GUMBOOTS
CONSULTING ENGINEERS

Geotechnical Appraisal Report

139 Parnell Street, Rawene

For

Pei Pei Allen-Scarlett

Ground and site feasibility for proposed minor development.
Gumboots Consulting Engineers reference 1140

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Revision History

Revision №	Prepared By	Description	Date
A	Kelly Wright	Geotechnical Appraisal Report	01 October 2021

Reviewed/Approved

On behalf of Gumboots Consulting Engineers Ltd by:

Akira Kepu

Geotechnical-Civil Engineer

MEngNZ, Board Member of EngNZ Northland Branch.

Member of NZGS & ISSMGE

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- Concept Plans
- Site Photos

1. Executive Summary

The subsoil conditions on the subject site (Legal description Lot 2 Deposited Plan 10830) comprise expansive soil characteristics. In accordance with AS 2870, the site (based on soil reactivity under normal moisture conditions) can be classified as Class H1 (Highly Reactive).

It is recommended that;

1. All structural foundation designs shall undertake specific engineering design by a Chartered Structural Engineer with due regard to the proposed development, site conditions and sustaining balancing environmental effects at post development stage.

AS 2870 can be adopted as informative guidance for foundation designs in this case

Professional opinions and recommendations within this report are based on in-situ field and lab test results, empirical relationships and local experiences.

As appropriate, this appraisal shall be read in its entirety to understand the context of the opinions and recommendations given.

2. Introduction

This report has been prepared for Pei Pei Allen-Scarlett in accordance with the brief given to us. Where appropriate, it is in accordance with the recommendations of NZS 4404 and Auckland Council - Code of practice for Land Development and Subdivision; Section 2 - Earthworks and Geotechnical Requirements and related documents.

- Objective and Scope

  The scope of work is to assess the general site and ground bearing capacity for the proposed minor development. General objectives through our investigations were to ascertain possible construction difficulties, identify obvious hazards and applicability of land for building design in accordance with NZS 3604:2011.

Limited Liability

This report has been prepared solely for the benefit of Pei Pei Allen-Scarlett our Client with respect to the brief and their intended use thereof. Reliance or use of this report by other parties without prior review and agreement in writing by Gumboots Consulting Engineers Ltd, be at such parties sole risk.

Field data used in this report were ascertained from limited test positions. The nature and continuity of subsoils away from test locations are inferred and it must be appreciated that actual conditions could vary from those modelled within.

It is recommended that we are notified immediately if final development plans and conditions encountered onsite (nominated development location) vary from that of this report.

Accordingly, further investigations/observations shall then be undertaken as appropriate.

3. Overall Proposal Philosophy

The OPP in this case is the Minimal Impact Footprint of the proposed works in all aspects.

4. Site Description

The subject property (legal description Lot 2 Deposited Plan 10830) is an irregular shaped block (0.1180 ha). The property is moderately sloping (≅17^0) eastward (as depicted in figure 1 below) and is located within the southern fringes of the Rawene Township.

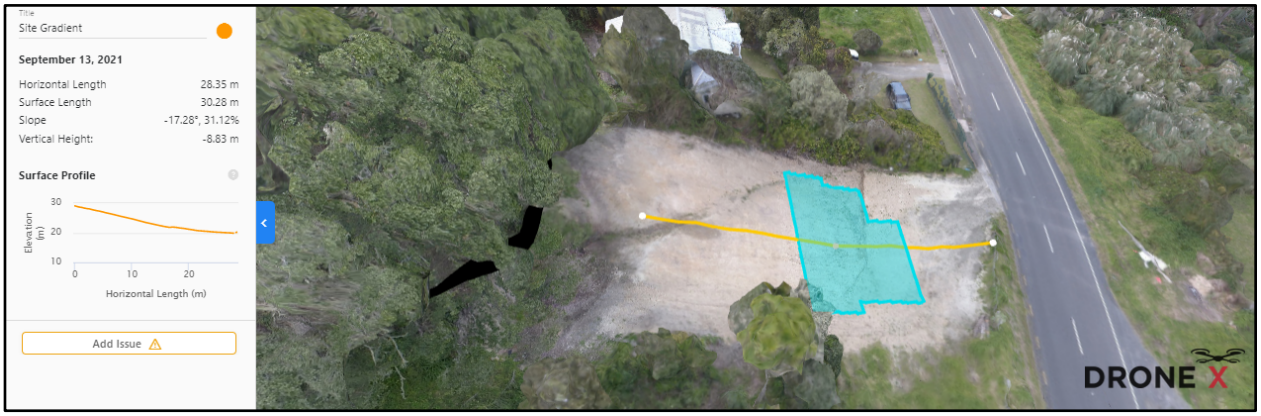


Figure 1 - Site Gradient (adapted from DroneX Aerial Survey)**.**

The property is vacant and has undergone initial clearing and cutting as it awaits building consent. The neighbouring properties in all aspects comprise established residential occupation. The west, north and south constitute land rich with vegetation and established natives.

The abundance of native flora ensures a sustainable *land functional resilience*.

Access

Is off Parnell Street bounding the lot along the eastern periphery. The road is *kerbed* which constitutes a primary flow path [PFP] that aids the water into the stormwater collection points within/underneath the road.

This readily equilibrates stormwater runoff and effective stormwater management in this instance.

5. Geomorphology

Macro Landscape

Depicts a prominent hilly country that is bisected by the Hokianga Harbour meandering inland [northeast-east].

Additionally, the higher overarching reaches of the adjoining Maungataniwha [Waima Forest] represent [within the wider north-north west] the overthrusting result of the Tangihua Complex (Kt) which overlie less dense sedimentary rocks of underlying thrust-bounded units.

Figure 2 - Macro Landscape (maps adapted from Quick Map Enterprises and Google Earth Maps)**.**

The parabolic shape [as depicted in figure 5 below] of the prominent land exhibits good water shedding features. Likewise, the wider dips and ridge fringes are well established with native flora life form.

Moreover, the presence of native trees and vegetation within these sensitive areas encourages land resilience and balancing effects from surface water fretting of land during extreme weather events.

Figure 3 - Landscape Features (maps adapted from Quick Map Enterprises and Google Earth Maps)**.**

The site location depicted above is for illustrative purposes only. The most relative facet is presented in the following figure four.

Consequently, the landscape, resident occupants and supporting infrastructures altogether portrays a natural environment in equilibrium state.

Micro Landscape

Within and close vicinity of the property attributes good water shedding surface configuration and spread runoff but no acceleration i.e. linear divergent[1].

The coastal facing property sits on the eastern fringes of a north trending ridgeline. The area is established mostly by the local settlement and constitutes the township in this case. Parnell Road bounds the eastern base of the landform northward towards the Rawene Ferry terminal.

Further east comprise resideal properties and the majority as coastal alluvial flats of the Hokianga Harbour.

[1] *TP58 - 'good water shedding surface, spreads but does not accelerate runoff'.*

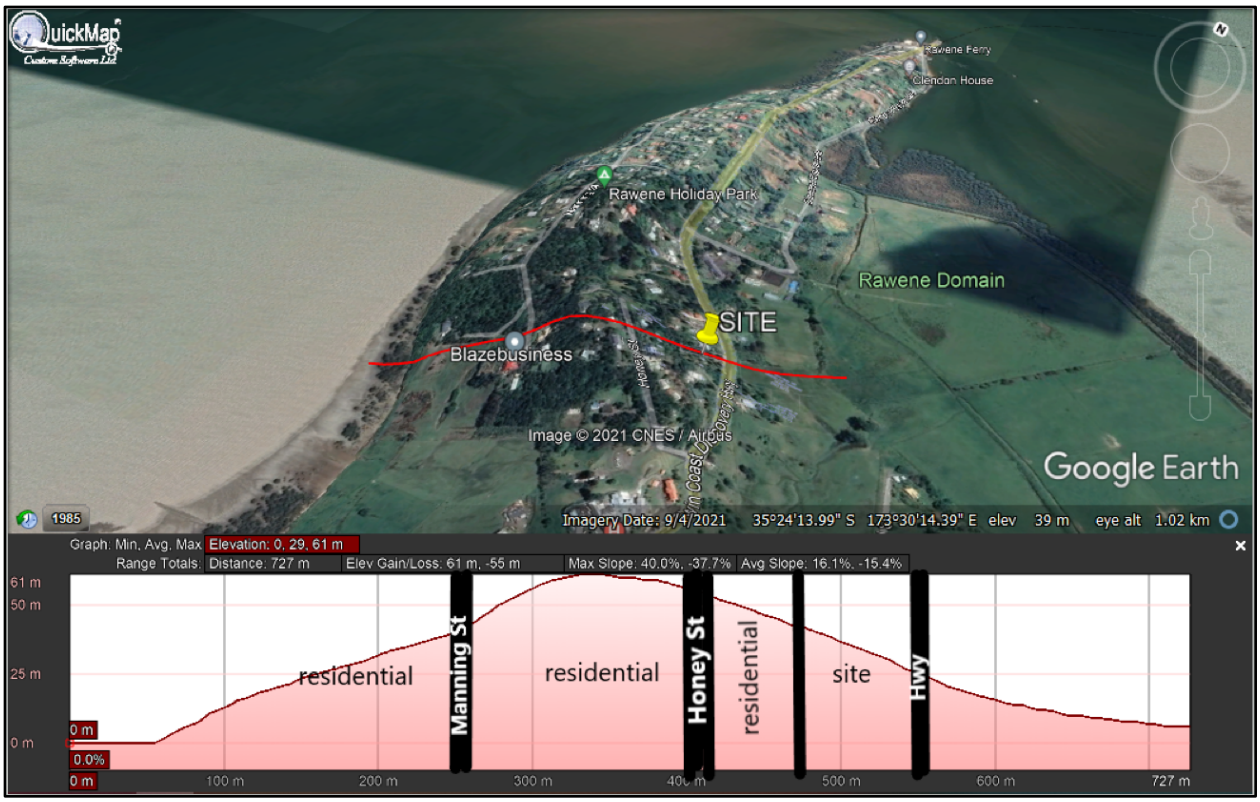


Figure 4 - Micro Landscape (maps adapted from Quick Map Enterprises and Google Earth Maps)**.**

The precedent[2] is also true of the leading down slope fringe configuration approximately 96m further north and into the natural water courses [PFP} within the locale. As depicted in figure five below. The outlined [purple] area within the plate depicts the subject discussed in this case.

6. Cultural Landscape

In this instance, points to the direct anthropogenic effects upon the natural landscape over time.

Land Use

Is predominantly residential living. A few houses had been implemented within the locale with the majority [older] along the northern/southern aspect.

The surrounding western aspect beyond Manning St is currently yet to be vacated allotments of the wider subdivision.

Plate 1 - South Rawene Settlement. (adopted from QuickMaps Enterprises).

Infrastructures

That is; roads, wastewater and stormwater reticulation serving the community are well established and considered generically accepting in context of the proposed home.

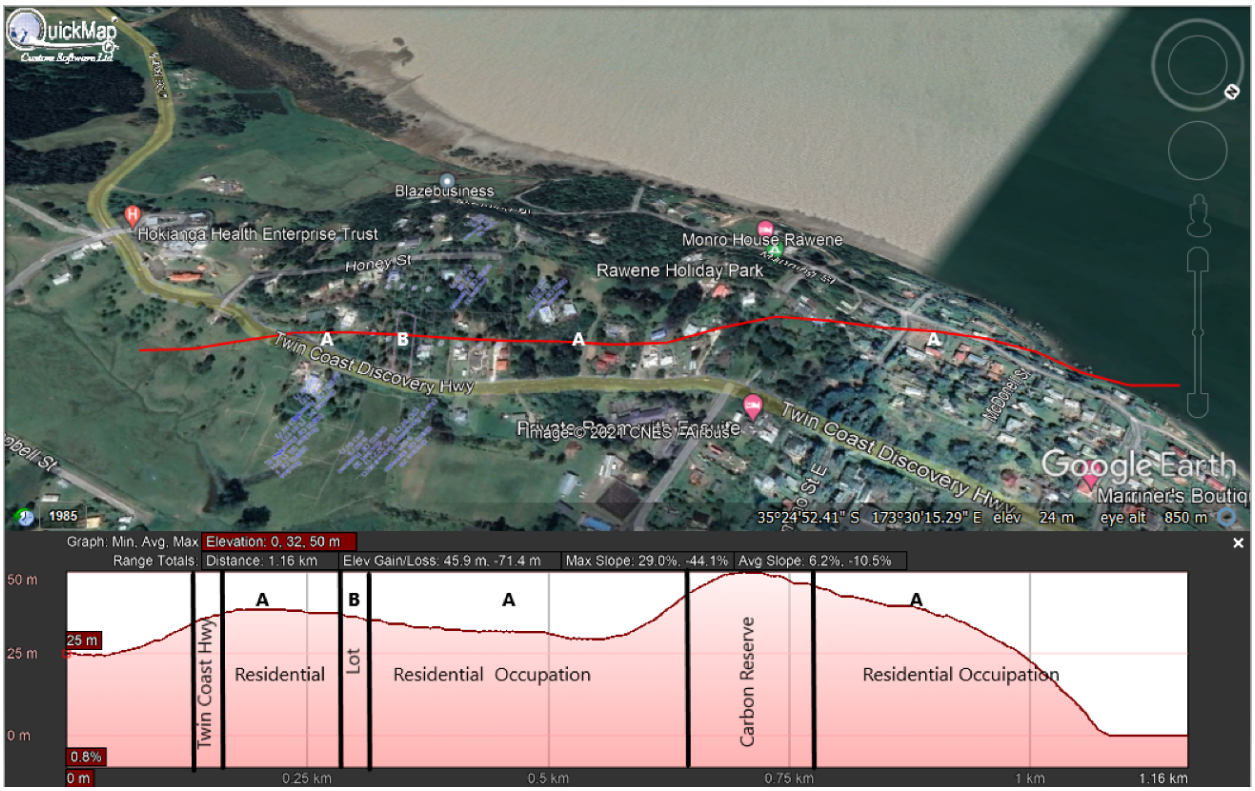


Figure 5 - Outstanding Land Feature (maps adapted from Quick Map Enterprises and Google Earth Maps)

Table 1 - Processes and Settlement Cluster

	A	B	A	
	Dominant Settlement. [transition mechanism point]			Processes
Periphery				**Center**
	Few vacant Lots	Scattered home developments established. Including the subject Lot. [low-medium density]	Established township [high density]	Patterns

During the site walkover inspection[2] NO boggy and/or saturated ground was encountered. During intense rainfall events, it is anticipated that surface water will be absorbed in low-moderate volumes with the majority as sheetflow along the natural site gradient and into the existing stormwater drains in service to the collective estate [subdivision].

