



Gibbons Civil Engineering Ltd

Engineering Assessment: Geotechnical Assessment
for 5 new Lots within a Proposed Subdivision

Report Prepared for: Beegee Trust

Site Location: 124 Maioro Road, Otatau

Date: 11th January 2021


Reference: R2020/793

ENGINEERING ASSESSMENT

Report Prepared For: Beegee Trust

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Report Reference Number: R2020/793

Date: 11th January 2021

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Revision	Date	Released	Approved
0	11 th January 2020	Final for release	T. Gibbons

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1. Executive summary

The clients propose to subdivide their property at 124 Maoro Road, Otatau.

Lots 1-5 are currently undeveloped and require geotechnical investigations to determine if there are suitable areas on each Lot to establish a residential building platform and if there are suitable areas to manage wastewater and stormwater within each Lots boundary.

Lot 6 is developed with an existing dwelling. This Lot covers the bulk of the subdivisions area. No further investigations have been carried out for Lot 6 as no new residential developments are proposed on the Lot as part of this subdivisional consent.

This report covers:

- A geotechnical assessment for the proposed building platform areas on Lots 1-5 as shown on the attached geotechnical site plans (Appendix B).
- Limitations and requirements for future earthworks and foundations for the 5 building platform areas.
- General stormwater and wastewater recommendations for future buildings on the 5 Lots.
- A Natural Hazard Risk Assessment as per section 106 of RMA.

The conclusion of this report is that the land at the location of the proposed building platforms for Lots 1-5 are suitable for development. Any future residential buildings at the proposed building platform areas will be safe and stable provided the parameters and recommendations in this report are followed to a high standard.

Wastewater and stormwater systems are both able to be managed within the boundaries of each of the proposed Lots.

Should the proposed location of the building platforms (Appendix B) be changed, then further geotechnical investigations may be required.



2. Introduction - Background Information

The clients are wishing to subdivide their rural property to create 5 new Lots for residential developments.

The new Lots in the subdivision are located on the northern and north-western sides of Maoro Road, with the new Lots also accessed off this road.

Proposed Lots 1 and 2 are located south-west of an existing residential Lot at 72 Maoro Road, whereas Lots 3-5 are located west of the existing dwelling on the property at 124 Maoro Road, Otatau (proposed Lot 6). The location of the proposed Lots is shown on the attached plans (Appendix B).

The land across the proposed Lots is currently used for stock grazing. Lots 1-4 has flat to gently sloping topography, while Lot 5 has moderately sloping topography which borders steeper sloping land.

The proposed Lots in the subdivision are raised above the surrounding low-lying areas and are not susceptible to flooding. No soil or slope instabilities were noted at the location of the proposed building platform areas during both onsite and desktop investigations.

The building platforms and wastewater areas shown on the attached geotechnical site plan (Appendix B) are covered in this report. The Lot boundary lines may change, however if the building platforms and suitable wastewater areas are changed then further investigations may be required in addition to this report.

There are no reticulated systems in existence for the proposed subdivision. Therefore, suitable wastewater disposal areas have also been identified for the proposed Lots (section 8). Specific wastewater assessments and stormwater assessments for each building platform will be required at building consent stage. Each Lot has been assessed to have suitable areas for onsite wastewater and stormwater disposal.

Desktop studies, site investigations and boreholes were undertaken across the five Lots. Details of these are provided into the following sections.

2.1 Site Legal Description

The existing property includes a dwelling at 124 Maioro Road, Otatau. The existing property is described as LOT 2 DP 13437 LOT 1 PT LOT 2 DP 17774 LOT 2 DP 103768 LOT 2 DP 149506 PT ALLOTS 58 59 178 179 WAIUKU WEST PSH.

The existing property is 139.91 Ha in area. Proposed Lots 1-5 will be between 4000 and 8500m².

The legal description of the Lots in the subdivision will change once subdivision approval is granted.

2.2 Existing reports

Gibbons Civil Engineering (GCEL) has no knowledge of any existing geotechnical, wastewater or stormwater reports which cover proposed Lots 1-5 on the property.

2.3 Architectural drawings

Survey plans of the proposed subdivision have been provided by The Surveying Company. These plans are dated October 2020 and have the reference number J1036.

Should the proposed building platform locations move from the areas shown on the attached plans (Appendix B), then further investigations may be required and GCEL shall be contacted for comment.



3. Desktop Studies

There are no limitations for site access for the proposed Lots, with existing farm gates providing access to the Lots off Maioro Road.

Desktop studies show all 5 Lots are covered in English grasses and have no identifiable soil or slope instabilities identified at the location of the building platforms.

Proposed Lots 1 and 2 are on flat to gently sloping ground with slopes less than 4 degrees towards the north-east. No overland flow paths or potential flood areas were identified on these Lots. There are no steep slopes directly bordering the proposed Lots.

The proposed building platforms for Lots 3 and 4 are flat to gently sloping with slope angles of less than 5 degrees. Across the building platform areas (1000m²) there is some undulation in the topography. There is a steep bowl-shaped feature with associated flow path located to the east of Lot 3. This steeply sloping area shows signs of erosion and soil creep. The topographical feature is located approximately 20m from the edge of the building platform on Lot 3 and will not adversely impact any building platform on the Lot. There is also steeply sloping ground along the northern boundary of Lot 4. The ground along the boundary slopes

at an angle greater than 30 degrees. This slope will not adversely effect the proposed building platform area.

The building platform area on Lot 5 slopes towards the north to east at a maximum angle of 12 degrees. Directly north-west of the building platform area there is steeply sloping ground >30 degrees into an area of bush. The ground at this location has soil creep and erosion present. No large scale or deep-seated instabilities were noted at this location. There is an overland flow path running towards the north. The flow path is located near the eastern boundary of the Lot. The wastewater disposal areas for Lots 4 and 5 are setback from this overland flow path.

As described in section 7 & 8 of this report, stormwater can be managed within the proposed Lots or natural receiving environment and there are also suitable areas to manage wastewater on each proposed Lot.

3.1 Aerial Photographs

Historic aerial photos reviewed for this site are from Retrolens Historical Image Resource and Google Earth.

- Retrolens images date from 1942 to April 2004.
- Google Earth Imaging is available from May 2004 to August 2020.

The historic photos show:

- The property has been used for farming from at least 1942, with the Lots covered in grasses at this time. It does not appear that slopes and features bordering the building platforms have changed shape or moved from images during 1942. The land at the proposed building platform areas shows no signs of instability.
- Recent Google Earth aerial images do not show any movement to land at the proposed building platforms or any significant movements on steeper slopes bordering building platform areas. No deep-seated or large-scale instabilities were identified.

For current conditions refer to section 4 of this report.

3.2 Council GIS review

A review of council GIS shows:

- The Lots on the property are raised above potential flood levels in the wider Aka Aka/ Otatau area.
- There is an overland flow path near the eastern boundary of Lot 5, which runs to a stream north of the Lots. The wastewater field areas have suitable setbacks from the overland flow path.
- The land at the location of the building platforms is gently to moderately sloping with no soil or slope instability features identified.

