Otane Developments Ltd

GEOTECHNICAL INVESTIGATION REPORT

FOR PROPOSED SUBDIVISION

20737 - 19-29 Russell Street, Otane

Project Reference : 20737
January 13, 2022

DOCUMENT CONTROL

Version	Issued For:	Prepared By	Reviewed & Authorised By
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EXECUTIVE SUMMARY

Based on the investigation and appraisal of the site reported herein, the proposed development has been assessed as stable with the nominated building areas generally considered to be suitable for conventional construction in accordance with the relevant codes of practice.

Ground with a geotechnical ultimate bearing capacity of at least 300kPa (allowable bearing pressure of at least 100kPa) is generally expected to exist beneath the future building footprints within the proposed lot boundaries, based on the shear vane and penetrometer results.

The foundations for the buildings are expected to be founded within the high strength residual materials expected to underly the site. This is expected to enable shallow conventional concrete NZS3604 (2011) and NZS4429 (2013) designs to be used with no modification necessary.

Information for the access road design has also been provided, along with additional recommendations regarding the proposed wastewater pump station and stormwater swale.

All other geotechnical hazards at the site, including slope instability mass movements, have been assessed as either not present or of acceptable risk provided that the various mitigation measures, inspection & certification requirements, and good practice recommendations made in this report are adopted.

CONTENTS

1 INTRODUCTION

LDE Ltd was engaged by Rob Douglas of Otane Developments Ltd to undertake a geotechnical investigation for a proposed Subdivision on Russell Street, Otane (Figure 1), with the property legally described as Lots 74-85 DP 119 (Figure 2). A scheme plan has been provided by Surveying The Bay (Figure 3) showing the proposed subdivision layout, creating twenty new residential lots (Lots 1 through 20). Two new road alignments are proposed for the development, with recommendations regarding the construction provided within.

The purpose of the investigation was to characterise the engineering geology of the site, assess the potential risk of ground deformation affecting it, and to provide geotechnical recommendations for the development of the site. It is intended to satisfy the requirements of Central Hawkes Bay District Council at Resource Consent level for the subdivision development and to inform the expected construction requirements for the future residential building developments on proposed new Lots 1 through 20.

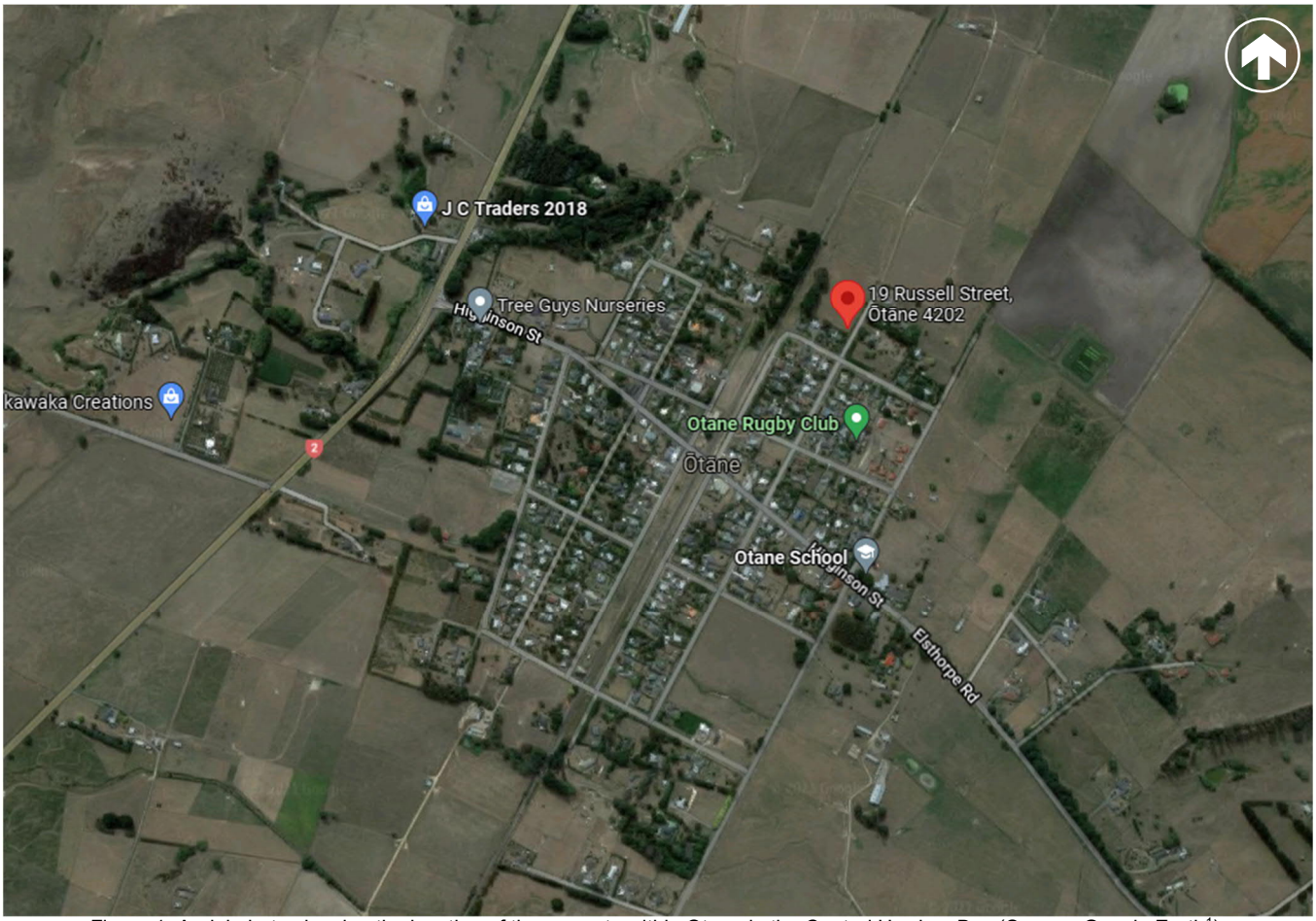

Figure 1: Aerial photo showing the location of the property within Otane in the Central Hawkes Bay (Source: Google Earth[1]).

[1] Google Earth (https://www.google.com/earth/)

Figure 2: Aerial Imagery showing the existing legal property boundaries for the proposed development (black), with the overall development outlined in red. (Source: CHBDC Intramaps[2]).

[2] Central Hawkes Bay Intramaps - https://maps.chbdc.govt.nz/IntraMaps96.

Figure 3: Scheme plan showing the proposed layout of the Lots and access roads within the development (Source: Surveying The Bay[3]).

2 Site Setting

2.1 Desktop Review

Google Earth[1], Hawke's Bay Regional Council Hazards Portal[4], GNS Active Faults Database[5], GNS Online Geological Map[6], and the Land Care Research Soils Map[7] were reviewed as a part of this desktop study and indicated the following:

[3] Surveying The Bay – Concept Subdivision of Lots 74-85 DP 119, 19-29 Russell Street, Otane. Drawing No. 5781-3 Dated November 2021.
[4] Hawkes Bay Regional Council Portal (https://hbmaps.hbrc.govt.nz/hazards/)
[5] GNS Online Active Fault Database (http://data.gns.cri.nz/af/)
[6] GNS Online Geological Map of New Zealand (http://data.gns.cri.nz/geology/)
[7] Land Care Research Soils Map (https://smap.landcareresearch.co.nz/maps-and-tools/app/)

- The site is situated outside of the liquefaction vulnerability zones mapped within the Central Hawke's Bay District[8].
- There are several fault lines mapped within the immediate vicinity of the site, with two "well defined" fault traces to the east and west of the site and a "distributed" fault trace to the south (GNS & HBRC Hazards). However, the Fault Avoidance Zones (FAZ) associated with these faults do not overlap the site boundaries (Figure 4), therefore no additional assessment is anticipated at this stage.
- The soils map for the area indicates that the near surface soils consist of moderately deep to deep (45-100cm+), poorly drained, with moderate to high soil moisture available within the topmost 1m. This assessment is generally consistent with the investigation findings.

A review of the Historical Aerial Imagery available on Google Earth has yielded the following:

- The site has remained relatively unchanged, with the site remaining undeveloped apart from a small shed accessed from Russell Street. A line of trees is also present along the western boundary, adjacent to the Williams Street paper road.
- The shed has recently been removed, along with the trees along the western boundary.

The site is immediately adjacent to a paper road to the west (Williams Street), which is also currently vacant and unused. The Palmerston North – Gisborne Rail corridor is also immediately adjacent to the Williams Street paper road, which runs in a NNE-SSW alignment.

[8] BJ Rosser & S Dellow (compilers) GNS 2017, Assessment of liquefaction risk in the Hawke's Bay. Volume 1: The liquefaction hazard model.

Figure 4: Aerial image showing the mapped faults in the immediate area of the site. The accurately mapped traces are shown in pink, with the distributed fault in green. (Source: Retrolens).

2.2 Published Geology

The 1:250,000 geological map of the region[9] shows the site as being underlain by Middle to Late Pleistocene River Deposits, consisting of loess covered gravel. The Whangai and Waipawa Formation (Tinui Group) mudstone is mapped some 820m to the east/southeast of the site. It is likely that the alluvial deposits mapped in this area may overlie the mudstone units in places, with varying thicknesses or absences across this area of Otane. Due to the age of these alluvial deposits, they may be indiscernible to the weathered residual soils associated with the mudstone and specific distinction may be difficult.

[9] Lee, J.M.; Townsend, D.; Bland, K.; Kamp, P.J.J. (compilers) 2011: GNS Science "Geology of the Hawke's Bay area: scale 1:250,000 geological map 8".

