GEOTECHNICAL ASSESSMENT REPORT
ON TAKANINI STRUCTURE PLAN AREA 6
Takanini Structure Plan Area 6 Limited

GENZNEWP12635
11 November 2008
11 November 2008

Takanini Structure Plan Area 6 Limited
C/- Hosken & Associates Limited
PO Box 99 387
Newmarket
Auckland 1149

Attention: Mr G Heap

Dear Gregory

RE: Geotechnical Assessment of Takanini Structure Plan, Area 6 Limited

This report presents the recommendations arising from a geotechnical assessment carried out by Coffey Geotechnics (NZ) Limited for Takanini Structure Plan Area 6 Limited and in accordance with instructions received from Hosken & Associates Limited.

If you have any queries or you require any further clarification on any aspects of this report, please do not hesitate to contact the undersigned.

For and on behalf of Coffey Geotechnics (NZ) Limited

JL Beaumont
Senior Geotechnical Engineer

Distribution:

- Takanini Structure Plan Area 6 Limited: 1 Copy
- Hosken & Associates Limited: 4 Copies
- Harrison Grierson Consultants Limited: 1 Copy
- Papakura District Council: 2 Copies
- Coffey Geotechnics (NZ) Limited: 1 Copy
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1 INTRODUCTION AND SITE DESCRIPTION

Foundation Engineering Consultants Limited (now Coffey Geotechnics (NZ) Limited) were commissioned by Takanini Structure Plan Area 6 Limited to undertake a geotechnical investigation into the adequacy of land for future development.

The project area has been identified as a growth area with scope to rezone from ‘rural’ to ‘mixed’ use (ie. residential/ commercial/ industrial). It is referred to in the Takanini Structure Plan as Area 6 (more specifically Area 6A and 6B).

The principle objectives of this report were to:

- Review the existing Woodward-Clyde (NZ) Limited (WCL) report dated March 2000, that was prepared to assess the geotechnical conditions of the greater Takanini Structure Plan Area, which also encompasses Area 6, as well as other reports relating to projects in the vicinity of the subject site prepared by Foundation Engineering Consultants Limited (FECL) and Tonkin and Taylor Limited (T&T).

- Undertake further preliminary geotechnical investigations to confirm the results and limitations of the Takanini Structure Plan in respect of Area 6.

Area 6 is roughly rectangular in shape, having an area of approximately 53 hectares. It is bounded by Takanini Road to the west, Porchester Road to the east, Papakura Stream to the north and Manuroa Road to the south. The project area lies within the jurisdiction of the Papakura District Council.

2 GEOLOGY

The subject area comprises shallow Pleistocene age Tauranga Group alluvial deposits, typically organic clayey silts and silty clays, overlying inorganic clays, silts and sands to considerable depth. These alluvial deposits overlie gently dipping Waitemata Group sandstones and mudstones of Miocene age. A raft of inorganic soils comprising soft to stiff, sometimes sandy silts, clayey silts and silty clays mantles the area to depths of up to more than 2 metres.

To the North of the Papakura stream there is a surface of weathered Waitemata Group sandstone (Miocene Epoch) gently sloping towards the stream. A fault running along the stream bed interrupts the Waitemata Group deposits which continue to the South beneath alluvium at a similar attitude through the Takanini Industrial area.

An indicative cross-section A-A is appended showing an inferred subsurface profile of the three main soil types. This is based on information derived from the appended Coffey Geotechnics Site Plan, dated 18 June 2008 (reference 12635) and FECL Soil Zonations Plan, dated 13 March 2006 (reference 12635), as well as the WCL Plan Set, dated 22 February 2000 (reference G-002 – G-005).

Our boreholes confirmed the presence of the alluvial and organic deposits. Weathered Waitemata Group soils were also identified at depth adjacent to the Papakura Stream.

3 RELATED REPORTS

As part of the preparation of this report we have reviewed the findings of a series of geotechnical reports carried out by this Consultancy, T&T and WCL for building developments in the vicinity of the site. A summary of the findings presented in the reports reviewed is presented below:
3.1 Sikh Temple, 70 Takanini School Road

In 2002 FECL prepared a report for Thorburn Consultants Limited assessing the preliminary foundation conditions for the development of large carpark areas, several single storey buildings and the main two storey Temple structure.

The subsurface soils comprised soft to firm brown/orange/black organic clayey silts and silty clays, becoming inorganic beyond a depth of 2.5 metres. Vane shear strengths within these materials ranged from 15 to 90 kPa. Based on knowledge of surrounding sites bedrock was anticipated to depths of between 5 and 10 metres, and this was later confirmed during construction.

The main Temple structure comprised conventional reinforced concrete framing with associated shear walls. There were no unusual structural conditions pertaining to building design in respect of tolerance to differential settlements or magnitude of foundation loads.

Surface rib raft type foundations were recommended for all structures provided that finished ground floor levels did not exceed 300mm height above the existing ground level. Ultimately the Temple structure was piled to bedrock at approximately 8 metres depth using 150 small end diameter timber piles spaced at the midpoints of grid intersections. An unfactored design live load of 4.0 kPa was used with an allowable construction load of 4.0 kPa.

Settlement of the Temple raft was anticipated to be as high as 150mm under a working load of 20 kPa, with differential settlements of up to half of that causing a maximum angular distortion of approximately 1 in 300. As the building was piled these settlements are not expected to have occurred.

The consultant Wilton Joubert Limited Polyraft Plan Set and Jim Hollings and Co. Limited Panel Layout and Piling Plan are contained in Appendix 1 and 2.

3.2 Arthur Lydiard House, Bruce Pulman Park, Walters Road

In 2006 FECL prepared a report for Hill Design Engineering Limited to assist in the design of foundations for Arthur Lydiard House, a two storey office facility with associated accessways. The structure comprised a combination of cast in situ reinforced concrete columns, precast concrete wall panels, structural steel and prestressed concrete suspended floors and a lightweight roof. Design floor live loads were up to 5 kPa.

Subsurface investigation shows that the inorganic raft was present across the site to depths of between 1.0 and 1.6 metres. Beneath the raft were soft organic/peaty clays with significant organic inclusions. These materials continued to depths of up to approximately 27 metres, with a layer of medium dense to dense pumiceous silts identified at approximately 19 metres. Machine borehole records indicate that this layer is approximately 0.5 to 1.0 metres thick and as such is not suitable to support piled foundations.

This site is currently undergoing a preloading programme to induce anticipated settlement prior to construction. Surface rib raft type foundations on a "structural" hardfill pad are proposed with a geotechnical ultimate bearing capacity of 180 kPa. Fill induced settlement is anticipated to be on the order of 15mm per 100mm of filling. The latest monitoring results dated 7 August 2008 indicate that the maximum settlement over the six month monitoring period is 160mm under approximately 1.0 metres of filling.

Building plans are currently unavailable for this development as it is not yet built.
3.3 Gymnasium and Multi-Sports Centre, Bruce Pulman Park, Walters Road

In 1998 FECL were involved with the foundation design for a Gymnasium and Multi-sport building at Bruce Pulman Park. Subsurface conditions were similar to the above neighbouring development. The two storey building comprises a concrete slab at the ground floor level with portal frames to span the main floor spaces. The exterior walls are part height concrete panels with colour steel cladding above, and the floor is prestressed concrete. The proposed ground floor level is approximately 600mm above the existing ground level.

Preloading for the single storey Stage 1 portion of the development comprised 1400mm of material monitored over a period of 120 days. An average consolidation of 142mm was recorded. Stage 2 comprised the two storey portion of the structure and accordingly was preloaded with 1700mm of material over a period of 926 days. An average settlement of 500mm was recorded upon reaching $t_{90}$ (ie. time for 90% consolidation).

The construction is typically lightweight with foundation pads and floor slab thickenings.

Hill Design Engineering Limited Foundation Plans are contained in Appendix 3.

3.4 Mitre 10 Centre, 238 Great South Road

T&T prepared a Geotechnical Report for Euroclass Commercial Design and Build Limited, dated February 2004 (reference 21500) to provide recommendations for foundation design of the now completed Mitre 10 retail store located near the corner of Great South Road and Walters Road.

The structure comprises tilt slab walls with a lightweight roof. Driven timber pile foundations were recommended to support column loads from the roof and any high concentrated loadings. These were piled to dense sands encountered at 8 to 10 metres depth and were designed assuming an ultimate bearing capacity of 2800 kPa. It was recommended that the perimeter walls be founded on strip footings limited to 1 metre width and constructed on a minimum of 500mm of hard fill. The panel details should include tolerances for differential settlements.

Ground floor slabs were founded on the firm to stiff fill and hardfill encountered overlying the site and were isolated from the piles to avoid excessive differential settlements between the slabs and the piles. Surcharge loads were limited to below 10 kPa to minimise settlement within the compressible peat layers.

The consultant Euroclass Commercial Design and Build Limited foundation and structure details are appended.

3.5 Takanini Structure Plan,

WCL completed a report for the Papakura District Council, dated 29 March 2002 (reference AA2747/07/02), to assess the geotechnical conditions of the greater Takanini Structure Plan area. This investigation included Area 6, which lay at the north-western margin of the study area. The WCL report took into account earlier investigations by Harrison Grierson Consultants Limited (1998) and Watercare Services Limited (1998). The findings and conclusions of the WCL report were summarised in the adopted draft report Takanini Structure Plan, dated 30 November 2000.

For the WCL field investigations a total of sixty-six shallow hand auger boreholes were drilled over the Structure Plan area, of which approximately sixteen boreholes were drilled within or near the confines of
Area 6. Visual appraisals of soil profiles in the existing road table drain excavations were also undertaken.

The WCL boreholes on Area 6 had a spacing of approximately 200 metres and were designed to identify the thickness of the competent raft materials. These boreholes encountered a relatively thin mantle comprising inorganic alluvial silts of thickness between 0.4 and 1.5 metres, overlying organic clays, silts and peat. To the northwest of the site no organic clays or peat were encountered.

Groundwater levels were determined to range between 0.7 and 1.8 metres depth under summer (February) conditions.

WCL identified key factors which needed to be considered with respect to the organic materials, as follows:

"Minimising of imposed bearing pressures coupled with shallow foundations."

"Site-specific structural design to address possible differential settlements."

"Managing groundwater to ensure retention of prevailing ground water levels."

"Ground water recharge by artificial means where a planned development affects natural recharge."

Based on the thickness of the identified competent soil raft, WCL nominated three building zones within Area 6, as follows:

"Zone 1 - suitable for low density development (suggested lifestyle blocks of 2000-3000 m²) as competent soil raft is less than 1 metre thick.

Zone 2: - suitable for medium density development (suggested density of 500-750 m² per dwelling), as competent soil raft is at least 1 metre thick.

Zone 3 – suitable for high density development (suggested density of 250-500 m² per dwelling), as competent soil raft is at least 2 metres thick."

The WCL demarcation shows Zone 3 in the northwest, Zone 1 in the south-east with Zone 2 occupying the land in between, this is shown in Figure 4 of the adopted draft report Takanini Structure Plan.

Due to the thin cover of raft materials in Zone 1, WCL considered that there was increased risk from:

"Changes to the water table."

"Higher levels of settlement."

"Bearing capacity limitations."

"Instability in the organic materials in the form of natural migration of large bodies of wood."