7. Hydrologic Cycle

Pertaining to the immediate and associated properties presents a good water way design in complementing the infrastructures implemented for the occupancies.

The primary flow paths [PFP] are well defined and layed in a manner as to provide efficient conveyance of surface [storm] water away from the properties and eventual discharge into the Hokianga Harbour. As depicted in figure 6 below, PFPs are depicted in aqua.

Figure 6 - PFP (map adapted from DroneX Aerial Survey).

The primary stormwater control network that is the established infrastructures were observed;

- To follow closely with the natural contours of the land and incorporate Parnell Street as the primary collection point.
- Land geometry i.e. relief, slopes and direction are in favour of the former.
- Sealed pipe network and catchpits as the collecting agents.
- Discharge point away from downstream settlers.

The natural configuration of land surfaces, in particular the downslopes, sustains a homogenous draining manner [eastward] as well as good surface water spreading characteristics.

[2] *following a rainy period within the tail end of a wet winter.*

All in all, land fretting in this aspect can be considered less than minor. However, imposed post development runoff in light of the project shall be managed appropriately by incorporating into the existing regime as one.

8. Development Proposal

The proposed development is to erect a 3 bedroom home on a piled foundation system with parking/hardstand areas.

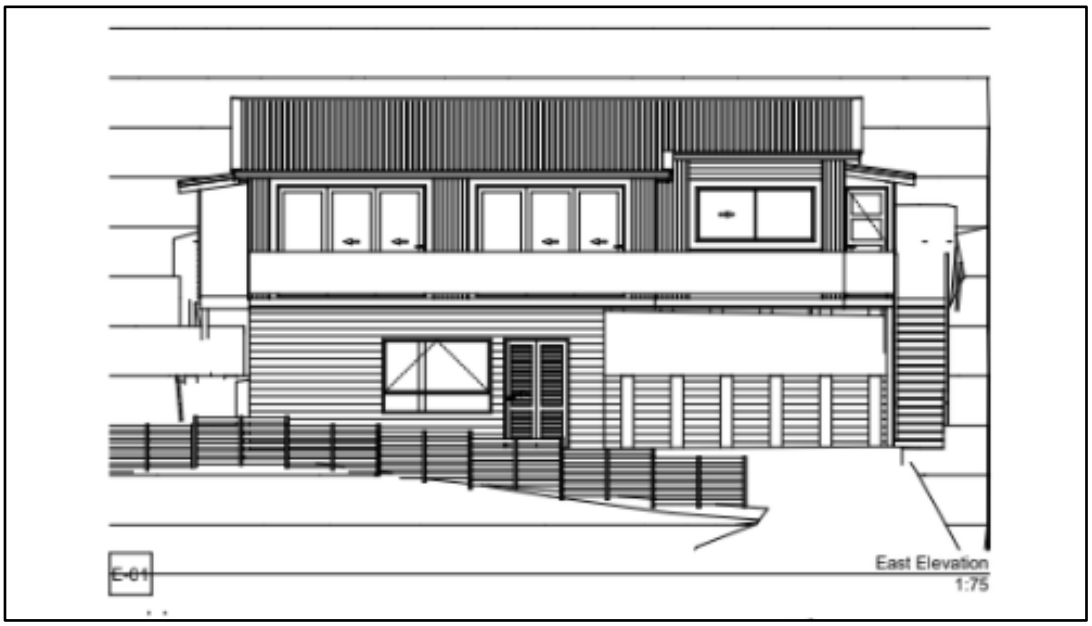


Figure 7 - Site Development Proposal (adapted from Hans Mitt Architectural Design 'Proposed New Home' Plans dated 17/09/21)

Primary flow paths are well defined/established in support of the property. It can be conceived that the proposal intention shall incorporate these features as vital to equilibrate the implementation and the existing land in sustaining LIFE in all aspects.

Consequently, it is anticipated that during intense rainfall events, surface water will be absorbed in moderate volumes with the majority envisioned as sheetflow east along the natural/landscaped site gradient and into the supporting stormwater drain/discharge points.

Enabling Earthworks

Had commenced at the time of our site visit. Topsoil and vegetation was cleared down to natural subgrade and featured a prominent site cut [south - north] within the [south]western aspect.

Based on the current topography, the cut is approximately 2.70m deep. The former shall be retained as appropriate.

Further discussion in this respect is undertaken within sections 18 and 19.

9. Geology

The geological information on hand indicates that the site is underlain by Whangai Formation (Kkw) i.e. fissile, dark grey to white-weathering siliceous mudstone, blue-grey calcareous mudstone, and minor micritic limestone and chert.

Reference:
Geology of the Kaitaia Area. Institute of Geological & Nuclear Sciences; 1: 250,000 geological map 1.

10. Lithology

The underlain lithology is Mudstone ($M4_1$) i.e. black, grey, brown and green, thinly bedded and closely fractured, locally calcareous or siliceous with minor muddy limestone ($L5_2$), carbonaceous siltstone, calcareous claystone and greensand (S4); moderately soft to moderately hard. Weathered to whitish clay to depths of 10m.

Reference:
Geology of the Kaitaia Area. Institute of Geological & Nuclear Sciences; 1: 250,000 geological map 1. Lower Hutt, New Zealand.

NZMS Sheet 290 O 04/05 Part Sheet O 03, 1:100,000 scale map, Edition 1, 1982: "*Kaitaia-Rawene"* (Rocks).

11. Subsoils

LandCare Research indicates the soils encountered here as Yellow Ultic (UY) which have a well structured clay enriched subsoil. They cover 3% of New Zealand and are most common in the far north, Wellington, Marlborough and Nelson regions.

Ultic

They occur in clay or sandy clay material derived by strong alteration of quartz-rich rocks over long periods of time. These soils have dispersible surface horizons prone to erosion.

Soils are strongly acidic with a small content of weatherable minerals. Kaolin and Vermiculite are the dominant minerals. The soils are *slow to imperfectly drained*.

More reference can be noted that these soils are of the Rolling and Hilly Land comprising Otangaroa clay and sandy clay loam (OC)- imperfectly to very poorly drained.

More reference can be noted that these soils are of the Rolling and Hilly Lands, Te Tio Clay loam (TFH) - i*mperfectly to very poorly drained*.

All in all it can be concluded that the soils encountered here greatly reflect the historical effects of local conditions.

Reference

Manaaki Whenua LandCare Research: New Zealand Soil Classification (NZSC) - Soil Order.

New Zealand Land Inventory - NZMS Sheet 290 P 04/05, 1:100,000 scale map, Edition 1, 1980: "*Kaitaia-Rawene"* (Soils).

12. Fieldwork

Our fieldwork for this report was commenced on the 13th September 2021 and involved the drilling of three machine augered boreholes down to a refusal depth ranging from 0.70m to 1.20m however, a targeted drilled depth of 3.00m was achieved in borehole three.

Vane shears were taken at 0.30m lifts to full drilled depths. Due to very stiff soils we were unable to advance further.

Further advancement within the BH1-BH2 were achieved through a series of DCP[3*] tests at terminated depths in the order of 1.10m to 1.60m within the respective boreholes.

In addition, an aerial survey was also carried out to enable further observations of the estate.

Figure 8 - Borehole Location Overview (adapted from DroneX aerial survey.)

[3]* ***D****ynamic* ***C****one* ***P****enetrometer*

Results of the in-situ soil tests together with detailed descriptions and depths of strata encountered during the drilling of the boreholes are appended. Soil descriptions included on the exploratory hole records are compliant with New Zealand Geotechnical Society (NZGS) publication 'Field Description of Soil and Rock', 2005.

The depths of strata and groundwater (where encountered) in the boreholes were recorded from ground levels at each exploratory hole.

13. Laboratory Testing

Two samples of Atterberg Limits and two Linear Shrinkage test samples were taken from the site, generally within the zone of likely influence of shallow foundations. These tests were in accordance with NZS 4402 - Sections 2.2, 2.3, 2.4 & 2.6 , "Methods of Testing Soils for Civil Engineering purposes".

These index tests primarily seek to give an indication of the likely subsoil behaviour, characteristics and conditions at its natural undisturbed state. Lab test results are appended.

All results are IANZ (International Accreditation New Zealand).

14. Summary of Ground Conditions

It can be viewed that the natural land layout and soils comprise sedimentary formation residual constituents through the weathering process of their parent geological unit deposited here historically. These are typical within the Northland area.

- Topsoil

  Observed [BH3 only] as clayey silt and grey with minor rootlets and mulch (approximately) 0.20 metres thick.

  Natural Ground

  The natural (cohesive) subsoils encountered generally comprise very stiff, yellowish brown and highly plastic. At higher relief i.e. western aspect, depths ≤ 1.20 metres, soils became light grey and becoming white and silty.

  The mechanical auger met refusal within this range [0.70m -1.20m] below ground level. The soil mantle is considered shallow along the ridge line as opposed to the lower relief side [BH3]. As depicted in Figure 9.

  The cream coloured soils depict the highly weathered well cemented mud/sandstone.

Figure 9 - Natural Soils Onsite - BH1 borings (adapted from the DroneX Survey).

Shear Vane Readings

Corrected vane shear readings recorded were ≥ 194 kPa.

Dynamic Cone Penetrometer Readings

The DCP test indicates stiff to very stiff cohesive soils with an overall average blow count/100mm within all probes of 18[4] blows/100mm. The former is indicative of *good ground* bearing in accordance with NZS 3604.

Groundwater

Groundwater was not encountered during our investigation. However, it would be prudent to note that water levels are likely to fluctuate with the seasons/peak rainfall events.

15. Discussion on Ground Conditions

Whangai Formation

Comprise more calcareous and siliceous lithologies, are generally highly shattered, sheared and crushed although to a lesser degree.

Moreover, they are known to be the more competent lithologies within the mixed northland geologies. They are commonly incorporated within the melange and are elongated fragments of blocks (usually more calcareous sandstones and mudstones). These blocks can be relatively large i.e. 10m to 20m or even greater.

The degree of shearing and disturbance generally shows a relatively close correlation to the intact strength of the rock.

[4] *Effective average blow counts for all DCPs were taken @ refusal depths in BH1-BH2.*

As a general rule of thumb, the more calcareous, siliceous or sandy the bedrock is (i.e. the greater the rock strength) the lesser the degree of shearing. Generally, the gentler the slope [$\leq 12^0$], the lower the shear strength of the soil/rock transition.

On the contrary, the more calcareous, siliceous mud/sandstones within the allochthon stand at slopes 20^0 - 26^0 as consistent with the observed characteristic of the property physical landscape.

All in all, heavy machinery may need to be employed for foundation work due to the well [packed] lithified nature of the weathered bedrock.