2.3 Site Characteristics

The subject site is located on the northern outskirts of the township of Otane. The property is relatively flat, with no discernible geomorphic features, with the shed and trees visible in the historic aerial imagery subsequently removed. There are several burn piles and areas where woodchips and bark have been placed to the north of the site, expected to be from the trees removed from this area. At least one tree stump was still remaining, however others may be obscured by the grass overgrowth across the site.

A trial pit had been excavated close to the current site entrance prior to the site investigation, which exposes the underlying geology within the site.

Figure 5: Photo of the site looking south, showing the generally flat nature of the site.

Figure 6: Photo of the western boundary showing the Williams Street paper road and the rail corridor beyond.

Figure 7: Photo looking along the western boundary showing the woodchips and bark remaining from the trees removed in this area.

Figure 8: Woodchip pile and burn pile to the west of the site.

Figure 9: Test pit excavation present during the site investigation, showing the underlying geology of the site.

3 GROUND CONDITIONS

3.1 General

The nature of the ground beneath the site is summarised below and in the appended logs. It is based on an integration of published and unpublished data, the geomorphology of the site, and subsurface investigations carried out at discrete locations. The nature of the ground between the investigation points is inferred and may vary from that described. For details of the materials encountered and measurements of their respective strengths please review the appended investigation logs.

3.2 Subsurface Investigations

Our investigation of the site included the following ground investigation work:

- Twenty 50mm hand augered boreholes (one per Lot) were put down to a target depth of 2m to 3m or refusal, within the proposed building platforms and on the critical slopes below or above the building platforms.
- Twenty dynamic penetrometer tests were put down alongside the hand augered boreholes, to a target depth of 2m to 3m or refusal with measurements taken in 50mm increments, each forming a Test Site (TS) with the borehole.
- Six additional dynamic penetrometer tests were put down along the proposed access road alignments to determine subgrade strengths to a target depth of 1m or refusal, with measurements taken in 50mm increments.
- An additional 4 hand augered boreholes were put down at each end of the two access road alignments to determine topsoil depths and subgrade materials.

The locations of the subsurface investigations are shown in Figure 10 below and on the Geotechnical Investigation Plan in Appendix A. Logs of the boreholes and penetrometer tests are presented in Appendix B. The field work was completed in summer.

Figure 10: Scheme Plan showing the location of the Test Sites (TS) (Source: Surveying The Bay).

3.3 Subsurface Conditions

In summary, our investigations generally encountered high strength alluvial soils consistent with the sediments shown on the geological maps for the site.

Specifically, the investigations indicate that the site is underlain by a surface layer of organic sandy SILT **(Topsoil)** encountered down to 0.2 to 0.4m beneath the site.

Underlying the topsoil layer, the investigations encountered **Alluvial Soils,** which comprised high strength (very stiff to hard; dense to very dense) SILT mixtures, and SAND mixtures, with some layers of mudstone gravels which are all inferred as near source weathering products of the nearby mudstone bedrock, deposited by alluvial processes.

The hand augered boreholes refused on hard to dense material within these high strength soils. The penetrometer results within the proposed building platforms indicate that this very high strength layer is present at approximately 0.3 to 1.6m depth, however some tests managed to advance to at least 2.0m depth.

3.4 Soil Moisture Profile and Groundwater Conditions

The hand augered boreholes indicated that the soils beneath the building site were generally dry to moist.

Groundwater was not encountered in any of the boreholes, however we expect the permanent groundwater table to lie several metres below the surface of the subject site based on the elevation of the site to the surrounding watercourses.

The moisture content of the near surface soils is expected to be higher during the winter months or extended periods of wet weather resulting in their saturation at times. The extent of the wetting front will be dependent on the duration of the period of rainfall, but may extend down some 1m to 2m of the surface. Similarly, the groundwater table is expected to rise some 1m to 2m during extended periods of wet weather. Complete saturation of the site is unlikely to occur.

3.5 Seismic Subsoil Category

We consider that the site should be conservatively categorised as a Class C shallow soil site as defined by NZS 1170.5 (2004) “Structural Design Actions: Part 5: Earthquake actions – New Zealand”.

4 Natural Hazards and Ground Deformation Potential

4.1 General

This section summarises our assessment of the natural hazards within the property as generally defined in Section 106 of the Resource Management Act (1991 and subsequent amendments) and the Building Act (2004) and the potential risk that these present to the proposed building in terms of vertical and lateral ground deformation. This section also includes our assessment of ground beneath the building site which is outside the definition of “Good Ground” as defined by the Compliance Document for the NZ Building Code, NZS3604 (2011) “Timber Framed Buildings” and NZS4229 (2013) “Concrete Masonry Buildings Not Requiring Specific Engineering Design”. This is any ground which could foreseeably experience movement of 25mm or greater for any reason including one or a combination of compressible ground, land instability, ground creep, subsidence, liquefaction, seasonal swelling and shrinking, frost heave, changing groundwater level, erosion, dissolution of soil in water, and the effect of tree roots.

4.2 Earthquake Hazards

4.2.1 Earthquake Shaking

The site is located in a region of high seismicity. As such, the site can be expected to be subject to high levels of earthquake shaking generated by large distant earthquakes every 20 to 25 years, with a 10% probability of a significant local earthquake occurring within the 50 year design life of the structure. Potential ground deformation resulting from earthquake shaking is discussed in the following sections.

The New Zealand Geotechnical Society (NZGS) and Ministry of Business Innovation & Environment (MBIE) released guidelines for Earthquake Geotechnical Engineering Practice in New Zealand (Module 1, Rev 1, 29 November 2021) for adopting a revised methodology for determining peak ground accelerations under Section 175 of the Building Act. Current best practice in geotechnical seismic design and ground performance is to adopt this methodology over NZS1170.5 (2004). Note that NZS1170 is still the current legal / codified requirement for the structural design of bracing elements etc.

Noting that the seismic subsoil category of the site is no longer needed to be taken into consideration for geotechnical performance, the current guidelines indicates a peak ground acceleration of 0.58g can be expected during an Ultimate Limit State (ULS) earthquake event and 0.12g during a Serviceability Limit State (SLS) earthquake event.

4.2.2 Fault Line Surface Rupture

The GNS NZ Geology Webmap and Active Faults Database[10] do not show any faults passing beneath the site, with the nearby GNS mapped Fault Avoidance Zones (HBRC Hazards Portal) not extending across the subject site, although it is noted that a distributed fault terminates just to the south of the site which has a trajectory that would intersect the site if it continued further to the north (Figure 4). There does not however appear to be any surface expressions which would indicate the presence of an active fault line beneath or within close proximity to the site. We therefore consider that the surface fault line rupture risk to be low and that no further detailed trenching assessment is warranted.

4.3 Liquefaction

The site is outside of the liquefaction vulnerability zones mapped within the Central Hawke's Bay District[11].

As the subject site is generally located on high strength and typically non-liquefiable cohesive silts, silty sands, the geomorphic and engineering setting of the site does not meet the criteria for the build-up of pore water pressures and the development of potential liquefaction conditions. A shallow ground water table was also not encountered;

[10] http://data.gns.cri.nz/geology/
[11] Hawkes Bay Regional Council Hazards Portal (https://hbmaps.hbrc.govt.nz/hazards/)

therefore, the site is not considered to be at risk of liquefaction settlement or lateral spreading in response to earthquake shaking.

4.4 Compressible Ground and Consolidation Settlement

The organic sandy SILT (topsoil) encountered between 0.2m to 0.4m across the site is expected to be subject to consolidation due to loading. This will need to be removed from beneath any concrete slab and any piled foundations will need to extend beneath this layer in order to avoid long term deformation of the building. Apart from this surficial layer, there does not appear to be any compressible ground beneath the building site as defined by NZS3604 (2011).

4.5 Ground Shrinkage and Swelling Potential

Plastic soils can be subject to shrinkage and swelling due to soil moisture content variations which can result in apparent heaving and settlement of buildings, particularly between seasons.

The near surface soils appear to be non-plastic to slightly plastic, with a liquid limit likely to be below 50% and/or a linear shrinkage value likely to be below 15% (the NZS3604 limiting criteria) based on their physical characteristics determined during the investigation. Based on the absence of any significant plasticity of the soils, the soils are not considered to be expansive and therefore no modifications to the foundations are required.

4.6 Tree Root Deformation

Trees within close proximity to buildings can result in potentially significant building damage due to heaving as a result of tree root growth, and also settlement due to soil shrinkage from the moisture uptake of the roots.

There are no large trees near the proposed building footprint which considered to have the potential to result in soil settlement due to the uptake of water from the tree roots or ground heave from tree root growth. Therefore, no modifications to the foundations recommendations below are considered necessary to address this issue. However, if any remaining root structures from the removed trees are present within the building footprints, they should be removed from the excavation.

4.7 Conclusions

From our assessment of the natural hazard and ground deformation risks presented to the proposed development we consider that buildings can be safely located on the nominated platforms within site, provided that the recommendations given in Section 5 are adhered to.

5 ENGINEERING RECOMMENDATIONS

5.1 General

It should be appreciated that the recommendations given below are based on the surface and subsurface conditions encountered at the time of the investigation. In addition to the possible variations in the subsurface conditions away from the investigation points within and around the site, changes to the site levels can have a dramatic effect on the recommendations given. We should be contacted immediately should the ground conditions encountered vary from that described in this report.

5.2 Building Platform Development

We expect that a minor degree of earthworks will be required for the proposed building sites and associated accessways, although the exact extent of any earthworks should be developed with respect to the future building developments in order to minimise the associated earthworks.

The platforms are likely to be cut or filled to develop the building platforms to the desired height for optimum stormwater runoff. Careful construction of the platform will be required to ensure its long-term integrity and availability of good ground beneath each proposed building site.

5.2.1 Cuts

No exposed cuts are anticipated for the development of the site.