4 FIELDWORK

Our fieldwork was commenced on 3 March 2006 and involved the drilling of thirty-one hand auger boreholes to depths of up to 5 metres in the positions indicated on the appended site plan. Descriptions and depths of strata encountered during the drilling of the boreholes are appended. Borehole locations were spaced at approximately 100m intervals.

We have also appended the relevant WCL borehole records and their approximate locations are also shown on the Soil Zonations plan.
5 SUMMARY OF SITE CONDITIONS

5.1 Topsoil
The depth of topsoil typically ranged between 0.1 and 0.3 metres.

5.2 Inorganic Soils
All boreholes encountered a mantle (raft) of inorganic soils comprising soft to stiff, sometimes sandy silts, clayey silts and silty clays. The deposits were sometimes organic stained and hard to distinguish from the overlying topsoil.

Shear vane dial readings measured in situ ranged from 25 to 140, indicating that these deposits display wide variations in strength.

Using the same criteria as in the WCL report, the thickness of the inorganic raft has been categorised into three zones, as follows:

Zone 1: Raft of inorganic soils up to 1 metre thick. Zone 1 was encountered over the south-eastern section of the site.

Zone 2: Raft of inorganic soils between 1 and 2 metres thick. Zone 2 was apparent over the majority of the study area.

Zone 3: Raft of inorganic soils over 2 metres thick. Zone 3 was apparent over parts of the central and northern portions of the study area.

The attached Soil Zonations plan delineates these three zones and is indicative only. The thickness of the inorganic raft encountered in each borehole is also labelled on the site plan.

5.3 Organic Deposits
Beneath the raft of inorganic soils, all boreholes except 17, 18, 26, 27, 28, 31, encountered very soft organic (muddy) clayey silts and silty clays, often containing large amounts of decayed wood/twigs and inclusions of amorphous organic matter (peat). The organic deposits were present to at least the depths drilled in most cases. The appended cross-section compiled using information contained within the WCL Structure Plan Report indicates that the thickness of the organic soils varies over the site with depths generally increasing towards the south. Depths range from approximately 1 metre adjacent to Popes Road to approximately 11 metres adjacent to Manuroa Road.

5.4 Groundwater
The standing water levels ranged in depth from 1.0 to 3.2 metres depth, averaging approximately 1.6 metres. No groundwater table was detected in boreholes 6, 10, 18, 21, 22, 23, 25, 27 and 29 during the time of our site visit. However, if standpipes were installed and groundwater monitoring undertaken, we anticipate that equilibrium levels will be similar to those displayed elsewhere on the site.

The depth of groundwater detected in each borehole is labelled on the attached site plan.
5.5 Laboratory Testing

Two sets of Expansive soil tests were carried out on samples taken from boreholes 8 and 28 at depths ranging from 0.3 to 0.7 metres. These tests were carried out in accordance with NZS 4402:1986, “Methods of Testing Soils for Civil Engineering Purposes” test section 2 and were primarily intended to assess the Expansive Classes of the site materials in terms of AS 2870. The tests carried out on this site produced Cone Penetration Limits of 95 and 128 and Linear Shrinkages of 14 and 17%.

6 DISCUSSION ON GROUND CONDITIONS

6.1 General

Our findings are comparable to those presented in the WCL report.

Insitu shear vane dial readings within the inorganic soil raft varied markedly, but were typically soft to firm.

The underlying organic soils (where present) typically comprised muddy clayey silts and silty clays with wood and amorphous peat inclusions. The basal level of the organics has not been established in this investigation although it has been identified by WCL.

The inorganic raft thickness and strength, plus the presence of organic deposits beneath the inorganic mantle, bestow geotechnical constraints to development. These are discussed in more detail below and generally concur with the geotechnical conclusions and recommendations in the WCL report.

An average AS 2870 soil Class ‘M’ likely prevails across the site, although further testing is recommended during future subdivisional development as variations are expected.

Notwithstanding these issues, with appropriate engineering and application of the provisions of the District Plan, the concept of mixed use development over this site is considered (in principle) geotechnically feasible with individual developments requiring specific site investigation and foundation design.

6.2 Organic Deposits

These deposits are susceptible to irreversible consolidation settlements which may be induced from lowering of the groundwater table (eg. from interruption to groundwater recharge via sealed catchment areas, groundwater drawdown from drains and/or large trees, etc) or imposed surcharge loads (eg. from buildings and/or earth fills, etc). Therefore, planning for development of this site must consider the following key points:

- Applied bearing pressures from shallow foundations associated with buildings should be minimised on account of varying, but generally low strength, ground conditions.
- Light-weight, flexible structural designs are desirable to accommodate potential differential settlements.
- Floor live loads for industrial/commercial developments may be limited. Heavily loaded areas/foundations may require piling, and/or other methods of ground improvement.
- Careful stormwater management should allow for artificial groundwater recharge to ensure that existing water table levels are maintained.
GEOTECHNICAL ASSESSMENT

- Diligent landscaping/vegetation and earthworks designs must minimise potentially adverse effects (eg. induced settlements) for the reasonably foreseeable future.

6.3 Raft Soils

Within the area of Zone 1 the raft is generally less than 1 metre thick. Here, there is a greater degree of risk of higher levels of settlement from changes in groundwater level and the importance of artificial groundwater recharge becomes paramount, as do the limitations on bearing capacity, landscaping and earthworks.

The thickness of the raft increases in Zones 2 and 3 effectively lowers the risks associated with fluctuations in groundwater, landscaping and earthworks.

However, it appears that the shear strength of the inorganic (raft) soils within all Zones is highly variable. This places greater limitations on bearing capacity. This is a site specific investigation and design issue which would need to be addressed at the relevant consent stages.

Further, it must be pointed out that the zones and associated conditions presented in the WCL report are related specifically to residential development and as such do not apply to industrial development as proposed here. Instead, each industrial lot will require specific site investigation and foundation design to address the geotechnical issues presented by individual and varying building structures that may be built on the land.

6.4 Geotechnical Works

It is apparent that substantial (relatively high density) residential developments border the southern and northern boundaries of Area 6. Commercial and industrial developments are located to the west. It is inferred that WCL Zone 1, 2 and 3 soils encroach into these established areas with no obvious adverse affects on development.

Therefore, with appropriate engineering measures as discussed below, we consider that the identified geotechnical conditions alone should not constrain the density of development upon the zonations described above.

However, it is our professional opinion that the use of a rule such as the one shown below is prudent and should address the broad geotechnical issues likely to be encountered during the development of the land.

"All subdivision, resource consent or building consent applications shall be accompanied by a site specification Geotechnical Investigation Report, prepared by a suitably qualified Geotechnical Engineer, confirming that the lot will be suitable for development of a Permitted Activity, or for a development approved by means of a resource or subdivision consent.

(a) The Geotechnical Investigation Report shall make recommendations for future site development in respect of the following matters:

1. Consolidation settlement
2. Differential settlement
3. Foundation bearing pressure
4. Maintaining Groundwater equilibrium
GEOTECHNICAL ASSESSMENT

5. Service line; and

(b) A site specific groundwater recharge system design shall be prepared by a Stormwater Engineer; and

(c) Specific structural and civil engineer design measures shall be undertaken by Structural and Civil Engineers that make provision for the site specific geotechnical and groundwater recharge requirements, for example foundation design and preloading, if required.”

7  PRELIMINARY FOUNDATION TYPES

Based on the information presented on the cross-section as attached, we anticipate typical foundation solutions for industrial type buildings at this site to comprise either shallow strip and pad foundations or piles. Piles should be expected to extend to depths of up to approximately 15 metres in the southern parts of the site with anticipated depths reducing to the north to approximately 5 to 8 metres. Actual pile depths will depend on the ground conditions encountered during the subsequent specific site investigations.

The pile depths discussed above are not unusual and many successful developments in Auckland have been built using piled foundations in a variety of ground conditions with many having foundation piles extending to depths well beyond 15 metres. It is also important to realise that the foundation type required is not just a function of the ground conditions but is also influenced by the actual development proposal and the associated loadings.

As a rough estimate we normally expect the foundation cost for piling to be in the order of 15% of the project value while the approximate cost for shallow foundations is expected to be in the order of 10% of the total construction cost

We do not expect the foundation cost percentages for buildings at this site to vary significantly from those estimated above.

Pads or raft type foundations should be able to be utilised with preloading and ground improvement (eg. construction of a hardfill pad etc.) for heavy structures or large footprint (or differential settlement intolerant) as above.

The need or otherwise for preloading is dependent on the ground conditions present at a specific site as well as the expected loadings and/or settlement sensitivity. This is typically assessed at the specific investigation and foundation design stage. In addition it must be pointed out that preloading and piled foundations have been successfully undertaken on many sites in the Auckland area without rendering the developments unviable.

Based on our discussions with Contractors we anticipate the cost of importing and placement of aggregate for preloading to be in the order of $65/m³. For a 10kPa preload this equates to $32.5/m² and for a 20kPa preload it equates to $65/m². This does not make allowance for the holding cost of the land and we would expect that any preloading would need to be in place for 6 to 12 months.

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1 Personal communication with Davis Langdon Limited (August 2008)

2 Personal communication with HEB Contractors (August 2008)
Also based on past experience in the area, preload settlements are anticipated to be in the range of approximately 50 to 75mm for a 10 kPa preload and between approximately 100 and 150mm for a 20 kPa preload.

However, it must be accepted that this may vary significantly depending on the total preload area and height.

Other specific design alternatives such as stiffened rafts, post tensioned and suspended floor slabs may also be suitable depending on actual floor live loads.

8 GROUNDWATER RECHARGE

As the organic soils present here are likely to be subject to significant irreversible settlements if the groundwater table is drawn down beyond the normal seasonal fluctuations it is important to ensure that groundwater recharge is achieved.

Industrial developments tend to cover most of the lot area with impermeable surfaces (eg. roofs and pavements) and so groundwater recharge will be required through the use of rain gardens and dispersal trenches or similar. The rain gardens would serve to collect runoff from paved areas before distributing the water through a network of groundwater recharge trenches beneath the paved area and designed for an even dispersion. Any overflow would simply be piped through the stormwater drainage network.

Water from the roofs may be able to be disposed of directly into the ground beneath the building floorslabs via a specifically designed dispersal trench system.

We would expect the rain gardens to either be visible at the surface or to have a removable concrete lid to allow for maintenance. Further, the dispersal trenches could have flushing ports to enable flushing to prevent blockage of the trenches.

We have attached a layout sketch (Appendix 9) of a groundwater recharge system without rain gardens although these could easily be added to a system like the one shown attached. We expect that flushing of this system could be undertaken from cesspit and manhole locations.

It must be accepted that each individual development will require a specific groundwater recharge design.

9 PAVEMENT DESIGN

We expect design subgrade CBR values here to be low (1% to 2%) and that in order to provide adequate access and yard areas suitable for industrial use subgrade undercuts with geotextile underlay and possibly geogrid may be required. These are proven strategies for constructing pavements on soft ground. In any event each individual lot will require a specific pavement design taking into account the ground conditions specific to that lot.

10 LIMITATION

This report has been prepared solely for the use of our client, Takanini Structure Plan Area 6, their professional advisers and the relevant Territorial Authorities in relation to the specific project described herein. No liability is accepted in respect of its use for any other purpose or by any other person or entity.
GEOTECHNICAL ASSESSMENT

All future owners of this property should seek professional geotechnical advice to satisfy themselves as to its ongoing suitability for their intended use.