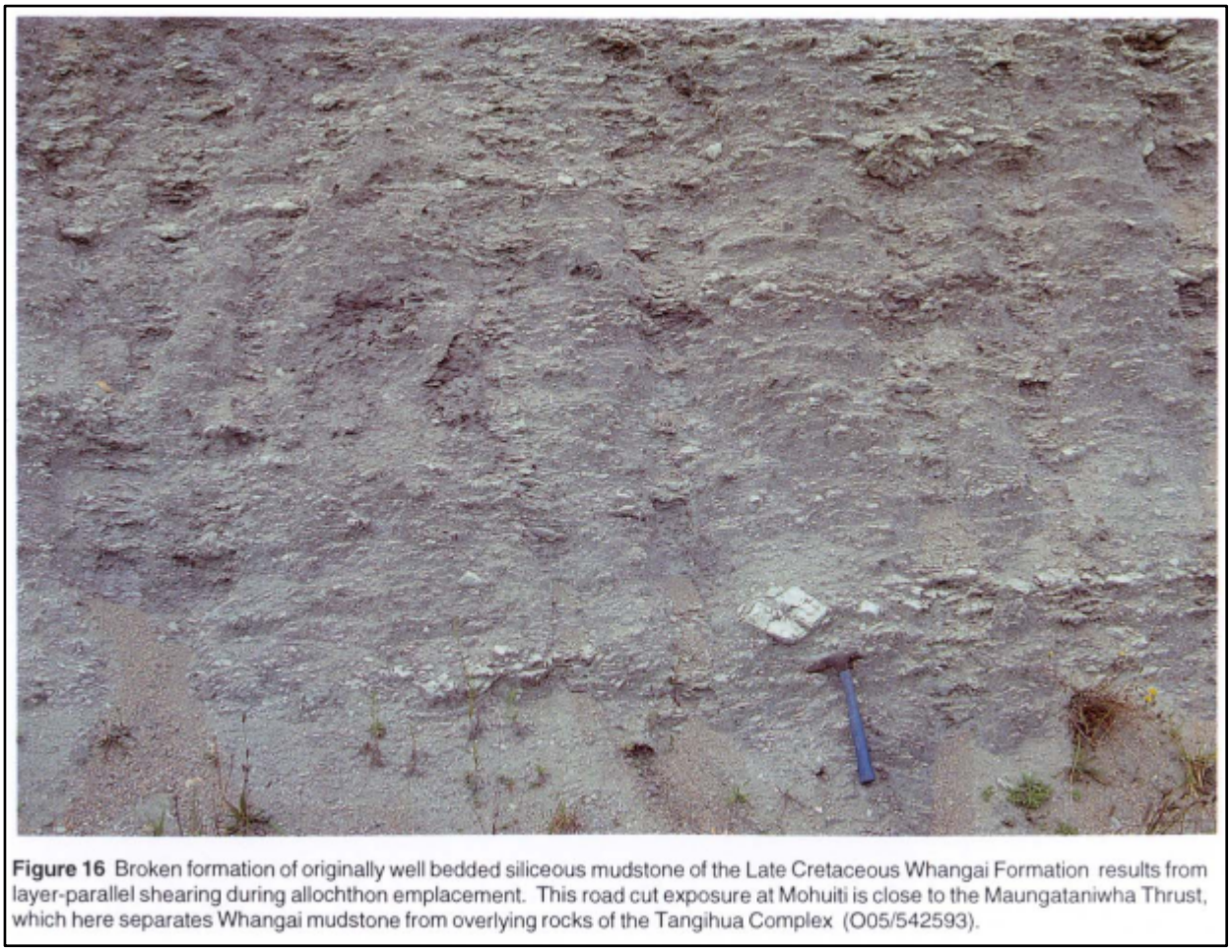


Figure 16 Broken formation of originally well bedded siliceous mudstone of the Late Cretaceous Whangai Formation results from layer-parallel shearing during allochthon emplacement. This road cut exposure at Mohuiti is close to the Maungataniwha Thrust, which here separates Whangai mudstone from overlying rocks of the Tangihua Complex (O05/542593).

Plate 2 - Whangai Formation.- [Geology of the Kaitaia Area. Institute of Geological & Nuclear Sciences; 1: 250,000 geological map 1. Lower Hutt, New Zealand.}.

Whangai formation is typically 300-500m thick. The siliceous mudstone is commonly quarried for low-grade roading material. Below depicts the bedded mudstones observed within the mantle [site cut] onsite.

Plate 2 - Natural Soil Stratification Onsite (Adapted from DroneX Aerial Survey)

16. Engineering Geology

Whangai rocks range from cemented, jointed, centimeter-bedded limestone and chert to massive moderately soft mudstone. In many places, rock properties are determined by the degree of shearing and shattering.

Even very broken Whangai lithologies will stand in moderately steep faces where above the water table.

Reference:
Geology of the Kaitaia Area. Institute of Geological & Nuclear Sciences; 1: 250,000 geological map 1.

17. Discussion on Subsoil Classification

- Expansive Soils

  Plastic soils found throughout this region have an expansive nature and tendency to shrink and swell. This phenomenon is common with these soils (where encountered) throughout the Northland region, particularly when these soils are subject to seasonal volume changes caused by wetting and drying.

  Technically, expansive soils are defined in NZS 3604 as those soils having a liquid limit of more than 50% and a linear shrinkage of more than 15%.

Considering the local mapped geology and the laboratory test results, it is considered that the subsoils onsite exhibit highly plastic traits.

On the contrary, foundations based on the proposed concept are founded within the more competent highly [weathered] calcareous underlying mudstone. As a consequence, the site can be classified as a Class H1 site.

Accordingly, foundation design [informative] guidance may be adopted in accordance with A.S 2870.

Soil Laboratory Characterisation

Indicates the placement of the Atterberg's Limits test result on the plasticity chart. Plate 3 below depicts the likely characteristics of the encountered soils onsite.

Soils that plot below the A-line generally have *good engineering* properties. The opposite is true for soils plotted above the A-line.

All in all, it can be concluded that the soils encountered onsite are in a *compact state*[5]. Consequently, the natural moisture content presented within at the [sampled] time is in the order of 21% - 22%.

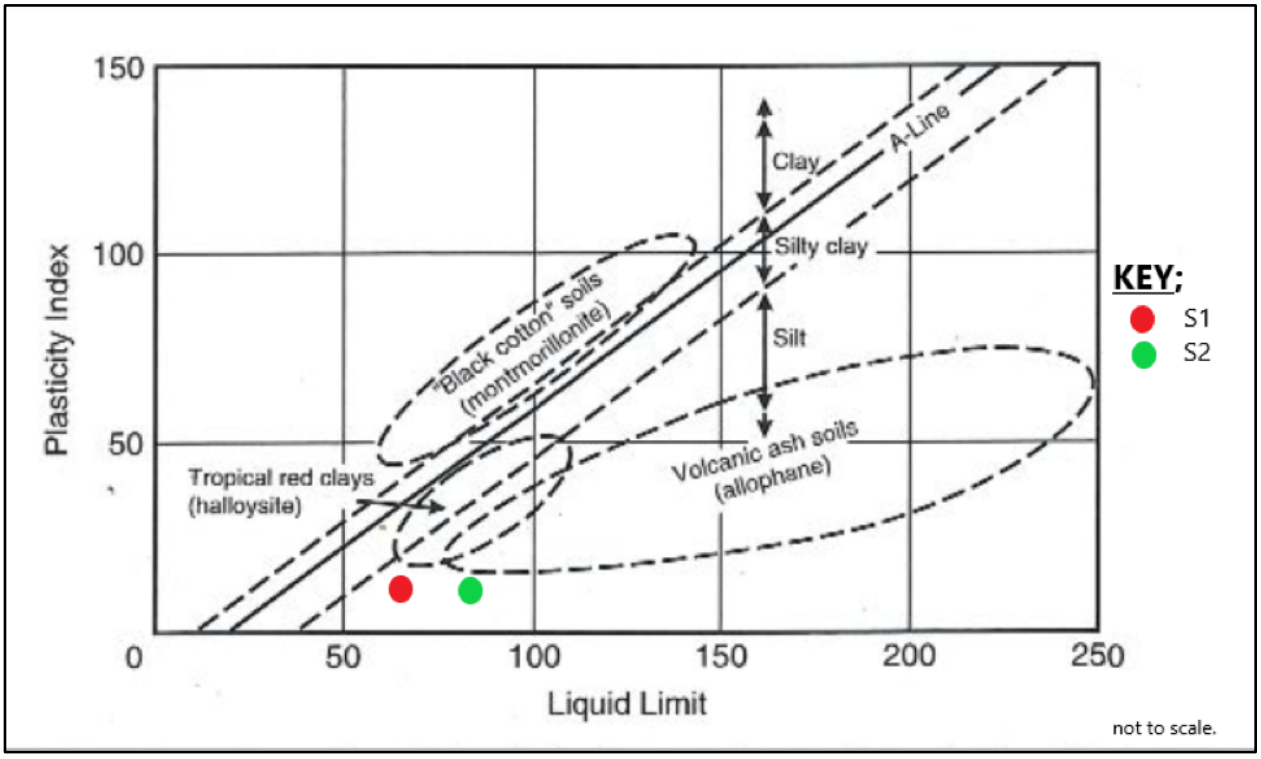


Plate 3 - Plasticity Chart.- [Cassagrande}.

[5] *liquidity index < 1.*

Reference

A.S. 2870, “Residential Slab and Footings - Construction”.

NZS 3604, “Timber Framed Buildings”

L.D. Wesley.

18. Specific Comments and Recommendations

Foundations

For this project shall undertake specific engineering design [SED] to establish appropriate foundation depths and passive support with due regard to the soil conditions and site.

Table 2 below presents the bearing strengths for vertical loads (only) for foundation designs.

Table 2 - Bearing Strength Design Parameters	
Ultimate Bearing Capacity	300 kPa
Soil Classification (AS 2870)	H1

Subsequently, finished ground level and overland flow paths [where noted] onto the site shall be graded/maintained for the purpose of directing all surface water away from the founding ground so as to minimise adverse effects of surface water influences with respect to the former.

Geotechnical Soil Parameters

Effective stress soil parameters below are based on in-situ field results, empirical relationships and local experience:

Table 3 below presents the bearing strengths for vertical loads (only) for foundation designs.

Table 3 -Effective Stress Parameters for Structural Design			
Description	Bulk Unit Weight(ɣ) kN/m^3	Effective Cohesion(c’) kPa	Effective Angle of Friction(ø’)
Stiff clayey silts and silty clays	17	5	28

Structural Engineering - Foundation Design Considerations

For foundations founded on expansive soils. It is prudent for the designing structural engineer to consider that one or more of the following criteria are met:

1. Sufficient dead-load pressure is exerted on the foundation.
2. The swelling potential of the foundation soils can be eliminated or reduced
3. Deepened pole embedment to negate lateral earth pressure.

All limit states must be considered in design to ensure adequate safety and serviceability.

Structural - Pre-Construction Foundation Check

To ensure that the founding ground is sound and foundation system is adequately rigid, it is prudent to check the following conditions before construction i.e.

1. Determine if there are soft pockets in the excavation or final subgrade level which may influence settlement.
2. Ensure that the piles/walls are sufficiently embedded to allow positive support against lateral earth pressure.
3. Surface [sub]drains shall be implemented to divert all surface overflows away from foundations.

Retaining Wall

Structural engineer to adopt the soil parameters in Table 3 for the design. Granular [GAP40] soil is recommended to be used as backfill material. Average natural slope angle onsite to be retained is in the order of approximately 26^0.

It is prudent to consider the length of the wall to span across the southern-northern phase of the upslope in order to direct any surface water flows away from the home, as well as providing adequate land retention in this aspect.

Careful consideration is also advised in regards to the effects of the interaction of bearing soils and the two structures i.e. the house poles and retaining wall.

18. Earth works and Construction

ALL earthworks shall be undertaken in accordance with NZS 4404 - Section 2.2 and where appropriate, in conjunction with NZS 4431 and related documents.

- Site Considerations

Where encountered, all deleterious materials shall be removed completely from foundation ground where foundations Works are proposed.

Provisions for safeguarding the final (foundation ground) subgrade during temporary excavation/construction works shall carefully be considered and executed at ALL times.

Consequently, adverse effects of the proposed works with regard to imbalance of natural moisture content to the founding ground can be limited.

Planning

Earthworks shall be planned carefully and conducted in a systematic manner according to the proposed plans. That is, all effective areas of work and related areas are clearly defined before work commences.

As a consequence, permitting effective control of works.

All in all, the development concept shall include an effective work plan detailing the proposed work for review and approval [structural engineer] prior work commencement.

Site Clearing

Had commenced during our site visit. It was noted that topsoil and deleterious materials seemed cleared from the natural subgrade.

Subgrade Protection

Specifically where the driveway and hardstanding area is proposed, it is recommended to be covered with subbase-base course straight after topsoil stripping.

Subsequently, natural moisture content is sustained at an optimum state.

Site Filling

Is not recommended for this site and the proposed work. However, it is considered minimal i.e. limited to the retaining wall backfill and hard standing areas in this case. Where appropriate, it shall be subject to professional engineering advice [control].

Site Cuts

Within the site shall be retained as appropriate. SED of retaining wall shall be undertaken for all cut phases subjected to surcharge.