5.2.2 Fills

All fill forming part of the building platform needs to be placed in a controlled manner to an engineering specification that follows the general methodology given in NZS4431 (1989) “Code of practice for earthfill for residential development”. This includes the design, inspection and certification of the fill by a Chartered Professional Engineer or Professional Engineering Geologist. This will be particularly important to enable the building proposed for the site to be able to be constructed in accordance with NZS3604 (2011) “Timber Framed Buildings” or NZS4229 (2013) “Concrete Masonry Buildings Not Requiring Specific Design”.

The following specification is recommended:

1. All topsoil and unsuitable materials, including low strength ground, uncontrolled fill, rubbish etc shall be stripped from the footprint area of the fill.
2. All fill placed on slopes greater than 1V to 4H shall be benched.
3. The fill footprint area shall be inspected by the certifying engineer’s representative prior to the placement of fill.
4. The fill shall be placed uniformly in horizontal layers not exceeding 150mm in thickness at the optimum moisture content recommended by the suppliers of the material. Alternatively, the material should be

inspected and approved as suitable material by a Suitably Qualified Professional. Material which is wet or saturated shall not be placed unless that is the optimum moisture content for the fill. The fill should be compacted to achieve the strengths given in the Table 2 below.

Table 2: Recommended Fill Compaction Criteria

Undrained shear strength for cohesive fill (measured by *in situ* vane to plasticity corrected shear strength values)		
	Average not less than	140kPa
	Minimum single value	110kPa
Dynamic penetrometer (non-cohesive fill)		
	Average value not less than	3 blows/50mm
	Minimum single value	2 blows/50mm

Compaction should be carried out using seven passes over each lift with a vibratory steel drum roller (hard fill) or pad/sheep foot roller (cohesive fill). Compaction using a Bobcat, excavator, truck or other vehicle other than a compactor is not likely to achieve the required strength for the fill to be certified.

Provision should be made to ensure that the earthworks are conducted with due respect for the weather, particularly due to the low permeability of the underlying ground. The fill should not be placed into a saturated excavation, especially if ponded water is present.

Vibration compaction should not be used if the base of the excavation is wet or if the fill is wet of optimum otherwise the fill strength may be significantly reduced from the resultant moisture uptake until the excess pore pressures have dissipated. The time for this to occur is variable, but is likely to take more than one day.

5.2.3 Site Contouring and Topsoiling

As soon as possible, all final cut-slopes and fill slopes should be covered with topsoil a minimum of 0.10m thick to prevent the ground from drying out readily resulting in the development of cracks. Hydroseeding should be considered for all slopes steeper than 1V:2H to assist in the rapid stabilising of the slopes.

The finished ground level should be graded so that water cannot pond against, beneath or around the building and retaining walls for the economic life of structure. To achieve this it will be important that the building platforms beneath the topsoil grades away from the platforms.

Contouring should avoid the potential for concentration and discharge of surface water over point locations which could result in soil erosion or instability.

5.3 Foundation Design and Construction Recommendations

We consider that conventional shallow foundation systems in accordance with NZS3604 (2011) and NZS4429 (2013) are generally expected to be appropriate for the site.

Ground with a geotechnical ultimate bearing capacity of at least 300kPa (allowable bearing pressure of at least 100kPa) is generally expected to exist beneath the topsoil layer within the proposed lots based on the penetrometer results and bearing capacity calculations.

The foundations for the buildings are expected to be founded within the high strength residual soils. This is expected to enable shallow conventional concrete NZS3604 (2011) and NZS4429 (2013) designs to be used with no modification necessary. Conventional waffle slabs can also be constructed without modification.

The high strength material beneath the site is expected to be able to be augered and excavated with conventional hydraulic or flight auger equipment.

5.4 Access Road Construction

The proposed access roads servicing building platforms commencing from Russell Street. Careful consideration should be given to the earthworks for the road which should include topsoil stripping removing all deleterious material and compaction of the pavement materials in layers. This should be carried out in a similar nature as the building platforms and as described in Section 5.2 above.

5.4.1 Subgrade Performance

The expected subgrade conditions are high strength residual soils. Based on the penetrometer tests carried out along the alignment (TS21 – TS26) the materials encountered at subgrade level are expected to have a minimum **CBR value of at least 5%** below the topsoil at the subgrade level and can be used for any future design of the pavement surface. The topsoil layer along the proposed access roads is also expected to be approximately 0.4m thick and should be allowed for with the road design and material supply estimates.

5.5 Verification Checks

5.5.1 Fill Placed Beneath Foundations

As required by NZS3604 (2011) and NZS4229 (2013), any fill beneath the building will need to be certified by a Chartered Professional Engineer or Professional Engineering Geologist in accordance with NZS4431 (1989). A “Certificate of Suitability of Earthfill for Residential Development” will also be required in accordance with NZS3604 (2011) and NZS4229 (2013).

In order for the fill to be certified, the excavation will need to be inspected by the certifying Engineer or Engineer’s representative to ensure that all compressible materials are removed prior to the placement of the new fill. Verification strength testing of the backfill by the certifying Engineer or Engineer’s representative will also be required to ensure that the minimum fill strengths specified in this report have been achieved.

5.5.2 Foundation Excavations

Verification testing of the ground by a Suitably Qualified Professional is recommended to ensure that the ground conditions at the base of the foundation excavations are as described in this report, and that all unsuitable and loose materials have been removed as required by NZS3604 (2011) and NZS4229 (2013). We should be contacted immediately if these conditions vary from that described in this report. Deepening of the foundations or a modification to the recommendations or design may be required.

5.6 Surface Water Disposal

It is important to ensure that all surface water from roof, paved and retaining wall areas are appropriately collected and discharged to a suitable point sufficiently away of the buildings/walls any areas of fill, and any obvious signs of soil instability (soil erosion, soil creep).

The stormwater system should be connected as soon as the roof is in place to ensure that the surrounding ground is not compromised by the negative effects and potential consequences of soil saturation.

5.6.1 Swale Drain

As part of the development, a swale drain is proposed to capture any stormwater runoff during both the earthworks phase and while the dwellings are being constructed. Once the dwellings have been constructed, the majority of the stormwater will be captured and moved off site once the systems are in place.

The location of the swale drain is proposed to be within the Williams Street paper road, near the rail corridor. It is important that the swale drain is not positioned close to the railway tracks, to prevent any settlement issues for the track system. It is recommended that the swale drain be positioned **at least 5m away from the base of the ballast shoulder,** to prevent any negative affects on the railway embankment.

5.6.2 Wastewater Pump Station

A wastewater pump station is also proposed as part of the stormwater disposal system for the site enabling works. This is expected to be excavated to at least 2m depth and based on our investigation data, it should be within the high strength residual soils underlying the site. The geotechnical ultimate bearing capacity of at least 300kPa (allowable bearing pressure of at least 100kPa) is expected to be available at this depth.

5.7 Effluent Disposal

The effluent disposal for the sites is expected to be collected by the reticulated system along Russell Street, therefore no on-site disposal is anticipated at this stage.

5.8 Service Pipes

All service pipes, stormwater structures, and culverts should be designed and constructed to ensure adequate capacity, strength, and water tightness to prevent leakage into the platform through blockage, running under pressure, or structural failure.

All service pipes installed within the fill should be flexible, or flexibly joined, so that they may deflect without breaking if the ground settles.

A record should be kept of the position, type, and size of all subsoil drains, and in particular of their outlets.

5.9 Garden Trees and Shrubs

We consider that that gardens and trees can be established adjacent to the building, however due to the detrimental effect that these can have on the building (particularly trees) we suggest the following be taken into consideration:

- The development of the gardens should not interfere with any subfloor ventilation or the drainage system for the building.
- Care should be taken to avoid the over watering of gardens close to building footings.
- To reduce the potential for heave damage associated with tree root growth or foundation settlement due to soil shrinkage due to moisture uptake by the trees, trees should be planted a minimum of 0.5 times the mature height of the tree away from the foundation.

5.10 Site Maintenance

Prompt repair of plumbing leaks should be undertaken. Blocked, broken or faulty spouting should be attended to immediately.

The discharge of uncontrolled surface water over the site and surrounding areas should be avoided at all costs.

6 LIMITATIONS

This report has been prepared exclusively for Otane Developments Ltd with respect to the particular brief given to us in support of a Resource Consent application to Central Hawke's Bay District Council. Information, opinions and recommendations contained in it cannot be used for any other purpose or by any other entity without our review and written consent. LDE Ltd accepts no liability or responsibility whatsoever for or in respect of any use or reliance upon this report by any third party.

This report was prepared in general accordance with current standards, codes and practice at the time of this report. These may be subject to change.

Opinions given in this report are based on visual methods, and subsurface investigations at discrete locations. It must be appreciated that the nature and continuity of the subsurface materials between these locations are inferred and that actual conditions could vary from that described herein. We should be contacted immediately if the conditions are found to differ from that described in this report.

This report should be read in its entirety to understand the context of the opinions and recommendations given.