3.3 Regional Published Geology

The published soil geology is from a GNS science 1:250000 geological map which has given the soil designation of Pad.

These are mainly dune sands of the Awhitu Group of Coastal Sediments.

The soils are described as cemented dune sands and associated facies.

The soils are of the Pliocene Era and are approximately 5.3 million years old.

Onsite investigations confirm the published geology, however, predominantly silts and clays were encountered rather than sands, the soils are likely to become sandier at deeper depths.

3.3.1 Published Fault Information

GNS science does not identify any published faults in the wider Awhitu Peninsula, undiscovered faults still have the potential to be located within the area.

Buildings must be built in accordance with the building code and NZS3604 for timber framed buildings. Flexible pipe connections are also recommended to allow for any minor movements.

3.4 Liquefaction assessment

The soils encountered are elevated, very stiff, mature silty clay deposits >5 million years old. Groundwater was also not encountered. Therefore, the risk of liquefaction is low and no specific design considering liquefaction is required for the foundations.



4. Site investigations

The soils encountered during the geotechnical investigation consist predominantly of very stiff, silty Clay soils with good in-situ shear strengths.

Even though inferences have been made about the nature and continuity of soils across building areas on the five Lots from isolated boreholes, there is the potential for soil characteristics and strengths to vary from the confirmed borehole testing. Gibbons Civil Engineering Ltd shall be contacted should the soil strengths or characteristics at earthworks stage of developments differ from the soil conditions logged during the investigation.

4.1 Scope of Works for Site Visit and Testing

The site was visited on the 21st of December 2020 to inspect the land contour, the soil conditions, and to undertake a soil profile using a hand auger kit.

Geotechnical testing has been carried out at the proposed building platform areas for proposed Lots 1-5. The locations of the boreholes within the subdivision are shown on the attached geotechnical site plans (Appendix B). The locations for the tests were measured off existing boundaries and site features.

In situ Shear strength and reform values were measured in 0.3-0.5m intervals using an IANZ calibrated hand-held shear vane #2938. The testing was done in accordance with the NZ Geotechnical Society Inc (NZGS) testing procedures titled '*Guidance for Handheld Shear Vane Test*' dated August 2001.

Logging of soils was completed by an engineering geologist using guidance given in the NZGS Soil Field Guide Sheet.

Two geotechnical boreholes were carried out across the proposed building platform areas for each of the five proposed Lots to a depth of 1.5m. These boreholes were sunk to assess the underlying soil characteristics and strengths and to check for any ground water which could impact on the proposed development.

The borehole test results are shown in Appendix C. The locations of the boreholes are shown on the geotechnical site plan (Appendix B).

4.2 Site conditions from walkover

The site visit/walkover revealed that the site characteristics and features identified from desktop studies in section 3 of this report are accurate. No soil or slope instabilities were identified at any of the five building platform areas.

4.3 Boreholes – Soil characteristics

Topsoil depths measured across the proposed building platform areas for the five Lots were recorded as being 100-200mm in depth. The topsoils are brown and silty. All topsoils were dry during the site visit.

Underlying the topsoil layer, the soils have been classified as silty Clay soils. The soils are orange-brown or yellow brown in colour. The soils are also very stiff, dense, and slightly plastic. The soils become plastic at a depth of approximately 1m.

At various depths across the building platform areas there are orange, red and grey streaks present; however, at a depth of between 1 and 1.3m the soils often become a red colour with grey streaks present.

The soils encountered within the profile were dry until a depth of between 0.8 and 1.1m, where the soils then became moist. No wet soils or groundwater was encountered during the site visit and is not expected to be encountered until depths greater than 3m, due to the elevated position of Lots in the subdivision.

No inference on the type of soils or the bearing capacity is made outside of the proposed building platform area for each Lot as shown on the attached geotechnical site plan (Appendix B). Should the proposed building platforms change and move away from the area shown in the geotechnical site plan, then further geotechnical investigations may be required.

The soils at the location of the proposed building platforms are not considered 'good ground' under NZS 3604 due to the presence of expansive soils (M class). Good ground is achieved in terms of soil bearing capacity and stability conditions.

Lot #	Max depth drilled (m)	Insitu Shear Strength range (kPa)	Remoulded Strength range (kPa)
1	1.5	106-195+	30-140
2	1.5	173-195+	38-101
3	1.5	120-195+	28-109
4	1.5	136-195+	40-128
5	1.5	160-195+	45-117

Table 1: Shear Vane Results

The full soil results are shown on the attached bore logs (Appendix C).

4.4 Soil Classification for foundation design

The site shrink/swell soil classification is moderately expansive (Class M) as per B1 of the New Zealand Building Code and AS 2870.

- The characteristic vertical movement of Class M soils are expected to be in the range of 22 to 44mm (B1 amendment 19 cl3.2.4).
- All building foundations are to be designed by a Chartered Professional Engineer to allow for expansive soil.

- The characteristic vertical movement of soils could be higher for buildings which are close to trees (within a distance of 1.5 times the mature height of the tree). This applies regardless, whether the existing trees are retained or removed. The foundation design engineer should make allowance for this. Design guidance is given in AS2870 Appendix H.

The site subsoil classification in accordance with 5.3.3 of NZS 3604 is C.



5. Earthworks

No earthworks have recently been carried out within the proposed building platforms for Lots 1-5. Historical earthworks were also not evident from desktop investigations at the building platform areas.

Earthworks within the subdivision must be completed during the summer works period to avoid any complications caused by increased moisture within the soil profile. To ensure the stability of the soil and site no earthworks are to be undertaken during the "winter works" time period, unless approved and supervised by a Chartered Professional Engineer (an experienced Civil or geotechnical engineer PEngGeol) who is familiar with the contents of this report.

At earthworks stage Gibbons Civil Engineering Ltd shall be contacted should the underlying soils differ in type or strength from the soils mentioned in this report. The location of the proposed building platform areas is shown on the attached geotechnical site plans (Appendix B).

General requirements:

- Any earthworks within the building foundation or over 0.5m in height must be supervised by a suitably qualified engineer.
- Any earthworks carried out on slopes over 10 degrees must be benched to provide a level platform for fill material.
- Cut and fill batters shall have a maximum angle of **1V:3H** (18 degrees). Should this batter angle not be able to be achieved (depending on house and site configuration), then some retaining will be required with slope angles cut back behind the retaining wall.
- All cut and fill must be observed by a suitably qualified engineer with the building platform to reach a minimum allowable bearing strength of 100kPa.
- The earthworks contractor must confirm the construction timetable with the observation engineer prior to any works commencing.
- No stormwater to be discharged into the ground within 5m of the building platforms as the presence of water may lead to instabilities and a shrink/ swell behaviour within the soils.

5.1 Building Platforms for Lots 1-5

The proposed building platforms for Lots 1-5 are on gently to moderately sloping topography covered in grasses with no soil or slope instabilities. These building platforms have maximum slope angles of 12 degrees. The building platforms on these Lots are raised above potential flood levels.

