



ON SITE WASTEWATER DISPOSAL ASSESSMENT REPORT

MURIWAI DOWNS GOLF

COURSE PROJECT

PROJECT:1976

Date: MARCH 2022



MCKENZIE & CO.

DOCUMENT CONTROL RECORD

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CLIENT: The Bears Home Project Management Ltd

PROJECT LOCATION: 451, 610, 614, 670, 697 Muriwai Road, Muriwai, Auckland

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APPENDIX A – MCCL ENGINEERING PLANS (Wastewater Plans Attached separately)

APPENDIX B – GEOTECHNICAL INVESTIGATIVE REPORTS

1. Introduction

McKenzie and Co Consultants Ltd have been engaged by “The Bears Home Project Management Ltd” (the Applicant) to prepare an On-Site Wastewater Disposal Assessment (WDA) report in support of the Resource Consent application for the proposed Muriwai Downs Golf Resort Project (the Project).

The aim of this report is demonstrating the viability of the proposed disposal of wastewater on site.

This report has been prepared to demonstrate how on-site wastewater disposal can be achieved including assessments of demand flows, management systems and disposal approach. It is not a detailed design of the system which will be carried out at building consent stage.

This report should be read in conjunction with the overall consent application for context

2. Property Information

The subject property is located adjacent to Muriwai Road as shown in Figure 1 below:



Figure 1 – Property Location (courtesy of Auckland Council GeoMaps)

2.1 Property Description

The property is located on Muriwai Road approximately 1.5km northwest of the Muriwai township. It is made up of several rural land parcels all accessible from Muriwai Road (see Table 1). The property's current zoning and land use is rural production and has an aggregate land area of 504ha.

The northern portion of property features land formations characterised as rolling terrain with fall generally from the more elevated southern portions near Muriwai Road towards the north boundary defining the Ōkiritoto Stream.

There are several incising gully features predominately across the west and central portions of the property which form a series of intermittent streams and wetlands all tributing into the main permanent Ōkiritoto stream along the north boundary.

This southern portion of the property falls from Muriwai Road in a north-eastern direction into three prominent gully features which also consist of intermittent streams and associated wetland features. Two main streams traverse the east and western perimeters of the main quarry operation onsite, and both join to ultimately connect into the Ōkiritoto stream to the north via an existing culvert crossing (1500Ø under Muriwai Road. The eastern most gully feature on the southern side

of site conveys the Rarataua Stream which tributes into the Ōkiritoto Stream traversing north under an existing bridge crossing under Muriwai Road near the eastern boundary.

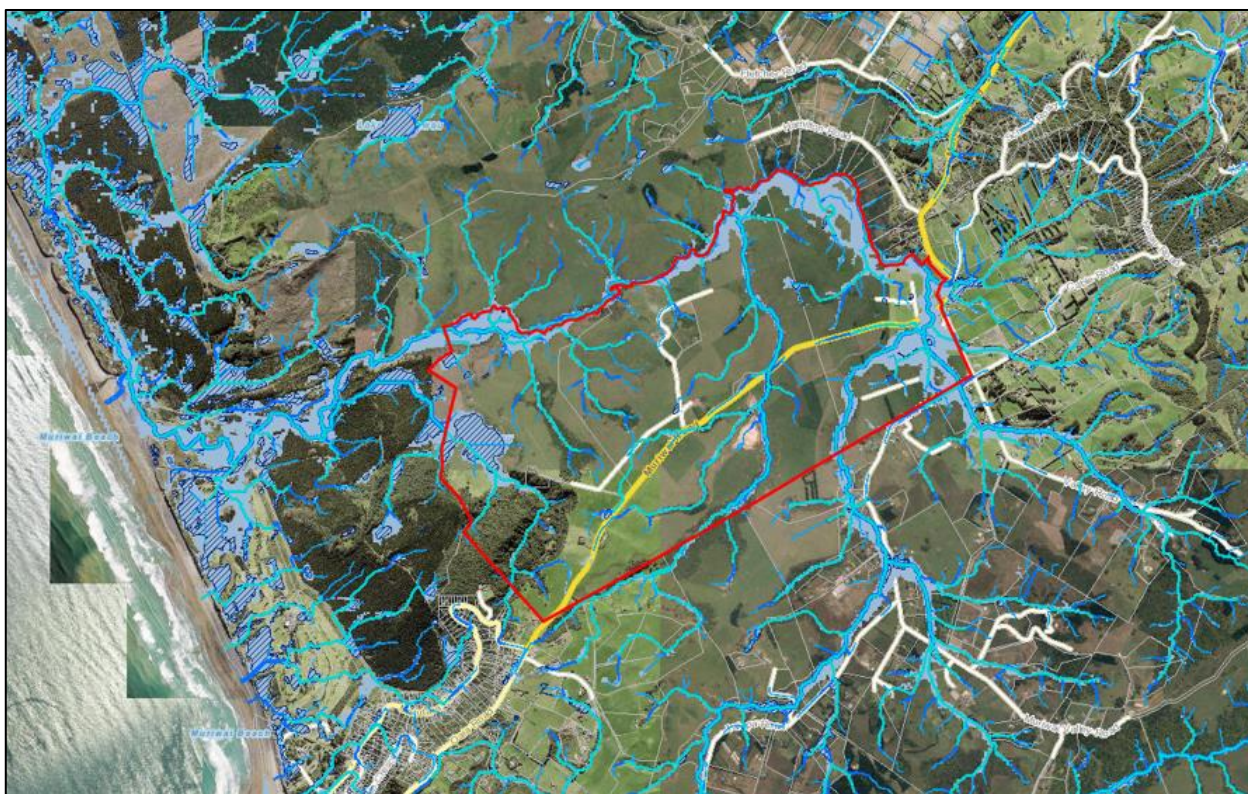


Figure 2 – Existing Overland Flow Paths

The property coverage is generally pasture and includes pockets of high value ecological resources including kauri forest, extensive wetlands (including the Ōkiritoto Wetland) and a large inland dune lake (Lake Ōkaihau). Some of these areas are denoted as Significant Ecological Areas (SEA) and Outstanding Natural Features (ONF) under the Auckland Council Unitary Plan (AUP). A Quality-sensitive Aquifer Management Area also underlies much of the property hence there are provisions in the AUP that protect the water quality of this aquifer.

Table 1 - Existing Property Summary Table

EXISTING PROPERTY SUMMARY INFORMATION	
Property Address	<ul style="list-style-type: none"> ● 451 Muriwai Road, Muriwai Valley ● 610 Muriwai Road, Muriwai Valley ● 614 Muriwai Road, Muriwai Valley ● 670 Muriwai Road, Muriwai Valley ● 680 Muriwai Road, Muriwai Valley ● 697 Muriwai Road, Muriwai Valley
Legal Description	<ul style="list-style-type: none"> ● Lot 4 DP 187060, Lot 3 DP 196479, Sec 3 SO 41485 (112.6571ha) ● Lot 2 DP 196478 (Area = 140.8011ha) ● Lot 1 DP 196478 (Area = 5.4989ha) ● Lot 1 DP 187057 (Area = 143.9175ha)

EXISTING PROPERTY SUMMARY INFORMATION

	<ul style="list-style-type: none"> Lot 1 DP 163736 (Area = 1.8781ha) Lot 5 DP 187061 (Area = 101.4371ha)
Current Land Use	<ul style="list-style-type: none"> Site predominantly utilised as pastoral land use with residential dwellings and sheds located on site.
Zone	<ul style="list-style-type: none"> Rural – Rural Production Zone
Current Building Coverage	<ul style="list-style-type: none"> N / A
Historical Land Use	<ul style="list-style-type: none"> Rural
Overlays	<ul style="list-style-type: none"> Natural Resources: Significant Ecological Area. Quality-Sensitive Aquifer Management Areas – Kaipara Sand Aquifer (rp) Natural Resources: Lake Management Areas Overlay (Natural and Urban Lake) [rp] – Lake Ōkaihou, Natural. Natural Resources: Wetland Management Overlay (Ōkiritoto Swamp and Lake Ōkaihou). Natural Resources: Natural Stream Management Area Overlay. Natural Heritage: Outstanding Natural Features Overlay [rcp/dp] – ID 225, Toroanui and Ōkiritoto Falls and Lake Ōkaihou.

Refer to Figure 2 (below) for AUP Overlay Map of the properties and surrounds:

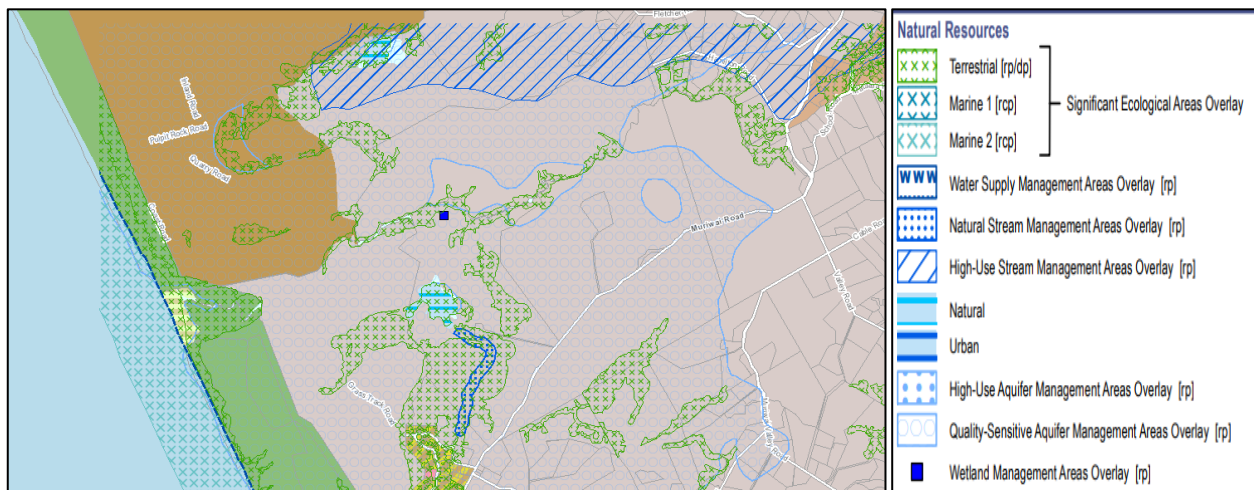


Figure 3 – Auckland Unitary Overlay Plan (Courtesy AUP GeoMaps)

2.2 Geology

Reference to NZ Geological Mapping: 1:250,000 Map of Auckland Area, refer to Figure 4 (below). The property is primarily underlain with cemented dune sands and associated facies (i.e., Awhitu Group).

Across the eastern portion of the property, there is evidence of alluvial deposits (Tauranga Group) and a small area located across the central portion to the site that is underlain with basalt flow and pillow lavas (i.e., Waiatarua Formation).

Across the northern and southern portions of the property there are small areas of volcanoclastic sandstone and siltstone (i.e., Nihotupu Formation). Towards the western portion of the property there is evidence of mobile sand dunes (i.e., Kariotahi Group).

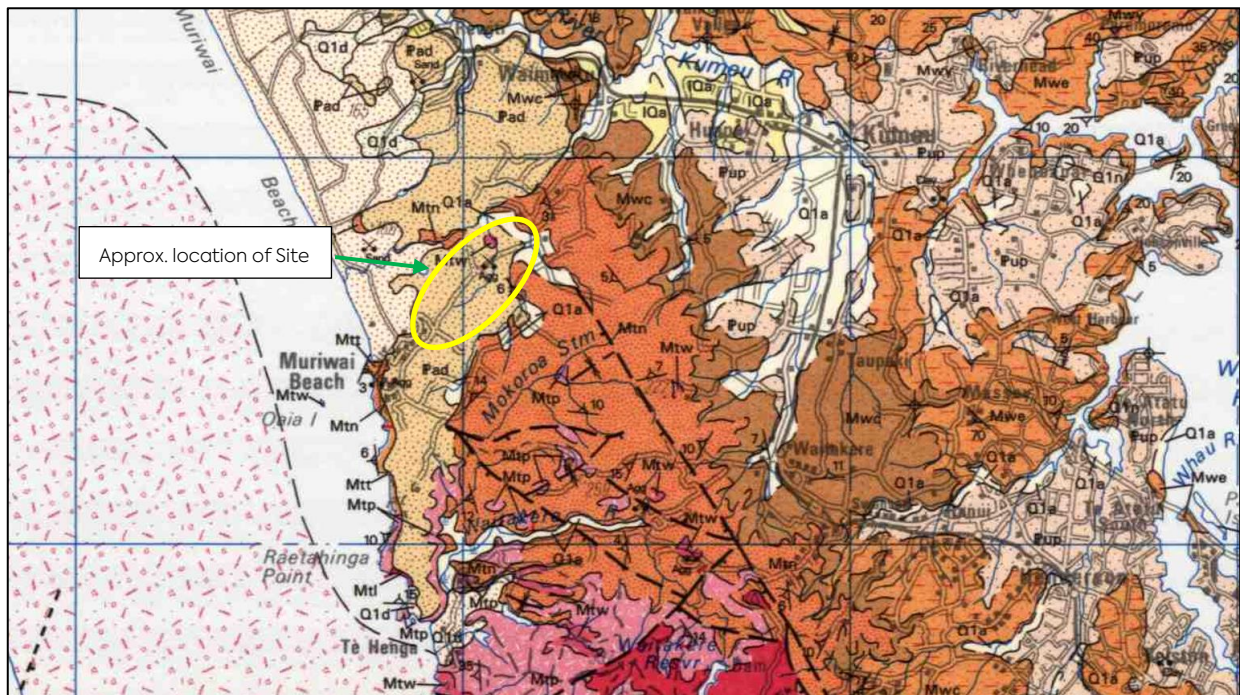


Figure 4 - Site Geology Map Auckland 1:250,000 (Courtesy of GNS)

Landers Geotechnical Consultants Ltd (LGC) have undertaken a Geotechnical Investigation to ascertain and identify any broad geotechnical constraints for the Project. LGC's particular focus for the site investigation was to assess geotechnical suitability and stability of the land earmarked for the future development of the proposed amenities earmarked for the Project. The Geotechnical Investigation Report (GIR) prepared by Landers provides further detailed information to help inform future earthworks and construction stages. See Appendix 4 of the AEE.