APPENDIX A

GEOTECHNICAL INVESTIGATION PLAN

1. Image Source: Surveying The Ba

NOT FOR CONSTRUCTION

LAND DEVELOPMENT & ENGINEERING

Proposed Subdivision of 19-29 Russell Street, Otane
Geotechnical Investigation Plan

DRAWN	JED
CHECKED	DD
DATE	17-Dec-21
PROJECT	20737

APPENDIX B

SUBSURFACE INVESTIGATION DATA

Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

Test ID:	**TS01**
Project ID:	20737
Sheet:	1 of 1

Client:	Otane Developments Ltd	**Coordinates:**	5577716mN, 1910446mE	**Test Date:**	14/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	SL/JED
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	2523

Depth (m)	Material Description	Geology
0.0	Sandy SILT, with trace rootlets; dark brown. Stiff; dry; non-plastic; sand, fine.	Topsoil
	SILT, with some sand; dark yellowish brown. Hard; dry; low plasticity; sand, fine.	Alluvial Deposits
0.5	SILT, with some sand and gravel; light yellowish brown. Hard; dry; sand, fine, gravel, fine, subangular to subround, highly weathered, Mudstone.	
	Gravelly SAND; light yellowish brown. Dense; dry; gap graded; sand, fine to medium; gravel, fine to medium, subangular to angular, highly weathered, Mudstone.	
1.0		
1.5		

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200

Test Values	Depth (m)
UTP	-0.5
UTP	-1.0
UTP	-1.5

Hole Depth: 1.00m

Termination: Equipment refusal - on dense gravelly sand.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

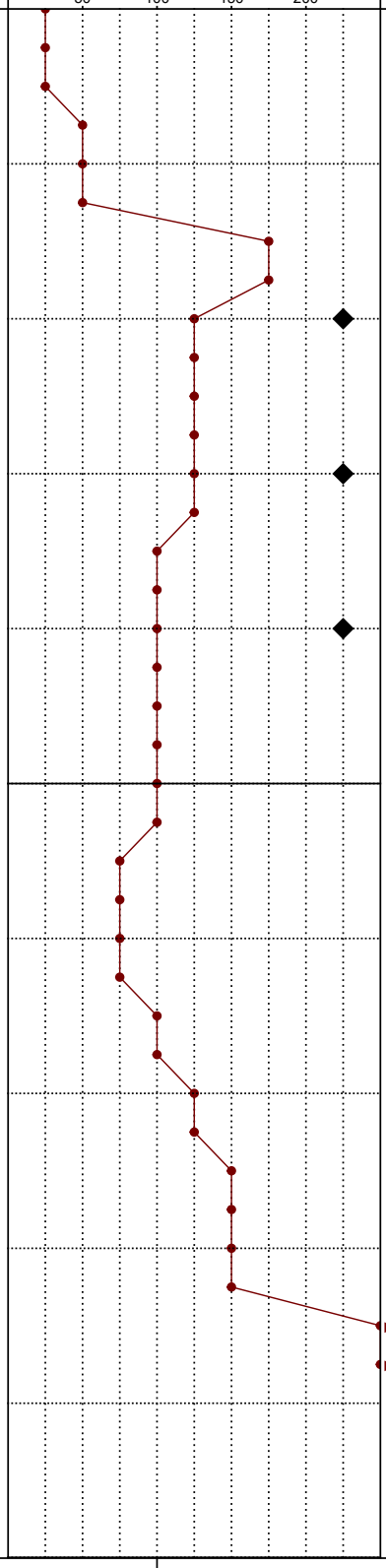
Method: 50mm Hand Auger + DCP

Test ID:	**TS02**
Project ID:	20737
Sheet:	1 of 1

Client:	Otane Developments Ltd	**Coordinates:**	5577730mN, 1910424mE	**Test Date:**	14/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	SL/JED
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	2523

Depth (m)	Material Description	Geology
0	Sandy SILT; dark brown. Stiff; dry; non-plastic; sand, fine.	Topsoil
0.5	SILT, with some sand; yellowish brown. Hard; dry; low plasticity; sand, fine.	Alluvial Deposits
	Sandy SILT, with some clay, with minor gravel; yellowish brown. Hard; dry to moist; low plasticity; sand, fine; gravel, fine, subangular to angular, highly weathered, Mudstone.	
1.0		
1.5		

Water: Groundwater Not Encountered



Depth (m): 0, -0.5, -1.0, -1.5

Hole Depth: 1.00m

Termination: Equipment refusal - on hard sandy silt.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

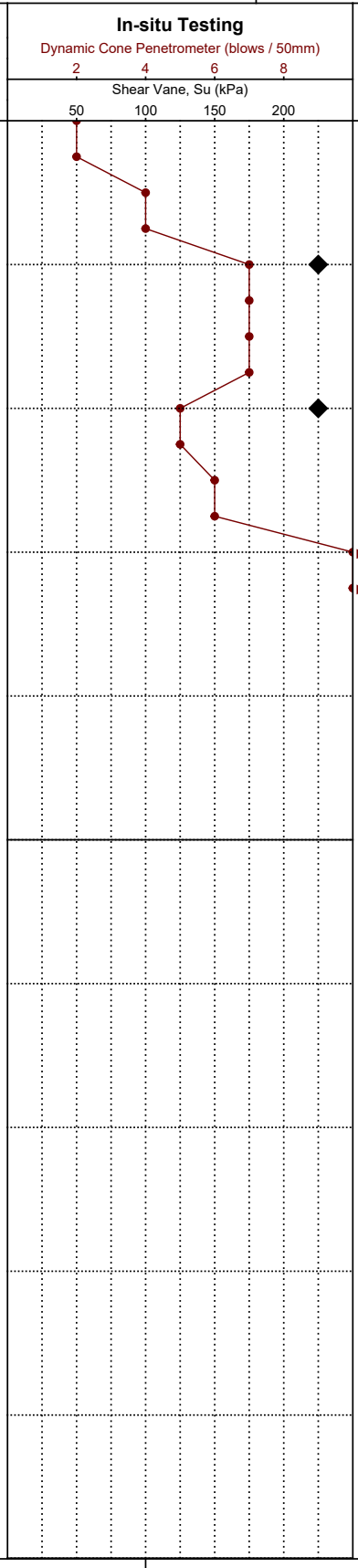
Method: 50mm Hand Auger + DCP

Test ID:	**TS03**
Project ID:	20737
Sheet:	1 of 1

Client:	Otane Developments Ltd	**Coordinates:**	5577742mN, 1910401mE	**Test Date:**	14/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	SL/JED
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	2523

Depth (m)	Material Description	Geology
0.0	Sandy SILT; dark brown. Stiff; dry; non-plastic; sand, fine.	Topsoil
	SILT, with some sand; light brownish grey. Hard; dry; non-plastic; sand, fine.	Alluvial Deposits
0.5	SILT, with some clay and sand, with trace gravel; yellowish brown. Hard; dry; low plasticity; sand, fine; gravel, fine, subangular to angular, highly weathered, Mudstone.	
1.0		
1.5		

Water: Groundwater Not Encountered



Depth (m): 0.0, -0.5, -1.0, -1.5

Hole Depth: 0.60m

Termination: Equipment refusal - on hard silt.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

Test ID:	**TS04**
Project ID:	20737
Sheet:	1 of 1

Client:	Otane Developments Ltd	**Coordinates:**	5577753mN, 1910381mE	**Test Date:**	14/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	SL/JED
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	2523

Depth (m)	Material Description	Geology
0.0	Sandy SILT; dark brown. Stiff; dry; non-plastic; sand, fine.	Topsoil
0.5	Clayey SILT, with minor sand; yellowish brown. Hard; dry; low plasticity; sand, fine.	Alluvial Deposits
	Sandy SILT, with some clay, with trace gravel; yellowish brown. Hard; dry to moist; low plasticity; sand, fine; gravel, fine, subangular to angular, highly weathered.	
1.0	Silty SAND, with trace clay; yellowish grey. Medium dense to dense; dry to moist; poorly graded; sand, fine to medium.	
	Sandy SILT, with some gravel; yellowish grey. Hard; dry to moist; low plasticity; sand, fine to medium; gravel, fine, subangular to angular, highly weathered, Mudstone.	
1.5	Silty sandy GRAVEL; light grey. Very dense; dry to moist; gravel, fine to medium, angular, highly weathered; sand, fine.	

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm) — 2, 4, 6, 8

Shear Vane, Su (kPa) — 50, 100, 150, 200

Test Values	Depth (m)
UTP	0.0
UTP	-0.5
UTP	-1.0
10 UTP	-1.5
10	

Hole Depth: 1.50m

Termination: Equipment refusal - on very dense gravel.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

Test ID:	**TS05**
Project ID:	20737
Sheet:	1 of 1

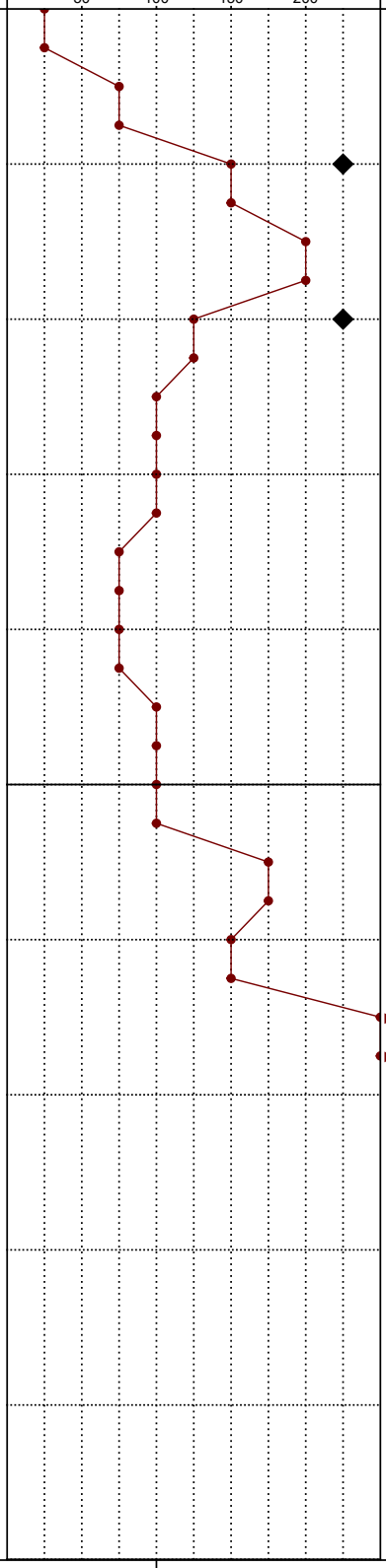
Client:	Otane Developments Ltd	**Coordinates:**	5577773mN, 1910389mE	**Test Date:**	14/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	SL/JED
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	2523