The silty Clay soils underlying the building platforms have suitable bearing strengths and characteristics for supporting residential foundations without significant ground improvements required.

All topsoils at the building platforms and 1m outside the perimeter of the foundations must be removed.

Cut and fill earthworks procedures will also likely be required for these building platforms to create level building areas for future dwellings to be situated on. Cut and fill limitations are covered in section 5.2, some retaining may also be required depending on future development plans.

5.2 Cut/Fill

In areas where engineered fill is to be placed to carry building loads, all earthworks procedures and compaction testing are to be carried out in accordance with NZS4404 and NZS4431.

Batter requirements:

- All un-retained cut/fill batters shall be not steeper than 1V:3H.
- Fill batter faces shall be compacted as a separate operation or, alternatively, overfilled and cut back.
- The maximum unsupported cut batter is 1.5m in vertical height.
- The maximum unsupported engineered fill level is 0.6m in vertical height.
- The maximum supported cut/fill level is 2.5m.
- If higher earthwork levels are required, then further analysis will be needed to be done by a Chartered Professional Engineer prior to any earthworks being carried out.

We strongly advise that retaining walls shall be designed by a Chartered Professional Engineer if they are:

- Over 1m in height.
- Within 1m of a boundary line.
- Subject to surcharge such as driveways, pools, buildings, or sloping ground behind the wall.
- In the path of an Over Land Flow Path (OLFP).

5.3 Earthworks limitation

Earthworks must not exceed the engineering guidelines in this report (section 5). No extension to the parameters of this report either by un-retained cut or fill depths are to be undertaken without written approval from the Council and with additional engineering from a suitable Chartered Professional Engineer. The work undertaken in this report considers the current condition of the site and any additional works need to be further reviewed by a professional engineer.

5.4 Environmental considerations

At all times environmental considerations must be followed during the development including silt control measures when near neighbouring properties, slopes, creeks, overland flow paths, streams, estuary's, or other waterways. Silt control measures must meet applicable Council guidelines.



6. Building Foundations

The As discussed in section 4, the soils have excellent bearing strengths and are suitable for the proposed development.

The soils at the location of the proposed building platforms on Lots 1-5 are not considered 'good ground' under NZS 3604 due to the presence of expansive soils (M class). Good ground is achieved in terms of soil bearing capacity and stability conditions.

The building platform areas are suitable for conventional concrete slab, concrete raft (pod-floor) and timber pile foundations.

Foundations shall be designed by a Chartered Professional Engineer who is familiar with the contents of this report.

6.1 Design requirements for dwellings

Concrete slab and raft foundations shall be designed to an allowable bearing strength of 100kPa. All cut and fill at the location of the building platforms and 1m outside the perimeter of the buildings shall be compacted to an allowable bearing strength of 100kPa.

For drilled or driven timber pile foundations, the depth of the pile shall be embedded a minimum of 600mm below topsoil. Anchor piles shall be imbedded to a minimum depth of 900mm below the topsoil layer.

The foundations shall be designed for expansive soils per section 4.4 of this report.

6.2 General Geotechnical Parameters Lots 1-5

For foundation and general design purposes, the soil parameters are assessed as:

Minimum In-situ shear strength measured onsite	106kPa
Apparent Internal Angle of Friction	$\phi' = 30$
Soil Unit Weight	$\gamma = 18 \text{ kN/m}^3$
Ultimate Bearing Capacity	$q_{ult} = 300 \text{ kPa}$
Allowable Bearing Capacity (F.O.S = 3)	$q_{allow} = 100 \text{ kPa}$
Cohesion	$C' = 5 \text{ kPa}$

For piles, skin friction shall not be relied upon for a depth of 1.15 m below ground level as per AS 2870 G5.3.

6.3 Adverse effects on foundations

Foundations can be adversely affected by an excessive change in moisture within the vicinity of the foundations. To ensure that the foundations perform satisfactorily for the life of the buildings, it is recommended to:

- Ensure the underlying soils remain covered with topsoil or paving.
- Avoid excessive watering near the foundations.
- Not plant trees within a distance of 1.5 times the mature height of the tree.
- Maintain drainage and plumbing with guttering.
- No Soakage systems to be located within 5m of the foundations.

6.4 Stormwater roof runoff

To ensure that the ground is not saturated around the foundations for the proposed building, the roof guttering shall be connected and operational as soon as the roof is in place. This is to

ensure that the ground within the vicinity of the building is not compromised by the negative effects and potential consequences of soil saturation.



7. Stormwater Management for Subdivision

Stormwater disposal for Lots 1-5 shall follow the operative District & Regional Plans and the Building Code. In summary this requires the following:

- Hydrogeological neutrality for all new developments should be provided for within the Lot boundaries and within the receiving environment (such as overland flow paths and wetland areas). In addition, the disposal of stormwater should not provide a nuisance to neighbouring properties.
- Stormwater should be designed and managed in such a way as to avoid unloading of uncontrolled stormwater onto or near slopes causing erosion to earthworks batters, retaining walls, effluent disposal areas and building structures. No stormwater to be discharged onto steep slopes bordering the building platform areas.
- As there is no public reticulated water or stormwater system the stormwater should be directed to orifice-controlled water tanks with a detention and retention volume within the Lots boundaries. Overflow from the tanks shall be directed to a controlled outlet such as rock riprap outlet, spreader bar or soakage trench.
- Stormwater should be managed in such a way as to have no significant effect on overall soil stability conditions.
- Specific storm water assessments carried out by a suitably qualified engineer will be required for the roof and any impervious driveway areas for the buildings within each new Lot once a full set of architectural plans have been prepared..
- The down pipes for the new roof area shall be operational as soon as the roofs are in place to eliminate any impact of uncontrolled flows from the new development.



8. On-site Effluent Disposal Design Requirements

Lots 1-5 have suitable areas for a package plant home aeration type system (AWTS). The on-site effluent disposal should be specifically designed using an aerial loading rate of 3-5mm or otherwise as given in NZS 1547. Onsite wastewater assessments shall be carried out by a suitably qualified engineer for each Lot at the building consent stage.

The package plant home aeration type system with shallow pressure compensating dripper irrigation (PCDI) is appropriate for the Lots in the subdivision. Other systems and methods of waste water disposal such as E.T.S Beds may also be suitable and shall be at the discretion of the suitably qualified engineer designing the specific waste water system at building consent stage.

The PCDI distribution method incorporates a series of dripper lines placed within appropriate planted gardens, bush areas, and low traffic lawn areas.

The proposed area for the wastewater treatment is flexible, however a suitable area is shown on the attached geotechnical plans for each Lot (Appendix B). The soil category is 3 as per NZS 1547.

The effluent disposal area is located using the following setbacks in accordance with the District/Regional Plans and NZS 1547:

- 1.5m from a property boundary.
- 5.0m from a dwelling.
- 20.0m from a water bore.
- >1.5m groundwater table clearance.
- >20m from a natural state or fisheries class
- >10m from all other surface water bodies

The following table shows an example of the required effluent disposal area for a variety of dwelling sizes using water saving fixtures. The table uses a design for secondary treatment and PDCI.

