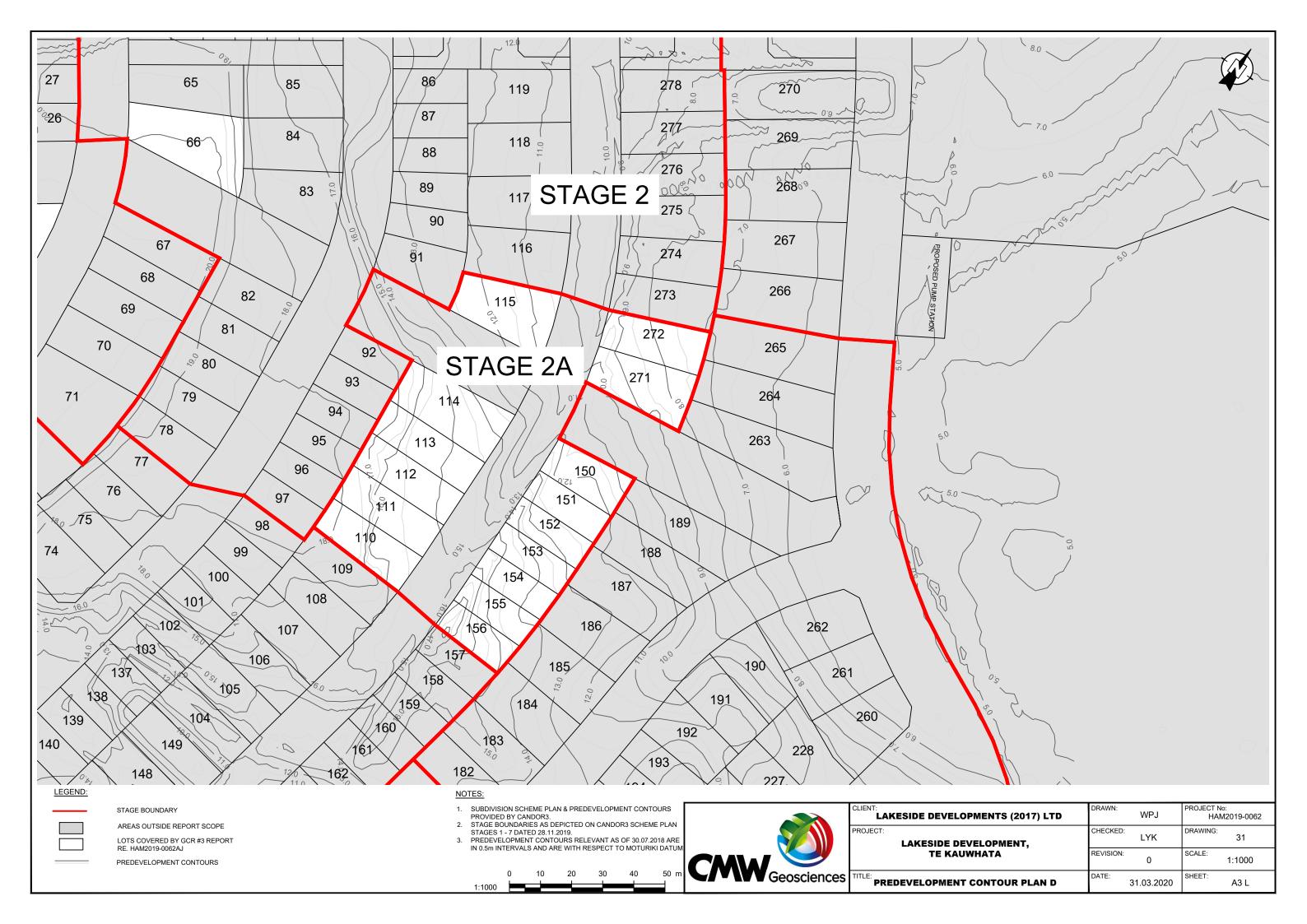
Drawings

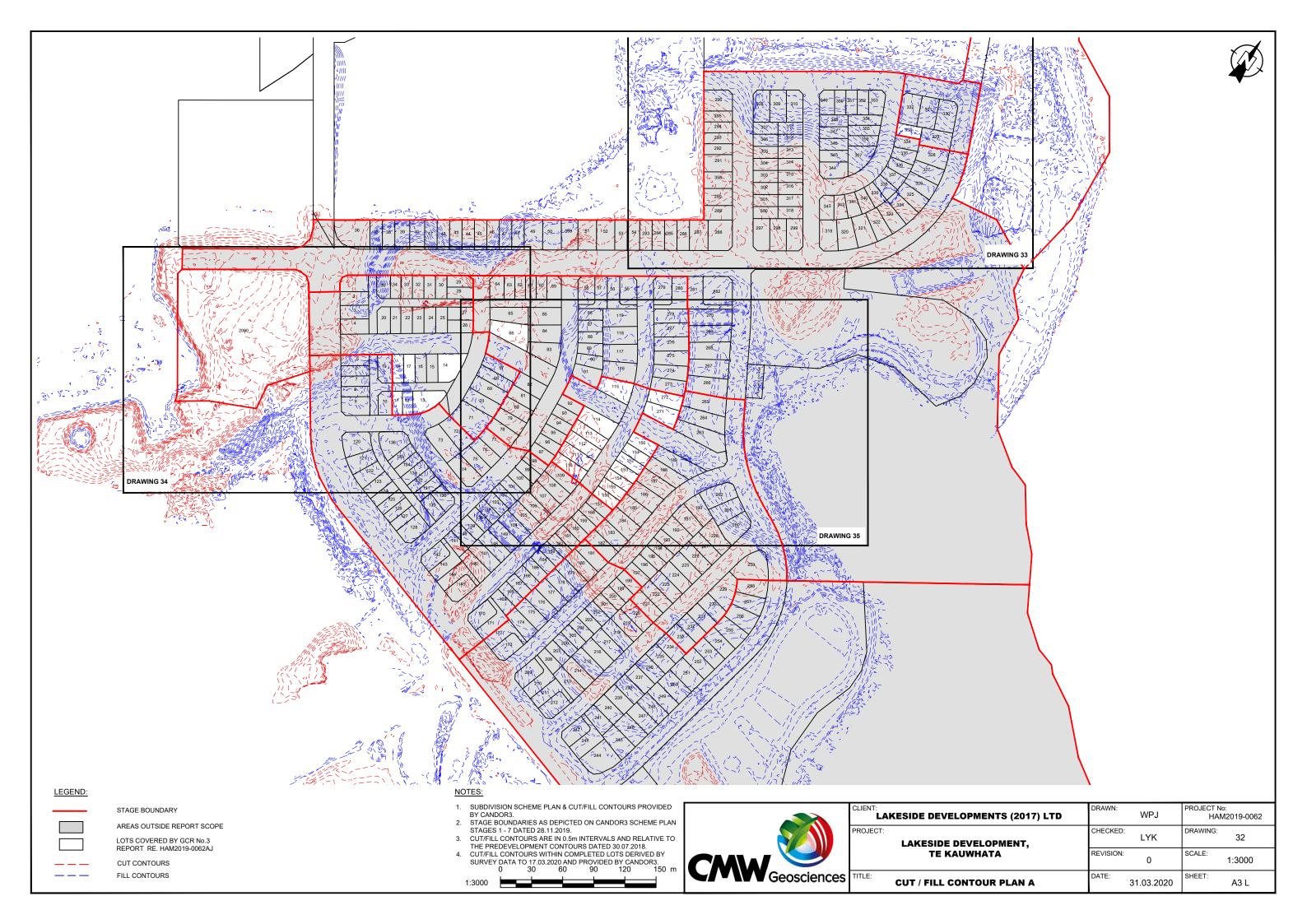


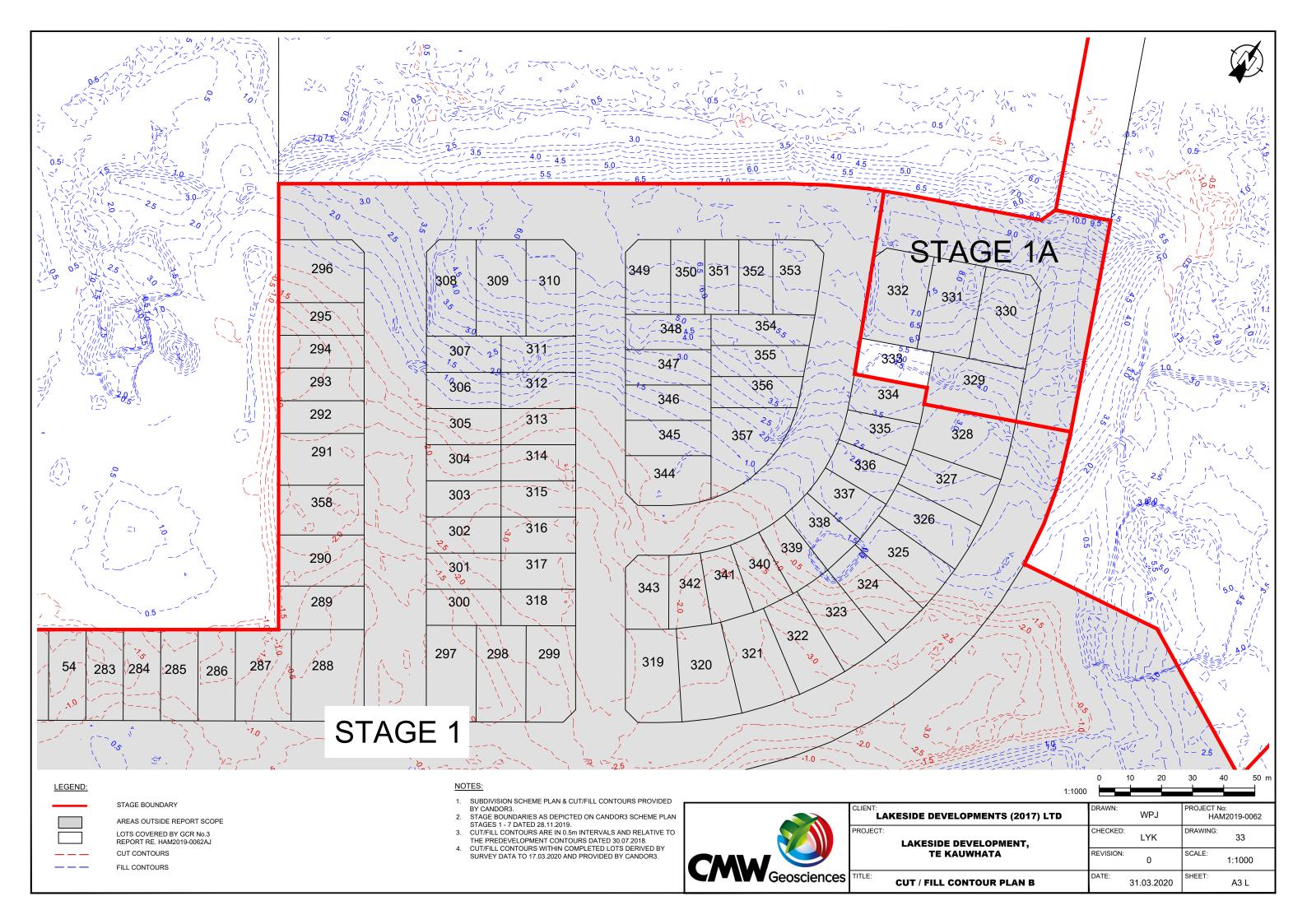


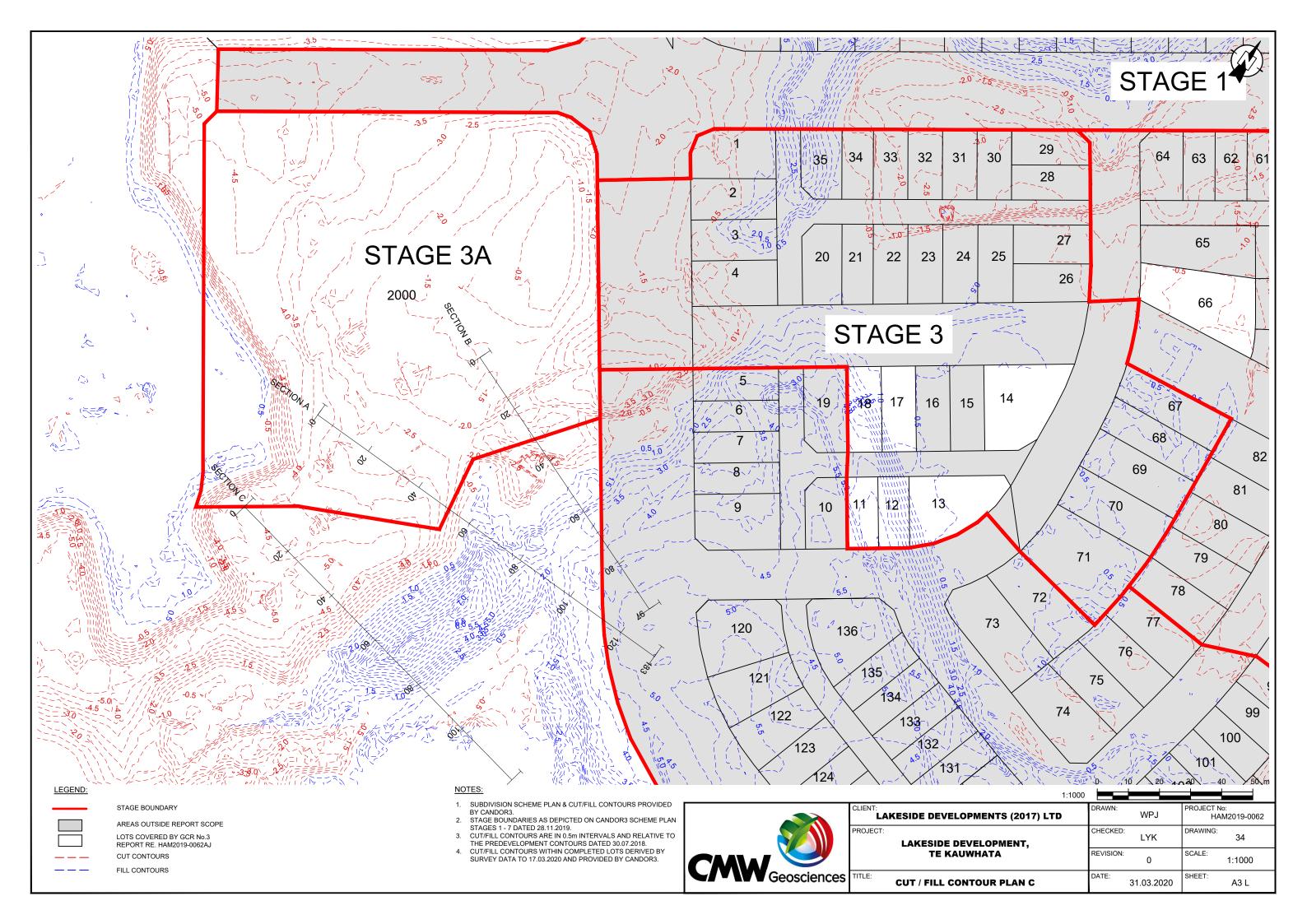


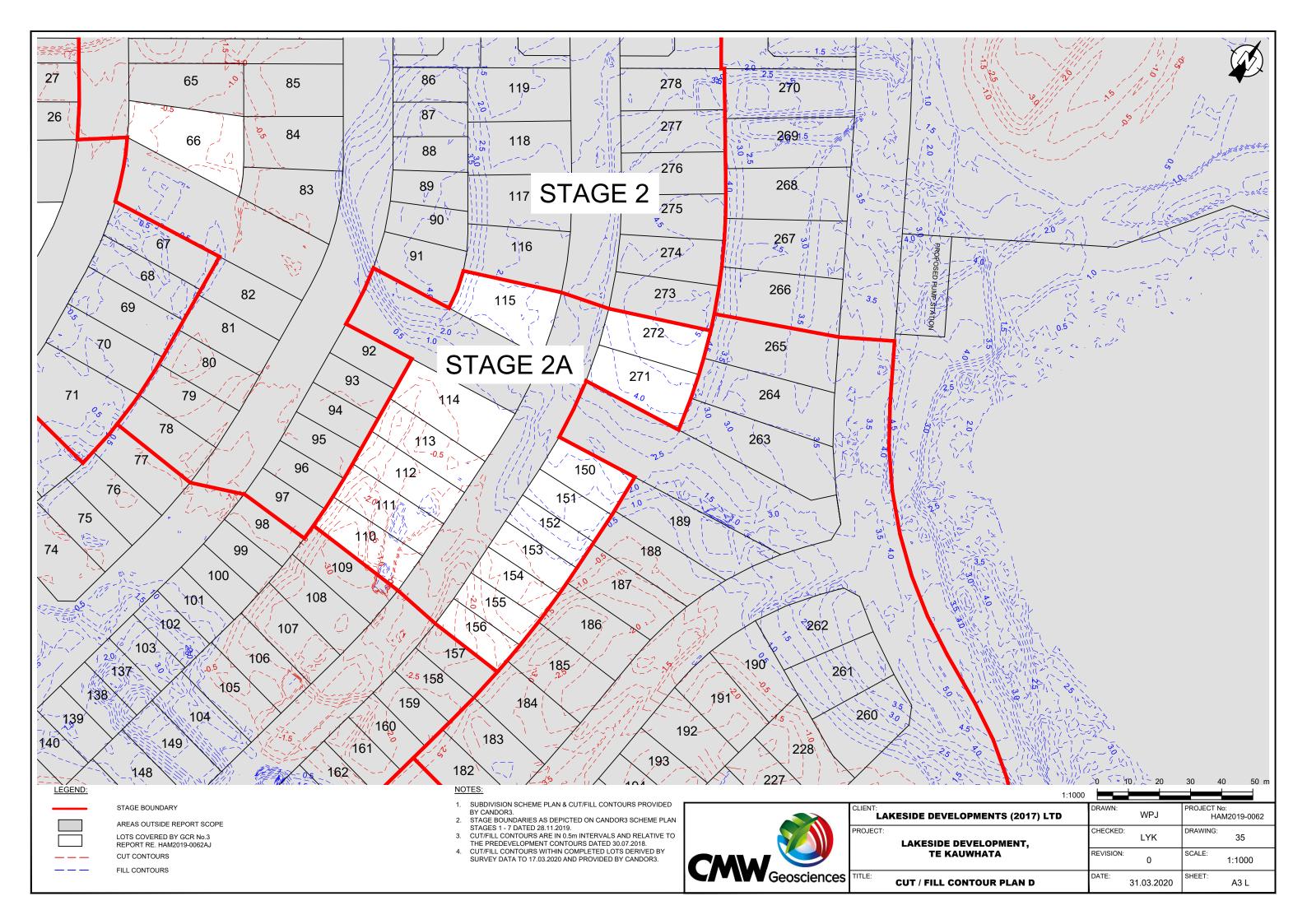


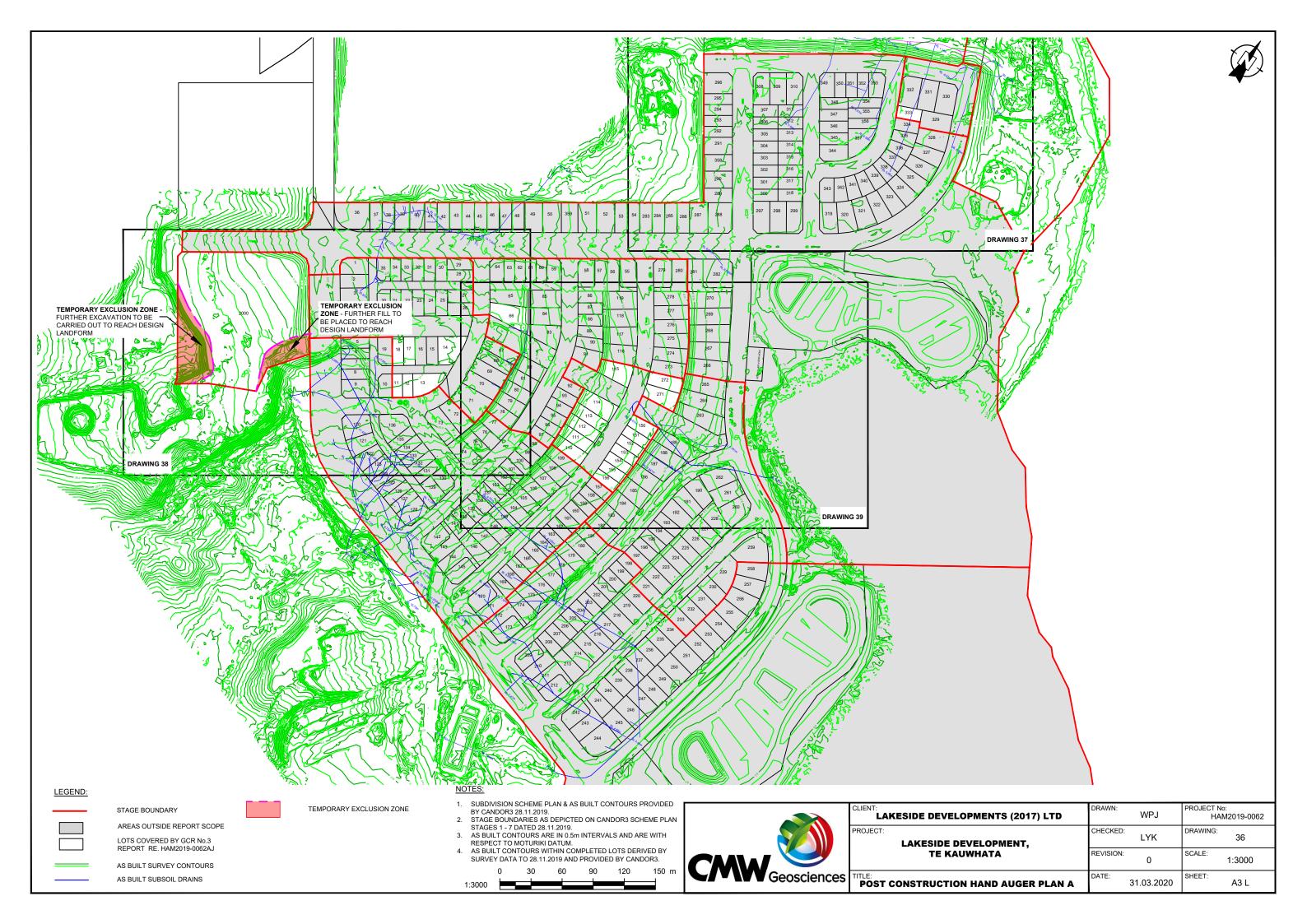


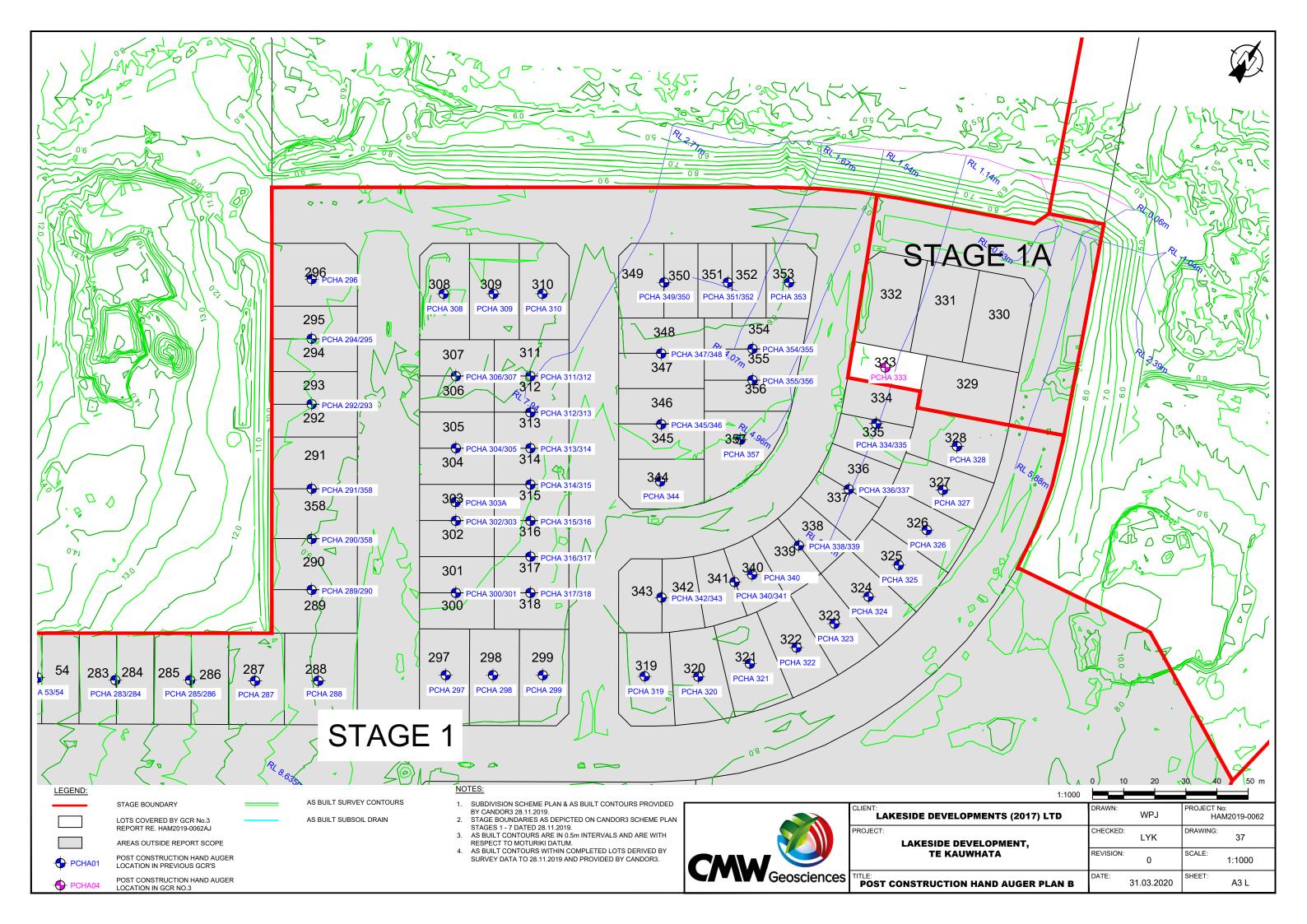


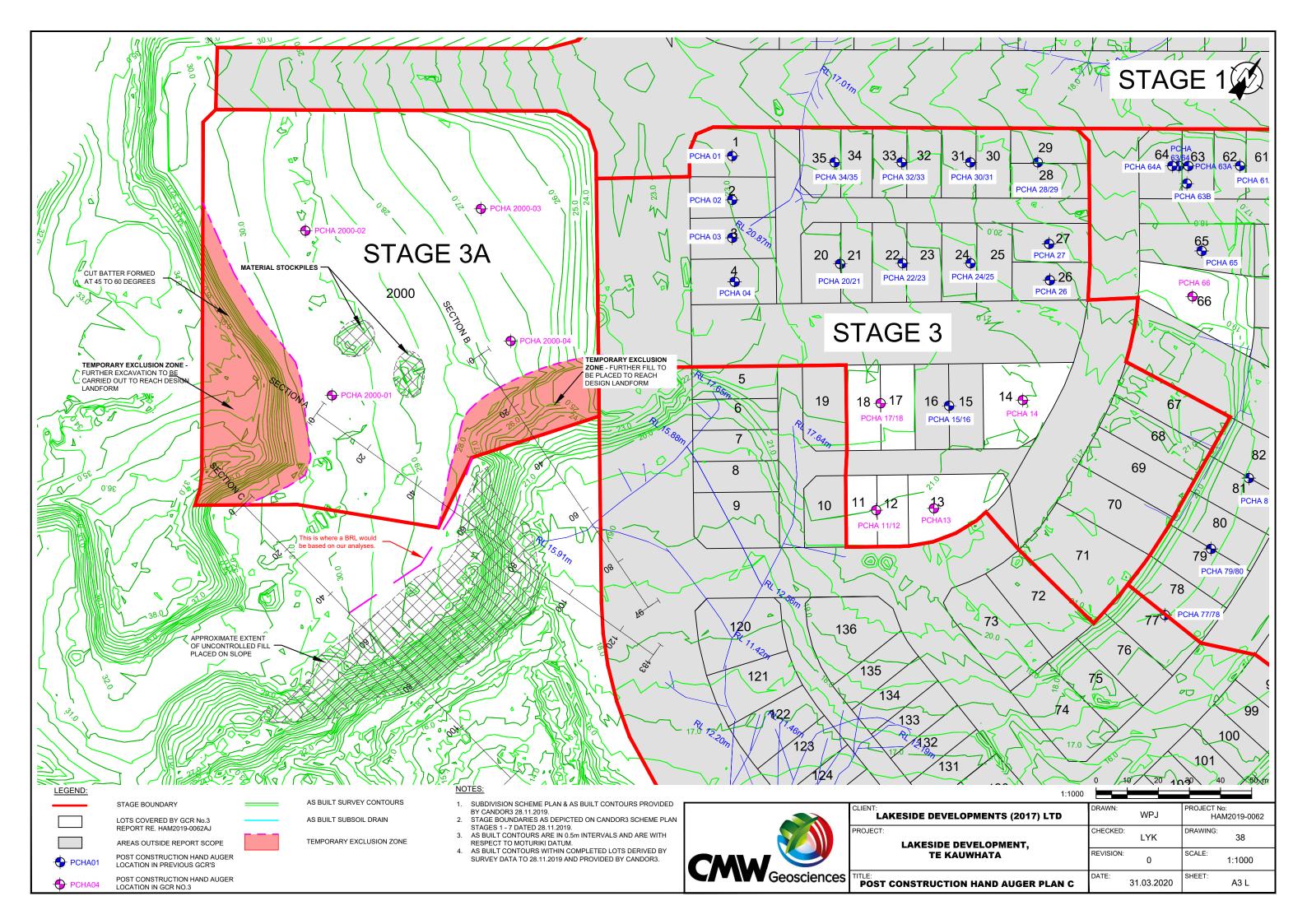


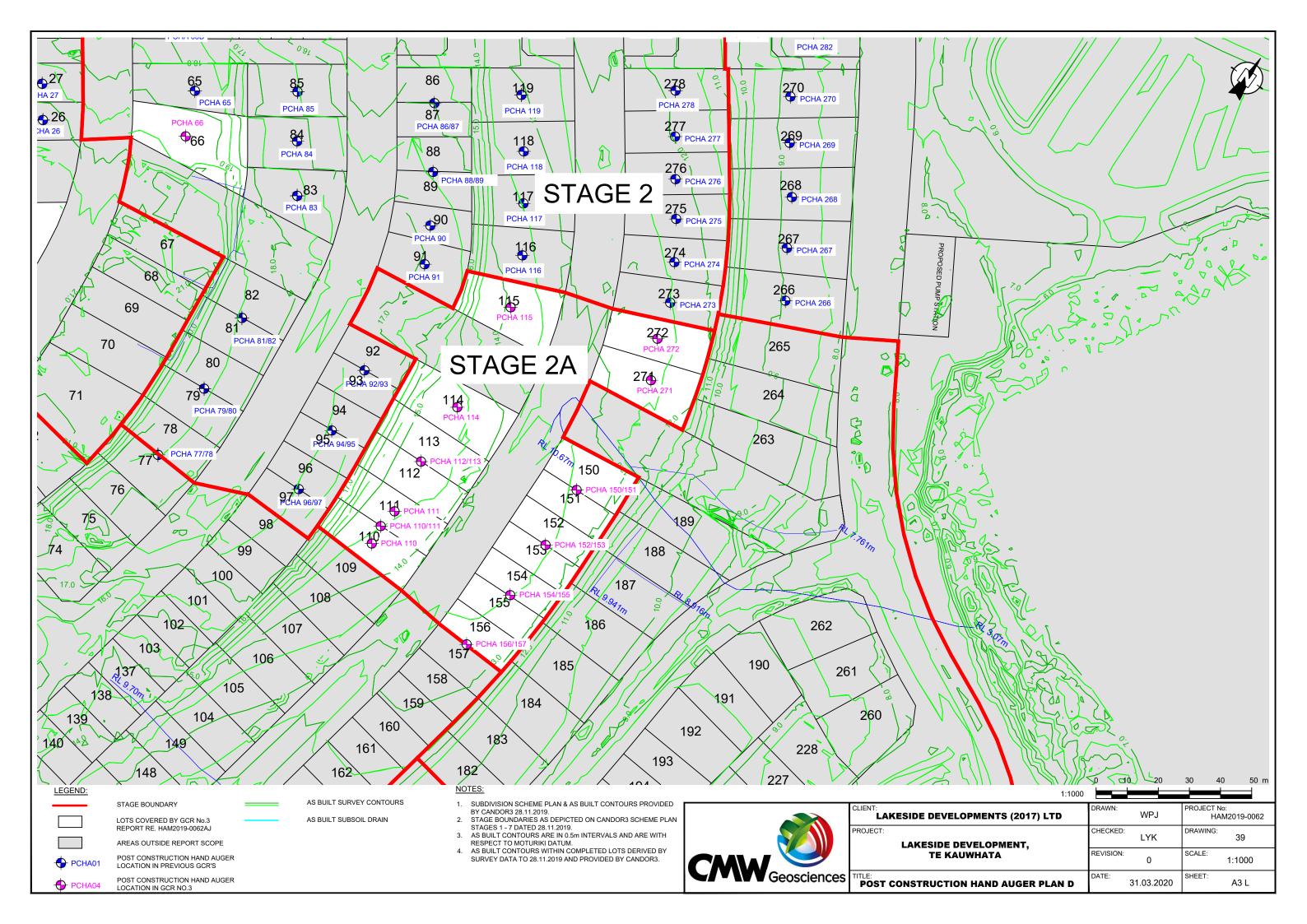


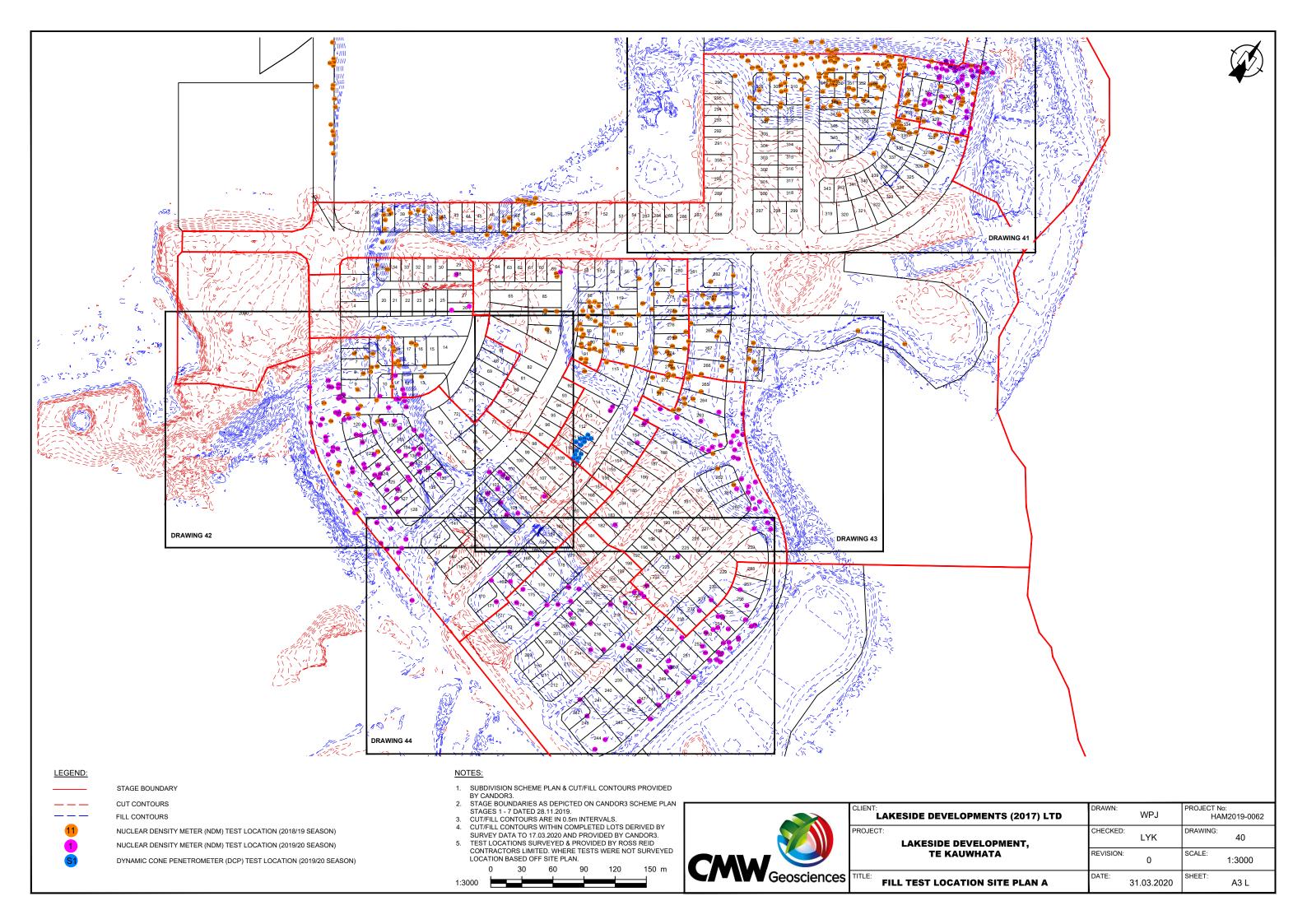


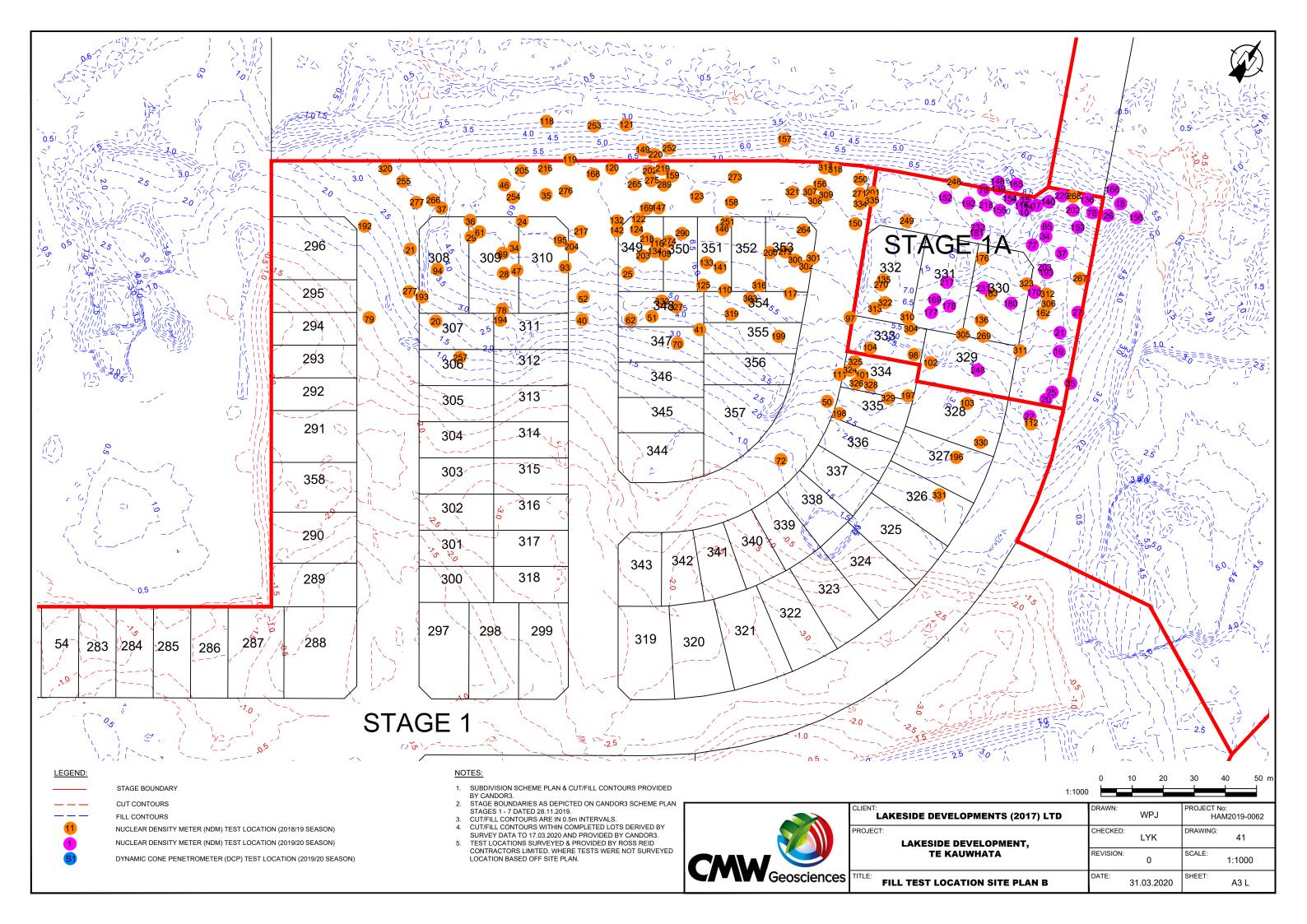


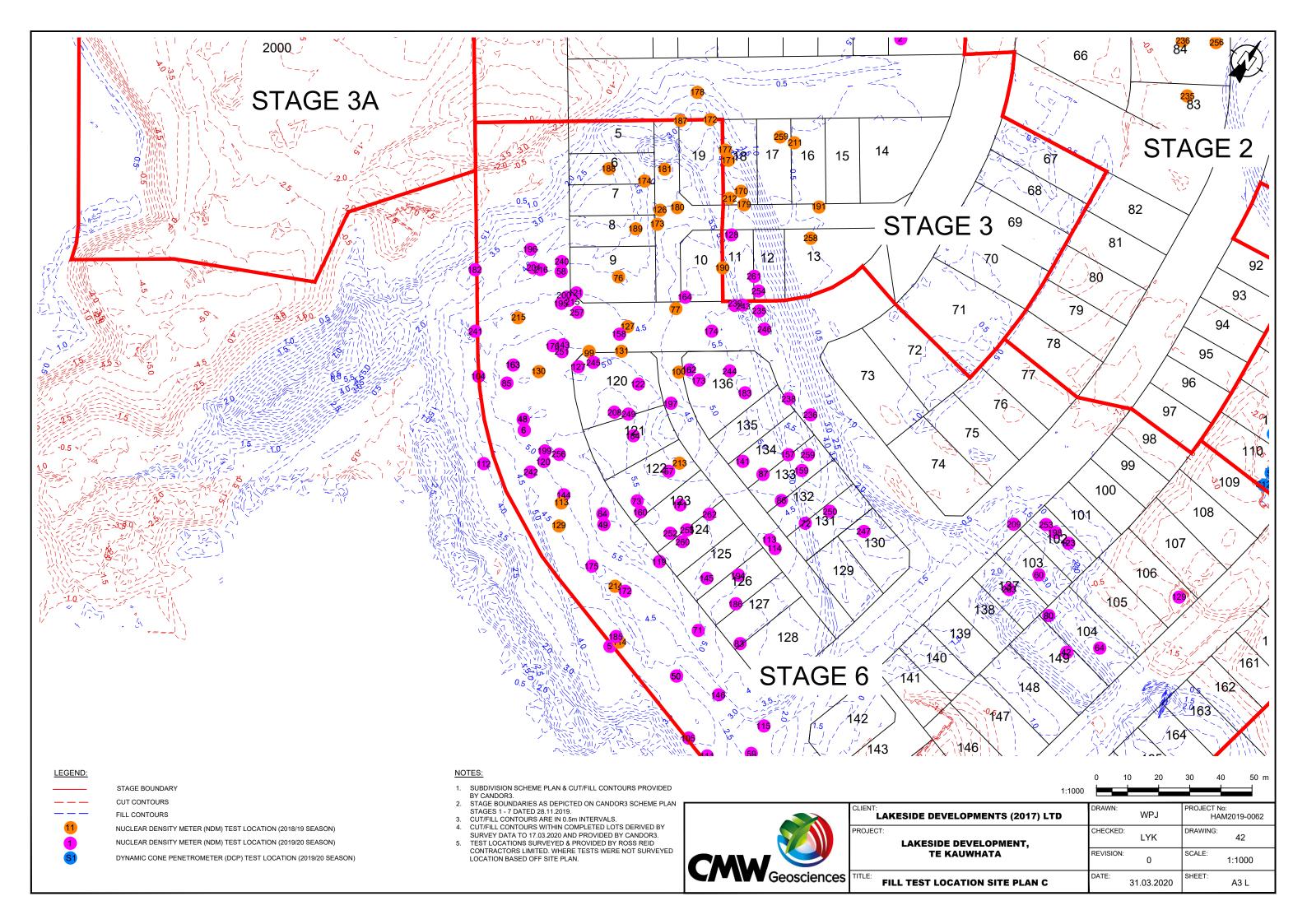


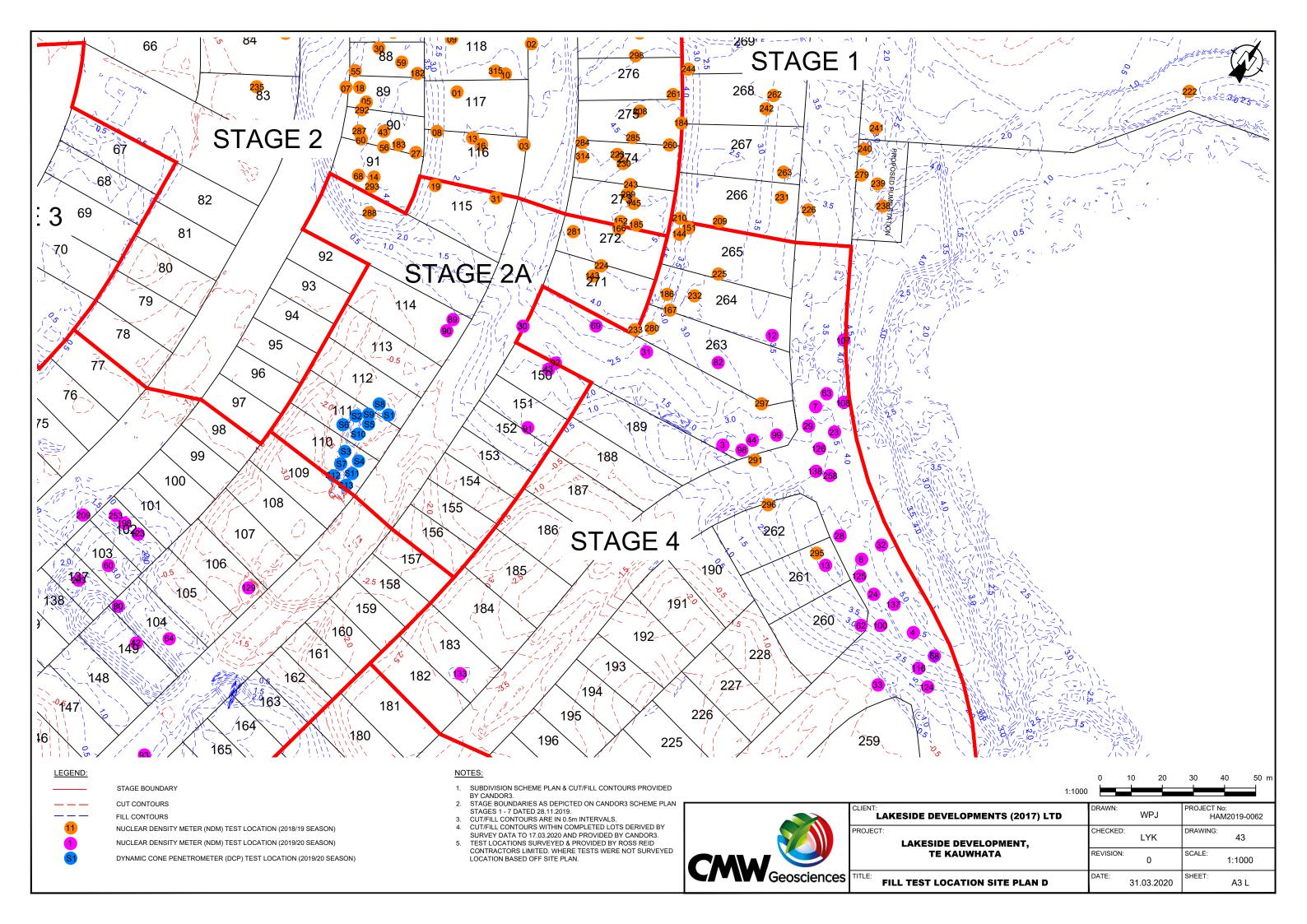


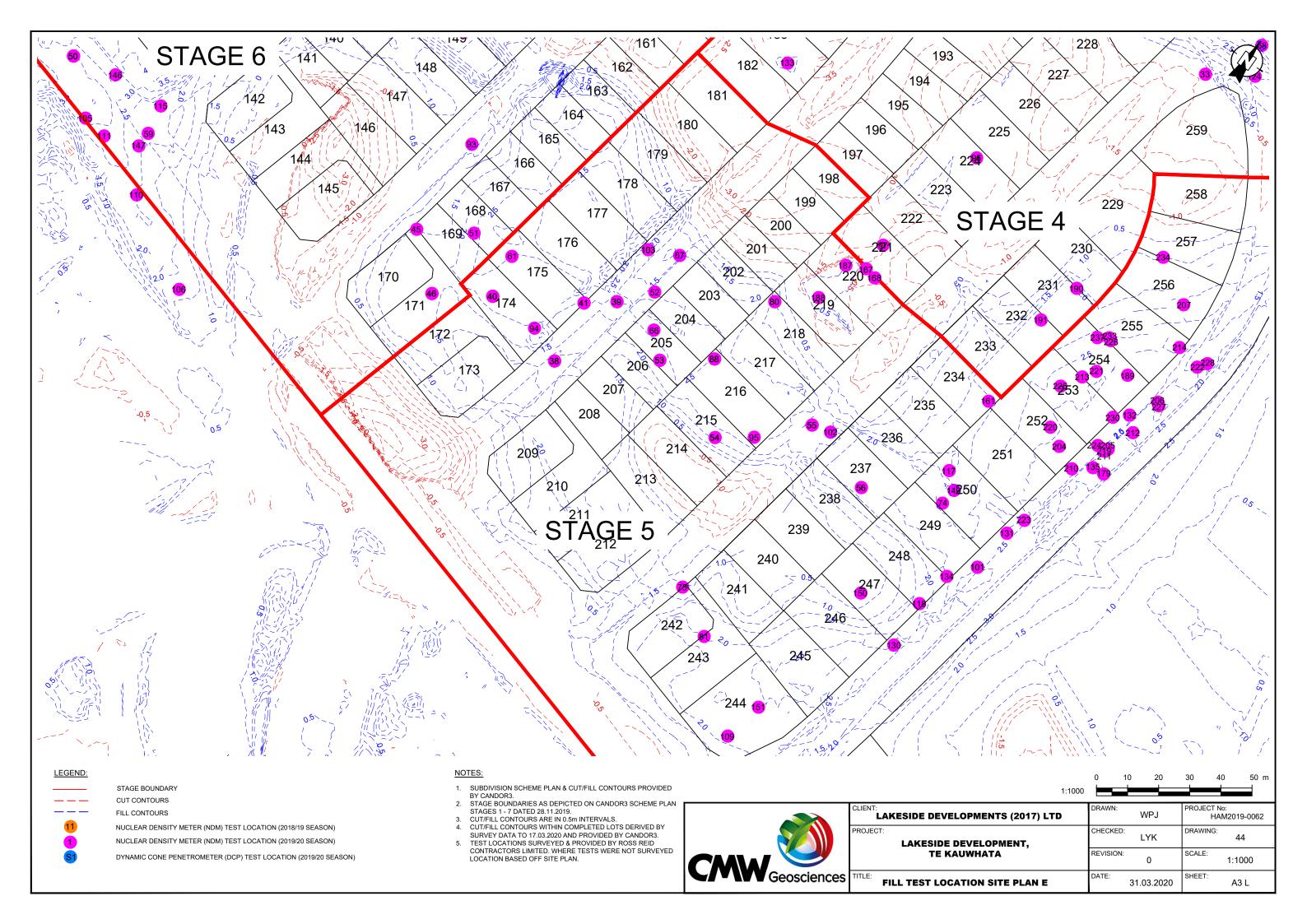












Appendix A: Suitability Statement & Lot Summary Report

APPENDIX 2A: SCHEDULE 2A (NZS 4404:2010) STATEMENT OF PROFESSIONAL OPINION ON SUITABILITY OF LAND FOR BUILDING CONSENT

Development: Lakeside Development Stages 1A, 2, 2A, 3 & 3A	
Developer: Lakeside Developments (20	17) Limited
Location: 98 Scott Street, Te Kauwhata	1
I, Kenneth John Read (Full name)	of CMW Geosciences (NZ) Ltd Partnership, 5 Hill Street Hamilton
	(Name and address of firm)

Hereby confirm that:

- 1. I am a geo-professional as defined in Clause 1.3.3 of Section 1 (General Information) of the Regional Infrastructure Technical Specification (RITS) and was retained by the developer as the geo-professional on the above development.
- 2. The extent of my preliminary investigations are described in the following Report(s):

Earthtech Stage 1 Geotechnical Design Report (ref: 4036-3), December 2017; Earthtech Stage 2 Geotechnical Design Report (ref 4036-4), January 2017; Earthtech Rata Street Extension Geotechnical Design Report (ref 4036-5), February 2017

- and the conclusions and recommendations of those documents have been reevaluated in the preparation of this report.
- 3. The extent of my inspections during construction, and the results of all tests and/or reevaluations carried out are as described in my geotechnical completion report:

Number: HAM2019-0062AJ Rev 1 Date: 06 May 2020

- 4. In my professional opinion, not to be construed as a guarantee, I consider that
 - (a) The earth fills shown on the attached Drawings Nos 32 to 35 within the subject Lots of the above report have been placed in compliance with the requirements of the Waikato District Council and the project specification.
 - (b) The completed works take into account land slope and foundation stability considerations, subject to the appended foundation recommendations and earthworks restrictions (which should be read in conjunction with the appended final site contour plan).
 - (c) Subject to 4(a) and 4(b) of this Schedule, the filled ground is suitable for the erection of buildings designed according to NZS 3604 provided that: The recommendations and procedures given in Geotechnical Completion Report No. 3, Ref HAM2019-0062AJ Rev 1, dated 06 May 2020 are followed.



- (d) Road subgrades have been formed with appropriate regard for slope stability and settlement risks.
- (e) This professional opinion is furnished to the TA and the developer 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 of any building.
- (f) This certificate shall be read in conjunction with my geotechnical report referred to in clause 3 above and shall not be copied or reproduced except in conjunction with the full geotechnical completion report.

Signed: Date: 06/05/2020

Full name: Kenneth John Read

Title: Principal Geotechnical Engineer

Professional qualifications: BSc Geology, MSc Engineering Geology, CPEng, CMEngNZ

Copyright waived¹

¹ Note: The above schedule is a copy of that included in NZS 4404:2010. The form is identical to Schedule 2A except in Clause 1 where the definition of a 'geo-professional' is referred to the definitions included in Section 1 of this RITS instead of the definitions included in NZS4404:2010.



Table 1: Lot Summary Table

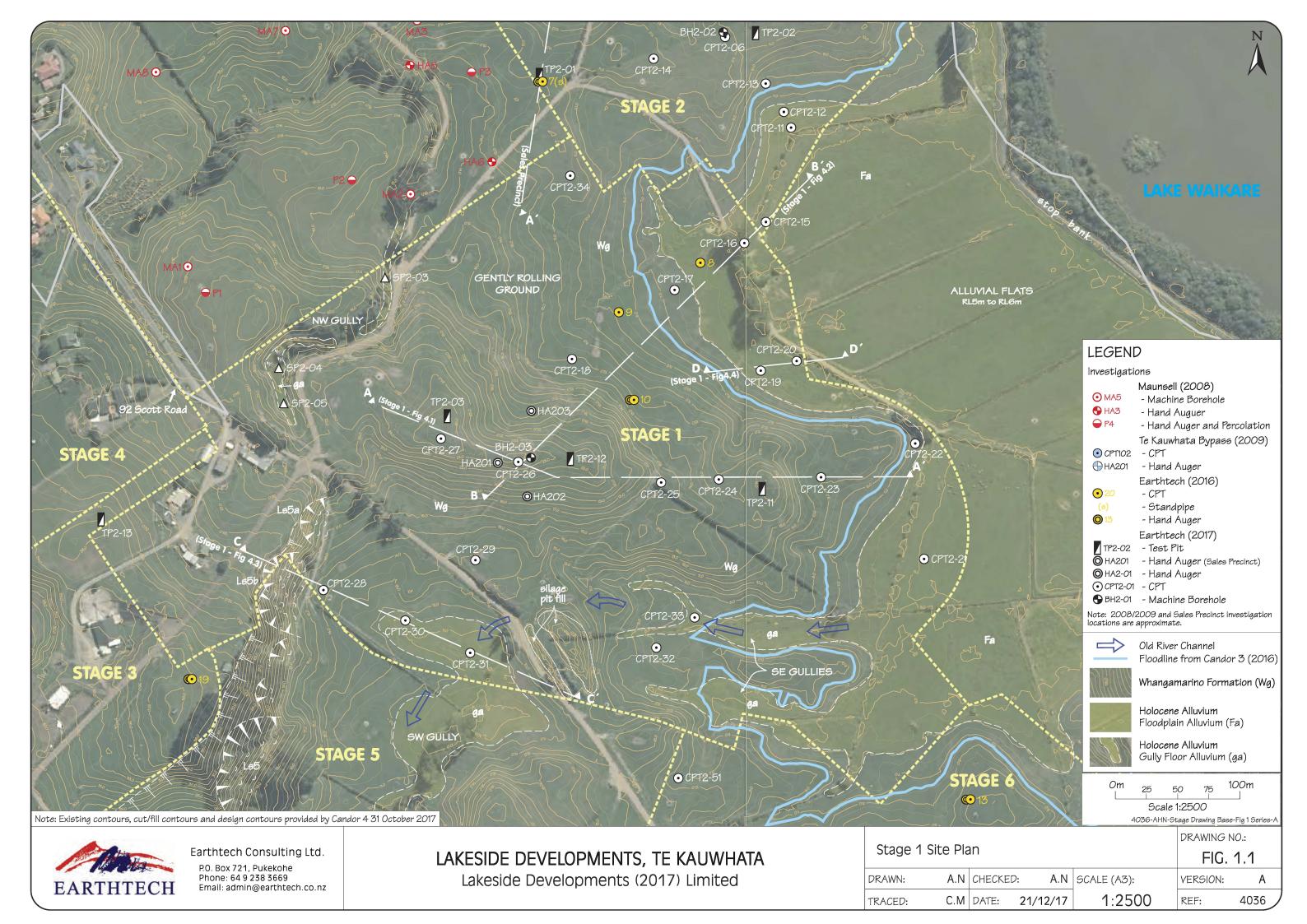
					Subsurf	ace Data			Found	lations	То	Bui	
Lot No:	Area (m²)	Stage	DCP (average blows per 100mm)	VSS (average kPa over upper 2m)		Fill	C	Cut	Conventional Shallow Foundation to NZS 3604:2011	Specific Design	Topsoil Thickenss (as provided by Candor3.	Building Restriction	Comments
					Y/N	Depth (m)	Y/N	Depth (m)	Y/N/NA	Y/N/NA	(m)	Line	
11	230	3	-	197	Υ	5.0	N	-	Υ	N	0.00	N	See Note 1.
12	230	3	-	197	Υ	5.0	N	-	Υ	N	0.00	N	See Note 1.
13	539	3	-	198	Y*	0.5	N	-	Υ	N	0.00	N	See Notes 1 and 2. Fill in 2017/18 in the order of 3.0m
14	613	3	37	>200	Υ	0.5	Y*	-	Υ	N	0.00	N	See Notes 1 and 2. Cut in 2017/18 in the order of 3.0m
17	303	3	-	>200	Υ	1.0	Y*	-	Υ	N	0.20	N	See Note 2. Cut in 2017/18 in the order of 1.0m.
18	303	3	-	>200	Υ	4.0	Y*	-	Υ	N	0.20	N	See Note 2. Cut in 2017/18 in the order of 1.0m.
66	708	2	4	179	Υ	0.3	Y*	0.5	Υ	N	0.00	N	See Notes 1 and 2. Cut in 2017/18 in the order of 3.0m.
110	428	2A	6	175	Υ	1.5	Υ	3.0	Υ	N	0.30	N	See Note 3.
111	429	2A	5	165	Υ	1.5	Υ	2.5	Υ	N	0.20	N	See Note 3.
112	429	2A	5	172	Υ	1.0	Υ	1.0	Υ	N	0.20	N	See Note 3.
113	436	2A	-	172	N	-	Υ	1.0	Υ	Ν	0.40	N	
114	609	2A	-	150	N	-	Υ	1.0	Υ	Ν	-	N	See Note 1.
115	568	2A	-	190	Υ	2.5	N	-	Υ	Ν	-	N	See Note 1.
150	361	2A	-	192	Υ	2.0	N	-	Υ	Ν	0.25	Ν	
151	281	2A	-	192	Υ	1.5	N	-	Υ	N	0.25	N	
152	275	2A	-	>200	Υ	1.0	N	-	Υ	Ν	0.30	N	
153	274	2A	-	>200	Υ	0.5	Υ	0.5	Υ	N	0.30	N	
154	271	2A	-	182	N	-	Υ	1.0	Υ	Ν	0.25	Ν	
155	275	2A	-	182	N	-	Υ	2.0	Υ	N	0.25	N	
156	273	2A	-	182	N	-	Y	3.0	Υ	N	0.25	N	
271	523	2A	-	>200	Υ	4.5	N		Υ	N	0.20	N	
272	448	2A	-	194	Υ	5.0	N	-	Υ	N	0.20	N	
333	279	1A	-	>200	Υ	5.5	N	-	Υ	N	0.15	N	
2000	15,293	3A	-	148	N	-	Y	4.5	-	N	-	N	See Notes 1, 4 and 5.