Depth (m)	Graphic Log	Material Description	Geology
0.0		Sandy SILT; dark brown. Stiff; dry; non-plastic; sand, fine.	Topsoil
		SILT, with some sand, with minor clay; yellowish brown. Hard; dry; low plasticity; sand, fine.	Alluvial Deposits
0.5		Clayey SILT, with minor sand and gravel; yellowish brown. Hard; dry; low plasticity; sand, fine, gravel, fine, subangular, highly weathered.	
1.0			
1.5			

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm)



Test Values
UTP
UTP

Depth (m): 0.0, -0.5, -1.0, -1.5

Hole Depth: 0.50m

Termination: Equipment refusal - on hard clayey silt.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

Test ID:	**TS06**
Project ID:	20737
Sheet:	1 of 1

Client:	Otane Developments Ltd	**Coordinates:**	5577790mN, 1910397mE	**Test Date:**	14/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	SL/JED
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	2523

Depth (m)	Material Description	Geology
0.0	Sandy SILT; dark brown. Stiff; dry; non-plastic; sand, fine.	Topsoil
0.5	Sandy SILT, with some clay; yellowish grey mottled orange. Hard; dry to moist; low plasticity; sand, fine.	Alluvial Deposits
	Sandy SILT, with some gravel; light yellowish brown. Hard; dry to moist; non-plastic; sand, fine; gravel, fine, subangular, highly weathered.	
1.0		
1.5		

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200

Test Values	Depth (m)
UTP	-0.5
10 UTP	-1.0
10	-1.5

Hole Depth: 0.70m

Termination: Equipment refusal - on hard sandy silt.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

Test ID:	**TS07**				
Project ID:	20737				
Sheet:	1 of 1				
Client:	Otane Developments Ltd	**Coordinates:**	5577807mN, 1910409mE	**Test Date:**	14/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	SL/JED
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	2523

Depth (m)	Graphic Log	Material Description	Geology	Water
0		Sandy SILT; dark brown. Stiff; dry; non-plastic; sand, fine.	Topsoil	Groundwater Not Encountered
		Clayey sandy SILT; dark brownish grey. Stiff; dry; non-plastic; sand, fine.		
0.5		Sandy SILT, with some gravel; light yellowish brown. Hard; dry; non-plastic; sand, fine; gravel, fine, subangular, highly weathered, Mudstone.	Alluvial Deposits	
1.0				
1.5				

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm)

2 4 6 8

Shear Vane, Su (kPa)

50 100 150 200

Test Values	Depth (m)
10 UTP	-0.5
10	-1.0
	-1.5

Hole Depth: 0.50m

Termination: Equipment refusal - on hard sandy silt.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

Test ID:	**TS08**
Project ID:	20737
Sheet:	1 of 1

Client:	Otane Developments Ltd	**Coordinates:**	5577826mN, 1910418mE	**Test Date:**	14/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	SL/JED
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	2523

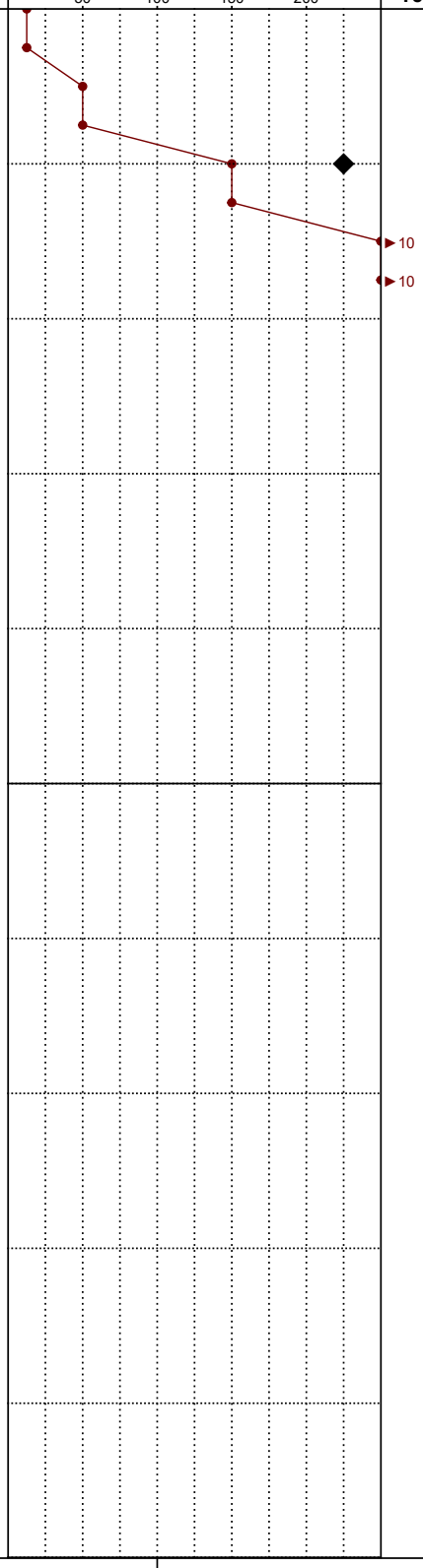
Depth (m)	Graphic Log	Material Description	Geology
0.0		Sandy SILT, with minor rootlets; dark brown. Stiff; dry; non-plastic; sand, fine.	Topsoil
0.5		Clayey SILT, with some sand; yellowish brown. Hard; dry; low plasticity; sand, fine.	Alluvial Deposits
1.0			
1.5			

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200



Test Values: UTP

Depth (m): 0.0, -0.5, -1.0, -1.5

Hole Depth: 0.40m

Termination: Equipment refusal - on hard clayey silt.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

Test ID:	**TS09**
Project ID:	20737
Sheet:	1 of 1

Client:	Otane Developments Ltd	**Coordinates:**	5577842mN, 1910428mE	**Test Date:**	14/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	SL/JED
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	2523

Depth (m)	Material Description	Geology
0	Sandy SILT; dark brown. Stiff; dry; non-plastic; sand, fine.	Topsoil
	Clayey sandy SILT; dark brownish grey. Hard; dry to moist; low plasticity; sand, fine.	
	Clayey SILT, with minor sand; light brownish grey. Hard; dry to moist; low plasticity; sand, fine.	Alluvial Deposits
0.5	Sandy SILT, with some clay, with minor gravel; yellowish brown. Hard; dry; non-plastic; sand, fine; gravel, fine, subangular to angular, highly weathered.	
	Sandy SILT, with trace gravel; yellowish grey. Hard; moist; non-plastic; sand, fine; gravel, fine to medium, subangular to angular, highly weathered.	
1.0	Silty sandy GRAVEL; light grey. Dense to very dense; wet to saturated; well graded; gravel, fine to medium, subangular to angular, highly weathered; sand, fine.	
1.5		

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200

Test Values	Depth (m)
UTP	-0.5
UTP	
UTP	-1.0
UTP	
10	-1.5
10	

Hole Depth: 1.20m

Termination: Equipment refusal - on very dense gravel.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

Test ID:	**TS10**
Project ID:	20737
Sheet:	1 of 1

Client:	Otane Developments Ltd	**Coordinates:**	5577830mN, 1910449mE	**Test Date:**	14/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	SL/JED
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	2523

Depth (m)	Material Description	Geology
0.0	Sandy SILT, with some rootlets; dark brown. Stiff; dry; sand, fine.	Topsoil
0.5	Clayey SILT, with some sand, with minor gravel; light brownish grey. Hard; dry; low plasticity; sand, fine; gravel, fine, subangular to angular, highly weathered.	Alluvial Deposits
1.0	Sandy SILT, with some clay and gravel; light yellowish brown. Hard; dry to moist; non-plastic; sand, fine; gravel, fine, subangular to angular, highly weathered.	
1.5		

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200

Test Values	Depth (m)
UTP	-0.5
UTP	
UTP	-1.0
UTP	
10	-1.5
10	

Hole Depth: 1.10m

Termination: Equipment refusal - on hard sandy silt.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

Test ID:	**TS11**
Project ID:	20737
Sheet:	1 of 1

Client:	Otane Developments Ltd	**Coordinates:**	5577822mN, 1910462mE	**Test Date:**	14/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	SL/JED
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	2523

Depth (m)	Graphic Log	Material Description	Geology
0		Sandy SILT; dark brown. Stiff; dry to moist; non-plastic; sand, fine.	Topsoil
0.5		SILT, with some sand, with trace gravel; light yellowish brown. Hard; dry to moist; low plasticity; sand, fine; gravel, fine, subangular, highly weathered.	Alluvial Deposits
1.0			
1.5			

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200

Test Values	Depth (m)
UTP	-0.5
UTP	
UTP	-1.0
10	
10	
10	-1.5

Hole Depth: 1.00m

Termination: Equipment refusal - on hard silt.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

Test ID:	**TS12**
Project ID:	20737
Sheet:	1 of 1

Client:	Otane Developments Ltd	**Coordinates:**	5577813mN, 1910478mE	**Test Date:**	14/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	SL/JED
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	2523

Depth (m)	Material Description	Geology
0.0	Sandy SILT; dark brown. Stiff; dry; non-plastic; sand, fine.	Topsoil
	Clayey SILT, with minor sand, with trace gravel; yellowish grey. Hard; dry; low plasticity; sand, fine; gravel, fine, subangular to angular, highly weathered.	Alluvial Deposits
0.5	Gravelly SILT, with some sand; light yellowish brown. Hard; dry; non-plastic; gravel, fine to medium, subangular to angular, highly weathered; sand, fine.	
1.0		
1.5		

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200

Test Values	Depth (m)
UTP	
10 UTP	-0.5
10	
	-1.0
	-1.5

Hole Depth: 0.60m

Termination: Equipment refusal - on hard gravelly silt.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