Number of Bedrooms*	Number of people	Volume per person per day**	Total daily design flow	Effluent disposal area including 50% reserve***
3	5	165 L/day	825 L/day	309m ²
4	6	165 L/day	990 L/day	375m ²

* Includes rooms such as a study, games room, library etc.

** Usage per day can vary depending on design and use of the building.

*** Area based on a loading rate of 4mm/day

The above calculation shows that at least a four-bedroom dwelling is feasible within each Lot with water saving fixtures.

Note that the calculations within this section do not consist of a full wastewater design. There are several effluent disposal systems and remedial measures which can be incorporated into a design should it be required for the building consent stage of the development.



9. Natural Hazards Risk Assessment

In accordance with Section 106 of the Resource Management Act, the following is a qualitative natural hazards risk assessment for the building platform areas as shown on the attached geotechnical site plan. The natural hazard consequence is listed by means of the overall risk matrix with the likelihood of it occurring vs the impact if it would occur

The impacts are based on the following classifications:

- VERY HIGH (20): There is a high probability that severe damage to the proposed house site could arise from an identified source without appropriate remedial action
- HIGH (15-16): The proposed house site is likely to experience significant damage from an identified source without remedial action
- MODERATE (8-12) It is possible that damage could arise to the proposed house site, but it is unlikely that such damage would be significant
- LOW (4-8) It is possible that damage could arise to the proposed house site from an identified source though this is likely to be mild or unlikely
- NEGLIGIBLE (1-3) The presence of the identified source does not give rise to the potential to cause significant damage to the proposed house site

Risk Matrix:

	Likelihood				
Severity	Improbable	Unlikely	Possible	Likely	Highly probable
Severe	4	8	12	16	20
Moderate	3	6	9	12	15
Minor	2	4	6	8	10
Negligible	1	2	3	4	5

Site specific natural hazards:

Hazard	Comment	Likelihood	Severity	Impact
Ground subsidence	Foundation to consider soil expansivity. Soils have excellent bearing strengths and are not prone to subsidence.	Unlikely	Severe	8
ULS earthquake	Design building to B1. No recently active faults, refer section 3.3.1	Unlikely	Severe	8
Slope instability	No slopes >12 degrees for the building platforms on Lots 1-5. Some steeper slopes bordering building areas present.	Unlikely	Severe	8
Liquefaction	Very stiff, mature silty Clay soils with no faults or groundwater means risk is low	Improbable	Moderate	3
Volcanic eruption/ash fall	No nearby active volcanoes	Improbable	Moderate	3
Tsunami	Site is remote from sea	Improbable	Severe	4
Flooding	The Lots are raised above flood levels in the area.	Unlikely	Moderate	6

Final Result Value = 8: Moderate impact.

This risk decreases with the recommendations in this report. Future foundation designs need to follow the recommendations within the report. The foundations also need to be designed by a Chartered Professional Engineer for M class expansivity as per section 4.4.

The proposed house sites satisfy Section 106 of the Resource Management Act.

Conclusions and Recommendations:

- 1. As stated in this report the suitable building platform areas for Lots 1-5 shown on the Geotechnical Plan will be suitable for development upon completion of earthworks on the property. The recommended work ensures that the site remains stable within the required parameters. If changes are made to the scope of the proposed work a suitably qualified Chartered Professional Engineer (CPEng) or PEngGeol is required to approve the changes. All recommendations in this report are to be complied with. Particular attention shall be given to the earthworks section (5) and foundations section (6).**
- 2. The building foundations on each Lot are suitable for concrete slab, concrete raft (Pod Floor) and timber pile foundations. The building foundations are to be designed and inspected by a Chartered Professional Engineer to allow for expansive soil, as per section 4.4 of this report.**
- 3. Silt control measures must be put in place and meet applicable Council guidelines**
- 4. All future dwellings must be built within the suitable building platform areas identified in the attached Geotechnical plans. Further geotechnical investigations may be required if the dwellings are moved outside of this area. Gibbons Civil Engineering Ltd may be contacted for approval.**
- 5. To ensure that the foundations perform satisfactorily for the life of the buildings, changes in soil moisture near the foundations should be controlled as per section 6.3 and 6.4 of this report. Stormwater from roof areas of the proposed buildings shall not be discharged onto or into the ground within 5m of the buildings**
- 6. Specific engineering design for both waste water and storm water will be required for building consent on each Lot. These designs shall comply with section 7 and 8 of this report.**

Limitations

This report has been prepared solely for the benefit of our client with respect to the brief given to us and may not be relied upon in other contexts or for any other purpose without prior review and agreement with the author of this report.

During excavation and construction, the site should be examined by an engineer competent to judge whether the exposed subsoils are compatible with the inferred conditions on which this report has been based. The author of this report can provide this service to supply continuity for this project.

It is important that if any changes are made to the design or construction of the proposed development then the author shall be contacted. Extensive changes to the design will make this report null and void.

No liability is accepted by this firm or its director, servants or agents, in respect of its use by any other person, and any other person who relies upon information contained herein does so entirely at their own risk.

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The assessment has been undertaken for the proposed site location. Any changes to the proposed location should be checked by a suitably qualified Chartered Professional Engineer.

The information provided within this investigation is valid for two years from the date provided due to ongoing changes with the Council requirements. After this time the author should be contacted to confirm the validity of the information provided in relation to the future project or whether further investigation is required.

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Appendix A – background information