Plate 4 - Site cut onsite (Adapted from DroneX Aerial Survey)

The above plate depicts a site cut ~2.70m[6] observed within the western portion of the site. This shall be retained as appropriate.

[6] *at the highest point.*

Erosion and Sediment Control

The earthworks contractor shall undertake full responsibility in ensuring that earthworks and all erosion and sediment control are conducted in accordance with the Far North District Council - Erosion and Sediment Control guidelines, and/or any Land Use Consent required to be obtained prior to commencing any site work.

Wastewater

Shall engage through the reticulated infrastructure in place. See Figure 10 below.

Stormwater

Shall engage directly through the reticulated stormwater infrastructure in place. See Figure 10 below.

Runoff conveyance shall utilise sealed pipes and discharge appropriately to the existing stormwater points on Parnell Street. This shall include [not limited to] retaining wall toe drainage and hard standing areas.

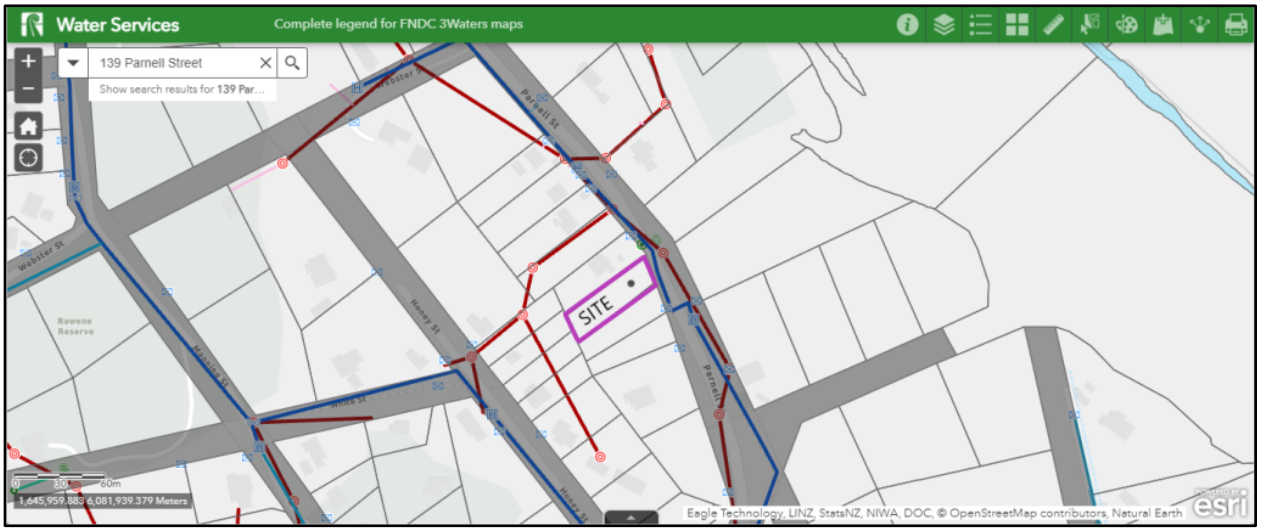


Figure 10 - 3 Waters Map - site outlined in purple (adapted from FNDC Water Services Map).

The stormwater management plan shall be detailed wihn the proposed development concept upon final submission to Council.

All management applications in this case shall be implemented by a qualified contractor [drainlayer]. Subsequently a PS3 and related documents[7] shall be issued by the contactor attesting to the work completed and integrity to the approved plans.

Stormwater Discharge

Onto the site shall be redirected away from the property as appropriate. As depicted below, two pipes assumed as overflow were observed to discharge directly onto the property at present.

[7] *As built plans.*

It is recommended that this is taken into account and addressed within the overall site development/design plans.

Figure 11 - Stormwater Discharge

19. Natural Hazards

Flood Hazard

Upon review of the Northland Regional Council Hazards maps, it indicates the subject area as not being within a flood extent area. As depicted in Figure 12 below.

Figure 12 - Natural Hazard Map - site outlined in purple (map adapted from NRC Natural Hazard Maps)**.**

Geological Fault Lines/Surface Ruptures

Reviewed geological maps show NO [active] fault lines through or nearby the general property. Seismic activity within the region is generally low. It was noted during our site walkover that NO signs of active shallow instability [soil creep] or relics were encountered.

Recent movement as a direct result of fault line activity within close vicinity to the subject were not observed. All in all, it can be considered that any risk pertaining to fault line/surface ruptures to be low at this site.

Active Mobile Land

Slides in natural soil may be caused by such external disturbances like undercutting the foot of an existing slope or digging an excavation with unsupported sides.

In this instance, the *critical point of interest [CPI]* primarily lies within Lot 1 DP 10830 and Lot 3 DP 10830. Anthropogenic i.e. excavations/undercutting activities in this space shall be carefully understood wholly [undermining effects] prior execution of work.

Specifically in account of resultant adverse effects of such undertakings to the subject property and allowing for safeguard provisions hereon.

Figure 13 - Critical Areas - (adapted from the DroneX Survey).

Slope Stability

No evidence of mobile land was encountered/observed upon the landform at present. Moreover, the area had been settled over the last seventy years. The existing houses within close vicinity were observed and showed no signs of structural stress due to land movement

This generally proves fundamental stability of the land. In this case, confidence impresses a positive assurance that;

- The natural subsoils bored were in a very stiff state.
- Well cemented subsoils encountered.
- Full saturation is highly unlikely due to the favourable topography of the land and low permeable subsoil characteristics.
- The employment of retaining structures shall reinforce secondary protection to land and property.

Consequently, we consider that a *low* risk of slope instability can be sustained in this instance. The impact of slope movement shall likely not impact the proposed project nor is the proposed development likely to effect any slope instability.

However, subject to adhering the recommendations provided herein and understanding the land, associated interactive systems and the impact of occupant activities thereafter.

Positive Topography

Has a significant and consistent effect on the weathering process and consequently on the type of minerals formed. The general relief of land in this case dictates a *well drained* site.

Residual soils comprised herein generally have good engineering properties.

Resident occupation shall utilise green/low impact systems with the purpose of heightened land capability/sustainability for prosterity.

20. Conclusion

Based on our site observations, field data and the general residential developments surrounding the subject property. It is our professional opinion that the subject site (legal description Lot 2 Deposited Plan 10830) can sustain the proposed minor development.

There is less than minor,

1. Significant risk from natural hazards, and;
2. The building work is likely to NOT accelerate, worsen, or result in a natural hazard on the hosting land or any other property.
3. The work in All shall sustain the equilibrium state at present.

It is my professional opinion on behalf of Gumboots Consulting Engineers Ltd that land on the subject property (legal description Lot 2 Deposited Plan 10830) can sustain the proposed residential development SUBJECT to;

- The proposed development shall be carefully implemented with respect to the existing natural environments within the respective lot. Natural surface water flow paths shall be carefully incorporated/maintained/managed within the overall development occupation as it shall provide long term sustainability in ALL aspects to the land, development and hosting environments.
- ALL recommendations stipulated within shall carefully be considered (understood) and ADHERED to within context.
- ALL proposed Works exhaust good sound engineering practices through means of extensive and conscientiously executing field observations during and after construction.
- ALL proposed Works are in accordance with Council Approved BC Plans, FNDC Engineering Standards and Guidelines and related documents and in conjunction with NZS 4404, Land Development and Subdivision Engineering.

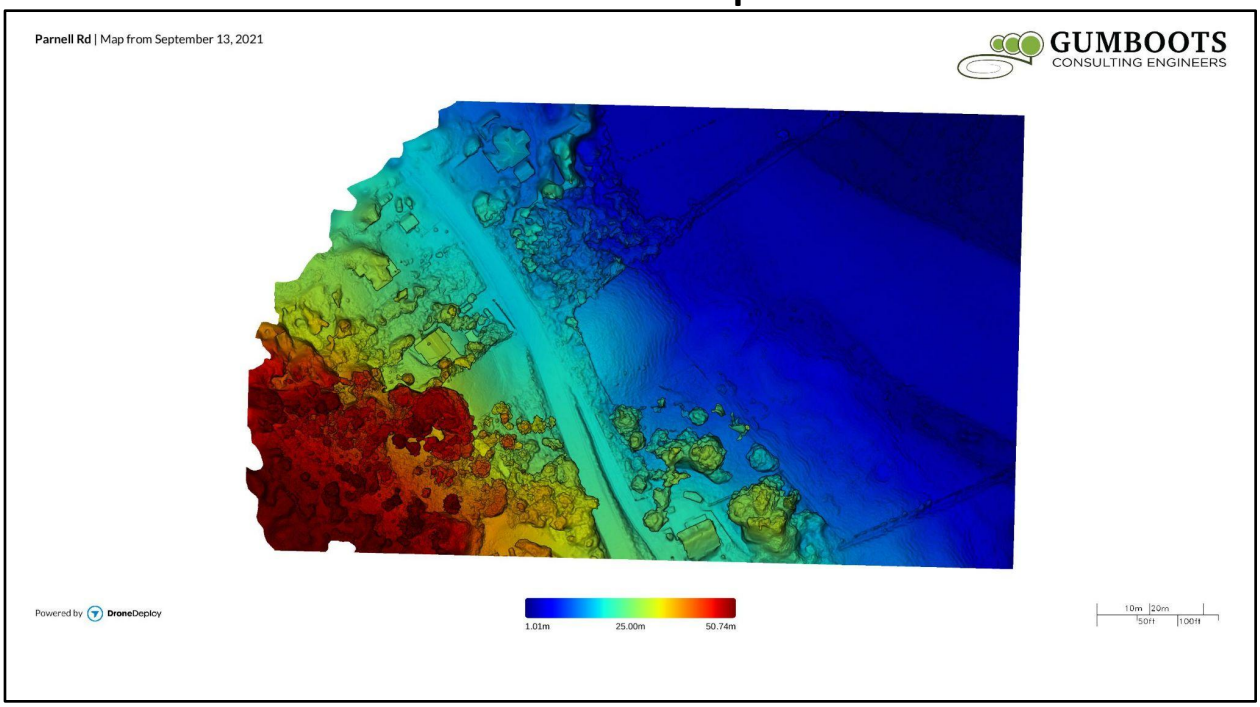
It shall be noted that, all subsequent work (which may be undertaken) pertaining to the site shall comply with the aforementioned and shall exhaust feasible consideration with regenerative/equilibrium effects to the hosting land, development and environment.

All in all, long term balancing effects of living can be of sustainable outputs in ALL aspects to the land, hosting environments and LIFE.

Appendix A

Attachments	Scale
Elevation Map	-
Annotation Report	-
Link to 3D Map	-
Geomorphology Overview Maps	NTS
Borehole Log 1	-
Borehole Log 2	-
Borehole Log 3	-
Dynamic Cone Penetrometer Sheet	-
Lab Test Results	-
Concept Plans - Provided by Client	-
Photos	-

Elevation Map



Annotation Report

Gumboots Consulting Engineers Ltd

Parnell Rd Annotation Report

Created on October 15, 2021

Captured on September 13, 2021

Location

Label	Title	Elevation	Coordinates
1	BH1	29.30 m	-35.4050066, 173.5061068
2	BH2	28.10 m	-35.4049562, 173.5061018
3	BH3	21.07 m	-35.4048636, 173.5062789
4	SW Double Catchpit	18.11 m	-35.4046440, 173.5062415

Distance

Label	Title	Horizontal Length	Surface Length	Slope	Vertical Height
5	Site Gradient	28.35 m	30.28 m	-17.28°, 31.12%	-8.83 m