LGC's investigations generally encountered ground water at approx. 10-15m below ground, however this was measured during the September – October period hence higher levels could be expected through the winter period.

A further detailed geological mapping assessment was also carried out by Riley Consultants Ltd at the proposed water reservoir site located in the south-eastern corner of the site. The Geotechnical Investigation Report (GIR) prepared by Riley's provides further detailed information to help inform future earthworks and construction stages related to the water reservoir. See Appendix 4 of the AEE.

3. Development Proposal

The project comprises the construction, operation, and maintenance of the following physical site components:

- An international, marquee standard 19-hole golf course with warm-up fairway and short-game practice area.
- A clubhouse.
- A sports academy including which will comprise of an academy building, academy driving range, practice green, 9-hole short course, and indoor and outdoor tennis facilities.
- A property maintenance and operations complex.
- A luxury lodge which includes accommodation, a wellness centre and retreat facilities.
- Dining facilities will also be provided which will include separate restaurants in the clubhouse and lodge and a café at the sports academy.
- Groundwater and surface water abstraction facilities.
- Off-line water storage reservoir.
- Significant ecological restoration and enhancement works; and
- Various supporting infrastructure associated with the above items.
- Retain existing farming operations and residences (i.e., 451, 610 & 614 Muriwai Road) across the property will be retained. Onsite amenities (e.g., stormwater, wastewater, and water supply) for these properties will remain unchanged.

Refer to Figure 4 (below) and MCCL drawings 1976-500 (Appendix B) for details pertaining to the proposed development layout.



Figure 5 – Proposed Preliminary Master Plan Layout (Courtesy of Kyle Phillips Golf Course Design)

4. On-site Wastewater

The Project will result in the generation of domestic wastewater typical of offices, accommodation, and function facilities. Minor amounts of maintenance equipment wash-water are also generated at the GPMC¹. The site will not generate any industrial or trade process wastewater.

The site location is such that it cannot be connected to any public wastewater network either adjacent to the site or in near proximity. Therefore, all wastewater generated will need to be collected, treated, and disposed on site. This can be designed in accordance with the Auckland Council Technical Publication Document TP58 (i.e., current GD06).

The following outlines the key principals and overall approach adopted for wastewater management on site along with relevant references to design criteria to demonstrate overall quality and quantity outputs expected. Detail design for all wastewater management components will be undertaken at building consent stage.

4.1 Existing Onsite Wastewater

The existing conglomerate of properties that comprise the site currently cater for their own individual private onsite wastewater treatment. The applicant has no information to suggest that the current domestic discharges do not comply with the AUP and/or the previous Rodney District Plan. The onsite wastewater treatment systems associated with these existing properties are believed to be of good sound condition and operating efficiently and effectively and there is no apparent evidence to suggest otherwise.

It is our understanding that the existing properties on 451, 610 and 614 Muriwai Road will be retained as existing farm operations as part of the development proposal and hence the residential dwelling and site amenities associated with these properties will remain. The proposal will see these properties retain their existing treatment systems with no upgrades or replacement envisaged. These will not be connected to the future onsite wastewater network proposed for the future development

Decommissioning and removal of the existing onsite wastewater systems no longer required for the future development should be conducted in accordance with the Contractors CMEP and the area suitably reinstated with redundant materials disposed of at an appropriate landfill area.

4.2 Wastewater Generation

The future wastewater generation will come from a variety of locations across the site. To determine the volume of wastewater it is necessary to establish the number of people potentially at or occupying each location or amenity.

The applicant has provided total staff numbers for activities on site over seven-day period and has been assess that no more that 75% of the staff will be onsite on any given day. This has been applied to the café, clubhouse, and academy.

The volume generated as per Table 2 is considered a peak daily volume with all facilities operating

at their maximum capacity. However, it is expected that for the majority of operational days the facility will not operate at its maximum capacity.

No allowances have been made or are considered necessary to cater for infiltration and inflow as the entire network of infrastructure will be newly constructed to full industry standards.

The following table below outlines the maximum potential number of users on site and their expected average wastewater generation per day.

Table 2 – Summary Population Generation

Activity	No People	Est Daily use (L)	Total Daily use (L)	Total Daily m ³ /day	Total Vol m ³ /day
Club Rooms					
Guests ⁸	50	60	3000	3	
Staff ^{4,7}	18	40	720	0.72	
Caddies ⁵	28	60	1680	1.68	
Office					
Staff ⁷	25	40	1000	1	
Maintenance Facility					
Staff ⁶	23	60	1380	1.38	
Operation building					
Staff ⁷	30	40	1200	1.2	8.98
Sports Academy					
Academy					
Staff ^{2,7}	15	40	600	0.6	
Golf NZ ⁷	25	40	1000	1	
Guests ¹⁰	30	60	1800	1.8	
Café					
Staff ^{3,7}	7	40	280	0.28	
Guests	100	30	3000	3	6.68
The Lodge					
Main Lodge Building					
Staff ⁶	30	60	1800	1.8	
Guests ¹	52	220	11440	11.44	
Meeting Yoga House					
Guests ⁹	10	60	600	0.6	
Wellness Centre					
Guests ⁹	20	60	1200	1.2	
Accommodation (26)					
Guests ¹	52	0	0	0	15.04
Golf Course Toilets					
Toilets	100	10	1000	1	1

¹ Guests of lodge are also staying in accommodation

² Café staff 9 over week assessed as 75% total on any day

- 3 Academy staff 12 over week assessed as 75% total on any day
- 4 Club house staff 25 over week assessed as 75% total on any day
- 5 Club house 40 caddies over week assessed as 75% total on any day
- 6 Some Day staff assessed as 60l/s high water usage per TP58 Table 6.2
- 7 Standard staff assessed as 40l/s per TP58 Table 6.2
- 8 Golf Club Guests assessed as 60 l/s as per high use staff to allow for washing gear and showering per TP58 table 6.2
- 9 Wellness Guests assessed as 60l/s high water usage staff per TP58 Table 6.2
Academy Guests assessed as 60 l/s as per high use staff to allow for washing gear
- 10 and showering per TP58 table 6.2
- 11 Water saving features used in toilets as per TP 58 Table 6.2

4.3 Water Conservation Devices

We recommend full water conservation devices be incorporated into the development to minimise wastewater production, consequently some or all the following devices should be fitted. Installation of these devices can provide a savings in the order of 20–25%.

- Restricted or dual flush toilet cisterns,
- Manual or low flush sensor urinals,
- Aerators tap faucets for the bathrooms,

4.4 Auckland Unitary Plan

In accordance with the AUP – E5: Onsite & Small-Scale Wastewater Treatment & Disposal, a summary of the activity status is detailed in Table 3 below:

Table 3 – AUP Activity Status

Auckland Unitary Plan Status of Activity – E5	
Estimated Total Daily Wastewater Flow	30,700 L/d (>3,000L/d – Rule E.5.6.2.4)
Compliance with AUP (Table E5.4.1 Activity Table)	No as total daily wastewater generation exceed 6m ³ – Discretionary Activity <i>(A5) – Discharges of up to 6m³ per day of treated domestic type wastewater via a land application disposal system = RD</i>
Effluent Treatment Quality	Recommended Tertiary

5. Site Wastewater Reticulation

Collection of wastewaters on site will be via a new private on-site reticulation system comprising gravity mains that drain wastewater to private pump stations. Refer to MCCL Drawings 1976-1-500 included in Appendix B. These drawings demonstrate the indicative concept and route of the wastewater network.

The site is essentially split into two wastewater catchments with the sports academy and GPMC in the eastern part of the site gravitating to a single pump station that transfers it to the treatment and disposal area in the western part of the site.

The Lodge and Clubhouses located in the western portion of the site separately serviced in the same way.

The collection system will be privately owned but will be designed to public standards (i.e., Watercare Code of practice for Land Development and Subdivision-Wastewater) as typically used in subdivisions. For example, 150dia wastewater mains with typical 1050dia manholes and changes of direction and grade. The pump stations will be a pre-packaged plant type installed below ground and will be located more than 100m from any waterbody. The pump stations will provide 24 hours storage for their respective contributing flows (Refer Table 4).

Emergency overflows from the pump stations are not considered necessary in this instance as the inflow can be controlled and facility closed in the event of any major disruption. Detail design will be undertaken at Building Consent stage.

5.1. Wastewater Treatment Approach

Treatment of wastewater generated from the lodge, clubhouse, sports academy, and GPMC will be treated using a high-quality proprietary system appropriately designed to cater for maximum expected wastewater flows (average and maximum peak). The system will provide for primary, secondary, and tertiary treatment.

While no decisions have yet been made on the treatment system type, there are several manufacturers and installers in New Zealand who have experience with designing, installing, and maintaining these types of proprietary system. Two suppliers are being considered:

- Reflections Wastewater Treatment Solutions and
- Innoflow Wastewater Specialists.

5.2. Primary Treatment

In general, primary treatment will be achieved through a multi chambered tank system of an appropriate combined volume to provide sufficient Hydraulic Retention Time (HRT) for the expected rates of wastewater generated at the source based on section 7.2.3 of TP58. The design will also allow for some buffer storage and operational flexibility so that treatment can be brought online progressively, manage high generation peaks, slowed down during periods of lower wastewater generation such as winter months.

During low flow periods, the treatment system will have the ability to manage low incoming flows to ensure the overall system operates efficiently thus avoiding long residencies time for waste volumes to pass through the network.

Primary treatment will comprise of approximately 46m³ of storage which will provide a 1.5-day Hydraulic Residence Time (HRT). This will likely be comprised of 3 separate tanks to manage low flow periods and future maintenance.

As wastewater is to be pumped to the treatment system, incoming flows will discharge to a settling chamber prior to entering the primary treatment chamber.

5.3. Secondary Treatment

Secondary treatment will likely consist of a Textile Media treatment process in conjunction with recirculation and associated recirculation tanks. Secondary treatment assists in reducing nutrient levels within the effluent.

The textile media has been conservatively assessed to process 5,500L/10m² of textile which would require approximately 55–60m² of textile for the treatment system. It is noted that as the flows are largely domestic in nature with the added implementation of grease traps proposed at the commercial kitchens a treatment process rate of 8,000L/10m² of textile would be expected. Based on the 8,000L/10m² of textile rate a required total area of approximately 40m² will be required. This will be confirmed with the specific manufacturer at the Building Consent stage.

5.4. Tertiary Treatment

As a final component UV filtering of the final effluent is proposed prior to land disposal. This additional level of treatment is not required due to either the quality of wastewater or onsite conditions for this proposal, however the applicant is seeking to achieve a high standard of treatment prior to discharge to ground.

Treated effluent will be discharged to a holding tank for disposal to the soakage field. This tank will typically be sized to accommodate the 24 hours of peak flow storage (e.g., 30.7m³) from the system.

5.5. Disposal

Disposal of treated effluent on site will be to land via a pressure compensating dripper line network installed in a designated land disposal area adjacent to Muriwai Road near the entrance to the Lodge and Clubhouse.

Auckland Regional Council Technical Publication No 58 (TP58) has been referenced to ascertain appropriate application loading rates and dimensions for the disposal field (refer Figure 11).

Table 5.1: TP58 Soil Category Description (comparison with AS/NZS:1547 2000)

Soil Category	Soil Description TP 58 3 rd Edition	Soil Category	Soil Description AS/NZS 1547:2000.
1	Gravel, coarse sand - rapid draining	1	Gravels and sands - rapidly drained
2	Coarse to medium sand - free Draining	2	Sandy loams - well drained
3	Medium-fine and loamy sand - good drainage	3	Loams - moderately well drained
4	Sandy loam, loam and silt loam - moderate drainage	4	Clay loams - imperfectly drained
5	Sandy clay-loam, clay-loam and silty clay-loam – moderate to slow drainage	5	Light clays - poorly drained
6	Sandy clay, non-swelling clay and silty clay - slowly draining	6	Medium to heavy clays - very poorly drained
7	Swelling clay, grey clay, hardpan - poorly or non-draining		

Figure 6 – Table 5.1 – Soil Category extracted from Auckland Council TP58

Based on the findings set out in the Land Development & Engineering (LDE) Geotechnical Onsite Wastewater parameters assessment report (refer Appendix AQ), the soil category at the proposed disposal site has been categorised Soil Category 6 (i.e., slow draining). This could be revised at detail design stage with more specific testing at the disposal location.

Using a soil category of 6, a conservative application rate of 3.0mm/day is recommended. With a daily volume of approximately 30.7m³ this equates to 10,250 m² (1.03ha).

TP58 recommends that for subsurface dripper lines a minimum reserve allocation area of between 33% and 100% be provided. In this instance a total area of 1.37ha (13,650m²) has been set aside to provide an excess of the recommended 100% storage. Refer to MCCL Drawings 1976-CH1-500 & 504 included in Appendix B.