Test ID:	**TS13**
Project ID:	20737
Sheet:	1 of 1

Client:	Otane Developments Ltd	**Coordinates:**	5577805mN, 1910496mE	**Test Date:**	14/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	SL/JED
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	2523

Depth (m)	Material Description	Geology
0.0	Sandy SILT, with trace rootlets; dark brown. Stiff; dry; non-plastic.	Topsoil
0.5	Sandy SILT; yellowish brown. Hard; dry; low plasticity.	Alluvial Deposits
	Clayey SILT; yellowish grey. Hard; dry to moist; low plasticity.	
1.0	Gravelly SAND, with some silt; light yellowish grey. Very dense; moist; sand, fine; gravel, fine to medium, subangular to angular, highly weathered, Mudstone.	
1.5		

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200

Test Values	Depth (m)
UTP	-0.5
UTP	
10	
10	-1.0
UTP	
	-1.5

Hole Depth: 1.10m

Termination: Equipment refusal - on very dense gravelly sand.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

Test ID:	**TS14**
Project ID:	20737
Sheet:	1 of 1

Client:	Otane Developments Ltd	**Coordinates:**	5577777mN, 1910475mE	**Test Date:**	14/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	SI/JED
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	2523

Depth (m)	Graphic Log	Material Description	Geology
0.0		Sandy SILT, with minor gravel; dark brown. Hard; dry to moist; non-plastic; sand, fine; gravel, fine to medium, subangular to angular, highly weathered.	Topsoil
0.5		Gravelly SILT, with some sand; light yellowish grey. Hard; dry; non-plastic; gravel, fine to medium, subangular to angular, highly weathered; sand, fine.	Alluvial Deposits
1.0			
1.5			

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm)

2 4 6 8

Shear Vane, Su (kPa)

50 100 150 200

10

10

Test Values: UTP

Depth (m): 0.0, -0.5, -1.0, -1.5

Hole Depth: 0.60m

Termination: Equipment refusal - on hard gravelly silt.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

Test ID:	**TS15**
Project ID:	20737
Sheet:	1 of 1

Client:	Otane Developments Ltd	**Coordinates:**	5577759mN, 1910462mE	**Test Date:**	14/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	SL/JED
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	2523

Depth (m)	Material Description	Geology	Water	In-situ Testing: Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8; Shear Vane, Su (kPa) 50 100 150 200	Test Values	Depth (m)
0	Sandy SILT, with minor gravel, with trace rootlets; dark brown. Stiff; dry; non-plastic; sand, fine; gravel, fine, subangular to angular, highly weathered.	Topsoil	Groundwater Not Encountered			0
0.5	Sandy SILT, with minor gravel; brown . Hard; dry to moist; non-plastic; sand, fine; gravel, fine, subangular to angular, highly weathered.	Alluvial Deposits			UTP UTP UTP UTP	-0.5
1.0	Silty CLAY, with some sand, with minor gravel; brown . Hard; moist; low plasticity; sand, fine; gravel, fine, subangular to angular, highly weathered.				UTP UTP	-1.0
1.5						-1.5

Hole Depth: 1.40m

Termination: Equipment refusal - on hard silty clay.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

Test ID:	**TS16**
Project ID:	20737
Sheet:	1 of 1

Client:	Otane Developments Ltd	**Coordinates:**	5577743mN, 1910460mE	**Test Date:**	16/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	JED/DEP
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	2523

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing: Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8; Shear Vane, Su (kPa) 50 100 150 200	Test Values	Depth (m)
0	TS	Sandy SILT; dark brown. Stiff; moist; non-plastic.	Topsoil				0
0.5		SAND, with some silt and gravel; light brownish grey. Medium dense to dense; dry; sand, fine; gravel, subangular, Mudstone. 0.5m: Abundant rock clasts.	Alluvial Deposits	Groundwater Not Encountered		UTP	-0.5
1.0							-1.0
1.5							-1.5

Hole Depth: 0.80m

Termination: Equipment refusal - on rock clasts.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

Test ID:	**TS17**
Project ID:	20737
Sheet:	1 of 1

Client:	Otane Developments Ltd	**Coordinates:**	5577755mN, 1910445mE	**Test Date:**	16/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	JED/DEP
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	2523

Depth (m)	Material Description	Geology
0.0	Sandy SILT; dark brown. Stiff; moist; non-plastic.	Topsoil
0.3	Silty SAND, with some gravel; greyish brown. Loose to dense; moist; sand, fine; gravel, subangular, Mudstone. 0.3m - 0.4m: Light greyish brown.	Alluvial Deposits
0.5	Sandy SILT; greyish brown. Hard; moist; non-plastic.	
1.0		
1.5		

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200

Test Values	Depth (m)
202+	0.0
UTP	
UTP	-0.5
UTP	
10	-1.0
	-1.5

Hole Depth: 1.00m

Termination: Equipment refusal - on hard material.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

Test ID:	**TS18**
Project ID:	20737
Sheet:	1 of 1

Client:	Otane Developments Ltd	**Coordinates:**	5577770mN, 1910418mE	**Test Date:**	16/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	JED/DEP
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	2523

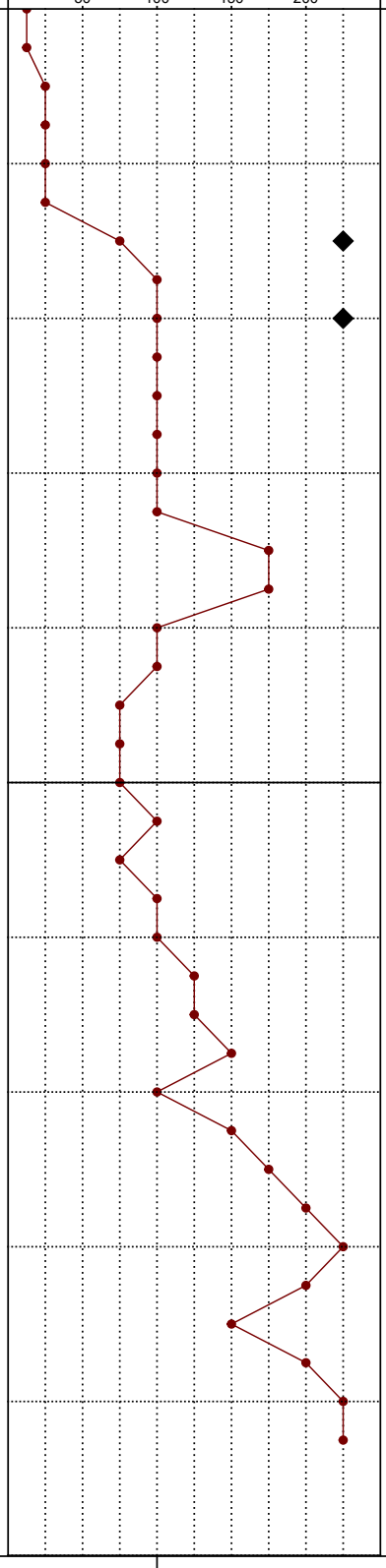
Depth (m)	Graphic Log	Material Description	Geology
0.0		Sandy SILT; dark brown. Stiff; moist; non-plastic.	Topsoil
0.5		Silty SAND, with some gravel; brownish grey with some orange mottles. Medium dense to dense; dry to moist; sand, fine; gravel, subangular, Mudstone.	Alluvial Deposits
1.0			
1.5			

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200



Test Values	Depth (m)
UTP	0.0
UTP	-0.5
	-1.0
	-1.5

Hole Depth: 0.60m

Termination: Equipment refusal - on hard material.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

Test ID:	**TS19**
Project ID:	20737
Sheet:	1 of 1

Client:	Otane Developments Ltd	**Coordinates:**	5577795mN, 1910428mE	**Test Date:**	16/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	JED/DEP
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	2523

Depth (m)	Graphic Log	Material Description	Geology	Water
0		Sandy SILT; dark brown. Stiff; moist; non-plastic.	Topsoil	
		Sandy SILT, with some clay; greyish brown with some orange mottles. Very stiff to hard; moist; non-plastic.	Alluvial Deposits	
		Sandy SILT; brownish grey. Hard; dry to moist; non-plastic.		
0.5		0.6m: With trace gravel. Gravel, subangular, Mudstone.		
1.0				
1.5				

Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm)

2 4 6 8

Shear Vane, Su (kPa)

50 100 150 200

Test Values	Depth (m)
202+	0
	-0.5
	-1.0
10	
10	
10	
	-1.5

Hole Depth: 1.00m

Termination: Equipment refusal - on hard material.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

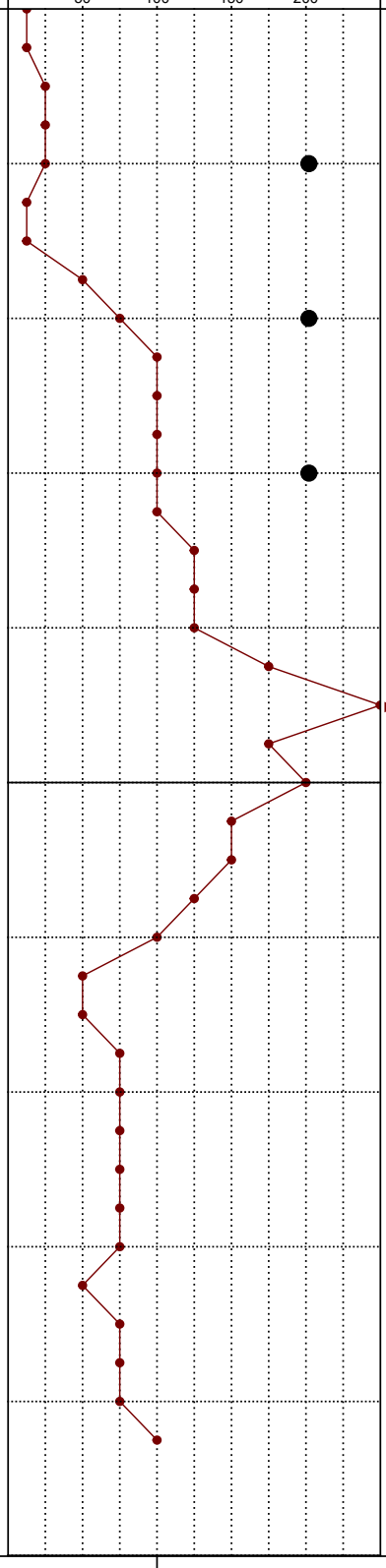
Test ID:	**TS20**				
Project ID:	20737				
Sheet:	1 of 1				
Client:	Otane Developments Ltd	**Coordinates:**	5577784mN, 1910452mE	**Test Date:**	16/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	JED/DEP
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	2523