Locality plan and geological map

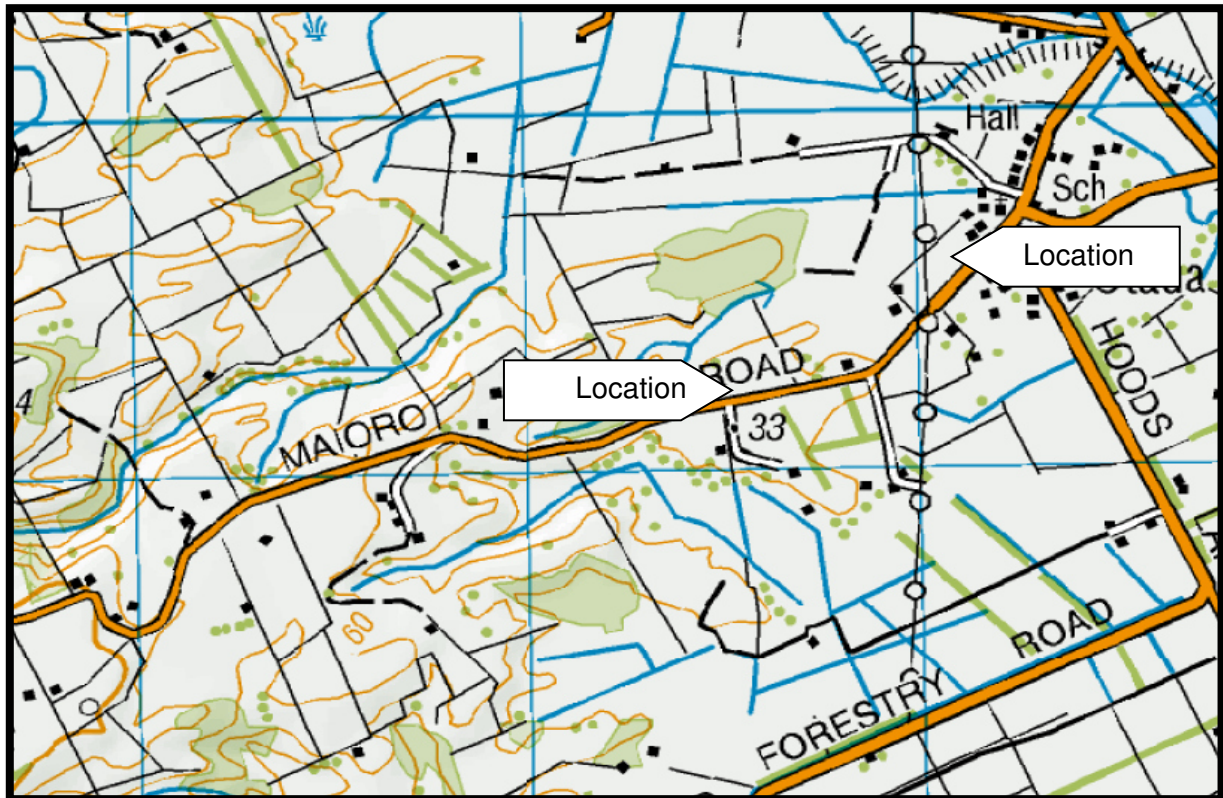


FIGURE 1: TOPO50 MAP AND SITE LOCATION

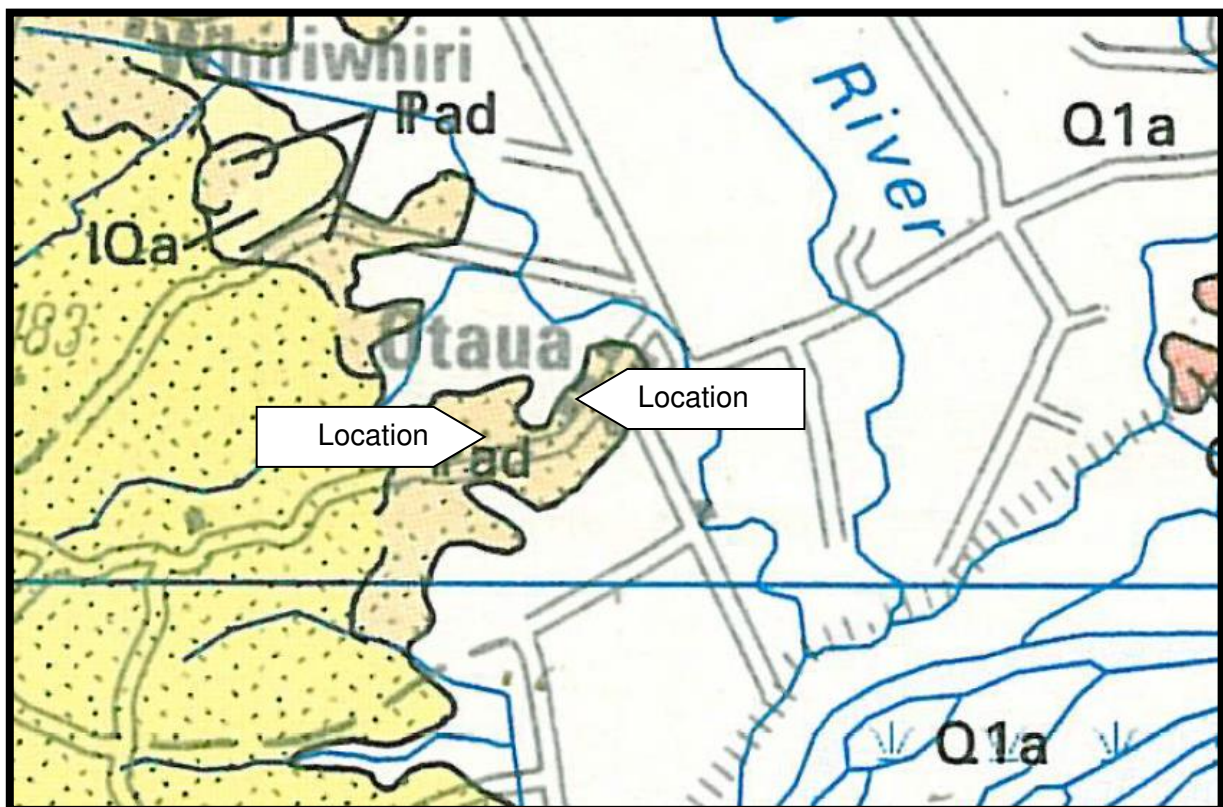


FIGURE 2: GEOLOGICAL MAP AND SITE LOCATION

Site photographs



Figure 3: View south-west across proposed Lot 1 & 2.



Figure 4: View south-west across the building platform for Lot 3.