This combined with the above soil classification and the ample space available on site provides confidence that there is more than adequate space on site to provide a high performing disposal field.

The disposal field itself will be divided into sections to allow phased introduction of the site (if required) and to assist with field maintenance. The final layout will be determined in conjunction with the manufacturer and as activities go online.

The volume generated as per Table 2-Section 4.2, is considered a peak daily volume with all facilities operating at their maximum capacity and it is expected that for the majority of days the facility will not operate at its maximum capacity.

5.6. Disposal Field Location

The proposed disposal field and reserve area is shown on MCCL Drawing 1976-1-500 and 504 included in Appendix B.

The location has been chosen as it is gently sloping, readily accessible and north facing to enhance evapotranspiration (which is not required but beneficial). It also provides large setbacks (approx. 100m) from local sensitive receiving environments. We recommend that stormwater runoff should be controlled so to avoid any infiltration of stormwater into any tanks, pumps, treatment plants and disposal fields.

TP58 provides guidelines on recommended minimum separation distance from the treatment plant and disposal field. Table 4 outlines this proposal in relation to these guidelines.

Table 4 - TP58 Requirement for separations

Location	TP58 Separation Recommendation (m)	Disposal Field Separation (m)	Treatment Plant Separation (m)
Boundaries	1.5	25	100
Watercourses	15	100+	100+
Groundwater	0.6	5+	n/a
Bores	20	100+	100+
Surface Water	15	100+	100+
Buildings	1.5-3.0	100+	75+

As can be seen the proposed treatment and disposal system easily meets the guideline clearances in TP58.

The portion of land dedicated for the disposal field will also continue to be utilised for rural production. This will need to be managed in terms of livestock (i.e., sheep grazing only) to ensure suitability for grazing during periods low moisture with attention to not overgraze the area. This can be managed by monitoring the disposal field soil moisture via the installation of either lysimeters or sensors in the ground with a trigger level set at which point grazing will cease to prevent damage. Larger livestock such as cattle and horses should not be permitted to grazing within this zone of the disposal field.

It is recommended the levels of grass is maintained at maximum growth height of 150mm.

5.7. Oncourse Toilets

There are two on-course toilets proposed for the golf course. These are remote from the main treatment area therefore are impractical to connect them to the primary treatment network. It is proposed that each of these toilets will have a standalone pre-packaged domestic wastewater treatment and pump system which include primary and secondary treatment via an Aerated Water Treatment System (AWTS) and will dispose to shallow wastewater pressure compensation lines. These separate systems would typically have 24hr storage capacity however we recommend

they have 48 hours of storage and the alarm monitoring its links to the main wastewater management system.

Based on the soakage rates, each toilet will only require 165m² of disposal field. In accordance with recommended separation distances in TP58, these individual systems will be located more than 20m from any watercourse, bore, boundary etc, hence satisfying minimum requirements of TP58.

The level treatment quality will be in accordance with Table 7.9 - TP58 as per Figure 7 below.

6. Assessment of Effects

6.1. Impact on Soil and Water

The onsite effluent will be treated by a tertiary system (i.e., manufacturer to be confirmed at Building Consent stage). The treatment quality will exceed the below requirements as shown in Figure 7 for a textile filter system.

In comparison to a similar facility recently developed within New Zealand, a textile filtration system has achieved the following average effluent quality exceeding the performance requirements set out in TP58:

- 6 mg/L cBOD5.
- 4 mg/L TSS.
- TN of 12 mg/L and NH3-N of 1 mg/L.

Table 7.9: Typical Performance Values for Conventional Septic Tanks and Secondary Sand/Textile Filter Systems

	Septic Tank with outlet filter	Intermittent Sand Filter	Recirculating Sand Filter	Textile Filter
BOD₅	120 – 200mg/L	<10mg/L	<10mg/L	<15mg/L
TSS	30 – 50mg/L	<10mg/L	<10mg/L	<15mg/L
NH₃	20 – 60mg/L	0.5 to 10mg/L	0 – 15mg/L	0 – 5mg/L
NO₃	<1mg/L	20-25mg/L	30mg/L (average)	
Total N	40 – 100mg/L		10 – 40mg/L (40% - 50% reduction)	5 – 30mg/L [Note 2]
PO₄		7mg/L		
FC	10 ⁵ – 10 ⁸ per 100mls	400 – 10,000 per 100mls	10 ² – 10 ⁵ /100mls (99% reduction) [Note 3]	10 ³ – 10 ⁵ /100mls (99% reduction) [Note 3]
Note:				
1. Based on a range of values from the literature.				
2. Nitrate reduction is an optional feature for textile filters.				
3. The number of faecal coliforms following treatment dependent upon influent numbers.				

Figure 7 - Table 7.9 TP58

The treated effluent will be discharged to land via subsurface dripper irrigation using pressure compensating dripper lines preferably laid on gently sloping ground well away from any building development thus ensuring compliance with TP58 clearance requirements. We note that the disposal field will be located with a minimum 100m clearance to any significant ecological area (e.g., wetland).

The proposed treatment system including the disposal area are located with sufficient clearance to any overland flow paths and 1% AEP flood risks as per TP58 guidelines.

Groundwater was located to depths of 2.6m-15.6mbgl in the proposed building areas and therefore, groundwater should meet the 600mm separation distance for groundwater as per the recommendations outlined in Table 4 below. Further investigation via 1.0 – 2.0m depth hand augers within the proximity of the proposed disposal field was carried out by LDE and these indicate topsoil

depths varying from approximately 200mm–500mm. There was no apparent groundwater recorded at the time of the investigation in these test locations - refer Appendix B. We recommend further investigation is carried out within the proposed disposal field location at the building consent stage to ascertain and confirm this information.

6.2. Visual Effects

Visual effects associated with the effluent system are mitigated by them being mostly buried below ground with appropriate clearances in accordance with TP58 and Auckland Council standard guidelines. The disposal field will have the dripper lines laid below the surface and the disposal field area will be retained with pasture as is the existing condition.

6.3. Noise and Odour

The modern system on the market generally produces minimal background noise. The treatment plant and disposal field are situated well away from the development amenities hence is very unlikely to cause any issue.

To minimize odour from any pumpstation or storage tanks, we recommend installing the system away from any buildings with at least a minimum 3.0m offset (as per minimum distance per TP58). Odour can be of concern if the system operation fails, and anaerobic conditions are developed within the system.

A well-maintained treatment system and periodically back flushed dripper lines will prevent any accumulated blockages and development of slime thereby always keeping aerobic conditions within the system.

We also recommend installing grease traps to remove any oil, grease, and fats from the effluent at source points where food is prepared (e.g., restaurants, cafes, and kitchens) and minimise these from entering the treatment system.

6.4. System Failure

The nominated system must have 24 hours emergency storage in addition to the daily operating flows should any system failure occur. In accordance with TP58 a 33% reserve area will be set aside in addition to the required primary disposal field area. We recommend a systematic approach to manage and remedy any failure to the system is set out in the Operation and Maintenance Plan.

6.5. Operation and Maintenance

The treatment system works by using the micro-organisms/bacteria present in the waste. These work effectively when the optimum environment for the bacteria is maintained. This includes periodic cleaning of the system and biological filtration. The filter should be removed and appropriately cleaned bi-annually at minimum. The dripper lines should be flushed regularly (preferably every 3 months).

Harsh detergents, chemical and plastics must not be flushed into the system as they can create blockages and system failure with potential for odour to occur.

All plant and equipment associated with the onsite wastewater system will be maintained in accordance with manufacturer and installer recommendations to ensure ongoing high performance of the system. The continual operation efficiency and quality of discharge from the of the system cannot be guaranteed without professional maintenance. We recommend regular

scheduled maintenance be carried out by a professional servicing operator in accordance with manufacturer requirements and records kept on site and available for inspection by Auckland Council.

A Management Plan that outlines the wastewater system, monitoring requirements and responsible stakeholders for continual maintenance will be prepared on completion of the installation of the private wastewater system. In the unlikely event of a system failure (i.e., power outage), all storage tanks including pump chambers will need to have emergency storage (i.e., 24hour) above the high-water level alarm to allow time for repair and or replacement works to be carried out.

Products such as detergents and cleaners with a chlorine base or caustic base are detrimental to the biological process as they kill the bacteria and therefore should not be allowed to enter the effluent treatment system. In addition, any antibiotic or antiseptic products are also not recommended to enter the system. Items such as personal sanitary products, disposable nappies, wipes, and plastics objects etc. are also not recommended to be disposed of into the system as these may result in unforeseen blockages occurring.

APPENDIX A – Geotechnical Parameter Assessment for Onsite Wastewater and Stormwater Disposal (March 2022)

- Prepared by Land Development & Engineering Ltd (LDE)



Project Reference: J01662

31/03/2022

The Bears Home Project Management Limited
60 Clearwater Avenue
Waimauku

C/- McKenzie and Co Consultants Limited

Attention: S. McIntyre

Dear Scott

Geotechnical Parameters for On-Site Wastewater and Stormwater Disposal at Muriwai Downs Golf Course, Muriwai,

1 INTRODUCTION AND SCOPE

LDE have been asked to undertake a field and laboratory testing in order to inform on-site stormwater and wastewater disposal design at the Muriwai Downs Golf Course, Muriwai. Our scope of work has included:

Stormwater Soakage Testing:

- Drill a 2m deep, 100mm diameter hand auger borehole in each of the four stormwater soakage locations indicated by McKenzie and Co and undertake falling head soakage tests as appropriate as outlined in TR2013/040, Appendix A, Annexure C, Worksheets W1.

Wastewater Disposal Field Testing:

- Drill a 2m deep, 50mm diameter hand auger borehole at each of six locations as indicated by McKenzie and Co and install a piezometer within each 2m deep borehole (allowance for 1500mm minimum depth to groundwater as outlined by TP58; Onsite Wastewater Systems, Table 5.2) and subsequent groundwater monitoring round not less than 1 week following installation and;
- Undertake Atterberg Limits and Particle Size Distribution laboratory testing on each of four representative soil samples retrieved from the hand auger boreholes.

Our fieldwork was undertaken on the 23rd and 24th of February 2022.

2 FINDINGS

2.1 Topsoil

Topsoil was present in each hand auger and percolation borehole between 0.2m and 0.5m depth.

2.2 Existing Fill

Existing fill was found to be present in HA105 to a depth of 1.2m deep. This comprised very stiff silty clay, however, as we are not aware of any certification or controls on this material, we assume it is non engineered.

2.3 Awhitu Group Fixed Dunes

The natural soils encountered in each of our test locations comprised Awhitu Group Fixed Dune deposits, which consisted generally of stiff to hard clays and silts. These comprised the cohesive mantle soils which tend to be found on this site in less steep areas and are generally between around 2m to 5m deep where present. Several of our boreholes (HA101, 102 and 104) terminated prior to target depth. This may be a result of a hard layer of consolidated sands in the area of these boreholes, which were also found in some instances in boreholes in our previous tranche of work undertaken in September 2021.

2.4 Groundwater

No groundwater was encountered in any of our boreholes over the depths drilled (1m to 2m deep) at the time of drilling (end of summer). Our groundwater monitoring of the piezometers installed in HA101 to 106, undertaken on 29 March 2022 found no groundwater over the depth of the piezometer (1.0m to 2.0m).

Test Name	Surface Level in m RL	Groundwater Level as measured 29 March 2022	
		Depth Below Existing Groundwater Level	Depth in m RL
HA101	110	1.45m	108.55m RL
HA102	110	0.9m	109.1m RL
HA103	110	1.43m	108.6m RL
HA104	109	NE* (borehole depth 1.0m)	NE* (borehole invert 108m RL)
HA105	26	1.55m	24.45m RL
HA106	51	1.4m	49.6m RL

*NE = groundwater not encountered over the depths drilled at the time of measuring groundwater.

Our deep tests undertaken in September 2021 found the groundwater levels were typically deep at this site (between approximately 10m and 20m deep, except where boreholes were placed close to lake/ stream surface level, and therefore the above results are not unexpected.

2.5 Percolation Test Results

Five percolation tests, Perc01 to Perc05, were undertaken in the locations indicated on the site plan, Figure 01. Tests were undertaken in accordance with TR 2013/040, Appendix A, Annexure C, Worksheet W1 – Falling Head Percolation Test. Percolation rates are as indicated on the table below:

Table 1: Percolation Test Summary

Test	Minimum Percolation Rate	Test Depth	Soil Materials Summary	Pre-Soak Conditions	Preceding Weather Conditions
Perc01	0.0059 L/m ² /min	2.0m	Clayey silt and silty clay, hard, moist, low to medium plasticity	20 Hrs	Dry
Perc02	0.0117 L/m ² /min	2.0m	Clayey silt, hard, moist, low plasticity	20 Hrs	Dry
Perc03	0.0472 L/m ² /min	2.0m	Clayey silt, hard, moist, low plasticity	20 Hrs	Dry
Perc04	0.0149 L/m ² /min	2.0m	Clayey silt and silty clay, hard, moist, low to medium plasticity	20 Hrs	Dry
Perc05	0.0609 L/m ² /min	2.0m	Clayey silt, hard, moist, low plasticity	20 Hrs	Dry

2.6 Laboratory Test Results

Laboratory testing was undertaken to determine particle size distributions and Atterberg Index properties for the determination of likely soakage properties. All results are IANZ (International Accreditation New Zealand) endorsed and full details are appended.