Depth (m)	Graphic Log	Material Description	Geology	Water
0.0	TS	Sandy SILT; dark brown. Stiff; moist; non-plastic.	Topsoil	
0.5		Sandy SILT; brownish grey. Very stiff to hard; dry to moist; non-plastic.	Alluvial Deposits	Groundwater Not Encountered
1.0				
1.5				

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm)

Shear Vane, Su (kPa)



Test Values	Depth (m)
202+	0.0
202+	-0.5
202+	-1.0
	-1.5

Hole Depth: 1.00m

Termination: Equipment refusal - on hard material.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

Test ID:	**TS21**
Project ID:	20737
Sheet:	1 of 1

Client:	Otane Developments Ltd	**Coordinates:**	5577735mN, 1910446mE	**Test Date:**	16/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	JED/DEP
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	

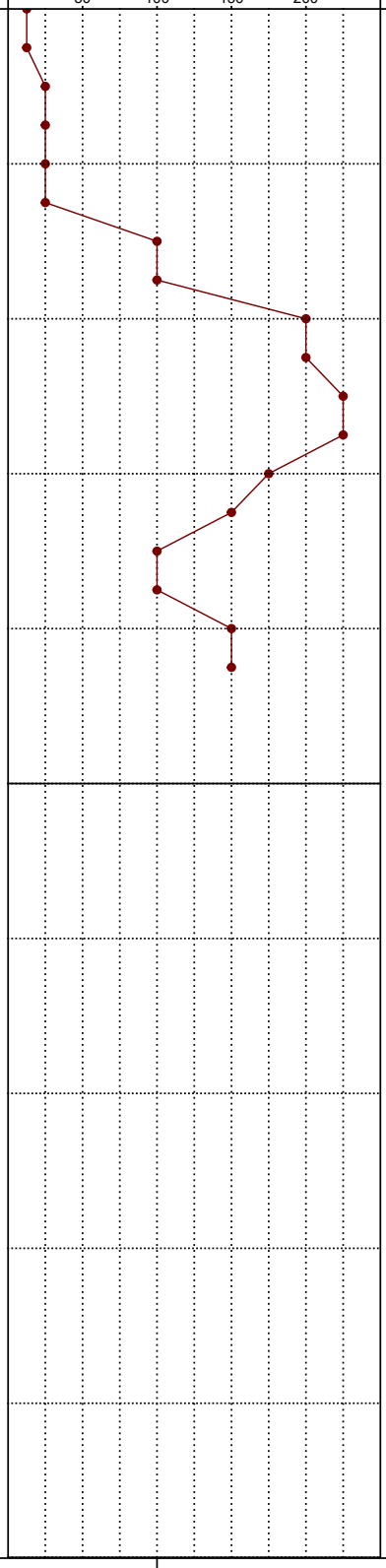
Depth (m)	Graphic Log	Material Description	Geology
0.0		Sandy SILT; dark brown. Stiff; moist; non-plastic.	Topsoil
0.5		Sandy SILT; greyish brown with some orange mottles. Very stiff to hard; dry to moist; non-plastic.	Alluvial Deposits
1.0			
1.5			

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200



Test Values

Depth (m): 0.0, -0.5, -1.0, -1.5

Hole Depth: 0.60m

Termination: Target depth reached.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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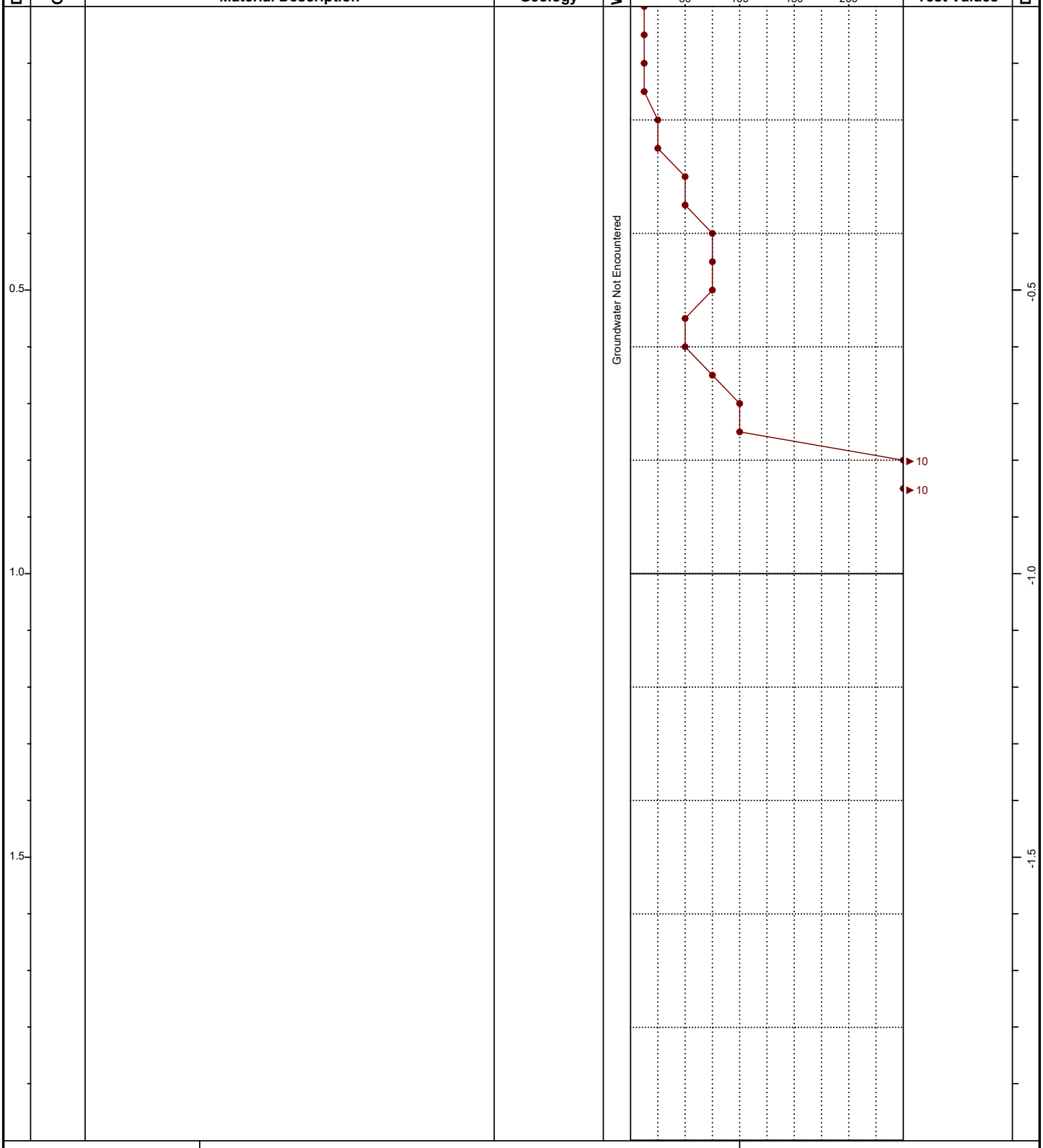
Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

Test ID:	**TS22**
Project ID:	20737
Sheet:	1 of 1

Client:	Otane Developments Ltd	**Coordinates:**	5577744mN, 1910432mE	**Test Date:**	16/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	JED/DEP
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing	Test Values	Depth (m)
					Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8; Shear Vane, Su (kPa) 50 100 150 200		



Hole Depth: 0.00m **Termination:** Target depth reached.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

Test ID:	**TS23**
Project ID:	20737
Sheet:	1 of 1

Client:	Otane Developments Ltd	**Coordinates:**	5577758mN, 1910405mE	**Test Date:**	16/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	JED/DEP
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	

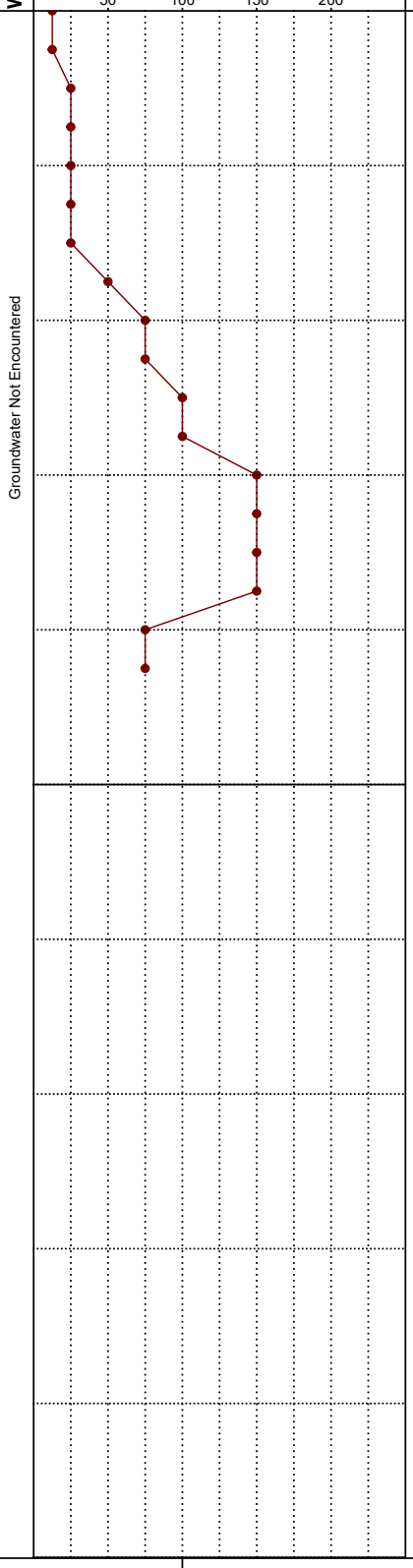
Depth (m)	Graphic Log	Material Description	Geology
0.0		Sandy SILT; dark brown. Stiff; moist; non-plastic.	Topsoil
0.5		Sandy SILT, with trace gravel; greyish brown with some orange mottles. Very stiff to hard; dry to moist; non-plastic; gravel, subangular, Mudstone.	Alluvial Deposits
1.0			
1.5			