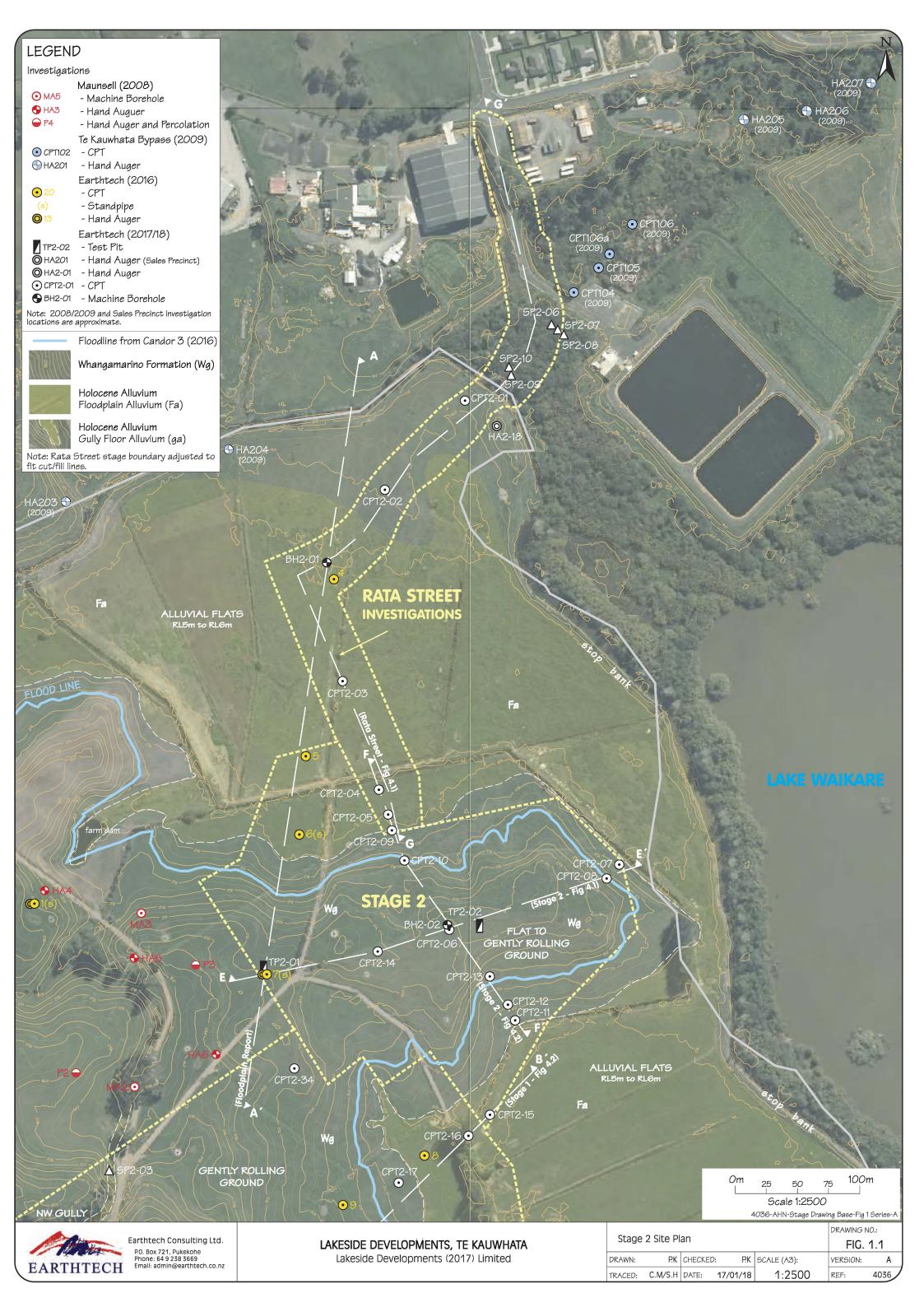
Notes:

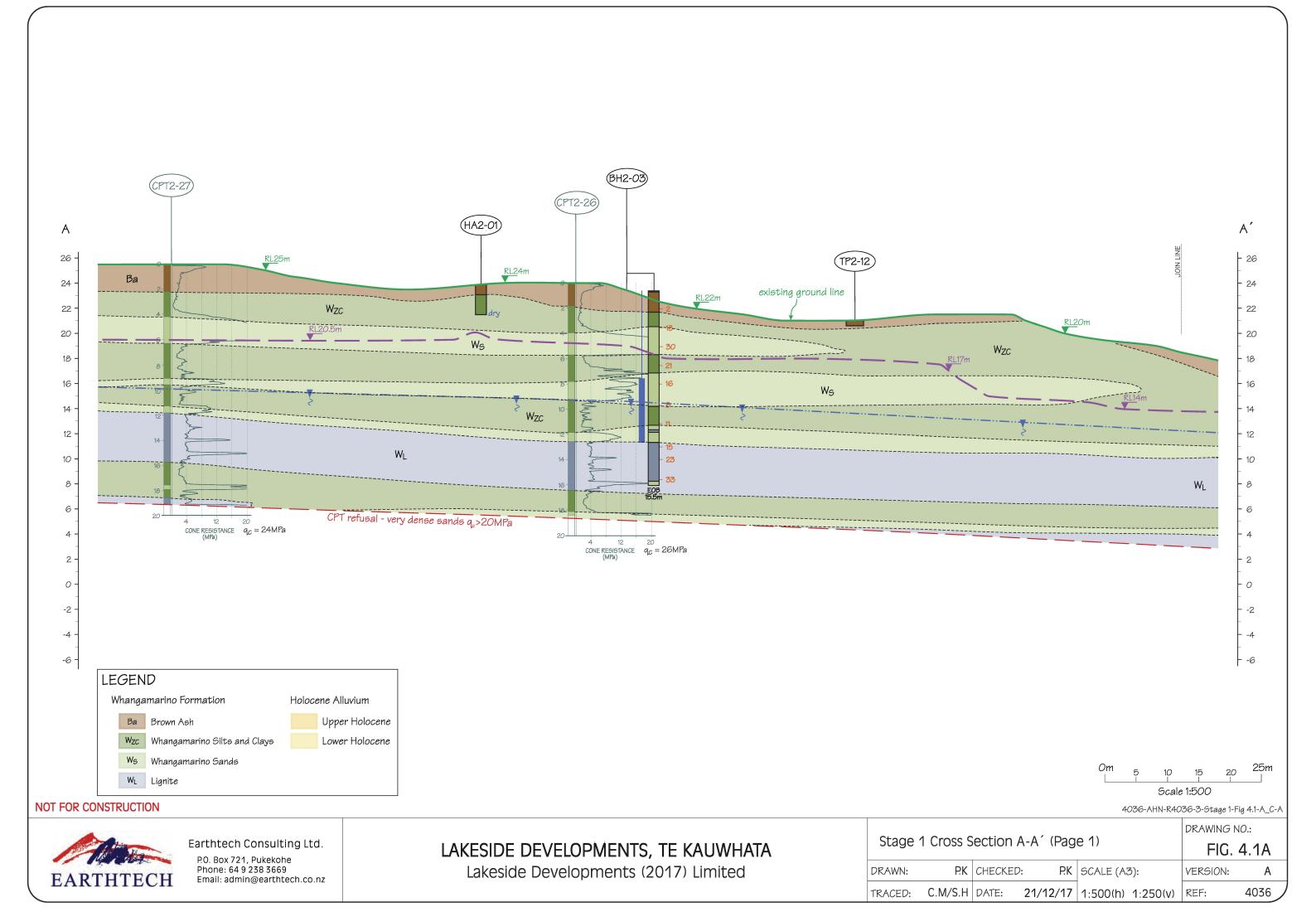
- 1. Topsoil thickness not determined at time of reporting. Depth to be checked by Lot purchaser.
- 2. Some works carried out during 2017/18 season.
- 3. Fill confined to a portion of the lot. Refer to *Drawing 35*.
- 4. Temporary exclusion zones nominated due to oustanding works. Refer to **Drawings 36 and 38**.
- 5. Foundation bearing capacity to be reassessed when building locations, foundation types and loads are known.

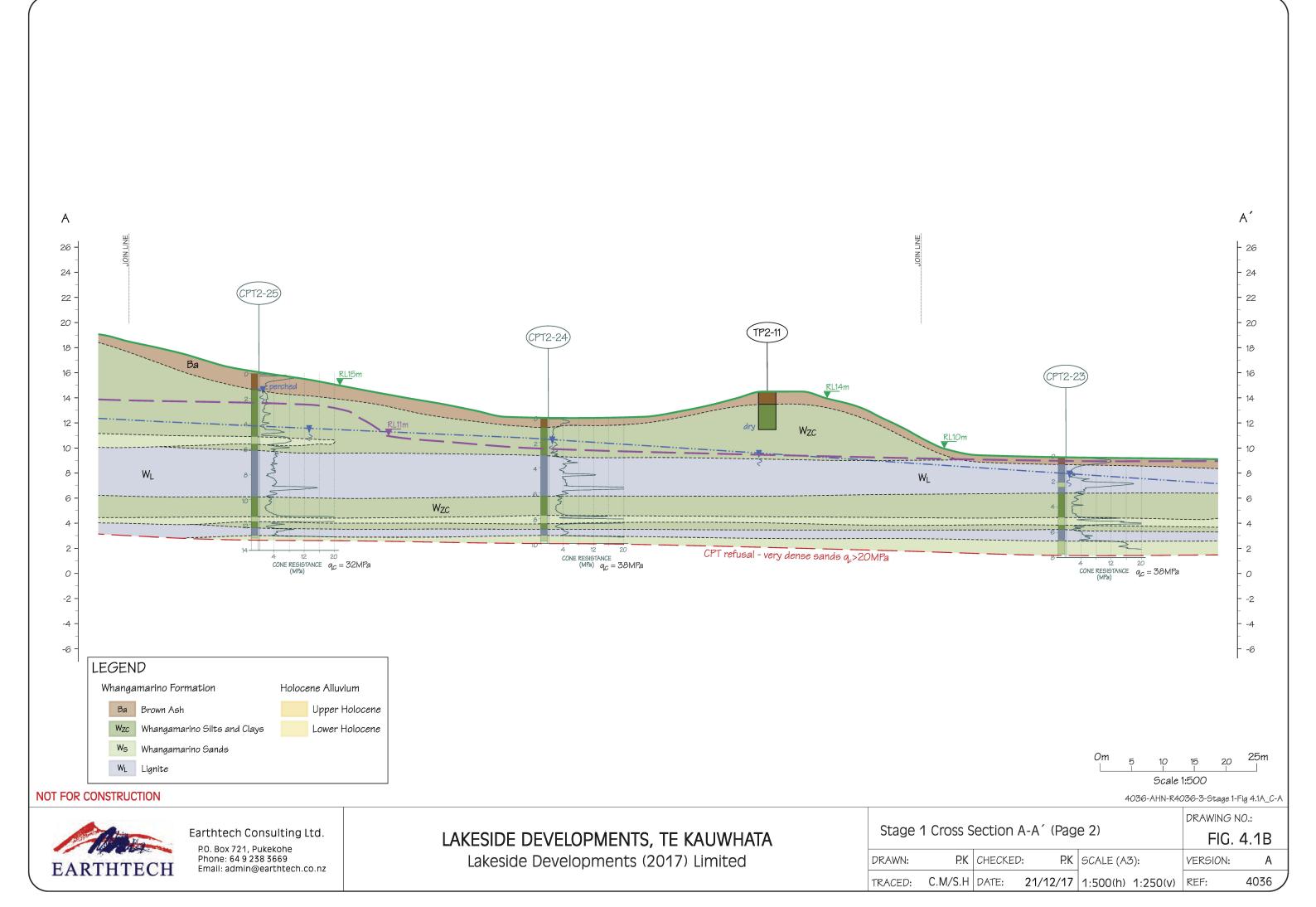
Page 1 of 1

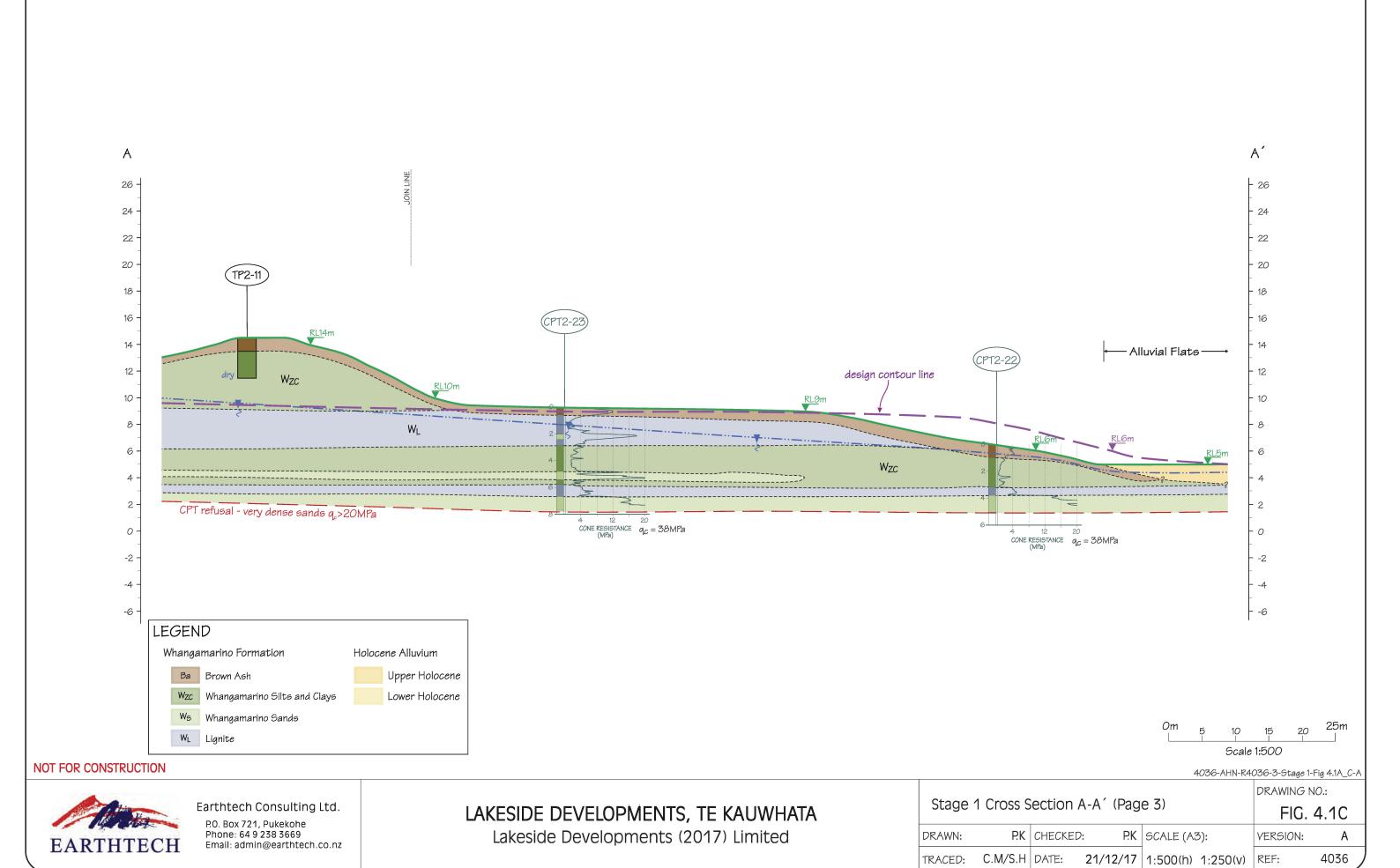
Appendix B: Relevant Pre-Development Field Investigation - Plans, Cross Sections and Data

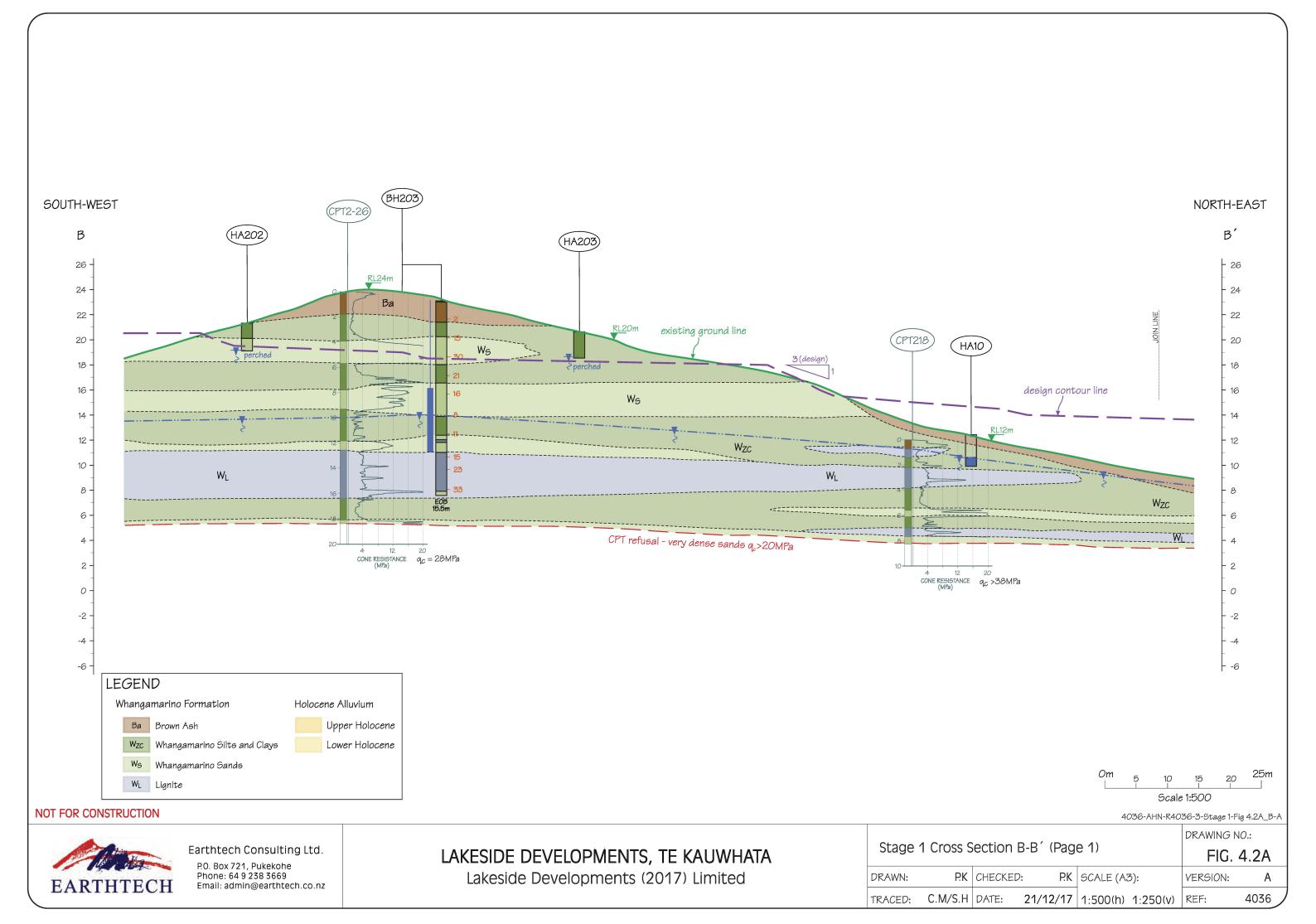


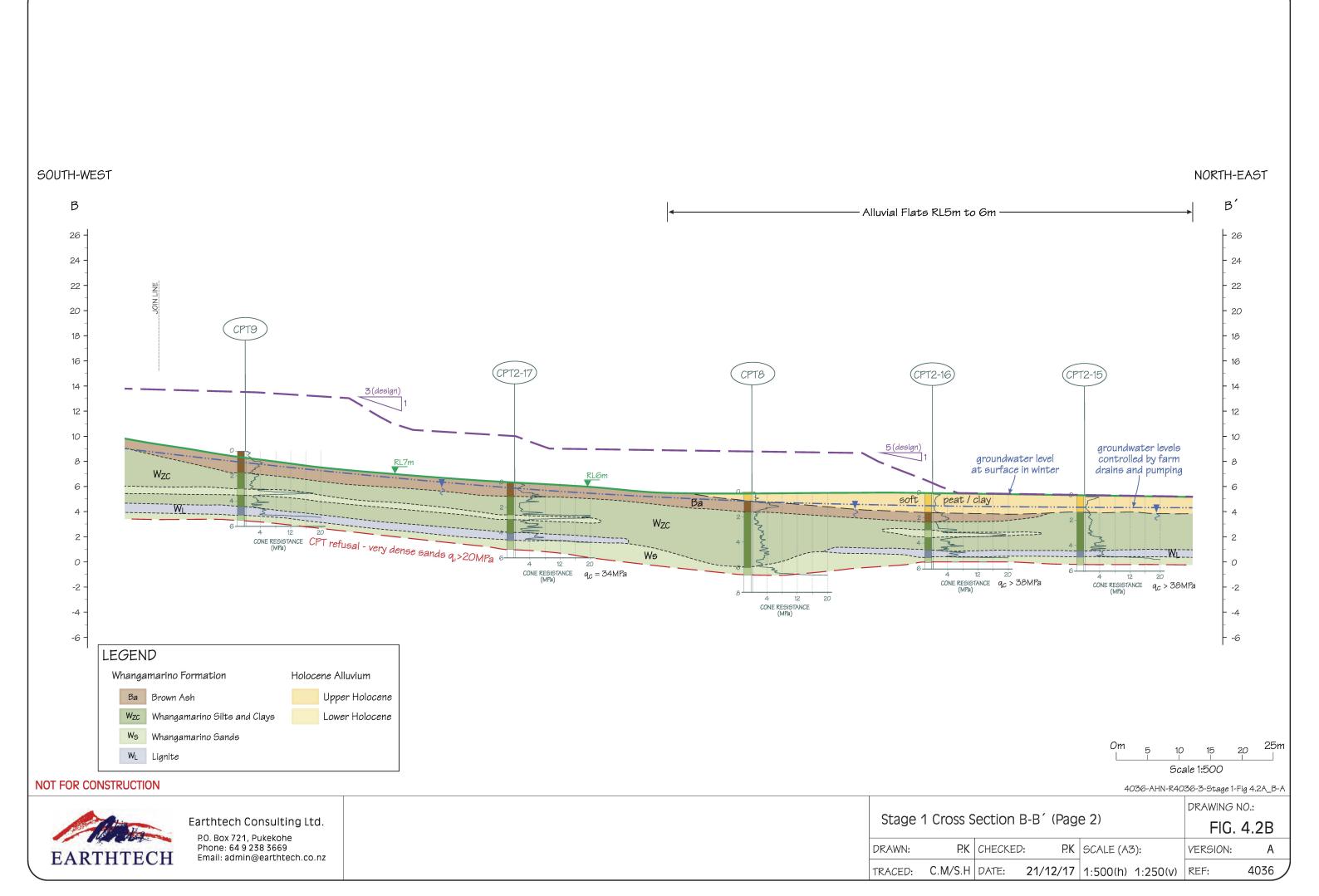


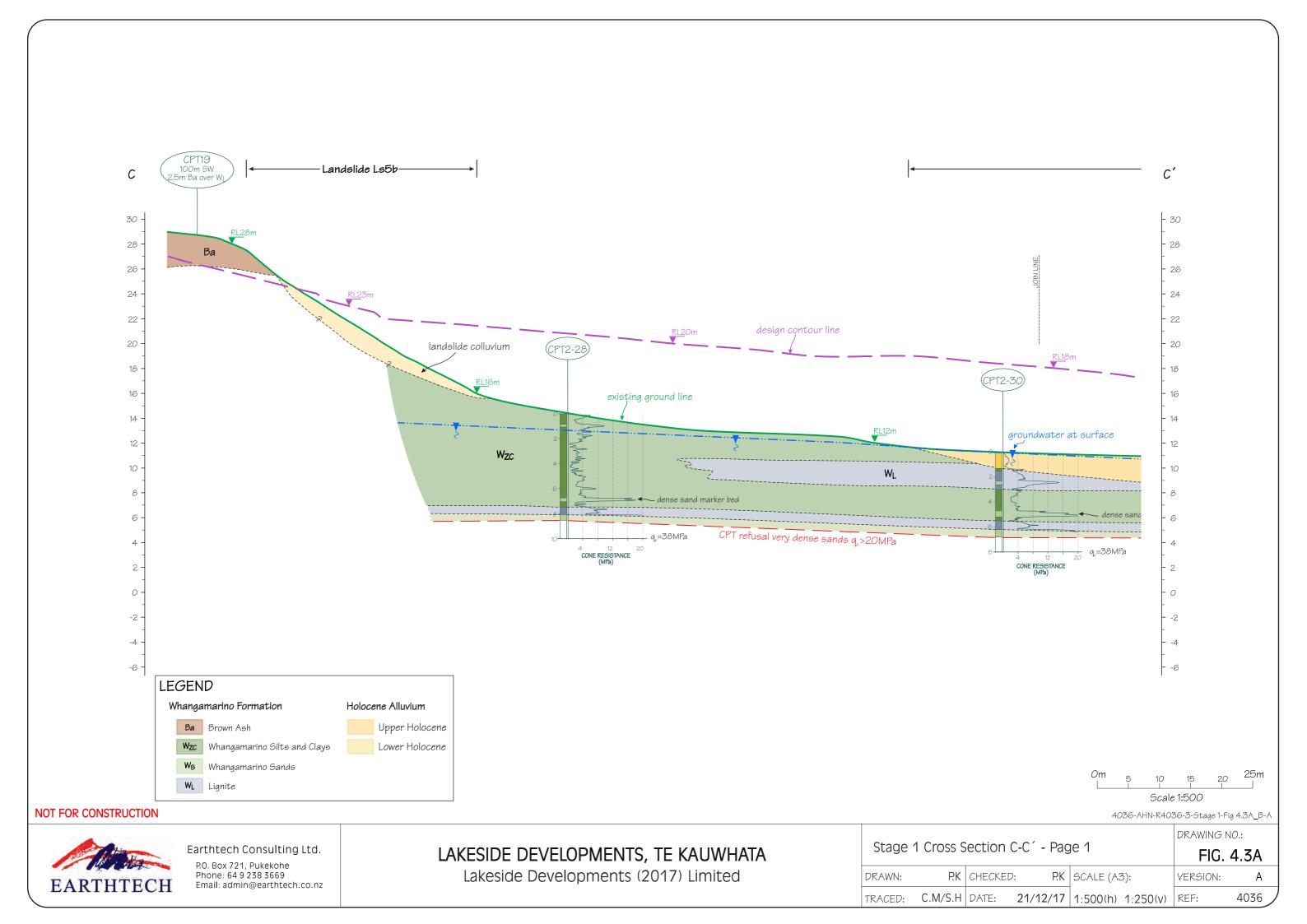


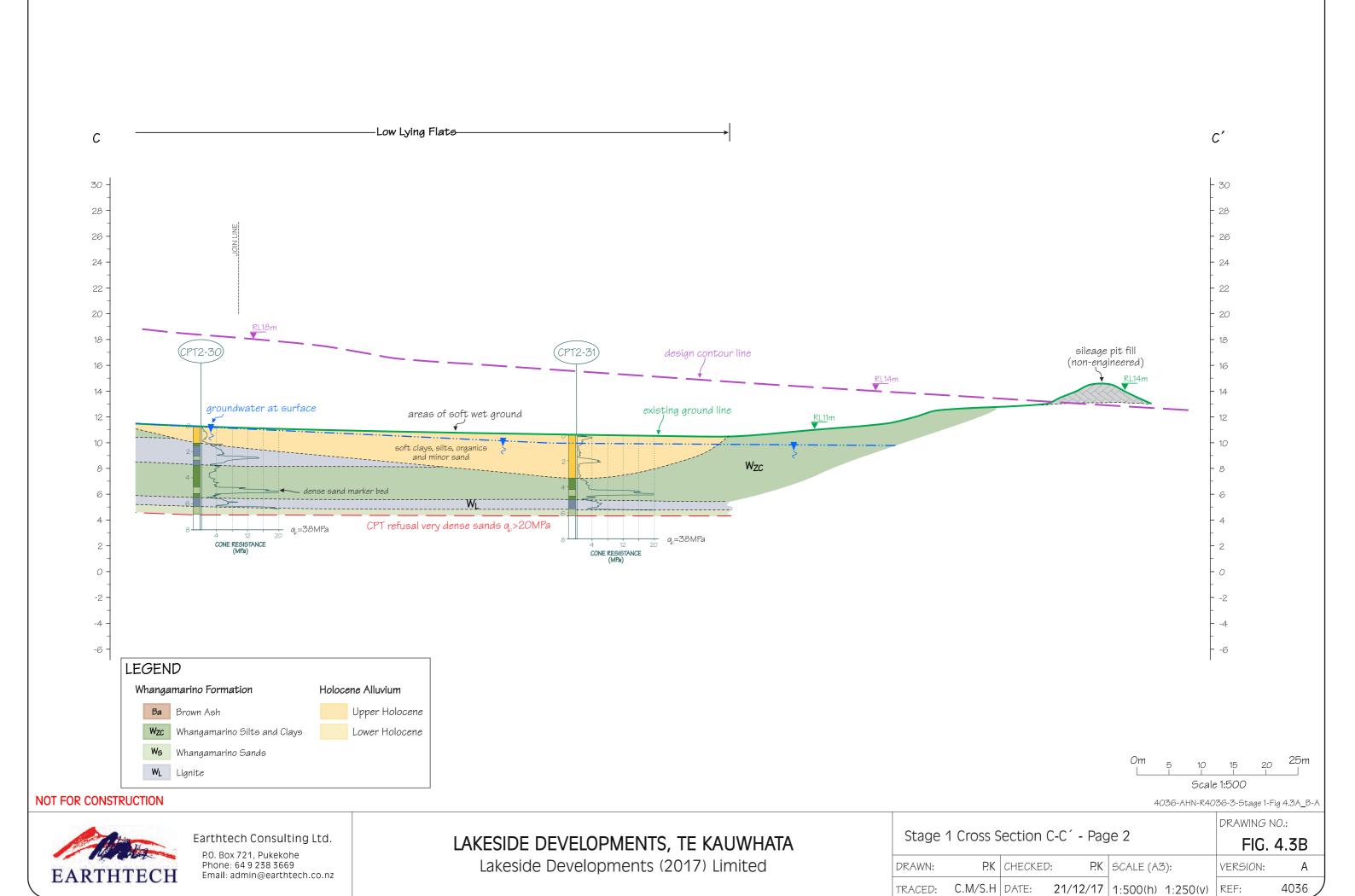




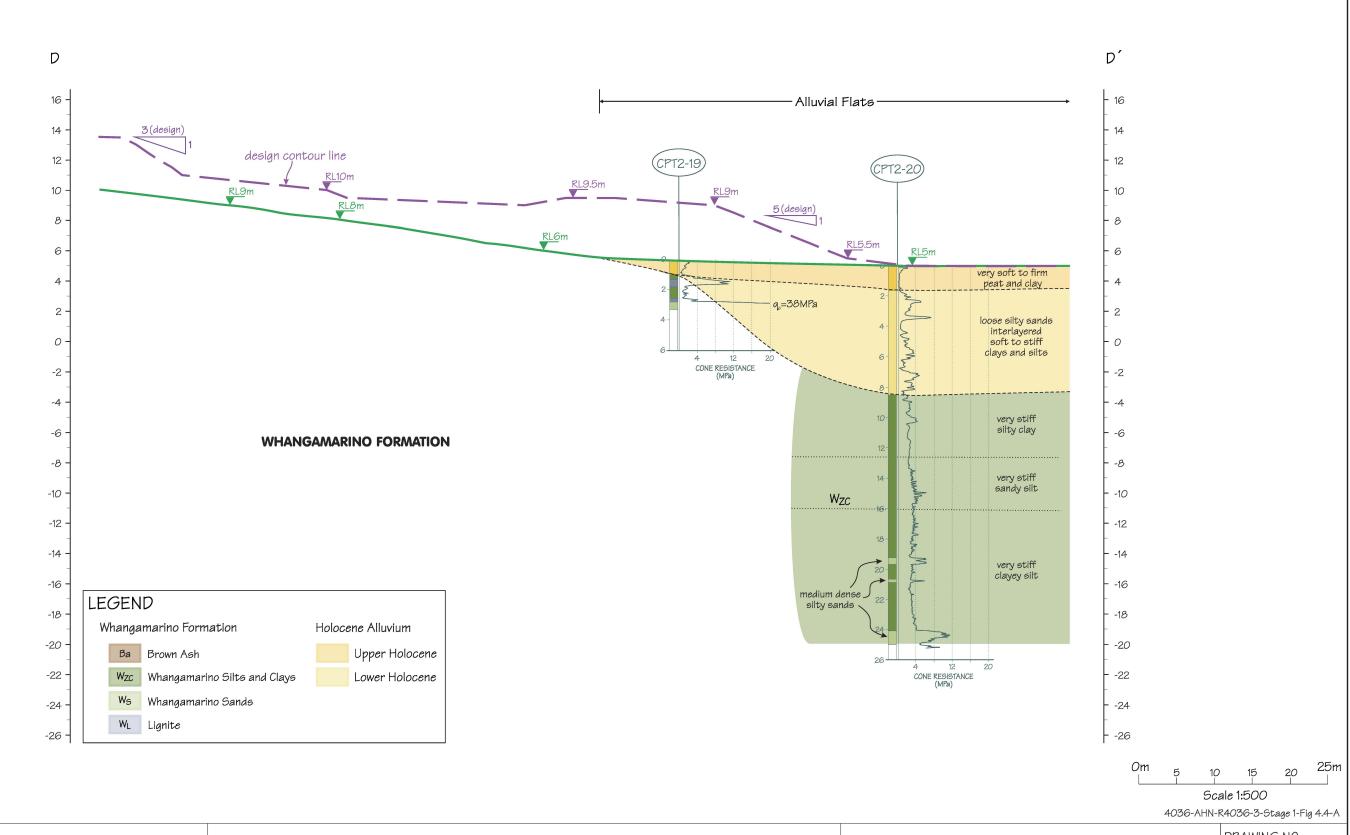








TRACED:



NOT FOR CONSTRUCTION

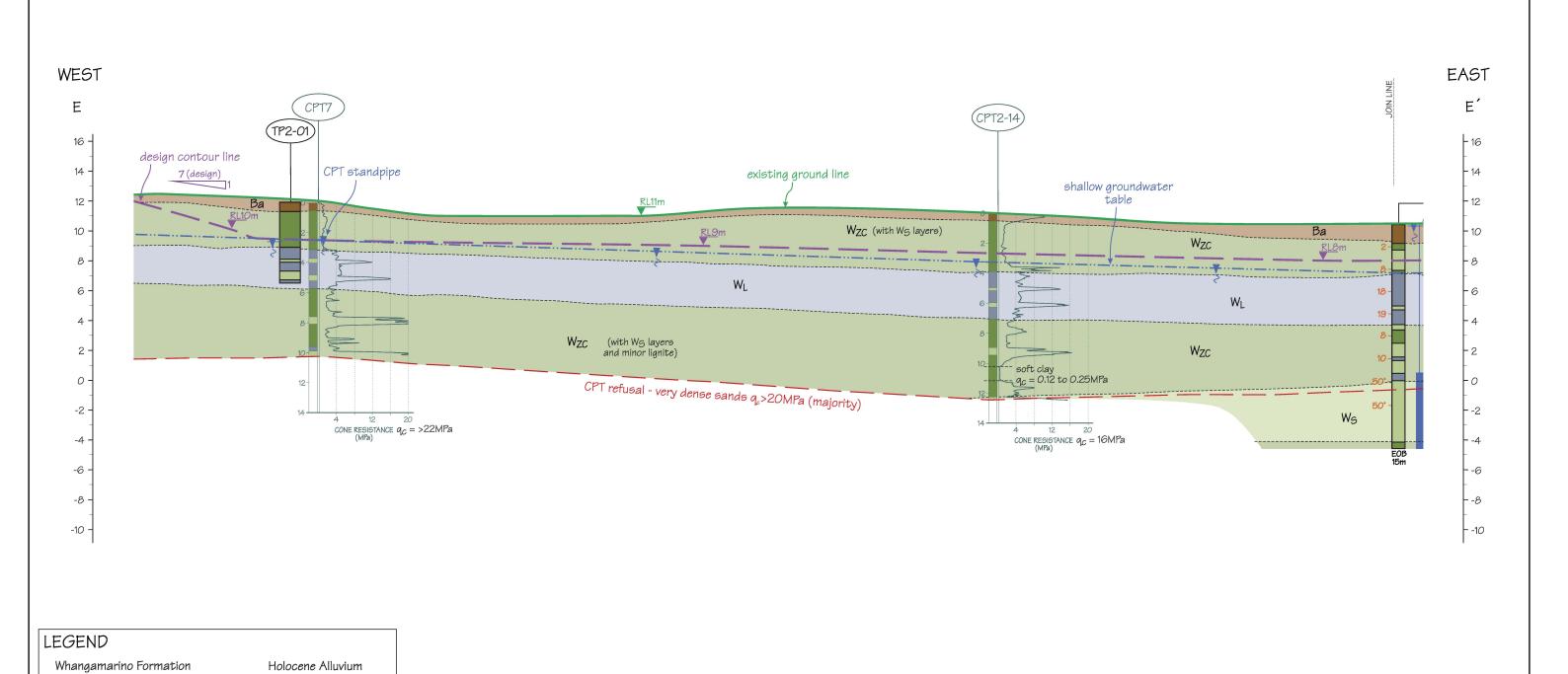
EARTHTECH

Earthtech Consulting Ltd.

P.O. Box 721, Pukekohe Phone: 64 9 238 3669 Email: admin@earthtech.co.nz

LAKESIDE DEVELOPMENTS, TE KAUWHATA Lakeside Developments (2017) Limited

04	4 0	N = 4.1 = F	D D'			DRAWING	10.:
Stage	1 Cross S	section i	J-D			FIG.	4.4
DRAWN:	P.K	CHECKED	P: P:K	SCALE (A3	3):	VERSION:	Α
TRACED:	C.M/S.H	DATE:	21/12/17	1:500(h)	1:250(v)	REF:	4036



EARTHTECH

Ba Brown Ash

W_L Lignite

NOT FOR CONSTRUCTION

Wzc Whangamarino Silts and Clays

Ws Whangamarino Sands

Earthtech Consulting Ltd.

Hu Upper Holocene

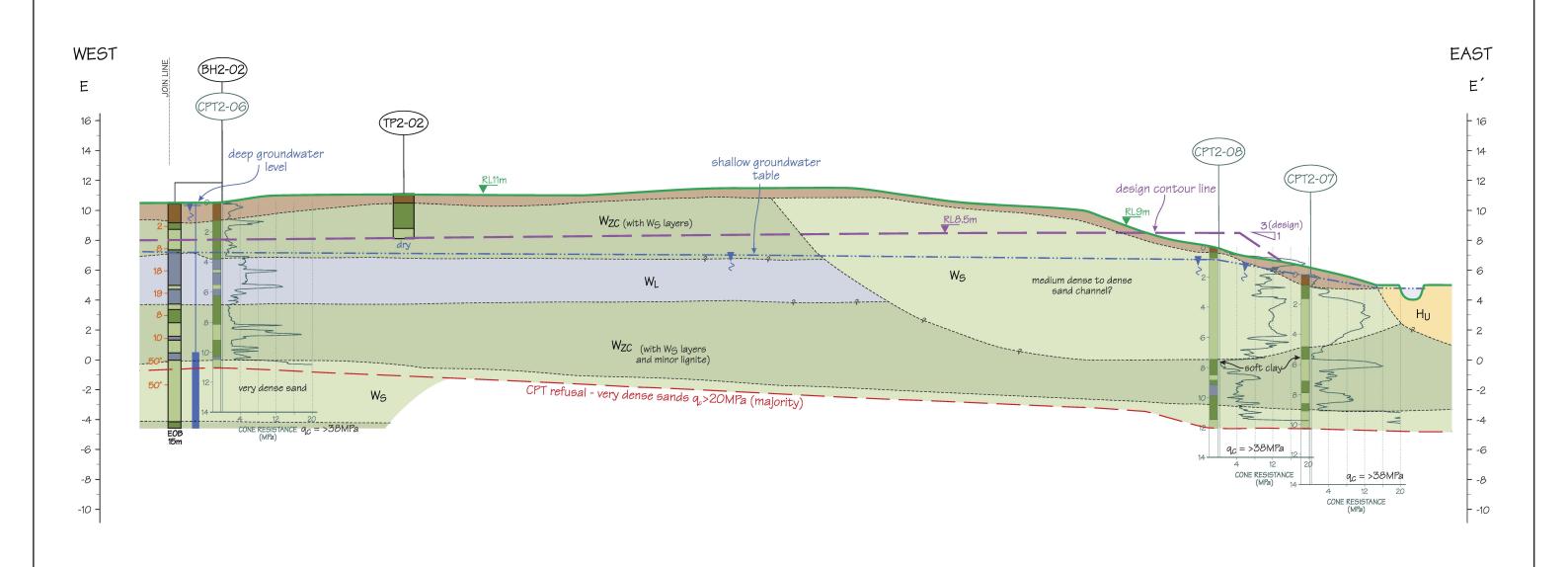
H_L Lower Holocene

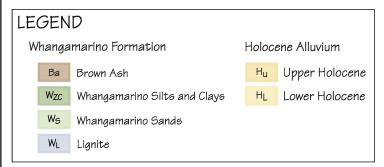
P.O. Box 721, Pukekohe Phone: 64 9 238 3669 Email: admin@earthtech.co.nz LAKESIDE DEVELOPMENTS, TE KAUWHATA Lakeside Developments (2017) Limited

	DRAWING NO.:							
Stage	2 Cross S	ess Section E-E´ (Page 1) FIG. 4.						
DRAWN:	P.K	CHECKED:	P.K	SCALE (A	3):	VERSION:	Α	
TRACED:	C.M/S.H	DATE:	17/01/18	1:500(h)	1:250(v)	REF:	4036	

Scale 1:500

4036-AHN-R4036-4-Stage 2-Fig 4.1A_B-A





Om 5 10 15 20 25m Scale 1:500

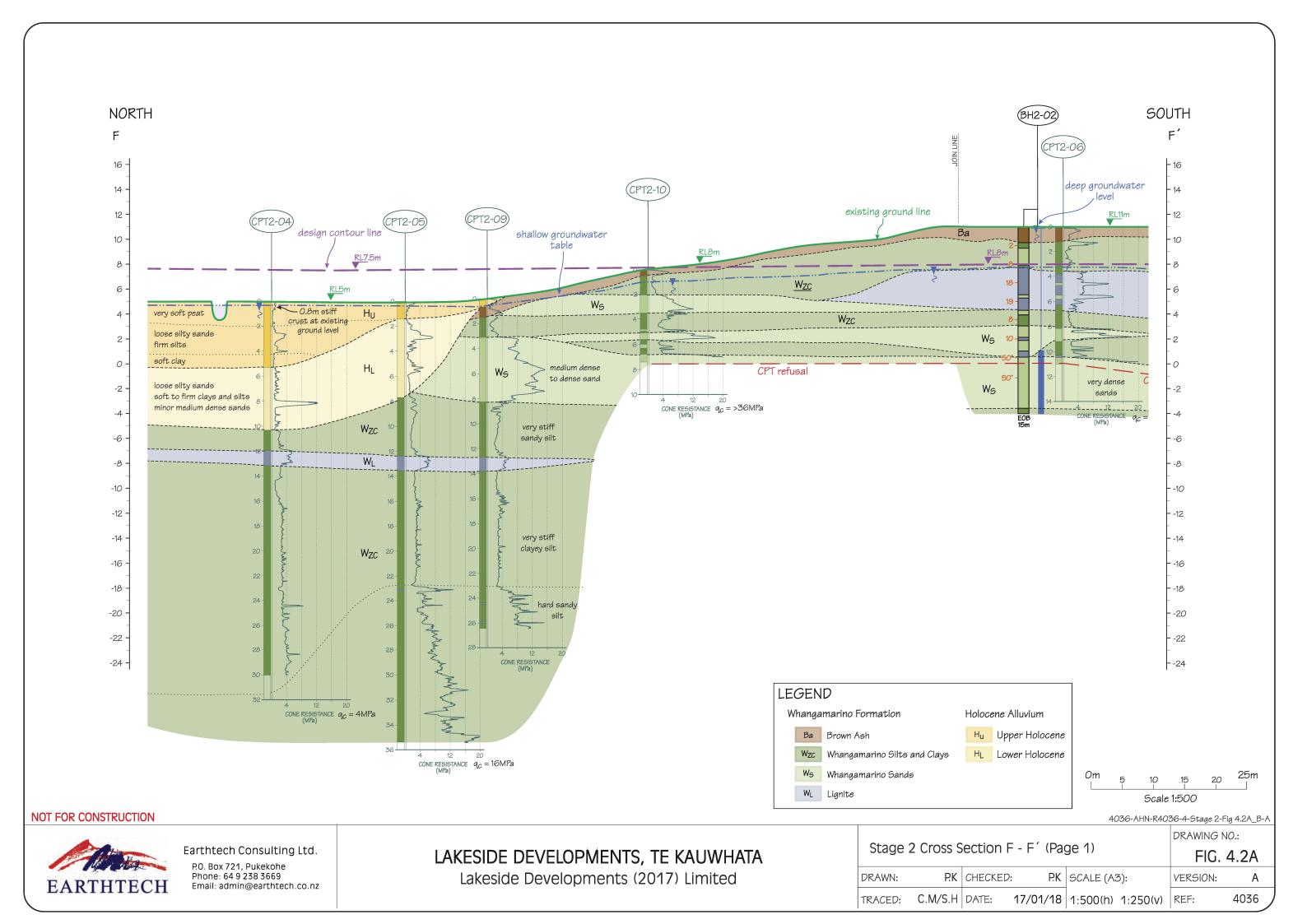
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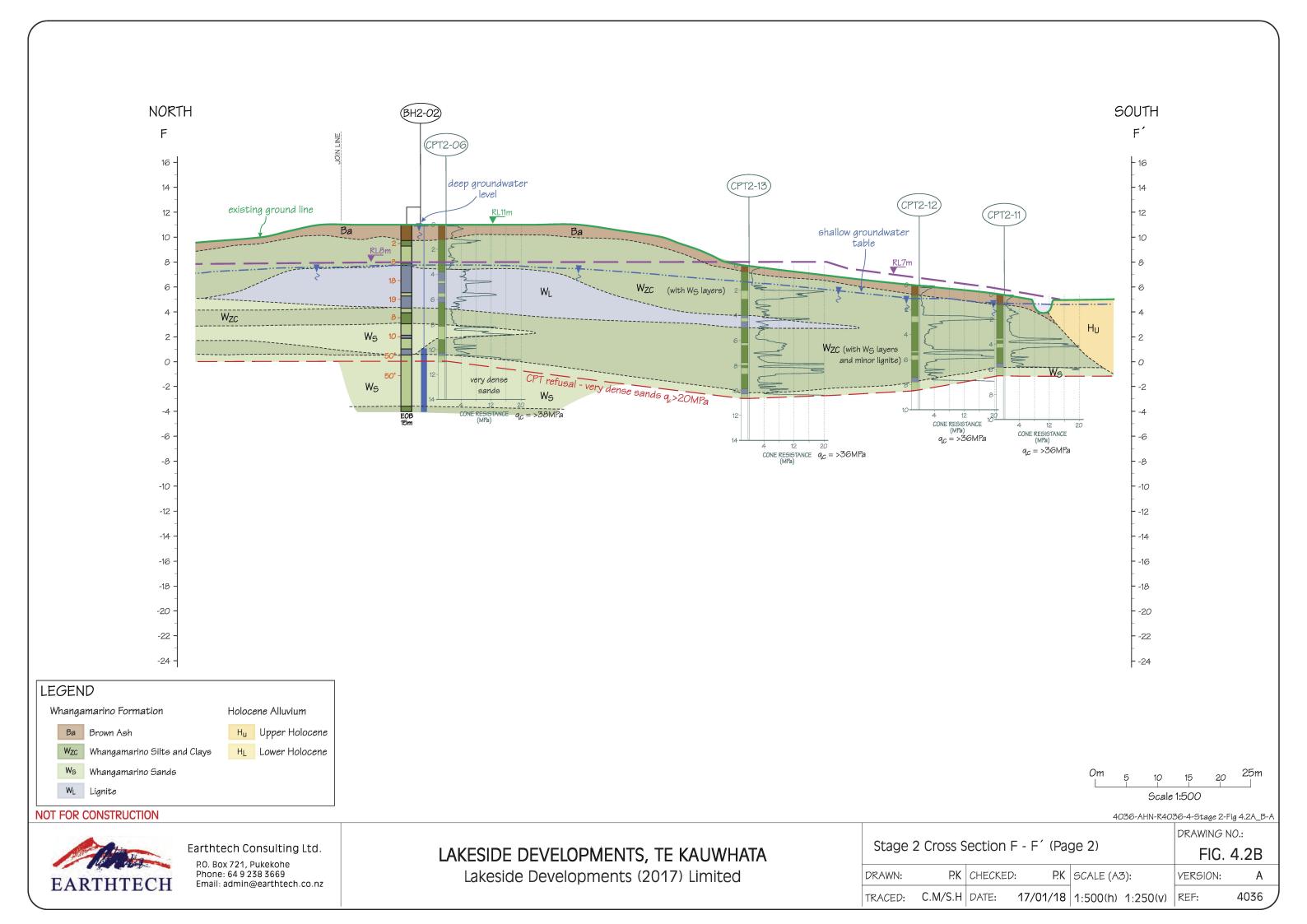
EARTHTECH

Earthtech Consulting Ltd.

P.O. Box 721, Pukekohe Phone: 64 9 238 3669 Email: admin@earthtech.co.nz LAKESIDE DEVELOPMENTS, TE KAUWHATA Lakeside Developments (2017) Limited

				4	1036-AHN-R40)36-4-Stage 2-	-Fig 4.1A_B-	-A	
		DRAWING NO.:							
Stage	2 Cross S	Section E	E-E' (Page	e 2)		FIG. 4.1B			
DRAWN:	P.K	CHECKED	: P.K	SCALE (A	3):	VERSION:	Α		
TRACED:	C.M/S.H	DATE:	17/01/18	1:500(h)	1:250(v)	REF:	4036		





HA07 Bore No.: **HAND-AUGER LOG** Project: Scott Road, Te Kauwhata Augered by: MW/SLH Checked by: MW 11/10/2016 Date:

Ref: 4036

\supset	<u> </u>	1			T	
Geology	Soil Description	Soll Symbol	Depth (m)	Water Level	Undrained Shear Strength	Scala Penetrometer Blows/100mm 0 0 1 2 3 4 5 6 7 8 9 10111213
TOP	SILT with minor fine sand; dark brown. Stiff; moist. Minor live rootlets. SILT with trace fine sand; brown. Very stiff; moist;	× × × × × × × × × × × × × × × × × × ×	- - - - - - - - - - -		131/44kPa 135/38kPa 131/38kPa	
BROWN ASH	CLAY; mottled orange and grey. Very stiff; moist; highly plastic (not pumiceous). Becoming light grey with light orange mottles.	x^xxx^ 	-1.0		153/50kPa 138/53kPa 149/68kPa 136/47kPa 153/74kPa 173/77kPa 109/56kPa 91/56kPa 153/68kPa UTP 157/59kPa	
WHANGAMARINO	SILT with minor pumiceous fine-coarse sand and trace fine pumice gravel; greyish white with orange iron oxide staining. Stiff; wet. 2.2m: Orange 2.6m onwards, firm.		2.0	₹	161/68kPa 200/53kPa 149/26kPa 115/24kPa 115/24kPa 104/26kPa 124/44kPa 121/41kPa 104/47kPa 92/34kPa	
W	Organic CLAY with trace pumice sand; black. Saturated. Organic LIGNITE; black. Hard; dry; numerous wood fragments.	x	3.0		41/18kPa	
	EOH = 3.7m bgl Target depth reached. Groundwater encountered at 2.6m. PK Shear Vane.		4.0			0 2 4 6 8 10 13 16 18 20 23 26 28 30 Inferred CBR 10%

HAND-AUGER LOG

HA10 Bore No.:

Project: Scott Road, Te Kauwhata

Checked by: MW 12/10/2016 Augered by: MW/SLH Date: Ref: 4036

Geology	Soil Description	Soil Symbol	Depth (m)	Water Level		drained Strength	Scala Penetrometer
-	SILT with minor sand; brown. Stiff; moist. Minor live	85	8	×	0	100 200	0 1 2 3 4 5 6 7 8 9 10 11 12 13
TOP SOIL	rootlets.	× × × × × × × × × × × × × × × × × × ×	F				
Z	SILT; light brown. Very stiff; moist; highly plastic.	* * * * * * * * * * * * * * * * * * *	F			102/37kPa	
BROWN ASH	0.5m: Minor pumice sand with light grey mottles.	× × × × × × × × × × × × × × × × × × ×	0.5			124/62kPa 173/59kPa	
	SILT with minor pumice sand; white/grey with orange mottles. Very stiff; moist.	×. · · ×. × · · · × · · × · · × ·	-			157/41kPa 127/41kPa	
	1.0m: Becoming wet and stiff.	× · × · × · × · × · × · × · × · × · × ·	1.0			131/50kPa 144/47kPa 140/47kPa 123/41kPa	
WHANGAMARINO	Medium-coarse sandy pumiceous SILT; light brown. Hard; wet.	× · · · × · × · × · × · × · × · × · × ·	_ _ _ _ 1.5			144/41kPa >219kPa 192/47kPa UTP	
WHA	CLAY; mottled orange with grey/white. Very stiff; moist; low plasticity.		2.0	₹		192/38kPa 217/34kPa	
	Highly organic HCNITE, block, Hard, caturated	 	<u>-</u>			192/41kPa 71/24kPa UTP	
	Highly organic LIGNITE; black. Hard; saturated.		_ - - - 2.5				
	EOH = 2.5m bgl Target depth. Groundwater encountered at 1.8m. PK Shear Vane.						
			 3.0 				
			_ _ _ _ _ _				
			- 3.5 - - - -				
			4.0				
			- - - -				
			- - 4.5 -				
			- - - - 5.0				
			3.0			•	0 2 4 6 8 10 13 16 18 20 23 26 28 30 Inferred CBR 10%



HA201 Bore No.: **HAND-AUGER LOG** Project: Scott Road, Te Kauwhata Checked by: AHN 07/03/2017 Augered by: AHN/SH Date: Ref: 4036

	Great by: 74 may 311 Greated by: 74 may					Ker. 4030
Geology	Soil Description	Soll Symbol	Depth (m)	Water Level	Undrained Shear Strength	Scala Penetrometer Blows/100mm
ō		₩		>	0 100 200	0 1 2 3 4 5 6 7 8 9 10 11 12 13
	TOPSOIL; dry.	~~~~	_ _ -			
HAMILTON- KAUROA ASH	Sandy SILT; light brown. Hard; dry.	×. ×. ×.	_			
P E		×·×·	_		UTP	
AM	Sandy CLAY; dark orange brown. Hard; slightly moist;	.:-:::	_ _ 0.5			
∓₹	plastic.	-· - ··	_			
	Clayey SAND; mottled yellow and white. Hard; slightly moist; slightly plastic.		_		UTP	
	moist, siigiltiy piastic.		_			
			_		UTP	
			- 1.0			
Σ			_			
PUKETOKA ALLUVIUM			_		UTP	
J.	Sandy CLAY; mottled orange and yellow, flecked red.		_			
A A	Moist; plastic.		_ _ 1.5			
OK/			_		>219/104kPa	
Ē.			_			
P	Clayey SILT (ignimbrite silt?); pale yellow white. Wet;	×_ ××-	_		>219/89kPa	
	plastic.	× × ×	_ _ _ 2.0			
		×-^××-			192/62kPa	
		××=-,	_			
	No ourse management below 0. Ama	×-×-	_		>219/62kPa	
	No auger recovery below 2.4m	127.4.	_		UTP	
		?	- 2.5		UIF-	
		<u> </u>	_		192/93kPa	
]}	_		192/83kPa	
	EOH =2.4m bgl No recovery.		_			
	Groundwater not encountered.		- 3.0			
	PK Shear Vane.		_			
			_			
			_			
			- - 3.5			
			_			
			_			
			_			
			-			
			- 4.0			
			_			
			_			
			_			
			- - 4.5			
			_			
			_			
			_			
			_ _ 5.0			
			2.0			0 2 4 6 8 10 13 16 18 20 23 26 28 30 Inferred CBR 10%
	A CONTRACTOR OF THE PARTY OF TH					I I I I I I I I I I I I I I I I I I I
		1		l l		

HAND-AUGER LOG

HA202 Bore No.:

Project: Scott Road, Te Kauwhata

Checked by: AHN 07/03/2017 Augered by: AHN/SH Date: Ref: 4036

Geology	Soil Description	Soll Symbol	Depth (m)	Water Level	Undrained Shear Strength	Scala Penetrometer Blows/100mm 0 1 2 3 4 5 6 7 8 9 10 11 12 13
	TOPSOIL; dry. Sandy SILT; pale yellow brown. Hard; slightly moist.	~~~~~ ~~~~ ~~~~ × · · · · · · · · · · · · · · · · · ·	- - - - - - - 0.5		UTP	
PUKETOKA ALLUVIUM	Sandy SILT; mottled yellow, orange and brown. Very stiff; moist; plastic.	× · · × · × · × · × · × · × · × · × · ×	1.0		VTP >219/59kPa	
PUKETOKA	Fine clean SAND; pale yellow white. Medium dense; non plastic; becomes grey white with occasional orange staining.		1.5			
	Wet below 2.1m		- 2.0 - -	₹		
	EOH =2.2m bgl Target depth reached. Groundwater encountered at 2.1m. PK Shear Vane.		3.5			0 2 4 6 8 10 13 16 18 20 23 26 28 30 Inferred CBR 10%

HAND-AUGER LOG

HA203 Bore No.:

Project: Scott Road, Te Kauwhata

Ref: 4036

Checked by: AHN 07/03/2017 Augered by: AHN/SH Date:

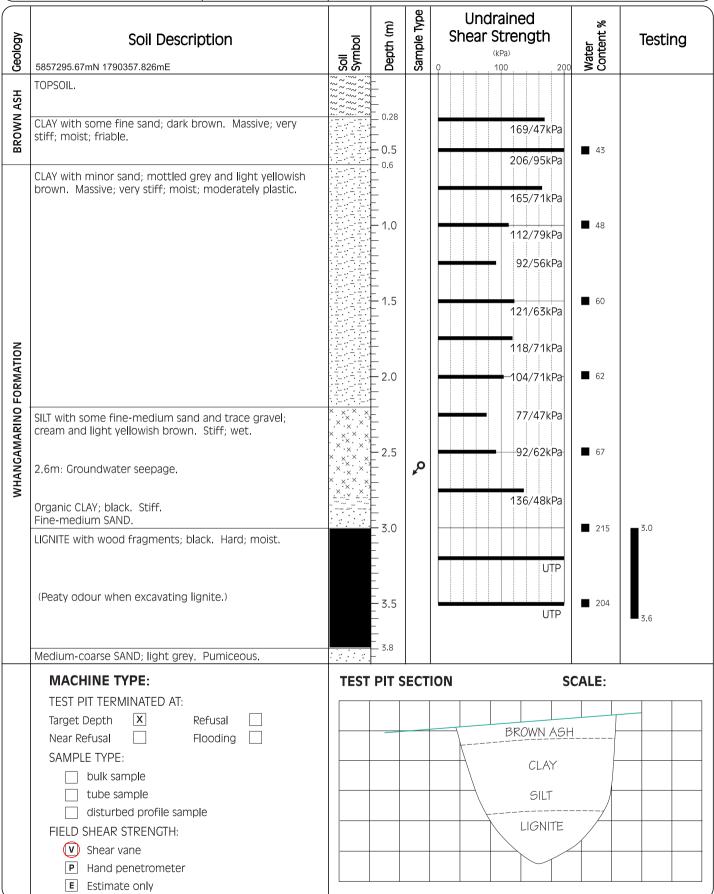
Geology	Soil Description	Soil	Depth (m)	Water Level	Undrained Shear Strength	Scala Penetrometer Blows/100mm 0 1 2 3 4 5 6 7 8 9 10111213
	TOPSOIL; dry.	~~~~				
	Sandy SILT; light orange brown. Stiff; slightly moist; moderately plastic; minor grit from hardpan layers. Becomes more sandy with depth.	× · · · × · · · · · · · · · · · · · · ·	- - - - - 0.5		UTP	
UVIUM		× · × · × · × · × · × · × · × · × · × ·	_ _ _ _		131/29kPa	
PUKETOKA ALLUVIUM	Silty SAND; yellow, white and orange. Medium dense; slightly moist; slightly plastic.	× · × · × · × · × · × · × · × · × · × ·	- 1.0 		UTP	
PUKE	Sandy CLAY; pale yellow and white. Very stiff; moist; highly plastic.	× · · × · · · · · · · · · · · · · · · ·	1.5		UTP	
	Tilgrily plastic.				199/95kPa	
	Wet below 2.1m; poor recovery; purplish brown; possibly top of lignite?		2.0	—	>219/62kPa	
	EOH =2.1m bgl Poor recovery. Groundwater encountered at 2.1m. PK Shear Vane.		3.5	→ ~		
			4.5			0 2 4 6 8 10 13 16 18 20 23 26 28 30 Inferred CBR 10%

SCALA PENETROMET	ER TEST SHEET	Project: Lake	side Developme	ents	
Augered By: NH/JP	Checked By: NH	Date:	27-11-17	Job No.:	4036

Test No.					<u> </u>							
1	Test	No.	SP2	2-03	SP2	2-04	SP2	2-05				
0.15 2.15 Pysh ————————————————————————————————————	0.05	2.05						5				
0.20	0.10	2.10						5				
1	0.15	2.15						4				
0.30	0.20	2.20	Pusn					4				
0.35 2.35 1	0.25	2.25						5				
0.35 2.35 1	0.30	2.30						7				
0.40			1				Push					
1												
No.	-				Push							
0.55												
0.60 2.60 1												
No.	-		1									
1	-		1									
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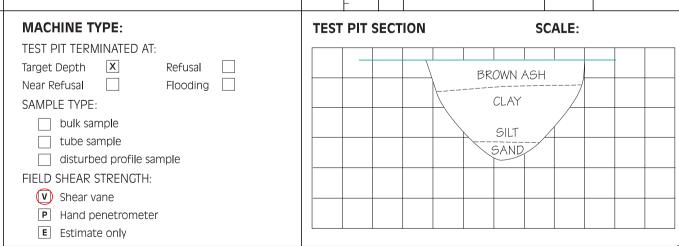
EARTHTECH CONSULTING LIMITED

TEST PIT LOG Test Pit No.: TP2-01 Project: Lakeside Developments (Stage 2) Excavator: 12t - SB Logged by: PK Date: 09/11/17 Ref: 4036



Test Pit No.: **TP2-01 -** Page 2 **TEST PIT LOG** Project: Lakeside Developments (Stage 2) Excavator: 12t - SB Logged by: PK Date: 09/11/17 Ref: 4036 Sample Type Undrained Water Content % Depth (m) **Shear Strength** Soil Description Geology **Testing** (kPa) 200 100 LIGNITE; black. Hard; moist. 241 WHANGAMARINO FORMATION UTP - 4.5 233 UTP Fine-medium SAND with trace silt. Medium dense; pumiceous. 45 - 5.0 LIGNITE; black. Hard; moist. 168 - 5.5 EOP = 5.4mTarget depth reached. Groundwater encountered at 2.6m PK shear vane. 6.0 - 6.5 7.0 F 7.5 **MACHINE TYPE: TEST PIT SECTION SCALE:** TEST PIT TERMINATED AT: X Target Depth Refusal **BROWN ASH** Flooding [Near Refusal SAMPLE TYPE: CLAY bulk sample tube sample SILT disturbed profile sample LIGNITE FIELD SHEAR STRENGTH: (V) Shear vane P Hand penetrometer **E** Estimate only

Test Pit No.: TP2-02 **TEST PIT LOG** Project: Lakeside Developments (Stage 2) Date: 09/11/17 Excavator: 12t - SB Logged by: PK Ref: 4036 Sample Type Undrained Water Content % Depth (m) Shear Strength Geology Soil Description **Testing** (kPa) 5857325.593mN 1790533.163mE 100 200 TOPSOIL. **BROWN ASH** 0.25 CLAY with minor fine sand; light yellowish brown. 169/53kPa Massive; very stiff; moist; friable. - 0.5 33 149/83kPa CLAY with some fine sand and trace fine grayl; mottled grey and light yellowish brown. Massive; stiff; moist. 0.6m-2.6m 126/79kPa NZ standard compaction OWC=49% 48 1.0 NWC=64% 123/63kPa MDD=1.03t/m3 S.. (OWC) = 162kPa 131/48kPa Av (OWC)=9 % Silty CLAY; light greyish brown. Massive; stiff; wet; low $sd=2.54t/m^{3}$ plasticity. F 1.5 **5**5 114/44kPa 1.6 FORMATION 106/41kPa **1** 76 -2.0 114/59kPa ×× Layered SILT; light grey. Stiff; moist; pumiceous; low WHANGAMARINO plasticity. - 2.3 115/48kPa Fine SAND with trace silt; light grey. Medium dense; moist; pumiceous. 2.5 **8**1 - 3.0 72 EOP = 3.0mTarget depth reached. Groundwater not encountered. PK shear vane. - 3.5 **MACHINE TYPE: TEST PIT SECTION** SCALE: TEST PIT TERMINATED AT: X Target Depth Refusal BROWN ASH Near Refusal Flooding CLAY SAMPLE TYPE:



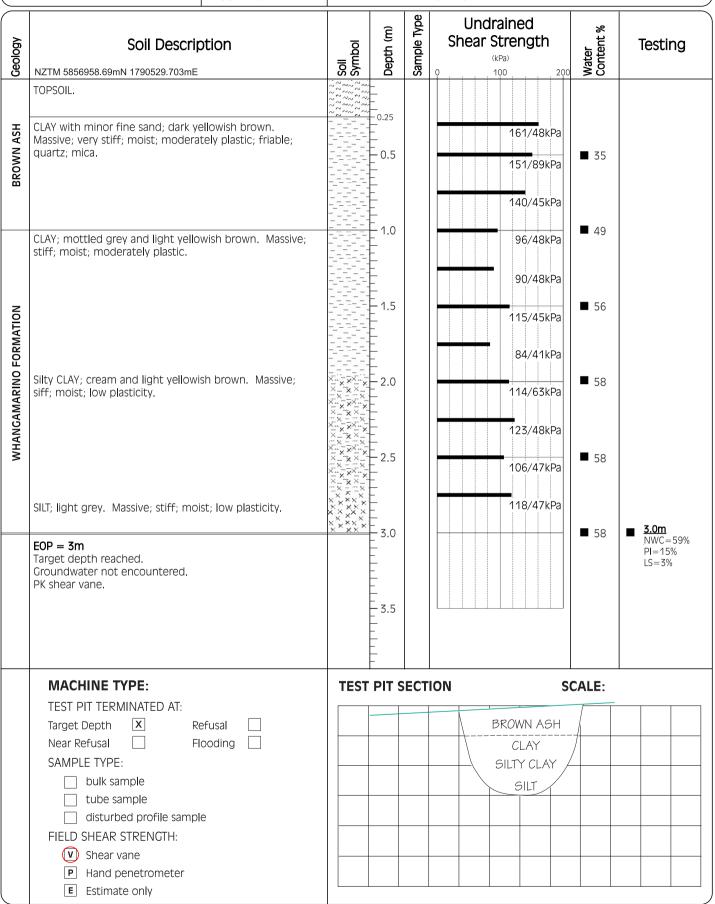
	TEST PIT	Test Pit No.: TP2-03								
	IESI PII	LOG	Proje	ct:	La	ıkeside D	evelopme	ents - S	tage 1	
Exca	avator: 12t SB	Logged by: PK	Date:		90	3/11/17			Ref: 4036	
Geology	Soil Descrip NZTM 5857023.034mN 1790277.810mB		Soil	Undrained Shear Strength				Water Content %	Testing	
BROWN ASH	TOPSOIL. CLAY with trace fine sand; light ye Massive; very stiff; moist; friable;	llowish brown.		0.25			UTP 213/59kPa 165/86kPa 184/101kPa 192/109kPa 202/83kPa	■ 46 ■ 47	■ 0.3 0.3m-1.7m NZ standard compaction MDD=1.17t/m³ OWC=44% NWC=42% ■ 1.0 S _u (0WC)=162kPa Av (0WC)=5% sd=2.71t/m³ CBR (0WC)=5% PI=46% LS=13% ■ 1.7	
NO FORMATION	CLAY; light grey and light yellowish stiff; moist; moderately plastic. Silty CLAY; light grey and reddish the stiff; moist.			- 1.8 - 2.0 - 2.3 - 2.5 - 2.5			151/83kPa 147/63kPa 149/71kPa	■ 51 ■ 68	1.7m-3.4m NZ standard compaction MDD=1.14t/m³ OWC=45% NWC=57% S _u (OWC)=162kPa Av (OWC)=5%	
WHANGAMARIN	Clayey SILT; light grey. Massive; st Silty medium-coarse SAND; light g dense; wet.		X. X	- 2.9 - 3.0 			71/38kPa 120/45kPa	■ 52 ■ 68	3 .4	
		efusal	TEST	PIT S	ECTIO	ON	S	CALE:		



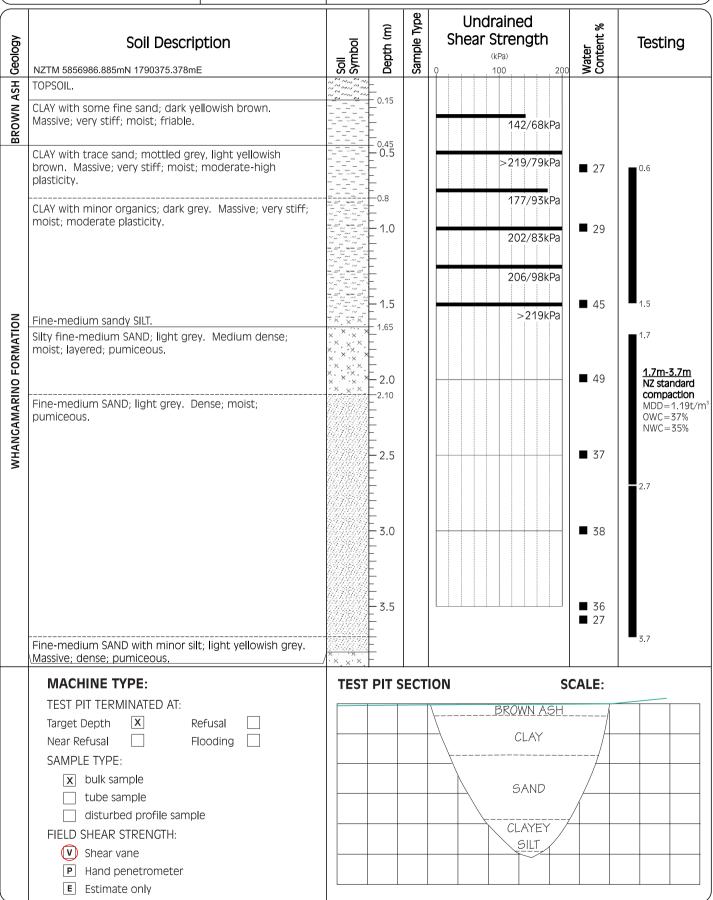
P Hand penetrometerE Estimate only

TEST PIT LOG				Test Pit No.: TP2-03 - Page 2								
	IESI PII	LOG	Project: Lakeside Developments									
xca	vator:	Date:	Date: 08/11/17									
Geology	Soil Descri 5857023.034mN 1790277.810mE	otion	Soil Symbol	Depth (m)	Sample Type		Irained Strength	Water Content %	Testing			
WHANGAMARINO FORMATION	Silty medium- coarse SAND; light medium dense; wet. Medium-coarse SAND; light grey.	4.8	X	- - - - - - - - - - - - - - - - - - -				■ 63 ■ 50	4.4			
WHANGA	dense; wet.							■ 51				
	EOP = 5.4m Target depth reached. Groundwater not encountered. PK shear vane.		TEST	5.5 	ECT!	ON		SCALE				
	MACHINE TYPE: TEST PIT TERMINATED AT:		TEST	PIT S	ECTI	ON		SCALE:				
		efusal										

TEST PIT LOG Test Pit No.: TP2-11 Project: Lakeside Developments - Stage 1 Excavator: 12t - SB Logged by: PK Date: 09/11/17 Ref: 4036



TEST PIT LOG Test Pit No.: TP2-12 Project: Lakeside Developments - Stage 1 Excavator: 12t - SB Logged by: PK Date: 09/11/17 Ref: 4036



TEST DIT	1.00	Test Pit No	Test Pit No.: TP2-12 - Page 2							
TEST PIT	LUG	Project:	Lakeside Developments							
Excavator: Logged by: PK		Date:	09/11/17	Ref: 4036						
			Ψ Use almatic and							

	Ivator: Logged by: PK	Date:		19/11/17		Ref: 4036
Geology	Soil Description 5856986.885mN 1790375.378mE	Soil Symbol Depth (m)	Sample Type	Undrained Shear Strength	Water 62 Content %	Testing
WHANGAMARINO FORMATION	Clayey SILT; light brownish grey. Massive; very stiff; moist; low plasticity.	X X X X X X X X X X X X X X X X X X X		151/48kPa	■ 42 ■ 83	
WHANGA	Fine-medium SAND; light grey. Massive; medium dense; moist.	5.0			■ 63	
	EOP = 5.2m Target depth reached. Groundwater not encountered. PK shear vane.	- 5.5 - 5.5 - 6.0 - 6.5 - 7.0				
	MACHINE TYPE: TEST PIT TERMINATED AT:	TEST PIT	SECT	TION S	CALE:	
	Target Depth X Refusal Near Refusal Flooding SAMPLE TYPE: X bulk sample tube sample disturbed profile sample FIELD SHEAR STRENGTH: V Shear vane P Hand penetrometer E Estimate only			BROWN ASH CLAY SAND CLAYEY SILT		

TEST PIT LOG				Test Pit No.: TP2-13								
	IESI PII	Proje	ect:	Lakeside Developments - 9					e 1			
Exca	avator: 12t - SB	Logged by: PK	Date		0	9/11/17				Ref: 4036		
Geology	Soil Descrip NZTM 5856946.089mN 1790000.557mB		Soil Symbol	Depth (m)	Sample Type	Undra Shear St	rength	Water Content %	Te	esting		
	TOPSOIL.	-			0,							
BROWN ASH	CLAY with some fine sand; dark br stiff; moist; friable; quartz; mica.	own. Massive; very		0.23			115/60kPa 138/81kPa 155/98kPa	■ 41 ■ 52				
	CLAY with trace sand; mottled gre brown. Massive; very stiff; moist;					>	83/48kPa 219/101kPa					
z	SILT with trace sand; dark yellowish stiff; wet; friable.	n brown. Massive; very	~ × × × × × × × ×	- 1.5 - 1.5 			142/48kPa	■ 64				
WHANGAMARINO FORMATION	SILT with some fine sand; light yell Massive; stiff; wet; low plasticity.	****** ****** ****** ****** ****** ****	- 2.0 - 2.5 - 3.0 - 3.5 - 3.95			131/71kPa 131/71kPa 93/48kPa 109/50kPa 98/47kPa 93/48kPa 86/44kPa	■ 88 ■ 95 ■ 79	01 64	ensitive soil n basis NWC 4% to 95% / 82%			
	MACHINE TYPE:		TEST	PIT S	ECT	ION	S	CALE:				
		efusal ooding e				Le soils subho	evel site rizontally la	yered				



P Hand penetrometerE Estimate only

	TEST PIT	Test Pit No.: TP2-13 - Page 2								
	TEST PIT	Project: Lakeside Developments								
Exca	vator:	Logged by: PK	Date:		09	9/11/17			Ref: 4036	
Geology	Soil Descrip NZTM 5856946.089mN 1790000.557mB		Soil Symbol	Depth (m)	Sample Type	Shear S	rained Strength 100 200		Testing	
WHANGAMARINO FORMATION	CLAY with minor sand; cream. Ma moderate plasticity; mica. SILT with some fine sand; cream a moist; low plasticity; pumiceous.						153/93kPa 127/95kPa 121/74kPa	■ 42 ■ 50	■ 5.0m	
7HM	EOP = 5.2m Target depth reached. Groundwater not encountered. PK shear vane.		****** ****** *****					■ 58	NWC=58% PI=40% LS=15%	
	MACHINE TYPE: TEST PIT TERMINATED AT:		TEST	PIT S	ECTI	ON	S	CALE:		
		efusal ooding efusal					Level site norizontally la	yered		

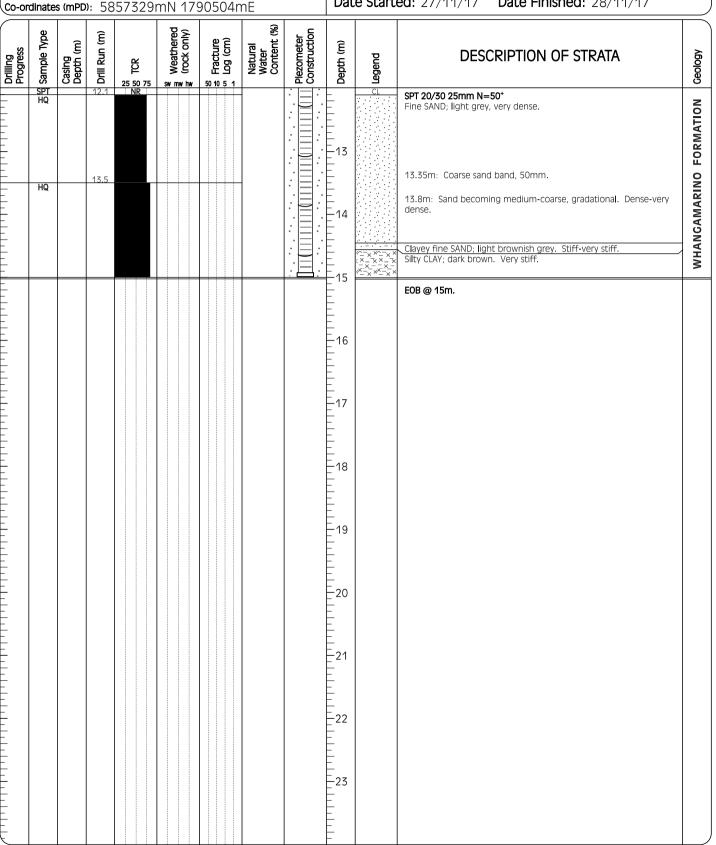


Bore No.: BH2-02 Sheet 1 of 2 **DRILL HOLE LOG** Client: WINTON PARTNERS Drilled by: DrillForce Project: LAKESIDE, TE KAUWHATA Ref: 4036 Collar Level: Date Started: 27/11/17 Date Finished: 28/11/17 (mPD): 5857329mN 179050/mF

Co-on	dinate	s (mPD): 58	57329n	<u>nN 179</u>	0504r	nE			Da	LE Starti	ed: 2//11/1/						
Drilling Progress	Sample Type	Casing Depth (m)	Drill Run (m)	알 25 50 75	wwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwww	Practure Log (cm)	Natural Water Content (%)	Content (%) Plezometer Construction			Plezometer Construction		Plezometer Construction		Depth (m)	Legend	DESCRIPTION OF STRATA	Geology
_	HQ									E	(×-×^-×^	TOPSOIL: Slightly sandy SILT with minor clay; brown.	Ξ					
-										1	X-XX-XX 	Slightly silty (1 AV with trace mica: light vellowish brown - Very stitt - I	BROWN ASH					
E			4.5							E		Fine SAND with some silt; light yellowish grey. Very stiff.	_					
	SPT		1.5				†	\geq		Ł	×_~×_~×	1.4m-1.45m: Medium SAND. SPT 1/1//1/0/1/0 N=2						
E			1.95							£		Silty CLAY; mottled yellowish brown.						
_	HQ		1.33				1			- 2		Medium SAND; light grey. Trace fine disseminated blackish brown						
												flecks. 1.95m: clay clasts to 100mmØ; medium dense-dense. Trace black and dark yellowish orange ferruginous staining.						
_	SPT		3				-			<u></u>	,	SPT 0/0//1/2/2/3 N=8						
F	01 1									Ӻ	x=_\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	SILT with minor clay; yellowish orange. Fe oxide on irregular fracture						
- - - - -	HQ		3.45							4		olanes. LIGNITE; black, hard. 3.5m-3.55m: Coarse SAND; grey. 3.65m: 50mm SILT clast; dark brown.						
E										E		4.5m-4.55m: medium SAND; grey.						
	SPT		4.5				1			E		SPT 1/2//2/5/4/7 N=18						
- 1			4.95							"		Core fractures on 85° to core axis (bedding).						
	HQ		4.33				1			- 5			_					
										‡			<u> </u>					
F										F		Medium SAND; light grey. Veinlets of organic black material.	-					
Εl										E			RMATION					
	CDT		6				1	\leq		_6		LIGNITE; black, hard. SPT 2/4//4/5/4/6 N=19	R					
F I	SPT									‡		6.15m: 10mm sand band; medium with clasts in lignite above sand	<u>Б</u>					
	HQ		6.45				-			E		horizon.						
F	ПЫ							\geq		}			2 2					
F									-	F ,		Medium SAND with minor clay; graduating to fine SAND.	ARIN					
E										£′	;_x_^;_x_^	SILT with minor clay; brownish grey. Very stiff.	۷					
⊨ I			7.5							‡	KX-XX-X		Ā					
E	SPT									ŧ	X_XX_X XX_XX_X XX_XX_X XX_XX_X	SPT 1/1//1/2/2/3 N=8 Thin black organic flecks disseminated throughout (1%-2%); wood fragments (2mm-3mmØ twigs).	ANGAM					
	HQ		7.95				†			[8	- x - x	Coarse pumiceous SAND; light grey with brown organic flecks.	¥					
F										1		LOOSE.	>					
F										丰	* 1 v 1 v	8.25m: 100mm lignite band.						
E										E		Fine SAND; light grey. Medium dense. Black disseminated organic						
<u> </u>	CDT		9				1		-	<u></u> ‡9		material.						
E	SPT							K	K	ŧ		SPT 3/4//2/2/4 N=10						
	HQ		9.45				1			F	내용감독	\& 8.85m: Lignite, 250mm Slightly clayey fine SAND. Medium dense. Black organic segregations.						
-	1162									#	[설문설문]	9.8m: Clayey SILT band.						
E									7.7 2.5	E ₁₀	1.00	Coarse SAND; grey. Medium dense.						
E								:	:	Ε'n		LIGNITE; black, hard. 10.2m: 30mm lignite band						
 			10.5							·⊨								
	SPT		10.5				1	٠.	[·]	.E		SPT 4/7//7/10/15/18 35mm N=50 ⁺ Fine SAND with slight silt; light grey. Localised banding due to						
F			10.95					:	_ :	F		fine/very fine sand bands 3mm-5mm width. Very dense.						
F	HQ						1			<u>-</u> 11								
F									\equiv	F								
E									= :	Έ								
 									∄'.	Ŀ								
			12				<u></u>		<u> </u>	<u> </u>	<u> </u>		_/					
Rema	rks.							Loc	ged	Bv:		NH Water Level Observations During Drilling						

Remarks:	Logged By:	NH	Water Level Observations During Drilling				
	Date:		Date	Time	Depth	Depth	Depth
	Checked By:	PIK	Date	Tille	of Hole	of Casing	of Water
	Scale:						
	Hole Length:	15m					
	Core Boxes:						





Remarks:	Logged By: NH	Water Level Observations During Drilling					
	Date:	Date	Time	Depth of Hole	Depth of Casing	Depth	
	Checked By: PIK	Date				of Water	
	Scale:						
	Hole Length: 15m						
	Core Boxes:						





0.0m-2.6m



2.6m-5.5m

BOREHOLE BH2-02

Page 1 of 3



5.5m-8.6m



8.6m-11.9m

BOREHOLE BH2-02

Page 2 of 3



11.7m-15m

Bore No.: BH203 Sheet 1 of 2 **DRILL HOLE LOG** Client: WINTON PARTNERS Drilled by: DrillForce Project: LAKESIDE, TE KAUWHATA Ref: 4036 Date Started: 25/11/17 Date Finished: 25/11/17 Co-ordinates (mPD): 5856989mN 1790343mE

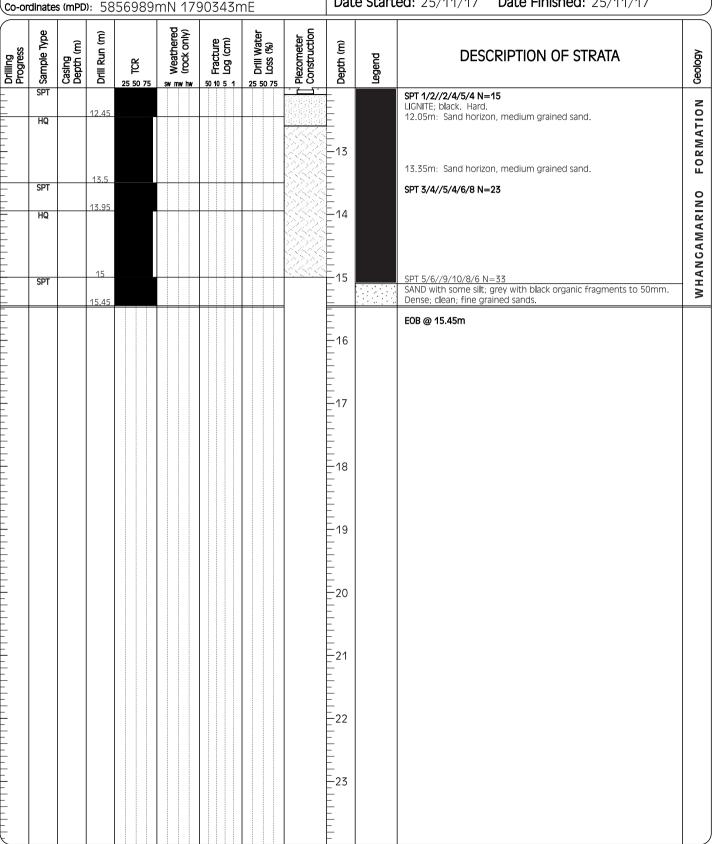
Co-ordinates (mPD): 5856989MN 1790343ME							<u> </u>			Date Started: 29/11/17 Date Finished: 29/11/17				
Drilling Progress	Sample Type	Casing Depth (m)	Drill Run (m)	25 25 50 75	¥ Weathered ₹ (rock only)	Fracture Log (cm) Togo (cm) Togo (cm) Togo (cm) Togo (cm) Togo (cm) Togo (cm)		Plezometer	מופח	Depth (m)	Legend	DESCRIPTION OF STRATA		
	HQ							\$\$\$\$\$\$\$\$.1	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	TOPSOIL. Clayey SILT; dark yellowish orange. Loose; firm-soft; Fe mottles; rootlets. Clayey SILT; light grey with orange Fe mottles. Loose. Becoming hematitic brown below 1.2m	АЅН	
	SPT		1.5 1.95							.2		SPT 0/1//1/0/0/1 N=2 1.6m: oxides; dark yellowish orange staining. Black MnO ₂ disseminated; fine grained. Slightly sandy SILT with trace clay; pale yellowish brown. Stiff; clasts, quartz dominated.	BROWN	
-	SPT		3								X X X X X X X X X X X X X X X X X X X	Increasing sand towards base, flakes of black organic material. SPT 2/2//3/4/4 N=13 Slightly silty SAND; light grey. Medium dense-dense; fine-medium		
	HQ		3.45	LC LC				\$\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\		· · · 4	X: X: X X: X: X X: X: X	grained. Trace veinlets of organic material, clear quartz; sand with trace pumice fragments; 1% disseminated black mineral.		
-	SPT		4.5 4.95							· · ·5	X X X X	SPT 6/7//7/8/8 N=30		
	SPT		6							· ·	X X X X X X X X X X X X X X X X X X X	CLAY; light brown with Greenish brown disseminated mottles. Stiffvery stiff; moderately plastic lacustrine clay. SILT with trace sand; greenish brown. Medium dense-dense; fine grained. SPT 4/5//5/4/5/7 N=21	RMATION	
	HQ		6.45							. 7	× × × × ×	Silty SAND with decreasing silt; light yellowish brown. Medium dense; black fine grained disseminated material; fine grained sand. Fine-medium grained SAND; grey. Medium-dense.	0 F0	
	SPT		7.5 7.95									SPT 2/3//4/5/4/3 N=16 Fine grained SAND; grey. Medium dense. Medium grained SAND; grey.	NGAMARIN	
										. 9		Fine grained SAND, slightly silty; light grey to light brownish grey; medium dense; clean sand. Silty SAND; light grey. Medium dense; very fine grained; becoming organic. SDT 1/2/2/4/2/3 N=8	WHAP	
	SPT		9.15								X	SPT 1/2//2/1/2/3 N=8 Sandy SILT; brown. Medium dense; very fine grained sand; organic.		
			10.7							· ·10 ·	**************************************	SILT with trace sand; brown. Medium dense; organic with thin lignite bands. 9.9m: 10mm lignite band 10.2m: 30mm lignite band SPT 2/2//3/2/2/4 N=11		
-	SPT		11.15							·11		Slightly silty SAND; grey. Medium dense; very fine grained. LIGNITE; black; hard. SAND with trace silt; brownish grey. Medium dense; clean;		
			12							· ·		medium-coarse grained.		

Note: Soil strengths from core, SPT and adjacent CPT2-26.

Logge	Logged By: NH			Water Level Observations During Drilling								
Date:			Date	Time	Depth	Depth	Depth					
Check	Checked By: PIK		Date	IIIIe	of Hole	of Casing	of Water					
Scale:		14/12/17										
Hole L	ength:	15.45m										
Core I	Boxes:											

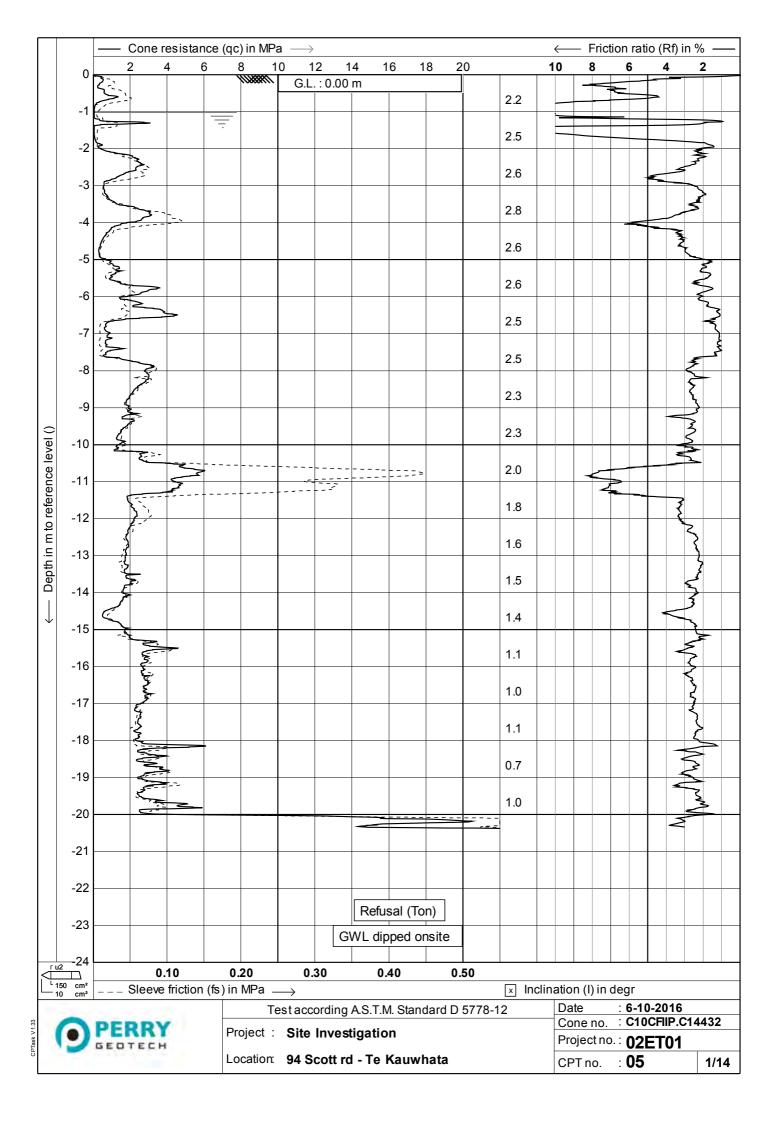


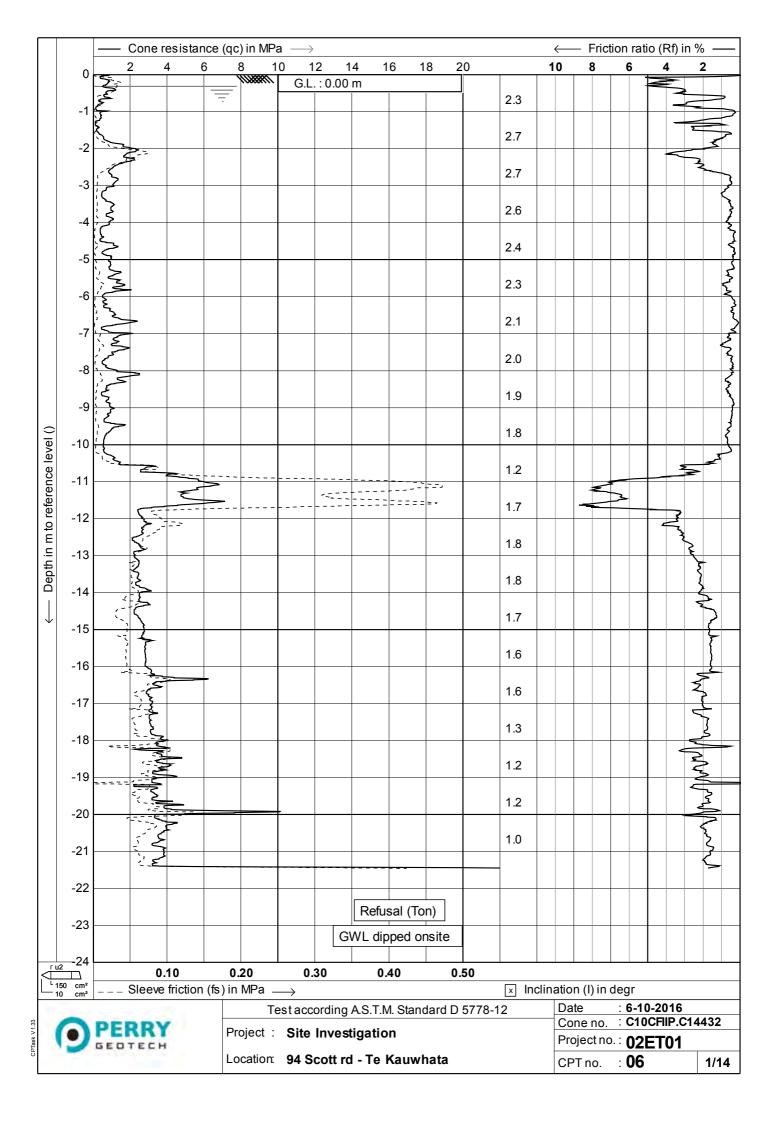
Bore No.: BH203 Sheet 2 of 2 **DRILL HOLE LOG** Client: WINTON PARTNERS Drilled by: DrillForce Project: LAKESIDE, TE KAUWHATA Ref: 4036 Collar Level: **Date Started**: 25/11/17 Date Finished: 25/11/17

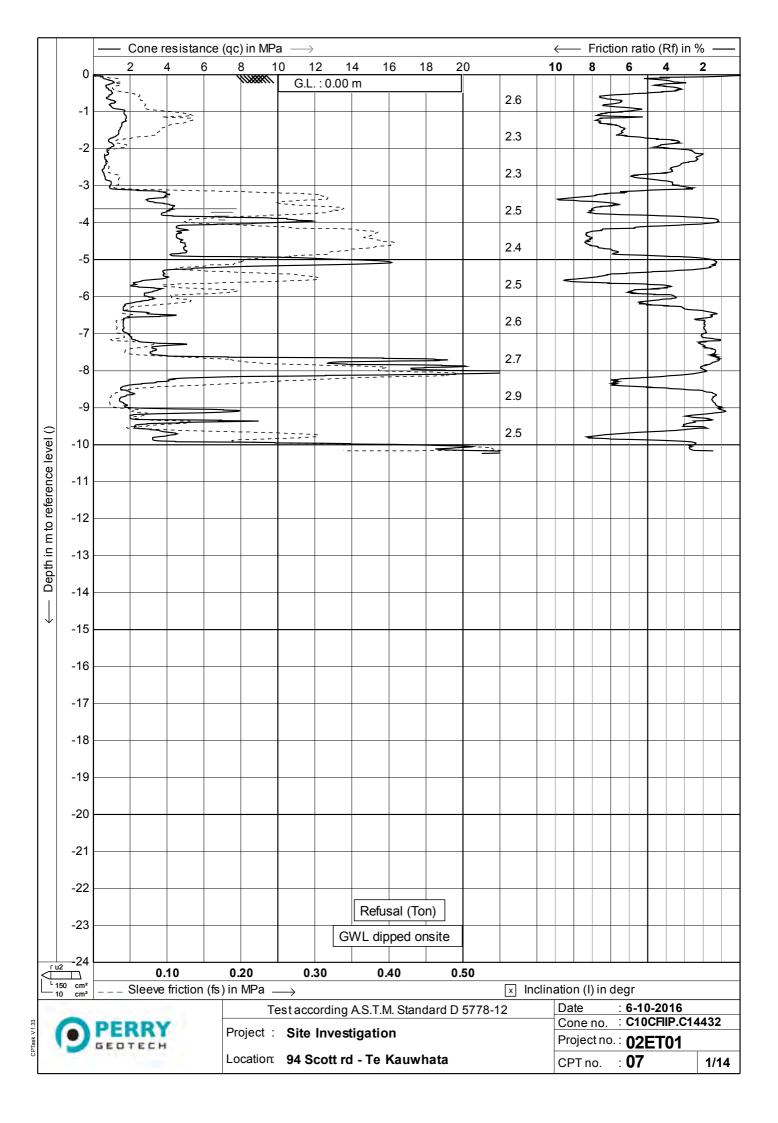


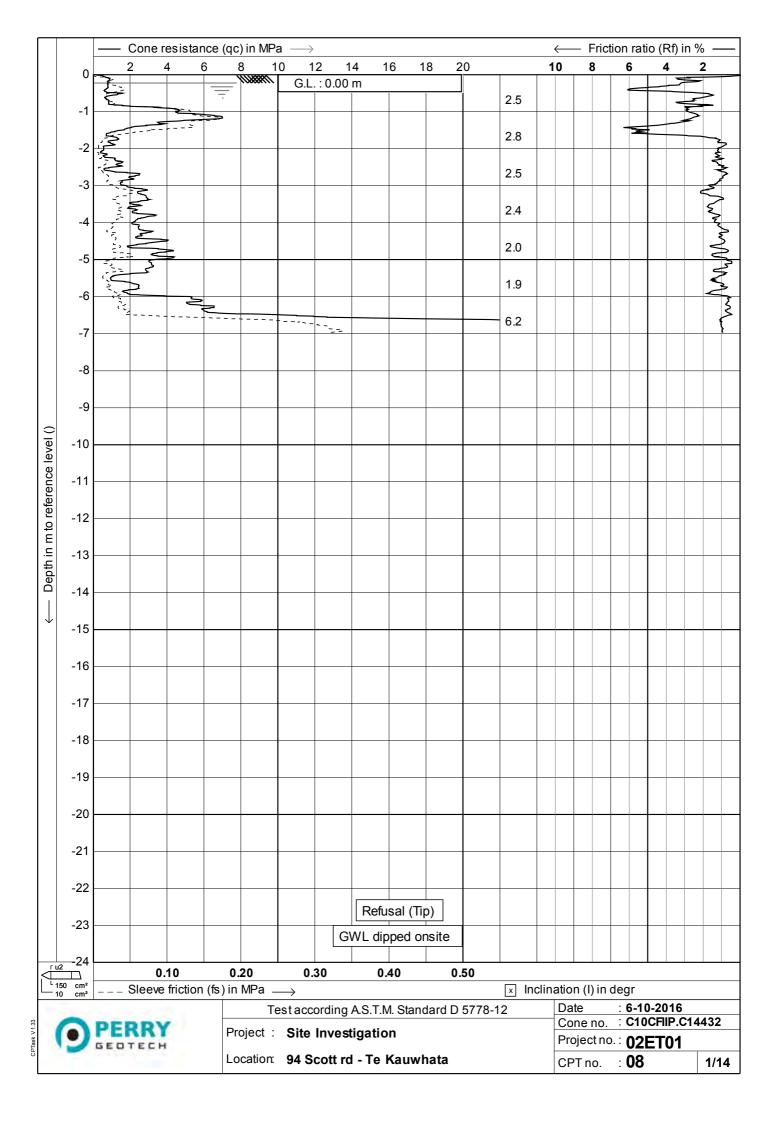
Remarks:	Logged By:	NH	Water Level Observations During Drilling				
	Date:		Date	Time	Depth	Depth	Depth
	Checked By:	NH	Date	Tille	of Hole	of Casing	of Water
	Scale:						
	Hole Length:	15.45m					
	Core Boxes:						