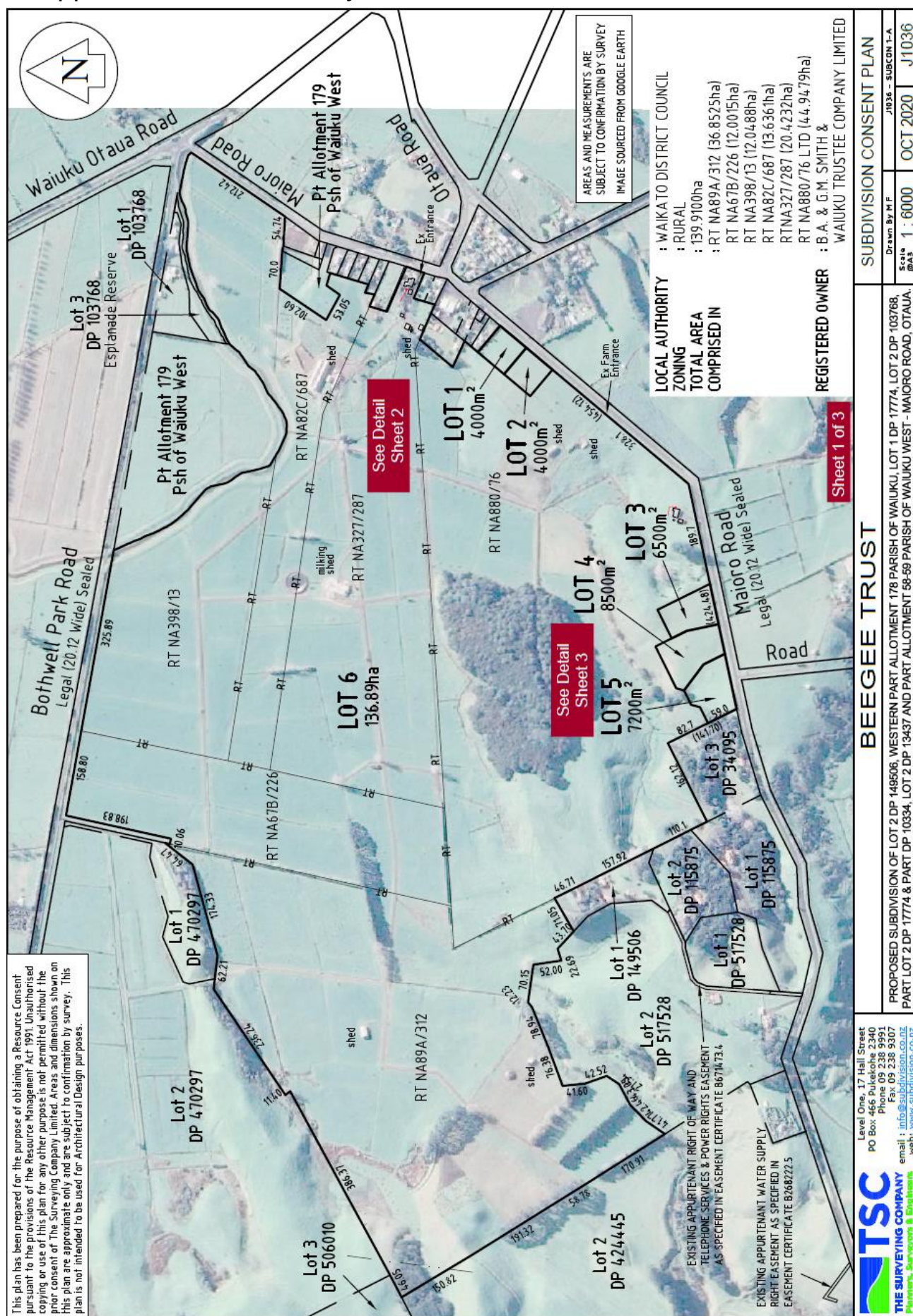


Figure 5: View north-east towards Lot 4.

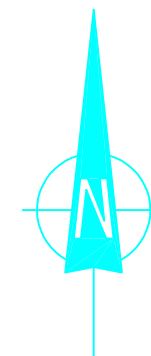


Figure 6: View south-west towards the building platform for Lot 5.

Appendix B – Site Survey Plan



Geotechnical Site Plans



Please refer to recommendations in report for full list of requirements

Please refer to final survey plan for accurate site layout. Site layout shown is indicative only.

If in doubt, Please ask.

GIBBONS CIVIL
ENGINEERING LTD
info@gcelimited.co.nz



Designed By Ryan Dixon
Drawn By Ryan Dixon
Approved By Talitha Gibbons
Project Name and Address
Subdivision at 124
Maioro Road
Otatau

Date 11/01/2021 Scale
Sheet 1.5:1@A3
Geotechnical Site Plan

R2020/793

Suitable waste water disposal field areas (250m²) + 50% reserve areas (125m²). Refer to report for more wastewater details. Location of fields may be changed when gaining building consent. Specific onsite wastewater design required as part of building consent application.

LOT 1

HA01

HA02

LOT 2

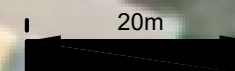
HA03

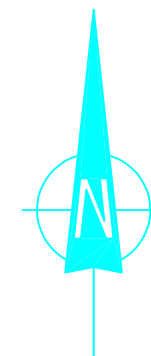
HA04

Suitable building platform areas. Should this location change, then further investigations may be required.

Flat to gently sloping land with no soil or slope instabilities

Approximate boundary lines. Please refer to survey plan.





Please refer to recommendations in report for full list of requirements

Please refer to final survey plan for accurate site layout. Site layout shown is indicative only.

If in doubt, Please ask.