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200



Test Values

Depth (m): 0.0, -0.5, -1.0, -1.5

Hole Depth: 0.50m

Termination: Target depth reached.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

Test ID:	**TS24**				
Project ID:	20737				
Sheet:	1 of 1				
Client:	Otane Developments Ltd	**Coordinates:**	5577782mN, 1910483mE	**Test Date:**	16/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	JED/DEP
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	

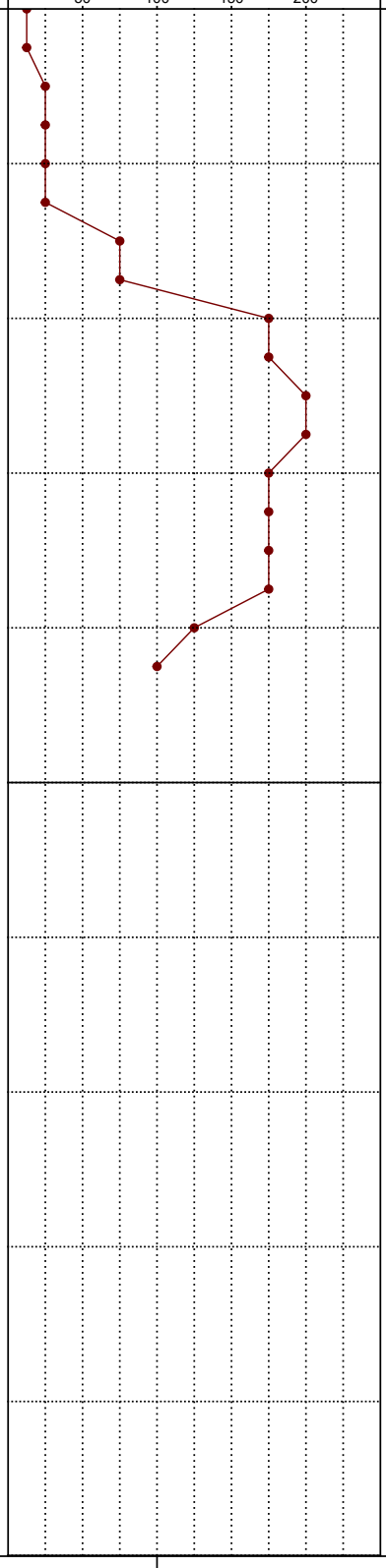
Depth (m)	Graphic Log	Material Description	Geology
0.0		Sandy SILT; dark brown. Stiff; moist; non-plastic.	Topsoil
0.5		Sandy SILT, with trace gravel; greyish brown with some orange mottles. Very stiff to hard; dry to moist; non-plastic; gravel, subangular, Mudstone.	Alluvial Deposits
1.0			
1.5			

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200



Test Values

Depth (m): -0.5, -1.0, -1.5

Hole Depth: 0.55m

Termination: Target depth reached.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Generated with CORE-GS by Geroc - HA/TP Log v5 - 13/01/2022 4:06:08 pm

Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

Test ID:	**TS25**
Project ID:	20737
Sheet:	1 of 1

Client:	Otane Developments Ltd	**Coordinates:**	5577795mN, 1910465mE	**Test Date:**	16/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	JED/DEP
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing	Test Values	Depth (m)
0.5				Groundwater Not Encountered	Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8; Shear Vane, Su (kPa) 50 100 150 200		-0.5
1.0							-1.0
1.5							-1.5

Hole Depth: 0.00m

Termination: Target depth reached.

Remarks: Groundwater not encountered

.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger + DCP

Test ID:	**TS26**
Project ID:	20737
Sheet:	1 of 1

Client:	Otane Developments Ltd	**Coordinates:**	5577807mN, 1910438mE	**Test Date:**	16/12/2021
Project:	Geotechnical Investigation for Proposed Subdivision	**System:**	NZTM	**Logged By:**	JED/DEP
Location:	19-29 Russell Street, Otane	**Elevation:**	Ground	**Checked By:**	DD
Test Site:	Refer to GIP	**Located By:**	GIS	**Vane ID:**	

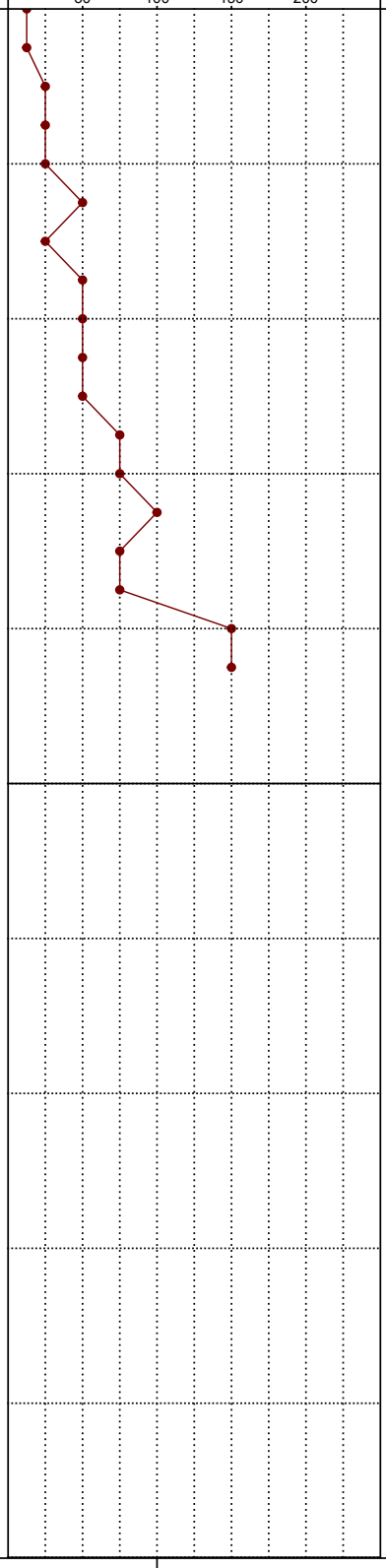
Depth (m)	Graphic Log	Material Description	Geology
0		Sandy SILT; dark brown. Stiff; moist; non-plastic.	Topsoil
0.5		Sandy SILT, with trace gravel; greyish brown with some orange mottles. Very stiff to hard; dry to moist; non-plastic; gravel, subangular, Mudstone.	Alluvial Deposits
1.0			
1.5			

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200



Test Values

Depth (m): 0, -0.5, -1.0, -1.5

Hole Depth: 0.60m

Termination: Target depth reached.

Remarks: Groundwater not encountered.

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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APPENDIX C

SUBDIVISION SCHEME PLAN

LOCAL AUTHORITY	:	CENTRAL HAWKES BAY DISTRICT
ZONING	:	TOWNSHIP
TOTAL AREA	:	1.2140 ha
COMPRISED IN	:	RT HBD4/649 (6070m²)
COMPRISED IN	:	RT HBD4/650 (6070m²)
REGISTERED OWNERS	:	RC SYMMANS

N

Lot 1
DP 16364

Lot 9
575m²

Lot 10
447m²

Lot 11
530m²

Lot 12
530m²

Lot 13
528m²

Lot 8
513m²

Lot 7
614m²

Lot 22
669m²

Lot 19
632m²

Lot 20
640m²

Lot 14
568m²

Lot 6
658m²

Lot 5
517m²

Lot 18
446m²

Lot 17
500m²

Lot 15
570m²

Lot 4
615m²

Lot 21
673m²

Lot 16
568m²

Lot 3
500m²

Lot 2
400m²

Lot 1
498m²

Lot 86
DP 119

Lot 87
DP 119

Lot 88
DP 119

Lot 89
DP 119

Palmerston North - Gisborne Line
(Legal Railway 20.12 Wide)

Williams Street
(Legal Road 20.12 Wide)

Russell Street
(Legal Road 20.12 Wide)

Ellison Street
(Legal Road 20.12 Wide)

RT HBD4/650

RT HBD4/649

150 UPVC Gravity Main

100 UPVC High Pressure Main

200 UPVC Gravity Main

100 Steel High Pressure Main

NOTE:
AERIAL PHOTO OBTAINED FROM
LINZ LDS AND MAY CONTAIN DISTORTION
(FLOWN 2017-2018).

SURVEYING THE BAY
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www.surveyingthebay.co.nz

CLIENT: DOUGLAS

PROJECT: CONCEPT SUBDIVISION OF LOTS 74-85 DP 119
19-29 RUSSELL STREET, OTANE

TITLE: CONCEPT PLAN

SCALE: 1: 750 @ A3

DATE: NOVEMBER 2021 *DRAWN BY:* PT & AM

DRAWING NO: 5781-3 | *REVISION:* - | *SHEET:* 1/1