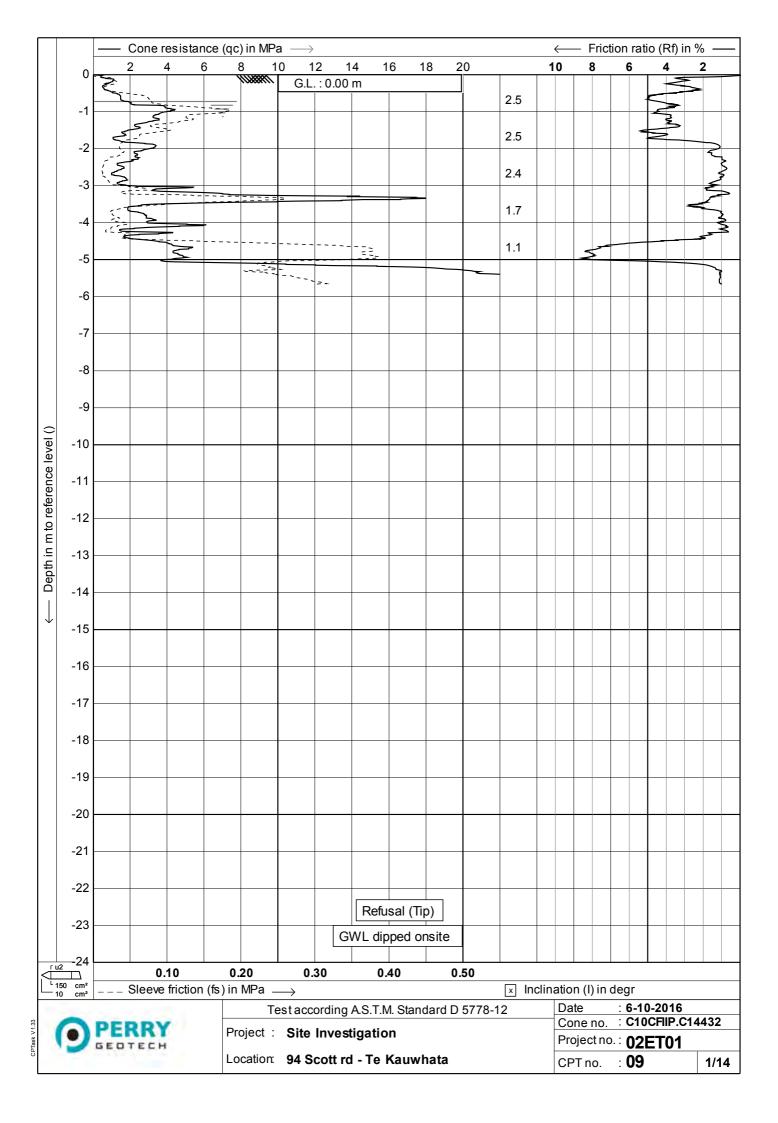


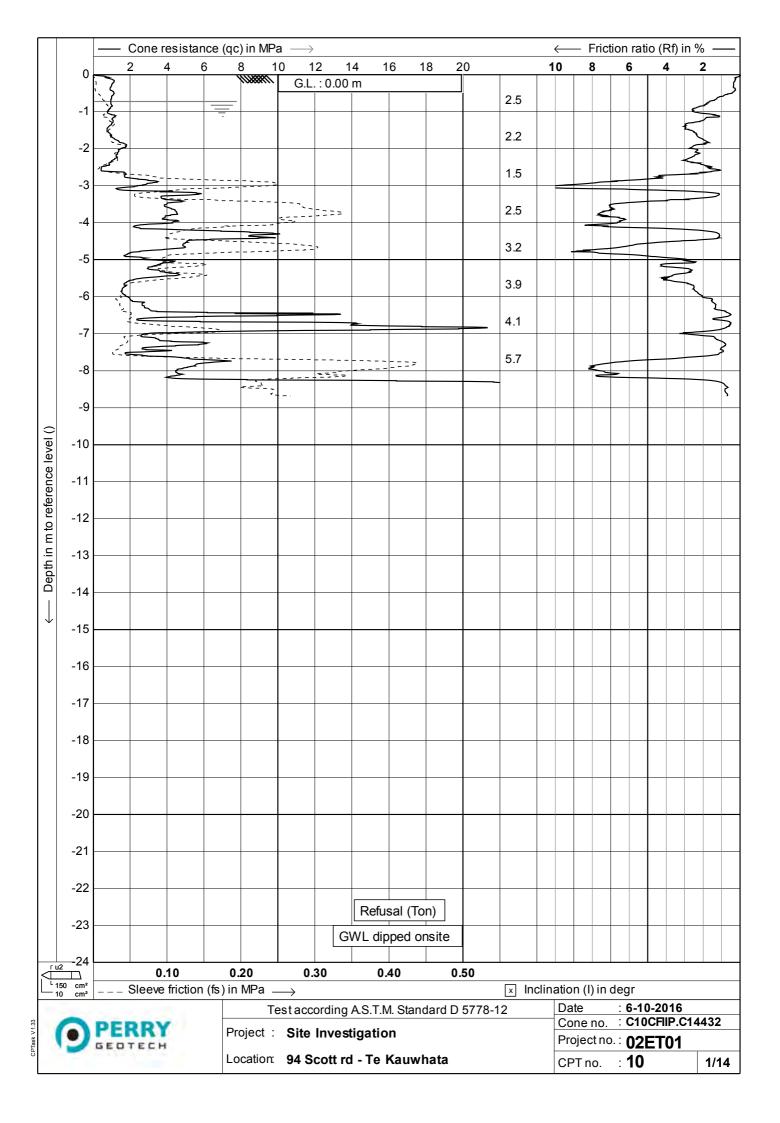


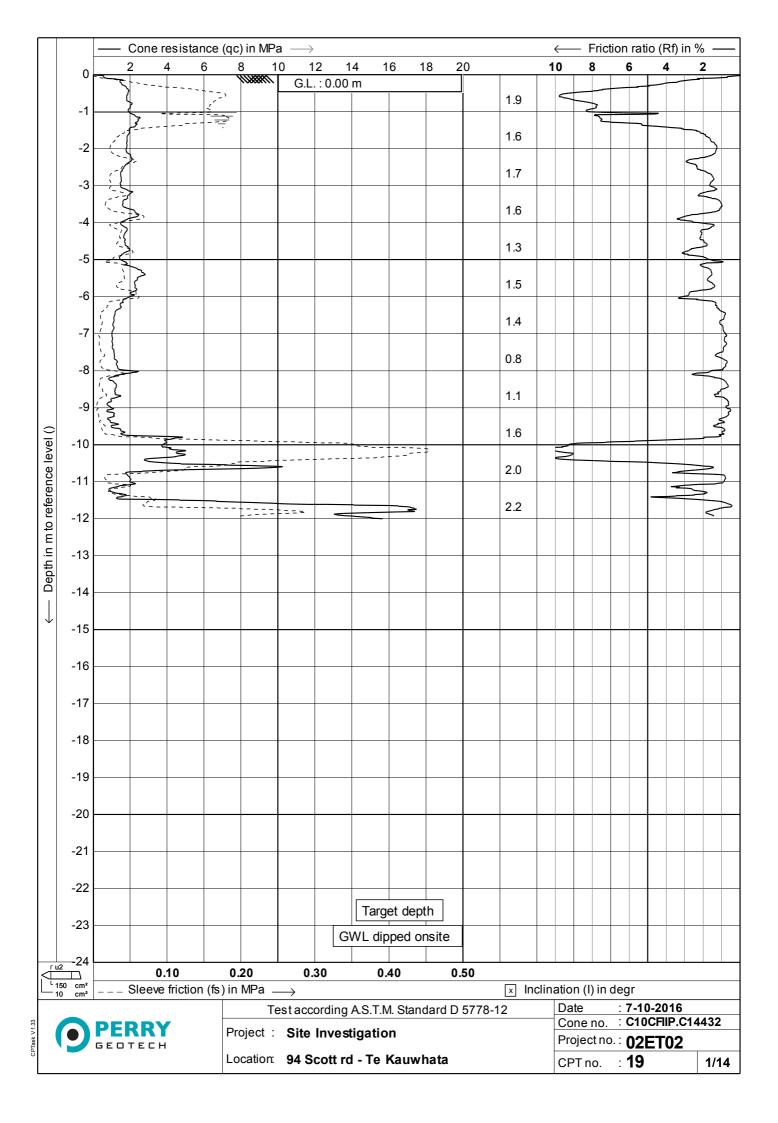


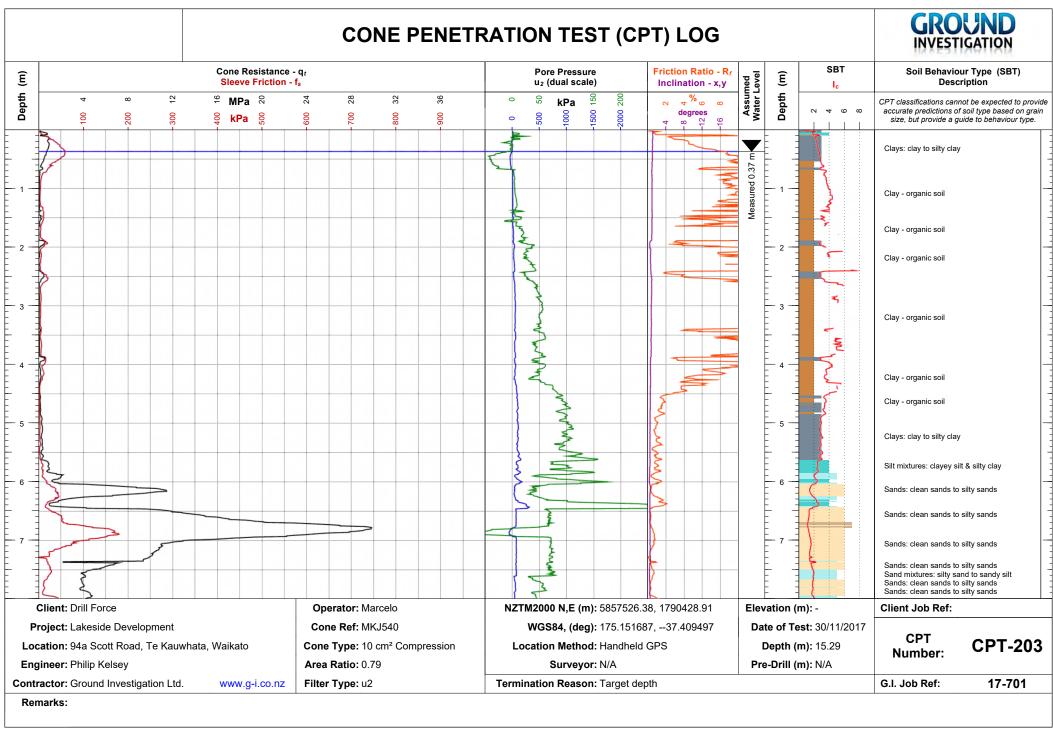


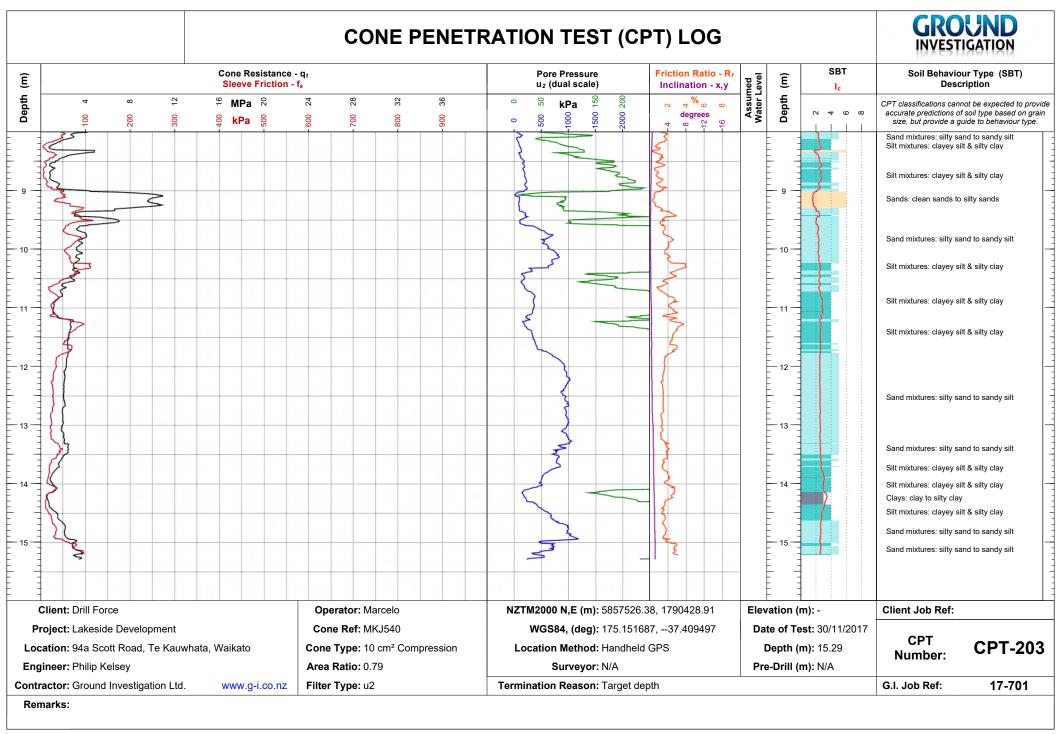


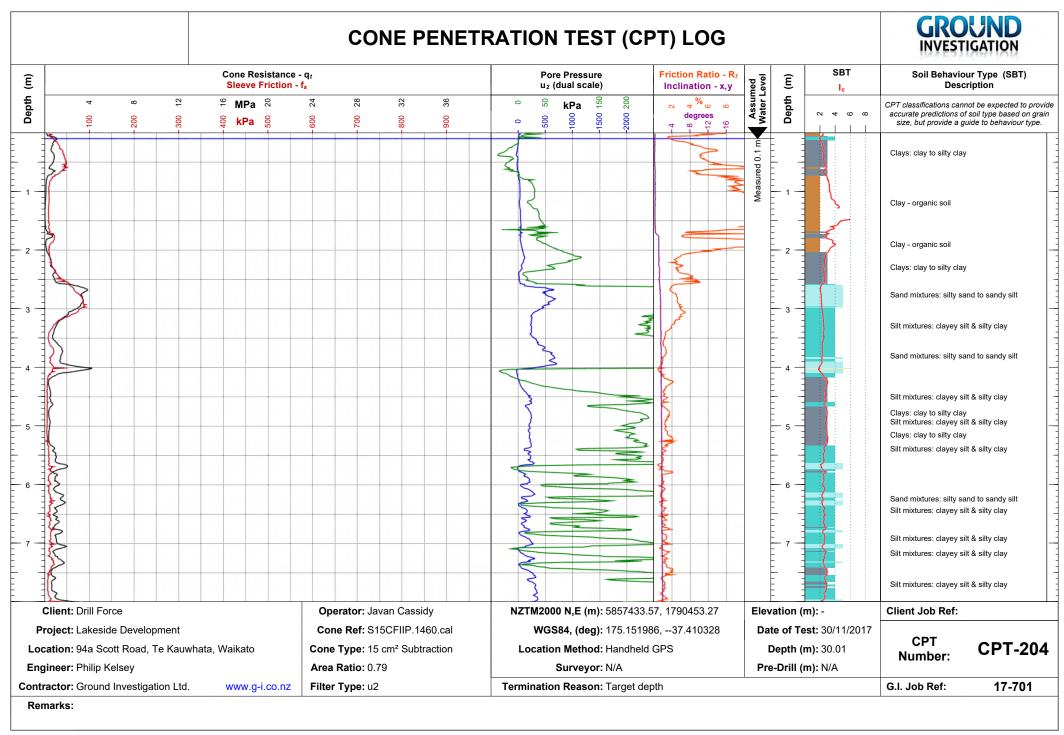


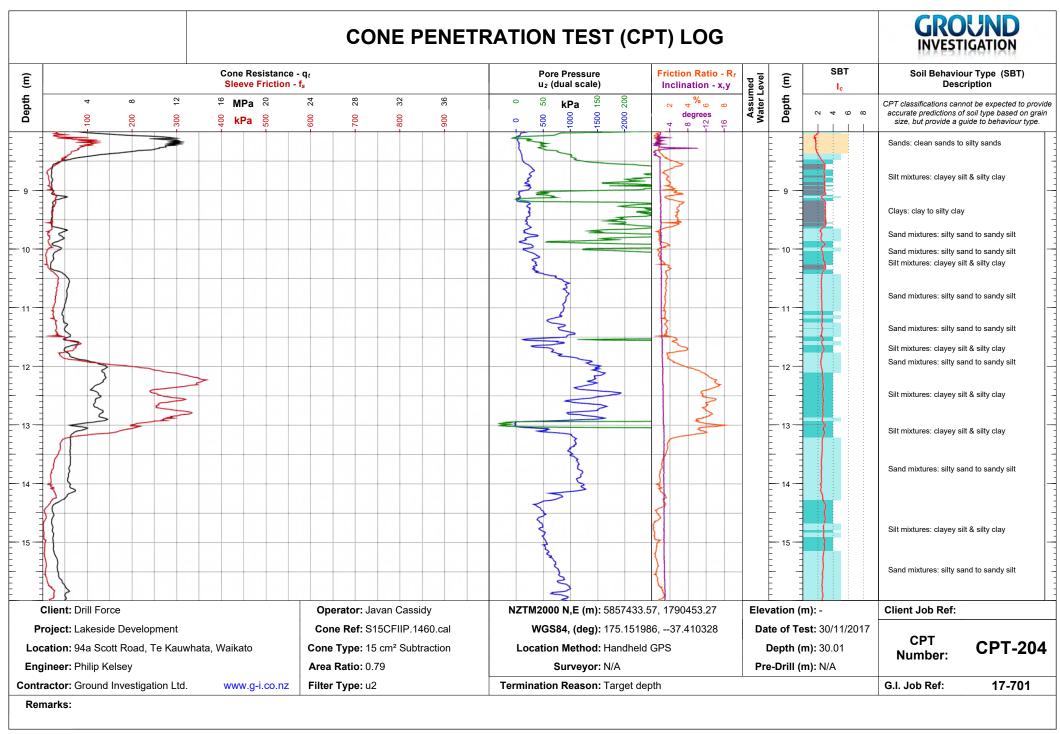


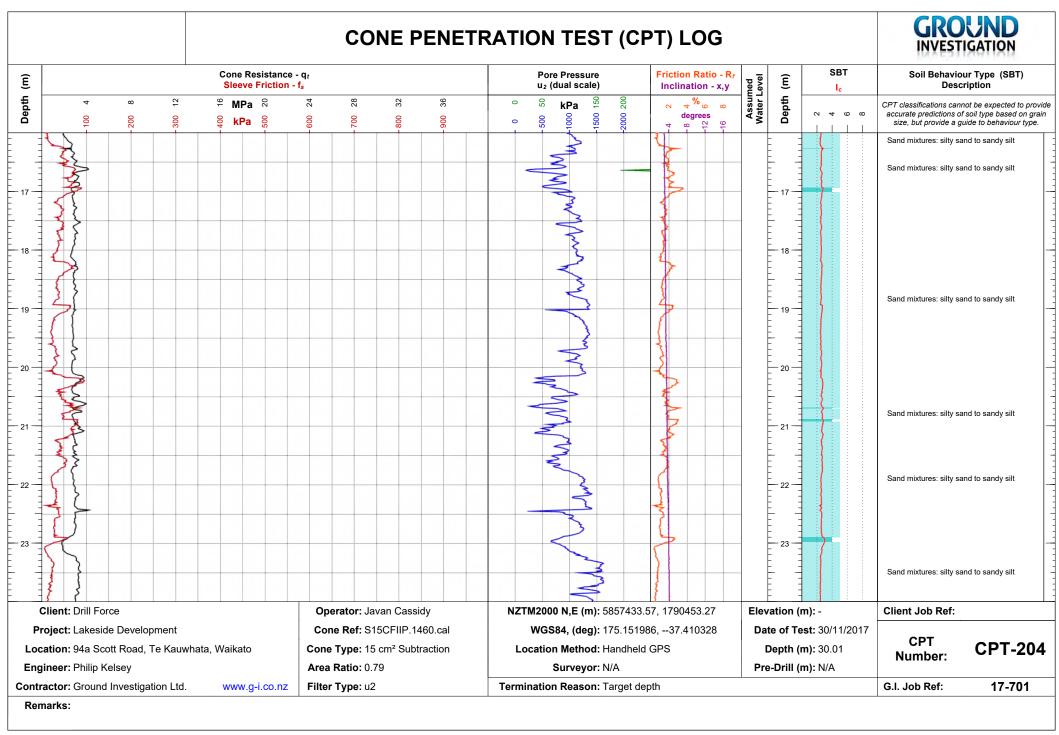


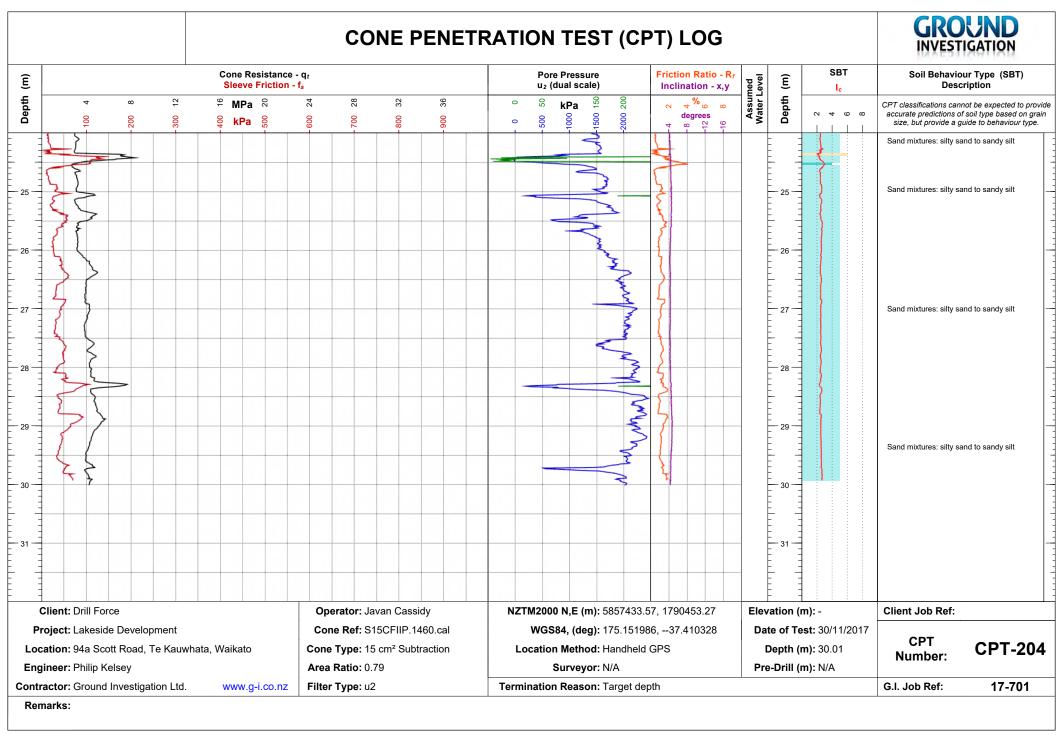


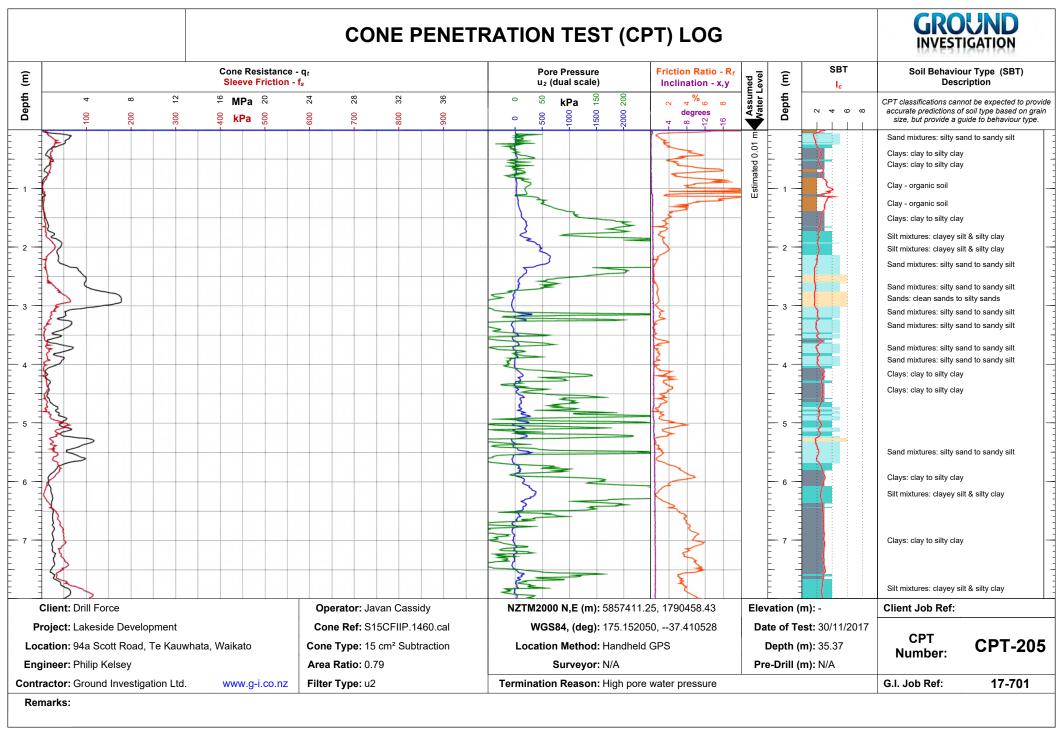


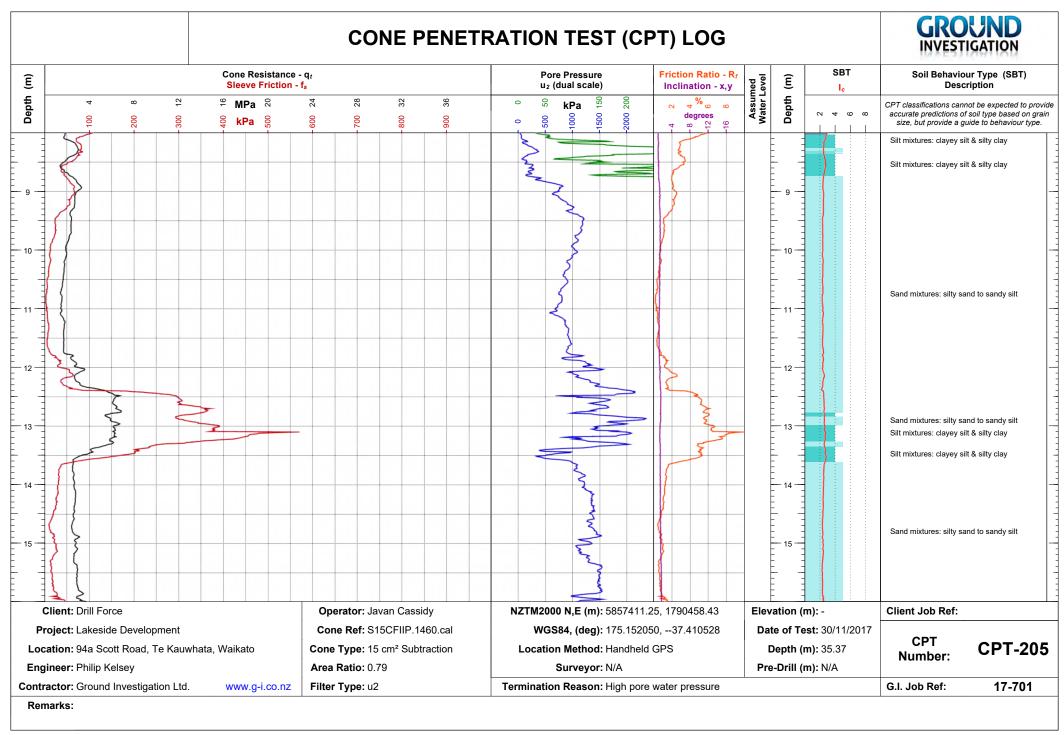


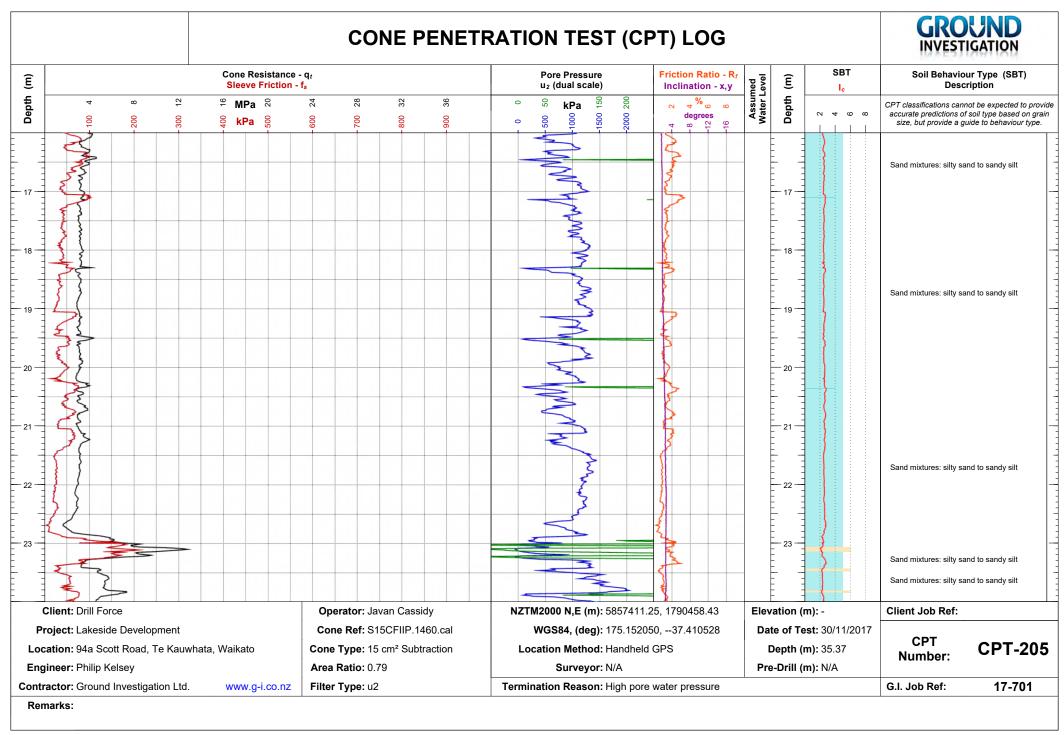


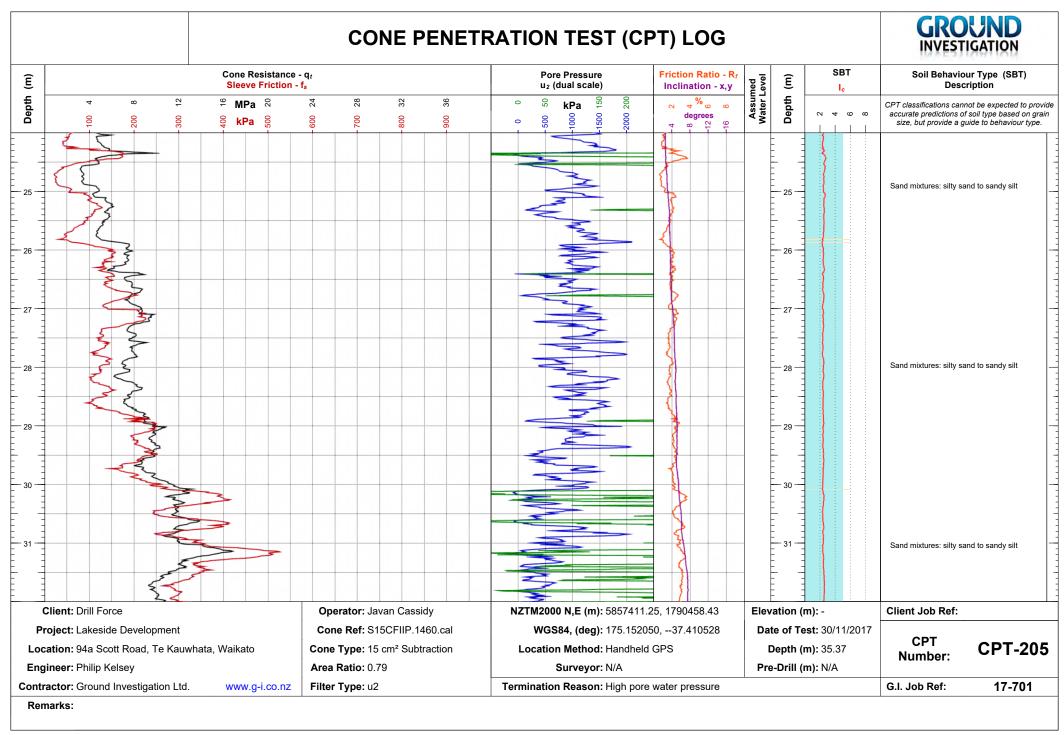


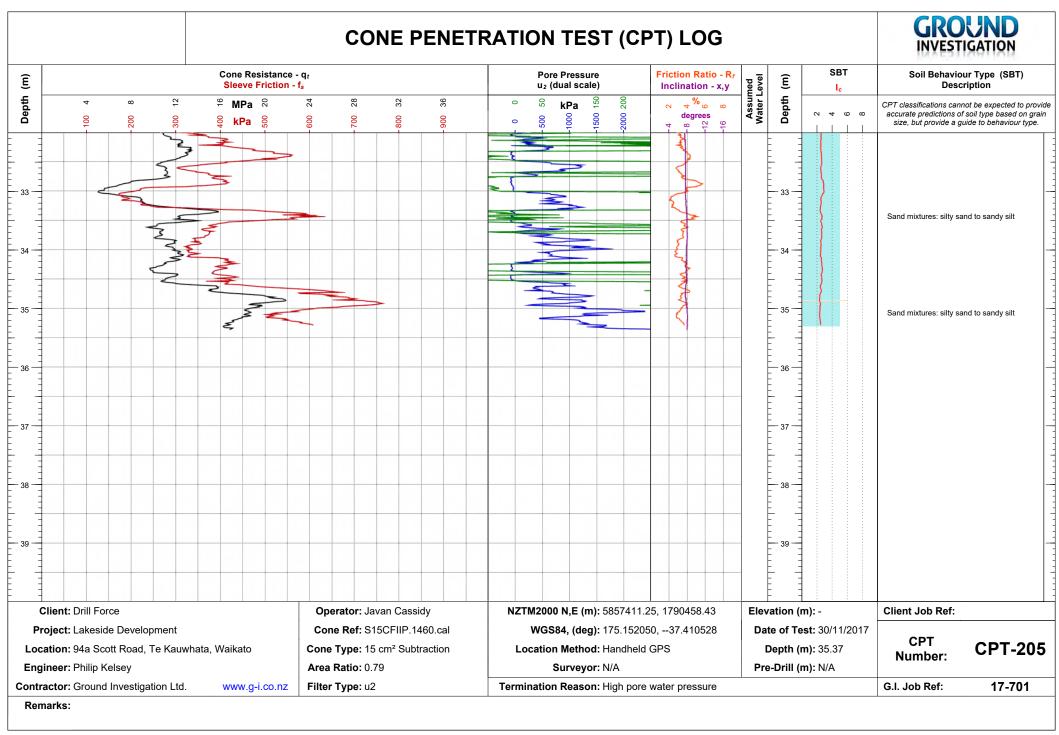


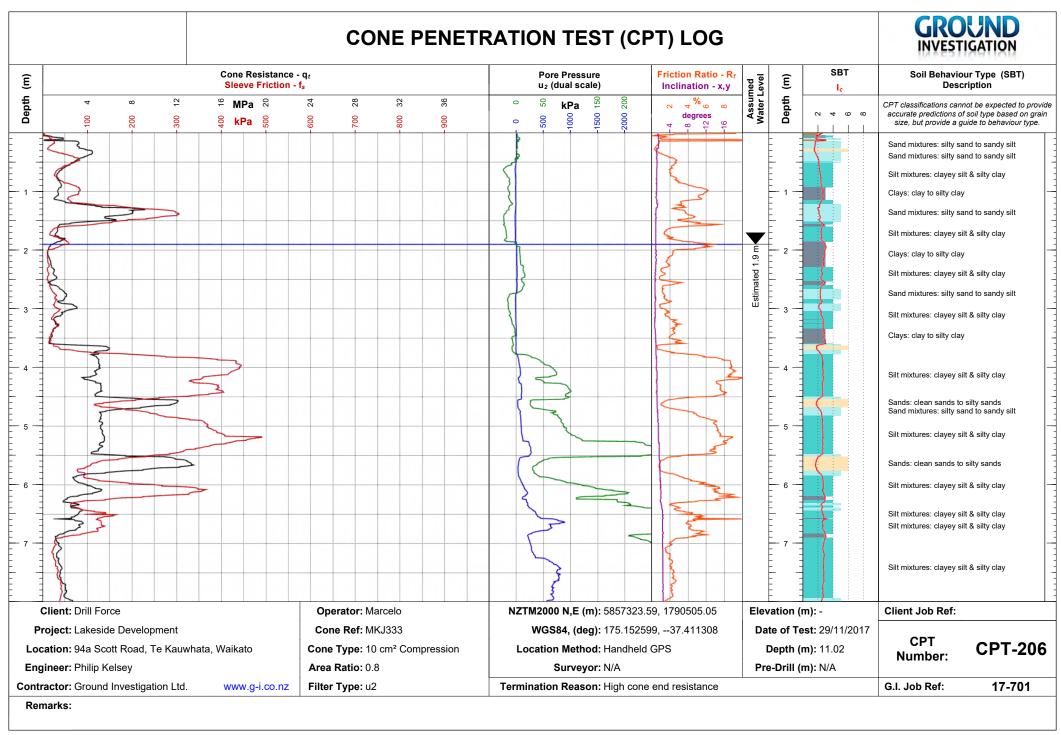


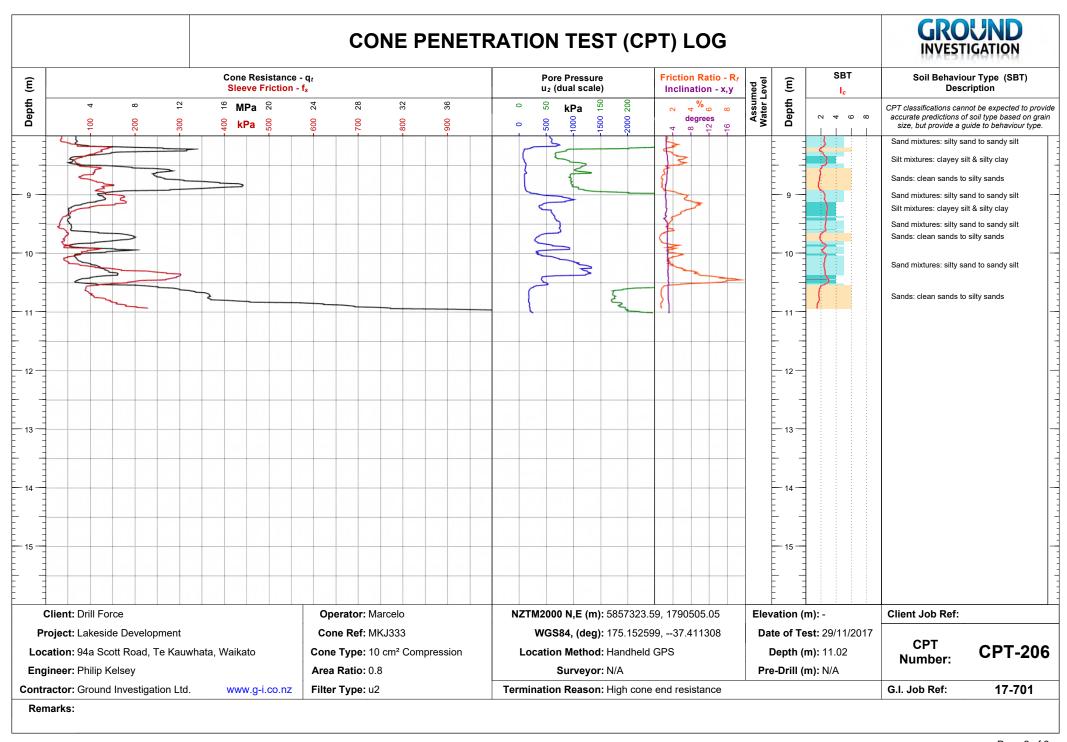


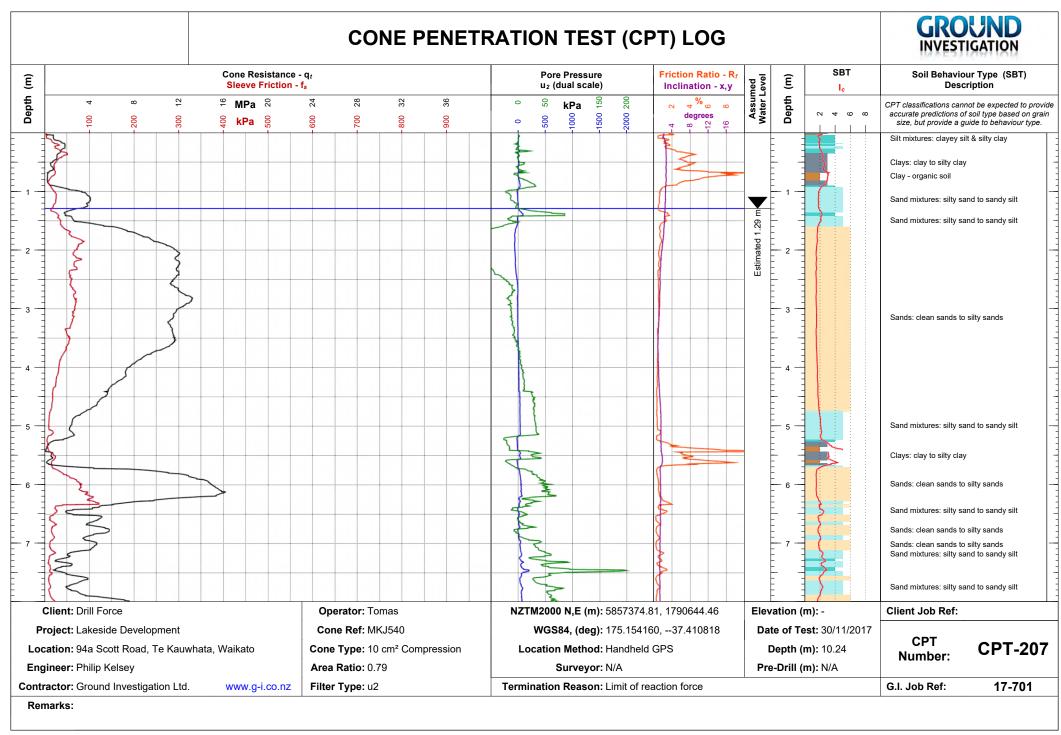


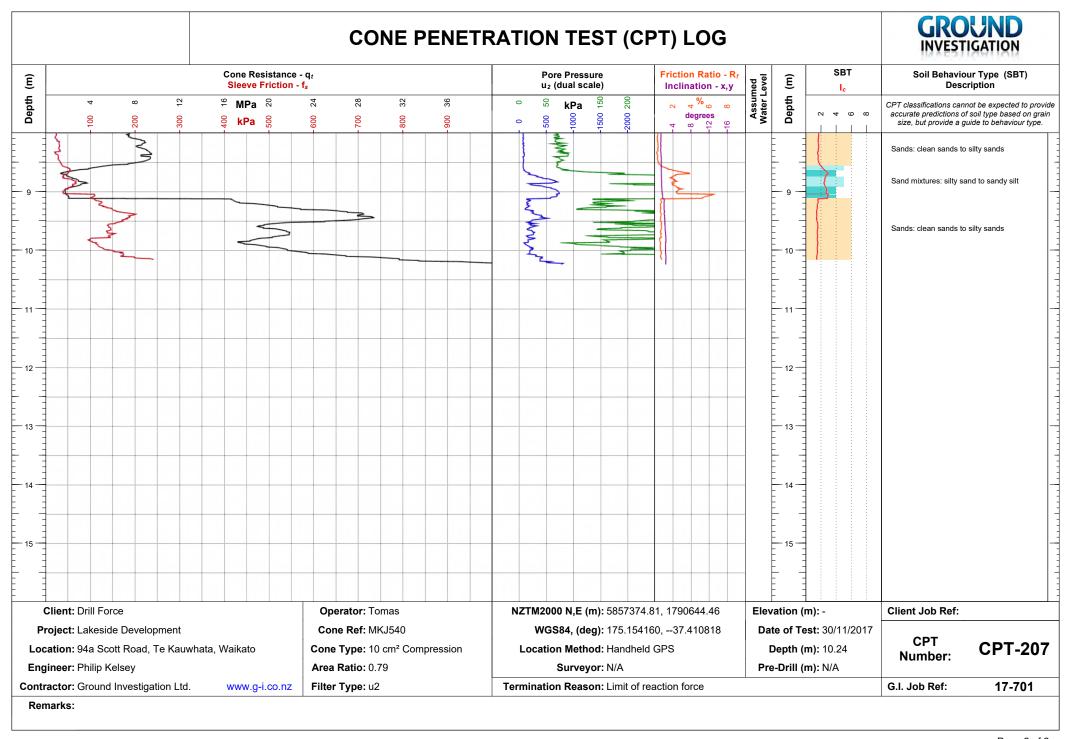


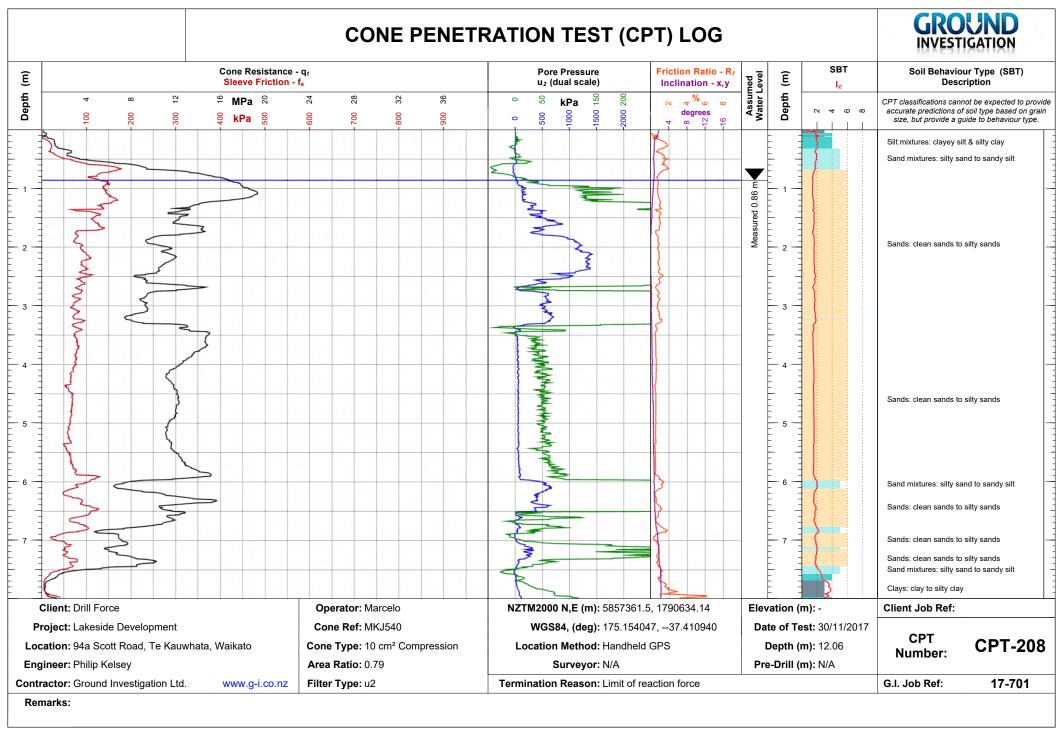


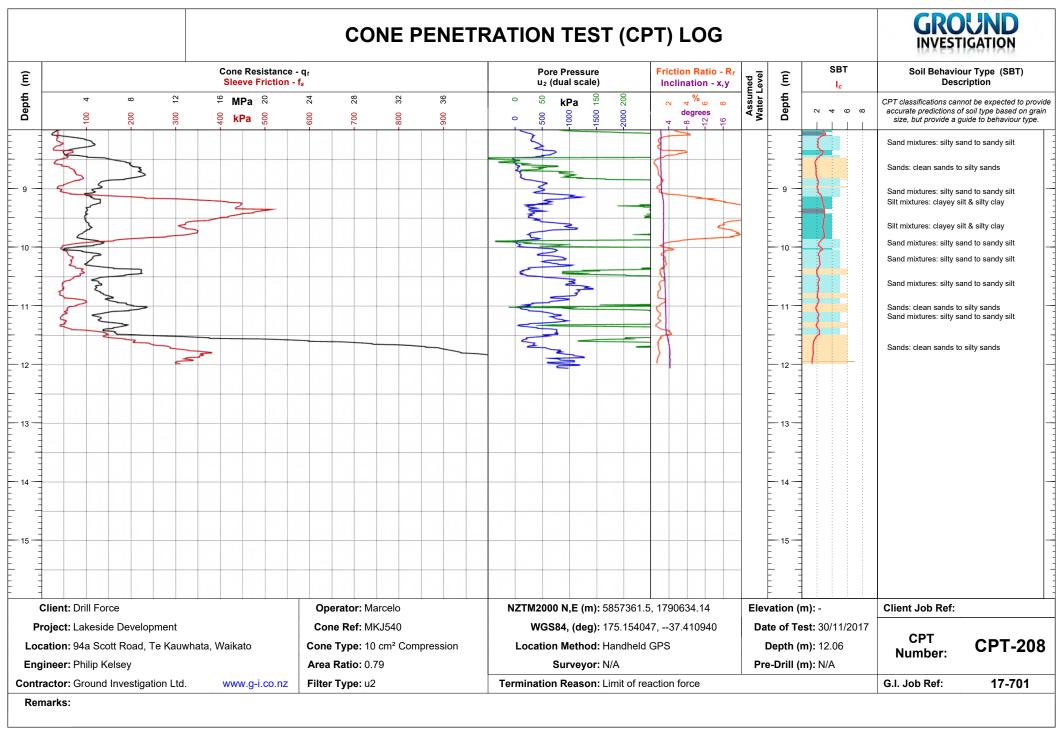


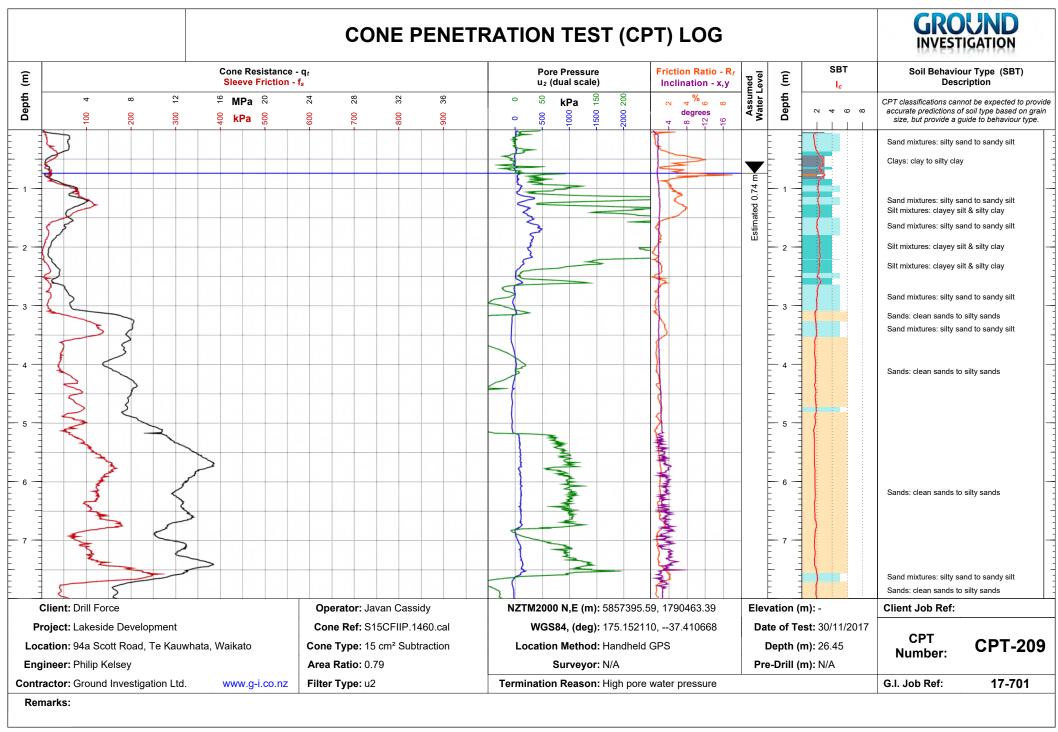


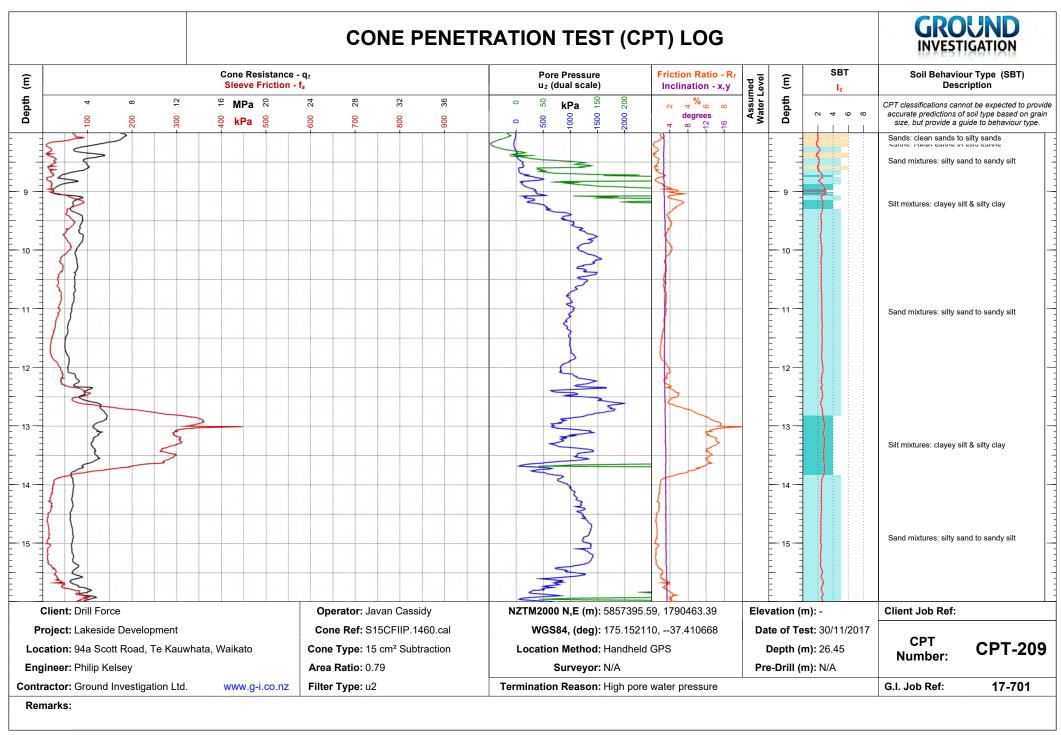


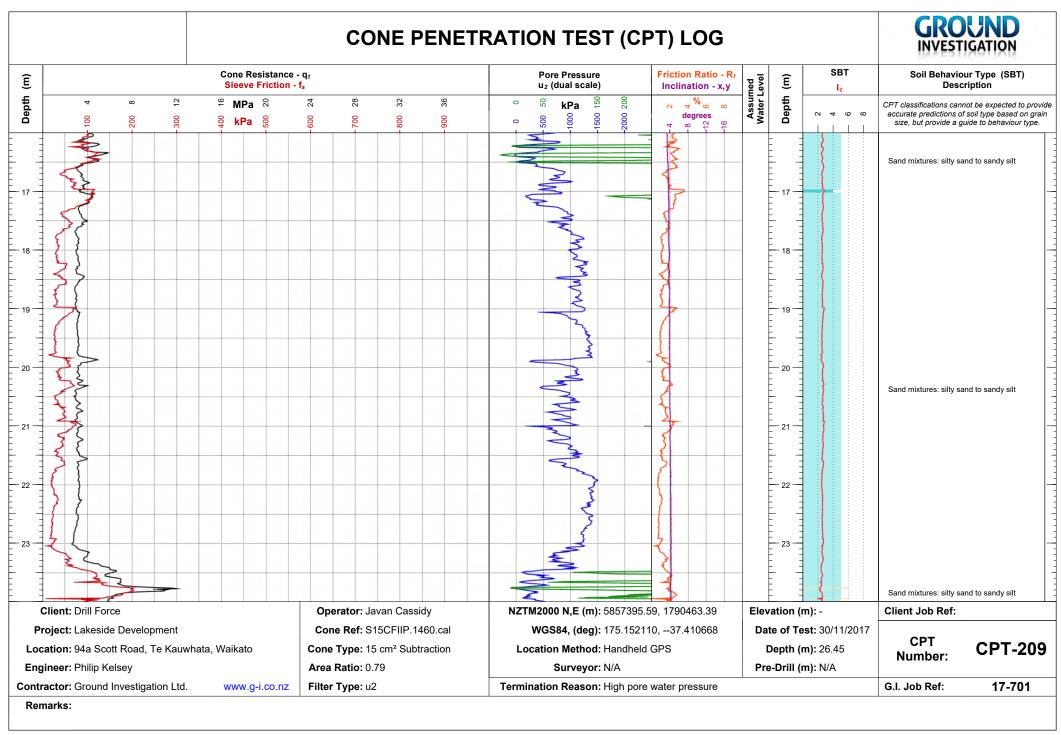


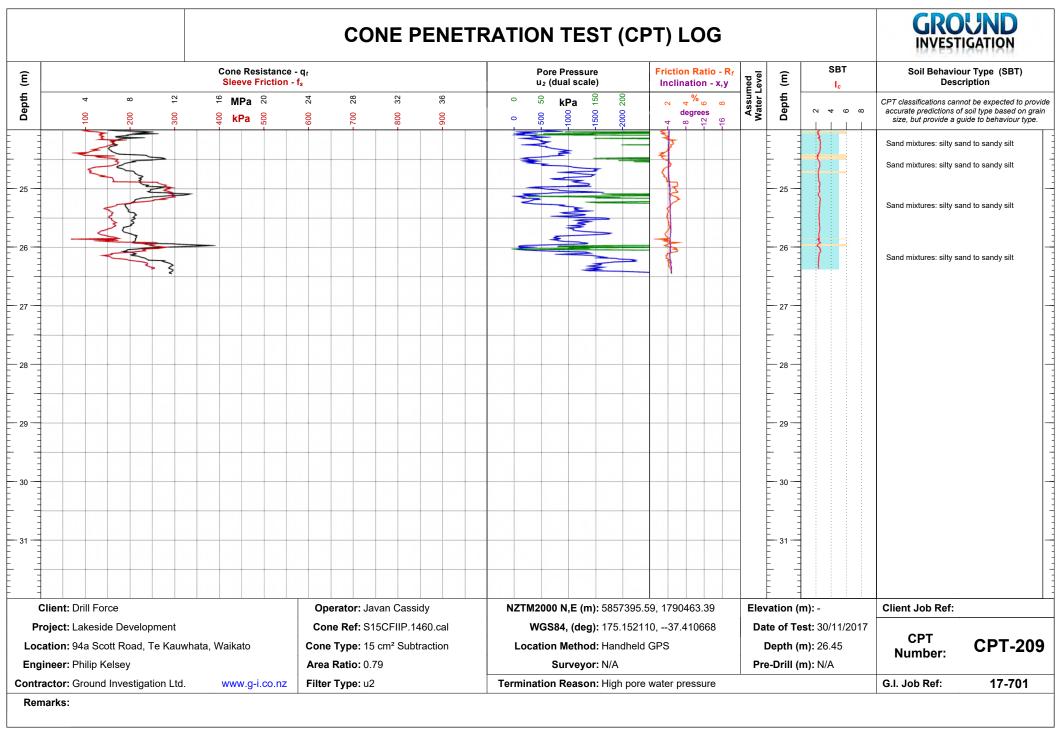


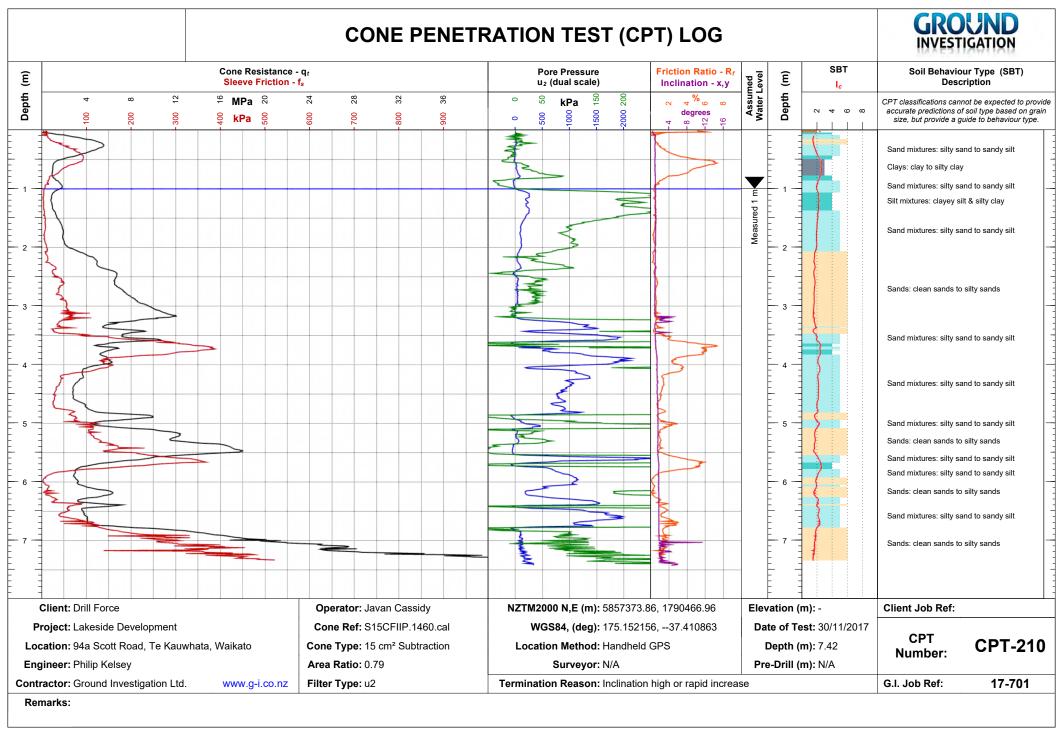


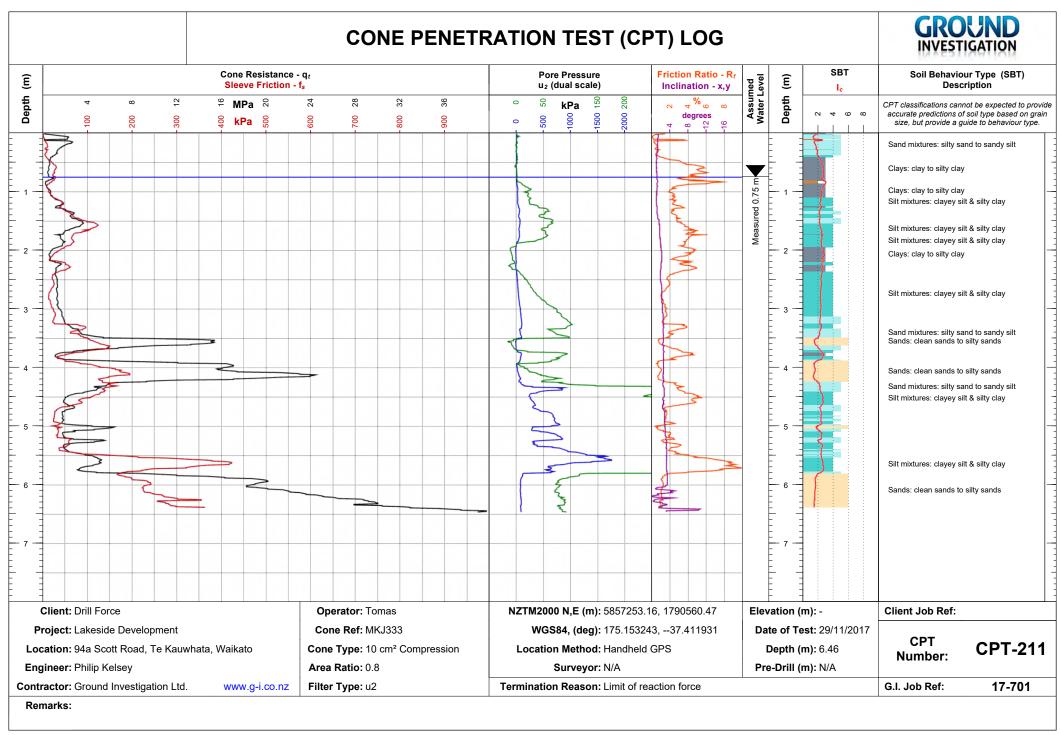


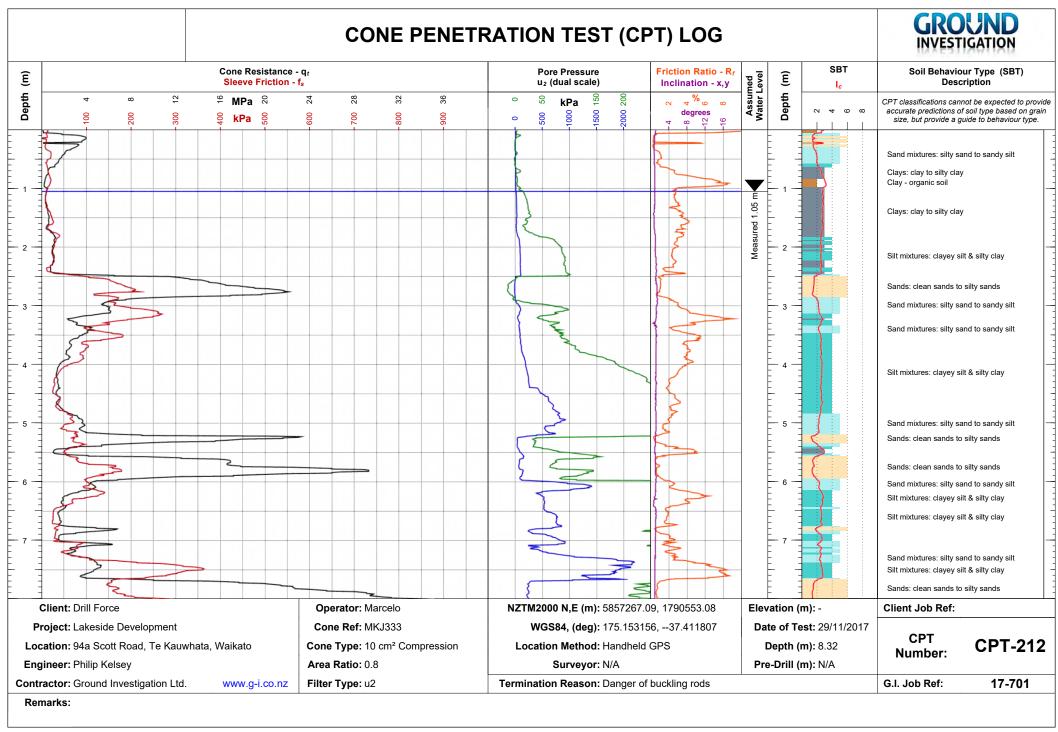


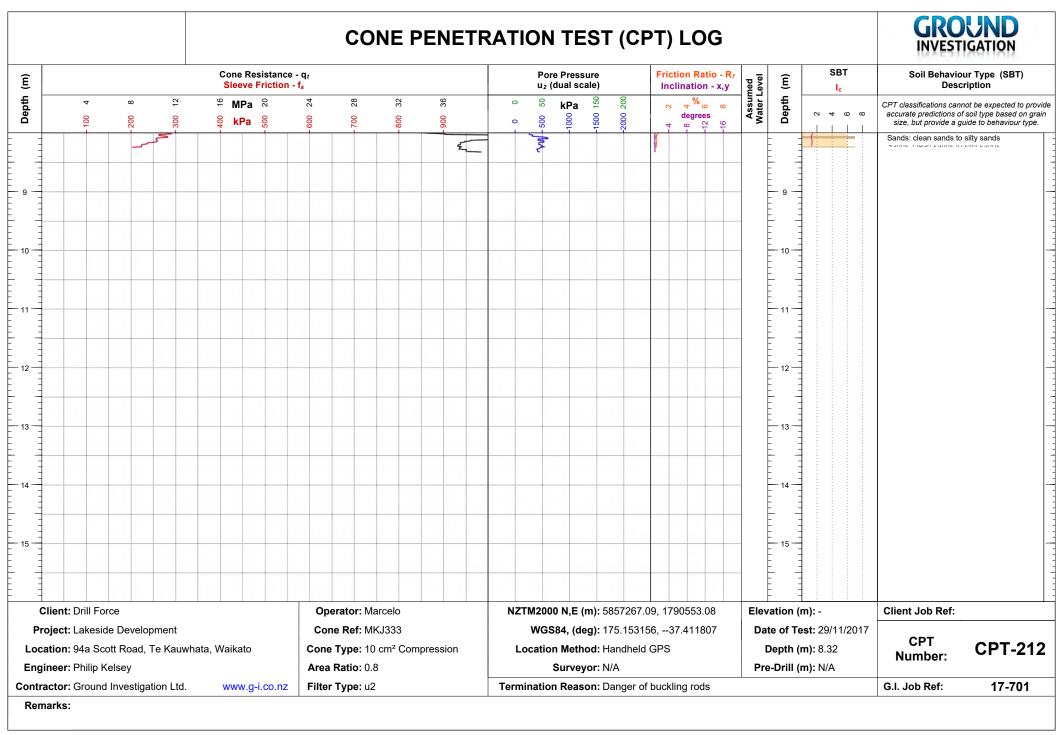


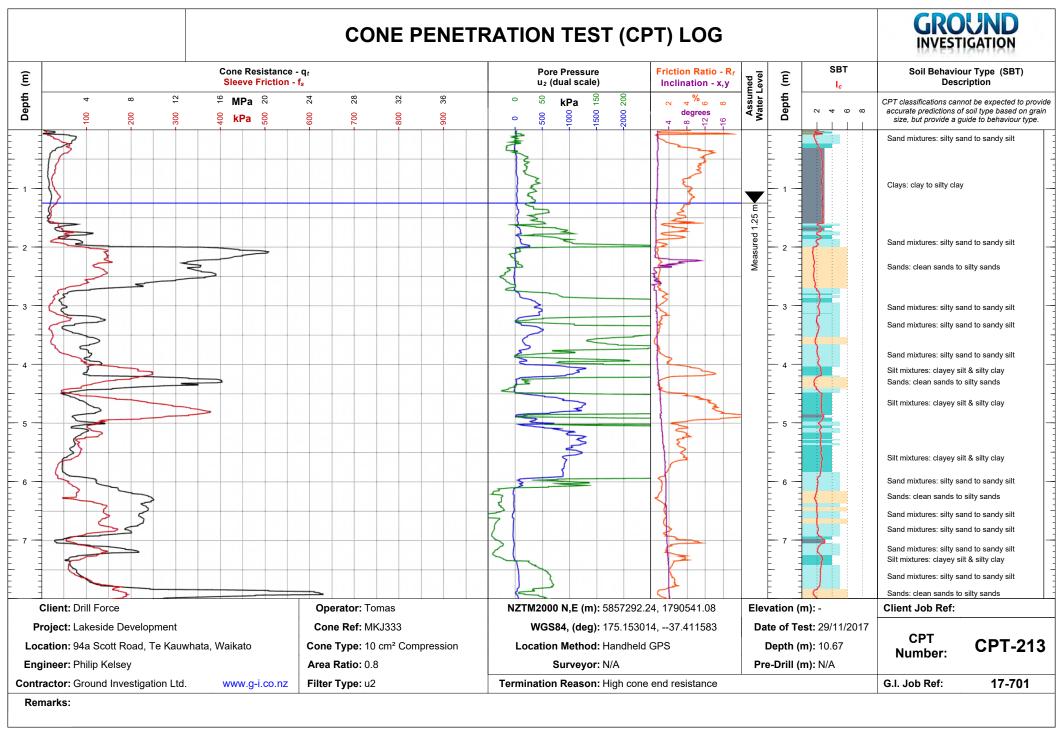


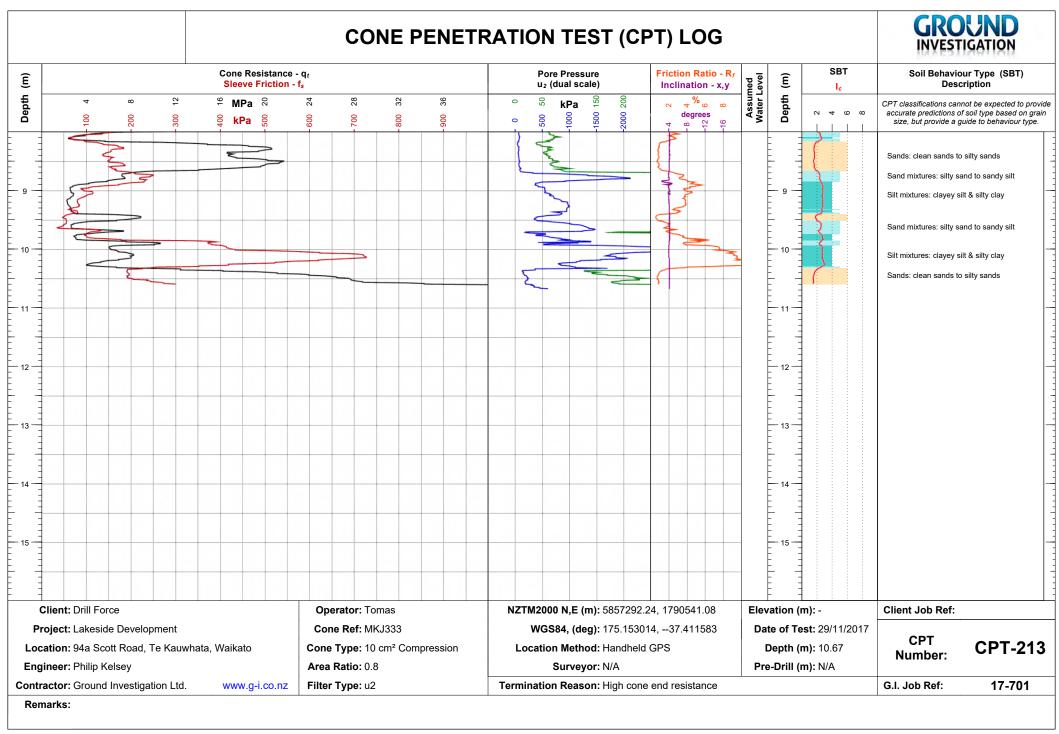


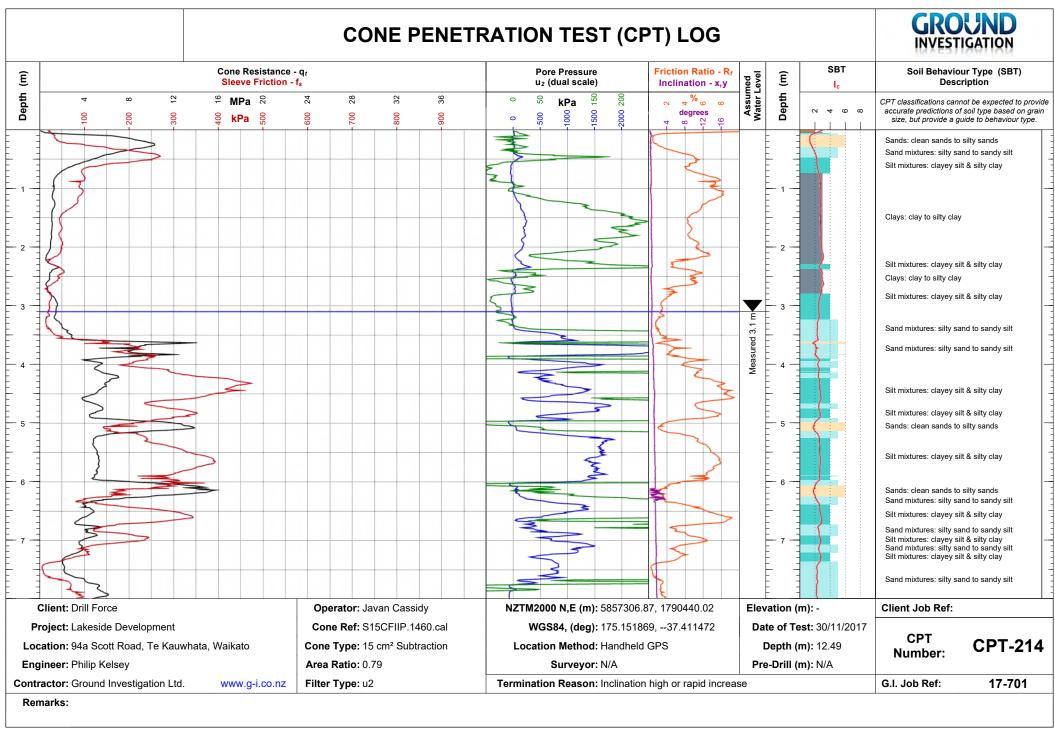


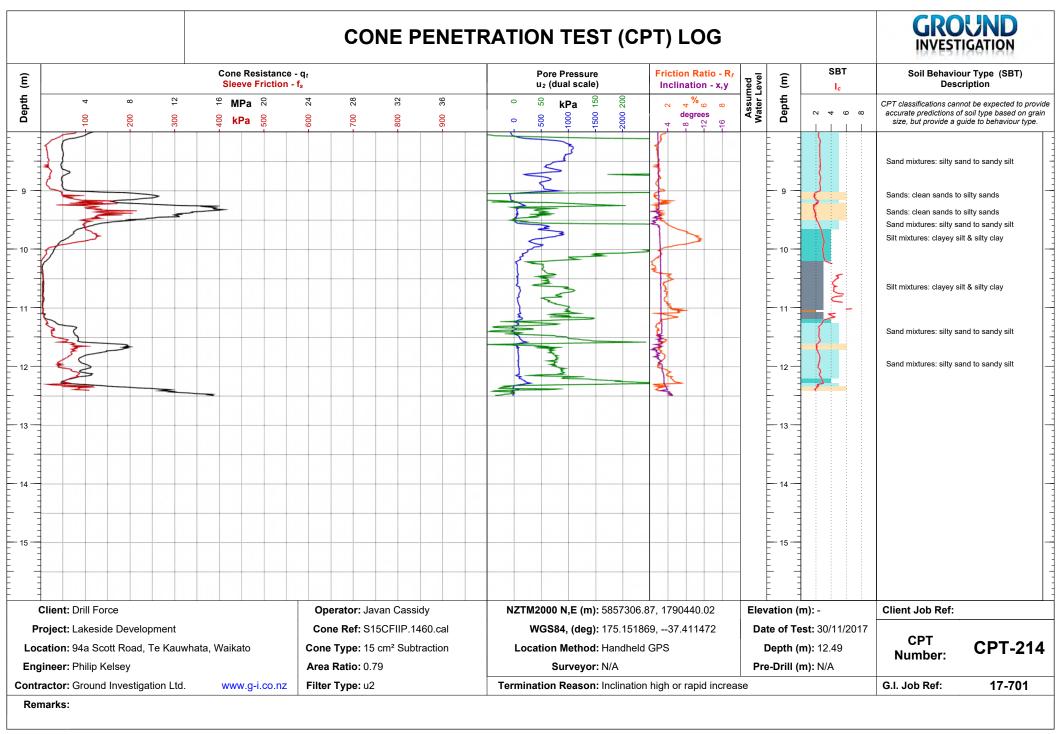


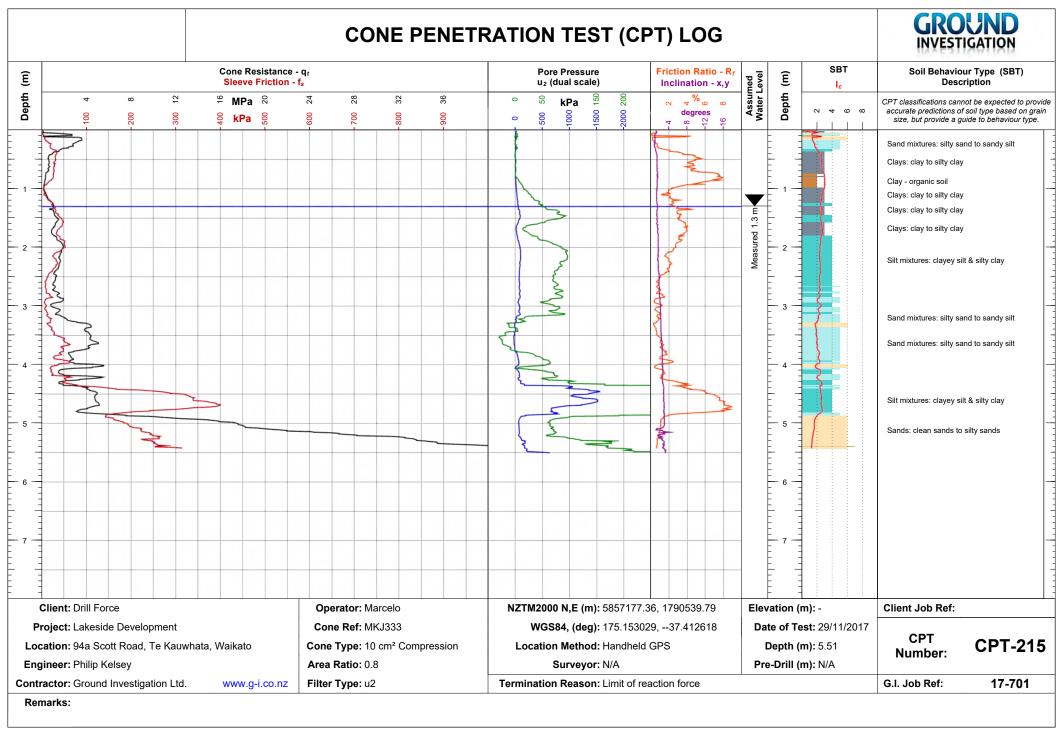


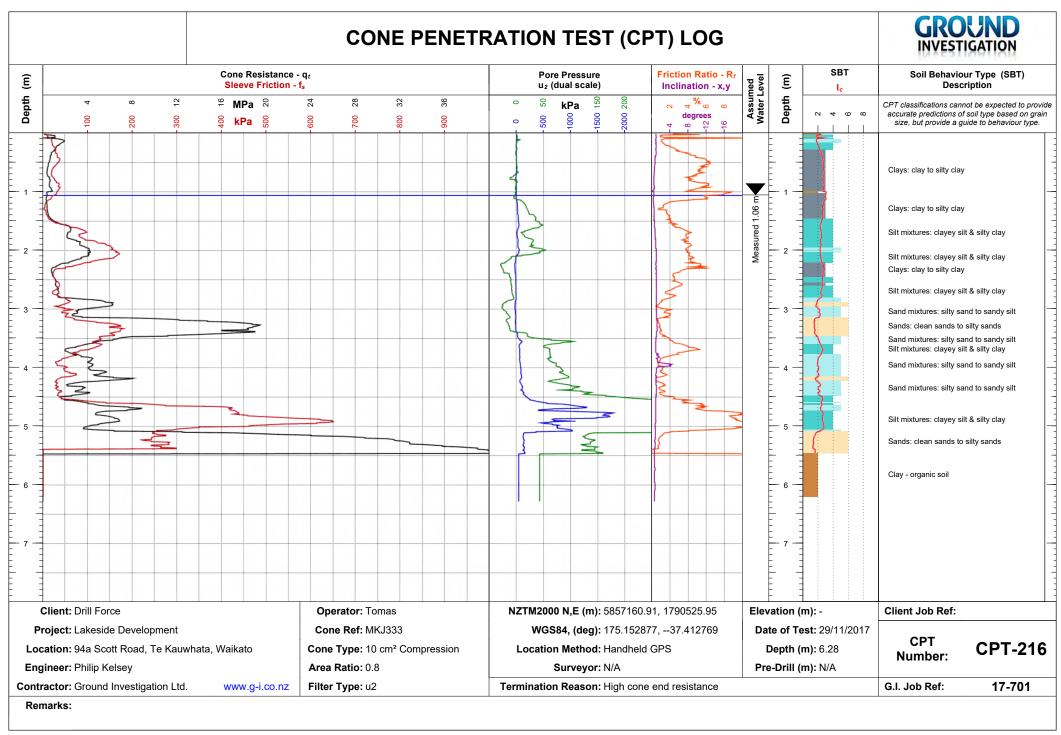


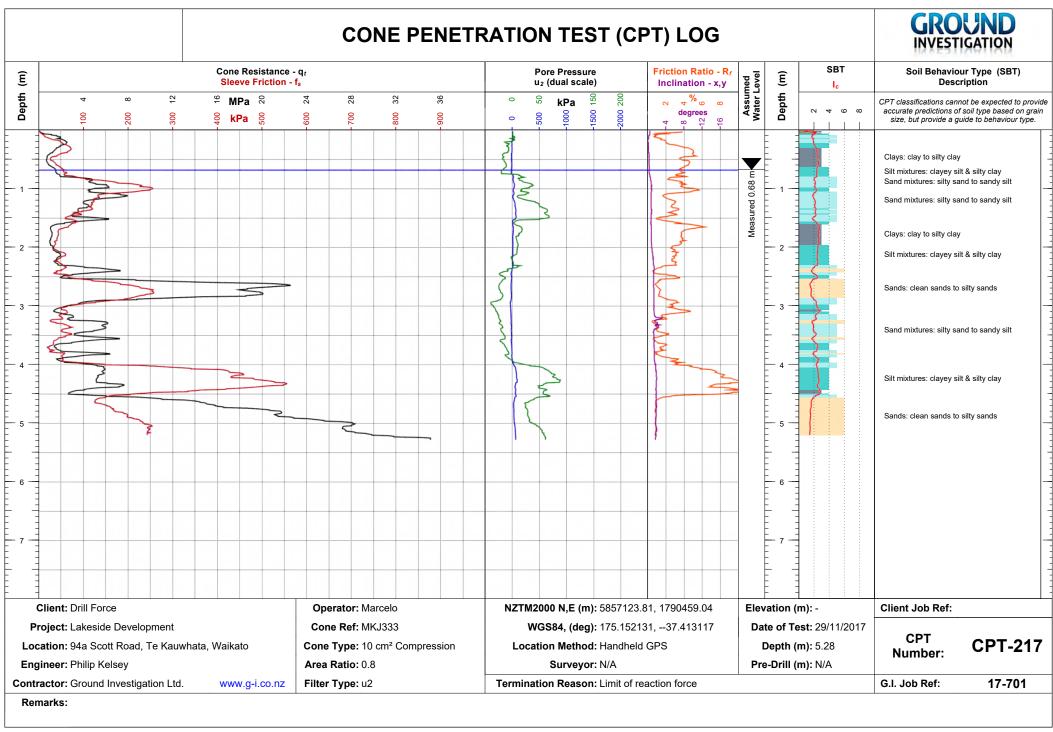


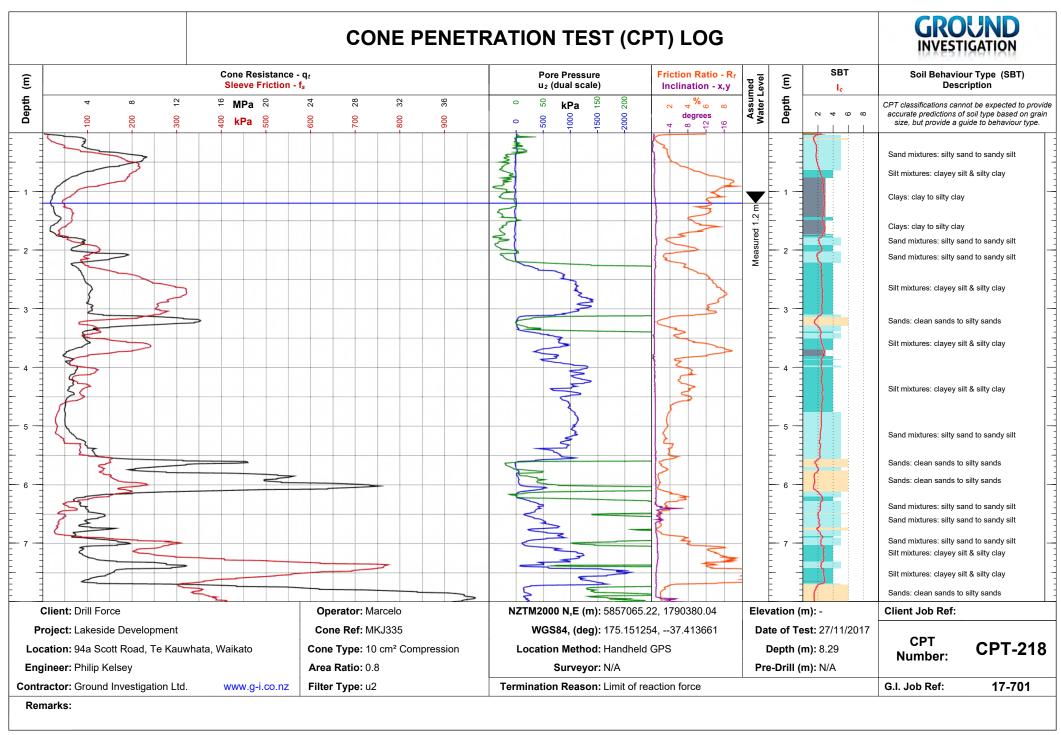


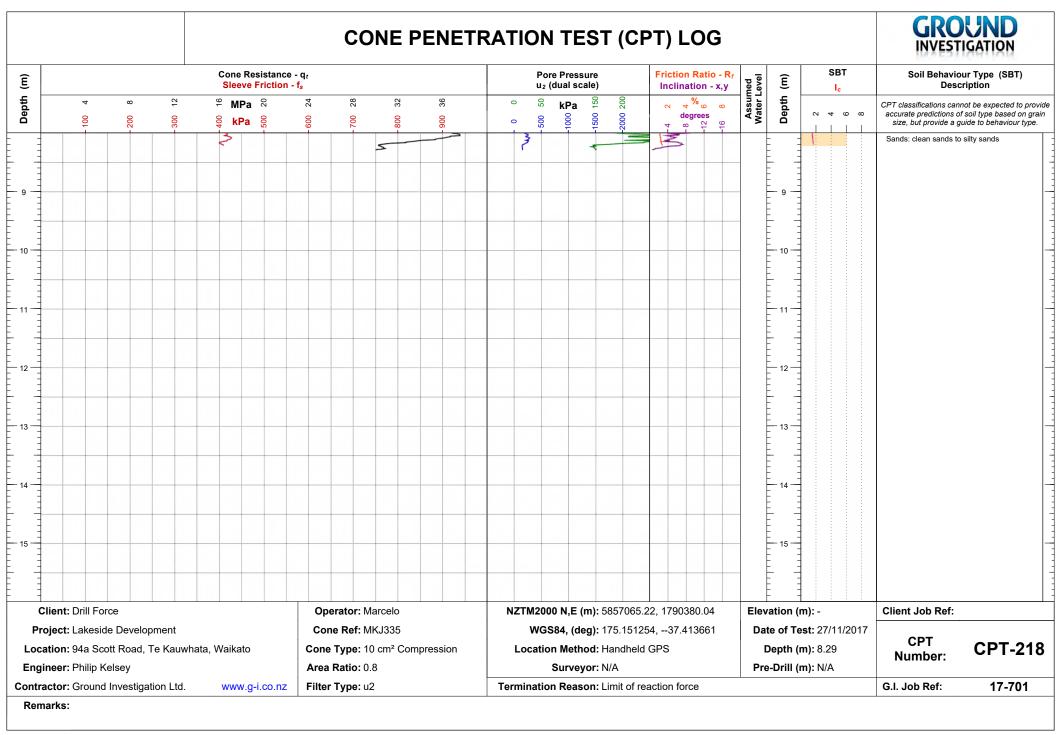


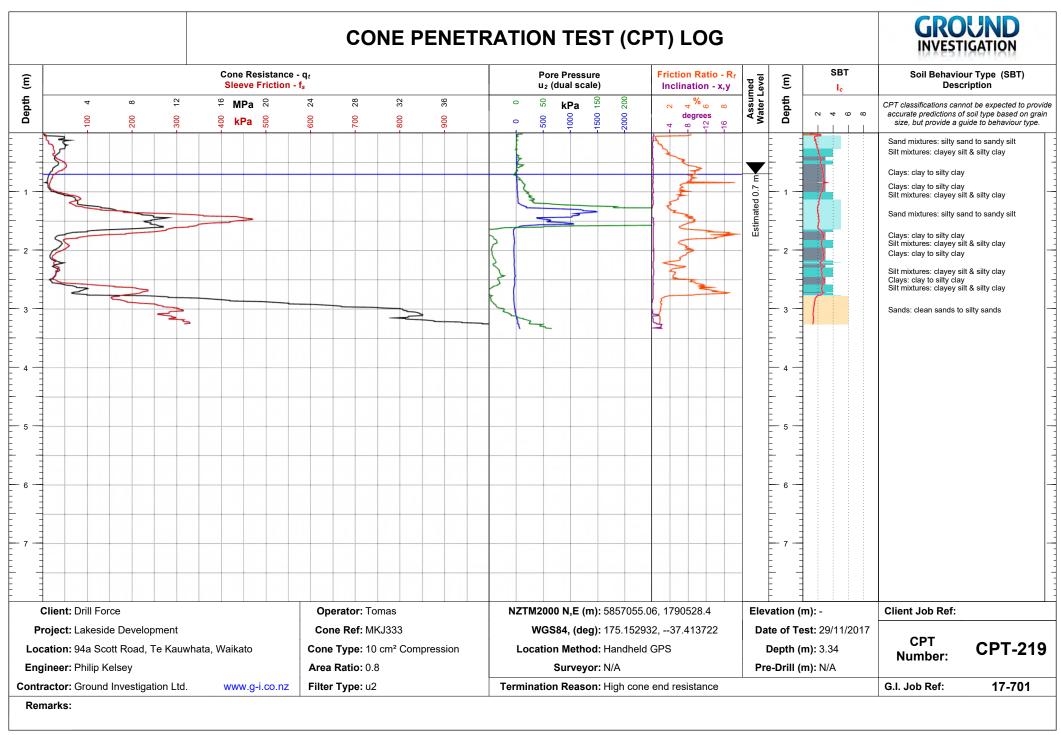