Area

Label	Title	Area	Surface Area
6	House	108.14 m2	117.45 m2

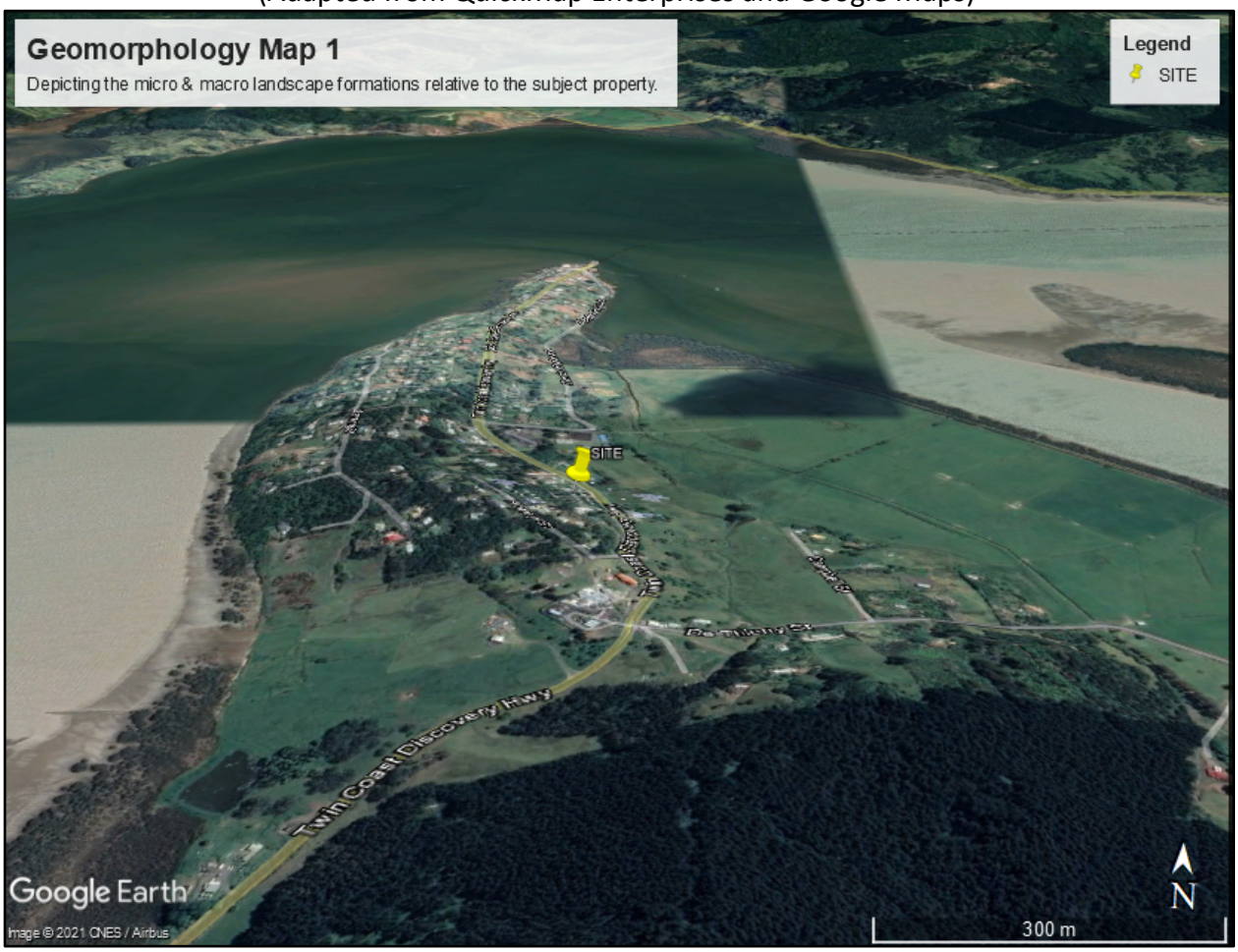
Link to 3D Map -

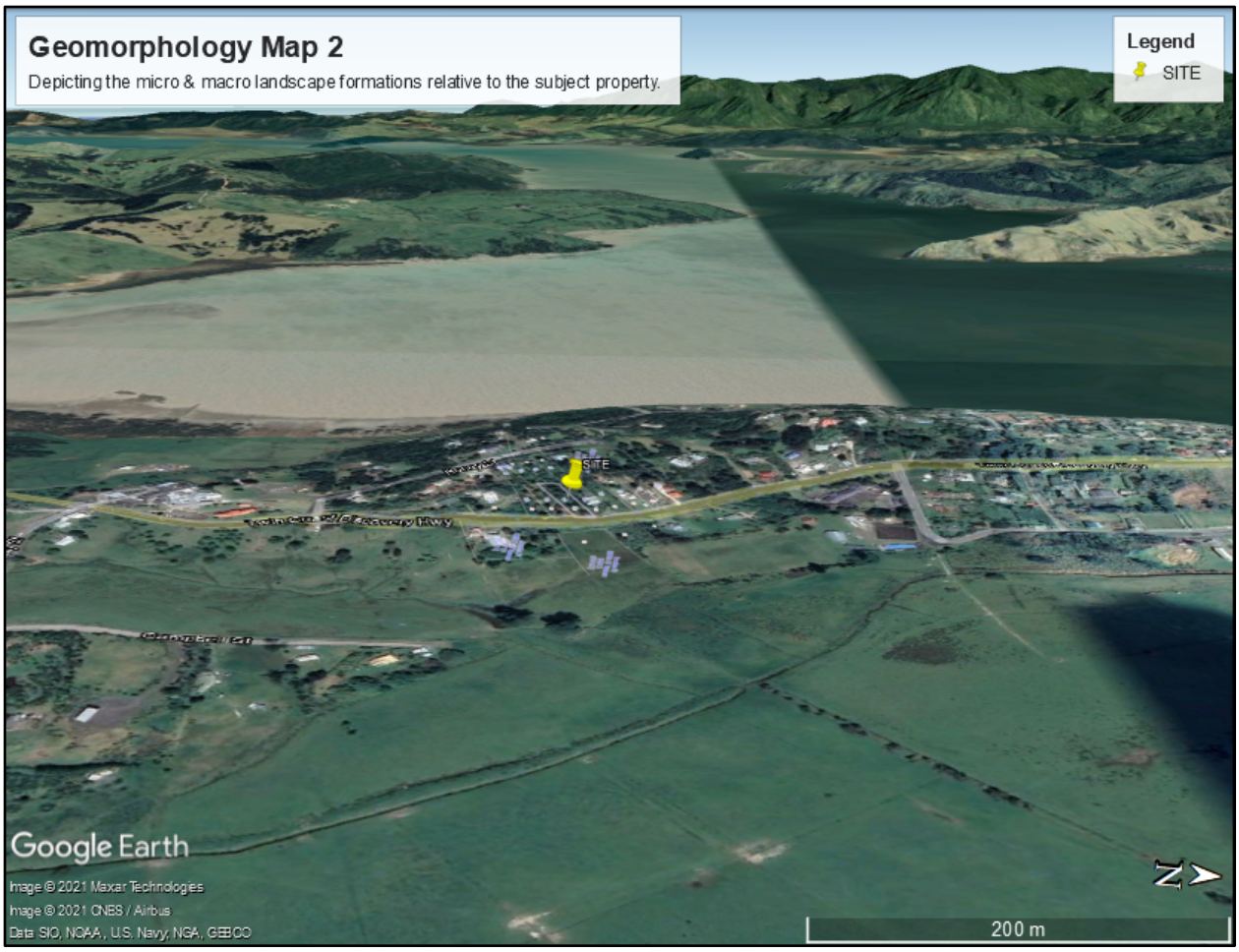
https://www.dronedeploy.com/app2/data/613f9cde21bce809044cbaa5?jwt_token=eyJ0eXAiOiJKV1QiLCJhbGciOiJIUzUxMiJ9.eyJleHAiOjI1MzQwMjMwMDc5OSwiaWQiOiI2MTNmOWNkZTIxYmNlODA5MDQ0Y2JhYTUiLCJzY29wZSI6WyI0YTI0YzgwNWMwX0MxMzQ3OENEOEZPUEVOUElQRUxJTkUiXSwidHlwZSI6IlJlYWRPbmx5UGxhbiIsIm92ZXJsYXlfZm9sZGVyX2lkIjoiNjEzZTkzM2U3NTgwZjk2ZDE0ODJiNDYyIn0.22Dk-p4rwTu4thh3-Nog9y_xdh23bNZMOyrBTmDuPmHOXzRpk9Ce6unm1QIURtYKT1EKuysN5t_YKI8-0DiqCQ

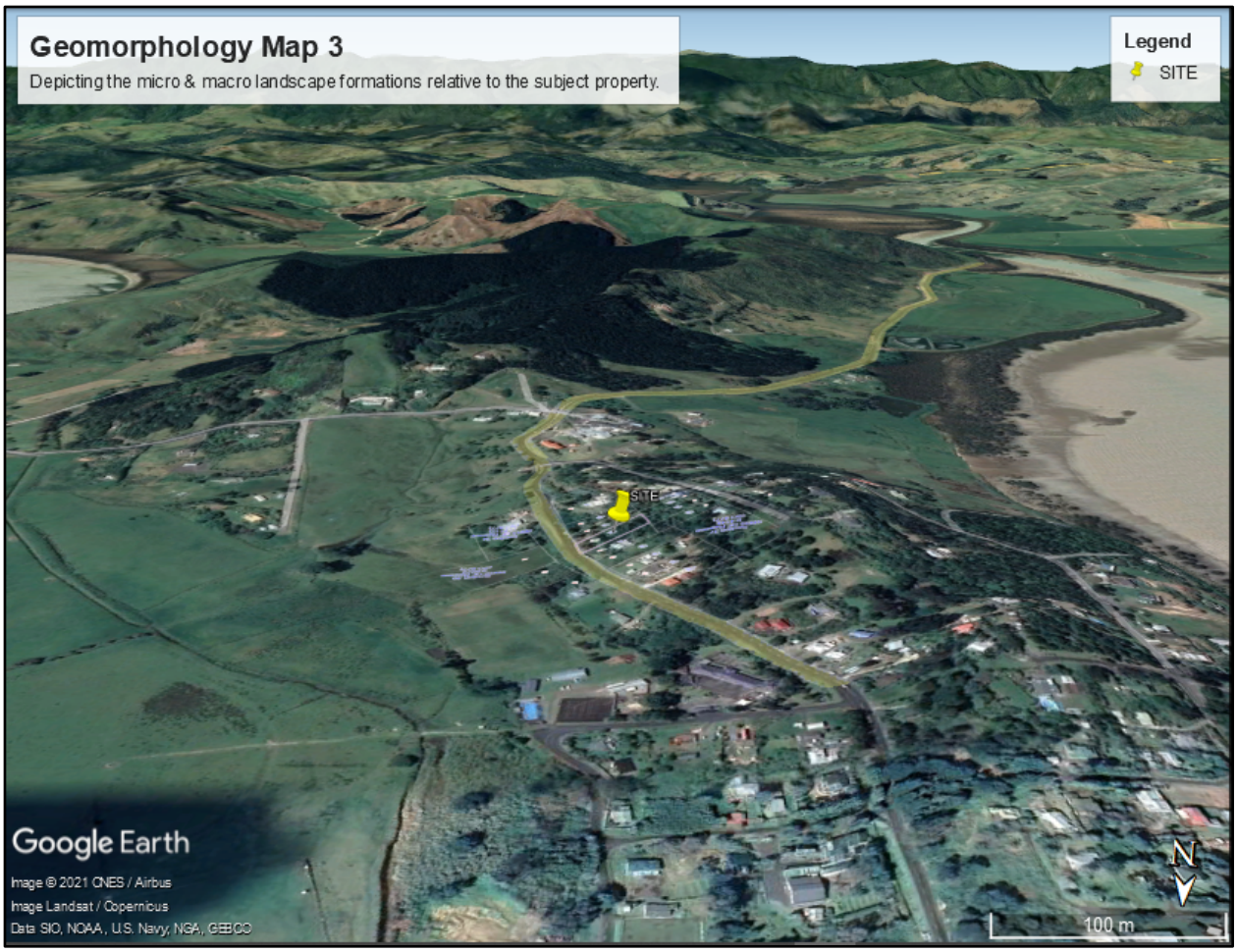
Legal Disclaimer: This aerial survey may contain confidential information. If you are not the intended recipient, you must not disclose or use the information contained in it. If you have received this link in error, please notify us immediately and discard the link.