GIBBONS CIVIL
ENGINEERING LTD
info@gcelimited.co.nz



Designed By Ryan Dixon

Drawn By Ryan Dixon

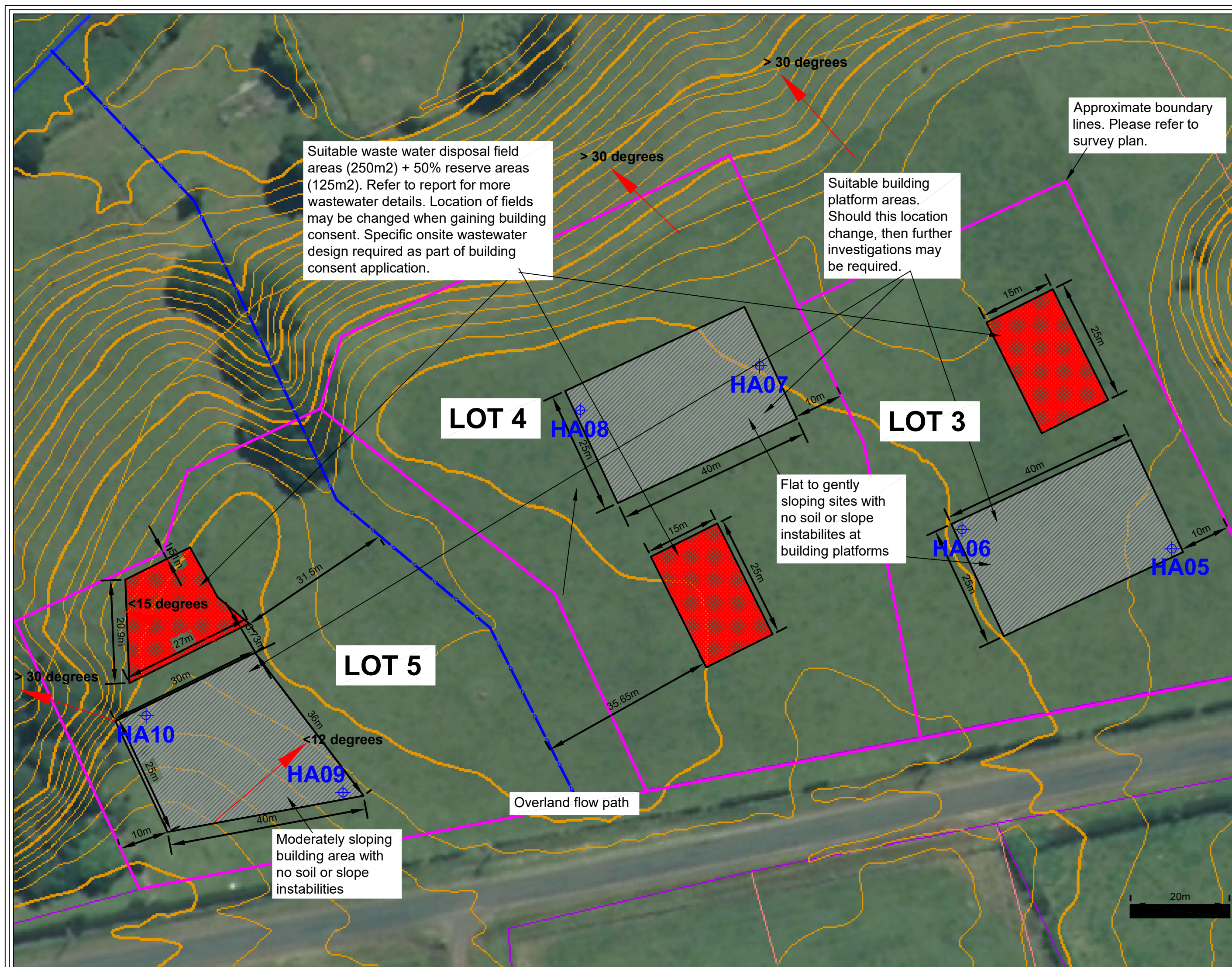
Approved By Talitha Gibbons

Project Name and Address
Subdivision at 124
Maioro Road
Otatau

Date 11/01/2021

Scale 1.5:1@A3
Sheet Geotechnical Site Plan

R2020/793



Appendix C – Results

Bore Logs



SOIL BORE LOG

GIBBONS CIVIL ENGINEERING LTD	Job number: R2020/793	Location: Suitable Building Area
112 Cameron Road, Waiuku	Client: Beegee Trust	Equipment: SV#2938
info@gcelimited.co.nz	Address: Lot 1 Maioro Road, Otatau	Augered by: RD
Phone: 09 600 2332	Drilling Method: Hand Auger	Checked by: RD
	Investigation Date: 21/12/2020	Bore No: HA01

COMMENTS

Soil Type	Depth (m)	Soil Symbol	Munsell Chart Number	Material Description	Soil Moisture	Ground Water Level	Scala Penetrometer Test (blows/150mm - kPa)	Field Shear Vane Test results / Reform (kPa)
	0.1			Topsoil, brown, silty	dry			
	0.2			Silty CLAY, orange brown, very stiff, slightly plastic, dense. Silica present.				106/30
	0.3							
	0.4							
	0.5				dry			
	0.6							
	0.7							195+/44
	0.8							
	0.9			Red streaks, plastic				
	1				moist			
	1.1							
	1.2							195+/80
	1.3			Becoming red with grey streaks				
	1.4				moist			
	1.5			EOB - No ground water, target depth reached				195+/117



SOIL BORE LOG

GIBBONS CIVIL ENGINEERING LTD

112 Cameron Road, Waiuku

info@gcelimited.co.nz

Phone: 09 600 2332

Job number: R2020/793

Client: Beegee Trust

Address: Lot 1 Maioro Road, Otatau

Drilling Method: Hand Auger

Investigation Date: 21/12/2020

Location: Suitable Building Area

Equipment: SV#2938

Augered by: RD

Checked by: RD

Bore No: HA02

COMMENTS

Soil Type	Depth (m)	Soil Symbol	Munsell Chart Number	Material Description	Soil Moisture	Ground Water Level	Scala Penetrometer Test (blows/150mm - kPa)	Field Shear Vane Test results / Reform (kPa)
	0.1			Topsoil, brown, silty	dry			
	0.2			Silty CLAY, orange brown, very stiff, slightly plastic, dense. Silica present.				195+/56
	0.3							
	0.4							
	0.5				dry			
	0.6							195+/53
	0.7							
	0.8							
	0.9							
	1.0			Bright orange, plastic	moist			
	1.1			Grey streaks				
	1.2			Red with grey streaks				195+/66
	1.3							
	1.4				moist			
	1.5			EOB - No ground water, target depth reached				195+140

Disclaimer Soil type and strength only applicable at location of bore hole.

produced by ESlog.ESdat.net on 23 Dec 2020



SOIL BORE LOG

GIBBONS CIVIL ENGINEERING LTD

112 Cameron Road, Waiuku

info@gcelimited.co.nz

Phone: 09 600 2332

Job number: R2020/793

Client: Beegee Trust

Address: Lot 2 Maioro Road, Otua

Drilling Method: Hand Auger

Investigation Date: 21/12/2020

Location: Suitable Building Area

Equipment: SV#2938

Augered by: RD

Checked by: RD

Bore No: HA03

COMMENTS

Soil Type	Depth (m)	Soil Symbol	Munsell Chart Number	Material Description	Soil Moisture	Ground Water Level	Scala Penetrometer Test (blows/150mm - kPa)	Field Shear Vane Test results / Reform (kPa)
	0.1			Topsoil, brown, silty	dry			
	0.2			Silty CLAY, orange brown, very stiff, slightly plastic, dense. Silica present.				195+/38
	0.3							
	0.4							
	0.5				dry			
	0.6							
	0.7							178/61
	0.8			Red streaks				
	0.9							
	1			Red with grey streaks, plastic	moist			175/82
	1.1							
	1.2							
	1.3							
	1.4				moist			
	1.5			EOB - No ground water, target depth reached				195+/77



SOIL BORE LOG

GIBBONS CIVIL ENGINEERING LTD

112 Cameron Road, Waiuku

info@gcelimited.co.nz

Phone: 09 600 2332

Job number: R2020/793

Client: Beegee Trust

Address: Lot 2 Maioro Road, Otatau

Drilling Method: Hand Auger

Investigation Date: 21/12/2020

Location: Suitable Building Area


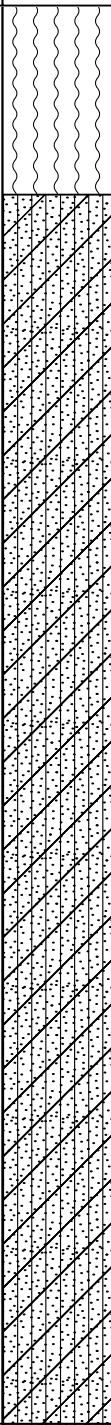
Equipment: SV#2938

Augered by: RD

Checked by: RD

Bore No: HA04

COMMENTS

Soil Type	Depth (m)	Soil Symbol	Munsell Chart Number	Material Description	Soil Moisture	Ground Water Level	Scala Penetrometer Test (blows/150mm - kPa)	Field Shear Vane Test results / Reform (kPa)			
	0.1			Topsoil, brown, silty	dry			195+/40			
	0.2			Silty CLAY, orange brown, very stiff, plastic, dense. Silica present.	dry						
	0.3										
	0.4										
	0.5								Red and grey streaks	moist	
	0.6										
	0.7										
	0.8										
	0.9			Red with grey streaks	moist						
	1										
	1.1										
	1.2										
	1.3			EOB - No ground water, target depth reached							173/43
	1.4										
	1.5										



SOIL BORE LOG

GIBBONS CIVIL ENGINEERING LTD 112 Cameron Road, Waiuku info@gcelimited.co.nz Phone: 09 600 2332	Job number: R2020/793 Client: Beegee Trust Address: Lot 3 Maioro Road, Otaua Drilling Method: Hand Auger Investigation Date: 22/12/2020	Location: Suitable Building Area Equipment: SV#2938 Augered by: RD Checked by: RD Bore No: HA05
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COMMENTS