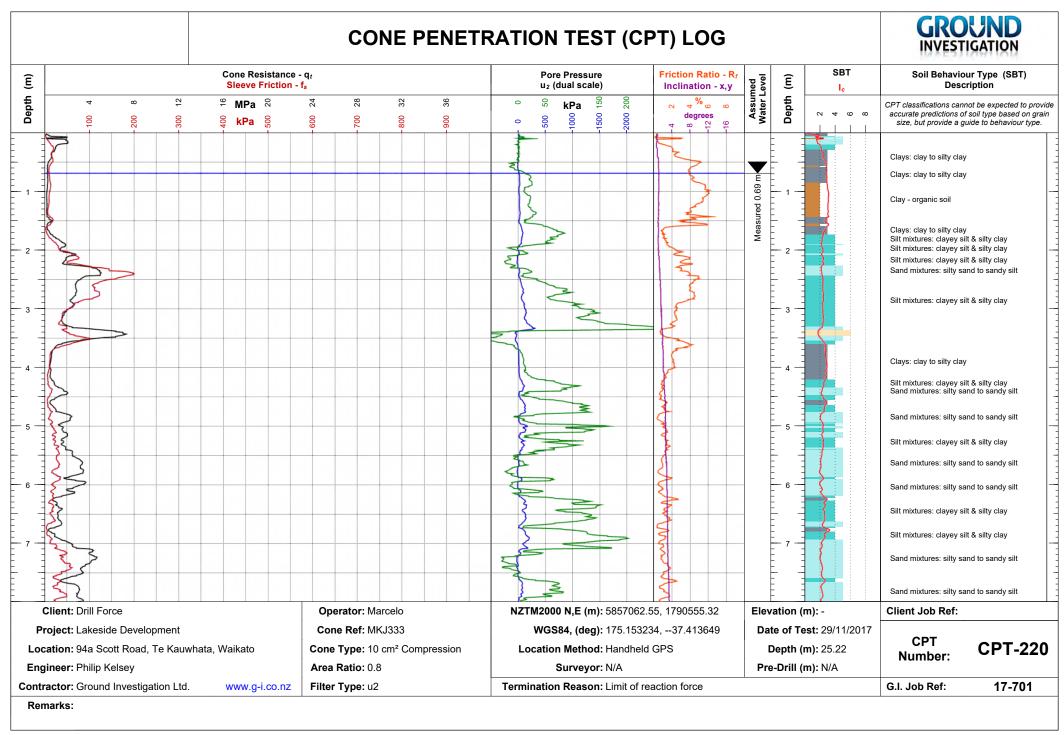


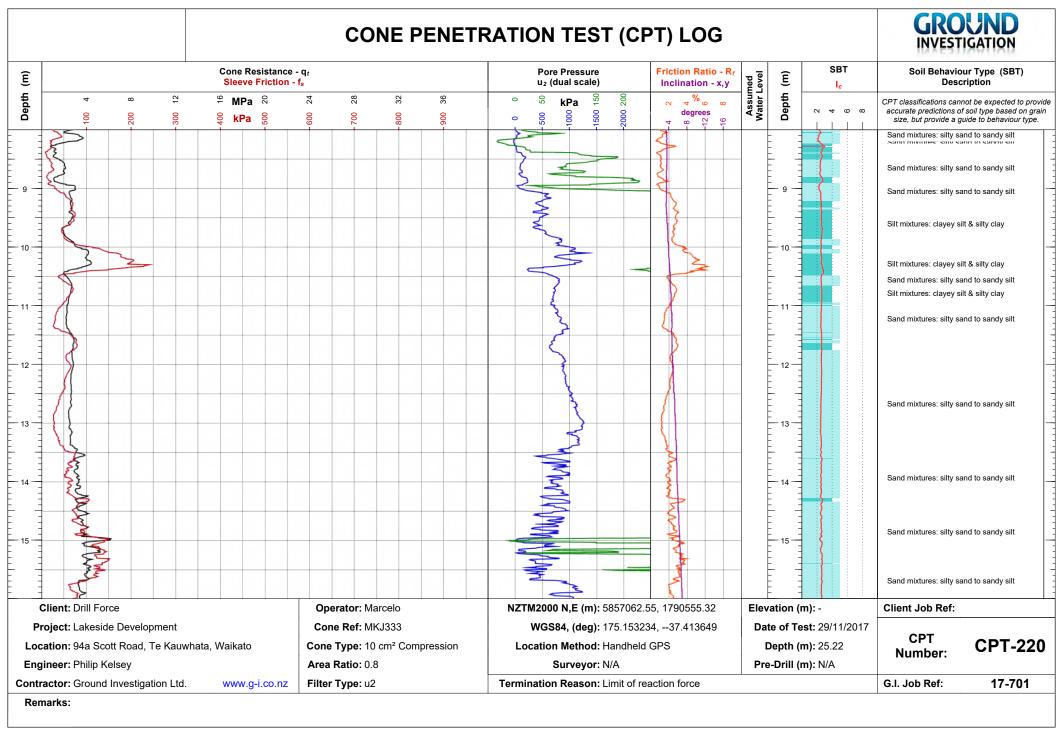


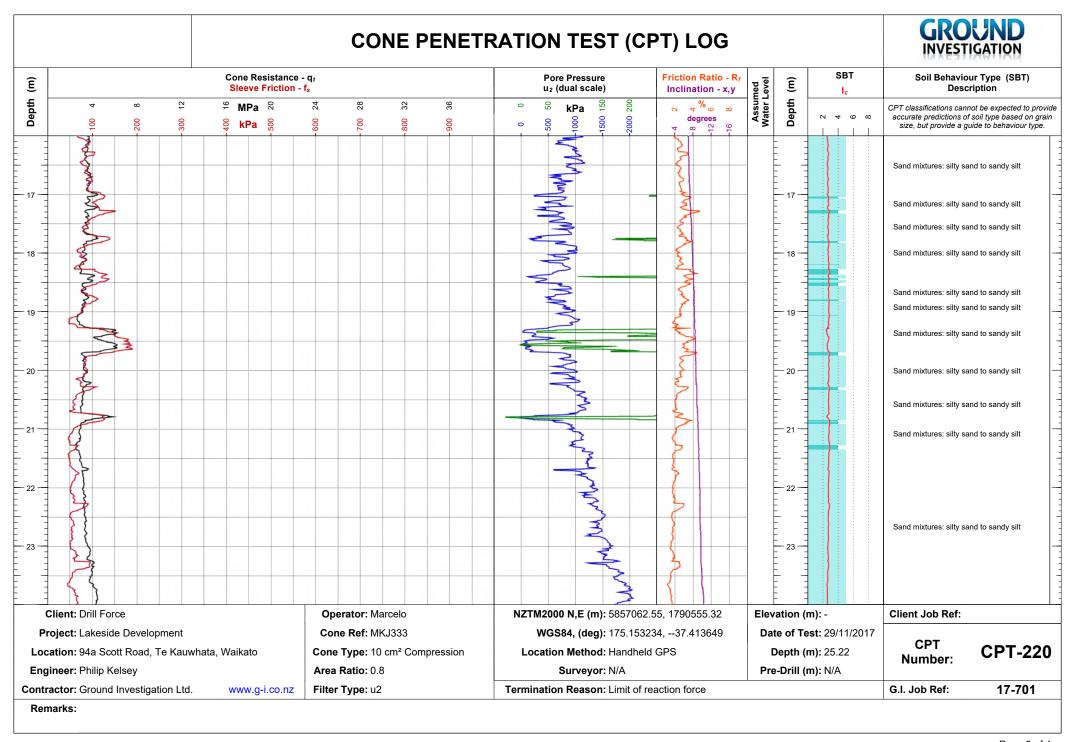


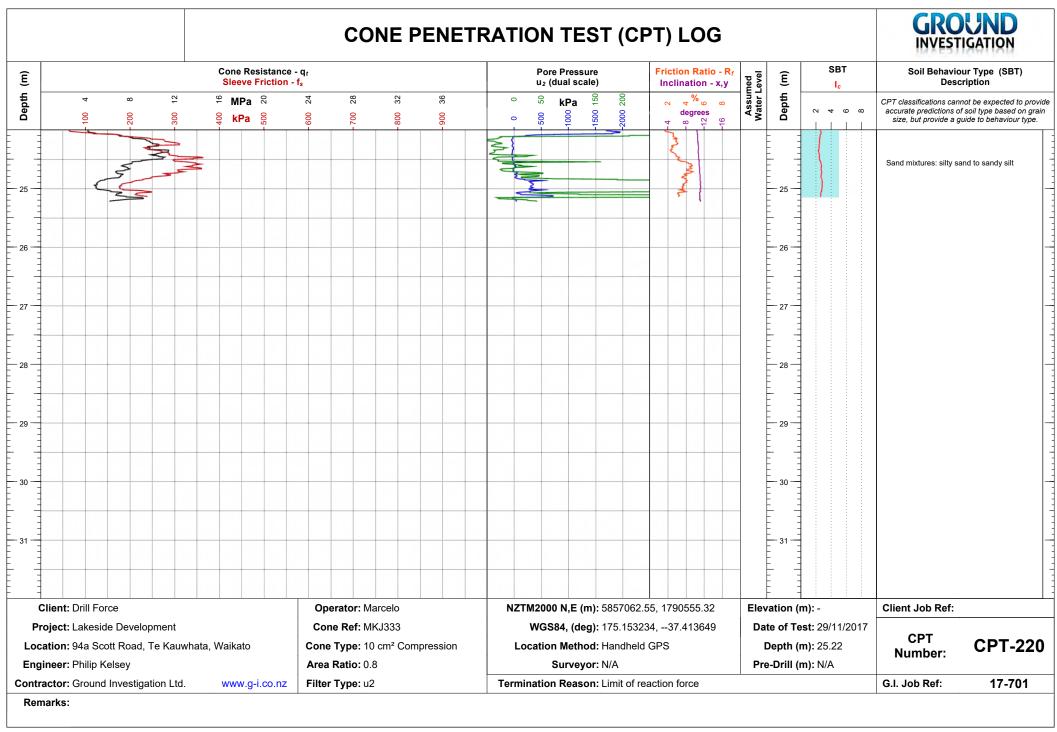


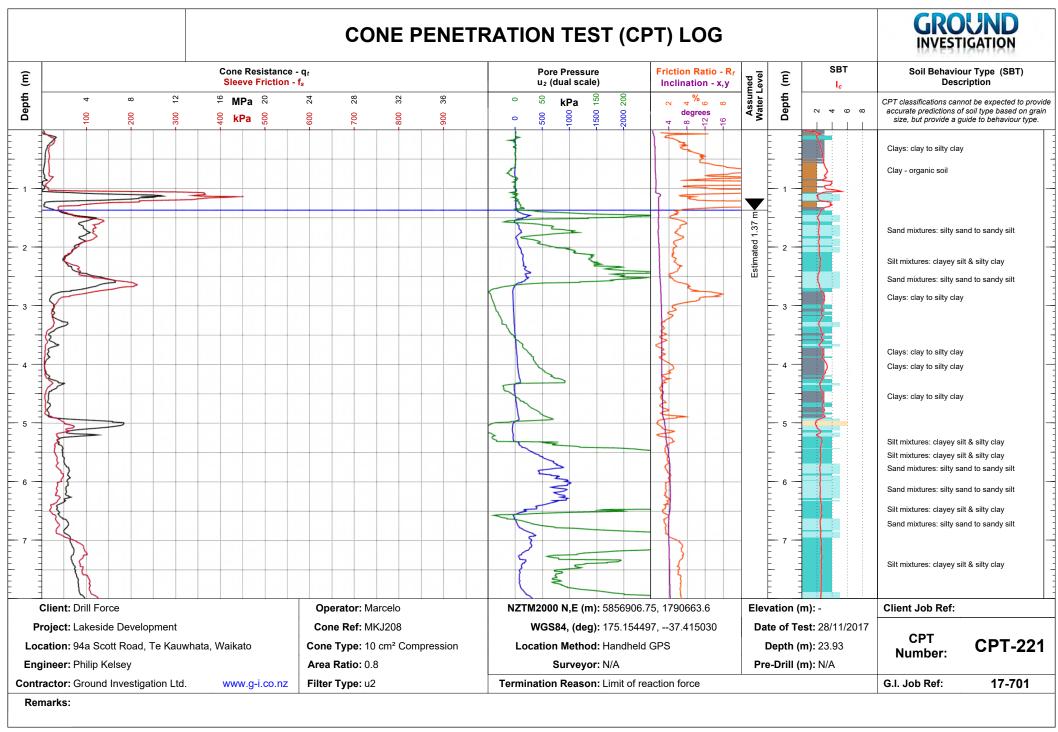


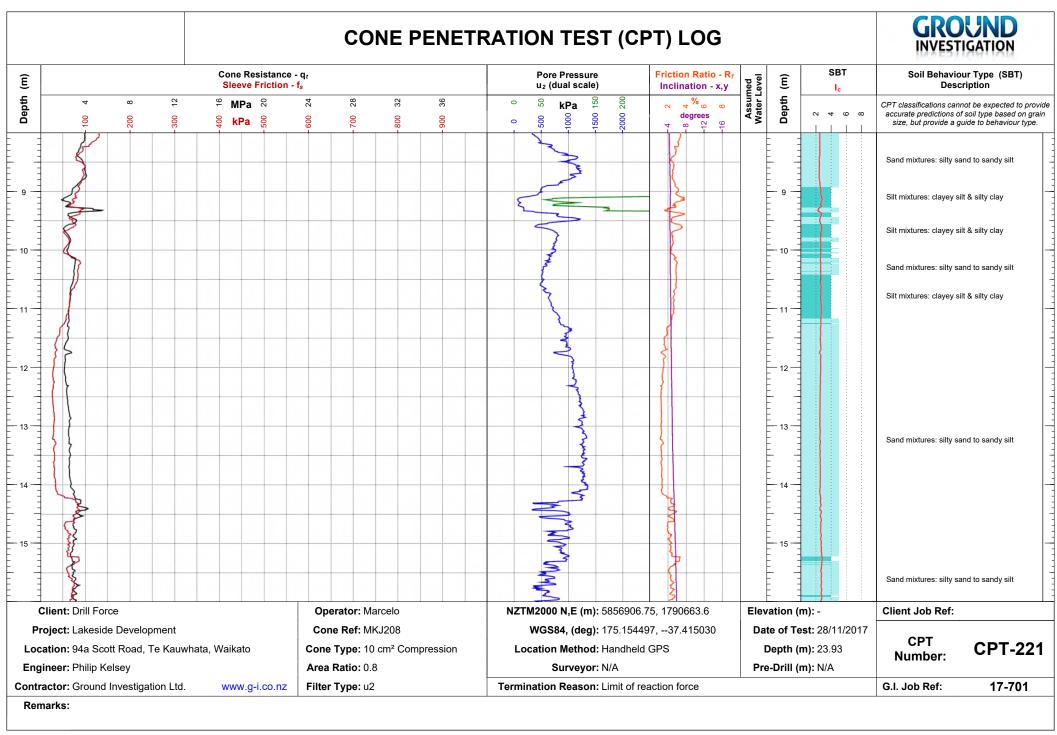


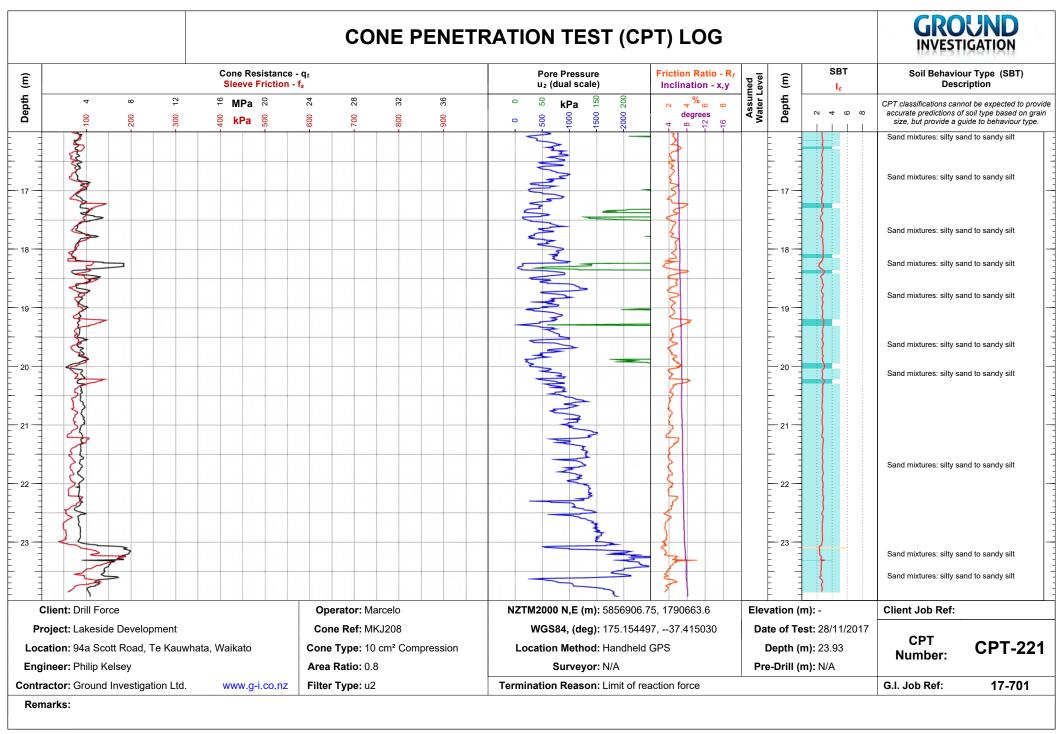


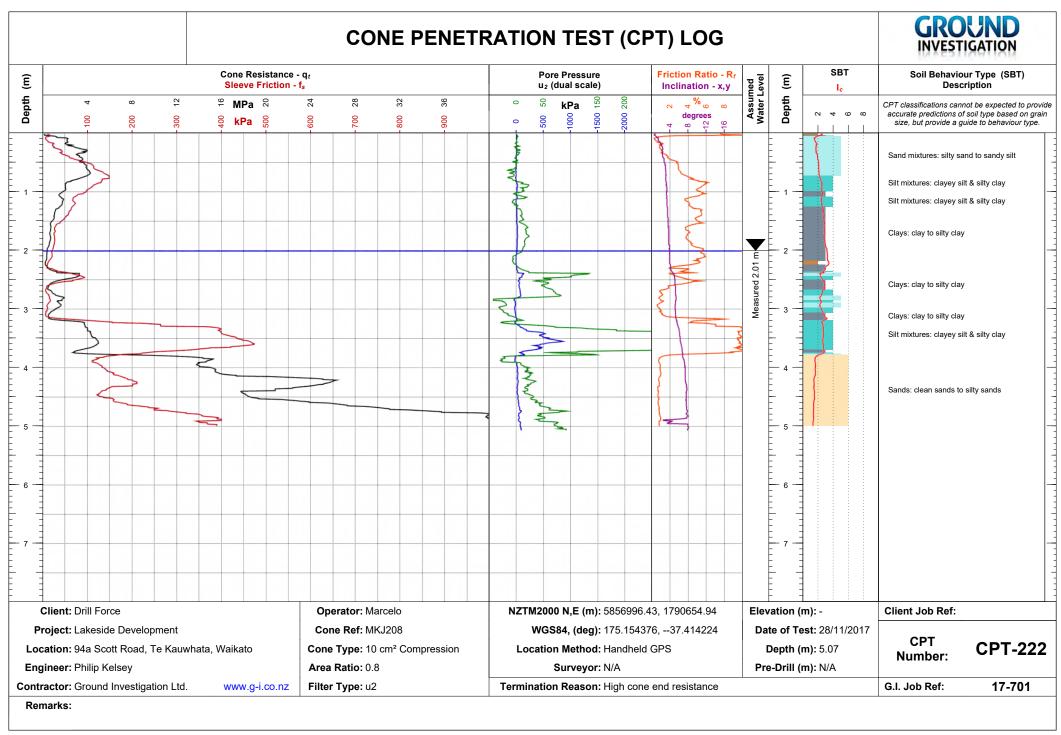


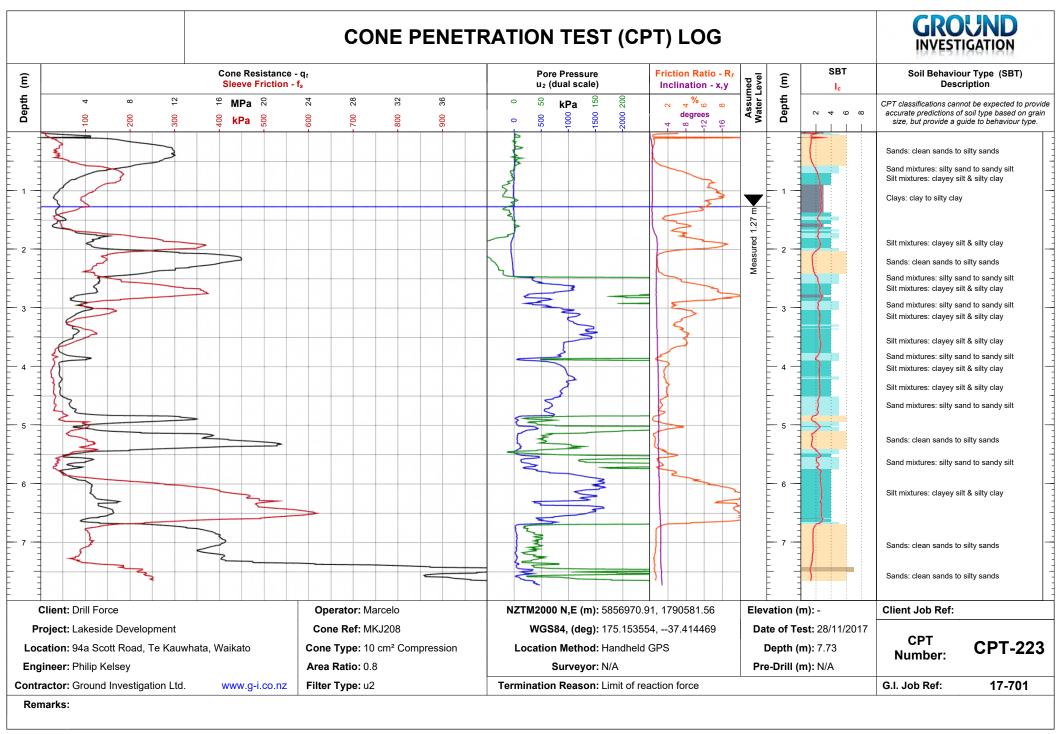


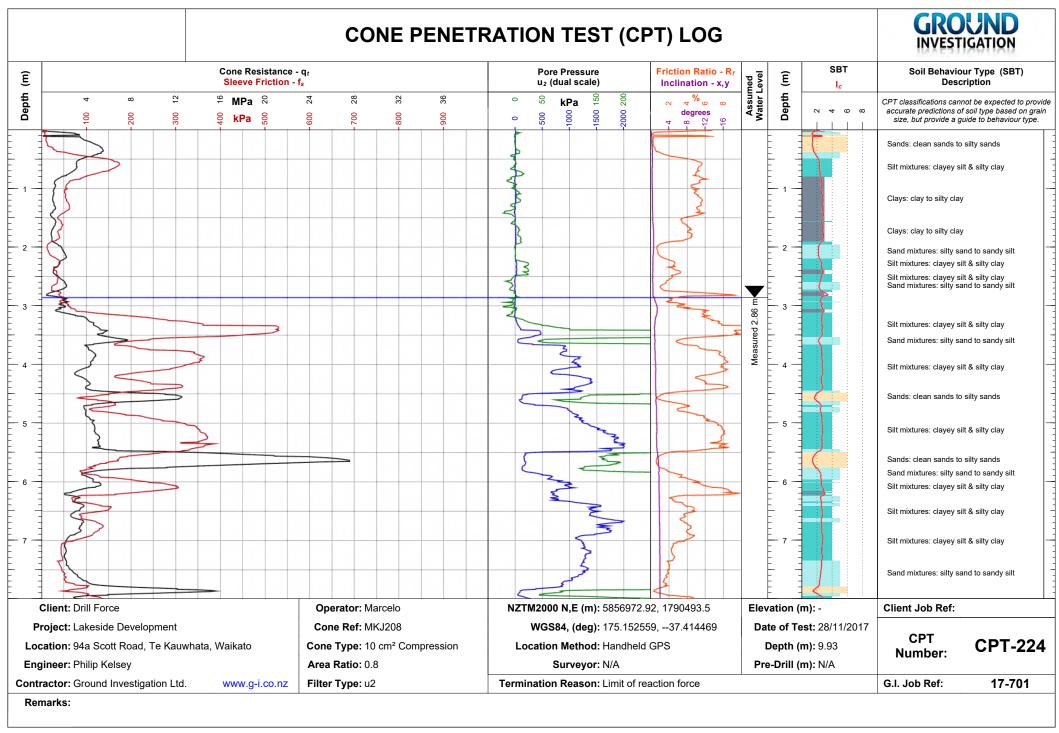


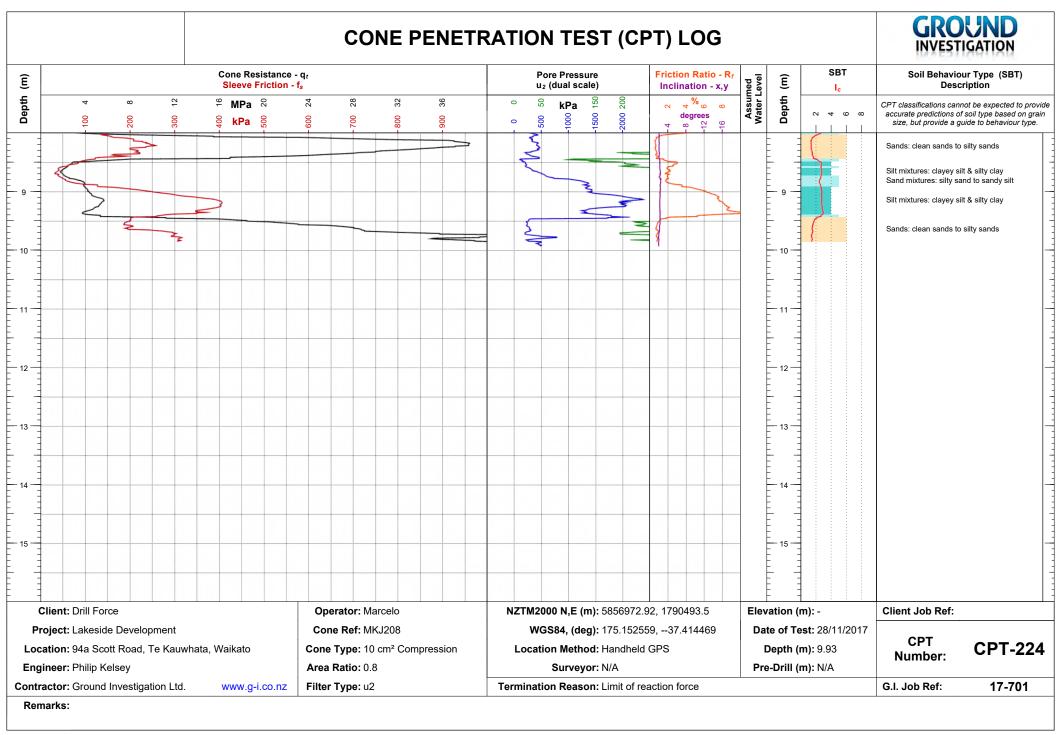


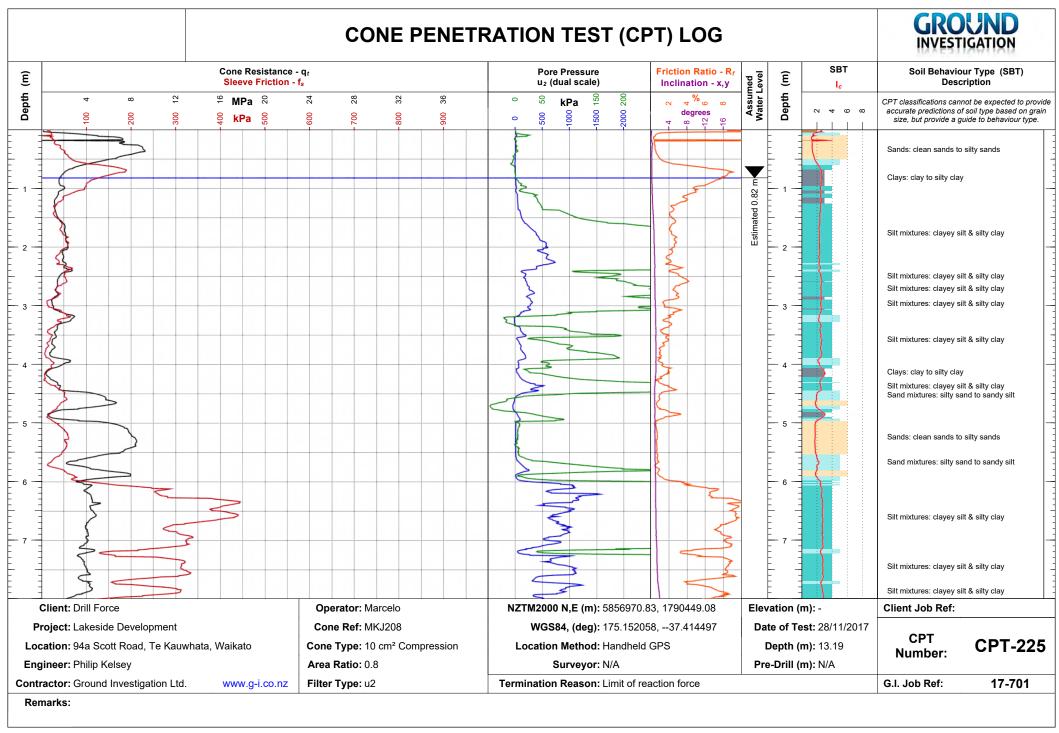


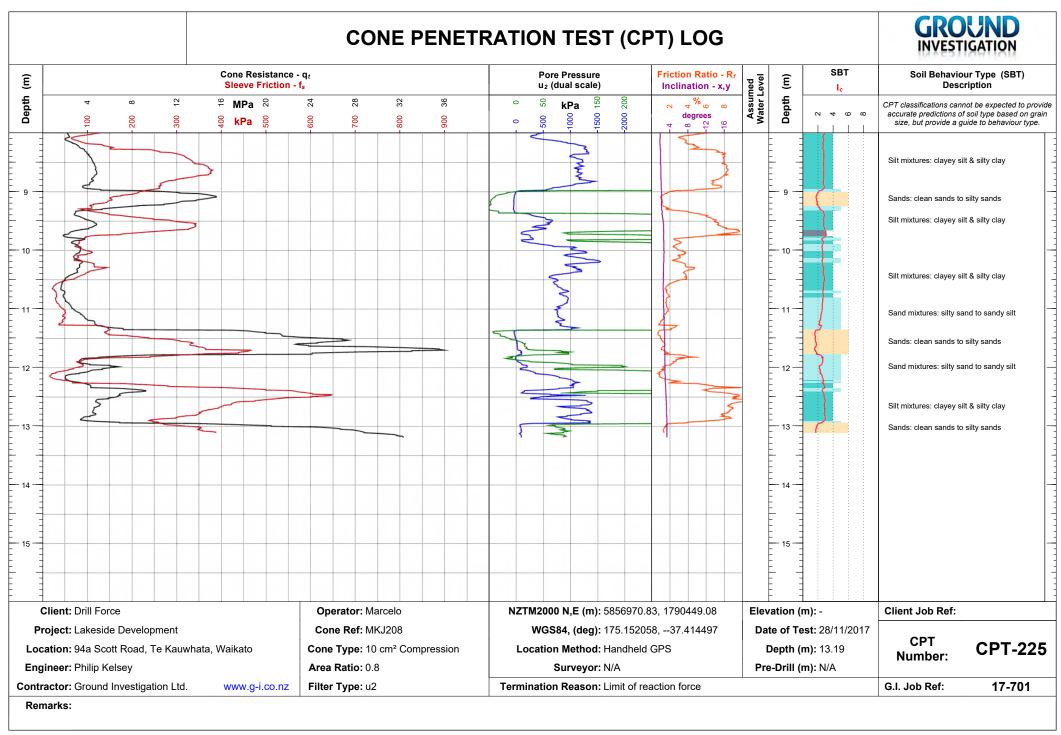


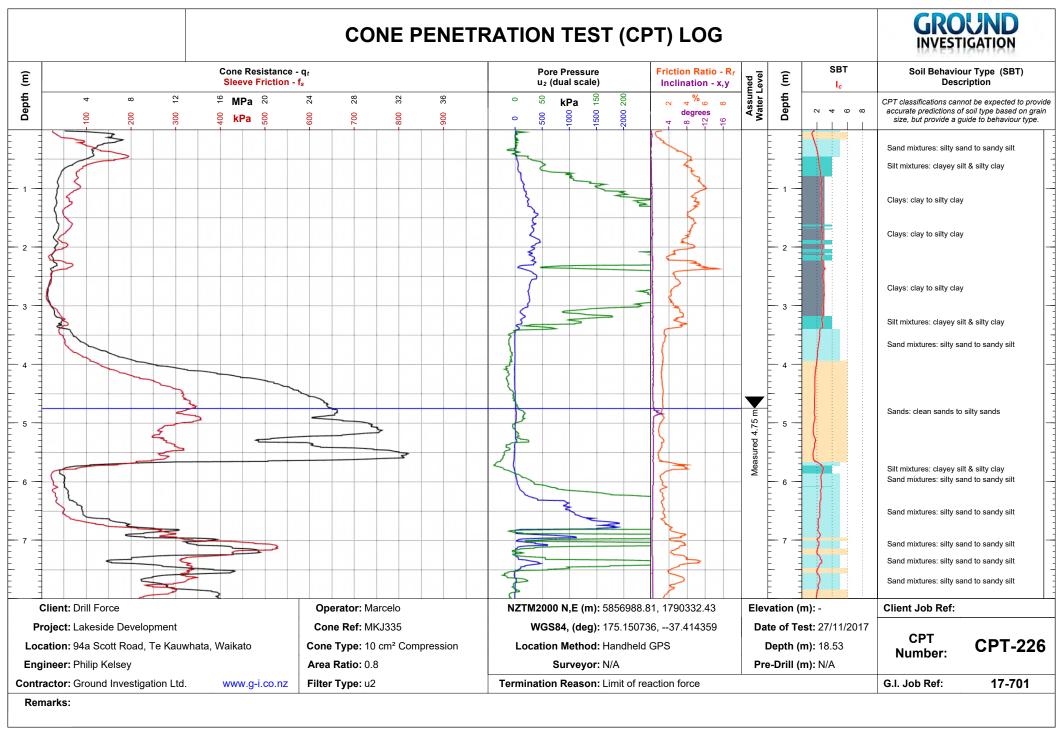


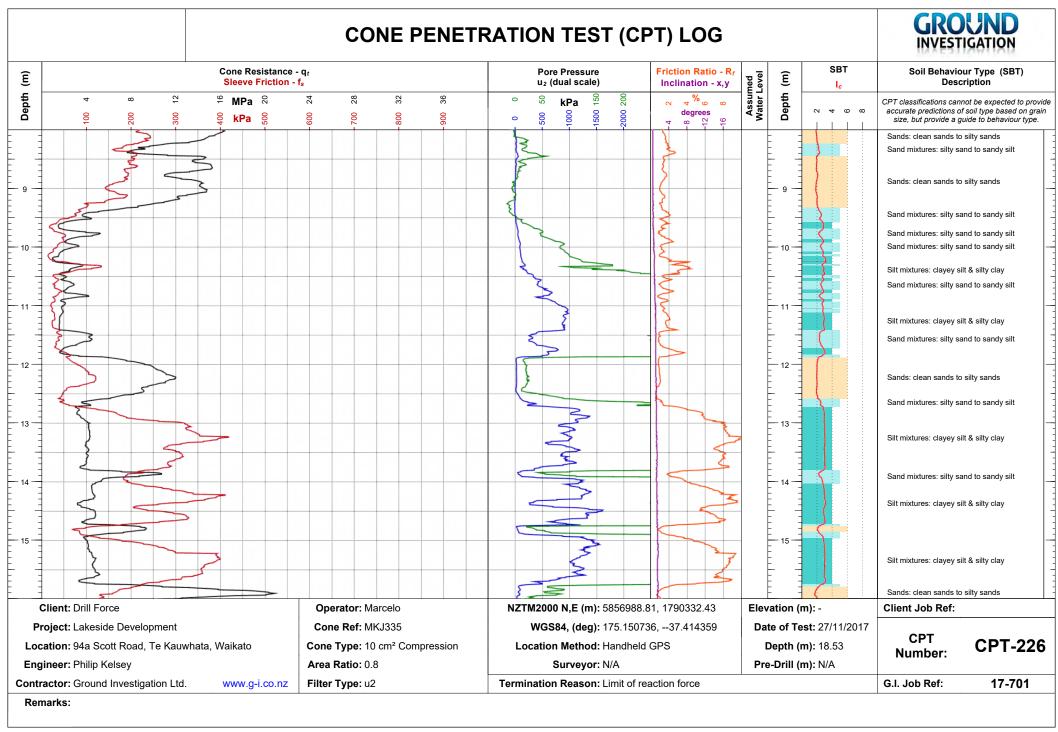


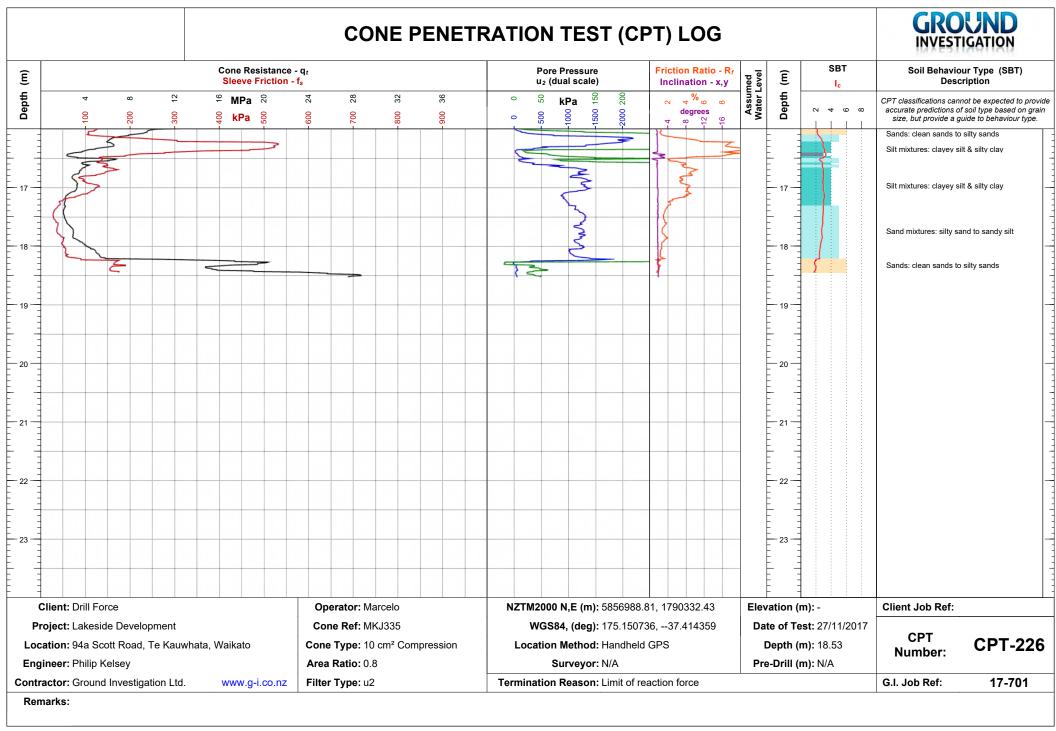


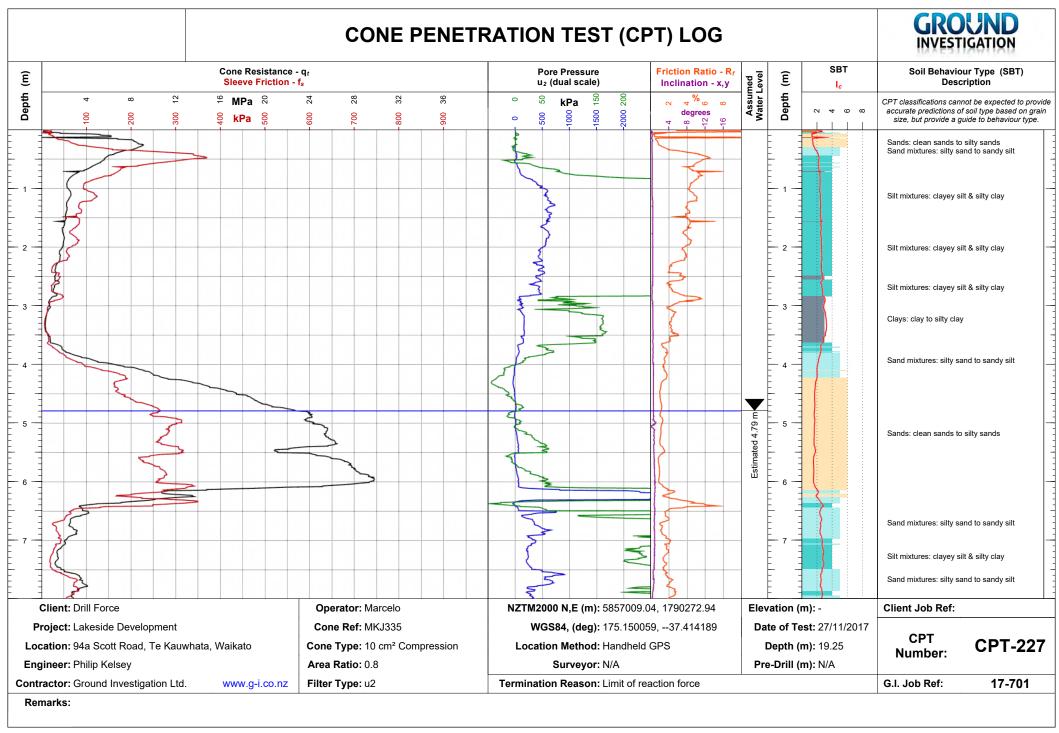


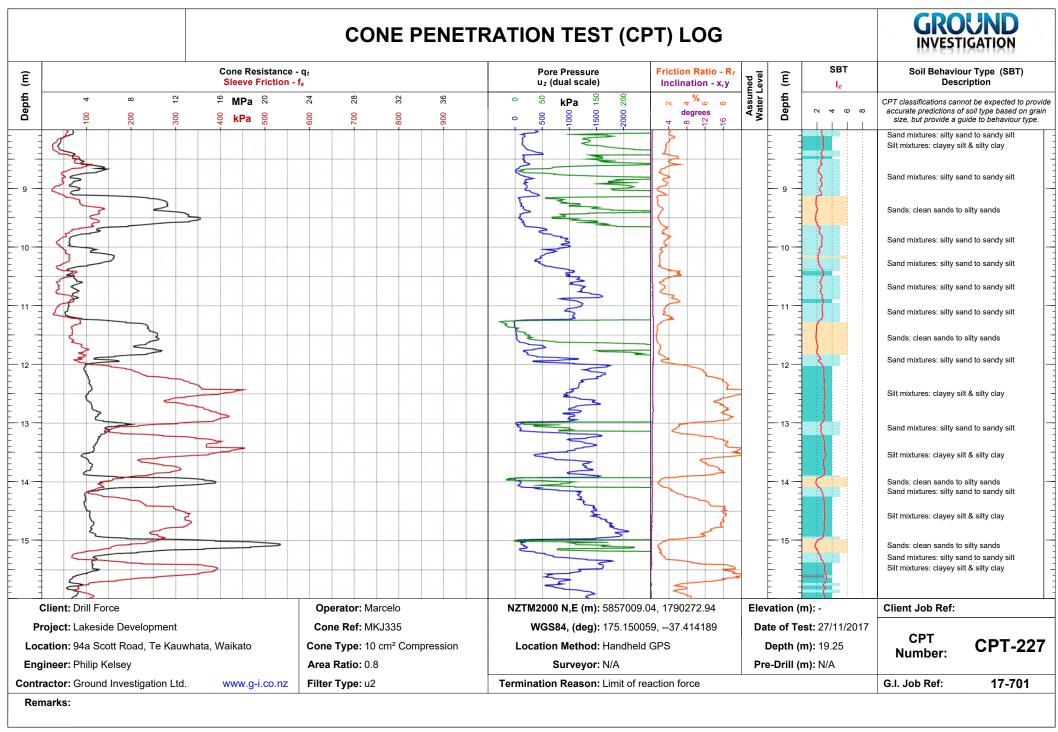


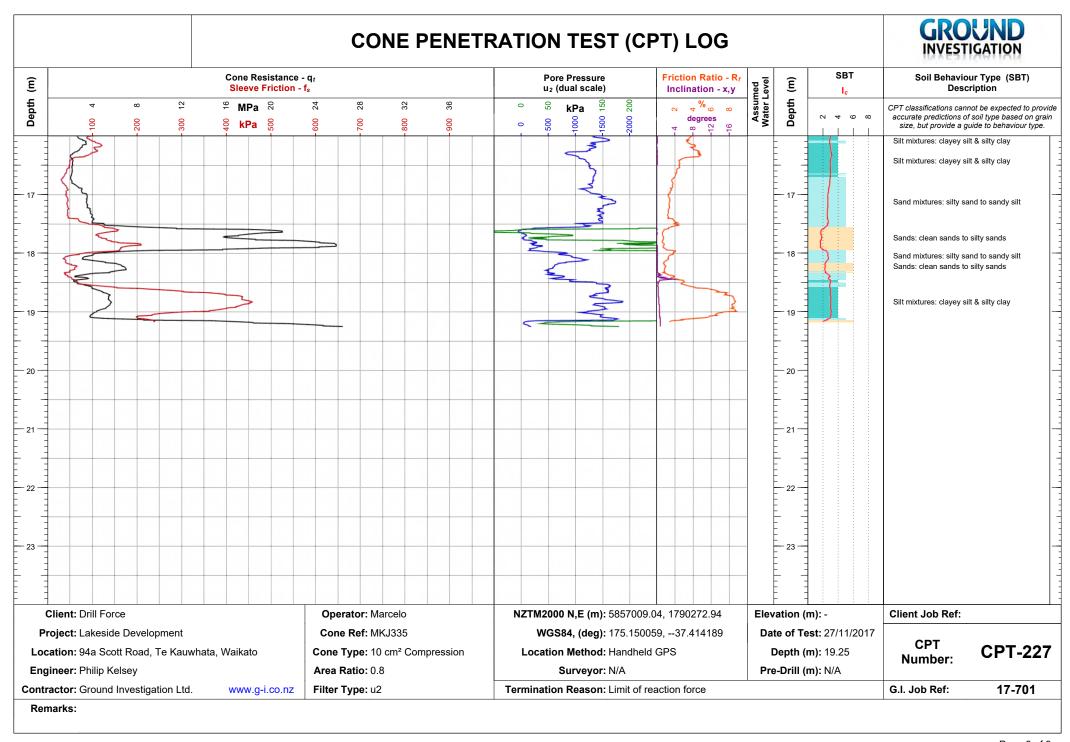


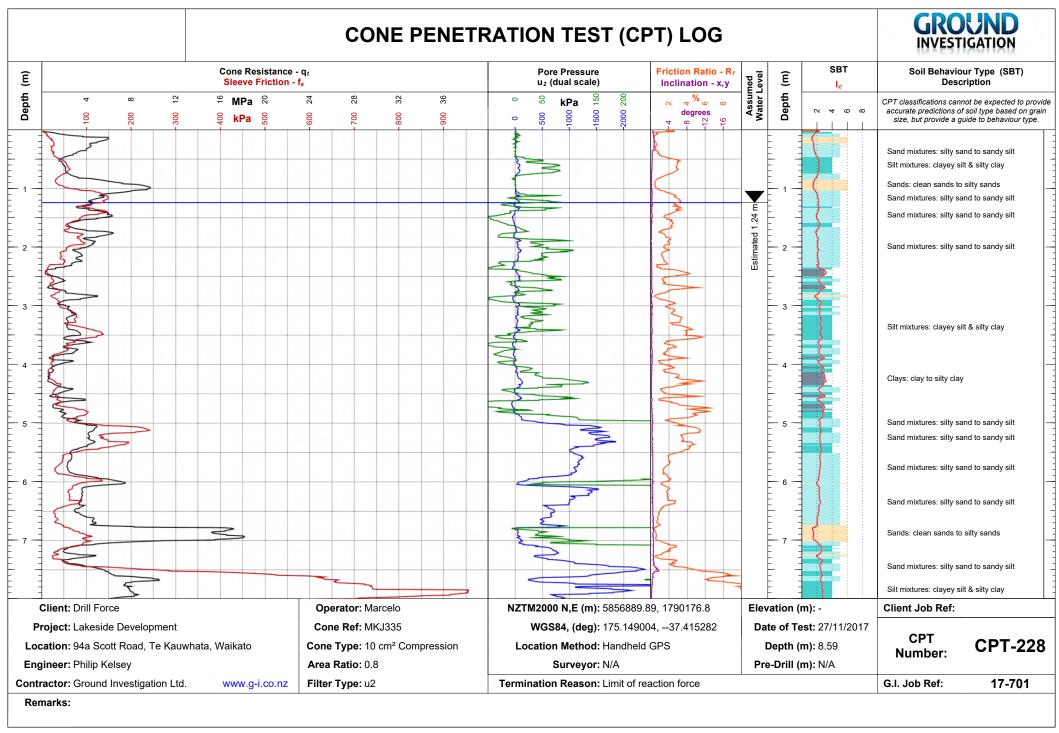


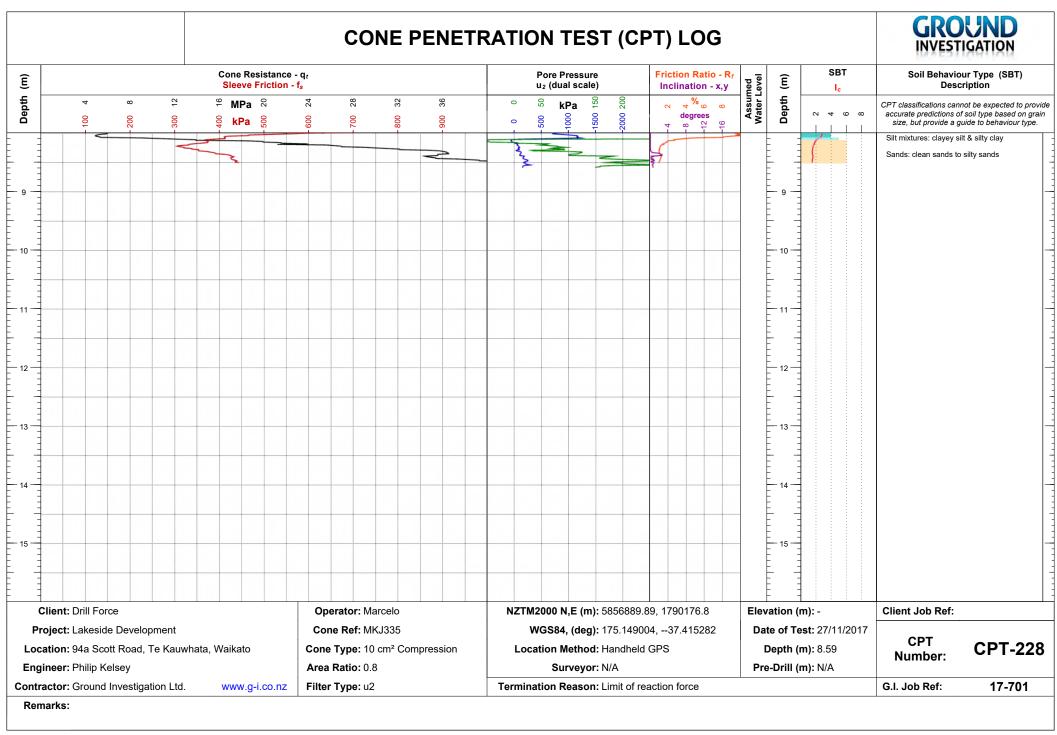


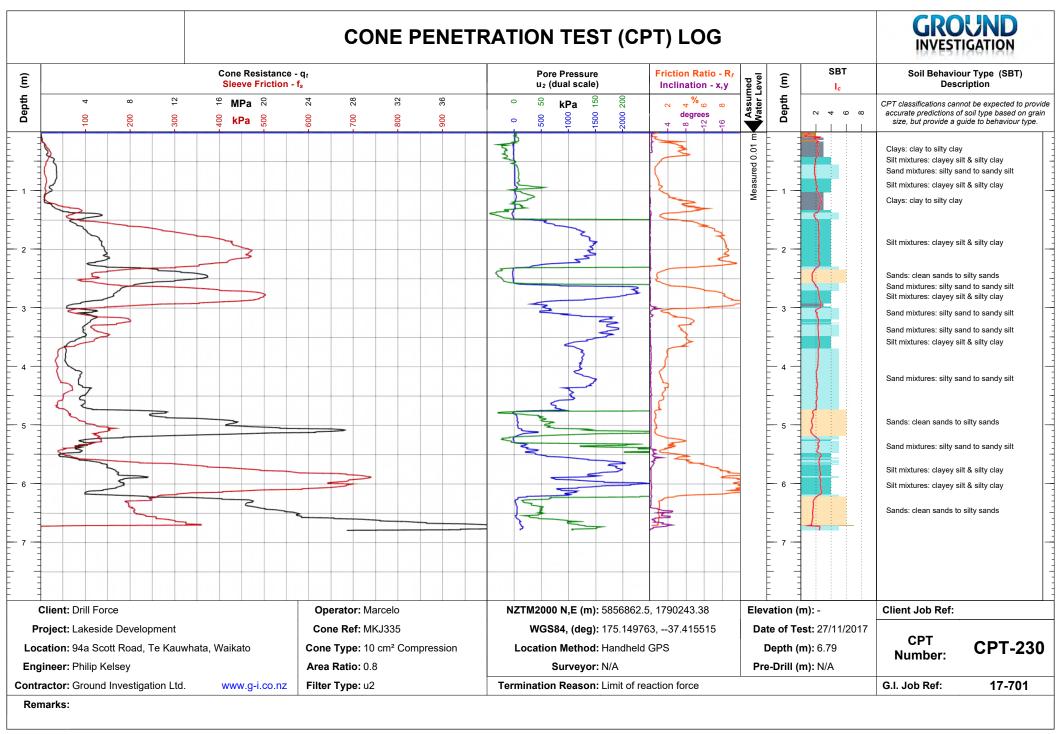


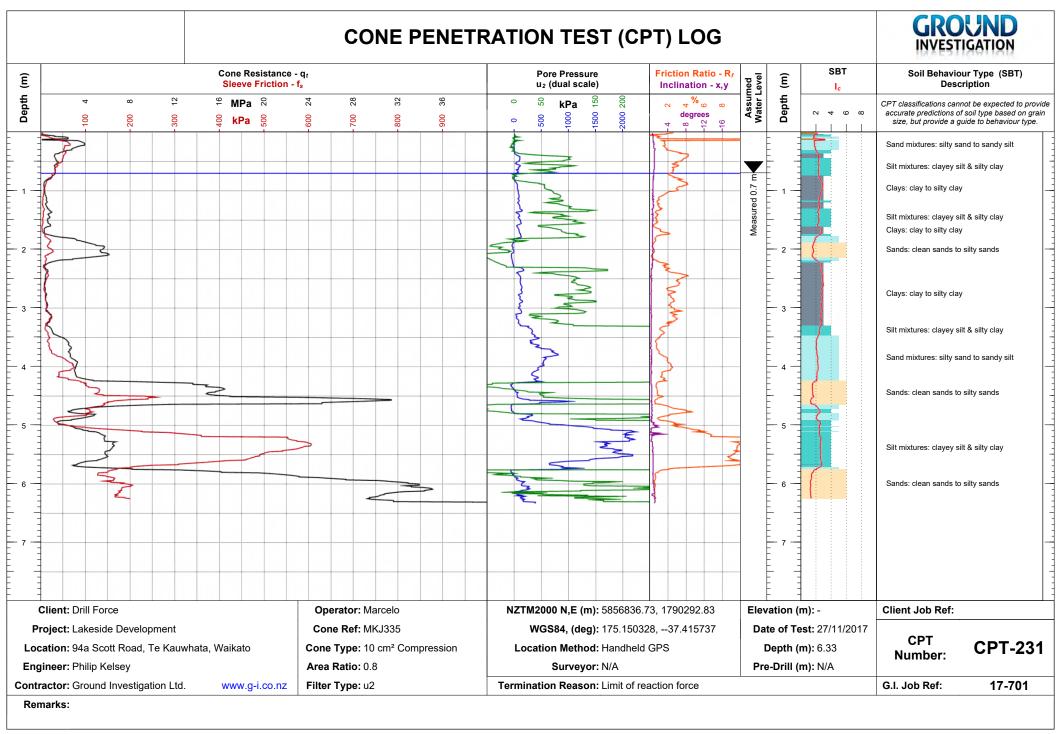


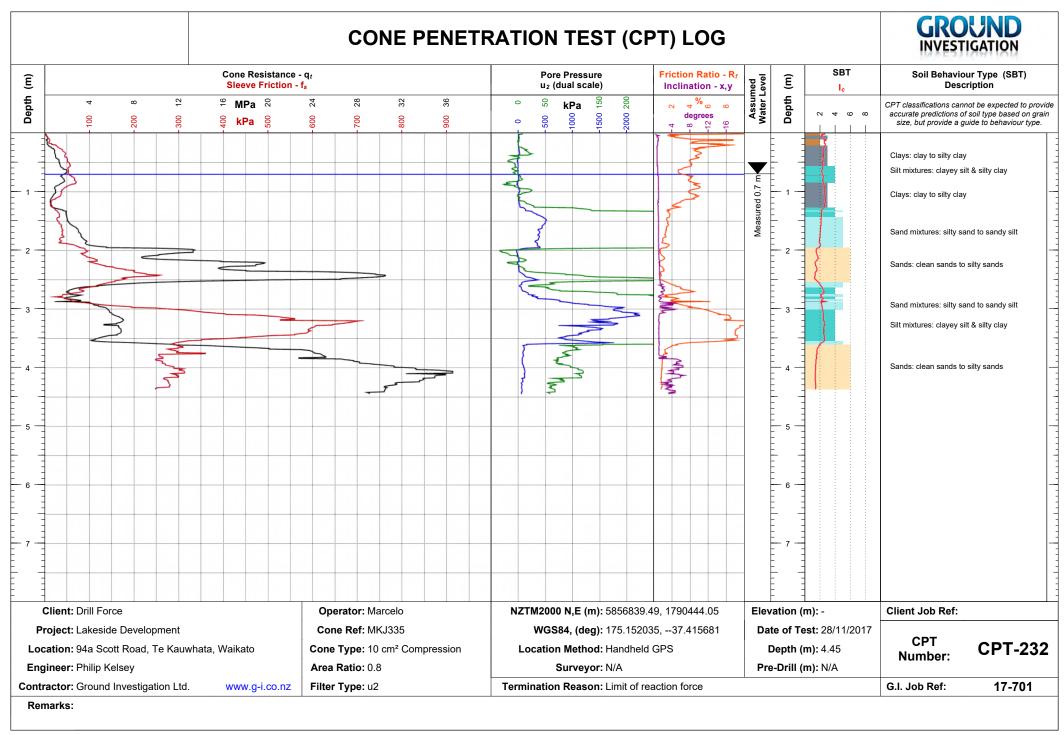


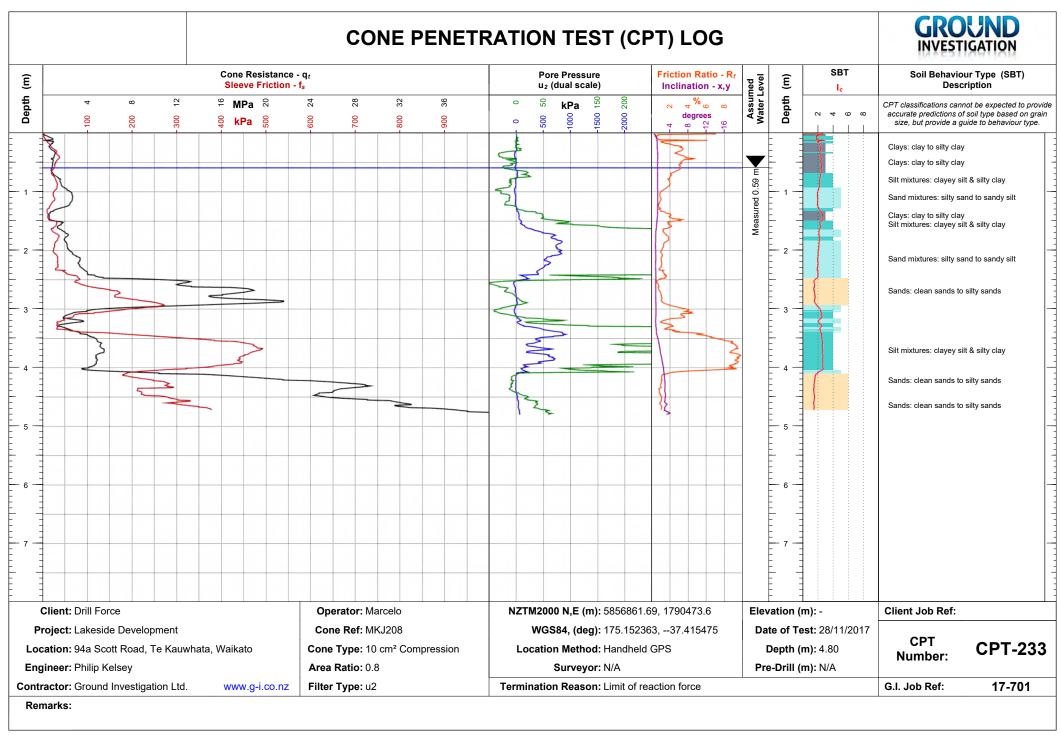


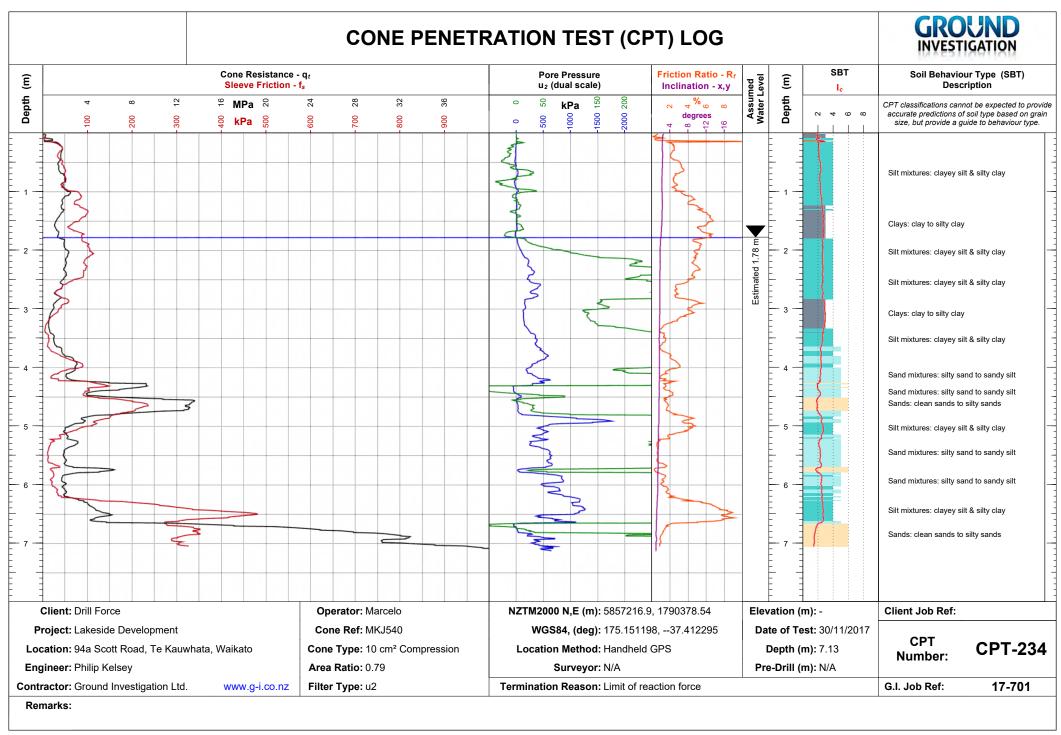












Appendix C: Laboratory Solid Density and Compaction Test Results



Private Bag 94000, Manukau City, Auckland 2241 www.stevenson.co.nz

Test Number:

172767

Report Number:

28802T

Date of Issue:

23rd November 2017

Page 1 of 2 Pages

FINAL REPORT FOR EARTHTECH CONSULTING LTD

Clients Address:

PO Box 721

PUKEKOHE 2340

Attention:

Philip Kelsey

Reference:

No. 4036

Subject:

SOIL TESTING

Clients Instructions:

Conduct the tests as detailed below on the soil sample received.