Table 1: Laboratory Testing Results Summary

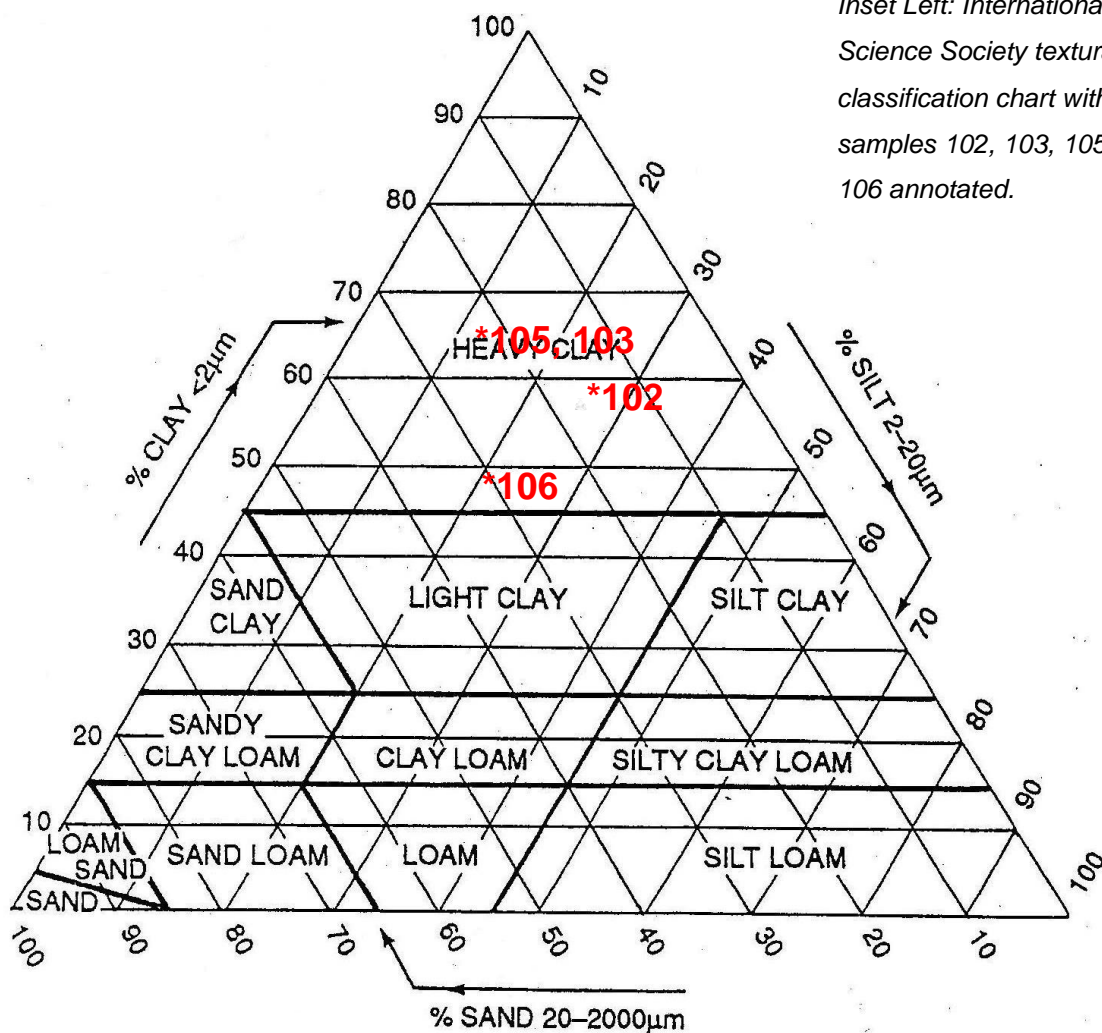
Sample	Particle Size Distribution			D30	Plasticity Index	Liquid Limit	Plastic Limit
	Clay	Silt	Sand				
HA102 (0.2-1.0m)	59%	27%	14%	<1.3µm	40	86	46
HA103 (0.3-1.5m)	63%	15%	22%	<1.3µm	67	94	27
HA105 (0.5-2.0m)	64%	14%	22%	<1.3µm	71	111	40
MH106 (0.3-1.2m)	49%	21%	30%	<1.3µm	51	76	25

3 ON-SITE STORMWATER ATTENUATION

Minimum percolation rates from our tests (up to 2.0m deep) ranged from 0.0059 L/m²/min to 0.0609 L/m²/min. Based on these results we consider that in-situ percolation will be likely be poor.

Further, based on laboratory testing, the soils samples recovered fall into the Heavy Clay category according to the International Soil Science Society textural classification chart as shown the inset below with each of samples 102, 103, 105 and 106 annotated.

The Auckland Regional Council TR2009/0072¹ (Review of Hydrologic Properties of Soils in the Auckland Region) defines clay soils as having a coefficient of permeability of between 1 and 5 mm per hour (Table 7, Section 3.3 of TR2009/0072).



Inset Left: International Soil Science Society textural classification chart with samples 102, 103, 105 and 106 annotated.

¹ Burford, P. (2008). Review of Hydrologic Properties of Soils in the Auckland Region. Prepared by URS for Auckland Regional Council. Auckland Regional Council, Technical Report No. 2009/072, December 2009.

4 ON-SITE EFFLUENT DISPOSAL

Based on visual-tactile observation of the soil types and the laboratory testing results (refer Section 3), we have classified the soils on this site as being soil category 6 (Table 5.1, TP58). Each on-site effluent disposal should be specifically designed at building consent stage using an aerial loading rate 3mm per day, given in TP58. We consider that there is suitable land on this site in relatively proximity to the nominated platforms to locate primary and secondary fields in this regard.

Due regard should be made to any overland flow paths and stormwater soakage in locating effluent fields.

Based on the groundwater depths observed in the boreholes, groundwater marginally met the 900mm to 600mm separation distance for groundwater for category 6 soils as per Table 5.2 of TP58.

The proposed effluent fields are set back from the steep slopes present on this site and we infer from the geomorphology that the proposed effluent field locations should be generally stable.

5 LIMITATIONS

This letter has been prepared exclusively for The Bears Home Project Management Limited with respect to the brief given to us. Information, opinions, and recommendations contained in it cannot be used for any other purpose or by any other entity without our review and written consent. LDE Ltd accepts no liability or responsibility whatsoever for or in respect of any use or reliance upon this report by any third party.

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

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

For and on Behalf of Land Development and Engineering Ltd

Report prepared by:





Jasmine Lam
Engineering Geologist
MEngNZ

Report reviewed by:



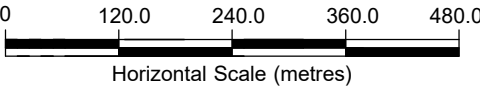
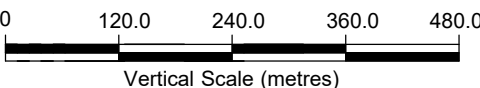

Shane Lander
Principal Geotechnical Engineer
CMEngNZ, CPEng, IntPENZ

Legend and/or Notes:

-  Hand Auger (2m)
-  Hand Auger + Percolation Test (2m)



Base Plan from Auckland Council GIS. Retrieved on 04.03.22

revision	description	drawn	approved	date	 <p>Horizontal Scale (metres)</p>  <p>Vertical Scale (metres)</p>	drawn	AT		client:	THE BEARS HOME PROJECT MANAGEMENT LTD	
						approved	AH		project:	MURIWAI DOWNS GOLF PROJECT	
						date	04.03.2022		title:	SITE INVESTIGATION PLAN	
						scale	1:8000		project no:	J 01662	figure no:
						original size	A3				



Hand Auger Borehole Log

Test ID: **HA101**

Project ID: J01662

Sheet: 1 of 1

Method:

Client: The Bears Home Project Management Limited

Project: Muriwai Downs Golf Project

Location: Muriwai Downs Golf Project

Test Site: Refer to site plan

Coordinates: 5924959mN, 1729234mE

System: NZTM

Elevation: Ground

Located By:

Test Date: 24/02/2022

Logged By: RZ

Checked By: AT

Vane ID: 307

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing				Test Values peak / remoulded (sensitivity)	Depth (m)
					Dynamic Cone Penetrometer (blows / 50mm)					
					Shear Vane, Su (kPa)					
					2	4	6	8		
					50	100	150	200		
0.0 - 0.1	TS	TOPSOIL								
0.1 - 0.5	x	Silty CLAY; orange brown. Hard; moist; high plasticity.	Awhitu Group						201+	-0.5
0.5 - 1.0	x	Clayey SILT, with trace sand; orange grey. Very stiff; moist; low plasticity; sand, medium.							201+	-1.0
1.0 - 1.4	x	1.4m: becoming yellow mottled orange								
1.4 - 1.5	x	1.5m: with trace limonite stained fine gravel							▶ 20	-1.5
1.5 - 2.0										-2.0
2.0 - 2.5										-2.5
2.5 - 3.0										-3.0
3.0 - 3.5										-3.5
3.5 - 4.0										-4.0
4.0 - 4.5										-4.5
4.5 - 5.0										-5.0
5.0 - 5.5										-5.5

Hole Depth: 1.50m **Termination:** Reached target depth

Remarks: End of Borehole at 1.5m. DCP found effective refusal at 1.6m.

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

● Vane peak ▼ Standing water level
 ○ Vane residual ◁ Groundwater inflow
 ◆ Vane UTP ▷ Groundwater outflow
 UTP = Unable to Penetrate

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Hand Auger Borehole Log

Test ID: **HA102**

Project ID: J01662

Sheet: 1 of 1

Method:

Client: The Bears Home Project Management Limited

Project: Muriwai Downs Golf Project

Location: Muriwai Downs Golf Project

Test Site: Refer to site plan

Coordinates: 5924908mN, 1729305mE

System: NZTM

Elevation: Ground

Located By:

Test Date: 24/02/2022

Logged By: RZ

Checked By: AT

Vane ID: 307

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing				Test Values peak / remoulded (sensitivity)	Depth (m)
					Dynamic Cone Penetrometer (blows / 50mm)					
					Shear Vane, Su (kPa)					
					2	4	6	8		
					50	100	150	200		
0.0 - 0.1	TS	TOPSOIL								
0.1 - 1.0	Orange cross-hatch pattern	Clayey SILT; orange brown. Hard; dry to moist; low plasticity. 0.7m: becoming moist	Awhitu Group						201+	-0.5
1.0 - 1.1				▼					201+	-1.0
1.1 - 1.2									▶ 20	-1.1
1.2 - 1.3										-1.2
1.3 - 1.4										-1.3
1.4 - 1.5										-1.4
1.5 - 1.6										-1.5
1.6 - 1.7										-1.6
1.7 - 1.8										-1.7
1.8 - 1.9										-1.8
1.9 - 2.0										-1.9
2.0 - 2.1										-2.0
2.1 - 2.2										-2.1
2.2 - 2.3										-2.2
2.3 - 2.4										-2.3
2.4 - 2.5										-2.4
2.5 - 2.6										-2.5
2.6 - 2.7										-2.6
2.7 - 2.8										-2.7
2.8 - 2.9										-2.8
2.9 - 3.0										-2.9
3.0 - 3.1										-3.0
3.1 - 3.2										-3.1
3.2 - 3.3										-3.2
3.3 - 3.4										-3.3
3.4 - 3.5										-3.4
3.5 - 3.6										-3.5
3.6 - 3.7										-3.6
3.7 - 3.8										-3.7
3.8 - 3.9										-3.8
3.9 - 4.0										-3.9
4.0 - 4.1										-4.0
4.1 - 4.2										-4.1
4.2 - 4.3										-4.2
4.3 - 4.4										-4.3
4.4 - 4.5										-4.4
4.5 - 4.6										-4.5
4.6 - 4.7										-4.6
4.7 - 4.8										-4.7
4.8 - 4.9										-4.8
4.9 - 5.0										-4.9
5.0 - 5.1										-5.0
5.1 - 5.2										-5.1
5.2 - 5.3										-5.2
5.3 - 5.4										-5.3
5.4 - 5.5										-5.4
5.5 - 5.6										-5.5

Hole Depth: 1.00m **Termination:** Reached target depth

Remarks: End of Borehole at 1.0m. DCP found effective refusal at 1.1m.

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

- Vane peak
- Vane residual
- ◆ Vane UTP
- ▼ Standing water level
- ◁ Groundwater inflow
- ▷ Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Test ID: **HA103**

Project ID: J01662

Sheet: 1 of 1

Method:

Client: The Bears Home Project Management Limited

Project: Muriwai Downs Golf Project

Location: Muriwai Downs Golf Project

Test Site: Refer to site plan

Coordinates: 5924808mN, 1729211mE

System: NZTM

Elevation: Ground

Located By:

Test Date: 24/02/2022

Logged By: MB

Checked By: AT

Vane ID: 1750

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing				Test Values peak / remoulded (sensitivity)	Depth (m)
					Dynamic Cone Penetrometer (blows / 50mm)					
					Shear Vane, Su (kPa)					
					2	4	6	8		
					50	100	150	200		
0.0 - 0.4	TS	TOPSOIL								
0.4 - 0.7	TS	silty CLAY, orange and grey mottled brown. Very stiff, moist, medium plasticity, moderately sensitive, with topsoil intermixed to 0.4m	Awhitu Group						139 / 62 (2.2)	-0.5
0.7 - 1.0	TS	0.7m: becoming moist to wet								
1.0 - 1.2	TS	1.0m: becoming insensitive							108 / 58 (1.9)	-1.0
1.2 - 1.5	TS	1.2m: becoming orange mottled light yellow/grey								
1.5 - 1.8	TS	1.5m: becoming stiff, high plasticity, with trace fine to medium sand							85 / 46 (1.8)	-1.5
1.8 - 2.0	TS	clayey SILT, orange streaked grey. Hard, moist, low plasticity								
2.0 - 2.0	TS								UTP	-2.0

Hole Depth: 2.00m **Termination:** Reached target depth

Remarks: End of Borehole at 2.0m.