For and on behalf of Coffey Geotechnics (NZ) Limited

Prepared By:

J L Beaumont  
Senior Geotechnical Engineer

Reviewed By:

S G Lander  
Associate Geotechnical Engineer  
MIPENZ, CPEng.
Appendix 1

Wilton Joubert Limited
Sikh Temple Plan Set
NOTES:

Piles shall be:
1.50 Small End Diameter timber piles driven to refusal on bedrock. (approx 8m)
Spaced at midpoints of grid intersections.
Refer to drawings by 'Jim Hollings & Co. Ltd.' for foundation details of loads bearing footings/pads.

Concrete strength minimum of 17.5MPa after 28 days.
Concrete shall be damp cured for at least 7 days before any loads are imposed.

Do not scale from Drawings. Refer Architectural Drawings for overall dimensions.

Design live load: 4.0 kPa (unfactored)
Allowable construction load: 4.0 kPa

Panels shall not be stacked on floor during construction.

Structural Engineers:
WILTON JOUBERT Ltd
PO BOX 11-381
ELLERSLIE
AUCKLAND
Ph (09) 579 1114
Fax (09) 579 7778

Community Facility
70 Takamini School Road
Takamini

Client:
Comraud Polycraft

Plan:
Wilton Joubert

Scale: 1:200
NOTES:

Piles shall be:
150 Small End Diameter timber piles driven to refusal on bedrock. (approx 8m)
Spaced at midpoints of grid intersections.

Refer to drawings by
Jim Hollings & Co. Ltd.
for foundation details of load bearing footing/pads.

Do not scale from Drawings.
Refer Architectural Drawings for overall dimensions.

Design live load:
4.0 kPa (unfactored)

Allowable construction load:
4.0 kPa

Panels shall not be stacked on floor during construction.

Structural Engineers:
WILTON JOUBERT LTD
P.O. BOX 11-381
ELLERSLIE
AUCKLAND
Ph (09) 579 1114
Fax (09) 579 7778

Community Facility
70 Takamini School Road
Takamini

User Name:

Contra Polyraft
Part Plan

DBL - Tim E
ARW
1100
21/01/2005
080266
Concrete strength minimum of 17.5MPa after 28 days.
Piles shall be: 150 Small End Diameter timber piles driven to refusal on bedrock. (approx 8m)
Spaced at midpoints of grid intersections.
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Do not scale from Drawings. Refer Architectural Drawings for overall dimensions.

Design live load: 4.0 kPa (unfactored)

Allowable construction load: 4.0 kPa

Panels shall not be stacked on floor during construction.

See Detail 9-53

See Detail 6-53
NOTES:
Piles shall be: 150 Small End Diameter timber piles driven to refusal on bedrock. (approx 6m)
Spaced at midpoints of grid intersections.
Refer to drawings by 'Jim Hollings & Co. Ltd.' for foundation details of load bearing footings/pads.

Do not scale from Drawings.
Refer Architectural Drawings for overall dimensions.

Design live load: 4.0 kPa (unfactored)
Allowable construction load: 4.0 kPa

Panels shall not be stacked on floor during construction.

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<td>06/08</td>
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</tbody>
</table>

Regional Engineer
WILTON JOUBERT Ltd
P.O. BOX 331
ELLERSLIE
AUCKLAND
Tel: (09) 579 1114
Fax: (09) 579 1718

Architectural Drawings
Co.

Community Facility
70 Takanini School Road
Takanini

Wilton Joubert

Contra Polyract
Details

--
CONTRA POLYRAFT
Internal Beam 200
Scale 1:25

GGS HRC mesh on 2/chars per pod

Detail
Contra Polyraft
Internal Beam 200
Scale 1:25

GGS HRC mesh on 2/chars per pod

Detail
Contra Polyraft
Internal Beam 200
Scale 1:25

GGS HRC mesh on 2/chars per pod

Detail
Contra Polyraft
Internal Beam 200
Scale 1:25

GGS HRC mesh on 2/chars per pod

Detail
Contra Polyraft
Internal Beam 200
Scale 1:25

Detailed construction:

- Design live load: 4.0 kPa (unfactored)
- Allowable construction load: 4.0 kPa
- Panels shall not be stacked on floor during construction.

NOTES:

Piles shall be:
- 150 Small End Diameter timber piles driven to refusal on bedrock. (approx 8m)
- Spaced at midpoints of grid intersections.
- Refer to drawings by 'Jim Hollings & Co. Ltd.' for foundation details of load bearing footings/pads.
- Do not scale from Drawings. Refer Architectural Drawings for overall dimensions.
- Design live load: 4.0 kPa (unfactored)
- Allowable construction load: 4.0 kPa
- Panels shall not be stacked on floor during construction.

Structural Engineer:
WILTON JOUBERT LTD
P.O. BOX 1138
ELLERSLIE
AUCKLAND
Ph: (09) 579 1114
Fax: (09) 579 7778

Community Facility
70 Takarini School Road
Takarini
Appendix 2
Jim Holliage & Co. Limited
Sikh Temple Panel Layout and Piling Plan
Appendix 3

Hill Design Engineering Limited
Bruce Pulman Park Gymnasium and Multi-Sports Centre Plan Set
Appendix 4

Euroclass
Mitre 10 Plan Set
DRIVEN TIMBER PILES

- All piles shall be
- Drilled, 5:1 to 1:2C, treated mangrove piles
- Piles to be in length 3-10m long confirmed by dam depth
- Piles subject to regular inspection. Supervision is
- Trenches to be left 5m deep for a single acting
- Ground water falling slope

BOLTING AT TYPICAL LINEs 2&7

TYPICAL ROLLER DOOR THRESHOLD

NOTES

- All foundations complete 20%
PANELS 1 & 8
125mm thk

PANELS 2 - 7
125mm thk

PANELS 9-13, 18, 20, 21, 23-36,
125mm thk

PANELS 12, 16, 22, 53, 54, 57-65.
125mm thk (27 similar except
Panes 33-52A as 125 mm 16 mm).

TYPICAL WELD PLATE DETAIL

PANELS 44-52
125mm thk

DETAL A

125mm thk

125mm thk

125mm thk

PANELS 119-125
125mm thk

PANELS 44-52
125mm thk

TYPICAL WELD PLATE DETAIL

DETAIL B

DETAIL C

DETAIL D

DETAIL E

DETAIL F

PROPOSED BULK RETAIL DEVELOPMENT
280 GREAT SOUTH ROAD, PAPAKURA, AUCKLAND
MITRE 10 (NZ) LTD. 6. Wakaes

EUROCLASS

PRECART PANEL REINFORCING
& FOUNDATIONS.
Appendix 5

Laboratory Test Results
# CLASSIFICATION TEST RESULTS

Test Methods: NZS 4402:1986 Tests 2.1, 2.5 & 2.6

<table>
<thead>
<tr>
<th>JOB NO</th>
<th>12635</th>
</tr>
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<tbody>
<tr>
<td>PROJECT</td>
<td>Area 6A &amp; 6B Plan Change</td>
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<tr>
<td></td>
<td>Takanini Structure Plan</td>
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<tr>
<td>CLIENT</td>
<td>Takanini Structure Plan Area 6 Limited</td>
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All tests reported herein have been performed in accordance with the laboratory’s scope of accreditation

N.G. Agarkova  Approved Signatory

<table>
<thead>
<tr>
<th>Borehole No</th>
<th>8</th>
<th>28</th>
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<tbody>
<tr>
<td>Sample No</td>
<td>S1 10.3.06</td>
<td>S1 10.3.03</td>
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<tr>
<td>Depth</td>
<td>0.3-0.6 m</td>
<td>0.3-0.6 m</td>
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<td>Water Content</td>
<td>%</td>
<td>%</td>
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Samples prepared from 'As Received' Natural Water Content

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<tr>
<th>Soil fraction used</th>
<th>Whole soil</th>
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<tbody>
<tr>
<td>Cone Penetration Limit</td>
<td>128</td>
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<tr>
<td>Linear Shrinkage</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>17</td>
<td>14</td>
</tr>
</tbody>
</table>

216 Gil St Rd Newmarket  
Ph: +64 9 523 5526  
20 Tamariki Ave Orewa  
Ph: +64 9 426 9707  

TESTED AT Newmarket  
DATE 17.03.06  
CHECKED  

FOUNDATION ENGINEERING
Appendix 6

Woodward-Clyde (NZ) Limited
Borehole Records
### DRILL HOLE LOG WCHA200

**Woodward-Clyde**

**Drilling Contractor:**
- **Drill Type:** 50mm Handauger
- **Logged By:** NS and LL
- **Checked By:** MH
- **Date Started:** 4-2-00
- **Data Finished:** 4-2-00
- **Coordinates:** mN, mE
- **Permit No.:**

**Project Reference:** AAAA2747000007/002

**Client:** Papakura District Council

**Sheet 1 of 1**

#### DESCRIPTION OF STRATA

<table>
<thead>
<tr>
<th>SAMPLE TYPE</th>
<th>DRILL RUN (m)</th>
<th>FIELD SHEAR STRENGTH (kPa)</th>
<th>PENETROMETER BLOWS (N)</th>
<th>SAMPLING AND OTHER TESTING</th>
<th>GROUND WATER DATA AND COMMENTS</th>
<th>PEGEOMETER CONSTRUCTION</th>
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<td>77/32</td>
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<td><a href="mailto:GVL@1.5m">GVL@1.5m</a> 4/2/00</td>
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<td>64/36</td>
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</tr>
</tbody>
</table>

**LEGEND**
- Black peaty and orange Silt [FILL]
- Brown orange SILT mixed grey, slightly moist, firm drilling [ALLUVIAL]
- @ 1.0m, becomes moist.
- @ 1.2m, becomes light cream grey.
- From 1.5m occasional streaks black peat.
- Cream CLAY, plastic, moist, moderately firm drilling
- From 1.8m occasional peat as spongy brown wood fragments
- EOB@ 2.2m: TARGET DEPTH

**GEOLOGICAL DESCRIPTION**

**REMARKS:**
1. Shear Vane DR2918
2. Borehole located approx 200m beyond the Northwest end of Takanini School Road
3. Scrubby area with rough surface suggesting veneer of fill
### Woodward-Clyde

**DRILL HOLE LOG WCHA203**

**Drilling Contractor:** Woodward-Clyde (NZ) Ltd.
385 Queen Street, Auckland

**Drill Type:** 50mm Handauger

**Logged By:** NS and LL
**Checked By:** MH
**Date Started:** 11-2-00
**Date Finished:** 11-2-00

**Logged By:** NS and LL
**Checked By:** MH
**Date Started:** 11-2-00
**Date Finished:** 11-2-00

**Sections Covered:**
- **0-1m:** Brown orange Silt: Dry, hard drilling (TAURANGA GROUP ALLUVIALS)
- **@0.8m:** Becomes light brown, Trace organics (Peat: 1.0%)
- **1.4-2.2m:** Soft, push auger down without drilling: Organic content mostly amorphous matrix material with 10-15% wood

**Remarks:**
1. Shear Vane DR2918
2. Borehole located approx 200m NW of Popes and Porchester Rds Intersection: 100m SE of Pakakura stream