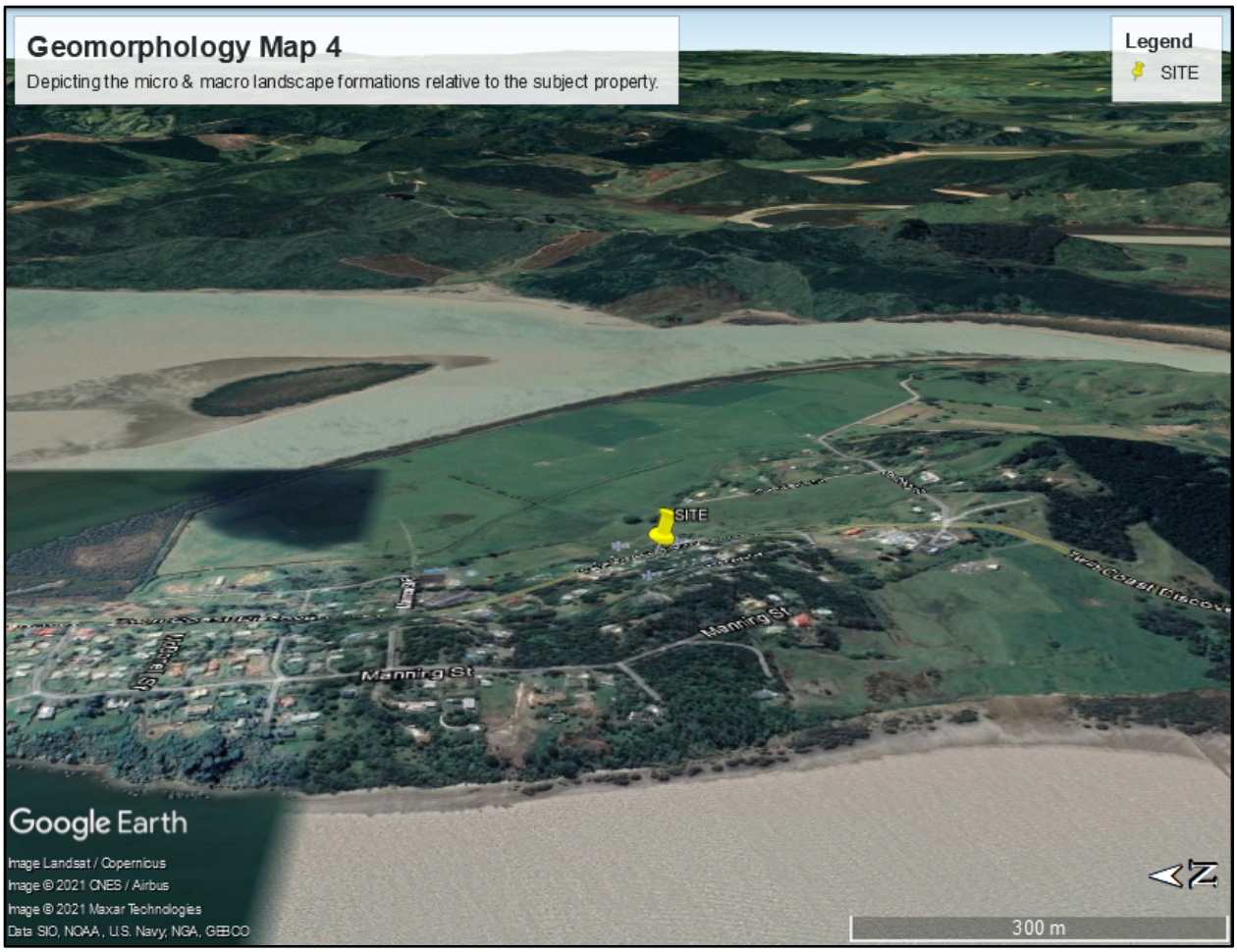
Geomorphology Maps

(Adapted from QuickMap Enterprises and Google Maps)




Geomorphology Map 2
Depicting the micro & macro landscape formations relative to the subject property.
Legend
SITE
SITE
Google Earth
Image © 2021 Maxar Technologies
Image © 2021 CNES / Airbus
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
200 m


Geomorphology Map 3
Depicting the micro & macro landscape formations relative to the subject property.
Legend
SITE
SITE
Google Earth
Image © 2021 CNES / Airbus
Image Landsat / Copernicus
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
N
100 m


Geomorphology Map 4
Depicting the micro & macro landscape formations relative to the subject property.
Legend
SITE
SITE
Manning St
Manning St
Parnell St
Google Earth
Image Landsat / Copernicus
Image © 2021 CNES / Airbus
Image © 2021 Maxar Technologies
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
300 m

Borehole Logs

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Kerikeri
Bay of Islands
New Zealand

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office@gumbootsconsulting.co.nz

BOREHOLE LOG No. 1 — Hole Location: Refer to Site Plan — **JOB No. 11 40**

CLIENT:	Pei Pei Allen-Scarlett	**SITE:**	139 Parnell St, Rawene.		
Date Started:	21/09/2021	**DRILLING METHOD:**	Mechanical Auger	**LOGGED BY:**	AK
Date Completed:	21/09/2021	**HOLE DIAMETER (mm)**	80mm	**CHECKED BY:**	KW

Soil Description (Based on NZGS Logging Guidelines 2005)	Depth (m)	Graphic Log	Geology	Water Level	Sensitivity	Corrected Shear Vane Strength (kPa)	Dynamic Cone Penetrometer (blows/100mm drop)
Silty CLAY, light greyish white, very stiff, damp and high plasticity.	0.5		Whangai Formation (Kkw).	NO Groundwater Encountered.		194	0 10 20 30
creamy mottles.						194	
damp	1.0					194	
EOBH @ 1.20m, UTP.						194	
	1.5						
	2.0						
	2.5						
	3.0						
	3.5						
	4.0						
	4.5						
	5.0						

LEGEND

TOPSOIL · CLAY · SILT · SAND · GRAVEL · FILL

Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

UTP - Unable to Penetrate
DCP- Dynamic Cone Penetrometer
EOBH - End of Borehole
EODCP - End of DCP

Notes - Impenetrable well cemented highly weathered rock.

- Atterberg's Limit and Linear Shrinkage test samples were taken @ 1.20m.

Average Scala Blows	17.5
Average Soil Sensitivity	0.0

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Bay of Islands
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BOREHOLE LOG No. 2

Hole Location: Refer to Site Plan

JOB No. 11 40

CLIENT:	Pei Pei Allen-Scarlett	SITE:	139 Parnell St, Rawene.		
Date Started:	21/09/2021	DRILLING METHOD:	Mechanical Auger	LOGGED BY:	AK
Date Completed:	21/09/2021	HOLE DIAMETER (mm)	80mm	CHECKED BY:	KW

Soil Description (Based on NZGS Logging Guidelines 2005)	Depth (m)	Graphic Log	Geology	Water Level	Sensitivity	Corrected Shear Vane Strength (kPa)	Dynamic Cone Penetrometer (blows/100mm drop)
Silty CLAY, light greyish white, very stiff, dry and high plasticity.	0		Whangai Formation (Kkw).	NO Groundwater Encountered.		194	0 20 40
very stiff	0.5					194	
dry							
EOBH @ 0.70m, UTP.	1.0						
	1.5						
	2.0						
	2.5						
	3.0						
	3.5						
	4.0						
	4.5						
	5.0						

LEGEND

TOPSOIL CLAY SILT SAND GRAVEL FILL

Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

UTP - Unable to Penetrate
DCP- Dynamic Cone Penetrometer
EOBH - End of Borehole
EODCP - End of DCP

Notes - Impenetrable well cemented highly weathered rock.

Average Scala Blows	18.5
Average Soil Sensitivity	0.0

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BOREHOLE LOG No. 3

Hole Location: Refer to Site Plan

JOB No. 11 40

CLIENT:	Pei Pei Allen-Scarlett	**SITE:**	139 Parnell St, Rawene.		
Date Started:	21/09/2021	**DRILLING METHOD:**	Mechanical Auger	**LOGGED BY:**	AK
Date Completed:	21/09/2021	**HOLE DIAMETER (mm)**	80mm	**CHECKED BY:**	KW

Soil Description (Based on NZGS Logging Guidelines 2005)	Depth (m)	Graphic Log	Geology	Water Level	Sensitivity	Visual Illustration	Dynamic Cone Penetrometer (blows/100mm drop)
TOPSOIL, clayey silt, grey and moist with rootlets.							
Silty CLAY, yellowish brown, very stiff, moist and high plasticity.	0.5		Whangai Formation (Kkw).	NO Groundwater Encountered.		194	
damp and very stiff						194	
mottled greyish white	1.0					194	
pale yellowish cream, moist very stiff and high plasticity.						194	
orangish brown streaks.	1.5					194	
cream with brown mottles, damp, very stiff and high plasticity.						194	
dry	2.0					194	
greyish orange streaks with fine - medium sub rounded gravels						194	
pockets of weathered sand stone	2.5					194	
light greyish whte silts and clays						194	
	3.0					194	
EOBL @ 3.00m.							
	3.5						
	4.0						
	4.5						
	5.0						

Dynamic Cone Penetrometer (blows/100mm drop): 0 to 1

LEGEND

TOPSOIL | CLAY | SILT | SAND | GRAVEL | FILL

Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

UTP - Unable to Penetrate
DCP- Dynamic Cone Penetrometer
EOBL - End of Borelog
EODCP - End of DCP

Notes - Atterberg's Limit and Linear Shrinkage test samples were taken @ 2.30m.

Average Scala Blows	0.0
Average Soil Sensitivity	0.0

DYNAMIC CONE PENETROMETER SHEET

SITE:	139 Parnell St, Rawene.									
JOB#:	1140	**Operator**	AK	**DATE:**	21/09/2021					
Test No.	1	2								
DEPTH (m)	**DCP Blows/100mm**									
0.1										
0.2										
0.3										
0.4										
0.5										
0.6										
0.7										
0.8		16								
0.9		18								
1.0		20								
1.1		20								
1.2										
1.3	15									
1.4	17									
1.5	18									
1.6	20									
1.7										
1.8										
1.9										
2.0										
2.1										
2.2										
2.3										
2.4										
2.5										
2.6										
2.7										
2.8										
2.9										
3.0										
3.1										
3.2										
3.3										
3.4										
3.5										
3.6										
3.7										
3.8										
3.9										
4.0										
4.1										
4.2										
4.3										
4.4										
4.5										
4.6										
4.7										
4.8										
4.9										
5.0										
5.1										
5.2										
5.3										
5.4										
5.5										
5.6										
5.7										
5.8										
5.9										
6.0										
6.1										
6.2										
6.3										
6.4										
6.5										
6.6										
6.7										
6.8										
6.9										
7.0										
7.1										
7.2										
7.3										
7.4										
7.5										
7.6										
7.7										
7.8										
7.9										
Total Depth	1.60m	1.10m								

Lab Test Results

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Whangarei Laboratory
166 Bank Street
Whangarei
M: 027 656 5226
E: info@geocivil.co.nz

TEST REPORT

Lab Job No: 8496-078

Your ref.: 1140

Date of Issue: 14/10/2021

Date of Re-Issue: -

Page: 1 of 5

Test Report No.
W21-1143

PROJECT: **GCE#1140 - Soil Classification Testing**

CLIENT: Gumboots Consulting
#N/A

ATTENTION: Kelly Wright

TEST METHODS: Determination of the liquid & plastic limits, Plasticity index and water content
NZS 4402:1986 Tests 2.1,2.2,2.3,2.4
Determination of the Linear Shrinkage
NZS 4402:1986 Test 2.6

SAMPLING METHOD: Sampled by client - sampling not accredited

TEST RESULTS: As per attached sheets

Alex Millar

A. Millar
Administrator

D. Krissansen
Approved Signatory

ACCREDITED IANZ TESTING LABORATORY

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

-CPT - Aggregates Testing - Soil Testing -

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166 Bank Street
Whangarei
P: 09 438 4417
E: info@geocivil.co.nz

DETERMINATION OF THE LIQUID & PLASTIC LIMITS, PLASTICITY INDEX & WATER CONTENT

NZS 4402:1986 Test 2.2,2.3,2.4

Lab Job No:	8496-078	**Sample No.:**	21-993
Client:	Gumboots Consulting Engineers	**Tested By:**	N.K
Location:	Unknown BH1 2.10m	**Date Tested:** **Checked By:**	30/09/2021 A.M
Date Received:	20/09/2021	**Date Checked:**	14/10/2021
Report No:	W21-1143	**Page:**	2 of 5
REF:	GCE#1140		
Sampling Method:	Sampled by client – Sampling not accredited	**Sampled By:**	Client
Date Sampled:	13/09/2021		

Test Details:

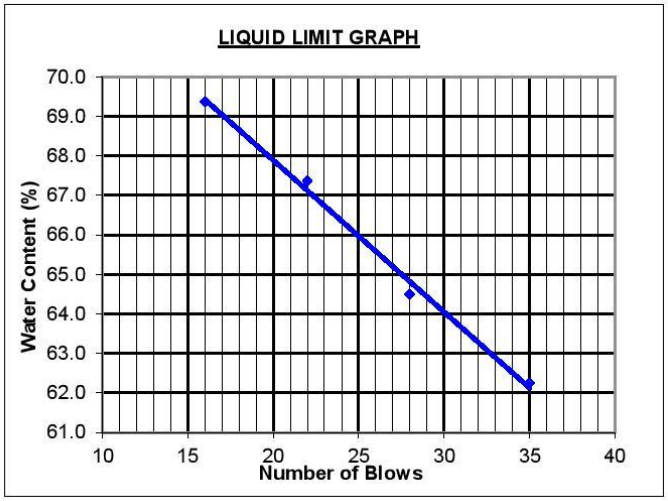
Test performed on: Fraction passing 425μm sieve

Sample history: Natural state

Description of Sample: Silty CLAY, minor sands to 2mm, grey mottled brown and yellow, dry

	Liquid Limit				Plastic Limit	
No. of blows	16	22	28	35		
Water content (%)	69.4	67.4	64.5	62.2	22.2	22.4

NWC	16.5
Liquid Limit	66
Plastic Limit	22
Plasticity Index	44



T:\Projects\8400-\8496, Gumboots\8496-078, GCE#1140\8496-078, GCE#1140 lab testing
PI 21-993
14/10/2021 Issue 3

D. Krissansen
Approved Signatory

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Whangarei
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E: info@geocivil.co.nz