- Vane peak ▼ Standing water level
- Vane residual ◁ Groundwater inflow
- ◆ Vane UTP ▷ Groundwater outflow

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

UTP = Unable to Penetrate



Hand Auger Borehole Log

Test ID: **HA104**

Project ID: J01662

Sheet: 1 of 1

Method:

Client: The Bears Home Project Management Limited

Project: Muriwai Downs Golf Project

Location: Muriwai Downs Golf Project

Test Site: Refer to site plan

Coordinates: 5924847mN, 1729126mE

System: NZTM

Elevation: Ground

Located By:

Test Date: 24/02/2022

Logged By: MB

Checked By: AT

Vane ID: 1750

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing				Test Values peak / remoulded (sensitivity)	Depth (m)
					Dynamic Cone Penetrometer (blows / 50mm)					
					Shear Vane, Su (kPa)					
					2	4	6	8		
					50	100	150	200		
0.0 - 0.5	TS	TOPSOIL		Groundwater Not Encountered						
0.5 - 1.0	X	clayey SILT, orange streaked brown/grey. Very stiff, dry to moist, low plasticity, sensitive	Awhitu Group						169 / 39 (4.3)	-0.5
1.0 - 1.1	X	clayey SILT, brown/red. Hard, dry to moist, low to no plasticity							UTP ▶ 20	-1.0
1.1 - 1.2									-1.1	
1.2 - 1.3									-1.2	
1.3 - 1.4									-1.3	
1.4 - 1.5									-1.4	
1.5 - 1.6									-1.5	
1.6 - 1.7									-1.6	
1.7 - 1.8									-1.7	
1.8 - 1.9									-1.8	
1.9 - 2.0									-1.9	
2.0 - 2.1									-2.0	
2.1 - 2.2									-2.1	
2.2 - 2.3									-2.2	
2.3 - 2.4									-2.3	
2.4 - 2.5									-2.4	
2.5 - 2.6									-2.5	
2.6 - 2.7									-2.6	
2.7 - 2.8									-2.7	
2.8 - 2.9									-2.8	
2.9 - 3.0									-2.9	
3.0 - 3.1									-3.0	
3.1 - 3.2									-3.1	
3.2 - 3.3									-3.2	
3.3 - 3.4									-3.3	
3.4 - 3.5									-3.4	
3.5 - 3.6									-3.5	
3.6 - 3.7									-3.6	
3.7 - 3.8									-3.7	
3.8 - 3.9									-3.8	
3.9 - 4.0									-3.9	
4.0 - 4.1									-4.0	
4.1 - 4.2									-4.1	
4.2 - 4.3									-4.2	
4.3 - 4.4									-4.3	
4.4 - 4.5									-4.4	
4.5 - 4.6									-4.5	
4.6 - 4.7									-4.6	
4.7 - 4.8									-4.7	
4.8 - 4.9									-4.8	
4.9 - 5.0									-4.9	
5.0 - 5.1									-5.0	
5.1 - 5.2									-5.1	
5.2 - 5.3									-5.2	
5.3 - 5.4									-5.3	
5.4 - 5.5									-5.4	
5.5 - 5.6									-5.5	

Hole Depth: 1.00m **Termination:** Reached target depth

Remarks: End of Borehole at 1.0m. DCP found effective refusal at 1.1m.

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

● Vane peak ▼ Standing water level
 ○ Vane residual ◁ Groundwater inflow
 ◆ Vane UTP ▷ Groundwater outflow
 UTP = Unable to Penetrate

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Hand Auger Borehole Log

Test ID: **HA105**

Project ID: J01662

Sheet: 1 of 1

Method:

Client: The Bears Home Project Management Limited

Project: Muriwai Downs Golf Project

Location: Muriwai Downs Golf Project

Test Site: Refer to site plan

Coordinates: 5925879mN, 1728572mE

System: NZTM

Elevation: Ground

Located By:

Test Date: 23/02/2022

Logged By: MB/RZ

Checked By: AT

Vane ID: 1750

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing				Test Values peak / remoulded (sensitivity)	Depth (m)
					Dynamic Cone Penetrometer (blows / 50mm)					
					Shear Vane, Su (kPa)					
					2	4	6	8		
					50	100	150	200		
0.0 - 0.5	TOPSOIL									
0.5 - 1.0	silty CLAY, red streaked orange/brown. Very stiff, moist, medium plasticity	FILL			○	●			131 / 19 (6.9)	-0.5
1.0 - 1.5	clayey SILT, orange/brown. Very stiff, moist, low to medium plasticity	Awhitu Group			○	●			123 / 39 (3.2)	-1.0
1.5 - 2.0	1.6m: with trace fine to medium sand			▼		○	●		212 / 112 (1.9)	-1.5
2.0 - 2.5						○	●		196 / 92 (2.1)	-2.0
2.5 - 3.0										-2.5
3.0 - 3.5										-3.0
3.5 - 4.0										-3.5
4.0 - 4.5										-4.0
4.5 - 5.0										-4.5
5.0 - 5.5										-5.0
5.5 - 6.0										-5.5

Hole Depth: 2.00m **Termination:** Reached target depth

Remarks: End of Borehole at 2.0m.

- Vane peak
 - Vane residual
 - ◆ Vane UTP
 - ▼ Standing water level
 - ◁ Groundwater inflow
 - ▷ Groundwater outflow
- UTP = Unable to Penetrate

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



Hand Auger Borehole Log

Test ID: **HA106**

Project ID: J01662

Sheet: 1 of 1

Method:

Client: The Bears Home Project Management Limited

Project: Muriwai Downs Golf Project

Location: Muriwai Downs Golf Project

Test Site: Refer to site plan

Coordinates: 5926255mN, 1729911mE

System: NZTM

Elevation: Ground

Located By:

Test Date: 24/02/2022

Logged By: RZ

Checked By: AT

Vane ID: 307

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing				Test Values peak / remoulded (sensitivity)	Depth (m)
					Dynamic Cone Penetrometer (blows / 50mm)					
					Shear Vane, Su (kPa)					
		TOPSOIL			2	4	6	8		
0.5		Silty CLAY; brown orange. Very stiff; moist; high plasticity.	Awhitu Group						201+	-0.5
1.0		1.2m: becoming orange brown							201+	-1.0
1.5									201+	-1.5
2.0		Silty CLAY, with trace gravel; orange mottled light grey. Hard; moist; low plasticity; gravel, fine, Pumiceous.							201+	-2.0
2.5										-2.5
3.0										-3.0
3.5										-3.5
4.0										-4.0
4.5										-4.5
5.0										-5.0
5.5										-5.5

Hole Depth: 2.00m **Termination:** Reached target depth

Remarks: End of Borehole at 2.0m.

- Vane peak
- Vane residual
- ◆ Vane UTP
- ▼ Standing water level
- ↙ Groundwater inflow
- ↘ Groundwater outflow

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

UTP = Unable to Penetrate



Hand Auger Borehole Log

Test ID: **Perc01**

Project ID: J01662

Sheet: 1 of 1

Method:

Client: The Bears Home Project Management Limited

Project: Muriwai Downs Golf Project

Location: Muriwai Downs Golf Project

Test Site: Refer to site plan

Coordinates: 5925136mN, 1728913mE

System: NZTM

Elevation: Ground

Located By:

Test Date: 23/02/2022

Logged By: MB/RZ

Checked By: AT

Vane ID: 1750

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing				Test Values peak / remoulded (sensitivity)	Depth (m)
					Dynamic Cone Penetrometer (blows / 50mm)					
					Shear Vane, Su (kPa)					
					2	4	6	8		
					50	100	150	200		
0.0 - 0.1	TS	TOPSOIL								
0.1 - 0.6	XX	clayey SILT with trace fine sand, light brown. Hard, dry to moist, low plasticity	Awhitu Group	Groundwater Not Encountered					UTP	-0.5
0.6 - 0.8	XX	0.6m: with trace fine to medium gravel inclusions								
0.8 - 1.0	XX	0.8m: becoming orange mottled brown								
1.0 - 1.5	XX	silty CLAY with trace fine sand, red streaked brown/orange. Hard, moist, medium plasticity, insensitive							270+	-1.0
1.5 - 1.8	XX							220 / 135 (1.6)	-1.5	
1.8 - 2.0	XX	clayey SILT, dark brown/orange. Hard, moist, low plasticity						UTP	-2.0	
2.0 - 2.5										
2.5 - 3.0										
3.0 - 3.5										
3.5 - 4.0										
4.0 - 4.5										
4.5 - 5.0										
5.0 - 5.5										
5.5 - 6.0										

Hole Depth: 2.00m **Termination:** Reached target depth

Remarks: End of Borehole at 2.0m.

- Vane peak ▼ Standing water level
- Vane residual ◁ Groundwater inflow
- ◆ Vane UTP ▷ Groundwater outflow

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

UTP = Unable to Penetrate



Hand Auger Borehole Log

Test ID: **Perc02**

Project ID: J01662

Sheet: 1 of 1

Method:

Client: The Bears Home Project Management Limited

Project: Muriwai Downs Golf Project

Location: Muriwai Downs Golf Project

Test Site: Refer to site plan

Coordinates: 5925418mN, 1728665mE

System: NZTM

Elevation: Ground

Located By:

Test Date: 23/02/2022

Logged By: MB/RZ

Checked By: AT

Vane ID: 1750

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing				Test Values peak / remoulded (sensitivity)	Depth (m)
					Dynamic Cone Penetrometer (blows / 50mm)					
					Shear Vane, Su (kPa)					
		TOPSOIL			2	4	6	8		
0.5		clayey SILT with trace fine sand, brown. Hard, dry to moist, low plasticity, with trace basalt gravel inclusions	Awhitu Group	Groundwater Not Encountered					UTP	-0.5
0.7		0.7m: becoming brown/red streaked orange/brown, low to medium plasticity								
1.0		1.0m: becoming red streaked light grey mottled dark brown/orange, with trace medium sand							UTP	-1.0
1.5		1.5m: becoming brown/orange, dry to moist, no plasticity, with trace medium to coarse sand, with hardened silt clasts							UTP	-1.5
1.8		1.8m: becoming moist, low to medium plasticity							UTP	-2.0
2.0										
2.5										
3.0										
3.5										
4.0										
4.5										
5.0										
5.5										

Hole Depth: 2.00m **Termination:** Reached target depth

Remarks: End of Borehole at 2.0m.

- Vane peak
- Vane residual
- ◆ Vane UTP
- ▼ Standing water level
- ◁ Groundwater inflow
- ▷ Groundwater outflow

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

UTP = Unable to Penetrate



Hand Auger Borehole Log

Test ID: **Perc03**

Project ID: J01662

Sheet: 1 of 1

Method:

Client: The Bears Home Project Management Limited

Project: Muriwai Downs Golf Project

Location: Muriwai Downs Golf Project

Test Site: Refer to site plan

Coordinates: 5925383mN, 1729122mE

System: NZTM

Elevation: Ground

Located By:

Test Date: 23/02/2022

Logged By: MB/RZ

Checked By: AT

Vane ID: 1750

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing				Test Values peak / remoulded (sensitivity)	Depth (m)	
					Dynamic Cone Penetrometer (blows / 50mm)						
					Shear Vane, Su (kPa)						
					2	4	6	8			
					50	100	150	200			
0.0 - 0.5	TOPSOIL										
0.5 - 0.7	clayey SILT, brown. Hard, moist, low plasticity		Awhitu Group	Groundwater Not Encountered					UTP	-0.5	
0.7 - 0.8	0.7m: becoming medium plasticity										
0.8 - 1.0	0.8m: becoming orange mottled brown									270+	-1.0
1.0 - 1.3	1.3m: becoming brown/orange, with trace medium sand										
1.3 - 1.6	1.6m: becoming dry to moist, no plasticity								UTP	-1.5	
1.6 - 2.0	2.0m: becoming insensitive								239 / 158 (1.5)	-2.0	
2.0 - 2.5										-2.5	
2.5 - 3.0										-3.0	
3.0 - 3.5										-3.5	
3.5 - 4.0										-4.0	
4.0 - 4.5										-4.5	
4.5 - 5.0										-5.0	
5.0 - 5.5										-5.5	

Hole Depth: 2.00m **Termination:** Reached target depth

Remarks: End of Borehole at 2.0m.