**Sample Type**

<table>
<thead>
<tr>
<th>SAMPLE TYPE</th>
<th>DRILL RUN (m)</th>
<th>FIELD SHEAR STRENGTH (MPa)</th>
<th>PENETROMETER BLOWS (n)</th>
<th>SAMPLING AND OTHER TESTING</th>
<th>GROUND WATER DATA AND COMMENTS</th>
<th>PIEZOMETER CONSTRUCTION DEPTH (m)</th>
<th>DESCRIPTION OF STRATA</th>
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<td></td>
<td>39/15</td>
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<td></td>
<td>1.4-2.2m: Soft, push auger down without drilling: Organic content mostly amorphous matrix material with 10-15% wood</td>
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<tr>
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<td>29/12</td>
<td></td>
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<td></td>
<td>1.4-2.2m: TARGET DEPTH</td>
<td></td>
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**Groundwater Level (GWL):**
- **1.1/2m:** 11/2/00

**Client:** Papakura District Council

**Project No.:** AAAA274700007/002

**Project Reference:** Takanini Structure Plan

**Logged By:** NS and LL
**Checked By:** MH
**Date Started:** 11-2-00
**Date Finished:** 11-2-00

**Permit No.:**

**Client:** Papakura District Council

**Phone:** 09 355 1300
**Fax:** 09 355 1333
<table>
<thead>
<tr>
<th>SAMPLE TYPE</th>
<th>DRILL RUN (m)</th>
<th>FIELD SHEAR STRENGTH (MPa)</th>
<th>PENETRATOR BLOWS (N)</th>
<th>SAMPLING AND OTHER TESTING</th>
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<td><strong>TOPSOIL</strong></td>
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<td>152/40</td>
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<td><strong>Dark brown orange Silt</strong>: Dry, stiff drilling [TAURANGA GROUP ALLUVIALS]</td>
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<tr>
<td>112/48</td>
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<td></td>
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<td></td>
<td>Light grey CLAY: Moist, hard drilling</td>
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</table>

**REMARKS:**
1) Shear Vane DR2918
2) Topography lowlying, rising slightly to north

**METHODOLOGY:**
- **Sample Type:**
- **Drill Run (m):** 105/28, 152/40, 112/48, 110/50
- **Field Shear Strength (MPa):** Not specified
- **Penetrometer Blows (N):** Not specified
- **Sampling and Other Testing:**
- **Ground Water Data and Comments:**
- **Piezometer Construction:**
- **Depth (m):**
  - 0.0: Topsoil
  - 1.0: **Dark brown orange Silt**: Dry, stiff drilling [TAURANGA GROUP ALLUVIALS]
  - 1.2: Light grey CLAY: Moist, hard drilling
  - 2.2: **EOB@2.2m**: Target Depth

**GEOLOGICAL DESCRIPTION:**
- **Non-Organic Taunangia Group Alluvials**
### DRILL HOLE LOG WCHA205

#### General Information
- **Client:** Papakura District Council
- **Project Reference:** AAAA2747000007/002 - Takanini Structure Plan

#### Drilling Details
- **Drill Type:** 50mm Handauger
- **Logged By:** NS and LL
- **Checked By:** MH
- **Date Started:** 17-2-00
- **Date Finished:** 17-2-00

#### Coordinates
- **Relative Level:** mRL
- **Coordinates:** mN mE
- **Permit No.:**

#### Sample Data

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<th>PENETROMETER BLOWS (N)</th>
<th>SAMPLING AND OTHER TESTING</th>
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<th>PIEZOMETER CONSTRUCTION DEPTH (m)</th>
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#### Description of Strata
- **Topsoil**
- **Dark brown orange SILT. Dry, firm drilling [TAURANGA GROUP ALLUVIALS]**
- **GVL@1.3m 17/2/00**
- **Black brown organic CLAY. Firm, moist**
  - Organic content comprises amorphous matrix material
- **Light grey CLAY, firm**
- **EOB@2.2m. TARGET DEPTH**

#### Remarks
- i) Shear Vane CR2918
Woodward-Clyde

DRILL HOLE LOG WCHA210

Woodward-Clyde (NZ) Ltd.
385 Queen Street Auckland

Phone 06 355 1300
Fax 06 355 1333

Drilling Contractor:

Logged By: NS and LL
Checked By: MH
Date Started: 14-2-00
Date Finished: 14-2-00

Relative Level: mRL
Coordinates: mN mE

Client:
Papakura District Council

Drill Type: 50mm Handuger

GWL@1.5m 14/2/00

TAKANINI STRUCTURE PLAN

DESCRIPTION OF STRATA

LEGEND

TOPSOIL: Brown SILT, dry
Yellow orange SILT: Dry, stiff drilling
Dark brown organic (15-20%) CLAY: Firm
Cream brown CLAY: Pumiceous, moist, firm drilling

REMARKS:

i) Shear Vane DR2018
ii) Borehole located Popes Rd, approx 100m West of Popes and Porchester Rds intersection
iii) Topography lowlying
**DRILL HOLE LOG WCHA211**

**Woodward-Clyde**  
**Takanini Structure Plan**

**Drilling Contractor:** Woodward-Clyde (NZ) Ltd.  
**Client:** Papakura District Council

**Drill Type:** 50mm Handauger  
**Logged By:** NS and LL  
**Relative Level:** mRL

**Checked By:** MH  
**Coordinates:** mN, mE

**Date Started:** 11-2-00  
**Date Finished:** 11-2-00  
**Permit No.:** 

---

**DESCRIPTION OF STRATA**

- **TOPSOIL:** Dark brown SILT, Dry
- **Dark grey brown SILT:** Non organic, dry, firm drilling; [TAURANGA GROUP ALLUVIALS]
- **PUMICITE:** White grey, hard silt
- **Grey CLAY:** Moist, firm drilling
- **EOB@2.2m:** TARGET DEPTH

---

**REMARKS:**

1) Shear Vane OR2918
2) Borehole located along Popes Rd approx midway between intersections with Porchester and Takanini School Rds
3) Topography low lying
**Drill Hole Log WCHA212**

- **Drill Type:** 50mm Handauger
- **Logged By:** NS and LL
- **Checked By:** MN
- **Date Started:** 4-2-00
- **Date Finished:** 4-2-00
- **Relative Level:** mRL
- **Coordinates:** mN, mE
- **Client:** Papakura District Council
- **Permit No.:**

### DESCRIPTION OF STRATA

1. **0-0.20 m:** Cream CLAY, plastic, moist, mod soft-firm drilling

2. **0.20-1.50 m:** Dark brown yellow SILT, moist, firm drilling: [ALLUVIALS]

3. **1.50-3.00 m:** black peaty SILT, poorly consolidated: organic content 20-30% [FILL from adjacent drain]

4. **3.00-3.50 m:** GWL@1.5m 4/2/00

5. **3.50-4.00 m:** Cream CLAY, plastic, moist, mod soft-firm drilling

6. **4.00-5.00 m:** Bentonite seal U.2-2.8m Walton Park gravels: Response zone 1.9-2.8m with single filter sock: Piezometer capped

### Remarks:
- Borehole located at corner of Porchester and Popes Road; Northeast side of intersection
- 1.5m deep drain adjacent to borehole: No organics: GWL @ approx 1.2m
- As-Built piezometer design: 0.0-0.2m Bentonite seal: 2.2-2.8m Walton Park gravels: Response zone 1.9-2.8m with single filter sock: Piezometer capped
**Woodward-Clyde**

**DRILL HOLE LOG WCHA213**

**Drilling Contractor:** Woodward-Clyde (NZ) Ltd

**Drill Type:** 60mm Handauger

**Logged By:** NS and LL
**Checked By:** MH
**Date Started:** 21-2-00
**Date Finished:** 21-2-00

**Relative Level:** mRL
**Coordinates:** mN, mE

**Client:** Papakura District Council

---

**Sample Type** | **Drill Run (m)** | **Field Shear Strength (IPN)** | **Penetrometer Blows (n)** | **Sampling and Other Testing** | **Ground Water Data and Comments** | **Piezometer Construction Depth (m)** | **GEOLOGICAL DESCRIPTION**
---|---|---|---|---|---|---|---

| 60/22 | 55/18 | 50/21 | 129/47 | See remark iv | | |

**Description of Strata**

- **Topsoil:** Peaty black silt, dry
- **Black brown organic (20-25%) silt:** Poorly consolidated, moist, moderately firm drilling [TAURANGA GROUP ALLUVIALS]
- **Organic content comprises:** 80-90% Amorphous matrix material 10-20% Solid to spongy twigs and wood

**Remark:**

- Shear Vane DR3918
- Borehole located away from roads: Approx 150m SW of Porchester and Popes Rds intersection
- Topography lowlying
- Shear strength reading @1.6m valid: Firm amorphous peat
- Shear strength readings @2.1 and 2.2m valid: Strength in peat reduces markedly below groundwater table

**Auger TSP - 15 EPS VICONE GDT 2/4/00**

**Remarks:**

1. Shear Vane DR3918
2. Borehole located away from roads: Approx 150m SW of Porchester and Popes Rds intersection
3. Topography lowlying
4. Shear strength reading @1.6m valid: Firm amorphous peat
5. Shear strength readings @2.1 and 2.2m valid: Strength in peat reduces markedly below groundwater table
### Drill Hole Log WCHA214

**Client:** Papakura District Council

**Drill Type:** 50mm Handauger

<table>
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<th>Sample Type</th>
<th>Drill Run (m)</th>
<th>Field Shear Strength (MPa)</th>
<th>Penetrometer Blows (N)</th>
<th>Sampling and Other Testing</th>
<th>Ground Water Data and Comments</th>
<th>Piezometer Construction</th>
<th>Depth (m)</th>
<th>Description of Strata</th>
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<td>TOPSOIL: Black Silt, dry</td>
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<td>Dark orange brown Silt: Non-organic, dry</td>
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<td>52/21</td>
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<td>1.1-2.2m</td>
<td>Dark brown organic (20-30%) Clay: Poorly consolidated, slightly moist, moderately firm drilling</td>
</tr>
<tr>
<td></td>
<td>58/18</td>
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<td></td>
<td>1.1-2.2m</td>
<td>Organic content comprises: 90% Amorphous, 10% Wood</td>
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<td></td>
<td>50/15</td>
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<td></td>
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<td></td>
<td>1.1-2.2m</td>
<td>1-1.2m: Soft, push auger down without drilling: Organics comprise 10-15% stringy and spongy wood, rest amorphous matrix material</td>
</tr>
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<td>ORGANIC TAUANGA GROUP ALLUMS</td>
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</tbody>
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**Remarks:**
1. Shear Vane DR2918
2. Topography lowlying
3. Marked reduction in strength of organics below groundwater table
PROJECT NO.: AAAA2747000007/002
Project Reference: Takanini Structure Plan

Client: Papakura District Council

Logged By: NS and LL
Checked By: MH
Date Started: 14-2-00
Date Finished: 14-2-00
Relative Level: mRL
Coordinates: mE
Permit No:

SAMPLE TYPE | DRILL RUN (m) | FIELD SHEAR STRENGTH (kPa) | PENETRATOR BLOWS (N) | SAMPLING AND OTHER TESTING | GROUND WATER DATA AND COMMENTS | PIZOZETER CONSTRUCTION | DEPTH (m) | DESCRIPTION OF STRATA | GEOLOGICAL DESCRIPTION
--- | --- | --- | --- | --- | --- | --- | --- | --- | ---
TOPSOIL
Grey brown SILT: Non organic, firm drilling (TAURANGA GROUP ALLUVIALS)
0.6-1.1m: Becomes slightly (5-7%) organic, dark brown, slightly moist
Black brown organic (25-30%) CLAY: Poorly consolidated, moist, soft, push auger down without drilling

DEEPER WATER LEVEL AT 1.3m 14/2/00

Remarks:
1) Shear Vane DR291B
2) Borehole located at corner of Takanini School and Spartan Roads
3) Topography: lowlying
4) As-Built piezometer construction: 0.0-0.3m Bentonite seal, 0.3-2.7m Walton Park gravels; Response zone 1.7-2.7m with double filter sock; Piezometer capped.