DETERMINATION OF THE LINEAR SHRINKAGE

NZS 4402:1986 Test 2.6

Lab Job No:	8496-078	**Sample No:**	21-993
Client:	Gumboots Consulting Engineers	**Tested By:**	N.K
Location:	Unknown BH1 2.10m	**Date:**	30/09/2021
		Checked By:	A.M
Date Received:	20/09/2021	**Date:**	14/10/2021
Report No:	W21-1143	**Page:**	3 of 5
REF:	GCE#1140		

Test performed on: Fraction passing 425mm sieve
History: Natural state

Description of Sample: Silty CLAY, minor sands to 2mm, grey mottled brown and yellow, dry

Linear shrinkage	**16**

T:\Projects\8400-\8496, Gumboots\8496-078, GCE#1140\8496-078, GCE#1140 lab testing
LS 21-993
14/10/2021 Issue 3

D. Krissansen
Approved Signatory

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Whangarei
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E: info@geocivil.co.nz

DETERMINATION OF THE LIQUID & PLASTIC LIMITS, PLASTICITY INDEX & WATER CONTENT

NZS 4402:1986 Test 2.2,2.3,2.4

Lab Job No:	8496-078	**Sample No.:**	21-994
Client:	Gumboots Consulting Engineers	**Tested By:**	N.K
Location:	Unknown BH3 2.3m	**Date Tested:** **Checked By:**	30/09/2021 A.M
Date Received:	20/09/2021	**Date Checked:**	14/10/2021
Report No:	W21-1143	**Page:**	4 of 5
REF:	GCE#1140		
Sampling Method:	Sampled by client – Sampling not accredited	**Sampled By:**	Client
Date Sampled:	13/09/2021		

Test Details:

Test performed on: Fraction passing 425μm sieve

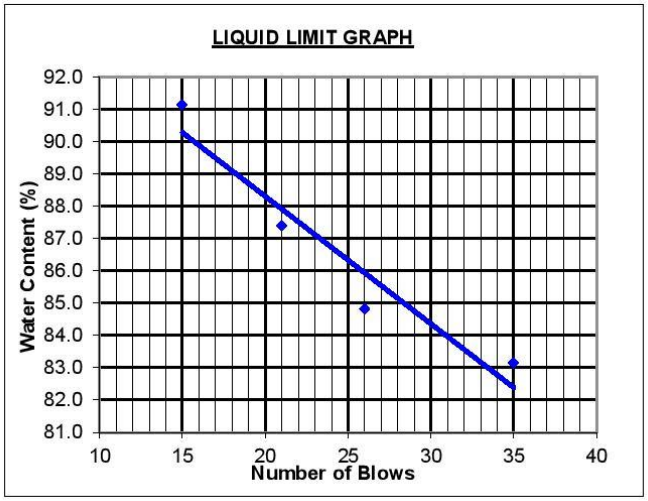
Sample history: Natural state

Description of Sample: Silty CLAY, traces of sands to 2mm, light yellow brown mottled orange and grey, moist

	Liquid Limit			
No. of blows	15	21	26	35
Water content (%)	91.1	87.4	84.8	83.1

Plastic Limit	
20.9	20.9

NWC	32.4
Liquid Limit	86
Plastic Limit	21
Plasticity Index	65



T:\Projects\8400-\8496, Gumboots\8496-078, GCE#1140\8496-078, GCE#1140 lab testing
PI 21-994
14/10/2021 Issue 3

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E: info@geocivil.co.nz

DETERMINATION OF THE LINEAR SHRINKAGE

NZS 4402:1986 Test 2.6

Lab Job No:	8496-078	**Sample No:**	21-994
Client:	Gumboots Consulting Engineers	**Tested By:**	N.K
Location:	Unknown BH3 2.3m	**Date:**	30/09/2021
		Checked By:	A.M
Date Received:	20/09/2021	**Date:**	14/10/2021
Report No:	W21-1143	**Page:**	5 of 5
REF:	GCE#1140		

Test performed on: Fraction passing 425mm sieve
History: Natural state

Description of Sample: Silty CLAY, traces of sands to 2mm, light yellow brown mottled orange and grey, moist

Linear shrinkage	**19**

T:\Projects\8400-\8496, Gumboots\8496-078, GCE#1140\8496-078, GCE#1140 lab testing
LS 21-994
14/10/2021 Issue 3

D. Krissansen
Approved Signatory

Concept Plans

Sheet Index	
Layout ID	Layout Name
	Sheet Index
101	Site Plan
102	Floor Plan
103	Elevations
104	Section AA
105	Foundation & Plumbi...
106	Roof Structural Plan