Test Methods:

1. NZS4402: 1986:Test

2.1: Determination of the Water Content

2.7.2: Determination of the Solid Density of Soil Particles

4.1.1: Dry Density/Water Content Relationship

- NZ Standard Compaction

2. NZ Geotechnical Society, Guideline

Determining the Shear Strength of a Cohesive Soil using a Hand Held

Shear Vane

Date Sampled:

9th November 2017

Date Received:

10th November 2017

Date of Test:

November 2017

Description of Sample:

TP202 (0.6 - 1.6 & 1.6 - 2.6m), Puketoka Silt/Clay

Source:

Lakeside Developments Te Kauwhata

Notes:

i. Field sample received in its natural state.

ii. Sample taken by P.Kelsley of Earthtech Consulting Ltd by an unknown method.

iii. Sampling of soil is not covered by this report.

for STEVENSON CONSTRUCTION MATERIALS LTD

T A WHITMORE

IANZ APPROVED SIGNATORY



Material:

Job:

TP202 (0.6 - 1.6 & 1.6 - 2.6m), Puketoka Silt/Clay

Source:

Lakeside Developments Te Kauwhata

Lakeside Developments

Test No.:

172767

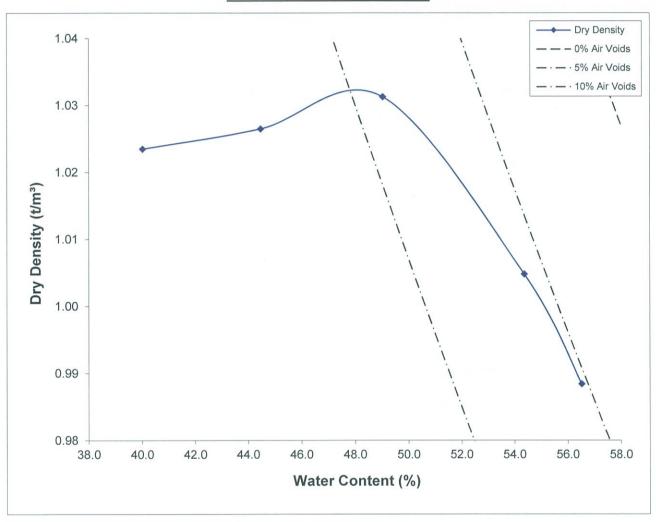
Date Sampled:

9th November 2017

Reference No.:

4036

NZ STANDARD COMPACTION



Maximum Dry	Optimum Water	Solid Density	Natural
Density	Content	Measured	Water Content
(t/m³)	(%)	t/m³	%
1.03			63.6

Water Content	(%)	40.0	44.5	49.0	54.4	56.5
Dry Density	(t/m³)	1.02	1.03	1.03	1.00	0.99
Shear Strength	(kPa)	UTP	UTP	162	112	59
Remoulded Shear Strength	(kPa)	UTP	UTP	18	9	3

- i. Test performed on material passing 19.0mm sieve (100%).
- ii. UTP = Unable to Penetrate.
- iii. Natural water content performed on whole sample.



Private Bag 94000, Manukau City, Auckland 2241 www.stevenson.co.nz

Test Number:

172768

Report Number:

28876T

Date of Issue:

30th November 2017

Page 1 of 3 Pages

FINAL REPORT FOR EARTHTECH CONSULTING LTD

Clients Address:

PO Box 721

PUKEKOHE 2340

Attention:

Philip Kelsey

Reference:

No. 4036

Subject:

SOIL TESTING

Clients Instructions:

Conduct the tests as detailed below on the soil sample received.

Test Methods:

1. NZS4402: 1986:Test

2.1: Determination of the Water Content

2.2: Determination of Liquid Limit

2.3: Determination of Plastic Limit

2.4: Determination of Plasticity Index

2.6: Determination of Linear Shrinkage

2.7.2: Determination of Solid Density of Soil Particles

4.1.1: Dry Density/Water Content Relationship

- NZ Standard Compaction

6.1.1: Determination of the California Bearing Ratio

2. NZ Geotechnical Society, Guideline

Determining the Shear Strength of a Cohesive Soil using a Hand Held

Shear Vane

Date Sampled:

8th November 2017

Date Received:

10th November 2017

Date of Test:

November 2017

Description of Sample:

TP203 (0.3 - 1.0 & 1.0 to 1.7m) Brown Ash

Source:

Lakeside Developments Te Kauwhata

Notes:

i. Field sample received in its natural state.

ii. Sample taken by P.Kelsley of Earthtech Consulting Ltd by an unknown method.

iii. Sampling of soil is not covered by this report.

for STEVENSON CONSTRUCTION MATERIALS LTD

T A WHITMORE
IANZ APPROVED SIGNATORY



Material:	TP203 (0.3 - 1.0 & 1.0 to 1.7m) Brown Ash	Test No.:	172768
Source:	Lakeside Developments Te Kauwhata	Date Sampled:	8 th November 2017
Job:	Lakeside Developments	Reference No.:	4036

TEST METHOD	RESULT	SPECIFICATION
Liquid Limit	85	-
Plastic Limit	39	-
Plasticity Index	46	-
Linear Shrinkage	13%	-

Notes: i. Plasticity Index Tests performed on material passing 0.425mm sieve.

CALIFORNIAN BEARING RATIO

		Result
Compaction effort		NZ Standard Compaction
Sample condition		Soaked
Surcharge mass	(kg)	6.7
Period of Soaking	(Days)	4
Compacted dry density	(t/m³)	1.18
Compacted water content	(%)	44.1
Soaked water content	(%)	46.6
Swell	(%)	0.0
Rate of penetration	(mm/min)	1
Depth CBR recorded	(mm)	2.5 & 5.0
California Bearing Ratio	CBR	5%

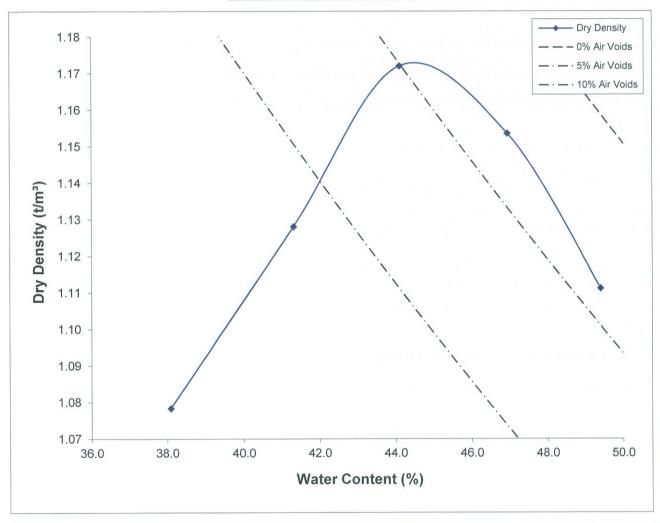
- i. Negative Swell implies shrinkage.
- ii. Test performed on material passing the 19.0mm Test Sieve (100%).

Material: TP203 (0.3 – 1.0 & 1.0 to 1.7m) Brown Ash

Source: Lakeside Developments Te Kauwhata Date Sampled: 8th November 2017

Job: Lakeside Developments Reference No.: 4036

NZ STANDARD COMPACTION



Maximum Dry	Optimum Water	Solid Density	Natural
Density	Content	Measured	Water Content
(t/m³)	(%)	t/m³	%
1.17	44.0	2.71	41.6

Water Content	(%)	38.1	41.3	44.1	46.9	49.4
Dry Density	(t/m³)	1.08	1.13	1.17	1.15	1.11
Shear Strength	(kPa)	UTP	UTP	162	65	38
Remoulded Shear Strength	(kPa)	UTP	UTP	80	32	15

- i. Test performed on material passing 19.0mm sieve (100%).
- ii. UTP = Unable to Penetrate.
- iii. Natural water content performed on whole sample.



Private Bag 94000, Manukau City, Auckland 2241 www.stevenson.co.nz

Test Number:

172769

Report Number:

28803T - Amendment One

Date of Issue:

5th December 2017

Page 1 of 2 Pages

FINAL REPORT FOR EARTHTECH CONSULTING LTD

Clients Address:

PO Box 721

PUKEKOHE 2340

Attention:

Philip Kelsey

Reference:

No. 4036

Subject:

SOIL TESTING

Clients Instructions:

Conduct the tests as detailed below on the soil sample received.

Test Methods:

1. NZS4402: 1986:Test

2.1: Determination of the Water Content4.1.1: Dry Density/Water Content Relationship

- NZ Standard Compaction

2. NZ Geotechnical Society, Guideline

Determining the Shear Strength of a Cohesive Soil using a Hand Held

Shear Vane

Date Sampled:

8th November 2017

Date Received:

10th November 2017

Date of Test:

November 2017

Description of Sample:

TP203 (1.7 - 2.7 & 2.7 - 3.4m), Puketoka Silt/Clay

Source:

Lakeside Developments Te Kauwhata

Notes:

i. Field sample received in its natural state.

ii. Sample taken by P.Kelsey of Earthtech Consulting Ltd by an unknown method.

iii. Sampling of soil is not covered by this report.

for STEVENSON CONSTRUCTION MATERIALS LTD

T A WHITMORE

IANZ APPROVED SIGNATORY





Private Bag 94000, Manukau City, Auckland 2241 www.stevenson.co.nz

Test Number:

172770

Report Number:

28877T

Date of Issue:

30th November 2017

Page 1 of 3 Pages

FINAL REPORT FOR EARTHTECH CONSULTING LTD

Clients Address:

PO Box 721

PUKEKOHE 2340

Attention:

Philip Kelsey

Reference:

No. 4036

Subject:

SOIL TESTING

Clients Instructions:

Conduct the tests as detailed below on the soil sample received.

Test Methods:

1. NZS4402: 1986:Test

2.1: Determination of the Water Content

2.2: Determination of Liquid Limit2.3: Determination of Plastic Limit

2.4: Determination of Plasticity Index2.6: Determination of Linear Shrinkage

2.7.2: Determination of Solid Density of Soil Particles

4.1.1: Dry Density/Water Content Relationship

- NZ Standard Compaction

6.1.1: Determination of the California Bearing Ratio

2. NZ Geotechnical Society, Guideline

Determining the Shear Strength of a Cohesive Soil using a Hand Held

Shear Vane

Date Sampled:

7th November 2017

Date Received:

10th November 2017

Date of Test:

November 2017

Description of Sample:

TP204 (1.0 - 2.0 & 2.0 to 3.0m) Puketoka Silt/Clay

Source:

Lakeside Developments Te Kauwhata

Notes:

i. Field sample received in its natural state.

ii. Sample taken by P.Kelsley of Earthtech Consulting Ltd by an unknown method.

iii. Sampling of soil is not covered by this report.

for STEVENSON CONSTRUCTION MATERIALS LTD





Material:	TP204 (1.0 – 2.0 & 2.0 to 3.0m) Puketoka Silt/Clay	Test No.:	172770
Source:	Lakeside Developments Te Kauwhata	Date Sampled:	7 th November 2017
Job:	Lakeside Developments	Reference No.:	4036

TEST METHOD	RESULT	SPECIFICATION
Liquid Limit	70	_
Plastic Limit	29	-
Plasticity Index	41	-
Linear Shrinkage	12%	-

Notes: i. Plasticity Index Tests performed on material passing 0.425mm sieve.

CALIFORNIAN BEARING RATIO

		Resulf
Compaction effort		NZ Standard Compaction
Sample condition		Soaked
Surcharge mass	(kg)	6.7
Period of Soaking	(Days)	4
Compacted dry density	(t/m³)	1.22
Compacted water content	(%)	38.7
Soaked water content	(%)	41.5
Swell	(%)	1.2
Rate of penetration	(mm/min)	1
Depth CBR recorded	(mm)	2.5 & 5.0
California Bearing Ratio	CBR	6%

- i. Negative Swell implies shrinkage.
- ii. Test performed on material passing the 19.0mm Test Sieve (100%).

Material: Source: TP204 (1.0 - 2.0 & 2.0 to 3.0m) Puketoka Silt/Clay

Source: Lakeside D Job: Lakeside D

Lakeside Developments Te Kauwhata

Lakeside Developments

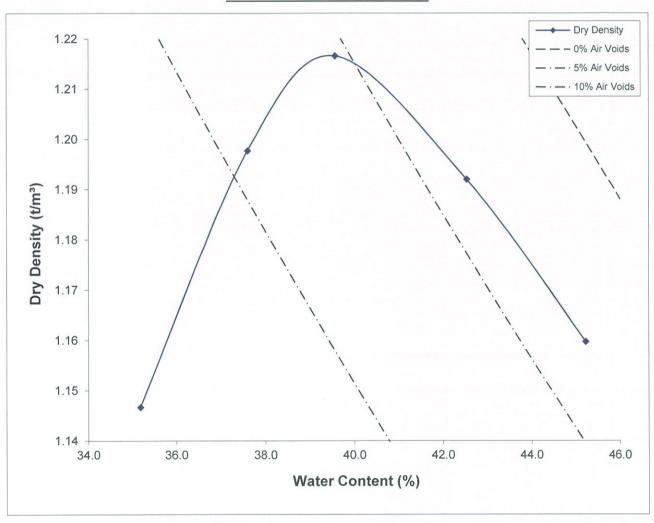
Test No.: 172770

Date Sampled: 7th N

7th November 2017

Reference No.: 4036

NZ STANDARD COMPACTION



Maximum Dry	Optimum Water	Solid Density	Natural
Density (t/m³)	Content (%)	Measured t/m³	Water Content %
1.22	40.0	2.62	47.0

Water Content	(%)	35.2	37.6	39.6	42.5	45.2
Dry Density	(t/m³)	1.15	1.20	1.22	1.19	1.16
Shear Strength	(kPa)	UTP	201	133	74	21
Remoulded Shear Strength	(kPa)	UTP	53	21	15	6

- i. Test performed on material passing 19.0mm sieve (100%).
- ii. UTP = Unable to Penetrate.
- iii. Natural water content performed on whole sample.



Private Bag 94000, Manukau City, Auckland 2241 www.stevenson.co.nz

Test Number:

172772

Report Number:

28858T

Date of Issue:

28th November 2017

Page 1 of 3 Pages

FINAL REPORT FOR EARTHTECH CONSULTING LTD

Clients Address:

PO Box 721

PUKEKOHE 2340

Attention:

Philip Kelsey

Reference:

No. 4036

Subject:

SOIL TESTING

Clients Instructions:

Conduct the tests as detailed below on the soil sample received.

Test Methods:

1. NZS4402: 1986:Test

2.1: Determination of the Water Content

2.7.2: Determination of the Solid Density of Soil Particles

4.1.1: Dry Density/Water Content Relationship

- NZ Standard Compaction

6.1.1: Determination of the California Bearing Ratio

2. NZ Geotechnical Society, Guideline

Determining the Shear Strength of a Cohesive Soil using a Hand Held

Shear Vane

Date Sampled:

8th November 2017

Date Received:

10th November 2017

Date of Test:

November 2017

Description of Sample:

TP205 (2.3 - 3.3 & 3.3 - 4.3m), Puketoka Sand

Source:

Lakeside Developments Te Kauwhata

Notes:

i. Field sample received in its natural state.

ii. Sample taken by P.Kelsley of Earthtech Consulting Ltd by an unknown method.

iii. Sampling of soil is not covered by this report.

for STEVENSON CONSTRUCTION MATERIALS LTD

T A WHITMORE

IANZ APPROVED SIGNATORY



Material:	TP205 (2.3 – 3.3 & 3.3 – 4.3m), Puketoka Sand	Test No.:	172772
Source:	Lakeside Developments Te Kauwhata	Date Sampled:	8 th November 2017
Job:	Lakeside Developments	Reference No.:	4036

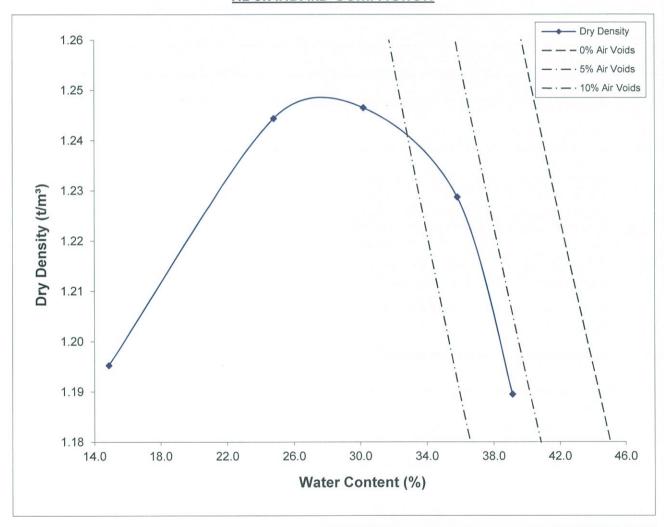
CALIFORNIAN BEARING RATIO

		Result
Compaction effort		NZ Standard Compaction
Sample condition		Soaked
Surcharge mass	(kg)	6.7
Period of Soaking	(Days)	4
Compacted dry density	(†/m³)	1.24
Compacted water content	(%)	29.7
Soaked water content	(%)	35.3
Swell	(%)	0.0
Rate of penetration	(mm/min)	1
Depth CBR recorded	(mm)	5.0
California Bearing Ratio	CBR	25%

- i. Negative Swell implies shrinkage.
- ii. Test performed on material passing the 19.0mm Test Sieve (100%).

Material:TP205 (2.3 – 3.3 & 3.3 – 4.3m), Puketoka SandTest No.:172772Source:Lakeside Developments Te KauwhataDate Sampled:8th November 2017Job:Lakeside DevelopmentsReference No.:4036

NZ STANDARD COMPACTION



Maximum Dry	Optimum Water	Solid Density	Natural
Density	Content	Measured	Water Content
(t/m³)	(%)	(t/m³)	%
1.25	30.0	2.52	36.7

Water Content	(%)	14.9	24.8	30.2	35.8	39.1
Dry Density	(t/m³)	1.20	1.24	1.25	1.23	1.19
Shear Strength	(kPa)	UTP	UTP	UTP	UTP	18
Remoulded Shear Strength	(kPa)	UTP	UTP	UTP	UTP	0

- i. Test performed on material passing 19.0mm sieve (100%).
- ii. UTP = Unable to Penetrate.
- iii. Natural water content performed on whole sample.



Private Bag 94000, Manukau City, Auckland 2241 www.stevenson.co.nz

Test Number:

172773

Report Number:

28856T

Date of Issue:

23rd November 2017

Page 1 of 2 Pages

FINAL REPORT FOR EARTHTECH CONSULTING LTD

Clients Address:

PO Box 721

PUKEKOHE 2340

Attention:

Philip Kelsey

Reference:

No. 4036

Subject:

SOIL TESTING

Clients Instructions:

Conduct the tests as detailed below on the soil sample received.

Test Methods:

1. NZS4402: 1986:Test

2.1: Determination of the Water Content4.1.1: Dry Density/Water Content Relationship

- NZ Standard Compaction

2. NZ Geotechnical Society, Guideline

Determining the Shear Strength of a Cohesive Soil using a Hand Held

Shear Vane

Date Sampled:

8th November 2017

Date Received:

10th November 2017

Date of Test:

November 2017

Description of Sample:

TP 205 (4.8 – 5.5m) Puketoka Silt (Sensitive)

Source:

Lakeside Developments Te Kauwhata

Notes:

i. Field sample received in its natural state.

ii. Sample taken by P.Kelsey of Earthtech Consulting Ltd by an unknown method.

iii. Sampling of soil is not covered by this report.

for STEVENSON CONSTRUCTION MATERIALS LTD

T A WHITMORE

IANZ APPROVED SIGNATORY



TP 205 (4.8 – 5.5m) Puketoka Silt (Sensitive) Material: Source:

Lakeside Developments Te Kauwhata

Lakeside Developments

Job:

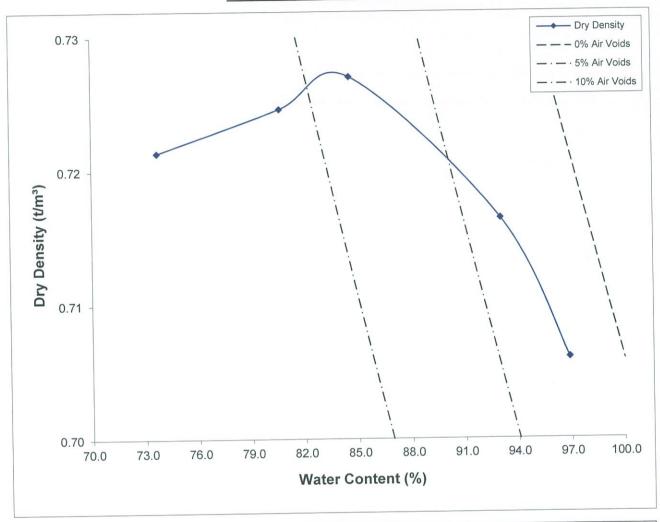
172773 Test No.:

Date Sampled:

8th November 2017

4036 Reference No.:

NZ STANDARD COMPACTION



Maximum Dry Density (t/m³)	Optimum Water	Solid Density	Natural
	Content	Assumed	Water Content
	(%)	t/m³	%
0.73	85.0	2.40	94.1

Water Content	(%)	73.7	80.6	84.6	93.0	96.9
Dry Density	(t/m³)	0.72	0.72	0.73	0.72	0.71
Shear Strength	(kPa)	201	162	145	59	38
Remoulded Shear Streng	jth (kPa)	12	27	24	3	0

- i. Test performed on material passing 19.0mm sieve (100%).
- ii. UTP = Unable to Penetrate.
- iii. Natural water content performed on whole sample.



Private Bag 94000, Manukau City, Auckland 2241 www.stevenson.co.nz

Test Number:

172774

Report Number:

28859T - Amendment One

Date of Issue:

5th December 2017

Page 1 of 3 Pages

FINAL REPORT FOR EARTHTECH CONSULTING LTD

Clients Address:

PO Box 721

PUKEKOHE 2340

Attention:

Philip Kelsey

Reference:

No. 4036

Subject:

SOIL TESTING

Clients Instructions:

Conduct the tests as detailed below on the soil sample received.

Test Methods:

1. NZS4402: 1986:Test

2.1: Determination of the Water Content4.1.1: Dry Density/Water Content Relationship

- NZ Standard Compaction

6.1.1: Determination of the California Bearing Ratio

2. NZ Geotechnical Society, Guideline

Determining the Shear Strength of a Cohesive Soil using a Hand Held

Shear Vane

Date Sampled:

7th November 2017

Date Received:

10th November 2017

Date of Test:

November 2017

Description of Sample:

TP206 (0.3 - 1.5 & 1.5 - 3.0m), Puketoka Silt & Sand

Source:

Lakeside Developments Te Kauwhata

Notes:

i. Field sample received in its natural state.

ii. Sample taken by P.Kelsley of Earthtech Consulting Ltd by an unknown method.

iii. Sampling of soil is not covered by this report.

for STEVENSON CONSTRUCTION MATERIALS LTD

T A WHITMORE

IANZ APPROVED SIGNATORY



Material: TP206 (0.3 – 1.5 & 1.5 – 3.0m), Puketoka Silt & Sand Test No.: 172774

Source: Lakeside Developments Te Kauwhata Date Sampled: 7th November 2017

Job: Lakeside Developments Reference No.: 4036

CALIFORNIAN BEARING RATIO

		Result
Compaction effort		NZ Standard Compaction
Sample condition		Soaked
Surcharge mass	(kg)	6.7
Period of Soaking	(Days)	4
Compacted dry density	(t/m³)	1.16
Compacted water content	(%)	39.4
Soaked water content	(%)	42.5
Swell	(%)	0.0
Rate of penetration	(mm/min)	1
Depth CBR recorded	(mm)	5.0
California Bearing Ratio	CBR	13%

- i. Negative Swell implies shrinkage.
- ii. Test performed on material passing the 19.0mm Test Sieve (100%).

Material:

TP206 (0.3 – 1.5 & 1.5 – 3.0m), Puketoka Silt & Sand

Test No.:

172774

Source: Job: Lakeside Developments Te Kauwhata

Lakeside Developments

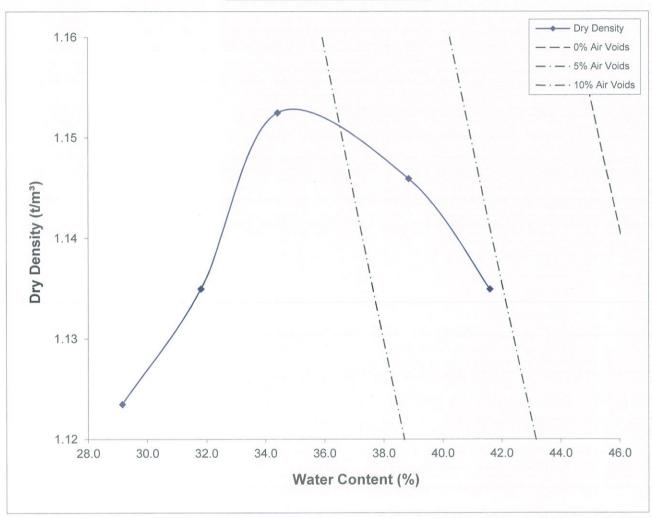
Date Sampled:

7th November 2017

Reference No.:

4036

NZ STANDARD COMPACTION



Maximum Dry	Optimum Water	Solid Density	Natural
Density	Content	Assumed	Water Content
(t/m³)	(%)	t/m³	%
1.15	34.0	2.40	48.0

Water Content	(%)	29.2	31.8	34.4	38.8	41.6
Dry Density	(t/m³)	1.12	1.13	1.15	1.15	1.13
Shear Strength	(kPa)	UTP	UTP	UTP	UTP	130
Remoulded Shear Strength	(kPa)	UTP	UTP	UTP	UTP	15

- i. Test performed on material passing 19.0mm sieve (100%).
- ii. UTP = Unable to Penetrate.
- iii. Natural water content performed on whole sample.



Private Bag 94000, Manukau City, Auckland 2241 www.stevenson.co.nz

Test Number:

172775

Report Number:

28860T

Date of Issue:

28th November 2017

Page 1 of 3 Pages

FINAL REPORT FOR EARTHTECH CONSULTING LTD

Clients Address:

PO Box 721

PUKEKOHE 2340

Attention:

Philip Kelsey

Reference:

No. 4036

Subject:

SOIL TESTING

Clients Instructions:

Conduct the tests as detailed below on the soil sample received.

Test Methods:

1. NZS4402: 1986:Test

2.1: Determination of the Water Content

2.7.2: Determination of the Solid Density of Soil Particles

4.1.1: Dry Density/Water Content Relationship

- NZ Standard Compaction

6.1.1: Determination of the California Bearing Ratio

2. NZ Geotechnical Society, Guideline

Determining the Shear Strength of a Cohesive Soil using a Hand Held

Shear Vane

Date Sampled:

7th November 2017

Date Received:

10th November 2017

Date of Test:

November 2017

Description of Sample:

TP206 (4.0 - 5.0 & 5.0 - 5.6m), Puketoka Sand

Source:

Lakeside Developments Te Kauwhata

Notes:

i. Field sample received in its natural state.

ii. Sample taken by P.Kelsley of Earthtech Consulting Ltd by an unknown method.

iii. Sampling of soil is not covered by this report.

for STEVENSON CONSTRUCTION MATERIALS LTD

T A WHITMORE

IANZ APPROVED SIGNATORY



Material:	TP206 (4.0 – 5.0 & 5.0 – 5.6m), Puketoka Sand	Test No.:	172775
Source:	Lakeside Developments Te Kauwhata	Date Sampled:	7 th November 2017
Job:	Lakeside Developments	Reference No.:	4036

CALIFORNIAN BEARING RATIO

		Result
Compaction effort		NZ Standard Compaction
Sample condition		Soaked
Surcharge mass	(kg)	6.7
Period of Soaking	(Days)	4
Compacted dry density	(t/m³)	1.00
Compacted water content	(%)	51.2
Soaked water content	(%)	47.8
Swell	(%)	-0.2
Rate of penetration	(mm/min)]
Depth CBR recorded	(mm)	5.0
California Bearing Ratio	CBR	18%

- i. Negative Swell implies shrinkage.
- ii. Test performed on material passing the 19.0mm Test Sieve (100%).

Material:

TP206 (4.0 – 5.0 & 5.0 – 5.6m), Puketoka Sand

Source:

Lakeside Developments Te Kauwhata

Job: Lakeside Developments

Test No.:

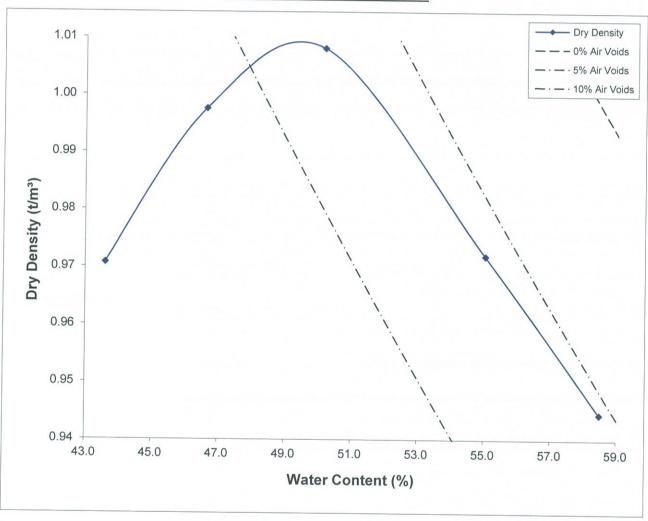
172775

Date Sampled:

7th November 2017

Reference No.: 4036

NZ STANDARD COMPACTION



Maximum Dry Density (t/m³)	Optimum Water Content (%)	Solid Density Measured (t/m³)	Natural Water Content
1.01	50.0	2.40	31.1

Water Content	(%)	43.6	46.7	50.2	55.0	58.5
Dry Density	(t/m³)	0.97	1.00	1.01	0.97	0.94
Shear Strength	(kPa)	UTP	UTP	UTP	27	15
Remoulded Shear Strength	(kPa)	UTP	UTP	UTP	9	3

- i. Test performed on material passing 19.0mm sieve (100%).
- ii. UTP = Unable to Penetrate.
- iii. Natural water content performed on whole sample.



Private Bag 94000, Manukau City, Auckland 2241 www.stevenson.co.nz

Test Number:

172776

Report Number:

28878T

Date of Issue:

30th November 2017

Page 1 of 3 Pages

FINAL REPORT FOR EARTHTECH CONSULTING LTD

Clients Address:

PO Box 721

PUKEKOHE 2340

Attention:

Philip Kelsey

Reference:

No. 4036

Subject:

SOIL TESTING

Clients Instructions:

Conduct the tests as detailed below on the soil sample received.

Test Methods:

- 1. NZS4402: 1986:Test
 - 2.1: Determination of the Water Content
 - 2.2: Determination of Liquid Limit
 - 2.3: Determination of Plastic Limit
 - 2.4: Determination of Plasticity Index
 - 2.6: Determination of Linear Shrinkage2.7.2: Determination of Solid Density of Soil Particles
 - 4.1.1: Dry Density/Water Content Relationship
 - NZ Standard Compaction
 - 6.1.1: Determination of the California Bearing Ratio
- 2. NZ Geotechnical Society, Guideline

Determining the Shear Strength of a Cohesive Soil using a Hand Held

Shear Vane

Date Sampled:

7th November 2017

Date Received:

10th November 2017

Date of Test:

November 2017

Description of Sample:

TP208 (0.35 - 1.5 & 1.5 & 2.5m) Brown Ash

Source:

Lakeside Developments Te Kauwhata

Notes:

i. Field sample received in its natural state.

ii. Sample taken by P.Kelsley of Earthtech Consulting Ltd by an unknown method.

iii. Sampling of soil is not covered by this report.

for STEVENSON CONSTRUCTION MATERIALS LTD

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Material:	TP208 (0.35 – 1.5 & 1.5 & 2.5m) Brown Ash	Test No.:	172776
Source:	Lakeside Developments Te Kauwhata	Date Sampled:	7 th November 2017
Job:	Lakeside Developments	Reference No.:	4036

TEST METHOD	RESULT	SPECIFICATION
Liquid Limit	76	-
Plastic Limit	34	-
Plasticity Index	42	-
Linear Shrinkage	13%	-

Notes: i. Plasticity Index Tests performed on material passing 0.425mm sieve.

CALIFORNIAN BEARING RATIO

		Result
Compaction effort		NZ Standard Compaction
Sample condition		Soaked
Surcharge mass	(kg)	6.7
Period of Soaking	(Days)	4
Compacted dry density	(t/m³)	1.24
Compacted water content	(%)	40.6
Soaked water content	(%)	41.8
Swell	(%)	0.0
Rate of penetration	(mm/min)	1
Depth CBR recorded	(mm)	2.5
California Bearing Ratio	CBR	4%

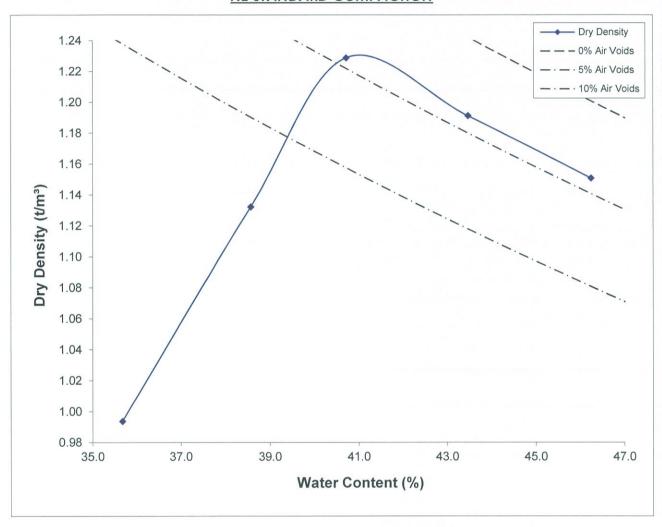
- i. Negative Swell implies shrinkage.
- ii. Test performed on material passing the 19.0mm Test Sieve (100%).

Material: TP208 (0.35 – 1.5 & 1.5 & 2.5m) Brown Ash Test No.: 172776

Source: Lakeside Developments Te Kauwhata Date Sampled: 7th November 2017

Job: Reference No.: 4036

NZ STANDARD COMPACTION



Maximum Dry Density (t/m³)	Optimum Water Content (%)	Solid Density Measured t/m³	Natural Water Content	
	(70)		/0	
1.23	41.0	2.70	45.1	

Water Content	(%)	35.7	38.6	40.7	43.5	46.2
Dry Density	(t/m³)	0.99	1.13	1.23	1.19	1.15
Shear Strength	(kPa)	UTP	UTP	115	47	27
Remoulded Shear Strength	(kPa)	UTP	UTP	56	30	12

- i. Test performed on material passing 19.0mm sieve (100%).
- ii. UTP = Unable to Penetrate.
- iii. Natural water content performed on whole sample.



Private Bag 94000, Manukau City, Auckland 2241 www.stevenson.co.nz

Test Number:

172777

Report Number:

28861T

Date of Issue:

28th November 2017

Page 1 of 3 Pages

FINAL REPORT FOR EARTHTECH CONSULTING LTD

Clients Address:

PO Box 721

PUKEKOHE 2340

Attention:

Philip Kelsey

Reference:

No. 4036

Subject:

SOIL TESTING

Clients Instructions:

Conduct the tests as detailed below on the soil sample received.

Test Methods:

1. NZS4402: 1986:Test

2.1: Determination of the Water Content

2.7.2: Determination of the Solid Density of Soil Particles

4.1.1: Dry Density/Water Content Relationship

- NZ Standard Compaction

6.1.1: Determination of the California Bearing Ratio

2. NZ Geotechnical Society, Guideline

Determining the Shear Strength of a Cohesive Soil using a Hand Held

Shear Vane

Date Sampled:

7th November 2017

Date Received:

10th November 2017

Date of Test:

November 2017

Description of Sample:

TP208 (2.5 - 3.6 & 3.6 - 4.6m), Puketoka Silt/Clay

Source:

Lakeside Developments Te Kauwhata

Notes:

i. Field sample received in its natural state.

ii. Sample taken by P.Kelsley of Earthtech Consulting Ltd by an unknown method.

iii. Sampling of soil is not covered by this report.

for STEVENSON CONSTRUCTION MATERIALS LTD

T A WHITMORE

IANZ APPROVED SIGNATORY



Material:	TP208 (2.5 – 3.6 & 3.6 – 4.6m), Puketoka Silt/Clay	Test No.:	172777
Source:	Lakeside Developments Te Kauwhata	Date Sampled:	7 th November 2017
Job:	Lakeside Developments	Reference No.:	4036

CALIFORNIAN BEARING RATIO

		Result
Compaction effort		NZ Standard Compaction
Sample condition		Soaked
Surcharge mass	(kg)	6.7
Period of Soaking	(Days)	4
Compacted dry density	(t/m³)	1.00
Compacted water content	(%)	51.8
Soaked water content	(%)	57.2
Swell	(%)	0.2
Rate of penetration	(mm/min)	1
Depth CBR recorded	(mm)	2.5 & 5.0
California Bearing Ratio	CBR	1%

- i. ii.
- Negative Swell implies shrinkage. Test performed on material passing the 19.0mm Test Sieve (100%).

Material: TP208 (2.5 - 3.6 & 3.6 - 4.6m), Puketoka Silt/Clay

Lakeside Developments Te Kauwhata

Job: Lakeside Developments

Source:

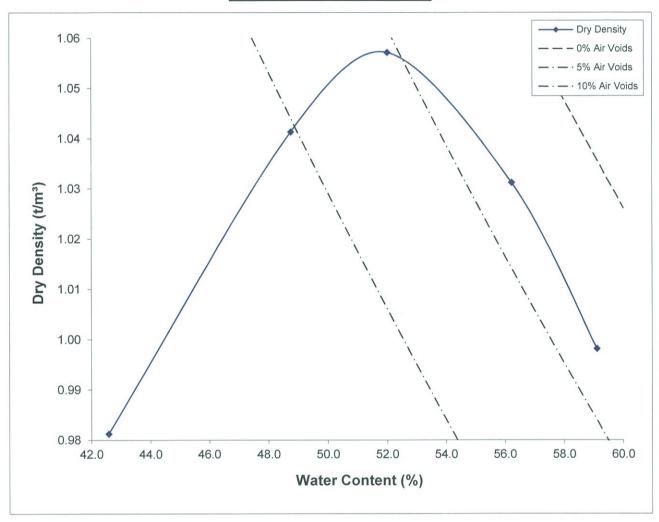
Test No.: 172777

7th November 2017 Date Sampled:

Reference No.:

4036

NZ STANDARD COMPACTION



Maximum Dry	Optimum Water	Solid Density	Natural
Density	Content	Measured	Water Content
(t/m³)	(%)	(t/m³)	%
1.06	52.0	2.67	

Water Content	(%)	42.6	48.8	52.0	56.2	59.1
Dry Density	(t/m³)	0.98	1.04	1.06	1.03	1.00
Shear Strength	(kPa)	UTP	198	94	59	18
Remoulded Shear Strength	(kPa)	UTP	50	27	12	3

- i. Test performed on material passing 19.0mm sieve (100%).
- ii. UTP = Unable to Penetrate.
- iii. Natural water content performed on whole sample.



Private Bag 94000, Manukau City, Auckland 2241 www.stevenson.co.nz

Test Number:

172778

Report Number:

28804T

Date of Issue:

23rd November 2017

Page 1 of 2 Pages

FINAL REPORT FOR EARTHTECH CONSULTING LTD

Clients Address:

PO Box 721

PUKEKOHE 2340

Attention:

Philip Kelsey

Reference:

No. 4036

Subject:

SOIL TESTING

Clients Instructions:

Conduct the tests as detailed below on the soil sample received.

Test Methods:

1. NZS4402: 1986:Test

2.1: Determination of the Water Content4.1.1: Dry Density/Water Content Relationship

- NZ Standard Compaction

2. NZ Geotechnical Society, Guideline

Determining the Shear Strength of a Cohesive Soil using a Hand Held

Shear Vane

Date Sampled:

8th November 2017

Date Received:

10th November 2017

Date of Test:

November 2017

Description of Sample:

TP210 (1.9 - 2.5 & 2.5 - 3.0m), Puketoka Sand/Silty Sand

Source:

Lakeside Developments Te Kauwhata

Notes:

i. Field sample received in its natural state.

ii. Sample taken by P.Kelsey of Earthtech Consulting Ltd by an unknown method.

iii. Sampling of soil is not covered by this report.

for STEVENSON CONSTRUCTION MATERIALS LTD

T A WHITMORE

IANZ APPROVED SIGNATORY

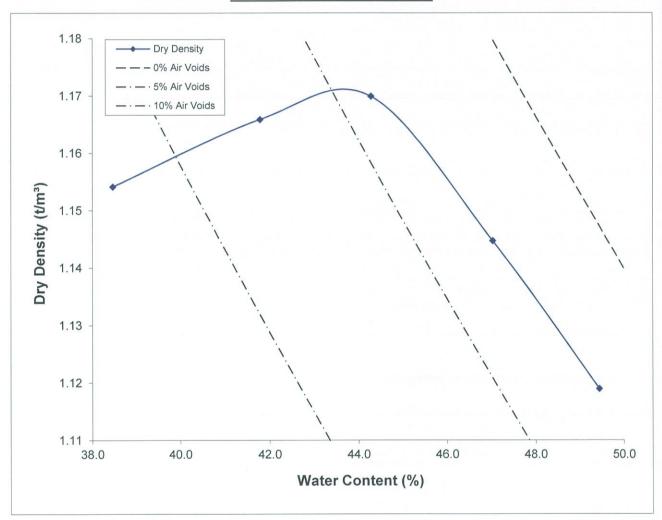


Material: TP210 (1.9 – 2.5 & 2.5 – 3.0m), Puketoka Sand/Silty Sand Test No.: 172778

Source: Lakeside Developments Te Kauwhata Date Sampled: 8th November 2017

Job: Lakeside Developments Reference No.: 4036

NZ STANDARD COMPACTION



Maximum Dry	Optimum Water	Solid Density	Natural
Density	Content	Assumed	Water Content
(t/m³)	(%)	t/m³	%
1.17	44.0	2.65	37.8

Water Content	(%)	38.5	41.8	44.3	47.0	49.4
Dry Density	(t/m³)	1.15	1.17	1.17	1.14	1.12
Shear Strength	(kPa)	UTP	174	94	35	21
Remoulded Shear Streng	th (kPa)	UTP	27	18	12	3

- i. Test performed on material passing 19.0mm sieve (100%).
- ii. UTP = Unable to Penetrate.
- iii. Natural water content performed on whole sample.



Private Bag 94000, Manukau City, Auckland 2241 www.stevenson.co.nz

Test Number:

172780

Report Number:

28805T

Date of Issue:

23rd November 2017

Page 1 of 2 Pages

FINAL REPORT FOR EARTHTECH CONSULTING LTD

Clients Address:

PO Box 721

PUKEKOHE 2340

Attention:

Philip Kelsey

Reference:

No. 4036

Subject:

SOIL TESTING

Clients Instructions:

Conduct the tests as detailed below on the soil sample received.

Test Methods:

1. NZS4402: 1986:Test

2.1: Determination of the Water Content

2.7.2: Determination of the Solid Density of Soil Particles

4.1.1: Dry Density/Water Content Relationship

- NZ Standard Compaction

2. NZ Geotechnical Society, Guideline

Determining the Shear Strength of a Cohesive Soil using a Hand Held

Shear Vane

Date Sampled:

9th November 2017

Date Received:

10th November 2017

Date of Test:

November 2017

Description of Sample:

TP212 (1.7 - 2.7 & 2.7 - 3.7m), Puketoka Sand

Source:

Lakeside Developments Te Kauwhata

Notes:

i. Field sample received in its natural state.

ii. Sample taken by P.Kelsey of Earthtech Consulting Ltd by an unknown method.

iii. Sampling of soil is not covered by this report.

for STEVENSON CONSTRUCTION MATERIALS LTD

T A WHITMORE

IANZ APPROVED SIGNATORY

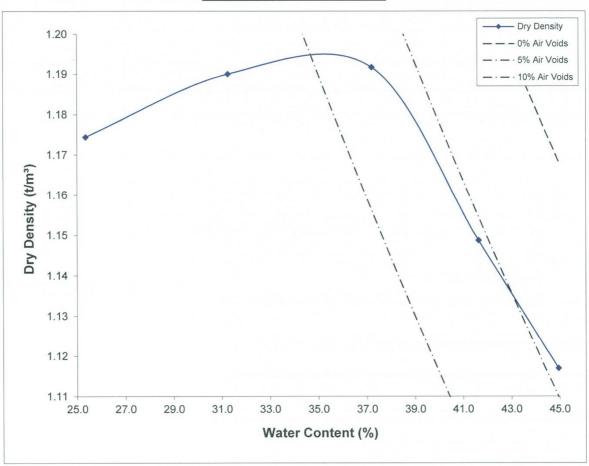


Material: TP212 (1.7 – 2.7 & 2.7 – 3.7m), Puketoka Sand Test No.: 172780

Source: Lakeside Developments Te Kauwhata Date Sampled: 9th November 2017

Job: Lakeside Developments Reference No.: 4036

NZ STANDARD COMPACTION



Maximum Dry	Optimum Water	Solid Density	Natural
Density	Content	Measured	Water Content
(t/m³)	(%)	t/m³	%
1.19	37.0	2.46	35.5

Water Content	(%)	25.3	31.3	37.2	41.6	44.9
Dry Density	(t/m³)	1.17	1.19	1.19	1.15	1.12
Shear Strength	(kPa)	UTP	UTP	UTP	18	12
Remoulded Shear Strength	(kPa)	UTP	UTP	UTP	3	0

- i. Test performed on material passing 19.0mm sieve (100%).
- ii. UTP = Unable to Penetrate.
- iii. Natural water content performed on whole sample.

DRY DENSITY / WATER CONTENT RELATIONSHIP STANDARD COMPACTION



Project:

Lakeside Developments

Location:

Lakeside Developments

Client:

CMW (NZ) Limited

Contractor:

-

Sampled by:
Date sampled:

Client Unknown

Sampling method:

Bulk Sample (as received)

Sampling method: Sample description:

SILT with some clay

S01 (Stage 1 Bulk Fill)

Sample condition:

As received

Solid density:

Source:

As received

2.60

t/m³ (Tested)

Project No : Lab Ref No : 2-68014.00

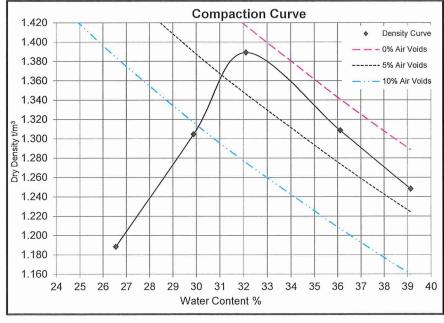
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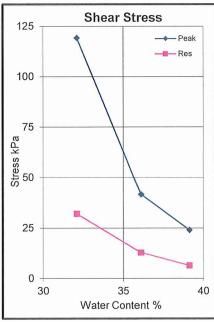
HA3889_1_MDD

Client Ref No:

HAM2018-0106

				Test Results				
Maximum dry den	sity	1.39	t/m³		Natural wate	r content	32.1	%
Optimum water co	ontent	32	%		Fraction teste	ed 10	0% Passing 19	mm
Sample ID		-180	-120	-60	NAT	60	120	
Bulk density	t/m³	1.473	1.504	1.694	1.835	1.781	1.737	
Water content	%	23.6	26.5	29.9	32.1	36.1	39.1	
Dry density	t/m³	1.192	1.188	1.305	1.389	1.309	1.248	
Sample condition		Very Stiff	Stiff	Stiff	Firm	Soft	Very Soft	
-		Dry	Dry	Dry-Moist	Moist	Moist	Wet	
Peak stress	kPa	Refusal	Refusal	Refusal	119	42	24	
Remoulded stress	kPa	Refusal	Refusal	Refusal	32	13	6	





Test Methods	Notes	
Compaction NZS 4402 : 1986 Test 4.1.1 (Standard)		
Shear Strength using a Hand Held Shear Vane, NZ Geotechnical Soc Inc 8/2001		

Date tested:

30/01/19

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.

Date reported:

04/02/19

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IANZ Approved Signatory

Designation: Senior Civil Engineering Technician

Date:

04/02/19

ACCREDITED LABORATORY

Tests indicated as not accredited are outside the scope of the laboratory's accreditation

PF-LAB-025 (19/03/2018)

Page 1 of 1

WSP Opus

Hamilton Laboratory

Quality Management Systems Certified to ISO 9001

Fox Street

Private Bag 3057, Waikato Mail Centre, Hamilton 3240, New Zealand Telephone +64 7 856 2870 Website www.wsp-opus.co.nz

DRY DENSITY / WATER CONTENT RELATIONSHIP STANDARD COMPACTION



Project:

Lakeside

Location:

Lakeside

Client:

CMW (NZ) Limited

Contractor:

Sampled by:

Client

Date sampled:

Unknown

Sampling method:

Bulk Sample (As received)

Sample description:

CLAY (Ash mix)

Sample condition:

As received

S02 Stage 1 fill

Solid density:

Source:

2.72

t/m³ (Tested)

Project No:

2-68014.00

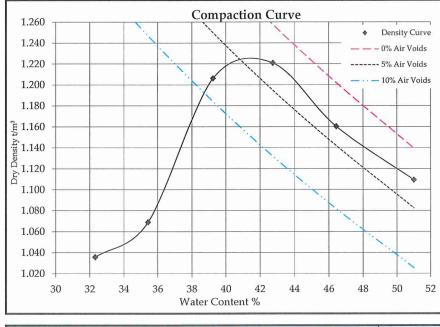
Lab Ref No:

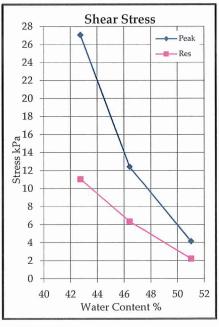
HA4413 MDD

Client Ref No:

HAM2018-0106

			1	est Results				
Maximum dry dens	sity	1.22	t/m³		Natural water	content	42.7	%
Optimum water co	ntent	41	%		Fraction teste	d 100%	passing 19mm	n sieve
Sample ID		-180	-120	-60	Nat	60	120	100
Bulk density	t/m³	1.370	1.448	1.679	1.743	1.699	1.675	
Water content	%	32.3	35.4	39.2	42.7	46.4	51.0	
Dry density	t/m³	1.036	1.069	1.206	1.221	1.160	1.109	
Sample condition		V.Stiff	V.Stiff	Stiff	Firm	Soft	Soft	
*:		Dry	Dry - Moist	Moist	Moist	Moist	Moist-wet	
Peak stress	kPa	Refusal	Refusal	Refusal	27	12	4	
Remoulded stress	kPa	Refusal	Refusal	Refusal	11	6	2	





Test Methods		Notes	
Compaction	NZS 4402: 1986 Test 4.1.1 (Standard)		
Shear Strength usin	g a Hand Held Shear Vane, NZ Geotechnical Soc Inc 8/2001		

Date tested:

16/05/19

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.

20/05/19 Date reported: This report may only be reproduced in full

IANZ Approved Signatory

Designation:

Senior Civil Engineering Technician

Date:

20/05/19

Tests indicated as not accredited are outside the scope of the laboratory's

PF-LAB-025 (19/03/2018)

Page 1 of 1

WSP Opus

Hamilton Laboratory

Quality Management Systems Certified to ISO 9001

Fox Street

Private Bag 3057, Waikato Mail Centre, Hamilton 3240, New Zealand

Telephone +64 7 856 2870 Website www.wsp-opus.co.nz

SOLID DENSITY OF SOIL TEST REPORT



Project:

Earthworks

Location:

Stockpile

Client:

Lakeside Developments c/o CMW Geosciences

Contractor:

9-

Sampled by:

CMW Geosciences

Date sampled:

15/11/19

Sampling method:

Bulk Sample (as received)

Sample condition:

As received

Project No:

2-68014.00

Lab Ref No:

HA5292 SD

Client Ref No:

HAM2019-0062

Stage 1A Imported Material

Test Results

Lab Ref No:

HA5292

Location ID:

Stockpile

Sample Depth (m) :

Unknown

Soil Fraction Tested:

Whole

Sample History:

Natural

Solid Particle Density (t/m³):

2.72

Sample Description:

CLAY

Test Methods

Notes

Solid Density :

NZS 4402:1986 Test 2.7.2

Date tested:

22/11/19

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.

Date reported: 25/11/19

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IANZ Approved Signatory

Designation :

Senior Civil Engineering Technician

Date:

25/11/19

ACCREDITED LABORATORY

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

PF-LAB-004 (10/19)

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WSP Opus

Hamilton Laboratory

Quality Management Systems Certified to ISO 9001

Fox Street

Private Bag 3057, Waikato Mail Centre, Hamilton 3240, New Zealand Telephone +64 7 856 2870 Website

DRY DENSITY / WATER CONTENT RELATIONSHIP STANDARD COMPACTION



Project : Earthworks
Location : Stockpile

Client: Lakeside Developments c/o CMW Geosciences

Contractor:

Source:

Sampled by: CMW Geosciences

Date sampled : 15/11/2019

Sampling method: As received (Bulk Sample)

Sample description: CLAY

Sample condition: As received

Solid density: 2.72 t/m³ (Tested)

Wards Quarry

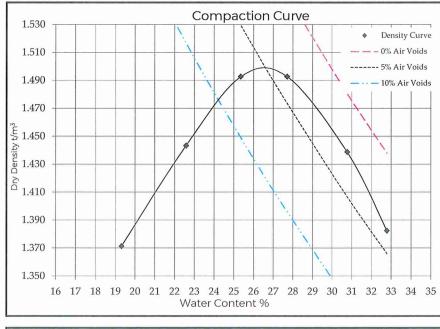
Project No: 2-68014.00

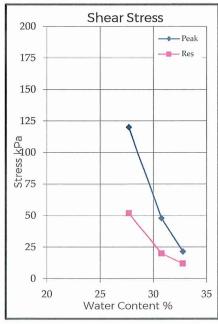
Lab Ref No : HA5292_MDD

Client Ref No: HAM2019-0062

Stage 1A Imported Material

				est Results				
Maximum dry der	nsity	1.50	t/m³		Natural wat	er content	25.3	%
Optimum water c	ontent	26.5	%		Fraction tes	ted All Pa	ssing 19mm	sieve
Sample ID		-120	-60	Nat	60	120	180	
Bulk density	t/m³	1.636	1.769	1.871	1.906	1.881	1.836	
Water content	%	19.3	22.6	25.3	27.7	30.8	32.8	
Dry density	t/m³	1.371	1.443	1.493	1.493	1.439	1.382	
Sample condition		V. Stiff	V. Stiff	Stiff	Firm	Soft	V. Soft	
		Moist	Moist	Moist	Moist	Moist	Wet	
Peak stress	kPa	UTP	UTP	>192	120	48	22	
Remoulded stre	kPa	UTP	UTP	>192	52	20	12	





Test Methods		Notes	
Compaction	NZS 4402 : 1986 Test 4.1.1 (Standard)		
Shear Strength usi	ng a Hand Held Shear Vane, NZ Geotechnical Soc Inc 8/2001	1	

Date tested: 22/11/19
Date reported: 25/11/19

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.

This report may only be reproduced in full

IANZ Approved Signatory

Designation: Senior Civil Engineering Technician

Date: 25/11/19



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

PF-LAB-025 (02/09/2019)

Page 1 of 1

PLASTICITY INDEX FOR SOILS **TEST REPORT**



Project:

Earthworks

Location:

Stockpile

Client:

Lakeside Developments c/o CMW Geosciences

Contractor:

Sampled by:

CMW Geosciences

Date received:

18/11/2019

Sampling method:

As received (Bulk sample)

Sample condition :

As received

Stage 1A Imported Material

Project No: 2-68014.00 Lab Ref No: HA5333 PI

Client Ref No: HAM2019-0062

		Test Results
	Lab Ref No :	HA5333_PI
	Location ID :	Stockpile
	Sample Depth (m) :	N/A
	Soil Fraction Tested :	-425um
	Liquid Limit :	52
	Plastic Limit :	28
	Plasticity Index :	24
	Natural Water Content (%) :	25.0
	Sample description :	CLAY
Test Methods		Notes
Water Content	NZS 4402 : 1986, Test 2.1	1. Unable to form groove and/or sample slipping in bowl.
Liquid Limit	NZS 4402 : 1986, Test 2.2	2. Unable to roll to specified dimensions.(Sandy sample)
Plastic Limit	NZS 4402 : 1986, Test 2.3	3. N.P. denotes Non Plastic
Plasticity Index	NZS 4402 : 1986, Test 2.4	

Date tested:

03/12/19

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.

Date reported: 09/12/19

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IANZ Approved Signatory

Designation:

Senior Civil Engineering Technician

Date:

09/12/19

ACCREDITED LABORATORY

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

LHF 2440 (10/19)

Page 1 of 1

LINEAR SHRINKAGE FOR SOILS TEST REPORT



HAM2019-0062

Project :

Earthworks

Location:

Stockpile

Client:

Lakeside developments c/o CMW Geosciences

Contractor:

Sampled by:

Client

Date received :

18/11/19

Sampling method:

As received (Bulk sample)

Sample condition:

As received

Stage 1A Imported Material

Project No : 2-68014.00 Lab Ref No : HA5333_LS

Client Ref No:

		Test Res	sults
	Lab Ref No :	HA5333_LS	
	Location ID:	Stockpile	
	Sample Depth (m) :	N/A	
	Soil Fraction Tested :	-425um	
	Blows at LS Point:	22	
	Water Content at LS Point (%):	53.0	
	Linear Shrinkage (%) :	12	
	Water Content (%):	25.0	
	Sample Description:	CLAY	
Test Methods			Notes
Water Content	NZS 4402 : 1986, Test 2.1		
Linear Shrinkage	NZS 4402 : 1986, Test 2.6		

Date tested :

03/12/19

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.

Date reported: 09/12/19

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IANZ Approved Signatory

Designation :

Senior Civil Engineering Technician

Date:

09/12/19



Tests indicated as not accredited are outside the scope of the laboratory's accreditation

LHF 2403B (10/19)

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WSP Opus Hamilton Laboratory Quality Management Systems Certified to ISO 9001 Fox Street Private Bag 3057, Waikato Mail Centre, Hamilton 3240, New Zealand Telephone +64 7 856 2870 Website

Winstone Aggregates | Auckland Laboratory



Test Report

CUSTOMER Winstone Aggregates

CLIENT REFERENCE

CUSTOMER ADDRESS PO Box 17 195, Greenlane, Auckland

SOURCE WA Pukekawa Quarry REASON FOR TEST Load-out Face

PRODUCT NAME Sand3

SPECIFICATION Sand3 Pukekawa Oct-14 STOCKPILE ID Not Applicable

SAMPLING METHOD CONDITION RECEIVED NZS4407:2015, Section 2.4.6.3.2 Natural SAMPLE DATE DATE RECEIVED 22/8/2019 22/8/2019

SAMPLED BY SAMPLE ID Georgia Robinson AKL19-2912 SAMPLED FROM **REPORT ID** WA Pukekawa Quarry 118114

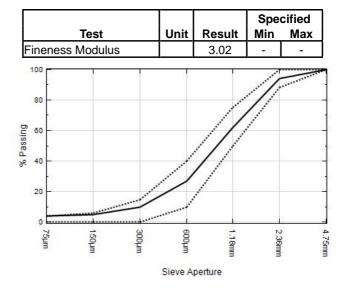
TEST METHODS

Lot 110-112 Imported Test Notes **Test Finish Date** Sand Fineness Modulus NZS3111:1986 test 6.5.2 23/8/2019 23/8/2019

TEST RESULTS

Sieve Analysis NZS3111:1986 test 6

	SIEVE ANALYSI	S	
Sieve	%	Spe	cified
Aperture	Passing	Min	Max
4.75mm	100	100	100
2.36mm	94	88	100
1.18mm	62	50	75
600µm	27	10	40
300µm	10	0	15
150µm	5	0	6
75um	4	l 0	4



COMMENTS

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Approved By:

All tests reported herein have been performed in accordance with the laboratory's

Tovo Takau Approved Signatory Date Issued: 25/8/2019

Page 1 of 1

Appendix D: Subdivision Earthworks Specification



17 October 2018 Document Ref: HAM2018-0106AB Rev 1

Land Development Earthworks Specification For: Stages 1 to 7 Lakeside Residential Development, Scott Road, Te Kauwhata

1 INTRODUCTION AND SCOPE

This specification covers compaction control criteria for the cut-to-fill material at the above site. This is based on and cut-to-fill workability trials carried out on site by the earthworks contractor, use of the material during placement on the 80,000m³ site, suitability of the cut to fill materials on site, compaction testing carried out by CMW Geosciences (CMW) and our review of the compaction test results provided in the Earthtech Limited report referenced R4036-2-Rev B, dated 30 March 2017. It provides detail on the required specification for:

- Cut to fill earthworks operations;
- Fill materials and testing requirements;
- · Earthworks finishing and respread of topsoil; and,
- · As-built records.

Excluded from the scope are site clearance and preparation, geotextile reinforced slopes, subsoil drainage installation or retaining structures covered by a building consent.

Unless varied onsite by the Geotechnical Engineer, the following specification requirements must be met in order for CMW to provide a Geotechnical Completion Report for the works. Where there is any conflict or discrepancy in the requirements of this specification and the documents listed above the matter shall be referred to the Geotechnical Engineer (CMW) for clarification.

2 RELEVANT DOCUMENTS

2.1 Standards, Guidelines and Consents

The works shall comply with the relevant sections of the following standards, guidelines and consents:

- 1. Health and Safety at Work Act 2015 and Regulations 2016;
- 2. All Project Resource Consent Conditions and Engineering Works Approvals;
- 3. Waikato District Council Development and Subdivision Manual 2012;

- 4. The Waikato Regional Council, Erosion and Sediment Control Guidelines Technical Report No. 2009/02:
- 5. NZS 4431:1989 Code of Practice for Earth Fill for Residential Development;
- 6. NZS 4402: 1986 Methods of Testing Soils for Civil Engineering Purposes; and,
- 7. NZS 4404: 2010 Code of Practice for Urban Land Subdivision.

3 GEOTECHNICAL OBSERVATION REQUIREMENTS

3.1 Fill Materials and Conditioning

3.1.1 Soil Fill, Rock Fill or Soil and Rock Mixed Fill

Site won materials used as engineered filling shall be free of topsoil, organic matter and other unsuitable materials. The maximum particle size for soil and rock blended fill shall be 200mm and mixing and/ or crushing shall be carried in a manner that ensures that significant voids are not present in the filling between rock fragments.

For rock fill without soil blending, crushing is to occur to comply with the requirements for blended fills and needs to ensure that uniform compaction can occur without significant voids between particles in the absence of the soil fill.

3.1.2 Blending of Unsuitable Material to Create Acceptable Fill

The blending of 'unsuitable material' into structural fills may be undertaken only at the discretion of the Geotechnical Engineer following a request by the contractor and with sufficient time for appropriate consideration and onsite trials to demonstrate effectiveness of proposed blending

Approval for any such blending must be sought from and provided by the Geotechnical Engineer in writing prior to the commencement of any blending or trial.

Hardfill used as structural fill shall be a well graded, unweathered, durable, crushed rock product approved by the Geotechnical Engineer, with a grading suitable for compaction.

3.1.3 Material Conditioning

The cut materials on site may require some drying or wetting prior to compaction to achieve the required specification. This may be done by harrowing (such as with discs) and air drying when conditions permit or by the addition of hydrated lime.

Should the material require drying the addition of cement to engineered filling in concentrations greater than 3% requires the approval of the Geotechnical Engineer.

All additives such as cement proposed for use in backfill materials in contact with geosynthetics must be approved and monitored by the Geotechnical Engineer.