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

- Vane peak
- Vane residual
- ◆ Vane UTP
- ▼ Standing water level
- ◁ Groundwater inflow
- ▷ Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Test ID: **Perc04**

Project ID: J01662

Sheet: 1 of 1

Method:

Client: The Bears Home Project Management Limited

Project: Muriwai Downs Golf Project

Location: Muriwai Downs Golf Project

Test Site: Refer to site plan

Coordinates: 5925523mN, 1729615mE

System: NZTM

Elevation: Ground

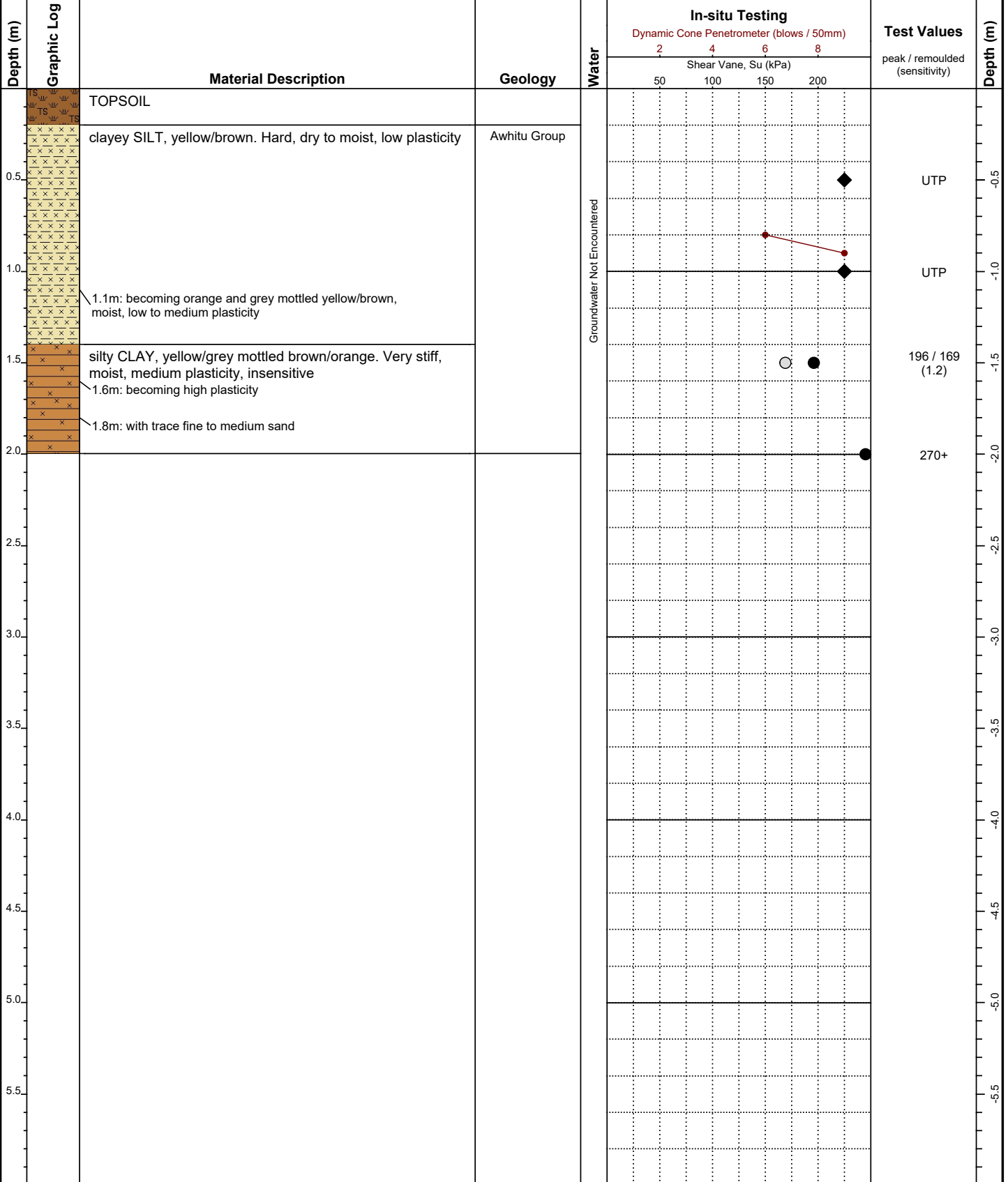
Located By:

Test Date: 23/02/2022

Logged By: MB/RZ

Checked By: AT

Vane ID: 1750



Hole Depth: 2.00m **Termination:** Reached target depth

Remarks: End of Borehole at 2.0m.

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

● Vane peak ▼ Standing water level
 ○ Vane residual ◁ Groundwater inflow
 ◆ Vane UTP ▷ Groundwater outflow
 UTP = Unable to Penetrate



Hand Auger Borehole Log

Test ID: **Perc05**

Project ID: J01662

Sheet: 1 of 1

Method:

Client: The Bears Home Project Management Limited

Project: Muriwai Downs Golf Project

Location: Muriwai Downs Golf Project

Test Site: Refer to site plan

Coordinates: 5925781mN, 1729785mE

System: NZTM

Elevation: Ground

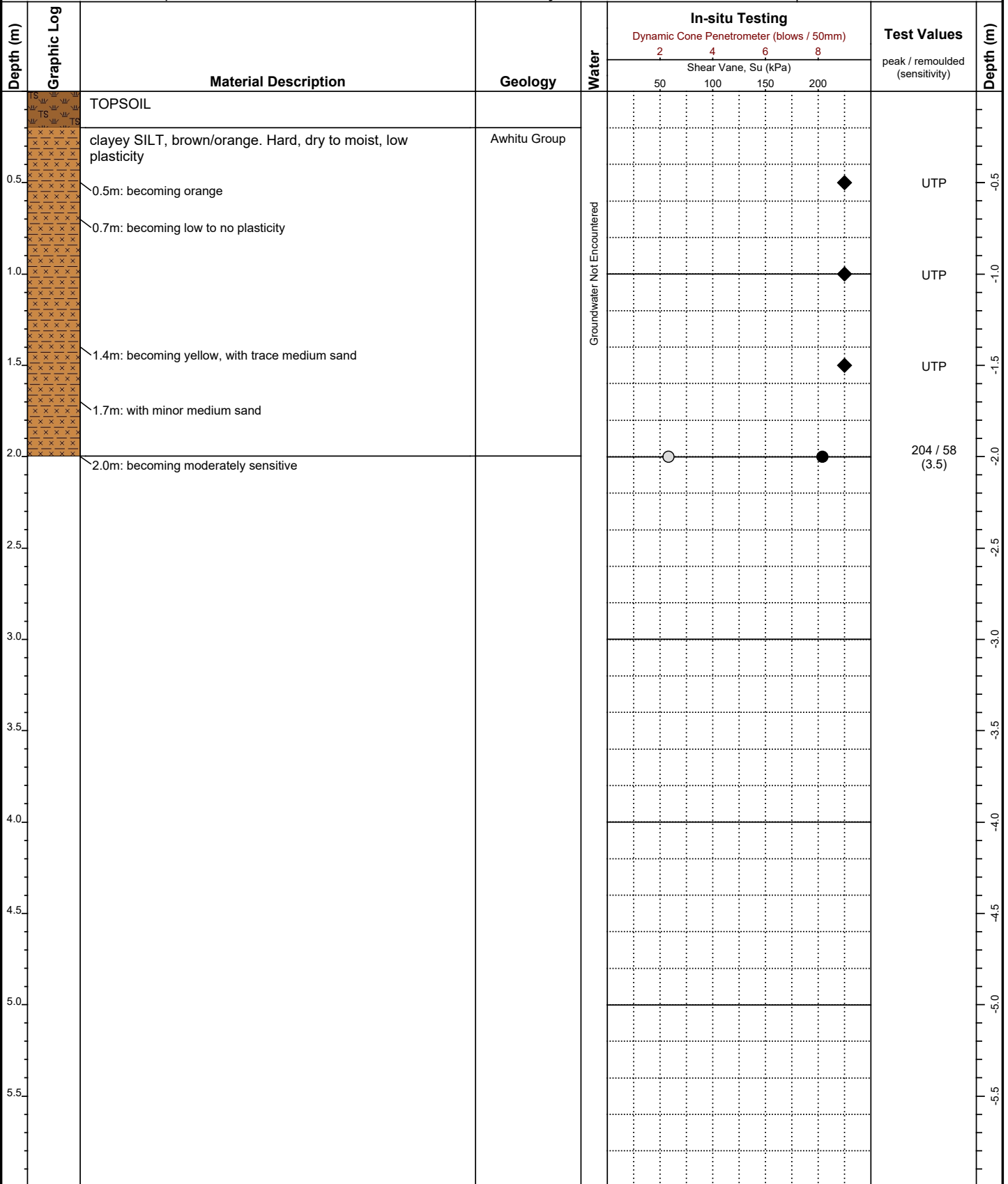
Located By:

Test Date: 23/02/2022

Logged By: MB/RZ

Checked By: AT

Vane ID: 1750



Hole Depth: 2.00m **Termination:** Reached target depth

Remarks: End of Borehole at 2.0m.

- Vane peak
- Vane residual
- ◆ Vane UTP
- ▼ Standing water level
- ◁ Groundwater inflow
- ▷ Groundwater outflow

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

UTP = Unable to Penetrate

STORMWATER PERCOLATION TEST

Client:	The Bears Home Project Management Limited	Job No:	J01662
Location:	Muriwai Downs Golf Project	Date:	24.02.22
		Page	1 of 2

Hole No:	Perc 01	Diameter:	0.1 (m)
----------	---------	-----------	---------

Location:		Depth:	2 (m)
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Weather conditions preceding test:	Dry
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Details of presoaking:	20 Hrs
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Time of Test (hr.min)	Time Interval (min)	Depth Reading (m)	Water Depth (m)	Cum Time (min)
10:24	-	0.00	2.00	0
10:25	1	0.03	1.97	1
10:26	1	0.05	1.95	2
10:29	3	0.10	1.90	5
10:34	5	0.15	1.85	10
10:39	5	0.20	1.80	15
10:54	15	0.27	1.73	30
11:24	30	0.38	1.62	60
11:54	30	0.45	1.55	90
12:24	30	0.49	1.51	120
12:54	30	0.53	1.47	150
13:24	30	0.57	1.43	180
13:54	30	0.58	1.42	210
14:24	30	0.59	1.41	240

Test	Perc 01	
Gradient	0.0003	m/min
Percolation	0.0059	L/m ² /min



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 Phone: 09 262 1528
 Email: shane@landergeotechnical.co.nz

Operator:	MB
Checked:	JL

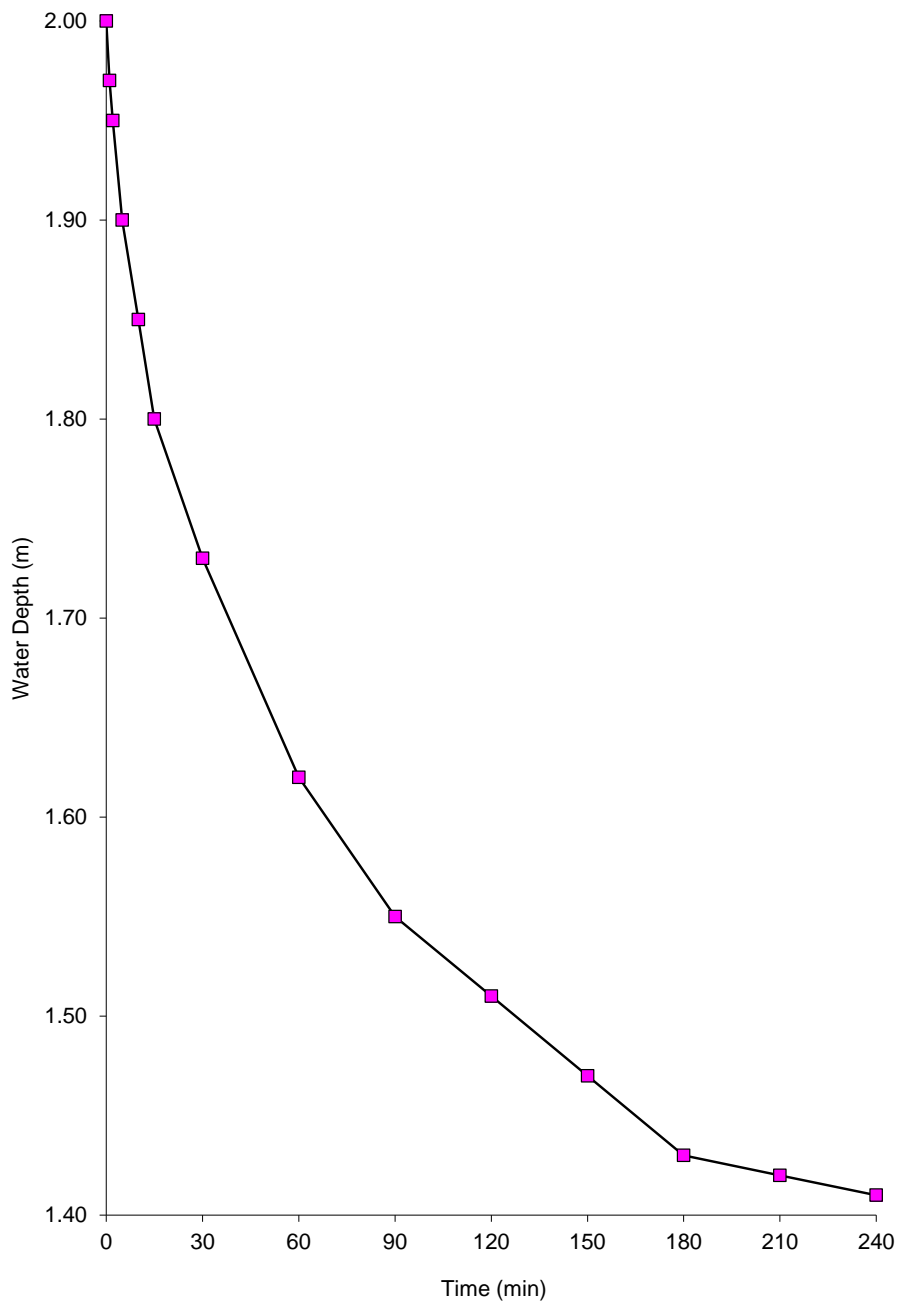
STORMWATER PERCOLATION TEST

Client: The Bears Home Project Management Lirr Job No: J01662
Location: Muriwai Downs Golf Project Date: 24.02.22
Page 2 of 2