Soil Type	Depth (m)	Soil Symbol	Munsell Chart Number	Material Description	Soil Moisture	Ground Water Level	Scala Penetrometer Test (blows/150mm - kPa)	Field Shear Vane Test results / Reform (kPa)
	0.1			Topsoil, light brown, silty	dry			
	0.2			Silty CLAY, orange brown, very stiff, slightly plastic, dense.				120/28
	0.3							
	0.4							
	0.5			Orange streaks	dry			
	0.6							
	0.7							195+/37
	0.8			Becoming red with grey streaks				
	0.9							
	1			Plastic	moist			
	1.1							195+/51
	1.2			Bright orange				
	1.3							
	1.4				moist			
	1.5			EOB - No ground water, target depth reached				195+/69



SOIL BORE LOG

GIBBONS CIVIL ENGINEERING LTD	Job number: R2020/793	Location: Suitable Building Area
112 Cameron Road, Waiuku	Client: Beegee Trust	Equipment: SV#2938
info@gcelimited.co.nz	Address: Lot 3 Maioro Road, Otatau	Augered by: RD
Phone: 09 600 2332	Drilling Method: Hand Auger	Checked by: RD
	Investigation Date: 22/12/2020	Bore No: HA06

COMMENTS

Soil Type	Depth (m)	Soil Symbol	Munsell Chart Number	Material Description	Soil Moisture	Ground Water Level	Scala Penetrometer Test (blows/150mm - kPa)	Field Shear Vane Test results / Reform (kPa)	
<div>Awbitu Group</div>	0.1			Topsoil, light brown, silty	dry			195+/32	
	0.2			Silty CLAY, orange brown, very stiff, slightly plastic, dense.					
	0.3				dry			159/43	
	0.4								
	0.5								
	0.6								
	0.7				moist			195+/109	
	0.8								Grey streaks, plastic
	0.9								
	1			Bright red with grey streaks	moist				
	1.1								
	1.2				moist			195+/88	
	1.3								
	1.4								
	1.5								
			EOB - No ground water, target depth reached				195+/88		



SOIL BORE LOG

GIBBONS CIVIL ENGINEERING LTD	Job number: R2020/793	Location: Suitable Building Area
112 Cameron Road, Waiuku	Client: Beegee Trust	Equipment: SV#2938
info@gcelimited.co.nz	Address: Lot 4 Maioro Road, Otatau	Augered by: RD
Phone: 09 600 2332	Drilling Method: Hand Auger	Checked by: RD
	Investigation Date: 22/12/2020	Bore No: HA07

COMMENTS

Soil Type	Depth (m)	Soil Symbol	Munsell Chart Number	Material Description	Soil Moisture	Ground Water Level	Scala Penetrometer Test (blows/150mm - kPa)	Field Shear Vane Test results / Reform (kPa)
	0.1			Topsoil, brown	dry			
	0.2			Silty CLAY, orange brown, very stiff, slightly plastic, dense.				
	0.3							
	0.4							195+/45
	0.5				dry			
	0.6							
	0.7							195+/56
	0.8			Plastic	moist			
	0.9							
	1.0							
	1.1							
	1.2							175/56
	1.3			Grey streaks				
	1.4				moist			
	1.5			EOB - No ground water, target depth reached				146/44



SOIL BORE LOG

GIBBONS CIVIL ENGINEERING LTD

112 Cameron Road, Waiuku

info@gcelimited.co.nz

Phone: 09 600 2332

Job number: R2020/793

Client: Beegee Trust

Address: Lot 4 Maioro Road, Otatau

Drilling Method: Hand Auger

Investigation Date: 22/12/2020

Location: Suitable Building Area

Equipment: SV#2938

Augered by: RD

Checked by: RD

Bore No: HA08

COMMENTS

Soil Type	Depth (m)	Soil Symbol	Munsell Chart Number	Material Description	Soil Moisture	Ground Water Level	Scala Penetrometer Test (blows/150mm - kPa)	Field Shear Vane Test results / Reform (kPa)
	0.1			Topsoil, brown, silty	dry			
	0.2			Silty CLAY, orange brown, very stiff, slightly plastic, dense.				136/40
	0.3							
	0.4							
	0.5				dry			
	0.6							
	0.7			Plastic				195+/120
	0.8			Orange	moist			
	0.9							
	1.0							
	1.1							
	1.2							195+/128
	1.3							
	1.4				moist			
	1.5			EOB - No ground water, target depth reached				170/40



SOIL BORE LOG

GIBBONS CIVIL ENGINEERING LTD	Job number: R2020/793	Location: Suitable Building Area
112 Cameron Road, Waiuku	Client: Beegee Trust	Equipment: SV#2938
info@gcelimited.co.nz	Address: Lot 5 Maioro Road, Otua	Augered by: RD
Phone: 09 600 2332	Drilling Method: Hand Auger	Checked by: RD
	Investigation Date: 22/12/2020	Bore No: HA09

COMMENTS

Soil Type	Depth (m)	Soil Symbol	Munsell Chart Number	Material Description	Soil Moisture	Ground Water Level	Scala Penetrometer Test (blows/150mm - kPa)	Field Shear Vane Test results / Reform (kPa)
	0.1			Topsoil, brown, silty	dry			
	0.2			Silty CLAY, orange brown, very stiff, slightly plastic, dense.				
	0.3							
	0.4							195+/48
	0.5				dry			
	0.6							
	0.7			Bright orange streaks				195+/45
	0.8							
	0.9							
	1							
	1.1			Red with grey streaks, plastic	moist			
	1.2							195+/117
	1.3							
	1.4				moist			
	1.5			EOB - No ground water, target depth reached				195+/106



SOIL BORE LOG

GIBBONS CIVIL ENGINEERING LTD	Job number: R2020/793	Location: Suitable Building Area
112 Cameron Road, Waiuku	Client: Beegee Trust	Equipment: SV#2938
info@gcelimited.co.nz	Address: Lot 5 Maioro Road, Otatau	Augered by: RD
Phone: 09 600 2332	Drilling Method: Hand Auger	Checked by: RD
	Investigation Date: 22/12/2020	Bore No: HA10

COMMENTS

Soil Type	Depth (m)	Soil Symbol	Munsell Chart Number	Material Description	Soil Moisture	Ground Water Level	Scala Penetrometer Test (blows/150mm - kPa)	Field Shear Vane Test results / Reform (kPa)
	0.1			Topsoil, brown, silty	dry			
	0.2			Silty CLAY, yellow brown, very stiff, slightly plastic, medium dense.				
	0.3							195+/58
	0.4							
	0.5				dry			
	0.6							
	0.7			Becoming dense				195+/93
	0.8							
	0.9							
	1.0							
	1.1			Plastic	moist			
	1.2							160/50
	1.3			Red streaks				
	1.4				moist			
	1.5			EOB - No ground water, target depth reached				195+