EOB@3.0m: TARGET DEPTH
# DRILL HOLE LOG WCHA220

**Drilling Contractor:** Woodward-Clyde

**Project No.:** AAAA2747000007/002

**Takanini Structure Plan**

**Drill Type:** 50mm Handauger

**Logged By:** NS and LL

**Checked By:** MH

**Date Started:** 21-2-00

**Date Finished:** 21-2-00

**Relative Level:** mRL

**Coordinates:** mN, mE

**Client:** Papakura District Council

## SAMPLE TYPE | DRILL RUN (m) | FIELD SHEAR STRENGTH (MPa) | PENETROMETER BLOWS (N) | GROUND WATER DATA AND COMMENTS | PEIZOMETER CONSTRUCTION DEPTH (m)
---|---|---|---|---|---
| | | | | | 0

### DESCRIPTION OF STRATA

**TOPSOIL**

Brown orange Silt: Dry, firm drilling [TAURANGA GROUP ALLUVIALS]

**Black brown, organic (20-35%) Silt: Poorly consolidated, slightly moist, moderately firm drilling**

Organic content comprises:

- 80-95%: Amorphous matrix material
- 5-10%: Twigs and other wood debris, poorly decomposed

1.5-2.2m: Soft, push auger down without drilling

2.0-2.1: Spongy wood

### REMARKS:

i) Shear Vane DR2018

ii) Borehole located away from roads in proposed 3,500 people density area

iii) Topography lowlying

iv) Shear strength reading at 2.6m affected by spongy wood material
# Drill Hole Log WCHA221

**Drill Contractor:** Woodward-Clyde

**Drill Type:** 60mm Handauger

**Logged By:** NS and LL  
**Checked By:** MH

**Date Started:** 11-2-00  
**Date Finished:** 11-2-00

**Coordinates:**  
- **mN:**  
- **mE:**

**Client:** Papakura District Council

## Sample Type

<table>
<thead>
<tr>
<th>SAMPLE TYPE</th>
<th>DRILL RUN (m)</th>
<th>FIELD SHEAR STRENGTH (KPa)</th>
<th>PENETROMETER BLOWs (N)</th>
<th>SAMPLING AND OTHER TESTING</th>
<th>GROUND WATER DATA AND COMMENTS</th>
<th>PIEZOMETER CONSTRUCTION</th>
<th>DEPTH (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHEET 1 OF 1</td>
<td>72/16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHEET 1 OF 1</td>
<td>67/16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHEET 1 OF 1</td>
<td>57/19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHEET 1 OF 1</td>
<td>38/12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHEET 1 OF 1</td>
<td>72/15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHEET 1 OF 1</td>
<td>58/5</td>
<td>WOOD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHEET 1 OF 1</td>
<td>42/12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHEET 1 OF 1</td>
<td>56/14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHEET 1 OF 1</td>
<td>67/12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Description of Strata

- **GROUND DESCRIPTION**
  - **TOPSOIL**
    - Dark brown orange SILT: Dry, firm drilling. [TAURANGA GROUP ALLUVIALS]
  - Black brown organic (30-40%) SILT: Firm-stiff drilling, dry
    - Organic content comprises: 70-80%: Amorphous matrix material  
  - 20-30%: Wood, poorly to highly decomposed, some spongy
    - 1.0m-2.9m: Soft, push auger down without drilling
  - 1.5-1.6m: Light grey pumiceous silt layer
  - 1.7-1.8m: Spongy poorly decomposed wood
  - **PEAT:** Dark brown, amorphous, firm drilling
  - **ECB@2.2m: TARGET DEPTH**

## Remarks

- i) Shear Vane DR2918
- ii) Shear strength @ 1.8m high due to spongy wood
## Woodward-Clyde

### DRILL HOLE LOG WCHA222

**Woodward-Clyde (NZ) Ltd**  
355 Queen Street Auckland  
Phone 09 355 1300  
Fax 09 355 1333

**Project No.:** AAAA2747000007/002  
**Project Reference:** Takanini Structure Plan

**Client:** Papakura District Council

**Drill Type:** 80mm Handauger

<table>
<thead>
<tr>
<th>SAMPLE TYPE</th>
<th>DRILL RUN (m)</th>
<th>FIELD SHEAR STRENGTH (kPa)</th>
<th>PENETROMETER BLOWS (m)</th>
<th>SAMPLING AND OTHER TESTING</th>
<th>GROUND WATER DATA AND COMMENTS</th>
<th>PIEZOMETER CONSTRUCTION DEPTH (m)</th>
<th>DESCRIPTION OF STRATA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TOPSOIL: Black brown SILT, dry</td>
</tr>
<tr>
<td></td>
<td>68.19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.3-0.5m: Possible residual soil (Black brown slightly (9-10%) peaty silt) Difficult to differentiate from topsoil</td>
</tr>
<tr>
<td></td>
<td>70.23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Black organic (20-25%) CLAY: Poorly consolidated, slightly moist, moderately firm drilling [TAURANGA GROUP ALLUVIALS]</td>
</tr>
<tr>
<td></td>
<td>51.36</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Organic content comprises:</td>
</tr>
<tr>
<td></td>
<td>199.18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>85-90%: Amorphous matrix material</td>
</tr>
<tr>
<td></td>
<td>30.17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10-15%: Wood, spongy to highly decomposed</td>
</tr>
<tr>
<td></td>
<td>35.19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Light grey PUMICITE: Stiff</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dark brown organic (20-30%) CLAY: Poorly consolidated, soft, push auger down without drilling; Organic content mostly amorphous with some wood debris</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.8-1.9m: Solid wood obstruction</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><a href="mailto:EOB@1.2m">EOB@1.2m</a>: TARGET DEPTH</td>
</tr>
</tbody>
</table>

**REMARKS:**  
1) Shear Vane DR2018  
2) Borehole locate in proposed 3,300 people density area  
3) Topography lowlying
DESCRIPTION OF STRATA

0.5-0.9m: Becomes slightly (5-7%) organic, black grey: Organics as amorphous matrix material

0.9-1.2m: Dark brown, organics <5% as peaty wood

Cream brown CLAY: Non organic, firm drilling

Black brown organic (30-35%) CLAY: Poorly consolidated, soft

EOB@2.2m: TARGET DEPTH

REMARKS:  i) Shear Vane DR2918
    ii) Borehole located along Takanini School Rd approx 100m South of Spartan Rd
<table>
<thead>
<tr>
<th>SAMPLE TYPE</th>
<th>DRILL RUN (m)</th>
<th>FIELD SHEAR STRENGTH (kPa)</th>
<th>PENETROMETER BLOWS (N)</th>
<th>SAMPLING AND OTHER TESTING</th>
<th>GROUND WATER DATA AND COMMENTS</th>
<th>PIEZOMETER CONSTRUCTION DEPTH (m)</th>
<th>DESCRIPTION OF STRATA</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>36/16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>FILL: Brown orange SILT mixed with peaty brown SILT, occasional (&lt;1.0%) gravel; Possible buried topsoil from 0.6m to black peaty SILT</td>
</tr>
<tr>
<td></td>
<td>55/18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>Black brown organic (20-35%) SILT; Poorly consolidated, slightly moist, moderately firm drilling</td>
</tr>
<tr>
<td></td>
<td>42/19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>PEAT: Amorphous, dark brown, firm</td>
</tr>
<tr>
<td></td>
<td>55/28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>Black brown organic SILT, soft; Organic content mostly amorphous with some stringy wood</td>
</tr>
<tr>
<td></td>
<td>61/26</td>
<td>Firm Peat</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td><a href="mailto:EDB@2.2m">EDB@2.2m</a>: TARGET DEPTH</td>
</tr>
<tr>
<td></td>
<td>42/17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>32/12</td>
<td>VALID</td>
<td>See remark iv</td>
<td></td>
<td></td>
<td>0</td>
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<tr>
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<td>29/13</td>
<td>VALID</td>
<td>See remark iv</td>
<td></td>
<td></td>
<td>0</td>
<td></td>
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</tbody>
</table>

**REMARKS:**

i) Shear Vane DR2018
ii) Borehole located away from roads in proposed 3,500 people density area
iii) Topography indicating no signs of filling evident
iv) Shear strength readings @ 2.0 and 2.1m valid: Strength of peat reduces markedly below groundwater table
Appendix 7

Previous Investigation Data
(March 2006)
### SOIL DESCRIPTION

**TOPSOIL**

- **NATURAL:** Firm, non-plastic, light brown clayey SILT

- Soft, moderately plastic, dark brown silty CLAY, with slightly organic stained

- Soft, very plastic, black organic silty CLAY, with occasional rootlets
  - becoming wet

**E.O.B.** at 5.0 metres.

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Standing Water Level</th>
<th>Vane Dial Reading</th>
<th>Soil Sensitivity</th>
<th>Sample and Laboratory Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>29</td>
<td>3.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>18</td>
<td>9.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td>20</td>
<td>6.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0</td>
<td>19</td>
<td>6.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0</td>
<td>17</td>
<td>6.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Foundation Engineering**

- **Groundwater encountered at 1.9 metres**

- **Borehole Diameter:** 50mm

- **Check:** Clay, Silt, Pumice, Volcanic
### Project Location:
Area 6A & 6B Plan Change
Takanini Structure Plan

### Job Number:
12635

### Client:
Takanini Structure Plan Area 6 Limited

### Borehole Location:
TOPSOIL

### Description:
Refer to site plan

### Soil Description

<table>
<thead>
<tr>
<th>Layer Description</th>
<th>Depth (m)</th>
<th>Standing Water Level</th>
<th>Vane Shear Strength</th>
<th>Soil Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOPSOIL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NATURAL: Firm, non-plastic, light brown SILT, friable</td>
<td>0.5</td>
<td>45</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>Stiff, slightly plastic, orange streaked dark brown/ black clayey SILT</td>
<td>1.0</td>
<td>30</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td>- becoming black, moist</td>
<td>1.5</td>
<td>22</td>
<td>5.5</td>
<td></td>
</tr>
<tr>
<td>Stiff, black moderately plastic, to very plastic, organic clayey SILT, with occasional rootlet - becoming wet</td>
<td>2.0</td>
<td>20</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>- with occasional twigs</td>
<td>2.5</td>
<td>28</td>
<td>2.3</td>
<td></td>
</tr>
</tbody>
</table>

E.O.B. at 2.6 metres. Too stiff to auger further - suspected branch.