3.2 Fill Placement, Compaction and Testing Requirements

3.2.1 Site Won Cohesive Fill

Attention is drawn to the blending of cohesive and granular material. The appropriate testing method will be determined by the Geotechnical Engineer on-site.

The test criteria and frequency for cohesive materials (Clays & Silts) are set out in Table 1 and 2 below.

CMW Geosciences

Table 1 – Cohesive Materials Compaction Test Criteria for Engineered Filling:

	Air \	Voids ⁽¹⁾	Shear Vane	Strength ⁽²⁾
	Average	Maximum Single Value	Average	Minimum Single Value
General Fill (cohesive)	8%	10%	120 kPa	100 kPa
Landscape Fill		TBC by Ge	otechnical Engineer in case	by case basis

⁽¹⁾ Air Voids Percentage (as defined in NZS 4402:1986)

Table 2 – Cohesive Materials Compaction Testing Frequencies for Engineered Filling:

Soil Type	Field Density & Air Voids %	Vane Shear Strength	Solid Density	Compaction Curve
General Fill (cohesive)	1 test per 1000m³ to 1500m³ of fill placed (subject to width and depth of fill) with not less than 1 test per 500mm lift of fill and for each 50m length of shear key excavation.	1 set of tests (4 readings within 1 metre of each other) per 1000m³ to 1500m³ of filling placed with not less than 1 set of tests per 500mm lift of fill for each fill area	Testing at CMW's discretion during the first month of earthworks and where different / unique soils conditions are exposed.	Testing at CMW's discretion during the first month of earthworks and where different / unique soils conditions are exposed.
Landscape Filling	TBC by Geotechnical E	Engineer of case by ca	se basis	

The test criteria and/or frequency may be modified (relaxed or made more stringent) at the discretion of the Geotechnical Engineer (CMW) for the project or in a discrete fill area subject to the consistency of the results achieved being acceptable over a specified period of time.

3.2.2 Granular Fill or Hardfill

Granular fill and/or hardfill shall be placed and compacted to 95% of the MDD determined from the laboratory MDD. If these conditions are not able to be met then appropriate adjustment of the moisture content or compaction equipment will be required. The Geotechnical Engineer may at their discretion, alter the compaction specification to a method compaction specification based on the compaction trial result for materials with a maximum particle size greater than 65mm.

Test frequencies and criteria for granular fill/hardfill are presented in Tables 3 and 4.

Table 3 – Granular Fill Compaction Test Criteria for Engineered Filling:

Fill Type	Air Voids (1)	Dry Density ⁽¹⁾	Scala Penetrometer
i iii i ype	Maximum Single Value	Minimum	Minimum
General Fill (Granular)	20%	95% MDD	5 blows per 100mm penetration

CMW Geosciences Ref. HAM2018-0106AB REV 1

⁽²⁾ Undrained Shear Strength (Measured by hand shear vane - calibrated using NZGS 2001 method)

Table 4 - Granular Fill Compaction Testing Frequencies for Engineered Filling:

Test	Frequency
Nuclear Densometer (NDM) OR Density Tube	Minimum 1 test per 1,000m³ to 1500m³ (subject to width and depth of fill). To be distributed over extent and depth of filling and tests recorded at least every 0.5 metre depth of filling, where practical.
Moisture Content	Minimum 1 test per 1,000m³ to 1500m³ (subject to width and depth of fill). To be distributed over extent and depth of filling and tests recorded at least every 0.5 metre depth of filling, where practical.
Scala Penetrometer	Minimum 1 x 0.8 metre deep test per 1,000m³ of filling to 1500m³ (subject to width and depth of fill), at least every 0.5 metre depth of filling, where practical.
Compaction Curve (NZ Standard Compaction) and Solid Density Test	Testing at CMW's discretion during the first month of earthworks and where different / unique soils conditions are exposed.

The test frequency may be modified (relaxed or made more stringent) at the discretion of the Geotechnical Engineer (CMW) for the project or in a discrete fill area subject to the consistency of the results achieved being acceptable over a specified period of time.

3.2.3 Compaction Trials

Compaction trials may be carried out to determine the optimum layer thickness, number of passes and material condition for the proposed plant in order to meet the specified degree of compaction.

The contractor shall construct a pad such that on one side there are layers of one constant thickness, and on the other side layers of a different constant thickness. Both sides shall be subjected to increasing passes of the roller and sequentially tested until no further benefit of rolling is obtained.

If the required compaction criteria cannot be achieved the test shall be repeated after appropriate conditioning of the soil. The Contractor shall agree with the Geotechnical engineer the most appropriate soil conditioning before proceeding.

3.2.4 Compaction Testing Reporting Requirements

- 1 All test location coordinates are to be recorded by GPS survey using the Moturiki 1953 Datum. Test location coordinates, with date and test number reference are to be provided to the Geotechnical Engineer in electronic (excel) format on a weekly basis). Alternatively, the Geotechnical Engineer may approve the use of site plans to mark the location of tests in lieu of GPS location.
- 2. The level within the fill of each test location is to be recorded.
- 3. The volume of fill placed for each progress claim month (typically ending 20th of the month) including all fill placed (undercut and cut to fill) are to be provided to the Geotechnical Engineer monthly by the contractor or Engineer to the Contract to allow assessment of test frequency adequacy.

3.3 Finishing Works and Topsoil Respread

3.3.1 Overcut

All areas cut to below finished level shall be reinstated with engineered filling to the satisfaction of the Geotechnical Engineer.

CMW Geosciences Ref. HAM2018-0106AB REV 1

⁽¹⁾ Minimum dry density non-compliance may be accepted on site by the Geotechnical Engineer on a case by case basis depending on the nature of the material and the other criteria results.

3.3.2 **Topsoil Depth**

Topsoil respread depth shall be between 100mm and 300mm, or as directed by the Engineer to the contractor. On ground steeper than 1V:3H the surface shall be roughened under the supervision of the Geotechnical Engineer prior to topsoil placement.

3.3.3 **Unsuitable Materials**

At the conclusion of earthworks all surplus unsuitable materials shall be removed from site or placed in designated reserve areas. The size and location of such stockpiles must be approved by the Geotechnical Engineer and recorded on the asbuilt drawings.

3.3.4 **Road Subgrades**

Testing and formation of road subgrades will be carried out as part of the subdivision civil works package.

4 ASBUILT INFORMATION REQUIREMENTS

In order to provide a Geotechnical Completion Report (GCR) certain asbuilt information must be provided to CMW. It is the contractor's responsibility to ensure that all of the following items are surveyed prior to placing filling. The survey of these items shall therefore form a hold point in the construction sequence.

- 1. The location and invert of all subsoil drainage; and,
- 2. The depth of filling placed including all benching, undercuts, and temporary ponds which have been backfilled.

CMW require the following asbuilt information to be provided for the GCR:

- 1. Cut and fill depth plan (including undercuts);
- 2. Final contour plan;
- 3. Drainage locations and inverts (surface and subsurface);
- 4. Drainage outlet locations (surface and subsurface);
- 5. Details of any defined overland flow paths;
- 6. Material data for imported products used such as draincoils, aggregates and geofabrics as well as confirmation that products installed comply with the requirements of the project drawings and this specification; and,
- 7. Any settlement monitoring data.

CMW Geosciences

Appendix E: Earth Fill Quality Control Data



Hamilton Laboratory

CMW Geosciences (NZ) Ltd Partnership Suite 2, 5 Hill Street, Hamilton 3204

PO Box 995, Waikato Mail Centre, Hamilton 3240

Phone: +64 (07) 2820 039

Test Methods:

Notes: Solid Density: Assumed

HAM2019-0062

6/03/2020

NZS 4402 1986 Test 2.1

Solid Density Data Source: N/A CMW Field Staff

Project No: Location: Report No: Report Date:

Client Address:

Project:

Client:

98 Scott Road, Te Kauwhata HAM2019-0062LAE Rev.0

Lakeside Developments (2017) Limited

Lakeside Development

NZS 4407 2015 Test 3.1 NZS 4407 2015 Test 4.2 Testing Locations Selected By:

NZS 4407 2015 Test 4.3

NZGS:August 2001 1 Blade size of 19mm used.

Tests indicated as not accredited are outside the scope of the laboratory's accreditation

Measurements marked * are not accredited and are outside the scope of the laboratories accreditation

			Test Location*				Van	e ID		n-situ Va	ne Shear	r Strength	ıs			Fi	eld and Lahora	tory Testing D	ata			
			rest Location		4		van	1		II-situ va	lile Sileai	Juengu	13				eiu aiiu Labora	itory resting b	, ata	l		
Pate Sampled	Sample No.	Loca	ation	RL/Details	Soil Description*	Solid Density (t/m³) *	Head#	Blade #	Test 1 (kPa)	Test 2 (kPa)	Test 3 (kPa)	Test 4 (kPa)	Ave.	Gauge Wet Density (t/m³) **	Gauge Dry Density (t/m³)	Gauge Water Content (%)	Gauge Air Voids (%)	Gauge Probe Depth (mm)	Oven Water Content (%)	Oven Dry Density (t/m³)	Oven Calculated Air Voids (%) *	Comments
10/12/2019	N80	Stage 5		12.1	CLAY	2.62	1785	1785	UTP	202	190	159	184+	1.79	1.26	41.7	-1	300	38.8	1.29	1	
	N81	Stage 5		7.5	CLAY	2.62	1785	1785	UTP	UTP	UTP	UTP	202+	1.84	1.42	28.9	4	300	24.9	1.47	7	
	N82	Stage 4		9	CLAY	2.62	1785	1785	UTP	UTP	202	UTP	202+	1.81	1.36	33.0	3	300	30.3	1.39	5	
11/12/2019	N83	Stage 6		12.6	CLAY	2.70	1785	1785	202	202	UTP	UTP	202+	1.95	1.57	24.3	4	300	20.8	1.62	7	
	N84	Stage 6		13.8	CLAY	2.70	1785	1785	159	118	124	150	138	1.91	1.53	24.5	6	300	25.2	1.52	5	
	N85	Stage 6		15.3	CLAY	2.70	1785	1785	UTP	UTP	UTP	UTP	202+	1.93	1.53	26.2	3	300	25.3	1.54	4	
	N86	Stage 6		13.6	CLAY	2.70	1785	1785	46	58	84	84	68	1.75	1.23	41.9	3	300	45.3	1.20	1	
	N87	Stage 6		-	CLAY	2.70	1785	1785	202	UTP	UTP	UTP	202	1.86	1.32	40.5	-3	300	39.1	1.34	-2	
	N88	Stage 5		-	CLAY	2.70	1785	1785	190	202	202	202	199	1.80	1.30	38.4	2	300				No sample taken
12/12/2019	N89	Stage 4		14.1	CLAY	2.70	1785	1785	UTP	UTP	UTP	UTP	202+	1.76	1.40	25.9	12	300	21.0	1.45	16	See N90
13/12/2019	N90	Stage 4		-	CLAY	2.70	1785	1785	UTP	202	202	UTP	202+	1.79	1.36	31.9	7	300	31.8	1.36	7	Retest of N89
	N91	Stage 4		13.4	CLAY	2.70	1785	1785	199	202	202	202	201	1.85	1.42	30.0	5	300	31.5	1.40	4	
	N92	Stage 4		13.3	CLAY	2.70	1785	1785	190	202	187	182	190	1.87	1.41	32.3	2	300	31.4	1.42	3	
	N93	Stage 5		10.8	CLAY	2.70	1785	1785	159	202	190	202	188	1.86	1.38	35.1	1	300	32.9	1.40	2	
	N94	Stage 5		9.3	CLAY	2.70	1785	1785	202	202	202	UTP	202+	1.89	1.45	30.1	2	300	28.8	1.47	3	
	N95	Stage 5		8.2	CLAY	2.70	1785	1785	202	202	202	202	202	1.82	1.34	36.5	2	300	44.0	1.27	-3	
30/12/2019	N96	Stage 4		8.7	CLAY	2.62	1911	1911	UTP	UTP	UTP	UTP	215+	1.82	1.41	29.3	5	300	23.2	1.48	9	
	N97	Stage 4		8.8	CLAY	2.62	1911	1911	UTP	UTP	UTP	UTP	215+	1.86	1.44	29.0	3	300	20.8	1.54	9	
3/01/2020	N98	Stage 4		-	CLAY	2.62	1911	1911	215+	UTP	UTP	UTP	215+	1.83	1.38	32.2	3	250	28.4	1.42	5	
	N99	Stage 4		-	CLAY	2.70	1911	1911	154	77	74	62	92									
	N100	Stage 4		-	CLAY	2.70	1911	1911	UTP	UTP	UTP	UTP	215+	1.69	1.29		13				18	See N126
	N101	Stage 5		-	CLAY	2.70	1911	1911	215+	UTP	123	UTP	169+	1.77	1.27	39.5	3	250	32.8	1.33	7	See N107
	N102	Stage 5		8	CLAY	2.62	1911	1911	215+	UTP	UTP	UTP	215+	1.72	1.32	30.3	10	250	26.6	1.35	12	See N108
	N103	Stage 5		-	CLAY	2.62	1911	1911	113	154	179	139	146	1.77	1.33	33.0	5	200	28.6	1.38	8	See N109
	N104	Stage 6		15.3	CLAY	2.70	1911	1911	UTP	UTP	UTP	UTP	215+	1.65	1.31	25.5	18	1		1.41	24	See N110
	N105	Stage 6		11.1	CLAY	2.70	1911	1911	200	UTP	UTP	UTP	200+	1.77	1.42	25.2	12	250	22.0	1.45	14	See N111
	N106	Stage 6		11.4	CLAY	2.70	1911	1911	UTP	UTP	UTP	UTP	215+	1.83	1.45	26.3	8	250	26.7	1.45	8	See N112

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** Gauge Wet Densities outside of the calibrated range of 1.728 to 2.756 t/m³ are not accredited and are outside the laboratories scope of accreditation.

10/01/2020 Created By: WPJ Date: 9/03/2020 Checked By: JLM Date: 2/04/2020 Authorised Signatory: AC Date:

1 of 17 Page:



Hamilton Laboratory
CMW Geosciences (NZ) Ltd Partnership

Suite 2, 5 Hill Street, Hamilton 3204

PO Box 995, Waikato Mail Centre, Hamilton 3240 Phone: +64 (07) 2820 039

Phone: +64 (07) 282

Solid Density:

Assumed N/A

Lakeside Development HAM2019-0062

98 Scott Road, Te Kauwhata HAM2019-0062LAF Rev.0

Report Date: 6/03/2020

6/03/2020

Client: Lakeside Developments (2017) Limited

Client Address:

Project:

Project No:

Location:

Report No:

Test Methods:NZS 4402 1986 Test 2.1
NZS 4407 2015 Test 3.1

Solid Density Data Source: Testing Locations Selected By:

CMW Field Staff

NZS 4407 2015 Test 4.2 NZS 4407 2015 Test 4.3

NZGS:August 2001

1 Blade size of 19mm used.



Tests indicated as not accredited are outside the scope of the laboratory's accreditation

Measurements marked * are not accredited and are outside the scope of the laboratories accreditation

			Test Location*				Van	ne ID	I	n-situ Va	ne Shear	Strengt	hs			Fie	ld and Labora	tory Testing D	ata		•	
Date Sampled	Sample No.		Location	RL/Details	Soil Description*	Solid Density (t/m³) *	Head #	Blade #	Test 1 (kPa)	Test 2 (kPa)	Test 3 (kPa)	Test 4 (kPa)	Ave.	Gauge Wet Density (t/m³) **	Gauge Dry Density (t/m³)	Gauge Water Content (%)	Gauge Air Voids (%)	Gauge Probe Depth (mm)	Oven Water Content (%)	Oven Dry Density (t/m³)	Oven Calculated Air Voids (%)	Comments
6/01/2020	N107	Stage 4		7.5	CLAY	2.70	2349	2349	UTP	UTP	UTP	UTP	204+	1.66	1.35	22.4	20	300	21.3	1.36	20	Retest of N101, See 116
	N108	Stage 4		7.4	CLAY	2.70	2349	2349	UTP	UTP	UTP	UTP	204+	1.80	1.49	20.7	14	300	21.0	1.49	14	Retest of N102, See 125
	N109	Stage 5		7.2	CLAY	2.70	2349	2349	UTP	204+	134	160	166+	1.81	1.34	35.5	3	300	28.2	1.41	8	Retest of N103
	N110	Stage 6		11.7	CLAY	2.70	2349	2349	UTP	UTP	UTP	UTP	204+	1.88	1.52	23.2	8	300	21.1	1.55	10	Retest of N104, See N113
	N111	Stage 6		11.6	CLAY	2.70	2349	2349	UTP	UTP	UTP	204	204+	1.84	1.47	25.5	8	300	27.1	1.45	7	Retest of N105, See N115
	N112	Stage 6		15.0	CLAY	2.70	2349	2349	UTP	UTP	UTP	UTP	204+	1.81	1.41	28.6	8	300	25.4	1.44	10	Retest of N106, See N120
7/01/2020	N113	Stage 6		12.0	Clayey SILT	2.62	2532	2532	UTP	UTP	UTP	UTP	205+	1.74	1.33	30.7	8	300	30.7	1.33	9	Retest of N110, See N114
	N114	Stage 6		12.0	Clayey SILT	2.62	2532	2532	UTP	UTP	UTP	UTP	205+	1.78	1.35	31.4	6	300	31.8	1.35	6	Retest of N113
	N115	Stage 6		14.0	Clayey SILT	2.62	2532	2532	UTP	UTP	UTP	UTP	205+	1.73	1.28	35.6	6	300	32.1	1.31	8	Retest of N111, See N127
8/01/2020	N116	Stage 4		7.3	Clayey SILT	2.62	2532	2532	UTP	UTP	205+	UTP	205+	1.64	1.31	25.3	17	300	23.3	1.33	18	Retest of N107, See N124
	N117	Stage 5		7.6	Clayey SILT	2.62	2532	2532	161	205+	UTP	164	177+	1.73	1.20	44.2	1	300	46.3	1.18	0	
	N118	Stage 5		7.4	Clayey SILT	2.62	2532	2532	UTP	UTP	UTP	UTP	205+	1.76	1.29	36.7	4	300	30.5	1.35	7	
	N119	Stage 6		14.1	Clayey SILT	2.62	2532	2532	UTP	UTP	UTP	UTP	205+	1.82	1.42	28.3	6	300	26.4	1.44	7	
	N120	Stage 6		15.2	Clayey SILT	2.62	2532	2532	UTP	UTP	UTP	UTP	205+	1.71	1.28	33.6	8	300	33.7	1.28	8	Retest of N112, See N127
	N121	Stage 6		17.0	Clayey SILT	2.62	2532	2532	UTP	UTP	UTP	UTP	205+	1.80	1.47	22.6	11	300	16.3	1.55	16	See N128
	N122	Stage 6		15.6	Clayey SILT	2.62	2532	2532	UTP	UTP	UTP	UTP	205+	1.81	1.44	26.4	7	300	24.9	1.45	8	
	N123	Stage 6		14.7	Clayey SILT	2.62	2532	2532	UTP	UTP	UTP	UTP	205+	1.71	1.27	35.1	7	300	32.6	1.29	9	
9/01/2020	N124	Stage 4		-	CLAY	2.70	2349	2349	149	204	190	UTP	181+	1.83	1.37	33.3	4	300	24.9	1.46	10	Retest of N116
	N125	Stage 4		-	CLAY	2.70	2349	2349	190	204	190	204	197	1.76	1.36	29.5	10	300	27.5	1.38	11	Retest of N108, See N138
	N126	Stage 4		-	CLAY	2.70	2349	2349	204	UTP	UTP	UTP	204+	1.74	1.36	28.5	11	300	24.4	1.40	14	Retest of N100, See N137
	N127	Stage 6		-	CLAY	2.70	2349	2349	204	UTP	UTP	UTP	204+	1.84	1.42	29.7	5	300	26.1	1.46	8	Retest of N120
	N128	Stage 6		-	CLAY	2.70	2349	2349	204	204	UTP	UTP	204+	1.85	1.33	39.4	-2	300	35.6	1.37	1	Retest of N121
	N129	Stage 5		-	CLAY	2.70	2349	2349	204	204	204	204	204	1.84	1.34	37.3	0	300	34.5	1.37	2	
	N130	Stage 5		-	CLAY	2.70	2349	2349	175	149	204	160	172	1.78	1.34	33.1	6	300	28.0	1.39	9	
	N131	Stage 5		-	CLAY	2.70	2349	2349	175	76	134	32	104	1.75	1.29	35.3	7	300	34.7	1.30	7	See N135
	N132	Stage 5		-	CLAY	2.70	2349	2349	175	204	UTP	UTP	190+	1.85	1.40	31.8	4	300	32.4	1.39	3	
	N133	Stage 4		-	CLAY	2.70	2349	2349	UTP	UTP	UTP	UTP	204+	1.65	1.28	28.9	15	300	21.3	1.36	21	See N142
This report sh	anda antida											1		** Gauge Wet [ensities outside	e of the calibrate	d range of 1 728	to 2 756 t/m ³ a	re not accredited	d and are outsid	e the laboratorie	es scope of accreditation.

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** Gauge Wet Densities outside of the calibrated range of 1.728 to 2.756 t/m³ are not accredited and are outside the laboratories scope of accreditation.

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 13/01/2020

 Checked By:
 JLM
 Date:
 9/03/2020

 Authorised Signatory:
 AC
 Date:
 2/04/2020

Page:

2 of 17



Hamilton Laboratory

CMW Geosciences (NZ) Ltd Partnership Suite 2, 5 Hill Street, Hamilton 3204

PO Box 995, Waikato Mail Centre, Hamilton 3240

Phone: +64 (07) 2820 039

Project: Lakeside Development

Project No: HAM2019-0062
Location: 98 Scott Road, Te Kauwhata

 Report No:
 HAM2019-0062LAG Rev.0

 Report Date:
 6/03/2020

Client: Lakeside Developments (2017) Limited

Client Address:

Test Methods: NZS 4402 1986 Test 2.1 Solid Density:

Assumed N/A

Page:

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NZS 4407 2015 Test 3.1

Solid Density Data Source: Testing Locations Selected By:

CMW Field Staff

NZS 4407 2015 Test 4.2

NZS 4407 2015 Test 4.3

NZGS:August 2001 ① Blade size of 19mm used.

Notes:



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Measurements marked * are not accredited and are outside the scope of the laboratories accreditation

		Test Location*				Van	e ID	ı	n-situ Va	ne Shea	r Strengtl	15			Fie	ld and Labora	tory Testing (Data			
Date Sampled	Sample No.	Location	RL/Details	Soil Description*	Solid Density (t/m³) *	Head #	Blade #	Test 1 (kPa)	Test 2 (kPa)	Test 3 (kPa)	Test 4 (kPa)	Ave.	Gauge Wet Density (t/m³) **	Gauge Dry Density (t/m³)	Gauge Water Content (%)			Oven Water Content (%)	Oven Dry Density (t/m³)	Oven Calculated Air Voids (%)	Comments
10/01/2020	N134	Stage 5	-	CLAY	2.70	2532	2532	134	205	175	140	164	1.78	1.20	48.5	-2	300	54.0	1.16	-5	
	N135	Stage 5	-	CLAY	2.70	2532	2532	205	205	UTP	UTP	205+	1.63	1.25	31.2	15.02	300)			Retest of N131, See N149 No sample taken
	N136	Stage 1A	-	CLAY	2.70	2532	2532	UTP	UTP	UTP	UTP	205+	1.86	1.53	21.8	10	300	24.4	1.50	8	
	N137	Stage 4	-	CLAY	2.70	2532	2532	UTP	205	205	205	205+	1.81	1.38	30.8	6	300	27.9	1.41	8	Retest of N126, See N153
	N138	Stage 4	-	CLAY	2.70	2532	2532	UTP	UTP	UTP	UTP	205+	1.75	1.37	28.2	11	300	25.1	1.40	13	Retest of N125, See N258
13/01/2020	N139	Stage 1A	4.8	Imported CLAY	2.72	2532	2532	UTP	UTP	UTP	UTP	205+	1.87	1.45	28.3	5	300	24.3	1.50	8	
	N140	Stage 1A	4.5	Imported CLAY	2.72	2532	2532	UTP	UTP	UTP	UTP	205+	1.80	1.49		15	300	_	1.44	11	See N148
	N141	Stage 6	15.1	CLAY	2.70	2532	2532	UTP	UTP	UTP	UTP	205+	1.94	1.50	28.9	1	300	26.6	1.53	3	
	N142	Stage 4	-	CLAY	2.70	2532	2532	UTP	UTP	UTP	UTP	205+	1.65	1.28		16	300	24.4	1.32	19	Retest of N133, See N154
	N143	Stage 6	16.9	CLAY	2.70	2532	2532	UTP	UTP	UTP	UTP	205+	1.73	1.30		8	300		1.29	8	
	N144	Stage 6	15.3	CLAY	2.70	2532	2532	UTP	UTP	UTP	UTP	205+	1.86	1.46	27.4	6	300	23.8	1.50	9	
	N145	Stage 6	13.9	CLAY	2.70	2532	2532	UTP	UTP	UTP	UTP	205+	1.82	1.39	30.8	6	300	24.5	1.46	10	
	N146	Stage 6	12.6	CLAY	2.70	2532	2532	UTP	UTP	UTP	UTP	205+	1.85	1.38		2	300		1.42	5	
	N147	Stage 6	12.0	CLAY	2.70	2532	2532	UTP	UTP	UTP	UTP	205+	1.94	1.51	28.8	1	300	23.1	1.58	5	
	N148	Stage 1A	-	Imported CLAY	2.72	2532	2532	UTP	UTP	UTP	UTP	205+	1.91	1.52	25.6	5	300	26.2	1.51	5	Retest of N140
14/01/2020	N149	Stage 5	7.8	CLAY	2.62	2532	2532	205	205	76	105	148	1.83	1.40	-	3	300		1.43	5	Retest of 135, See N161
	N150	Stage 5	8.0	CLAY	2.62	2532	2532	UTP	UTP	UTP	UTP	205+	1.83	1.36		1	300		1.40		
	N151	Stage 5	7.9	CLAY	2.62	2532	2532	UTP	UTP	UTP	UTP	205+	1.75	1.20		-1	300		1.29		
15/01/2020	N152	Stage 6	5.9	Clayey SILT	2.62	2349	2349	UTP	204	UTP	204	204+	1.83	1.35		1	250		1.35	0	
	N153	Stage 4	5.3	Clayey SILT	2.62	2349	2349	UTP	204	175	172	184	1.81	1.41		6	300		1.39		Retest of N137
	N154	Stage 5	5.9	Clayey SILT	2.62	2349	2349	UTP	UTP	UTP	UTP	204+	1.78	1.39		8	100		1.38		Retest of N142
16/01/2020		Stage 1A	-	Imported CLAY	2.72	2532	2532	175	158	175	UTP	169+	1.91	1.53		6	300		1.48	3	
	N156	Stage 1A	-	Imported CLAY	2.72	2532	2532	175	205	205	205	198	1.90	1.52	24.6	6	300	28.9	1.47	3	
		1 1:60																			come of accordination

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** Gauge Wet Densities outside of the calibrated range of 1.728 to 2.756 t/m³ are not accredited and are outside the laboratories scope of accreditation.



Hamilton Laboratory

CMW Geosciences (NZ) Ltd Partnership Suite 2, 5 Hill Street, Hamilton 3204

PO Box 995, Waikato Mail Centre, Hamilton 3240

Phone: +64 (07) 2820 039

Project: Lakeside Development Project No:

HAM2019-0062

Location: 98 Scott Road, Te Kauwhata Report No: HAM2019-0062LAH Rev.0

Report Date:

Client: Lakeside Developments (2017) Limited

Client Address:

Test Methods: Notes:

NZS 4402 1986 Test 2.1 Solid Density Data Source: NZS 4407 2015 Test 3.1

N/A Testing Locations Selected By: CMW Field Staff

NZS 4407 2015 Test 4.2 NZS 4407 2015 Test 4.3

NZGS:August 2001 1) Blade size of 19mm used.



Tests indicated as not accredited are outside the scope of the laboratory's accreditation

Solid Density:

Measurements marked * are not accredited and are outside the scope of the laboratories accreditation

Assumed

		Test Location*				Van	ie ID		In-situ Va	ne Shea	r Strengtl	hs			Fie	eld and Labora	tory Testing D	ata			
Date Sampled	Sample No.	Location	RL/Details	Soil Description*	Solid Density (t/m³) *	Head #	Blade #	Test 1 (kPa)	Test 2 (kPa)	Test 3 (kPa)	Test 4 (kPa)	Ave.	Gauge Wet Density (t/m³) **	Gauge Dry Density (t/m³)	Gauge Water Content (%)	Gauge Air Voids (%)	Gauge Probe Depth (mm)	Oven Water Content (%)	Oven Dry Density (t/m³)	Oven Calculated Air Voids (%)	Comments
17/01/2020	N157	Stage 6	-	CLAY	2.70	1785	1785	118	173	170	173	159	1.82	1.34	35.3	3	300	29.1	1.41	7	
	N158	Stage 6	16.8	CLAY	2.70	1785	1785	182	202	104	147	159	1.86	1.41	32.1	3	300	30.3	1.43	4	
	N159	Stage 6	15.1	CLAY	2.70	1785	1785	UTP	UTP	UTP	UTP	202+	1.91	1.47	29.3	2	300	26.1	1.51	5	
	N160	Stage 6	14.8	CLAY	2.70	1785	1785	202	UTP	UTP	UTP	202+	1.80	1.29	39.2	2	300	32.6	1.35	6	
	N161	Stage 5	-	CLAY	2.70	1785	1785	147	150	202	124	156	1.85	1.39	32.9	3	300	24.9	1.48	8	Retest of N149
20/01/2020	N162	Stage 6	16.7	CLAY	2.70	2532	2532	76	85	91	94	87									See N173
	N163	Stage 6	16.7	CLAY	2.70	2532	2532	UTP	UTP	UTP	UTP	205+	1.78	1.33	33.4	6	300	30.8	1.36	8	
	N164	Stage 6	-	CLAY	2.70	2532	2532	UTP	UTP	205+	205+	205+	1.79	1.34	33.8	5	300	33.7	1.34	5	
	N165	Stage 1A	-	Imported CLAY	2.72	2532	2532	UTP	UTP	UTP	UTP	205+	2.05	1.77	16.1	7	300	17.0	1.75	6	
	N166	Stage 1A	-	Imported CLAY	2.72	2532	2532	UTP	UTP	UTP	UTP	205+	2.05	1.76	16.3	7	300	21.3	1.69	2	
21/01/2020	N167	Stage 5	-	CLAY	2.70	1785	1785		133	124	110	107	1.72	1.27	35.3	8	300	40.9	1.22	5	See N179. Lot 220
	N168	Stage 5	-	CLAY	2.70	1785	1785	75	61	124	135	99	1.71	1.21	40.8	5	300	34.4	1.27	9	See N187, N188. Lot 220
22/01/2020	N169	Stage 1A	7.3	Imported CLAY	2.72	2532	2532	UTP	UTP	UTP	UTP	205+	2.01	1.75	14.4	10	300	16.8	1.72		See N177
	N170	Stage 1A	6.2	Imported CLAY	2.72	2532	2532	UTP	UTP	UTP	UTP	205+	2.02	1.72	17.5	7	300	19.1	1.70	5	
	N171	Stage 6	14.9	CLAY	2.70	2532	2532	205	205	140	137	172	1.79	1.34	33.4	5	300	30.3	1.37	8	
	N172	Stage 6	14.5	CLAY	2.70	2532	2532	205	140	149	175	167	1.77	1.32		6	300		1.34	7	
24/01/2020	N173	Stage 6	-	CLAY	2.70	2532	2532		149	175	172	158	1.79	1.34		5	300		1.37		Retest of N162
	N174	Stage 6	16.7	CLAY	2.70	2532	2532	193	205	205	205	202	1.80	1.36		5	300		1.38		
	N175	Stage 6	14.5	CLAY	2.70	2532	2532	UTP	UTP	UTP	UTP	205+	1.82	1.39		6	300		1.45		
	N176	Stage 6	16.8	CLAY	2.70	2532	2532		190	UTP	UTP	198+	1.84	1.41	30.4	5	300		1.43		
	N177	Stage 1A	-	Imported CLAY	2.72	2532	2532	205	205	UTP	UTP	205+	2.02	1.72		6	300		1.72		Retest of N169
	N178	Stage 1A	7.5	Imported CLAY	2.72	2532	2532	205	205	205	202	204	1.95	1.61	21.2	7	300		1.58		
	N179	Stage 5	-	CLAY	2.70	2532	2532		205	105	105	119	1.75	1.30		7	300		1.31	8	Retest of N167, See N188
28/01/2020	N180	Stage 1A	7.4	Imported CLAY	2.72	2560	2560	UTP	UTP	UTP	UTP	191+	2.04	1.73	18.0	5	300		1.75	7	
	N181	Stage 1A	7.3	Imported CLAY	2.72	2560	2560	UTP	UTP	UTP	UTP	191+	1.97	1.67	18.0	9	300	16.6	1.69	10	

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** Gauge Wet Densities outside of the calibrated range of 1.728 to 2.756 t/m³ are not accredited and are outside the laboratories scope of accreditation.

Created By: WPJ Date: 20/01/2020 Checked By: JLM Date: 12/03/2020 Authorised Signatory: AC Date: 2/04/2020

4 of 17 Page:



Project:

Project No:

Location:

Client:

Client Address:

LF11 Rev.12 Soil Field Density NDM Direct Transmission with VSS Report (Cohesive Soils)

Hamilton Laboratory

Test Methods:

CMW Geosciences (NZ) Ltd Partnership Suite 2, 5 Hill Street, Hamilton 3204

PO Box 995, Waikato Mail Centre, Hamilton 3240

Phone: +64 (07) 2820 039

Notes: Solid Density: Assumed

Lakeside Development 98 Scott Road, Te Kauwhata

NZS 4402 1986 Test 2.1 NZS 4407 2015 Test 3.1 NZS 4407 2015 Test 4.2 Solid Density Data Source: N/A

Report No: HAM2019-0062LAI Rev.0 Report Date:

NZS 4407 2015 Test 4.3

Testing Locations Selected By: CMW Field Staff

6/03/2020 Lakeside Developments (2017) Limited

HAM2019-0062

NZGS:August 2001

1 Blade size of 19mm used.

ACCREDITED LABORATORY

not accredited are outside the scope of the laboratory's accreditation

Measurements marked * are not accredited and are outside the scope of the laboratories accreditation

		Test Location*				Van	e ID	I	n-situ Va	ne Shear	Strengt	ns			Fie	eld and Labora	tory Testing D	ata			
Date Sampled	Sample No.	Location	RL/Details	Soil Description*	Solid Density (t/m³) *	Head #	Blade #	Test 1 (kPa)	Test 2 (kPa)	Test 3 (kPa)	Test 4 (kPa)	Ave.	Gauge Wet Density (t/m³) **	Gauge Dry Density (t/m³)	Gauge Water Content (%)		Gauge Probe Depth (mm)		Oven Dry Density (t/m³)	Oven Calculated Air Voids (%) *	Comments
29/01/2020	N182	Stage 6	17.9	CLAY	2.70	1911	1911	215	UTP	215	215	215+	1.79	1.34	33.6	5	300	31.0	1.37	7	
	N183	Stage 6	16.2	CLAY	2.70	1911	1911	215	215	215	215	215	1.77	1.31	35.0	5	300	30.8	1.36	8	
	N184	Stage 6	15.8	CLAY	2.70	1911	1911	169	172	157	185	171	1.79	1.33	34.2	5	300	28.7	1.39	9	See N201 for retest
	N185	Stage 6	13.9	CLAY	2.70	1911	1911	UTP	UTP	157	151	154+	1.80	1.41	28.0	8	300	34.8	1.34	4	
	N186	Stage 5	13.8	CLAY	2.70	1911	1911	215	215	215	215	215	1.77	1.30	36.8	4	300	30.3	1.36	8	See N194 for retest
	N187	Stage 5	-	CLAY	2.70	1911	1911	126	132	157	215	158	1.76	1.24	41.8	2	200	35.4	1.30	6	Retest of N168. Lot 220
	N188	Stage 5	-	CLAY	2.70	1911	1911	46	43	86	55	58									Retest of N179. Lot 220. No sample taken
31/01/2020	N189	Stage 4	6.2	CLAY	2.70	2349	2349	216	UTP	UTP	UTP	216+	1.82	1.38	32.0	5	300	30.9	1.39	5	
	N190	Stage 4	7.3	CLAY	2.70	2349	2349	UTP	UTP	UTP	UTP	216+	1.79	1.33	34.1	5	300	29.7	1.38	8	
	N191	Stage 4	7.0	CLAY	2.70	2349	2349	UTP	UTP	UTP	UTP	216+	1.82	1.36	33.6	4	300	29.9	1.40	6	
	N192	Stage 1A	7.3	Imported CLAY	2.72	2349	2349	185	185	216	188	194	1.92	1.56	23.2	6	300	28.4	1.50	2	
	N193	Stage 1A	7.2	Imported CLAY	2.72	2349	2349	157	161	216	151	171	1.92	1.54	24.7	5	300	25.7	1.53	5	
	N194	Stage 6	14.8	CLAY	2.70	2349	2349	198	188	191	216	198	1.76	1.31	34.8	6	300	33.1	1.33	7	Retest of N186
	N195	Stage 6	17.6	CLAY	2.62	2349	2349	130	185	216	148	170	1.80	1.38	30.1	6	300	27.8	1.41	7	
	N196	Stage 6	18.1	CLAY	2.62	2349	2349	133	216	UTP	157	169+	1.75	1.28	36.4	4	300	44.6	1.21	0	
	N197	Stage 6	-	CLAY	2.70	2349	2349	117	71	133	80	100									See N199
3/02/2020	N198	Stage 5	15.6	CLAY	2.70	2349	2349	170	UTP	UTP	UTP	170+	1.77	1.35	30.8	8	300	23.2	1.44	13	See N209
	N199	Stage 6	16.4	CLAY	2.70	2349	2349	80	74	96	127	94									See N256
	N200	Stage 6	18.4	CLAY	2.70	2349	2349	170	185	157	167	170	1.61	1.23	30.3	17	300	22.2	1.31	22	See N215
	N201	Stage 6	18.1	CLAY	2.70	2349	2349	56	127	68	71	81									Retest of N184, See N208
4/02/2020	N202	Stage 1A	7.5	Imported CLAY	2.72	2349	2349	216+	216+	201	157	198+	1.92	1.55	23.3	7	300	26.1	1.52	4	See N229
	N203	Stage 1A	7.9	Imported CLAY	2.72	2349	2349	216	213	216	216	215	1.93	1.56	24.2	5	300	27.9	1.51	2	
	N204	Stage 4	5.8	CLAY	2.70	2349	2349	UTP	UTP	UTP	UTP	216+	1.63	1.14	42.6	9	300	39.0	1.17	11	See N210
	N205	Stage 4	5.3	CLAY	2.70	2349	2349	UTP	UTP	UTP	UTP	216+	1.69	1.29	31.2	12	300	32.1	1.28	11	See N211
	N206	Stage 4	5.2	CLAY	2.70	2349	2349	49	185	UTP	UTP	117+	1.83	1.46	25.2	9	300	22.8	1.49	11	See N212
	N207	Stage 4	6.5	CLAY	2.70	2349	2349	216	139	UTP	216	190+	1.80	1.31	37.1	3	300	27.1	1.42	9	See N227
	N208	Stage 6	-	CLAY	2.70	2349	2349	216	201	216	216	212	1.87	1.44	29.3	4	300	26.0	1.48	7	Retest of N201
	N209	Stage 5	-	CLAY	2.70	2349	2349	UTP	UTP	UTP	UTP	216+	1.85	1.46	26.3	7	300	25.6	1.47	8	Retest of N198
		1 1: 6 11													L						connect accordination

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Page: 5 of 17



Hamilton Laboratory

Test Methods:

CMW Geosciences (NZ) Ltd Partnership Suite 2, 5 Hill Street, Hamilton 3204

PO Box 995, Waikato Mail Centre, Hamilton 3240

Phone: +64 (07) 2820 039

Notes: Solid Density: Assumed

HAM2019-0062 98 Scott Road, Te Kauwhata

Lakeside Development

NZS 4402 1986 Test 2.1 NZS 4407 2015 Test 3.1 Solid Density Data Source: Testing Locations Selected By:

Report No: HAM2019-0062LAJ Rev.0 Report Date:

Project No:

Location:

Client:

Client Address:

6/03/2020

Lakeside Developments (2017) Limited

NZS 4407 2015 Test 4.2

CMW Field Staff

NZS 4407 2015 Test 4.3 NZGS:August 2001

1 Blade size of 19mm used.

Tests indicated as not accredited are outside the scope of the laboratory's accreditation

Measurements marked * are not accredited and are outside the scope of the laboratories accreditation

		Test Location*				Var	ne ID	ı	n-situ Va	ne Shea	r Strengt	hs			Fie	eld and Labora	tory Testing D	Data		•	
Date Sampled	Sample No.	Location	RL/Details	Soil Description*	Solid Density (t/m³) *	Head #	Blade #	Test 1 (kPa)	Test 2 (kPa)	Test 3 (kPa)	Test 4 (kPa)	Ave.	Gauge Wet Density (t/m³) **	Gauge Dry Density (t/m³)	Gauge Water Content (%)	_	Gauge Probe Depth (mm)		Oven Dry Density (t/m³)	Oven Calculated Air Voids (%)	Comments
10/02/2020	N210	Stage 4	5.7	CLAY	2.70	2349	2349	UTP	UTP	UTP	UTP	216+	1.80	1.36	33.0	5	300	26.9	1.42	9	Retest of N204, See N219 & N224
	N211	Stage 4	5.3	CLAY	2.70	2349	2349	UTP	UTP	UTP	UTP	216+	1.70	1.32	28.9	13	300	29.6	1.31	13	Retest of N205, See N223
	N212	Stage 4	5.7	CLAY	2.70	2349	2349	UTP	UTP	UTP	UTP	216+	1.88	1.42	32.4	2	300	30.2	1.44	3	Retest of N206
	N213	Stage 4	-	CLAY	2.70	2349	2349	UTP	UTP	UTP	UTP	216+	1.64	1.12	45.7	7	300	36.7	1.20	12	See N220
	N214	Stage 4	-	CLAY	2.70	2349	2349	UTP	UTP	UTP	UTP	216+	1.92	1.55	24.1	5	300	21.9	1.57	7	
	N215	Stage 6	18.3	CLAY	2.70	2349	2349	UTP	UTP	UTP	UTP	216+	1.72	1.37	25.4	15	300	21.1	1.42	18	Retest of N200, See N257
	N216	Stage 6	17.9	CLAY	2.70	2349	2349	UTP	UTP	UTP	UTP	216+	1.86	1.39	33.7	2	300	26.0	1.47	7	
	N217	Stage 1A	8.0	Imported CLAY	2.72	2349	2349	216	UTP	UTP	UTP	216+	1.96	1.55	26.1	2	300	23.4	1.59	5	
	N218	Stage 1A	7.9	Imported CLAY	2.72	2349	2349	93	80	216	90	120	1.87	1.48	26.5	6	300	29.4	1.45	4	
11/02/2020	N219	Stage 4	5.4	CLAY	2.70	2349	2349	UTP	UTP	UTP	UTP	216+	1.74	1.34	29.8	10	300	25.0	1.39	13	Retest of N211, See N226
	N220	Stage 4	7.1	CLAY	2.70	2349	2349	216	UTP	216	UTP	216+	1.72	1.19	44.5	3	300	37.7	1.25	7	Retest of N213
	N221	Stage 4	6.9	CLAY	2.70	2349	2349	124	142	114	154	134	1.77	1.29	37.9	4	300	35.0	1.31	5	
	N222	Stage 4	5.9	CLAY	2.70	2349	2349	UTP	UTP	UTP	UTP	216+	1.76	1.29	36.6	5	300	31.2	1.34	9	
13/02/2020	N223	Stage 4	-	CLAY	2.70	1911	1911	UTP	UTP	UTP	UTP	215+	1.69	1.12	50.6	2	300	40.5	1.20	7	Retest of N211
	N224	Stage 4	5.9	CLAY	2.70	1911	1911	UTP	UTP	UTP	UTP	215+	1.85	1.45	27.8	6	300	24.1	1.49	9	Retest of N210
	N225	Stage 4	7.8	CLAY	2.70	1911	1911	215	215	215	215	215	1.77	1.26	41.0	2	300	39.5	1.27	3	
	N226	Stage 4	7.6	CLAY	2.70	1911	1911	200	215	215	215	211	1.75	1.18	48.1	0	300	35.5	1.29	7	Retest of N219
	N227	Stage 4	5.7	CLAY	2.70	1911	1911	UTP	UTP	UTP	UTP	215+	1.94	1.57	24.1	4	300	23.0	1.58	5	Retest of N207
	N228	Stage 4	6.3	CLAY	2.70	1911	1911	215	215	UTP	UTP	215+	1.77	1.23	43.9	0	300	37.5	1.29	4	
	N229	Stage 1A	-	Imported CLAY	2.72	1911	1911	200	197	215	157	192	1.88	1.50	25.2	7	300	22.2	1.54	9	Retest of N202
14/02/2020	N230	Stage 4	8.0	CLAY	2.70	1911	1911	215	215	215	UTP	215+	1.77	1.28	38.4	3	300	32.1	1.34	7	
	N231	Stage 1A	8.3	Imported CLAY	2.72	1911	1911	UTP	UTP	UTP	UTP	215+	1.89	1.53	23.9	7	300	22.1	1.55	9	
	N232	Stage 1A	7.8	Imported CLAY	2.72	1911	1911	215	215	215	UTP	215+	1.92	1.58	21.8	8	300	23.0	1.56	7	
17/02/2020	N233	Stage 4	8.0	CLAY	2.70	1911	1911	UTP	UTP	UTP	UTP	215+	1.68	1.18	42.0	6	300	32.5	1.27	12	See N237
	N234	Stage 4	8.2	CLAY	2.70	1911	1911	UTP	UTP	UTP	UTP	215+	1.83	1.34	36.9	1	300	33.5	1.37	3	
	N235	Stage 3	18.5	CLAY	2.70	1911	1911	215	UTP	215	UTP	215+	1.67	1.16	43.4	7	300	41.6	1.18	8	
	N236	Stage 3	17.7	CLAY	2.70	1911	1911	UTP	UTP	UTP	UTP	215+	1.79	1.32	36.1	4	300	29.7	1.38	8	
		e reproduced in full	1										** Cauga Mat	Donaition autoid	lo of the calibrat	od rongo of 1 77	0 to 2 756 t/m3	are not accredite	ad and are suite	ido the laborate	ries scope of accreditation.

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Created By: WPJ Date: 20/01/2020 Checked By: JLM Date: 12/03/2020 Authorised Signatory: AC Date: 2/04/2020 * Gauge Wet Densities outside of the calibrated range of 1.728 to 2.756 t/m³ are not accredited and are outside the laboratories scope of accreditation.

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Hamilton Laboratory CMW Geosciences (NZ) Ltd Partnership Suite 2, 5 Hill Street, Hamilton 3204

PO Box 995, Waikato Mail Centre, Hamilton 3240

Phone: +64 (07) 2820 039

Project: Lakeside Development

Project No: HAM2019-0062

Location: 98 Scott Road, Te Kauwhata
Report No: HAM2019-0062LAK Rev.0

Report Date: 12/03/2020

Client: Lakeside Developments (2017) Limited

Client Address:

Test Methods: Notes: NZS 4402 1986 Test 2.1 NZS 4407 2015 Test 3.1

Solid Density:
Solid Density Data Source:
Testing Locations Selected By:

Assumed N/A CMW Field Staff

NZS 4407 2015 Test 4.2 NZS 4407 2015 Test 4.3

NZGS:August 2001

gust 2001 (1) Blade size of 19mm used.



Tests indicated as not accredited are outside the scope of the laboratory's accreditation

Measurements marked * are not accredited and are outside the scope of the laboratories accreditation

		Test Location*				Van	e ID	ı	n-situ Va	ne Shear	Strengtl	hs			Fie	ld and Labora	tory Testing D	ata			
Date Sampled	Sample No.	Location	RL/Details	Soil Description*	Solid Density (t/m³) *	Head#	Blade #	Test 1 (kPa)	Test 2 (kPa)	Test 3 (kPa)	Test 4 (kPa)	Ave.	Gauge Wet Density (t/m³) **	Gauge Dry Density (t/m³)	Gauge Water Content (%)	Gauge Air Voids (%)	Gauge Probe Depth (mm)	Oven Water Content (%)	Oven Dry Density (t/m³)	Oven Calculated Air Voids (%)	Comments
18/02/2020	N237	Stage 4	7.900	CLAY	2.70	1911	1911	UTP	UTP	UTP	UTP	215+	1.82	1.29	40.5	0	300	36.4	1.33	2	Retest of N233
	N238	Stage 3	18.100	CLAY	2.70	1911	1911	UTP	UTP	UTP	UTP	215+	1.75	1.24	41.1	3	300	34.3	1.30	7	
	N239	Stage 3	18.800	CLAY	2.70	1911	1911	UTP	UTP	UTP	UTP	215+	1.80	1.27	41.2	0	300	29.9	1.38	7	
19/02/2020	N240	Stage 6	18.700	CLAY	2.62	1911	1911	215	215	215	215	215	1.78	1.35	31.4	6	300	30.9	1.36	6	
	N241	Stage 6	17.600	CLAY	2.70	1911	1911	108	55	126	68	89									See N245
	N242	Stage 6	16.400	CLAY	2.70	1911	1911	UTP	UTP	UTP	UTP	215+	1.89	1.44	31.3	2	300	23.7	1.53	7	
	N243	Stage 6	19.100	CLAY	2.70	1911	1911	169	215	UTP	151	178+	1.74	1.28	35.9	6	300	32.0	1.32	9	
	N244	Stage 6	18.600	CLAY	2.70	1911	1911	215	212	215	188	208	1.69	1.14	47.8	3	300	44.1	1.17	5	
20/02/2020	N245	Stage 6	-	CLAY	2.70	1911	1911	UTP	UTP	UTP	UTP	215+	1.61	1.06	52.1	6	300	42.6	1.13	10	Retest of N241, See N249
	N246	Stage 6	19.100	CLAY	2.70	1911	1911	UTP	UTP	UTP	UTP	215+	1.75	1.30	34.8	7	300	31.0	1.33	9	See N250
21/02/2020	N247	Stage 6	15.900	CLAY	2.70	1911	1911	197	UTP	UTP	166	182+	1.79	1.32	35.9	4	300	31.9	1.36	6	
24/02/2020	N248	Stage 1A	8.600	Imported CLAY	2.72	1911	1911	UTP	UTP	UTP	UTP	215+	1.92	1.50	27.8	3	300	25.9	1.52	4	
25/02/2020	N249	Stage 6	-	CLAY	2.70	1911	1911	185	188	215	157	186	1.78	1.29	37.9	3	300	33.3	1.34	6	Retest of N245
	N250	Stage 6	-	CLAY	2.70	1911	1911	215	UTP	142	166	174+	1.82	1.25	45.2	-3	300	37.9	1.32	1	Retest of N246
27/02/2020	N251	Stage 6	18.200	CLAY	2.70	1911	1911	215	215	215	215	215+	1.76	1.27	38.3	4	300	31.9	1.34	8	
	N252	Stage 6	16.100	CLAY	2.70	1911	1911	197	157	111	105	143	1.71	1.26	35.7	8	300	37.7	1.24	7	See N255
	N253	Stage 6	15.700	CLAY	2.70	1911	1911	215	215	215	215	215+	1.85	1.39	32.8	3	300	31.7	1.40	4	
28/02/2020	N254	Stage 6	19.967	CLAY	2.70	1911	1911	203	215	UTP	UTP	209+	1.78	1.26	40.6	2	300	35.8	1.31	5	
	N255	Stage 6	16.100	CLAY	2.70	1911	1911	215	182	185	203	196	1.71	1.23	39.2	7	300	30.3	1.31	12	Retest of N252, See N260
	N256	Stage 6	16.400	CLAY	2.70	1911	1911	UTP	UTP	UTP	UTP	215+	1.86	1.41	32.3	2	300	25.2	1.49	8	Retest of N199
	N257	Stage 4	18.300	CLAY	2.70	1911	1911	UTP	UTP	UTP	UTP	215+	1.80	1.35	33.5	5	300	24.2	1.45	11	Retest of N215
	N258	Stage 4	7.400	CLAY	2.70	1911	1911	UTP	UTP	UTP	UTP	215+	1.79	1.37	30.7	7	300	28.8	1.39	8	Retest of N138
2/03/2020	N259	Stage 6	-	CLAY	2.70	1911	1911	157	65	58	95	94	1.46	1.08	35.9	22	300	31.6	1.11	24	See N261
	N260	Stage 6	-	CLAY	2.70	1911	1911	215	157	151	182	176	1.75	1.23	42.1	2	300	33.7	1.31	7	Retest of N255
5/03/2020	N261	Stage 6	20.699	CLAY	2.70	1911	1911	UTP	215	UTP	UTP	215+	1.78	1.31	36.4	4	300	27.7	1.40	10	Retest of N259
	N262	Stage 6	16.710	CLAY	2.70	1911	1911	UTP	215	209	UTP	212+	1.80	1.40	29.2	8	300		1.44	10	
	N263	Stage 6	14.606	CLAY	2.70	1911	1911	UTP	215	215	215	215+	1.74	1.25	38.6	5	300	38.0	1.26	5	

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** Gauge Wet Densities outside of the calibrated range of 1.728 to 2.756 t/m³ are not accredited and are outside the laboratories scope of accreditation.

 Created By:
 WPJ
 Date:
 27/02/2020

 Checked By:
 JLM
 Date:
 12/03/2020

 Authorised Signatory:
 AC
 Date:
 2/04/2020

Page: 7 of 17



Project: Lakeside 19/20

Project No: HAM2019-0062

Location: 98 Scott Road, Te Kauwhata

Report No: HAM2019-0062LAL Rev.0

9/12/2019 Test Date:

AC.

Authorised Signatory:

Tested By:

Lakeside Developments Ltd Client:

Client Address:

Hamilton Laboratory

CMW Geosciences (NZ) Ltd Partnership Suite 2, 5 Hill Street, Hamilton 3204

PO Box 995, Waikato Mail Centre, Hamilton 3240

Phone: +64 (07) 2820 039

CMW Field Staff Testing Locations Selected By:



Tests indicated as not accredited are outside the scope of the laboratory's accreditation

Equivalent CBR Values are not accredited and are outside the scope of the laboratory's accreditation

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Test No	S	51	S	52	S2 (Cont.	\$3		S3 Cont.	
Test Location	Lot 112	Undercut	Lot 111	Undercut	Lot 111 Under	cut (1.0m-2.0m)	Lot 110	Undercut	Lot 110 Undercut (1.0m-2.0m)	
Chainage & Offset		-		-		=	-		-	
Material & Layer	SA	ND	SA	ND	SA	AND	SAND		SAND	
Depth (mm)	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*
0 - 100	2	4	2	4	3	6	1	2	1	2
100 - 200	3	6	2	4	3	6	2	4	2	4
200 - 300	4	8	4	8	4	8	3	6	3	6
300 - 400	5	10	5	10	4	8	4	8	1	2
400 - 500	4	8	5	10	4	8	3	6	2	4
500 - 600	4	8	5	10	3	6	2	4		
600 - 700	4	8	5	10			2	4		
700 - 800	5	10	4	8			2	4		
800 - 900			4	8			2	4		
900 - 1000			3	6			1	2		
Test No										
Test Location										
Chainage & Offset										
Material & Layer										
Depth	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*
0 - 100										
100 - 200										
200 - 300										
300 - 400										
400 - 500										
500 - 600										
600 - 700										
700 - 800										
800 - 900										
900 - 1000										
							This	report should or	ly be reproduced	in full
Created by:	AS			Date:	3/03/2020) Guide to Pavement
Checked by:	JLM			Date:	9/03/2020		Technology Part 2, Figure 5.3, For Fine Grained Cohesive Soils, and are to fine grained cohesive soils only.			.,

2/04/2020



LF14 Rev.12 Dynamic Cone Penetration (DCP) Test Report

NZS 4402: 1988 Test 6.5.2

Project: Lakeside 19/20

Project No: HAM2019-0062

Location: 98 Scott Road, Te Kauwhata

Report No: HAM2019-0062LAM Rev.0

Test Date: 10/01/2020

Tested By: AS

Client: Lakeside Developments Ltd

Client Address:

Created by:

Checked by:

Authorised Signatory:

AS

JLM

AC.

Hamilton Laboratory

CMW Geosciences (NZ) Ltd Partnership Suite 2, 5 Hill Street, Hamilton 3204

PO Box 995, Waikato Mail Centre, Hamilton 3240

Phone: +64 (07) 2820 039

Testing Locations Selected By: CMW Field Staff



Tests indicated as not accredited are outside the scope of the laboratory's accreditation

*Equivalent CBR values calculated using AUSTROADS (2010) Guide to

Pavement Technology Part 2, Figure 5.3, For Fine Grained Cohesive Soils, and are relevant to fine grained cohesive soils only.

Page 9 of 17

* Equivalent CBR Values are not accredited and are outside the scope of the laboratory's accreditation

Test No	S4 (rete	est of S3)	S4	Cont.	S5 (rete	est of S2)				
Test Location	Lot 110	Undercut	Lot 110 Under	rcut(1.0m-2.0m)	Lot 111	Undercut				
Chainage & Offset		-		-		=				
Material & Layer	SA	AND	SA	AND	SA	ND				
Depth (mm)	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*
0 - 100	1	2	3	6	1	2				
100 - 200	3	6	1	2	1	2				
200 - 300	4	8	2	4	3	6				
300 - 400	3	6	3	6	5	10				
400 - 500	3	6			3	6				
500 - 600	7	15			4	8				
600 - 700	5	10			5	10				
700 - 800	6	13			6	13				
800 - 900	4	8			6	13				
900 - 1000	4	8								
Test No										
Test Location										
Chainage & Offset										
Material & Layer										
Depth	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*
0 - 100										
100 - 200										
200 - 300										
300 - 400										
400 - 500										
500 - 600										
600 - 700										
700 - 800										
800 - 900										
900 - 1000										
							This	report should on	ly be reproduced i	n full
							I			

3/03/2020

9/03/2020

2/04/2020

Date:

Date:



Lakeside 19/20

Project No:

HAM2019-0062

Location:

98 Scott Road, Te Kauwhata

Report No:

HAM2019-0062LAN Rev.0

Test Date:

14/01/2020

Tested By:

AS

Client:

Lakeside Developments Ltd

Client Address:

AC.

Authorised Signatory:

Hamilton Laboratory

CMW Geosciences (NZ) Ltd Partnership

Suite 2, 5 Hill Street, Hamilton 3204 PO Box 995, Waikato Mail Centre, Hamilton 3240

Phone: +64 (07) 2820 039

Testing Locations Selected By:

CMW Field Staff

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* Equivalent CBR Values are not credited and are outside the scope of the laboratory's accreditation

Test No	S6 (rete	est of S5)	S6	Cont.	S7 (rete	est of S4)	S7	Cont.	S8 (retest of S1)	
Test Location	Lot 111	Undercut	Lot 111 Unde	rcut (1.0m-2.0m)	Lot 110	Undercut	Lot 110 Under	rcut (1.0m-2.0m)	Lot 112 Undercut	
Chainage & Offset		-		-		-	-			-
Material & Layer	SA	ND	S	AND		ND	SAND		SA	ND
Depth (mm)	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*
0 - 100	1	2	3	6	2	4	4	8	1	2
100 - 200	4	8	2	4	3	6	4	8	2	4
200 - 300	3	6	1	2	3	6	5	10	3	6
300 - 400	3	6	1	2	3	6	5	10	3	6
400 - 500	3	6	2	4	4	8	2	4	4	8
500 - 600	3	6			4	8			4	8
600 - 700	5	10			5	10			2	4
700 - 800	4	8			5	10			2	4
800 - 900	3	6			5	10			3	6
900 - 1000	3	6			5	10				
Test No		•				•				
Test Location										
Chainage & Offset										
Material & Layer										
Depth	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*
0 - 100										
100 - 200										
200 - 300										
300 - 400										
400 - 500										
500 - 600										
600 - 700										
700 - 800										
800 - 900										
900 - 1000										
							Thi	s report should only	be reproduced in	full
Created by:	AS			Date:	4/03/2020			alues calculated using		
Checked by:	JLM			Date:	9/03/2020		Technology Part 2, Figure 5.3, For Fine Grained Cohesive Soils, and are reto to fine grained cohesive soils only.			.s, and are relevan

2/04/2020



Lakeside 19/20

Project No:

HAM2019-0062

Location:

98 Scott Road, Te Kauwhata

Report No:

HAM2019-0062LAO Rev.0

Test Date:

24/01/2020

Tested By:

AS

Client:

Lakeside Developments Ltd

Client Address:

Checked by:

Authorised Signatory:

JLM

AC.

Hamilton Laboratory

CMW Geosciences (NZ) Ltd Partnership Suite 2, 5 Hill Street, Hamilton 3204

PO Box 995, Waikato Mail Centre, Hamilton 3240

Phone: +64 (07) 2820 039

Testing Locations Selected By:

CMW Field Staff

to fine grained cohesive soils only.

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* Equivalent CBR Values are not accredited and are outside the scope o the laboratory's accreditation

Test No	S9 (rete	est of S8)	S10 (re	test of S6)	S10	Cont.	S11 (ret	est of S7)		
Test Location	Lot 112	Undercut	Lot 111	Undercut	Lot 111 Unde	rcut (Below 1m)	Lot 110	Undercut		
Chainage & Offset		-		-		-	-			
Material & Layer	SA	AND	S	AND	SA	SAND		SAND (incomplete backfill)		
Depth (mm)	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*
0 - 100	4	8	4	8	5	10	3	6		
100 - 200	7	15	6	13	5	10	3	6		
200 - 300	6	13	5	10	5	10	5	10		
300 - 400	5	10	5	10	3	6	5	10		
400 - 500	6	13	7	15	4	8	5	10		
500 - 600	6	13	8	18			5	10		
600 - 700	6	13	11	20+			5	10		
700 - 800	5	10	9	20			5	10		
800 - 900	3	6	7	15			3	6		
900 - 1000			8	18						
Test No										
Test Location										
Chainage & Offset										
Material & Layer										
Depth	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*
0 - 100										
100 - 200										
200 - 300										
300 - 400										
400 - 500										
500 - 600										
600 - 700										
700 - 800										
800 - 900										
900 - 1000										
Created by:	AS			Date:	4/03/2020		*Equivalent CBR va	s report should only slues calculated using Figure 5.3, For Fine G	AUSTROADS (2010) Grained Cohesive Soi	Guide to Pavement

9/03/2020

2/04/2020

Date:



Lakeside 19/20 Project:

HAM2019-0062 Project No:

Location: 98 Scott Road, Te Kauwhata

Report No: HAM2019-0062LAP Rev.0

Test Date: 26/02/2020

Tested By:

Client: Lakeside Developments Ltd

Client Address:

Checked by:

Authorised Signatory:

JLM

AC

Hamilton Laboratory

CMW Geosciences (NZ) Ltd Partnership Suite 2, 5 Hill Street, Hamilton 3204

PO Box 995, Waikato Mail Centre, Hamilton 3240

Phone: +64 (07) 2820 039

Testing Locations Selected By: CMW Field Staff



are relevant to fine grained cohesive soils only.