Hole No: Perc 01 Diameter: 0.1 (m)

Location: Depth: 2.0 (m)

Water Depth vs Time



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STORMWATER PERCOLATION TEST

Client:	The Bears Home Project Management Limited	Job No:	J01662
Location:	Muriwai Downs Golf Project	Date:	24.02.22
		Page	1 of 2

Hole No:	Perc 02	Diameter:	0.1 (m)
----------	---------	-----------	---------

Location:		Depth:	2 (m)
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Weather conditions preceding test:	Dry
------------------------------------	-----

Details of presoaking:	20 Hrs
------------------------	--------

Time of Test (hr.min)	Time Interval (min)	Depth Reading (m)	Water Depth (m)	Cum Time (min)
10:57	-	0.00	2.00	0
10:59	2	0.08	1.92	2
11:02	3	0.12	1.88	5
11:07	5	0.16	1.84	10
11:11	4	0.19	1.81	14
11:27	16	0.28	1.72	30
11:57	30	0.37	1.63	60
12:27	30	0.42	1.58	90
12:57	30	0.46	1.54	120
13:27	30	0.50	1.50	150
13:57	30	0.54	1.46	180
14:27	30	0.56	1.44	210
14:57	30	0.58	1.42	240

	Test	Perc 02	
	Gradient	0.0007	m/min
	Percolation	0.0117	L/m ² /min



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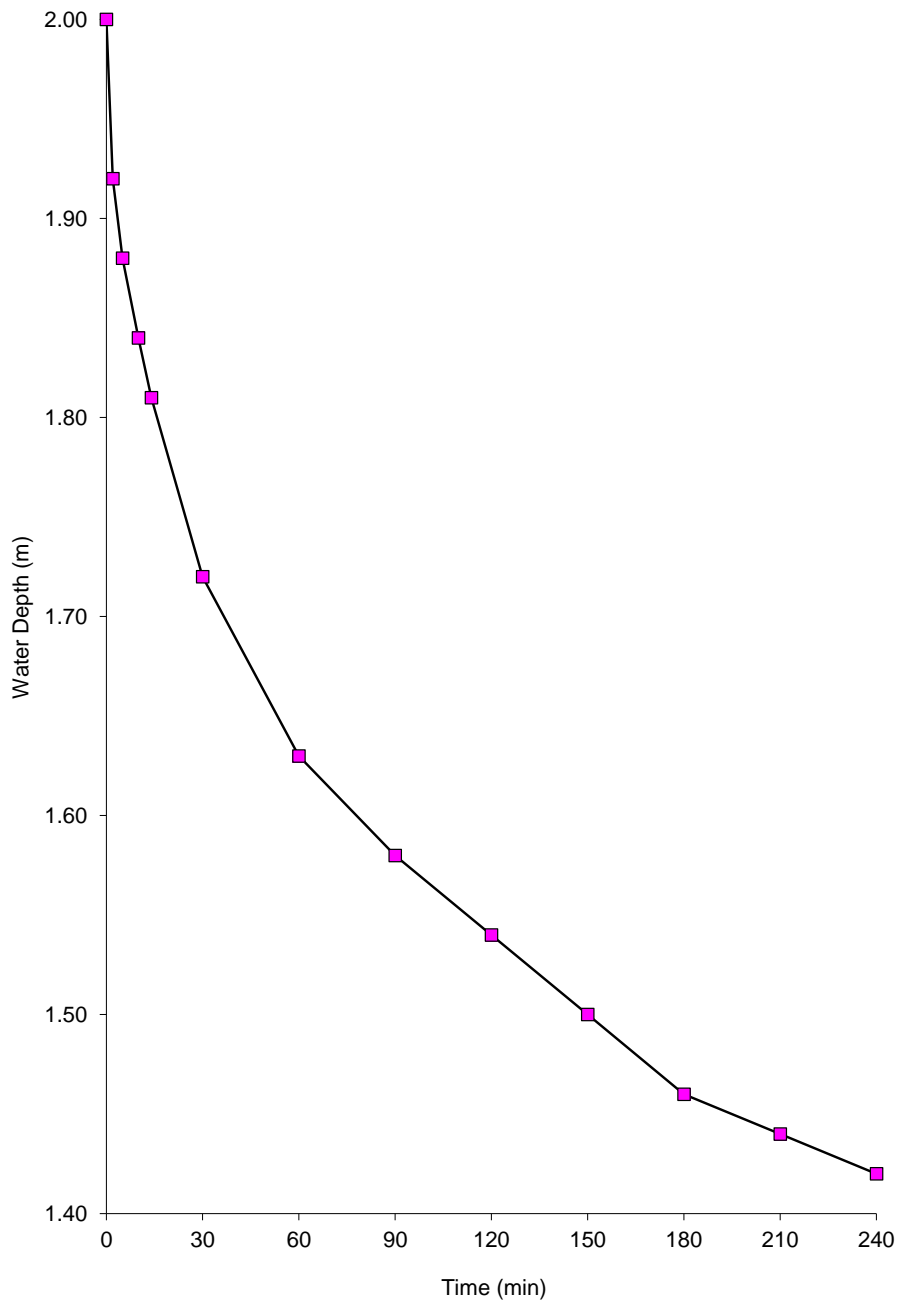
STORMWATER PERCOLATION TEST

Client: The Bears Home Project Management Lirr Job No: J01662
Location: Muriwai Downs Golf Project Date: 24.02.22
Page 2 of 2

Hole No: Perc 02 Diameter: 0.1 (m)

Location: Depth: 2.0 (m)

Water Depth vs Time



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STORMWATER PERCOLATION TEST

Client:	The Bears Home Project Management Limited	Job No:	J01662
Location:	Muriwai Downs Golf Project	Date:	24.02.22
		Page	1 of 2

Hole No:	Perc 03	Diameter:	0.1 (m)
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Location:		Depth:	2 (m)
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Weather conditions preceding test:	Dry
------------------------------------	-----

Details of presoaking:	20 Hrs
------------------------	--------

Time of Test (hr.min)	Time Interval (min)	Depth Reading (m)	Water Depth (m)	Cum Time (min)
9:47	-	0.00	2.00	0
9:48	1	0.06	1.94	1
9:50	2	0.14	1.86	3
9:52	2	0.20	1.80	5
9:57	5	0.29	1.71	10
10:02	5	0.34	1.66	15
10:17	15	0.45	1.55	30
10:47	30	0.59	1.41	60
11:17	30	0.69	1.31	90
11:47	30	0.72	1.28	120
12:17	30	0.79	1.21	150
12:47	30	0.85	1.15	180
13:17	30	0.91	1.09	210
13:47	30	0.97	1.03	240

Test	Perc 03
Gradient	0.0020 m/min
Percolation	0.0472 L/m ² /min



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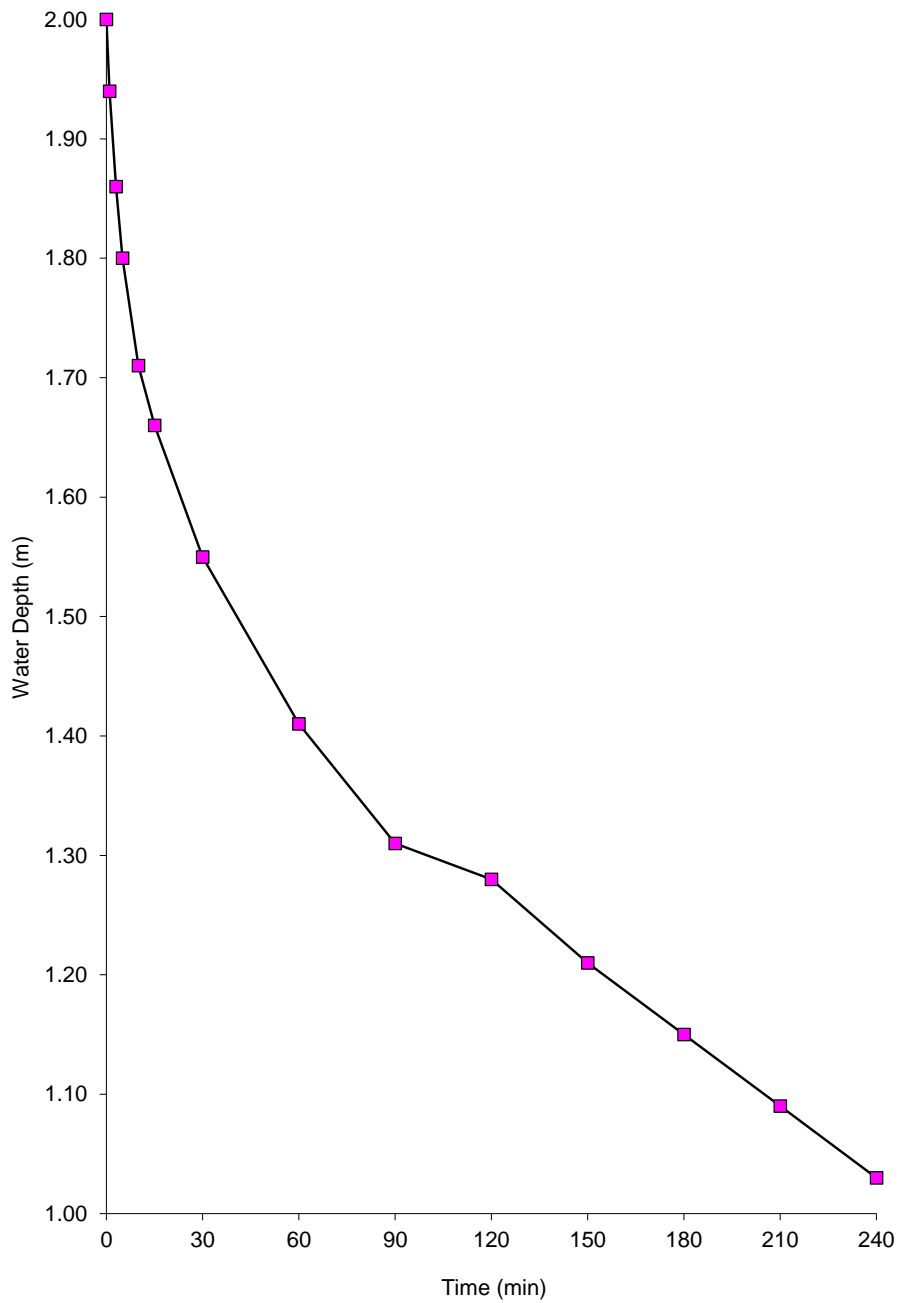
STORMWATER PERCOLATION TEST

Client: The Bears Home Project Management Lirr Job No: J01662
Location: Muriwai Downs Golf Project Date: 24.02.22
Page 2 of 2

Hole No: Perc 03 Diameter: 0.1 (m)

Location: Depth: 2.0 (m)

Water Depth vs Time



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STORMWATER PERCOLATION TEST

Client:	The Bears Home Project Management Limited	Job No:	J01662
Location:	Muriwai Downs Golf Project	Date:	24.02.22
		Page	1 of 2

Hole No:	Perc 04	Diameter:	0.1 (m)
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Location:		Depth:	2 (m)
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Weather conditions preceding test:	Dry
------------------------------------	-----

Details of presoaking:	20 Hrs
------------------------	--------

Time of Test (hr.min)	Time Interval (min)	Depth Reading (m)	Water Depth (m)	Cum Time (min)
10:58	-	0.00	2.00	0
11:00	2	0.38	1.62	2
11:02	2	0.45	1.55	4
11:07	5	0.58	1.42	9
11:12	5	0.65	1.35	14
11:17	5	0.70	1.30	19
11:42	25	0.84	1.16	44
12:00	18	0.88	1.12	62
12:28	28	0.94	1.06	90
12:58	30	0.99	1.01	120
13:22	24	1.02	0.98	144
13:52	30	1.04	0.96	174
14:22	30	1.06	0.94	204
14:58	36	1.08	0.92	240