### Comments:
Groundwater encountered at 2.6 metres

### Laboratory Test Details

- Sand
- Sandstone
- Plutonic
- No Core

- Gravel
- Siltstone
- Organic
- Limestone
- Pumice
- Volcanic
**SOIL DESCRIPTION**

**NATURAL**: non-plastic, brown slightly fine sandy SILT

- Firm, slightly plastic, orange/brown mottled black slightly clayey SILT, with occasional organic inclusions
  - becoming soft
  - becoming damp
  - with major wood inclusions

- Soft, moderately plastic, black clayey SILT, with occasional moderate wood inclusions
  - becoming wet
  - becoming dark brown and strong organic odour
  - with moderate wood inclusions layer

E.O.B. at 3.0 metres.

**Comments:**
Groundwater encountered at 3.0 metres
### Client:
Takanini Structure Plan Area 6 Limited

### Project Location:
Area 6A & 6B Plan Change
Takanini Structure Plan

### Job Number:
12635

**Borehole Location:**
- **mN**
- **mE**
- **Ground R.L.**

**Description:** Refer to site plan

---

### Soil Description

**Topsoil**

- Natural: Firm, non-plastic, brown slightly fine sandy SILT

Firm, slightly plastic, orange/brown mottled black organic slightly clayey SILT, with occasional minor organic inclusions

- Becoming black damp and minor wood inclusions

- With occasional minor to moderate wood inclusions

- With large wood inclusions

E.O.B. at 5.0 metres.

---

**Auger Borehole No.**

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Sounding Water Level</th>
<th>Voie Dial Reading</th>
<th>Soil Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td></td>
<td>54</td>
<td>6.8</td>
</tr>
<tr>
<td>1.0</td>
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<td>13</td>
<td>6.5</td>
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<td>1.5</td>
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<td>6.0</td>
</tr>
<tr>
<td>2.5</td>
<td></td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>3.0</td>
<td></td>
<td>13</td>
<td>4.3</td>
</tr>
<tr>
<td>3.5</td>
<td></td>
<td>140+</td>
<td></td>
</tr>
<tr>
<td>4.0</td>
<td></td>
<td>13</td>
<td>6.5</td>
</tr>
<tr>
<td>4.5</td>
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<td>15</td>
<td>7.5</td>
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<td>5.0</td>
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<td>18</td>
<td>4.5</td>
</tr>
<tr>
<td>5.5</td>
<td></td>
<td>15</td>
<td>7.5</td>
</tr>
</tbody>
</table>

**Comments:**
Groundwater encountered at 2.3 metres

---

**Foundation Engineering**

- **Drilled By:** PMS
- **Processed By:** RVP
- **Date:** 3.3.06

---

**Legend:**
- **Sandstone**
- **Plutonic**
- **No Core**
- **Fill**
- **Clay**
- **Organic**
- **Silt**
- **Pumice**
- **Volcanic**
**SOIL DESCRIPTION**

**TOPSOIL**
- NATURAL: Firm, non-plastic, brown SILT, friable

- Soft, moderately plastic, very dark brown clayey SILT, with occasional rootlet

- Soft, very plastic, black organic slightly clayey SILT, moist
  - becoming wet
  - with occasional twigs

E.O.B. at 3.0 metres.
Client: Takanini Structure Plan Area 6 Limited
Project Location: Area 6A & 6B Plan Change
Takanini Structure Plan

Auger Borehole No. 6

Job Number: 12635

Drilled By: GM
Processed By: RVP
Date: 3.3.06

Borehole Location: mN mE Ground R.L.
Description: Refer to site plan

SOIL DESCRIPTION

TOPSOIL

NATURAL: firm, non-plastic, light brown clayey SILT, with minor rootlet inclusions

0.5
50 3.8

Soft, slightly plastic, dark brown mottled light brown clayey SILT, with organic inclusions

1.0
30 3.0

Stiff, very plastic, dark brown clayey SILT, with root inclusions, moist

1.5
30 3.0

- with large roots inclusions

2.0
48 2.7

68 3.8

65 3.3

63 2.9

65 3.4

E.O.B. at 3.0 metres.

Comments: Groundwater not encountered
**Client:** Takanini Structure Plan Area 6 Limited

**Project Location:** Area 6A & 6B Plan Change

**Job Number:** 12635

**Auger Borehole No. 7**

**Drilled By:**

**Processed By:**

**Date:** 3.3.06

**Drilled Location:**

**mN | mE | Ground R.L.**

**Description:** Refer to site plan

### SOIL DESCRIPTION

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Standing Water Level</th>
<th>Soil Sensitivity</th>
<th>Sample and Laboratory Test Details</th>
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<tbody>
<tr>
<td>0.5</td>
<td>68</td>
<td>5.7</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>35</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>48</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>45</td>
<td>2.6</td>
<td></td>
</tr>
</tbody>
</table>

**SOIL DESCRIPTION**

- **TOPSOIL**
  - NATURAL: Firm, non-plastic, light brown Silt, friable
  - Soft, dark brown/ black moderately plastic to very plastic, clayey Silt, organic staining moist
    - with occasional organic roots and twigs inclusions

- E.O.B. at 2.2 metres. Too stiff to auger further - suspected branch.

**Comments:**

Groundwater not encountered

**CHECKED:**

- Clay
- Silt
- Organic
- Pumice
- Volcanic
**Client:** Takanini Structure Plan Area 6 Limited  
**Project Location:** Area 6A & 6B Plan Change  
**Job Number:** 12635  

<table>
<thead>
<tr>
<th>Borehole Location</th>
<th>mN</th>
<th>mE</th>
<th>Ground R.L.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Refer to site plan</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Soil Description

**Topsoil**

- **Natural:** Firm, non-plastic, light brown clayey silt
- **Soft, moderately plastic to very plastic, dark brown slightly organic stained silty clay, with minor root inclusions**

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Standing Water Level</th>
<th>Vein Dial Reading</th>
<th>Soil Sancelity</th>
<th>Sample and Laboratory Test Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td></td>
<td>28</td>
<td>4.0</td>
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<tr>
<td>1.0</td>
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<td>24</td>
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</tr>
<tr>
<td>1.5</td>
<td></td>
<td>22</td>
<td>5.5</td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td></td>
<td>24</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E.O.B. at 2.0 metres. Too stiff to auger further - suspected branch.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Foundation Engineering**

**Comments:** Groundwater encountered at 1.4 metres
**SOIL DESCRIPTION**

**TOPSOIL**
- Firm, non-plastic, light brown clayey Silt
  - Depth: 0.5 m, Van Veld Reading: 22, Soil Sensitivity: 5.5
- Soft, moderately plastic to very plastic, dark brown silty CLAY, organic stained
  - Depth: 1.0 m, Van Veld Reading: 32, Soil Sensitivity: 5.3
- Soft, very plastic, black organic silty CLAY, with occasional rootlets - becoming wet
  - Depth: 1.5 m, Van Veld Reading: 28, Soil Sensitivity: 4.7

E.O.B. at 3.0 metres.
<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Standing Water Level</th>
<th>Vane Dial Reading</th>
<th>Soil Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td></td>
<td>25</td>
<td>6.3</td>
</tr>
<tr>
<td>1.0</td>
<td></td>
<td>28</td>
<td>4.7</td>
</tr>
<tr>
<td>1.5</td>
<td></td>
<td>30</td>
<td>7.5</td>
</tr>
<tr>
<td>1.7</td>
<td></td>
<td>140++</td>
<td></td>
</tr>
</tbody>
</table>

E.O.B. at 1.7 metres. Possible Branch

**SOIL DESCRIPTION**

- **TOPSOIL**
  - NATURAL: Firm, non-plastic, light brown clayey Silt
  - Soft, moderately plastic to very plastic, dark brown silty CLAY, slightly organic stained
  - Soft, moderately plastic to very plastic, dark brown/ black organic silty CLAY, with some roots, twigs and branches

**Comments:**
- Groundwater not encountered
- Borehole Diameter: 50mm
- Topsoil
- Sand
- Sandstone
- Plutonic
- Fill
- Gravel
- Limestone
- Silt
- Clays
- Organic
- Siltstone
- Pumice
- Volcanic
**Client:** Takanini Structure Plan Area 6 Limited  
**Project Location:** Area 6A & 6B Plan Change  
**Job Number:** 12635

**SOIL DESCRIPTION**

**TOPSOIL**

- NATURAL: Firm, non-plastic, light brown SILT, friable
- Soft, moderately plastic, dark brown silt-rich CLAY, with occasional rootlets
- Soft, moderately plastic to very plastic, dark brown/black organic clayey SILT, moist
- Becoming black
- Becoming wet
- With occasional branches and twigs

E.O.B. at 3.0 metres.

**Comments:**
Groundwater encountered at 1.7 metres

**Groundwater**

- **Depth:** 1.7 m
- **Reading:** 2.5
- **Soil Sensitivity:** 2.5

**Sample and Laboratory Test Details**

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Standing Water Level</th>
<th>Vine Dial Reading</th>
<th>Soil Sensitivity</th>
<th>Sample and Laboratory Test Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>25</td>
<td>1.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>18</td>
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<td></td>
</tr>
<tr>
<td>1.5</td>
<td>25</td>
<td>2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td>18</td>
<td>2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>25</td>
<td>2.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td>25</td>
<td>2.6</td>
<td></td>
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<tr>
<td>3.5</td>
<td>25</td>
<td>2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0</td>
<td>25</td>
<td>2.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5</td>
<td>25</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0</td>
<td>25</td>
<td>1.0</td>
<td></td>
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<tr>
<td>5.5</td>
<td>25</td>
<td>0.5</td>
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</tr>
<tr>
<td>6.0</td>
<td>25</td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Auger Borehole No.** 11

**Drilled By:**  
**Processed By:**  
**Date:** 3.3.06

**Borehole Diameter:** 50mm

<table>
<thead>
<tr>
<th>传感器</th>
<th>传感器</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td>Sandstone</td>
</tr>
<tr>
<td>Gravel</td>
<td>Siltstone</td>
</tr>
<tr>
<td>Fill</td>
<td>Organic</td>
</tr>
<tr>
<td>Clay</td>
<td>Limestone</td>
</tr>
<tr>
<td>Silt</td>
<td>Pumice</td>
</tr>
<tr>
<td></td>
<td>Volcanic</td>
</tr>
</tbody>
</table>

**Checked:**
**Client:** Takanini Structure Plan Area 6 Limited  
**Project Location:** Area 6A & 6B Plan Change  
**Takanini Structure Plan**

**Job Number:** 12535

**Borehole Location:**

<table>
<thead>
<tr>
<th>Description</th>
<th>Refer to site plan</th>
</tr>
</thead>
</table>

**SOIL DESCRIPTION**

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Standing Water Level</th>
<th>Vane Shear Reading</th>
<th>Soil Silt Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>75</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>18</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>15</td>
<td>3.8</td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td>12</td>
<td>2.4</td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>20</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td>25</td>
<td>2.1</td>
<td></td>
</tr>
</tbody>
</table>

- **TOPSOIL**
  - NATURAL: Silt, non-plastic, dark brown SILT, friable
  - Soft, moderately plastic, dark brown clayey SILT, with rootlets
  - Soft, moderately plastic to very plastic, dark brown organic clayey SILT, with some rootlet inclusions
    - becoming wet
    - becoming saturated