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* Equivalent CBR Values are not accredited and are outside the scope of the laboratory's accreditation

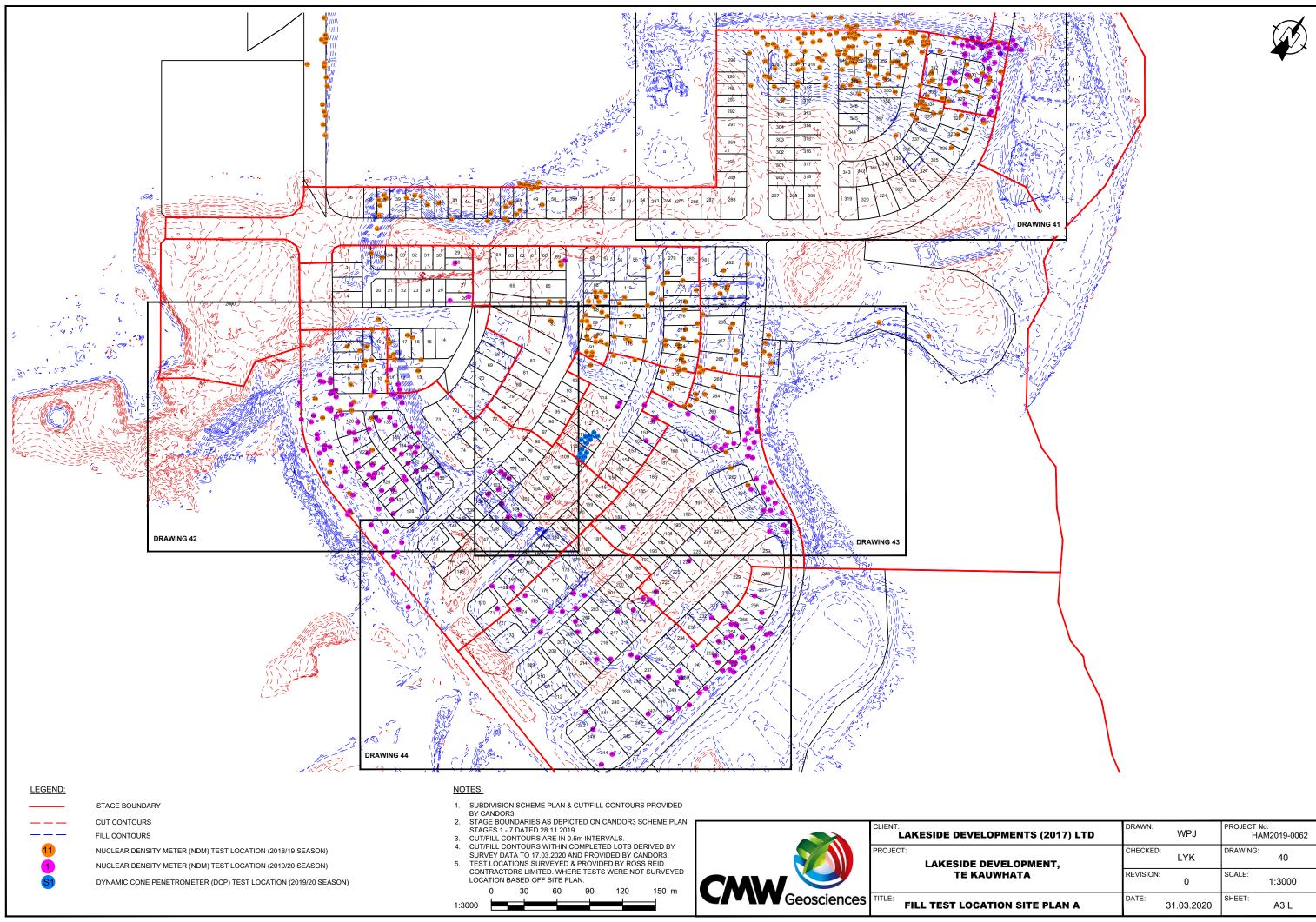
Test No	S12 (re	test of S11)	S13 (ret	est of S12)	S13	Cont.				
Test Location	Lot 110 Unde	rcut (incomplete)	Lot 110	Undercut	Lot 110 Under	rcut (1.0m-2.0m)				
Chainage & Offset		-		-		-				
Material & Layer	S	AND	SA	AND	S	AND				
Depth (mm)	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*
0 - 100	2	4	3	6	5	10				
100 - 200	3	6	3	6	5	10				
200 - 300	4	8	5	10	5	10				
300 - 400	4	8	5	10	5	10				
400 - 500	5	10	5	10	3	6				
500 - 600	4	8	5	10						
600 - 700	4	8	5	10						
700 - 800			5	10						
800 - 900			5	10						
900 - 1000			5	10						
est No										
est Location										
Chainage & Offset										
Material & Layer										
Depth	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*
0 - 100										
100 - 200										
200 - 300										
300 - 400										
400 - 500										
500 - 600										
600 - 700										
700 - 800										
700 - 800 800 - 900										

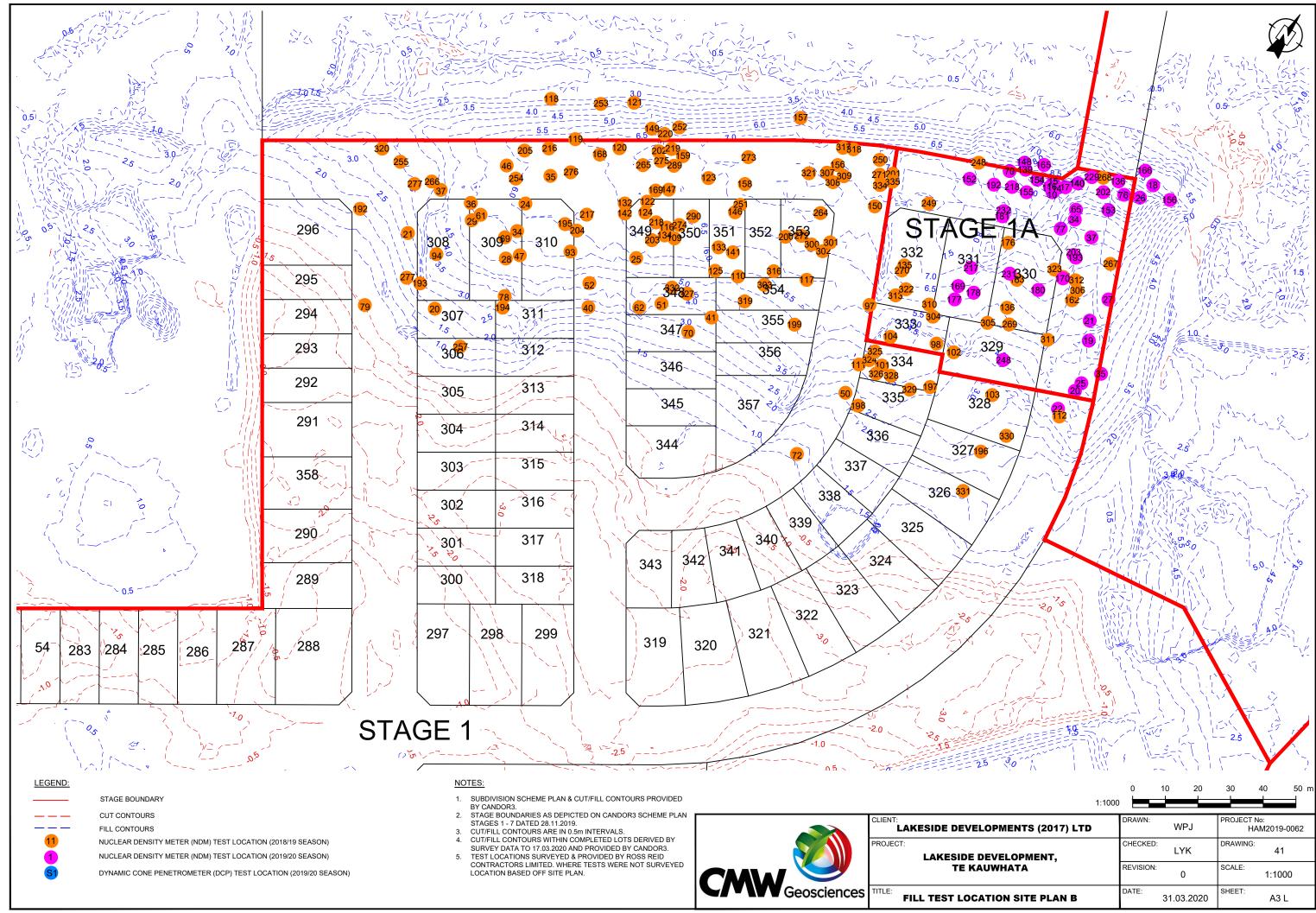
Date:

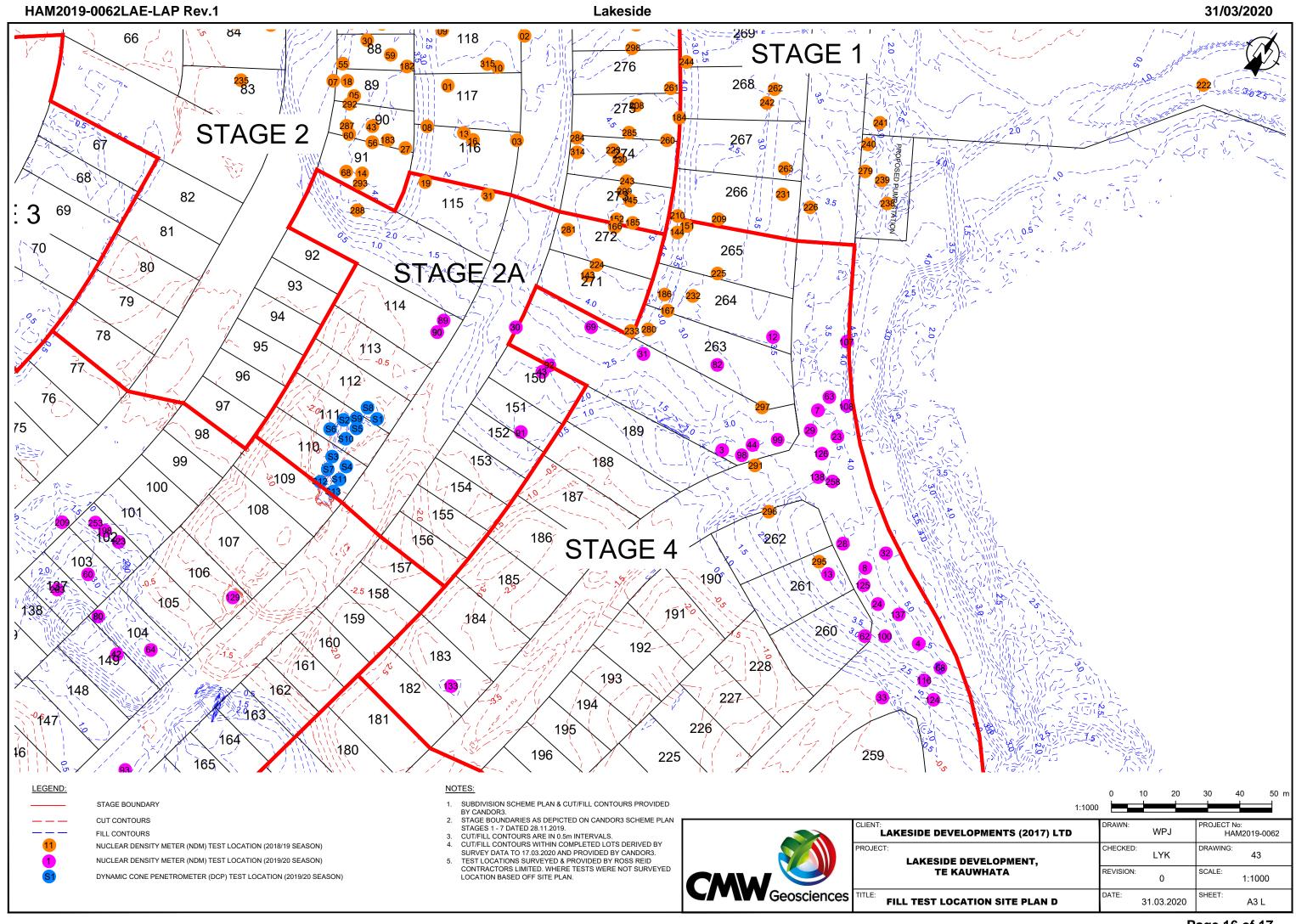
Date:

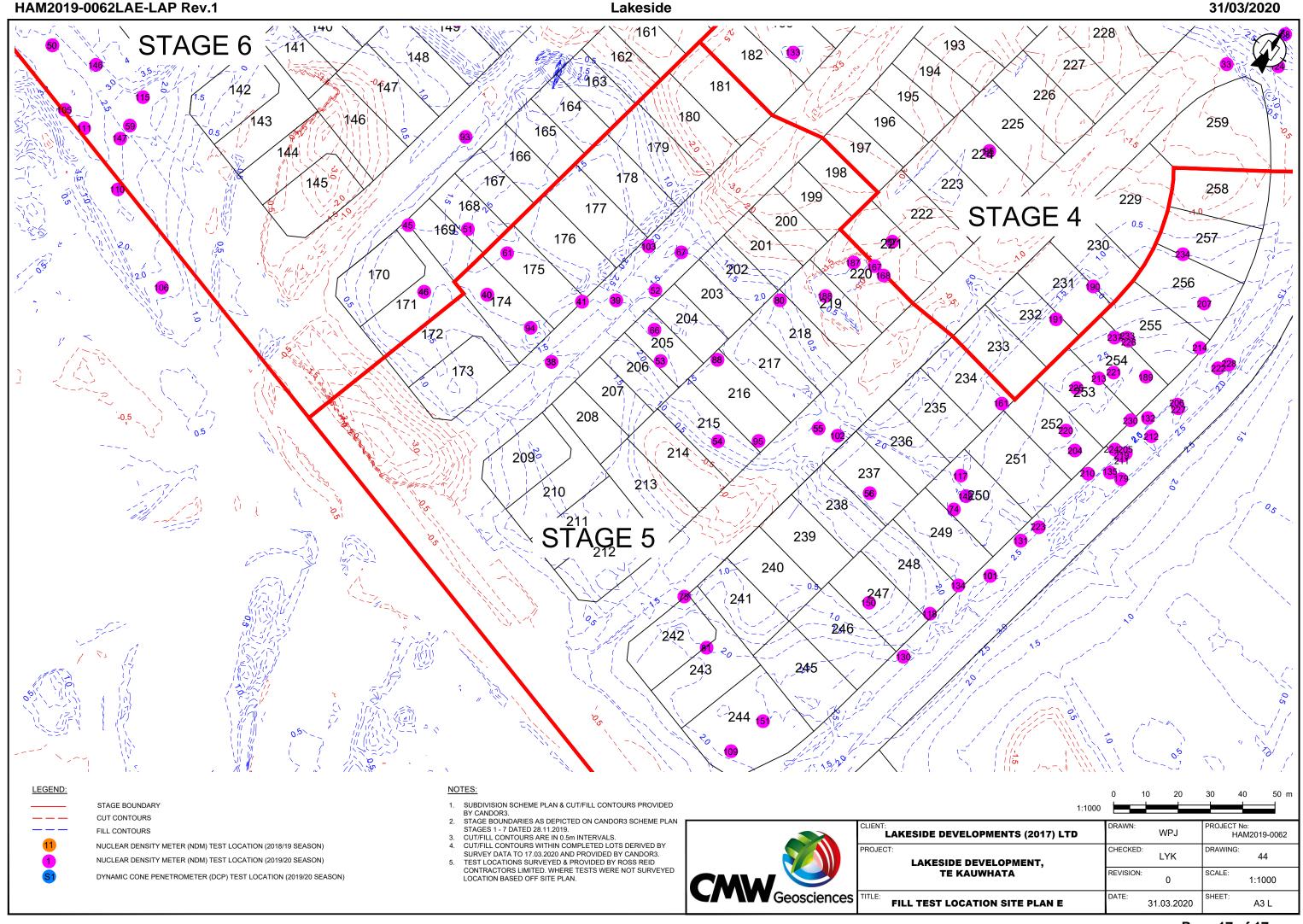
9/03/2020

2/04/2020









Appendix F: Post-Construction Hand Auger Borehole Logs

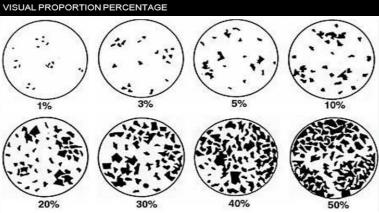
CMW Geosciences – SOIL (Field Logging Guide)

SEQUENCE OF TERMS:

Fine: Soil Symbol – Soil Type – Colour – Structure – (Consistency) – (Moisture) – Bedding – Plasticity – Sensitivity – Additional Comments – Origin/Geological Unit Coarse: Soil Symbol – Soil Type – Colour – Structure – Grading – Particle shape – (Relative Density) – (Moisture) – Bedding – Additional Comments – Origin/Geological Unit

BEHAVIOURAL	SOIL CLASSII	FICATION SY	/STEM	
Major Divisions	(behaviour bas	ed logging)	Soil Symbol	Soil Name
	Gravel	Clean gravel <5%	GW	Well graded gravel, fine to coarse gravel
	>50% of coarse	smaller 0.075mm	GP	Poorly graded gravel
	fraction	Gravel	GM	Silty gravel
Coarse grained soils more than 65%>0.06mm	>2mm	with >12% fines	GC	Clayey gravel
	Sand ≥50% of coarse fraction	Clean	SW	Well-graded sand, fine to coarse sand
		sand	SP	Poorly graded sand
		Sand	SM	Silty sand
	<2mm	with >12% fines	SC	Clayey sand
	Exhibits		ML	Silt
Fine grained	dilatant behaviour	inorganic	МН	Silt of high plasticity
Fine grained soils 35% or	beriavioui	organic	OL	Organic silt
more <0.06mm	No diletent	inorganic	CL	Clay of low plasticity
30.00 11111	No dilatant behaviour	inorganic	СН	Clay of high plasticity
		organic	OH	Organic clay
Highl	y Organic Soils	3	Pt	Peat

PROPORTIONAL TERMS DEFINITION								
Fraction	Term	% of Soil Mass	Example					
Major	() [UPPER CASE]	≥50 [major constituents]	GRAVEL					
Subordinate	() [lower case]	20 – 50	Sandy					
	with some	12 – 20	with some sand					
Minor	with minor	5 – 12	with minor sand					
	with trace of (or slightly)	< 5	with trace of sand (slightly sandy)					



GRAIN SIZE CRITERIA											
		COARSE									ORGANIC
			Gravel			Sand					
TYPE	Boulders	Cobbles	coarse	medium	fine	coarse	medium	fine	Silt	Clay	Organic Soil
Size Range (mm)	200	60	20	6	2	0.6	0.2	0.06	0.002		
Graphic Symbol			300						X X X X X X X X X		乔 乔 乔 4 尔 乔 乔 乔

ADDITIONAL GRAPHIC LOG SYMBOLS					
Term	Symbol				
Topsoil					
Fill	*****				
Bitumen					
Concrete					

ORGANIC SOILS / DESCRIPTORS							
Term	Description						
Topsoil	Surficial organic soil layer that may contain living matter. However, topsoil may occur at greater depth, having been buried by geological processes or man-made fill, and should be termed a buried topsoil.						
Organic clay, silt or sand	Contains finely divided organic matter; may have distinctive smell; may stain; may oxidize rapidly. Describe as for inorganic soils.						
Peat	Consists predominantly of plant remains. Firm: Fibres already compressed together Spongy: Very compressible and open structure Plastic: Can be moulded in hand and smears in fingers Fibrous: Plant remains recognisable and retain some strength Amorphous: No recognisable plant remains						
Rootlets	Fine, partly decomposed roots, normally found in the upper part of a soil profile or in a redeposited soil (e.g. colluvium or fill)						
Carbonaceous	Discrete particles of hardened (carbonised) plant material.						

SHADE AND COLOUR								
1	2	3						
light dark mottled streaked	pinkish reddish yellowish brownish greenish bluish greyish	pink red orange yellow brown green blue white grey black						

SOIL STRUCTU	IRE	GRADING (GRAVELS & SANDS)			
Term	Description	Term	Description		
Homogeneous	The total lack of visible bedding and the same colour and appearance throughout	ighout Well Good representation of all particle size rang			
Bedded	The presence of layers	Graded	largest to smallest		
Fissured	Breaks along definite planes of fracture with little resistance to fracturing		Limited representation of grain sizes – further		
Polished	Fracture planes are polished or glossy		divided into:		
Slickensided	Fracture planes are striated	Poorly	Uniformly graded	Most particles about the same size	
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further	Graded			
Lensoidal	breakdown		Gap graded	Absence of one or more intermediate sizes	



ROUNDING/PARTICLE SHAPE			
Rounded	Subrounded	Subangular	Angular

CONSISTENCY TER	RMS FOR FINE SOILS		
Descriptive term	Undrained Shear Strength (kPa)	Diagnostic Features	Abbreviation
Very Soft	<12	Easily exudes between fingers when squeezed	VS
Soft	12-25	Easily indented by fingers	S
Firm	25-50	Indented by strong finger pressure and can be indented by thumb pressure	F
Stiff	50-100	Cannot be indented by thumb pressure	St
Very Stiff	100-200	Can be indented by thumb nail	VSt
Hard	200-500	Difficult to indent by thumb nail	Н

DENSITY INDEX (RELATIVE DENSITY) TERMS	FOR COARSE SOILS		
Descriptive term	Density Index (RD)	SPT "N" value (blows/300mm)	Dynamic Cone (blows/100mm)	Abbreviation
Very Dense	> 85	> 50	> 17	VD
Dense	65 - 85	30 - 50	7 - 17	D
Medium dense	35 - 65	10 - 30	3 - 7	MD
Loose	15 - 35	4 - 10	1 - 3	L
Very loose	< 15	< 4	0 - 2	VL

- Where strength data cannot be confirmed Loosely Packed (LP) and Tightly Packed (TP) may be used.

 No correlation is implied between Standard Penetration Test (SPT) and Dynamic Cone Penetrometer (Scala) Test values.
- SPT "N" values are uncorrected.

	01 11 11	aldee die di	loon ooloa.					
MOISTURE	Description Coarse Soils Fine Soils Abbreviation Term Bed Thickness Term Inclination (from horizontal)							
Condition	Description		Fine Soils	Abbreviation	Term	Bed Thickness	Term	Inclination (from horizontal)
Dry		freely	powdery or	D	Thinly laminated	< 2mm	Sub-horizontal	0° - 5°
		hands			Laminated	2mm - 6mm	Gently inclined	6º - 15º
			moisture,		Very thin	6mm - 20mm		16º - 30º
Moist	Faula and		water on hands	М	Thin	20mm - 60mm	Steeply inclined	31° - 60°
	darkened		remoulding		Madarataly thin	60mm 200mm		61º - 80º
	in colour	cohere			Moderately thin	60mm - 200mm	Term Inclination (from horizon Sub-horizontal 0° - 5° Gently inclined 6° - 15° Moderately inclined 16° - 30° Steeply inclined 31° - 60° Very steeply inclined 61° - 80° Sub vertical 81° - 90° SENSITIVITY OF SOIL Descriptive Term Shear Strength Patio = undisture and start and	
10/-4			1 '		Moderately thick	0.2m - 0.6m	Sub vertical	01 - 90
Wet				VV			SENSITIVITY OF	SOIL
			when		Thick	0.6m - 2m		Choor Strongth
Saturated				S	Very thick	> 2m	Descriptive Term	Ratio = $\frac{undisturbed}{remoulded}$

		h	ands		Thick	0.6m - 2m	CENCITIVITY OF COLE	
		1			THICK	0.0111 - 2111		Shear Strength
Saturated		darkened in colour a present on the same LTS) Description Can be moulded or cracking or showing When moulded can	plour and S		Very thick	> 2m	Descriptive Term	$Ratio = \frac{undisturbed}{remoulded}$
Saturated Feels cool, darkened in colour and free water is present on the sample S Very thick > 2m			< 2					
Term		Description					Moderately sensitive	2 – 4
High plastic	ity					ntents without	Sensitive	4 – 8
		When moulde	nd can be cri	ımbled in the fin	Extra sensitive	8 – 16		
Low plastici	ty	behaviour	u can be cit	imbled in the iii	igers, may snow quick	or unatant	Quick	> 16

Revision 3 April 2018

HAND AUGER BOREHOLE LOG - PCHA 11/12

Client: Lakeside Developments 2017 Ltd Project: Lakeside Earthworks 2019/20 Site Location: 95 Scott Road Te Kauwhata

Project No.: HAM2019-0062

Date: 06/03/2020 Borehole Location: Stage 3 Logged by: IP Checked by: AS Sheet 1 of 1 Scale: 1:25 Position: 434118.2mE; 740544.7mN Projection: Mount Eden

Samo	oles & Insitu Tests		=	og		, c	cy/ nsit	Ĭ	enetr	omet/
Depth	Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density		Oynami Penetro Blows/1	100m] 0 1
0.3	Peak = 179kPa Residual = 43kPa				ML: Clayey SILT: with minor fine sand; light brown. Low plasticity. (Fill)		VSt to			
0.6	Peak = UTP		_			М	Н			
0.9	Peak = UTP		1 -		SP: Silty fine to medium SAND: white, mottled brown. Poorly graded. (Fill)	-				
1.2	Peak = UTP		-		ML: Clayey SILT: light brown. Low plasticity. (Fill)		Н			
1.6	Peak = UTP					W				
2.0	Peak = UTP		2 -		Borehole terminated at 2.0 m					<u> </u>
			3 -							
			-							
			4 -	-						
			-							
				1					l l	

DCP No: Shear Vane No: 1911

Remarks: Groundwater not encountered.

HAND AUGER BOREHOLE LOG - PCHA 13

Client: Lakeside Developments 2017 Ltd Project: Lakeside Earthworks 2019/20 Site Location: 95 Scott Road Te Kauwhata

Project No.: HAM2019-0062

Date: 06/03/2020

Borehole Location: Stage 3 Logged by: AS Checked by: LYK Scale: 1:25 Sheet 1 of 1

Position: 439576.8mE; 711014.1mN Projection: Mount Eden

Datum: Survey Source: Hand Held GPS

						Datum: Survey Source: Han	d Hel	d GI	PS			
	Sampl	les & Insitu Tests	RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	. ≽		Oynami Penetro Blows/1	c Cor mete	ne er m)
0	Depth	Type & Results	≅	Dep			S W	Cons		5 1	0 1	15
	0.3	Peak = UTP				ML: Clayey SILT: with minor fine sand; light brown. Low plasticity. (Fill)		VSt to				
	0.6	Peak = 187kPa		-				H				
	0.9	Peak = UTP		1 -		SP: Silty Fine SAND: white. Poorly graded. Low plasticity.	м					
	1.2	Peak = UTP				(Fill) ML: Clayey SILT: light brown mottled grey. Low plasticity. (Fill)		TP				
	1.5	Peak = UTP		-				D				
	1.8	Peak = UTP										
	2.0	Peak = UTP		2 -	1	Borehole terminated at 2.0 m						+
				3 -								
				-								
				4 -	-							
				5 -	-							

Termination Reason: Target depth

Shear Vane No: 1785 DCP No:

Remarks: Groundwater not encountered.

HAND AUGER BOREHOLE LOG - PCHA 14

Client: Lakeside Developments (2017) Limited

Project: Lakeside Developments

Site Location: 98 Scott Road, Te Kauwhata

Project No.: HAM2018-0106

Date: 14/05/2019

Borehole Location: Stage 3 - Lot 14 Logged by: LYK Checked by: YSL Scale: 1:25 Sheet 1 of 1

Position: Projection: Mount Eden Elevation: 21.00m Datum: Survey Source: Site Plan Dynamic Cone Penetrometer Samples & Insitu Tests **3raphic** Log Groundwater Material Description
Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit)
Rock: Colour; fabric; rock name; additional comments. (origin/geological unit) $\widehat{\Xi}$ (Blows/100mm) Depth (చ 10 Type & Results Depth 21.0 OL: Organic SILT: black. Low plasticity. (Topsoil) 20.8 CL: CLAY: brown. Low plasticity. 0.3 Peak = UTP (Fill) Μ 20.5 SP: Fine SAND with minor silt: white mottled yellow. Poorly graded; pumiceous. (Whangamarino Formation) VD Borehole terminated at 0.8 m 2

Termination Reason: Hand Auger refusal in dense sand.

Shear Vane No: DCP No:

Remarks: Groundwater not encountered. Shear vane no. 2560.



HAND AUGER BOREHOLE LOG - PCHA 17/18

Client: Lakeside Developments 2017 Ltd Project: Lakeside Earthworks 2019/20 Site Location: 95 Scott Road Te Kauwhata

Project No.: HAM2019-0062

Date: 08/12/2019

Borehole Location: Stage 3 Logged by: AS Checked by: LK Scale: 1:25 Sheet 1 of 1

					Datum: Survey Source: Han	<u>d He</u> l	<u>d G</u> F	25			
Sam	ples & Insitu Tests	RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	(E	Oynamio Penetro Blows/1	meter	r
Depth	Type & Results	씸	Dep	Graph		Moi	Consi Relative		5 10) 15	5
					OL: Organic SILT: brown. Low plasticity. (Topsoil) CL: CLAY: orange brown. Low plasticity.						
0.3	Peak = UTP				(Fill)						
0.5	Peak = UTP		-			D to					
0.8	Peak = UTP										
1.1	Peak = UTP		1 -				н				
1.4	Peak = UTP				SP: Fine SAND: with minor silt; white. Poorly graded (Whangamarino Formation)						
			-								
					SP: Fine SAND: with some clay; white mottled orange. Poorly graded. (Whangamarino Formation) CL: CLAY: with some fine sand; light brown. Low plasticity. (Whangamarino Formation)	М					
2.1	Peak = UTP		2 -								
					Borehole terminated at 2.2 m						
			-								
			-								
			3 -								
			-								
			4 -								
			-								
		-	5 -	1					旦	_	

Termination Reason: Target Depth Reached
Shear Vane No: 1785 DCP No:
Remarks: Groundwater not encountered.

HAND AUGER BOREHOLE LOG - PCHA 66

Client: Lakeside Developments 2017 Ltd Project: Lakeside Earthworks 2019/20 Site Location: 95 Scott Road Te Kauwhata

Project No.: HAM2019-0062

Date: 04/03/2020

Borehole Location: Stage 2 Logged by: AS Checked by: LYK Scale: Sheet 1 of 1 Position: Projection: Mount Eden Datum: Survey Source: Site Plan Dynamic Cone Penetrometer Samples & Insitu Tests **3raphic** Log Groundwate Moisture Condition Material Description
Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit)
Rock: Colour; fabric; rock name; additional comments. (origin/geological unit) $\widehat{\Xi}$ (Blows/100mm) Depth (귐 10 Type & Results Depth OL: SILT: dark brown. Non plastic. (Topsoil) M VSt ML: SILT: yellowish brown. Low plasticity. Peak = 114kPa Residual = 15kPa 0.3 (Holocene Alluvium) ML: SILT: grey. Low plasticity. (Whangamarino Formation) Peak = >200kPa Residual = 18kPa 0.6 Peak = >200kPa Residual = 25kPa 0.9 Peak = >200kPa Residual = 24kPa 1.2 ML: Sandy SILT: grey. Low plasticity; sand, fine (Whangamarino Formation) SM: Silty fine to medium SAND: yellowish brown. Poorly graded. (Whangamarino Formation) 5 MD ... at 1.80m. becoming grev. 3 2 2 Borehole terminated at 2.0 m

Termination Reason: Target Depth Reached

Shear Vane No: 1911 DCP No: 06

Remarks: Groundwater not encountered.

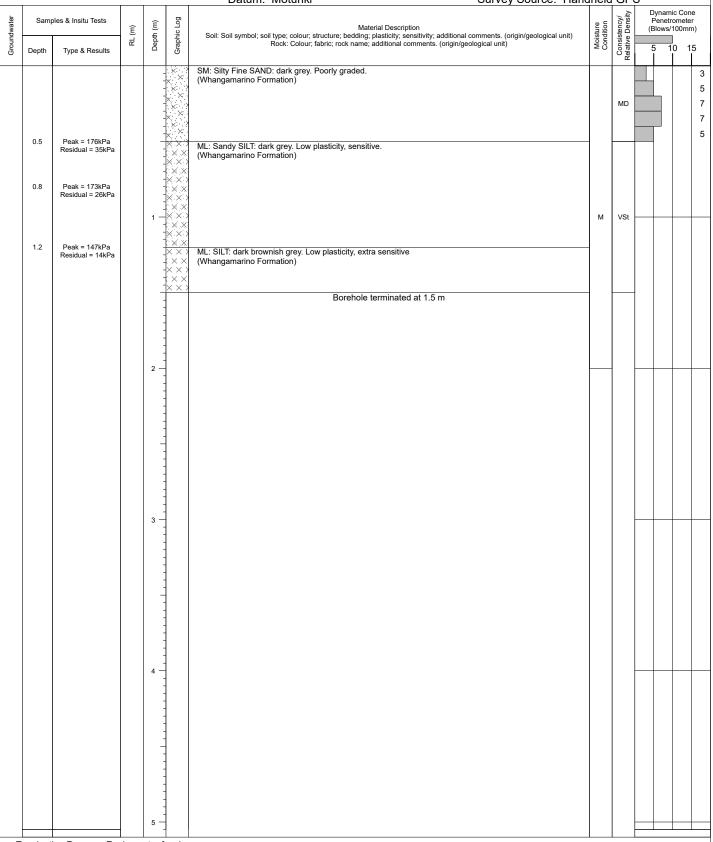
HAND AUGER BOREHOLE LOG - PCHA 110/111

Client: Lakeside Developments 2017 Ltd Project: Lakeside Earthworks 2019/20 Site Location: 95 Scott Road Te Kauwhata

Project No.: HAM2019-0062

Date: 05/11/2019

Borehole Location: Stage 2A Logged by: AS Checked by: LK Scale: 1:25 Sheet 1 of 1



Termination Reason: Equipment refusal

Shear Vane No: 1785 DCP No: 7

Remarks: Groundwater not encountered.

HAND AUGER BOREHOLE LOG - PCHA 110

Client: Lakeside Developments 2017 Ltd Project: Lakeside Earthworks 2019/20 Site Location: 95 Scott Road Te Kauwhata

Project No.: HAM2019-0062

Date: 30/01/2020

Logged by: IP Borehole Location: Stage 2A Checked by: AS Sheet 1 of 1 Scale: Position: 434289.5mE; 740595.6mN Projection: Mount Eden Datum: Survey Source: Hand Held GPS Dynamic Cone Penetrometer Samples & Insitu Tests Groundwater **3raphic** Log Moisture Condition Material Description
Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit)
Rock: Colour; fabric; rock name; additional comments. (origin/geological unit) $\widehat{\Xi}$ (Blows/100mm) Depth 귐 10 Depth Type & Results SP: Fine SAND: light grey. Poorly graded, rounded. (Whangamarino Formation) 12 6 8 0.3 Peak = UTP 5 6 5 Peak = 185kPa Residual = 40kPa 0.6 TP 4 4 Peak = >200kPa Residual = 46kPa 0.9 ML: Gravelly SILT: with minor fine sand; dark brown. Low plasticity, Sensitive; Gravel, fine to medium. Peak = 197kPa Residual = 22kPa 1.2 VSt to 1.6 Peak = UTP MH: SILT: dark brown. High plasticity, Moderately sensitive. Poor recovery. (Whangamarino Formation) W to Peak = >200kPa 1.8 Residual = 46kPa Peak = UTP 1.9 Borehole terminated at 1.9 m. 2

Termination Reason: Refusal on dense silt.

Shear Vane No: 1911 DCP No: 06

Remarks: Groundwater not encountered.

HAND AUGER BOREHOLE LOG - PCHA 111

Client: Lakeside Developments 2017 Ltd Project: Lakeside Earthworks 2019/20 Site Location: 95 Scott Road Te Kauwhata

Project No.: HAM2019-0062

Date: 30/01/2020

Borehole Location: Stage 2A Logged by: IP Checked by: AS Sheet 1 of 1 Scale: Position: 434290.2mE; 740610.0mN Projection: Mount Eden Datum: Survey Source: Handheld GPS Dynamic Cone Penetrometer Samples & Insitu Tests Graphic Log Groundwater Moisture Condition Material Description
Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit)
Rock: Colour; fabric; rock name; additional comments. (origin/geological unit) $\widehat{\Xi}$ (Blows/100mm) Depth (귐 10 15 Type & Results Depth ML: Sandy SILT: light greenish grey. Low plasticity, sensitive; sand, fine. (Whangamarino Formation) D Peak = 169kPa Residual = 34kPa 0.3 √St to Peak = 135kPa Residual = 25kPa 0.6 Peak = >200kPa Residual = 25kPa 0.9 ML: Sandy SILT: grey. Low plasticity, sensitive; sand, fine. (Whangamarino Formation) 1.2 Peak = UTP Н 1.6 Peak = >200kPa Residual = 34kPa W Peak = >200kPa Residual = 40kPa 2.0 Borehole terminated at 2.0 m

Termination Reason: Target depth

Shear Vane No: 1911 DCP No:

Remarks: Groundwater not encountered.

HAND AUGER BOREHOLE LOG - PCHA 112/113

Client: Lakeside Developments 2017 Ltd Project: Lakeside Earthworks 2019/20 Site Location: 95 Scott Road Te Kauwhata

Project No.: HAM2019-0062

Date: 06/11/2019



					Datum: Moturiki Survey Source: Han	dheld	I GP	S			
Samp	ples & Insitu Tests	Ê	(E)	c Log	Material Description		tency/ Density	[ynami Penetro Blows/1	mete	er
Depth	Type & Results	RL (m)	Depth (m)	Graphic Log		Moisture Condition	Consistency/ Relative Density		5 10) 1	5
0.3	Peak = Utp			-X X X X X X X X X X X X X X X X X X X	(Whangamarino Formation)	D	н				
0.7	Peak = 131kPa Residual = 20kPa			X X X X X X X X X X X X X X X X X X X		M					
0.9	Peak = Utp		1 -	X X X X X X X X X X X X X X X X X X X							
1.2	Peak = 143kPa Residual = 26kPa			X X X X X X X X X X X X X X X X X X X	ML: SILT: grey mottled brown. Low plasticity. (Whangamarino Formation)	w	VSt to H				
1.6	Peak = Utp			X X X X X X X X X X X X X X X X X X X		W to					
2.0	Peak = 158kPa Residual = 12kPa		2	X X X X X X X X X X X X X X X X X X X							
			3 ·								
			4								
			5	-							-

Termination Reason: Target depth

Shear Vane No: 2349 DCP No:

Remarks: Groundwater not encountered.

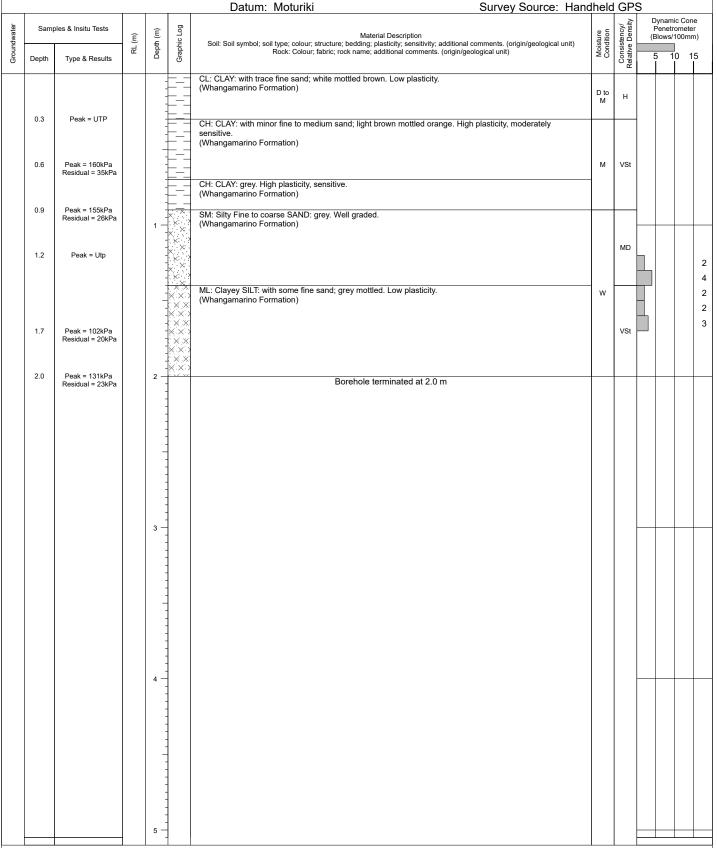
Client: Lakeside Developments 2017 Ltd Project: Lakeside Earthworks 2019/20 Site Location: 95 Scott Road Te Kauwhata

Project No.: HAM2019-0062

Date: 06/11/2019

Borehole Location: Stage 2A Logged by: LK Checked by: LK Scale: 1:25 Sheet 1 of 1

Position: 443469.2mE; 702046.7mN Projection: Mount Eden



Termination Reason: Target depth

Shear Vane No: 2349 DCP No: 7

Remarks: Groundwater not encountered.

Client: Lakeside Developments (2017) Limited

Project: Lakeside Developments

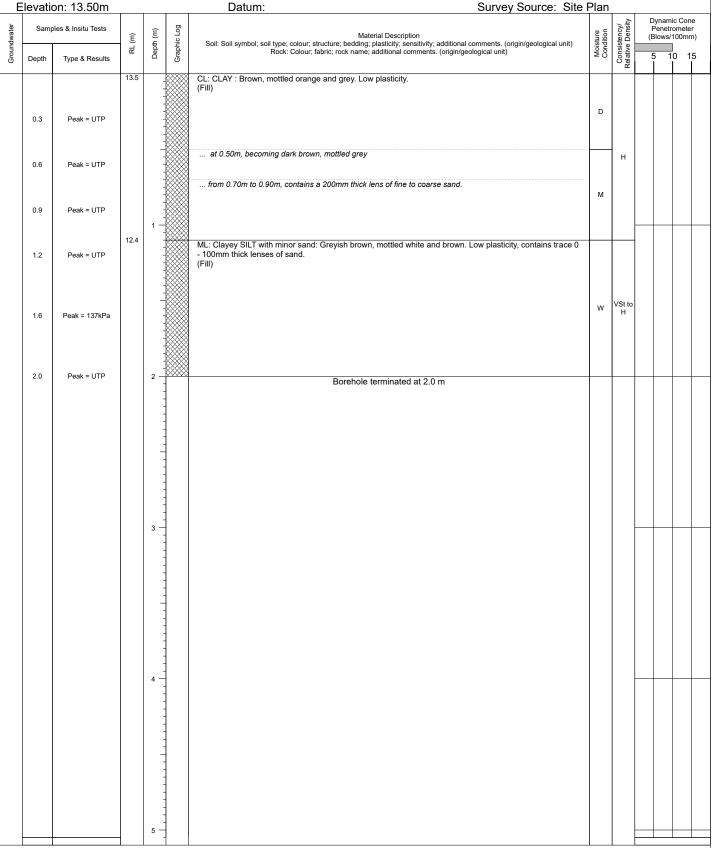
Site Location: 98 Scott Road, Te Kauwhata

Project No.: HAM2018-0106

Date: 06/05/2019

Borehole Location: Stage 2 - Lot 115 Logged by: LYK Checked by: YSL Scale: 1:25 Sheet 1 of 1

Position: Projection: Mount Eden



Termination Reason: Target Depth Reached

Shear Vane No: DCP No:

Remarks: Groundwater not encountered. Shear vane no. 2349.



Client: Lakeside Developments 2017 Ltd Project: Lakeside Earthworks 2019/20 Site Location: 95 Scott Road Te Kauwhata

Project No.: HAM2019-0062

Date: 06/01/2020

Borehole Location: Stage 2A Logged by: LK Checked by: LK Scale: 1:25 Sheet 1 of 1

						Datum: Survey Source: Har	ndheld	I GP	S		
Groundwater	Samp	oles & Insitu Tests	RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	(E	Penetro	Cone ometer 00mm)
Grou	Depth Type & Results		<u>«</u>	De	Grap	Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	కొం	Cons		5 10 I I) 15
	0.3	Peak = UTP		-		Organic SILT: black. Low plasticity. (Topsoil) ML: SILT: grey mottled brownish orange. Low plasticity. (Fill)	D	-			
	0.6	Peak = UTP		-		CH: Silty CLAY: grey mottled orange. High plasticity. (Fill)	М	н			
	0.9	Peak = UTP Peak = UTP		1 -		ML: Clayey SILT: with minor fine to coarse sand; light grey mottled brownish orange. Low plasticity. (Fill)	D to M				
				-		ML: Clayey SILT: light brown mottled grey. Low plasticity. (Fill)					
	1.6	Peak = 152kPa Residual = 41kPa					W	VSt to H			
	2.0	Peak = UTP		2		Borehole terminated at 2.0 m					
				3							
				4 —							

Termination Reason: Target depth

Shear Vane No: 2532 DCP No:

Remarks: Groundwater not encountered.

Client: Lakeside Developments 2017 Ltd Project: Lakeside Earthworks 2019/20 Site Location: 95 Scott Road Te Kauwhata

Project No.: HAM2019-0062

Date: 06/01/2020

Borehole Location: Stage 2A Logged by: AS Checked by: LK Scale: Sheet 1 of 1 Position: 434310.2mE; 740674.1mN Projection: Mount Eden Datum: Survey Source: Handheld GPS Dynamic Cone Penetrometer Samples & Insitu Tests **3raphic** Log Groundwater Material Description
Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit)
Rock: Colour; fabric; rock name; additional comments. (origin/geological unit) $\widehat{\Xi}$ (Blows/100mm) Depth (귐 10 15 Type & Results Depth OL: Organic SILT: dark brown. No plasticity. 0.3 Peak = UTP CH: Silty CLAY: light greyish yellow. High plasticity. (Fill) 0.6 Peak = UTP 0.9 Peak = >200kPa Н CH: CLAY: light brown. High plasticity. (Whangamarino Formation) 1.2 Peak = >200kPa ... from 1.40m to 2.00m, becoming light yellowish brown. 1.6 Peak = >200kPa Peak = >200kPa 2.0 Borehole terminated at 2.0 m

Termination Reason: Target depth

Shear Vane No: 2349 DCP No:

Remarks: Groundwater not encountered.

Client: Lakeside Developments 2017 Ltd Project: Lakeside Earthworks 2019/20 Site Location: 95 Scott Road Te Kauwhata

Project No.: HAM2019-0062

Date: 15/11/2019

Borehole Location: Stage 2A Logged by: IP Checked by: LK Scale: 1:25 Sheet 1 of 1

Position: Projection: Mount Eden
Datum: Survey Source: Site Plan

					Datum: Survey Source: Site	<u>Plan</u>				
Groundwater S S	amples & Insitu Tests	RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	(E	Penetro Blows/1	(00mm)
Dep	th Type & Results	"	ă	Gra	Nock. Coloui, labric, lock flame, additional confinients. (origin/geological drift)	≥ŏ	Con	!	5 10 I I	0 15 I
0.3	Peak = >200kPa Residual = 82kPa			X X X X X X X X X X X X X X X X X X X		D to	VSt to			
0.6	Peak = 161kPa Residual = 58kPa			X X X X X X X X X X X X		M				
0.9	Peak = UTP		1 -		CH: Clayey SILT: grey mottled black. High plasticity. (Whangamarino Formation)		Н			
1.2	Peak = 161kPa Residual = 50kPa		'	(ML: SiLT: with some fine sand; grey. Low plasticity, moderately sensitive to sensitive. (Whangamarino Formation)					
1.5	Peak = 175kPa Residual = 29kPa		-	(w	VSt to H			
1.8	Peak = >200kPa Residual = 38kPa			(X X X X X X X X X X X X X X X X X X X						
			2 -	-	Borehole terminated at 2.0 m					
			-	-						
			3 -							
			-	-						
			4 -							4
			-	-						
			5 -	1						\pm
Termin	I nation Reason: Tai	raet de	anth.							

Termination Reason: Target depth

Shear Vane No: 2532 DCP No:

Remarks: Groundwater not encountered.

Client: Lakeside Developments 2017 Ltd Project: Lakeside Earthworks 2019/20 Site Location: 95 Scott Road Te Kauwhata

Project No.: HAM2019-0062

Date: 15/11/2019



Position: Projection: Mount Eden

Datum: Survey Source: Site Plan

	Datum: Survey Source: Site						Plan					
Groundwater		oles & Insitu Tests	RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	E (E	Oynamio Penetro Blows/1	metei 00mm	1)
G	Depth	Type & Results		Δ	ő	,	20	Relai	,	5 10) 1: 	5
	0.3	Peak = >200kPa Residual = 53kPa		-	× × × × × × × × × × × × × × × × × × ×	ML: Sandy SILT: grey. Low plasticity, moderately sensitive to sensitive; sand, fine. (Whangamarino Formation)	М	н				
	0.5	Peak = 160kPa Residual = 15kPa		-	X X X X X X X X X	ML: SILT: grey. Low plasticity, sensitive to extra sensitive. (Whangamarino Formation)						
	0.8	Peak = 99kPa Residual = 23kPa		1 -	X X X X X X X X X X X X X X X		M to W	St to VSt				
	1.2	Peak = 190kPa Residual = 18kPa		-	(
	1.3	Peak = >200kPa Residual = 29kPa			× × ×	ML: SILT: dark brown. Low plasticity, sensitive. (Whangamarino Formation)						
	1.5	Peak = UTP		-	(X X (X X) (X X)	ML: SILT: with some fine sand; dark grey. Low plasticity. (Whangamarino Formation)	М	н				
	1.8	Peak = UTP		-	X X X X X X							
	2.0	Peak = UTP		2 -	$\times \times \rangle$	from 1.90m to 2.00m, becoming fine sandy silt. Borehole terminated at 2.0 m	-		<u> </u>	\square		
				3								
				5 —								
												_

Termination Reason: Target depth

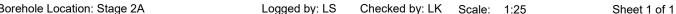
Shear Vane No: 2349 DCP No:

Remarks: Groundwater not encountered.

Client: Lakeside Developments 2017 Ltd Project: Lakeside Earthworks 2019/20 Site Location: 95 Scott Road Te Kauwhata

Project No.: HAM2019-0062

Date: 02/01/2020



Borehole Location: Stage 2A Logged by: LS Checked by: LK Scale: 1:25 Sheet 1 of 1 Position: Projection: Mount Eden Datum: Survey Source: Site Plan Dynamic Cone Penetrometer Samples & Insitu Tests **3raphic** Log Groundwater Material Description
Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit)
Rock: Colour; fabric; rock name; additional comments. (origin/geological unit) $\widehat{\Xi}$ (Blows/100mm) Depth 귐 10 15 Type & Results Depth ML: Fine to medium sandy SILT: Light brownish grey. Low plasticity. (Fill) 0.3 Peak = UTP D 0.6 Peak = UTP CH: CLAY: with trace fine to medium sand: Dark brown. High plasticity. (Fill) 0.9 Peak = UTP ... from 0.95m to 1.30m, colour change to light brown. 1.2 Peak = >200kPa ... from 1.30m to 1.80m, colour change to brown. 1.6 Peak = >200kPa ... from 1.80m to 2.00m, colour change to dark brown. Peak = >200kPa 2.0 Borehole terminated at 2.0 m

Termination Reason: Target Depth Reached Shear Vane No: 1911 DCP No: Remarks: Groundwater not encountered.

Client: Lakeside Developments 2017 Ltd Project: Lakeside Earthworks 2019/20 Site Location: 95 Scott Road Te Kauwhata

Project No.: HAM2019-0062

Date: 06/01/2020

Borehole Location: Stage 2A Logged by: LK Checked by: LK Scale: Sheet 1 of 1 Position: 434332.7mE; 740701.7mN Projection: Mount Eden Datum: Survey Source: Handheld GPS Dynamic Cone Penetrometer Samples & Insitu Tests **Graphic Log** Groundwater Moisture Condition Material Description
Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit)
Rock: Colour; fabric; rock name; additional comments. (origin/geological unit) $\widehat{\Xi}$ (Blows/100mm) Depth (귐 10 15 Type & Results Depth CH: CLAY: brown mottled greyish orange. High plasticity. (Fill) D 0.3 Peak = UTP 0.6 Peak = UTP M Н 0.9 Peak = UTP 1.2 Peak = UTP 1.6 Peak = 193kPa MH: Silty CLAY: brown mottled orange. High plasticity. VSt Peak = 172kPa 2.0 Borehole terminated at 2.0 m

Termination Reason: Target depth

Shear Vane No: 2532 DCP No: Remarks: Groundwater not encountered.

Client: Lakeside Developments 2017 Ltd Project: Lakeside Earthworks 2019/20 Site Location: 95 Scott Road Te Kauwhata

Project No.: HAM2019-0062

Date: 23/02/2020



Position: Projection: Mount Eden Datum: Survey Source: Site Plan Dynamic Cone Penetrometer Samples & Insitu Tests **3raphic** Log Groundwater Material Description
Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit)
Rock: Colour; fabric; rock name; additional comments. (origin/geological unit) $\widehat{\Xi}$ (Blows/100mm) Depth (귐 10 15 Type & Results Depth ML: SILT: dark brown. No plasticity. CL: CLAY: light brown, mottled brown and grey. Low plasticity. D 0.3 Peak = UTP 0.6 Peak = >200kPa 0.9 Peak = >200kPa 1.2 Peak = >200kPa 1.5 Peak = >200kPa Peak = UTP 1.8 Peak = >200kPa 2.0 2 Borehole terminated at 2.0 m

Termination Reason: Target Depth Reached Shear Vane No: 1911 DCP No: Remarks: Groundwater not encountered.

Client: Lakeside Developments 2017 Ltd Project: Lakeside Earthworks 2019/20 Site Location: 95 Scott Road Te Kauwhata

Project No.: HAM2019-0062

Date: 04/03/2020

Borehole Location: Stage 3A Logged by: AS Checked by: LYK Scale: 1:25 Sheet 1 of 1

Position: Projection: Mount Eden Datum: Survey Source: Site Plan Dynamic Cone Penetrometer Samples & Insitu Tests **3raphic** Log Groundwater Moisture Condition Material Description
Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit)
Rock: Colour; fabric; rock name; additional comments. (origin/geological unit) $\widehat{\Xi}$ (Blows/100mm) Depth (귐 10 Type & Results Depth OL: SILT: dark brown. Low plasticity. (Topsoil) M Peak = 172kPa Residual = 65kPa 0.3 ML: Clayey SILT: yellowish brown. Low plasticity, moderately sensitive. (Whangamarino Formation) VSt ML: SILT with some clay: white, mottled pinkish brown. Low plasticity, moderately sensitive to sensitive. Peak = 129kPa Residual = 31kPa 0.6 (Whangamarino Formation) Peak = 89kPa Residual = 31kPa 0.9 Peak = 182kPa Residual = 43kPa 1.2 1.5 Peak = >200kPa Residual = 43kPa Peak = >200kPa Residual = 49kPa 1.8 Peak = >200kPa Residual = 46kPa 2.0 Borehole terminated at 2.0 m

Termination Reason: Target Depth Reached
Shear Vane No: 1911 DCP No:
Remarks: Groundwater not encountered.

Client: Lakeside Developments 2017 Ltd Project: Lakeside Earthworks 2019/20 Site Location: 95 Scott Road Te Kauwhata

Project No.: HAM2019-0062

Date: 06/03/2020

Borehole Location: Stage 3A Logged by: IP Checked by: AS Scale: 1:25 Sheet 1 of 1

						Datum: Survey Source: Hand	<u>Hel</u>	<u>d G</u> F	S			
Sa	ample	es & Insitu Tests	RL (m)	Depth (m)	ic Log	Material Description	Moisture Condition	£ί	E (E	Oynami Penetro Blows/1	mete	er
Depti	th	Type & Results	R	Dept	Graphic Log	Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Mois	Consis Relative		5 10) 1	15
						OL: Organic SILT: brown. Low plasticity. (Topsoil)	D					1
0.3	3	Peak = 121kPa Residual = 80kPa				CH: CLAY: dark brown. High plasticity. (Whangamarino Formation)	М					
0.6		Peak = 148kPa		-	<u> </u>	CH: CLAY: with some silt; light orange brown. High plasticity. (Whangamarino Formation)		VSt				
		Residual = 80kPa										
0.9		Peak = 89kPa Residual = 46kPa		1 -	 	CH: Silty CLAY: light orange brown. High plasticity. Moderately sensitive. (Whangamarino Formation)			_			
1.2	2	Peak = 86kPa Residual = 37kPa			X_^ XX		w					
				_	X X X X X X X X X X X X X X X X X X X	ML: Clayey SILT: pinkish orange mottled white. Low plasticity. Moderately sensitive. (Whangamarino Formation)		St				
1.6	5	Peak = 65kPa Residual = 18kPa			-{ × × - × × >	ML: SILT: white. Low plasticity. Sensitive. (Whangamarino Formation)						
					X X X X X X X X X							
2.0		Peak = 71kPa Residual = 15kPa		2 -	-	Borehole terminated at 2.0 m						1
				-	-							
					- - - -							
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				4 -	-							1
					-							
				-	-							
					-							
				5 -	-							1

Termination Reason: Target Depth Reached
Shear Vane No: 1911 DCP No:
Remarks: Groundwater not encountered.

Client: Lakeside Developments 2017 Ltd Project: Lakeside Earthworks 2019/20 Site Location: 95 Scott Road Te Kauwhata

Project No.: HAM2019-0062

Date: 06/03/2020

Borehole Location: Stage 3A Logged by: IP Checked by: AS Scale: 1:25 Sheet 1 of 1

Position: 433951.3mE; 740558.0mN Projection: Mount Eden

Datum: Survey Source: Hand Held GPS

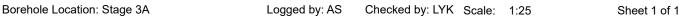
					Datum: Survey Source: Hand	d He	d GI	2S			
Sar	nples & Insitu Tests	RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	_ ≥	(I	Oynamio Penetro Blows/1	omete	er
Depth	Type & Results	집	Dep	Grap		Con	Consi		5 10	0 1	5
0.3	Peak = UTP				OL: Organic SILT: brown. Low plasticity. (Topsoil) CL: Silty CLAY: white mottled, orange. Low plasticity. (Whangamarino Formation)						
0.6	Peak = UTP			X_		D	н				
0.9	Peak = >200kPa Residual = 123kPa		1	X							
1.2	Peak = UTP			X	MH: Clavev SILT: light grev. High plasticity. Moderately sensitive.	М		-			
1.6	Peak = 92kPa Residual = 25kPa			XX XX XX XX XX XX XX XX		w	St to VSt				
2.0	Peak = 117kPa Residual = 31kPa		2	‡××	Borehole terminated at 2.0 m						
				-							
			3								
			4								
			5	-					Ш		ŀ

Termination Reason: Target Depth Reached
Shear Vane No: 1911 DCP No:
Remarks: Groundwater not encountered.

Client: Lakeside Developments 2017 Ltd Project: Lakeside Earthworks 2019/20 Site Location: 95 Scott Road Te Kauwhata

Project No.: HAM2019-0062

Date: 08/03/2020



Position: Projection: Mount Eden Datum: Survey Source: Site Plan Dynamic Cone Penetrometer Samples & Insitu Tests **3raphic** Log Groundwater Material Description
Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit)
Rock: Colour; fabric; rock name; additional comments. (origin/geological unit) $\widehat{\Xi}$ (Blows/100mm) Depth 귐 10 Type & Results Depth GP: Fine to coarse GRAVEL with some sand and silt: brown. Well graded; sand, fine. (Fill) ML: Clayey SILT: grey, mottled pinkish orange. Low plasticity, insensitive to sensitive. (Whangamarino Formation) Peak = >200kPa Residual = 112kPa 0.6 Peak = >200kPa Residual = 66kPa 0.9 Peak = 199kPa Residual = 40kPa 1.2 1.5 Peak = UTP Peak = 86kPa 1.8 ML: SILT: grey. Low plasticity, sensitive. (Whangamarino Formation) Residual = 17kPa St 2.1 Peak = 84kPa ML: Clayey SILT: yellowish brown. Low plasticity, sensitive. (Whangamarino Formation) Residual = 23kPa VSt 2.3 Peak = 107kPa Borehole terminated at 2.3 m Residual = 23kPa

Termination Reason: Target Depth Reached
Shear Vane No: 1785 DCP No:
Remarks: Groundwater not encountered.

Appendix G: Stage 3A Slope Stability Analyses

Stage 3A / Lot 2000: Southern Slope - Stability Analyses

INTRODUCTION

As described in Section 7.2.2 further analyses of the slope the slope immediately south of Lot 2000 (Stage 3A) has been undertaken

We understand that the land to the south of the lot may not be developed for some time. We have therefore carried out stability analyses for the current ground profile below Lot 2000 (as of 05/02/20) as provided by Candor 3.

The sections analysed are illustrated on **Drawings 30, 34 and 38** and we have used nearby ground investigation data and observations made during construction to develop the ground model.

2 **ANALYSES**

2.1 **Design Criteria**

The stability of the slope under a range of design conditions is expressed in terms of a factor of safety, which is defined as the ratio of forces resisting failure to the forces causing failure.

We have assessed the stability of the current landform under long term conditions as at this stage we do not know when the future development to the south will occur.

The following performance standards are recommended for slope stability assessment (Table 1):

Table 1: Slope Stability Factor of Safety Criteria										
Condition	Target Minimum Factor of Safety									
Static long-term condition (drained soil conditions, normal groundwater)	1.5									
Transient case (long term static condition with temporary pre-load in place)	1.2									
Ultimate Limit State (ULS) seismic condition	1.0*									
Note*: Factor of safety < 1.0 acceptable where displacement-based approach	is adopted.									

An assumed distributed load of 15 kPa was applied to represent combined dead and live floor loading from a widespread commercial building.

The ULS PGA was calculated based on a 50-year design life in accordance with the New Zealand Building Code and importance level (IL) 2 structures. These design peak ground acceleration and earthquake magnitude has been assessed and presented in the Ground Investigation and Design Reports previously referred to.

A magnitude (M) of 5.8 with peak ground accelerations of 0.22g were calculated for the ultimate limit state (ULS) earthquake scenario and used in our slope stability assessment below.

2.2 Slope Profile

It was noted that in the locations of Sections A and C uncontrolled fill to depths of up to 1.0m and 6.0m respectively have been placed on the slope as illustrated on Drawing 34.

In the case of Section A this is minimal and is not expected to act as a buttress to the slope.

At the location of Section C the uncontrolled fill exceeds the design surface for the slope and may be excavated as part of remedial works mentioned in Section 7.2.2.

We have therefore ignored any beneficial effects of the uncontrolled fill acting as a buttress to the slope with our analysed slope profiles consisting of a combination of the existing surface for Lot 2000 and the predevelopment slope profile beneath it.

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2.2.1 Shear Strength Parameters

2.2.1.1 Effective Stress Parameters

Representative drained shear strength parameters for the various geological units were based on previous design reports for future stages of the development and calibrated using back analysis techniques of the steepest slope section (Section C). These are summarised in Table 2 below.

2.2.2 Total Stress Parameters

The soils include cohesive silts and clays that will behave in an undrained state during short term seismic loading.

Undrained soil shear strengths (Su), used for assessing the stability of the slope were taken from the hand held shear vane results, and inferred from the CPT data based on the following relationship:

$$Su = \frac{qc - \sigma}{Nk}$$

Where: qc = CPT cone resistance (kPa)

 σ = total overburden pressure (kPa)

Nk = factor, typically between 10 and 20, 12 was adopted for this case.

Undrained shear strength correlations from the CPT provide a range of values across the project.

Lower bound values used for preliminary seismic assessment were based on the hand held shear vane and CPT based correlation.

The undrained shear strength parameters adopted in the design are presented on Table 2 below.

Table 2: Soil Shear Strength Parameters Adopted											
Stratum	Bulk Density	Undrained Shear	Drained Shear Strength Parameters								
	γ (kN/m³)	Strength Su (kPa)	Cohesion c´(kPa)	Friction angle φ´ (degrees)							
Very Stiff to Hard Clay (Volcanic Ash)	16	100	5	28							
Stiff Clay/Silt (Whangamarino Fm)	18	60	1	28							
Stiff to Very Stiff Clay/Silt (Whangamarino Fm)	18	120	2	28							
Dense Sand with a lenses of Lignite (Whangamarino Fm)	18	n/a	0	35							

2.2.3 Slope Stability Analyses

Slope stability analyses were undertaken using the Morgenstern-Price method of slices under circular failure mechanisms using the proprietary software SLIDE Version 8. Selected stability printouts are attached and results summarised below.

Back Analyses Slope Profile

A back analysis of the critical case Section C, *Drawing 30* was carried out to model a slip plane similar to that observed on site of Ls5b described by Earthtech to determine drained shear strength

CMW Geosciences Ref. HAM2019-0062AJ Rev 1 parameters for the soils forming the slope. Soil parameters and groundwater conditions were varied until a Factor of Safety of 1 was calculated.

Analyses of Existing Slopes

The parameters derived from the back analyses (as shown on Table 1) were then used to assess the stability of the slope forming the southern edge of Lot 2000.

Acceptable factors of safety for the prevailing and elevated groundwater stability cases are achieved at a distance behind the slope crest of least 4m and 8m for Section A and C respectively. For Lot 2000 based on Section A a setback distance of 4m from the crest of the slope is recommended which falls outside the lot boundary.

Results for seismic loading conditions on Section A indicate that failures are limited to the slope face and therefore there is a low risk of deep-seated instability effecting the above lot in a seismic event.

Based on the above analyses and the landform presented by Candor3 (05/02/20) it is concluded that there is a low risk of deep-seated instability affecting structures located within Lot 2000.

It was noted that in the location of Section C-C up to 7m of uncontrolled fill has been placed on the slope with a face angle of up to 38 degrees from the horizontal. This is not expected to have the required factors of safety and therefore is at risk of instability. The implications of this are discussed in Section 7.2.2.

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