BEACHSIDE

Job Title **Proposed New Home**

For ***Pei Pei & Damion Allen-Scarlett***

At **139 Parnell Street, Rawene**

Hans Mitt Architectural Design

Ph.[09] 4054 876, 021 405484, Email: hans_mitt@msn.com

Drawing Title **Sheet Index**

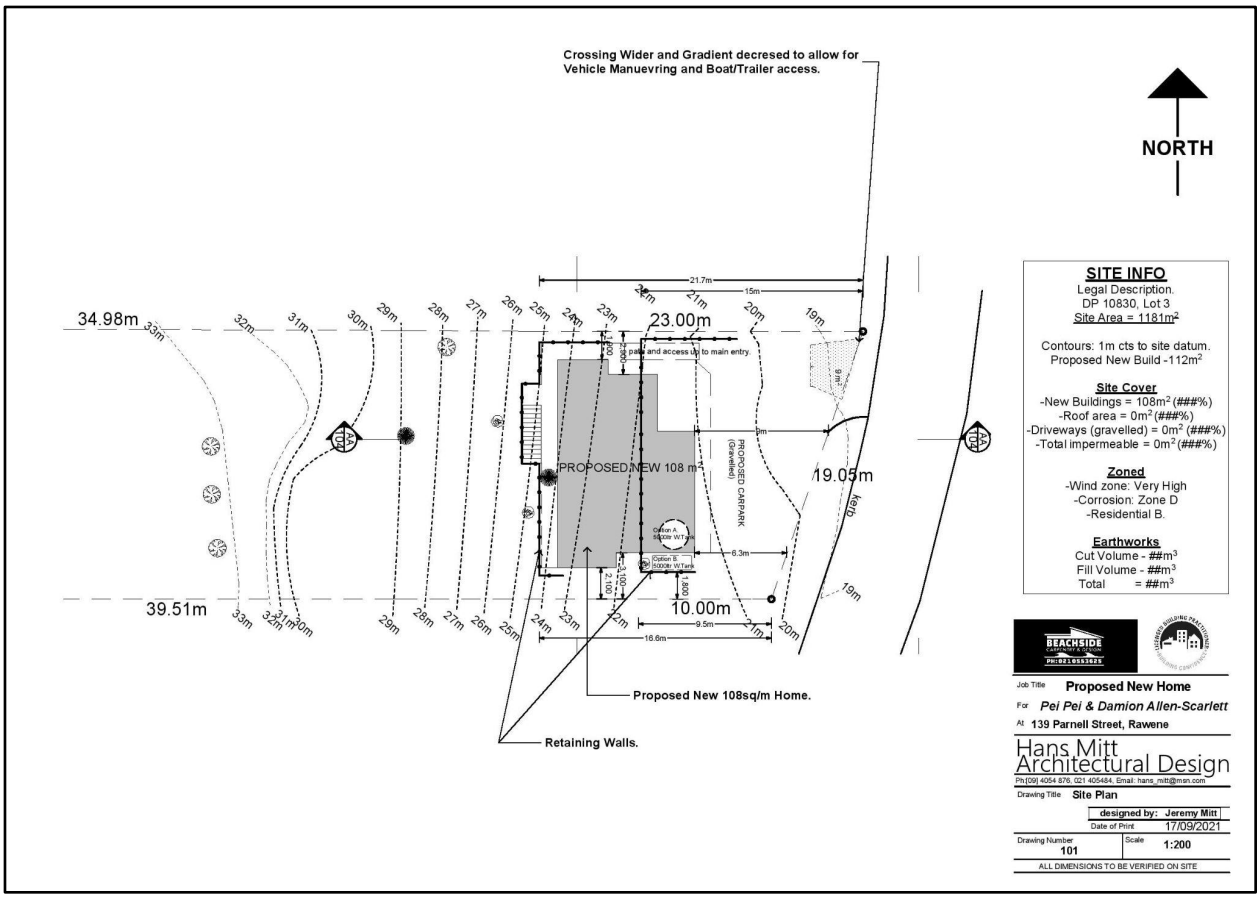
designed by: Jeremy Mitt

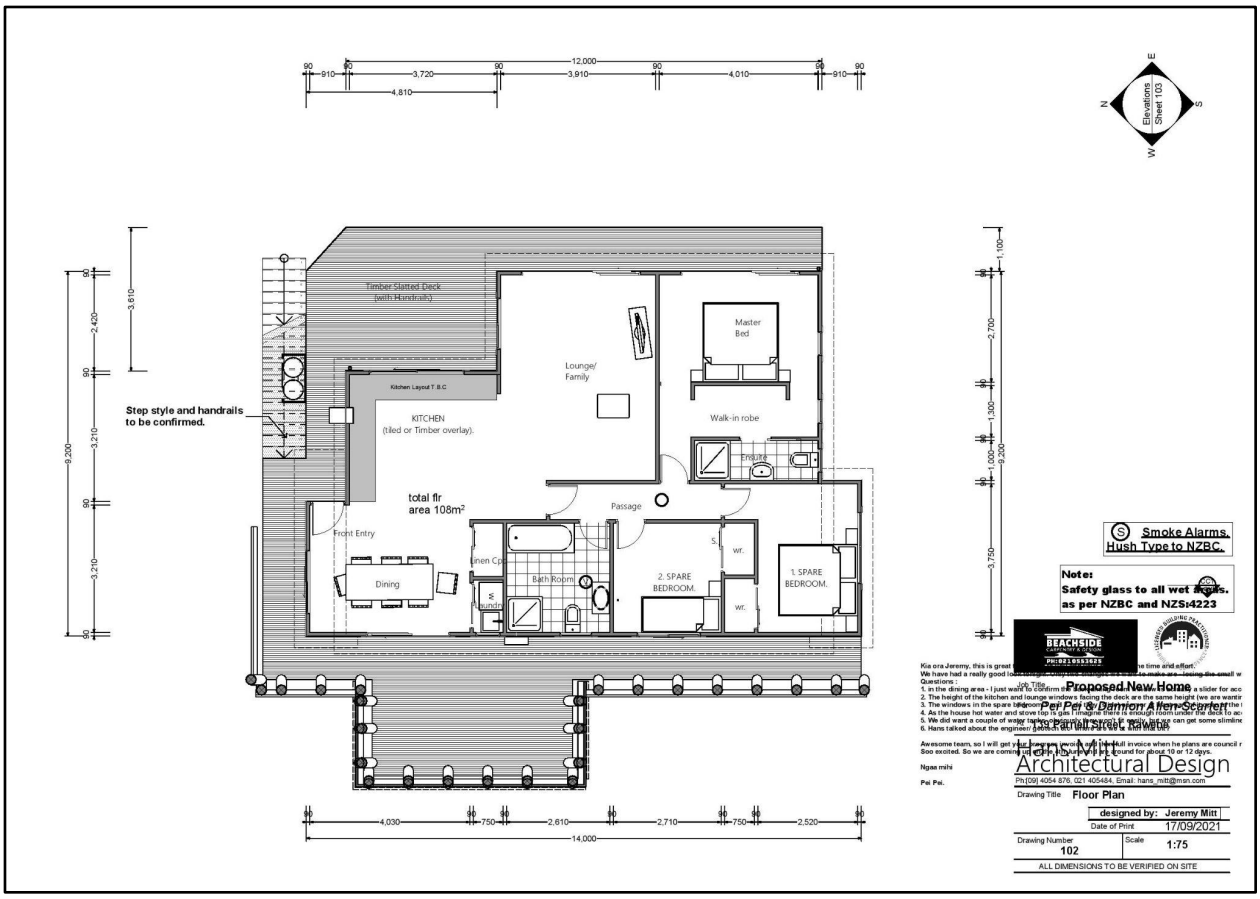
Date of Print 17/09/2021

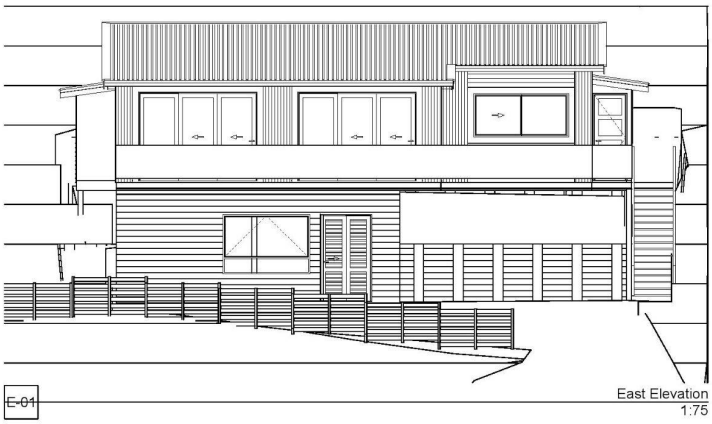
Drawing Number

Scale 1:1, 1:0.4621, 1:1.3148, 1:0.6315

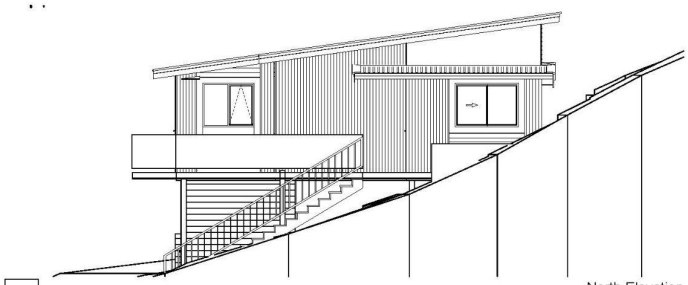
ALL DIMENSIONS TO BE VERIFIED ON SITE


Crossing Wider and Gradient decresed to allow for Vehicle Manuevring and Boat/Trailer access.
NORTH
34.98m
23.00m
39.51m
10.00m
19.05m
PROPOSED NEW 108 m²
PROPOSED CARPARK (Gravelled)
Kerb
Proposed New 108sq/m Home.
Retaining Walls.
SITE INFO
Legal Description.
DP 10830, Lot 3
Site Area = 1181m²
Contours: 1m cts to site datum.
Proposed New Build -112m²
Site Cover
-New Buildings = 108m² (###%)
-Roof area = 0m² (###%)
-Driveways (gravelled) = 0m² (###%)
-Total impermeable = 0m² (###%)
Zoned
-Wind zone: Very High
-Corrosion: Zone D
-Residential B.
Earthworks
Cut Volume - ##m³
Fill Volume - ##m³
Total = ##m³
BEACHSIDE
Job Title Proposed New Home
For Pei Pei & Damion Allen-Scarlett
At 139 Parnell Street, Rawene
Hans Mitt Architectural Design
Ph [09] 4054 876, 021 405484, Email: hans_mitt@msn.com
Drawing Title Site Plan
designed by: Jeremy Mitt
Date of Print 17/09/2021
Drawing Number 101
Scale 1:200
ALL DIMENSIONS TO BE VERIFIED ON SITE


Timber Slatted Deck
(with Handrail)
Step style and handrails
to be confirmed.
Kitchen Layout T.B.C
KITCHEN
(tiled or Timber overlay).
Lounge/
Family
Master
Bed
Walk-in robe
Ensuite
Passage
total flr
area 108m²
Front Entry
Dining
Linen Cp
Bath Room
S.
Laundry
2. SPARE
BEDROOM.
S.
wr.
wr.
1. SPARE
BEDROOM.
12,000
4,810
3,720
3,910
4,010
910
14,000
4,030
2,610
2,710
2,520
750
9,200
3,610
2,420
3,210
2,700
1,300
1,000
3,750
1,100
Elevations
Sheet 103
Smoke Alarms.
Hush Type to NZBC.
Note:
Safety glass to all wet areas.
as per NZBC and NZS:4223
BEACHSIDE
Ph: 021 0553625
Job Title
Proposed New Home
139 Parnell Street, Rawene
Per Pei & Damon Architecture
Hans Mitt
Architectural Design
Ph:[09] 4054 876, 021 405484, Email: hans_mitt@msn.com
Drawing Title
Floor Plan
designed by: Jeremy Mitt
Date of Print
17/09/2021
Drawing Number
102
Scale
1:75
ALL DIMENSIONS TO BE VERIFIED ON SITE



E-01 East Elevation
1:75



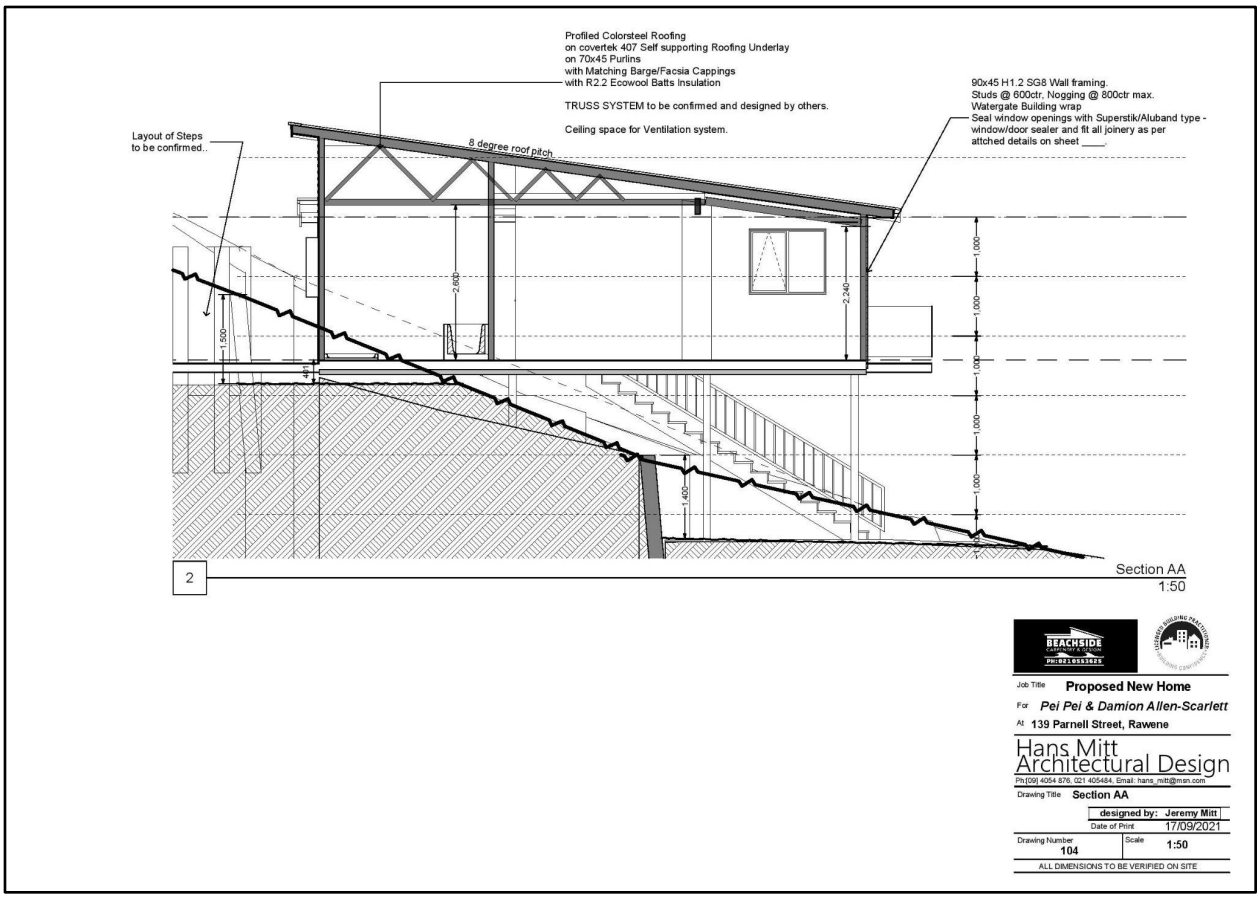
E-04 North Elevation
1:75

BEACHSIDE
CARPENTRY & DESIGN
PH: 021 0553 626

Job Title **Proposed New Home**
For ***Pei Pei & Damion Allen-Scarlett***
At **139 Parnell Street, Rawene**

Hans Mitt
Architectural Design
Ph [09] 4054 876, 021 405484, Email: hans_mitt@msn.com

Drawing Title **Elevations**
designed by: Jeremy Mitt
Date of Print 17/09/2021
Drawing Number **103**
Scale **1:75, 1:1.3333**
ALL DIMENSIONS TO BE VERIFIED ON SITE


Profiled Colorsteel Roofing
on covertek 407 Self supporting Roofing Underlay
on 70x45 Purlins
with Matching Barge/Facsia Cappings
with R2.2 Ecowool Batts Insulation
TRUSS SYSTEM to be confirmed and designed by others.
Ceiling space for Ventilation system.
90x45 H1.2 SG8 Wall framing.
Studs @ 600ctr. Nogging @ 800ctr max.
Watergate Building wrap
Seal window openings with Superstik/Aluband type - window/door sealer and fit all joinery as per attched details on sheet ____.
Layout of Steps to be confirmed..
8 degree roof pitch
2,600
2,240
1,500
400
1,400
1,000
1,000
1,000
1,000
1,000
2
Section AA
1:50
BEACHSIDE
Job Title Proposed New Home
For Pei Pei & Damion Allen-Scarlett
At 139 Parnell Street, Rawene
Hans Mitt
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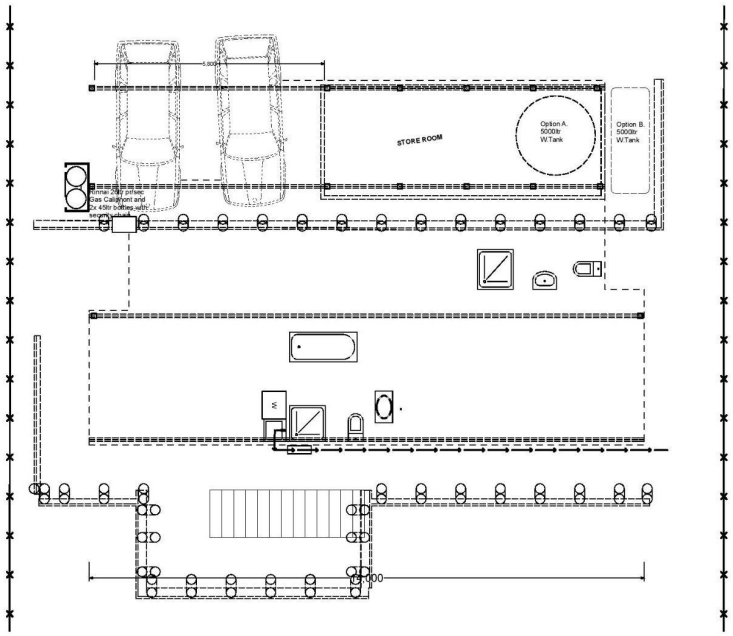
Ph[09] 4054 876, 021 405484, Email: hans_mitt@msn.com
Drawing Title Section AA
designed by: Jeremy Mitt
Date of Print 17/09/2021
Drawing Number 104
Scale 1:50
ALL DIMENSIONS TO BE VERIFIED ON SITE



BEACHSIDE
CARPENTRY & DESIGN
PH:0210553625

Job Title **Proposed New Home**

For ***Pei Pei & Damion Allen-Scarlett***

At **139 Parnell Street, Rawene**

Hans Mitt
Architectural Design

Ph:[09] 4054 876, 021 405484, Email: hans_mitt@msn.com

Drawing Title **Foundation & Plumbing PLan**

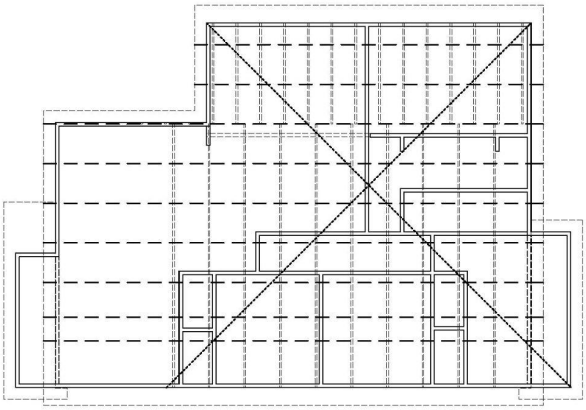
designed by: Jeremy Mitt

Date of Print 17/09/2021

Drawing Number **105**

Scale **1:75**

ALL DIMENSIONS TO BE VERIFIED ON SITE



BEACHSIDE

Job Title **Proposed New Home**

For ***Pei Pei & Damion Allen-Scarlett***

At **139 Parnell Street, Rawene**

Hans Mitt
Architectural Design

Ph [09] 4054 876, 021 405484, Email: hans_mitt@msn.com

Drawing Title **Roof Structural Plan**

designed by: **Jeremy Mitt**

Date of Print 17/09/2021

Drawing Number **106**

Scale **1:75, 1:1.1533**

ALL DIMENSIONS TO BE VERIFIED ON SITE

Photos

Photo 1 - Entrance to the subject property and neighbouring property to the north.

Photo 2 - Facing south down Parnell Street.

Photo 3 - Facing north up Parnell Street.

Photo 4 - Southern boundary of subject property..

Photo 5 - Pano of the subject property.

Photo 6 - Facing east from the southwest corner of the property.