  **E.O.B. at 2.8 metres.**

**Comments:**

Groundwater encountered at 1.5 metres.
**SOIL DESCRIPTION**

<table>
<thead>
<tr>
<th>Description</th>
<th>Depth (m)</th>
<th>Vane Shear (KPa)</th>
<th>Sample Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOPSOIL</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soft, non-plastic, light brown SILT, friable</td>
<td>0.5</td>
<td>30</td>
<td>3.8</td>
</tr>
<tr>
<td>Soft, moderately plastic, orange flecked dark brown silty CLAY, moist</td>
<td>1.0</td>
<td>31</td>
<td>4.4</td>
</tr>
<tr>
<td>- becoming wet</td>
<td></td>
<td>45</td>
<td>4.1</td>
</tr>
<tr>
<td>Stiff, moderately plastic, to very plastic, brown silty CLAY, with occasional rootlets</td>
<td>1.5</td>
<td>55</td>
<td>6.9</td>
</tr>
<tr>
<td>- becoming wet</td>
<td></td>
<td>48</td>
<td>6.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>48</td>
<td>4.0</td>
</tr>
<tr>
<td><strong>E.O.B. at 3.0 metres.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments: Groundwater encountered at 3.0 metres.
**Client:** Takanini Structure Plan Area 6 Limited  
**Project Location:** Area 6A & 6B Plan Change  
Takanini Structure Plan  
**Job Number:** 12635

<table>
<thead>
<tr>
<th>Borehole Location</th>
<th>mN</th>
<th>mE</th>
<th>Ground R.L.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Refer to site plan</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SOIL DESCRIPTION

**TOPSOIL**

**NATURAL:** Firm, non-plastic, light brown SILT, friable

Soft, moderately plastic, dark brown/ black clayey SILT, moist with slight organic odour (organic stained)

- becoming firm, with common rootlet and twig

- becoming wet

Very soft, dark brown organic CLAY, with minor organic inclusions

- with abundant twigs and rootlet

- becoming firm

Firm, very plastic, light grey silty CLAY

E.O.B. at 4.4 metres. Too stiff to auger further.

**Auger Borehole No. 14**

**Processed By:** RVP 3.3.06

**Sample and Laboratory Test Details**

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Standing Water Level</th>
<th>Volume Dial Reading</th>
<th>Soil Spongibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>43</td>
<td>4.3</td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>23</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>70</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td>45</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>79</td>
<td>6.6</td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td>14</td>
<td>1.4</td>
<td></td>
</tr>
<tr>
<td>3.5</td>
<td>70</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>4.0</td>
<td>60</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td>4.5</td>
<td>72</td>
<td>1.7</td>
<td></td>
</tr>
</tbody>
</table>

**Comments:**

Groundwater encountered at 2.6 metres
**Client:** Takanini Structure Plan Area 6 Limited  
**Project Location:** Area 6A & 6B Plan Change  
**Takanini Structure Plan**  
**Job Number:** 12635  
**Borehole Location:**  
**Description:** Refer to site plan

### SOIL DESCRIPTION

**TOPSOIL**

- **NATURAL:** Firm, moderately plastic, dark brown silty CLAY

**SOIL DESCRIPTION**

- Soft, moderately plastic to very plastic, dark brown/ black (organic stained) silty CLAY, with occasional rootlet inclusions
- becoming moist
- becoming wet with occasional twigs and branches

**E.O.B. at 3.0 metres.**

**Comments:** Groundwater encountered at 1.2 metres.
Client: Takanini Structure Plan Area 6 Limited
Project Location: Area 6A & 6B Plan Change
Takanini Structure Plan
Job Number: 12635

Borehole Location: Refer to site plan

SOIL DESCRIPTION

TOPSOIL

NATURAL: Firm, non-plastic, light brown fine sandy clayey SILT, friable

Firm, slightly plastic, dark brown silty CLAY

Soft, moderately plastic, dark brown/ black silty CLAY, with occasional organic inclusions

Firm, very plastic, light brown/ cream silty CLAY (slightly organic stained)

- becoming wet
- becoming stiff

E.O.B. at 3.0 metres.

Comments: Borehole Diameter.

Groundwater encountered at 1.8 metres.
**SOIL DESCRIPTION**

**TOPSOIL**

- **NATURAL**: Firm, non-plastic, light brown clayey SILT
  - becoming moderately plastic

- **Firm, moderately plastic, brown silty CLAY**
  
- **Firm, very plastic, speckled orange light brown/cream silty CLAY**
  - becoming wet
  - becoming stiff

E.O.B. at 3.0 metres.

**Comments:**
Groundwater encountered at 2.0 metres.
Client: Takanini Structure Plan Area 6 Limited
Project Location: Area 6A & 6B Plan Change
Takanini Structure Plan
Job Number: 12635

Borehole Location: mN mE Ground R.L.
Description: Refer to site plan

SOIL DESCRIPTION

TOPSOIL

NATURAL: Firm, non-plastic, light brown clayey SILT
- becoming stiff, slightly plastic, brown

- becoming speckled orange

Stiff, moderately plastic to very plastic, light brown/cream silty CLAY

E.O.B. at 3.0 metres.

Sample and Laboratory Test Details

Auger Borehole No. 18
Sheet 18 of 31

Depth (m) Standing Water Level Vane Dial Reading Soil Stability
70 3.9
130 9.3
140+
140++
140+
90 2.0
60 2.0

Comments: Groundwater not encountered
## SOIL DESCRIPTION

### TOPSOIL

- **NATURAL**: Firm, non-plastic, light brown speckled dark brown SILT (slight organic odour), damp and friable with minor rootlet inclusions
- **Soft, moderately plastic, dark brown clayey SILT, moist (slight organic odour)**
- **Very soft, very plastic, dark brown to black organic CLAY, with minor amorphous organic inclusions**
  - becoming organic silty clay, with common twigs and rootlets
  - becoming wet

E.O.B. at 1.9 metres. Too stiff to auger further. Suspect wooden inclusions.

### Comments:
Groundwater encountered at 1.8 metres.
Client: Takanini Structure Plan Area 6 Limited
Project Location: Area 6A & 6B Plan Change
Takanini Structure Plan
Job Number: 12635

<table>
<thead>
<tr>
<th>Borehole Location</th>
<th>Description</th>
<th>Ground R.L.</th>
</tr>
</thead>
<tbody>
<tr>
<td>mN</td>
<td>mE</td>
<td>Ground R.L.</td>
</tr>
<tr>
<td>TOPSOIL</td>
<td>Refer to site plan</td>
<td></td>
</tr>
</tbody>
</table>

SOIL DESCRIPTION

- NATURAL: Firm, non-plastic, light brown SILT, friable
- Firm, moderately plastic to very plastic, orange flecked dark brown sandy silty CLAY, moist (organic stained) with trace rootlets
  - becoming soft, dark brown (heavily organic stained)
  - becoming soft, organic clayey silt with more rootlet and amorphous material
- Soft, moderately plastic, black organic clayey SILT, saturated with slightly more amorphous material
  - with decaying wood inclusions
- E.O.B. at 2.2 metres. Too difficult to auger further, suspected log.

Groundwater encountered at 1.9 metres.
**Client:** Takanini Structure Plan Area 6 Limited  
**Project Location:** Area 6A & 6B Plan Change  
Takanini Structure Plan  
**Job Number:** 12635

<table>
<thead>
<tr>
<th>Borehole Location</th>
<th>Depth (m)</th>
<th>Standing Water Level</th>
<th>Valve Dial Reading</th>
<th>Soil Sensitivity</th>
<th>Sample and Laboratory Test Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOPSOIL</strong></td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>NATURAL:</strong></td>
<td>0.5</td>
<td>80</td>
<td>10</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Stiff, slightly plastic, dark red/ brown slightly clayey SILT</td>
<td>0.5</td>
<td>80</td>
<td>10</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>- becoming soft, dark brown</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firm, slightly plastic, dark brown/ black (organic stained) slightly clayey SILT</td>
<td>1.0</td>
<td>68</td>
<td>4.5</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>- with occasional minor organic inclusions (fibrous)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firm, very plastic, orange/ brown mottled grey/ brown silty CLAY, with occasional minor to moderate woody inclusions</td>
<td>1.5</td>
<td>51</td>
<td>4.6</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>- becoming soft, damp</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- becoming orange/ brown mottled grey</td>
<td>2.0</td>
<td>38</td>
<td>2.7</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>- becoming soft, blue/ grey slightly fine sand</td>
<td>2.5</td>
<td>46</td>
<td>3.3</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Firm, very plastic, orange/ brown mottled grey/ brown silty CLAY, with occasional minor to moderate woody inclusions</td>
<td>3.0</td>
<td>24</td>
<td>3.4</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>E.O.B. at 3.0 metres.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SOIL DESCRIPTION**

**Topsoil:** Groundwater not encountered

**Borehole Diameter:** 50mm

**Comments:**

---

**Foundation Engineering**

**Checked:**

- Clay
- Organic
- Silt
- Pumice
- Volcanic
**SOIL DESCRIPTION**

**TOPSOIL**
- NATURAL: Soft, non-plastic, brown slightly fine sandy SILT
- Soft, slightly plastic, brown slightly clayey SILT
- becoming black streaked brown (organic stained)
- Soft, slightly plastic, dark brown/ black slightly clayey SILT, moist with frequent moderate organic and woody inclusions
- becoming very frequent large fibrous organic and woody inclusions
- becoming wet

E.O.B. at 2.5 metres. Too stiff to auger further. Suspected log.
Client: Takanini Structure Plan Area 6 Limited
Project Location: Area 6A & 6B Plan Change
Takanini Structure Plan
Job Number: 12635

Auger Borehole No. 23
Sheet 23 of 31

Drilled By: PMS
Processed By: DAB
Date: 3.3.06

Borehole Location: mN mE Ground R.L.
Description: Refer to site plan

SOIL DESCRIPTION

TOPSOIL
NATURAL: Stiff, slightly plastic, orange/brown slightly clayey fine sandy SILT
- becoming soft, brown
- becoming organic stained, slightly woody

Stiff, moderately plastic, dark brown streaked brown slightly clayey fine sandy SILT
with occasional minor woody inclusions
- with occasional moderate woody inclusions
- becoming firm, moist

Firm, very plastic, orange/brown streaked grey slightly fine sandy silty CLAY, with
occasional minor woody inclusions

E.O.B. at 3.0 metres.

Comments: Groundwater not encountered

Sample and Laboratory Test Details

Borehole Diameter: 50mm
Topsoil
Sand
Siltstone
Fill
Gravel
Siltstone
Clay
Organic
No Core
Silt
Pumice
Limestone
Volcanic

Foundation Engineering
### SOIL DESCRIPTION

#### TOPSOIL

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Sample and Laboratory Test Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td></td>
</tr>
</tbody>
</table>

FILL: Stiff, non-plastic, brown slightly fine sandy SILT, with moderate occasional cobbles

- becoming firm

#### NATURAL

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Sample and Laboratory Test Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td></td>
</tr>
</tbody>
</table>

Firm, moderately plastic, light grey and dark brown streaked light brown fine sandy clayey SILT

- with occasional minor wood inclusions

- becoming firm

#### FIRM, VERY PLASTIC

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Sample and Laboratory Test Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td></td>
</tr>
</tbody>
</table>

Firm, very plastic, brown and orange/brown streaked light brown/grey fine sandy silty CLAY, moist with occasional minor wood inclusions

- becoming soft

- becoming firm, light brown and orange/brown streaked blue/grey very fine sand

#### FIRM, GREY, DAMP

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Sample and Laboratory Test Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td></td>
</tr>
</tbody>
</table>

Firm, moderately plastic, grey very fine sandy clayey SILT, wet with occasional minor woody inclusions

#### STIFF, SLIGHTLY PLASTIC

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Sample and Laboratory Test Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td></td>
</tr>
</tbody>
</table>

Stiff, slightly plastic, blue/grey fine sandy slightly clayey SILT (moderately weathered siltstone)

- with frequent minor siltstone inclusions (angular)

#### STIFF, DARK GREEN

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Sample and Laboratory Test Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td></td>
</tr>
</tbody>
</table>

Stiff, slightly plastic, dark green/grey very fine sandy SILT (slightly weathered sandstones)

E.O.B. at 5.0 metres.

**Notes:**

- Groundwater encountered at 2.9 metres.

**Checked:**

- Clay
- Organic
- Limestone
- Silt
- Pumice
- Volcanic

**Boresome Diameter:** 50mm

**Comments:**

- Foundation engineer

**Sample and Laboratory Test Details**

- Depth (m)
- Sample and Laboratory Test Details

**Groundwater**

- Encounter at 2.9 metres.
**SOIL DESCRIPTION**

**TOPSOIL**

- **Natural:** Stiff, non-plastic, brown slightly fine sandy SILT

- **Description:**
  - Becoming orange/brown streaked light grey/white

- **Depth:** 0.5
  - **Ground R.L.:** 136
  - **Vane Shear Test:** 9.2
  - **Soil Sensitivity:** 6.6

- **Depth:** 1.0
  - **Ground R.L.:** 119
  - **Vane Shear Test:** 2.9
  - **Soil Sensitivity:** 6.6

- **Depth:** 1.5
  - **Ground R.L.:** 120
  - **Vane Shear Test:** 2.2
  - **Soil Sensitivity:** 2.2

- **Depth:** 2.0
  - **Ground R.L.:** 84
  - **Vane Shear Test:** 1.9
  - **Soil Sensitivity:** 1.9

- **Depth:** 2.5
  - **Ground R.L.:** 90
  - **Vane Shear Test:** 2.1
  - **Soil Sensitivity:** 2.1

- **Depth:** 3.0
  - **Ground R.L.:** 30
  - **Vane Shear Test:** 1.4
  - **Soil Sensitivity:** 1.4

  E.O.B. at 3.0 metres.

**COMMENTS:**

- Groundwater not encountered
- Borehole Diameter: 50mm

**Sample and Laboratory Test Details**

- **Drilled By:** PMS
- **Processed By:** DAB
- **Date:** 3.3.06

**Foundation Engineering**
### Takanini Structure Plan Area 6 Limited

#### Project Location:
Area 6A & 6B Plan Change
Takanini Structure Plan

#### Job Number:
12635

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**Auger Borehole No. 26**

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Standing Water Level</th>
<th>Soil Sensitivity</th>
<th>Sample and Laboratory Test Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>140++</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>112</td>
<td>2.2</td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>62</td>
<td>2.8</td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td>43</td>
<td>3.7</td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>42</td>
<td>2.8</td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td></td>
<td></td>
<td>140+</td>
</tr>
</tbody>
</table>

**SOIL DESCRIPTION**

<table>
<thead>
<tr>
<th>Topsoil</th>
<th>Natural: Stiff, non-plastic, brown slightly fine sandy Silt</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stiff, slightly plastic, orange streaked light brown slightly clayey very fine sandy Silt</td>
</tr>
<tr>
<td></td>
<td>- becoming firm</td>
</tr>
<tr>
<td></td>
<td>- becoming damp</td>
</tr>
<tr>
<td></td>
<td>- becoming light grey orange/brown</td>
</tr>
<tr>
<td></td>
<td>- becoming orange/brown and limonite stained grey with occasional minor siltstone clasts</td>
</tr>
<tr>
<td></td>
<td>- becoming orange/brown streaked and limonite stained brown</td>
</tr>
<tr>
<td></td>
<td>- becoming brown</td>
</tr>
<tr>
<td></td>
<td>- with occasional major wood inclusions</td>
</tr>
</tbody>
</table>

E.O.B. at 2.85 metres. Too stiff to auger further. Suspected log.

---

**Comments:**
Groundwater encountered at 2.8 metres.
Client: Takanini Structure Plan Area 6 Limited
Project Location: Area 6A & 6B Plan Change
Takanini Structure Plan
Job Number: 12635

Auger Borehole No. 27
Sheet 27 of 31

Drilled By: PMS
Processed By: DAB
Date: 10.3.06

Borehole Location: mN mE Ground R.L.
Description: Refer to site plan

SOIL DESCRIPTION

TOPSOIL

NATURAL: Stiff, non-plastic, brown slightly fine sandy SILT

- Stiff, slightly plastic, orange/brown mottled brown slightly fine sandy slightly clayey SILT
  - becoming brown

- becoming orange/brown speckled light grey

- becoming orange/brown mottled brown
  - Firm, moderately plastic, dark brown (organic stained) clayey SILT, with minor organic inclusions
  - Stiff, slightly plastic, dark brown slightly clayey SILT, with frequent moderate organic and woody inclusions
  - Firm, moderately plastic, black/dark brown streaked brown clayey SILT, moist with occasional moderate to major woody inclusions

E.O.B. at 3.0 metres.

Sample and Laboratory Test Details:

Depth (m) Vane Dial Reading Soil Sensitivity
0.5 90 1.6
1.0 140++
1.5 140++
2.0 140++
2.5
3.0 112 14 (wood)
89 3.1

Comments:
Groundwater not encountered
Client: Takanini Structure Plan Area 6 Limited
Project Location: Area 6A & 6B Plan Change
Takanini Structure Plan
Job Number: 12635

Borehole Location: mN mE Ground R.L.
Description: Refer to site plan

SOIL DESCRIPTION

TOPSOIL
NATURAL: Firm, non-plastic, brown slightly fine sandy SILT

- Firm, slightly plastic, brown slightly fine sandy slightly clayey SILT
  - becoming stiff
  - becoming orange/ brown streaked light orange/ brown
  - becoming orange/ brown streaked light grey

- Stiff, slightly plastic, grey slightly clayey moderately sandy SILT
  - becoming orange/ brown mottled grey, moist
  - becoming orange/ brown streaked brown
  - becoming saturated
  - becoming orange/ brown

- Stiff, slightly plastic, blue/ grey slightly clayey very fine sandy SILT

E.O.B. at 4.0 metres. Too stiff to auger further.

Comments:
Groundwater encountered at 3.1 metres.
### SOIL DESCRIPTION

**TOPSOIL**

- **NATURAL:** Stiff, non-plastic, brown slightly fine sandy SILT
  - becoming white mottled brown ashy silt
  - becoming orange/brown

- **Still, slightly plastic, dark brown (organic stained) slightly fibrous clayey SILT**
  - Firm, moderately plastic, orange/brown streaked brown slightly fine sandy clayey SILT, with occasional minor woody inclusions
  - becoming white speckled and orange/brown streaked light grey
  - becoming damp

- **Still, slightly plastic, orange/brown slightly clayey very fine sandy SILT, moist**
  - becoming orange/brown streaked brown/grey

E.O.B. at 1.8 metres. Too stiff to auger further.

### Sample and Laboratory Test Details

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Standing Water Level</th>
<th>Yea/d Readings</th>
<th>Soil Samynality</th>
<th>Sample and Laboratory Test Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>150+</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>95</td>
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<td></td>
</tr>
<tr>
<td>1.5</td>
<td>42</td>
<td>2.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td>150++</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SOIL DESCRIPTION

TOPSOIL

NATURAL: Stiff, slightly plastic, orange/brown mottled brown slightly fine sandy slightly clayey SILT
- becoming limonite stained and orange/brown streaked grey
- becoming black and orange/brown mottled
Stiff, slightly plastic, light grey and orange/brown streaked cream clayey SILT
Soft, moderately plastic, dark brown clayey SILT, moist with frequent black fibrous woody inclusions
Soft, slightly plastic, brown very fine sandy slightly clayey SILT, wet
Stiff, slightly plastic, orange/brown streaked green/grey slightly clayey very fine sandy SILT
- becoming blue/grey
- becoming saturated (seepage)
E.O.B. at 2.2 metres. Too stiff to auger further.

Groundwater encountered at 1.6 metres.

Borehole Diameter: 50mm
Fill
Gravel
Sandstone
Plutonic
No Core

Checked: Clay
Silt
Organic
Limestone
Volcanic

Comments:

Drilled By: PMS
Processed By: DAB
Date: 6.3.06
Sheet 30 of 31
**Client:** Takanini Structure Plan Area 6 Limited  
**Project Location:** Area 6A & 6B Plan Change  
Takanini Structure Plan  
**Job Number:** 12835

<table>
<thead>
<tr>
<th>Borehole Location</th>
<th>Description</th>
<th>Ground R.L.</th>
</tr>
</thead>
<tbody>
<tr>
<td>mN</td>
<td>mE</td>
<td></td>
</tr>
</tbody>
</table>

**SOIL DESCRIPTION**

**Topsoil**

- Natural: Stiff, slightly plastic, orange/brown slightly fine sandy slightly clayey Silt (0.5 m)
- Becoming orange/brown streaked light orange/brown (1.0 m)
- Becoming orange/brown streaked light grey/cream (1.5 m)

- Stiff, slightly plastic, orange/brown streaked light grey slightly clayey fine sandy Silt (2.0 m)
- Becoming white speckled and orange/brown streaked brown (2.5 m)
- Becoming saturated (3.0 m)
- Becoming grey streaked orange/brown (3.5 m)

- Stiff, slightly plastic, blue/grey slightly clayey very fine to medium sandy Silt (weathered sandstone) (4.0 m)
- E.O.B. at 4.4 metres. Too stiff to auger further.

**Comments:** Groundwater encountered at 3.2 metres.
Appendix 8
Site Plans and Cross-Sections
LEGEND AND/OR NOTES:

- Hand Auger Borehole (FEL-drilled of 3/3/06)
- Existing Borehole (Woodward Clyde Feb. 2002)
- Machine Borehole (Manukau City Council)
- Depth of Inorganic "Raft" ([1.0m]
- Depth of Organics (metres)
- Depth To Groundwater (metres)

ZONE 1: Raft of inorganic soils up to 1 metre thick
ZONE 2: Raft of inorganic soils between 1 & 2 metres thick
ZONE 3: Raft of inorganic soils greater than 2 metres thick
Disclaimer: This cross section has been prepared using information provided by Papakura District Council and URS (NZ) Limited.
Appendix 9

Groundwater Recharge Sketches
Takanini Structure Plan Area 6
Limited

Plan Change Report (Attached)

13/8/08

Takanini

Indicative Groundwater Recharge Layout Plan (NT5)

* Not for Construction. Specific groundwater recharge design is required for each lot.
Indicative Recharge Trench Schematic

*Not for Construction. Specific groundwater recharge design is required for each lot.*