Test	Perc 04
Gradient	0.0006 m/min
Percolation	0.0149 L/m ² /min



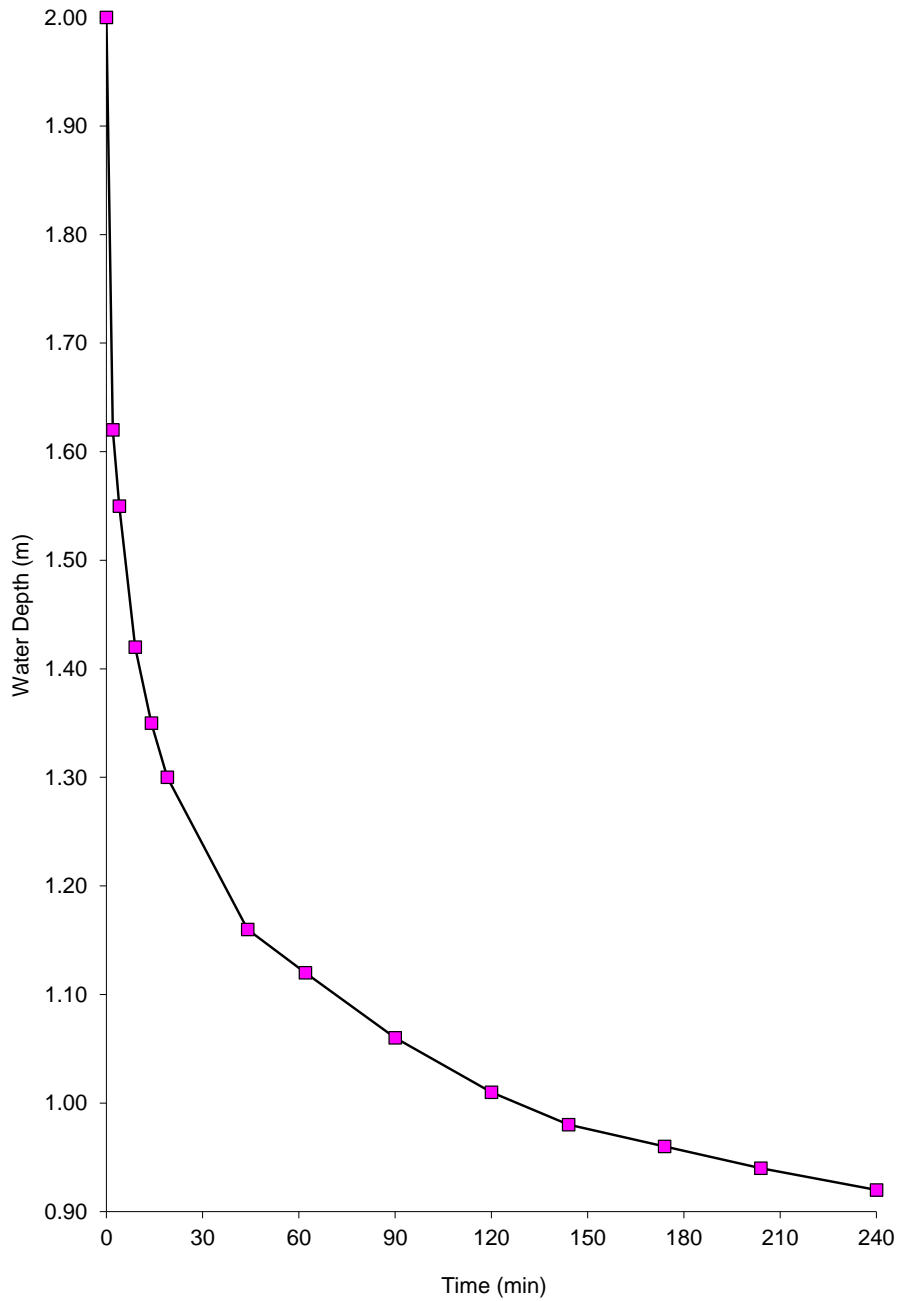
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Operator:	MB
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STORMWATER PERCOLATION TEST

Client:	The Bears Home Project Management Lirr	Job No:	J01662
Location:	Muriwai Downs Golf Project	Date:	24.02.22
	0	Page:	2 of 2
Hole No:	Perc 04	Diameter:	0.1 (m)
Location:	0	Depth:	2.0 (m)

Water Depth vs Time



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Operator: MB
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STORMWATER PERCOLATION TEST

Client:	The Bears Home Project Management Limited	Job No:	J01662
Location:	Muriwai Downs Golf Project	Date:	24.02.22
		Page	1 of 2

Hole No:	Perc 04	Diameter:	0.1 (m)
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Location:		Depth:	2 (m)
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Weather conditions preceding test:	Dry
------------------------------------	-----

Details of presoaking:	20 Hrs
------------------------	--------

Time of Test (hr.min)	Time Interval (min)	Depth Reading (m)	Water Depth (m)	Cum Time (min)
10:58	-	0.00	2.00	0
11:00	2	0.38	1.62	2
11:02	2	0.45	1.55	4
11:07	5	0.58	1.42	9
11:12	5	0.65	1.35	14
11:17	5	0.70	1.30	19
11:42	25	0.84	1.16	44
12:00	18	0.88	1.12	62
12:28	28	0.94	1.06	90
12:58	30	0.99	1.01	120
13:22	24	1.02	0.98	144
13:52	30	1.04	0.96	174
14:22	30	1.06	0.94	204
14:58	36	1.08	0.92	240

Test	Perc 04
Gradient	0.0006 m/min
Percolation	0.0149 L/m ² /min



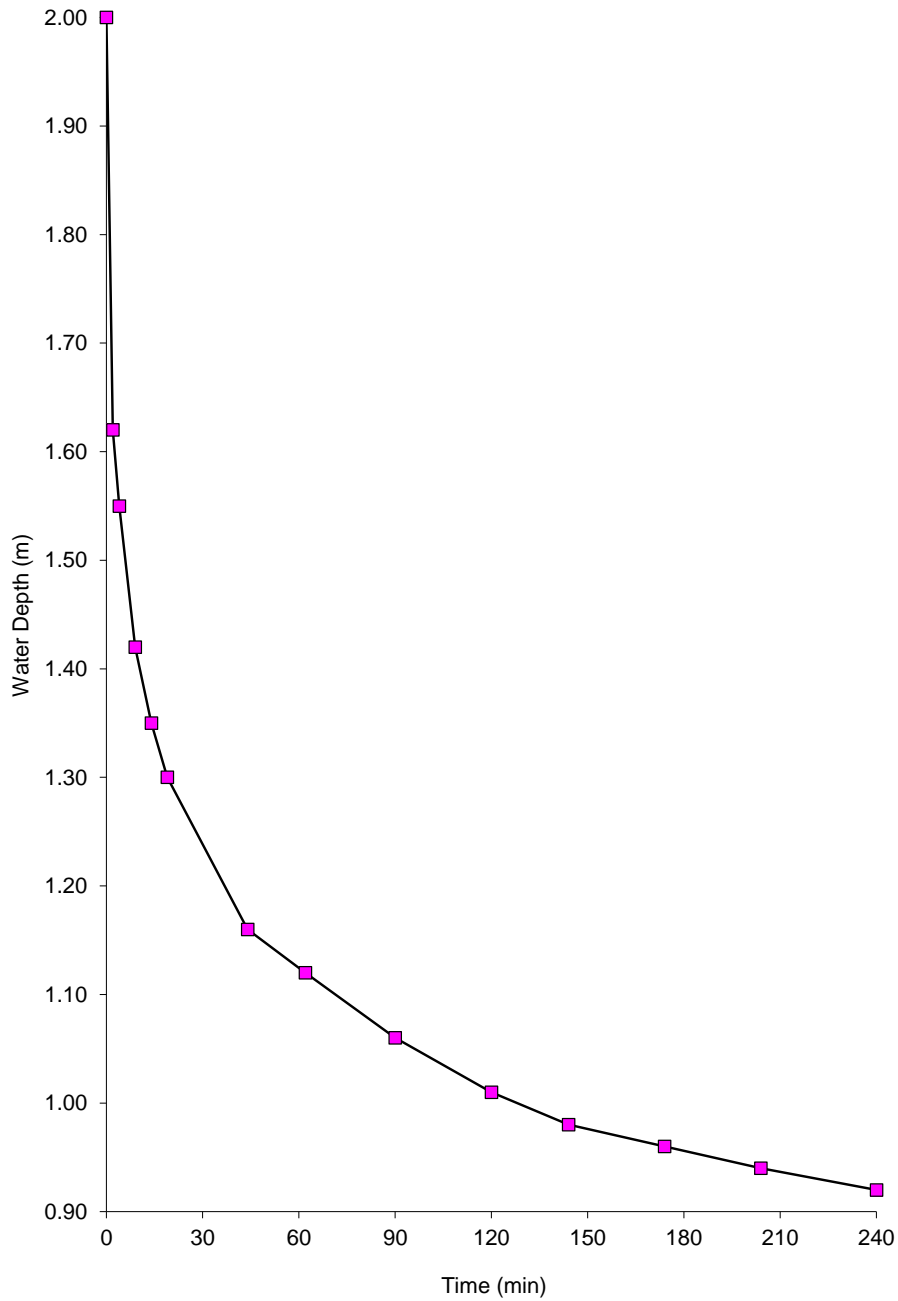
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Operator:	MB
Checked:	JL

STORMWATER PERCOLATION TEST

Client:	The Bears Home Project Management Lirr	Job No:	J01662
Location:	Muriwai Downs Golf Project	Date:	24.02.22
	0	Page:	2 of 2
Hole No:	Perc 04	Diameter:	0.1 (m)
Location:	0	Depth:	2.0 (m)

Water Depth vs Time



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Operator: MB
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STORMWATER PERCOLATION TEST

Client:	The Bears Home Project Management Limited	Job No:	J01662
Location:	Muriwai Downs Golf Project	Date:	24.02.22
		Page	1 of 2

Hole No:	Perc 05	Diameter:	0.1 (m)
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Location:		Depth:	2 (m)
-----------	--	--------	-------

Weather conditions preceding test:	Dry
------------------------------------	-----

Details of presoaking:	20 Hrs
------------------------	--------

Time of Test (hr.min)	Time Interval (min)	Depth Reading (m)	Water Depth (m)	Cum Time (min)
10:30	-	0.10	1.90	0
10:32	2	0.14	1.86	2
10:38	6	0.34	1.66	8
10:42	4	0.42	1.58	12
10:52	10	0.52	1.48	22
11:22	30	0.75	1.25	52
11:52	30	1.02	0.98	82
12:22	30	1.12	0.88	112
12:52	30	1.21	0.79	142
13:22	30	1.29	0.71	172
13:52	30	1.34	0.66	202
14:22	30	1.43	0.57	232
14:30	8	1.46	0.54	240

	Test	Perc 05
	Gradient	0.0017 m/min
	Percolation	0.0608 L/m ² /min

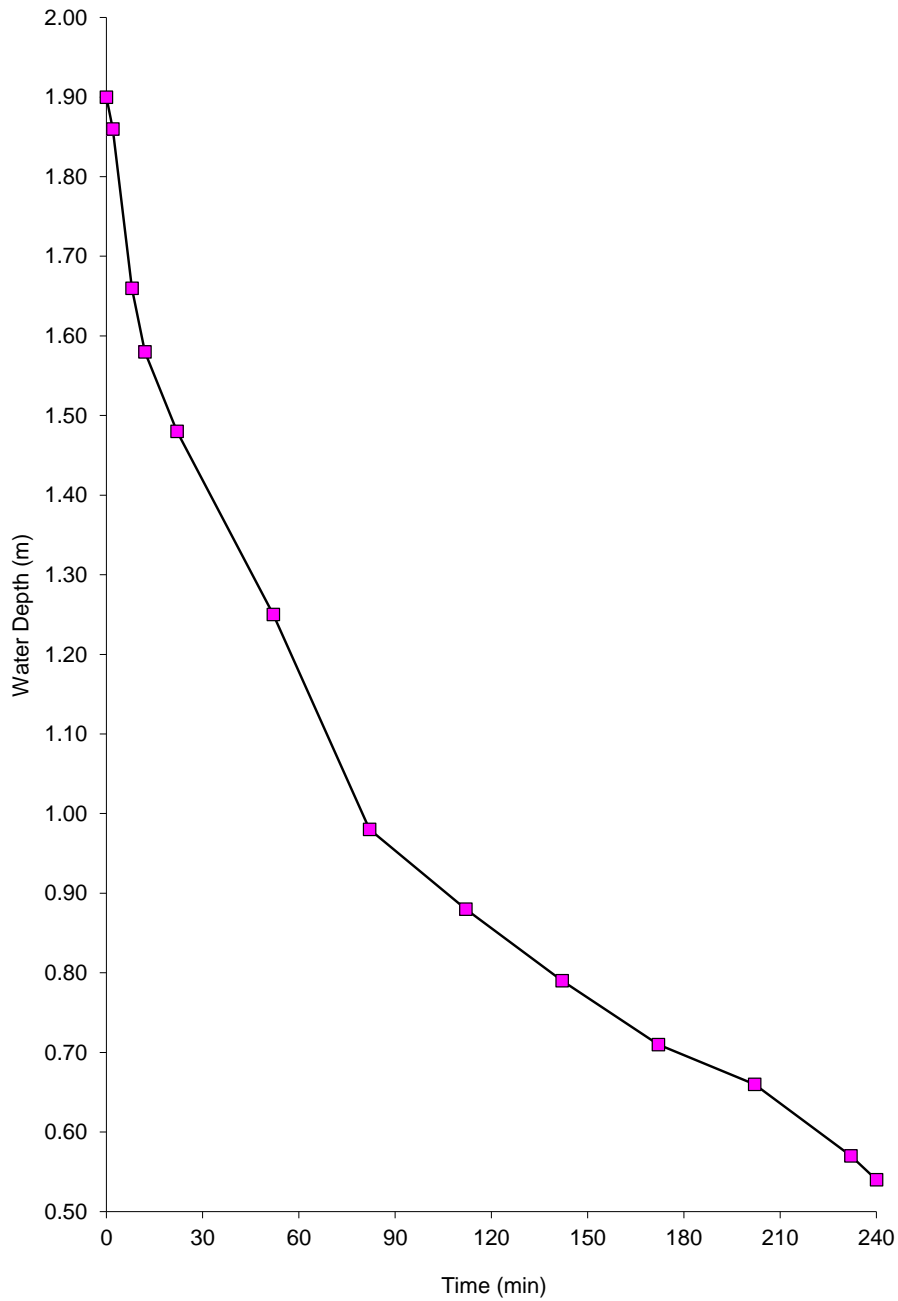
	<p>LDE Limited 320 Ti Rakau Dr, Burswood, Auckland 2013 Phone: 09 262 1528 Email: shane@landergeotechnical.co.nz</p>	<p>Operator: MB Checked:</p>
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STORMWATER PERCOLATION TEST

Client: The Bears Home Project Management Lirr Job No: J01662
Location: Muriwai Downs Golf Project Date: 24.02.22
Page 2 of 2

Hole No: Perc 05 Diameter: 0.1 (m)
Location: Depth: 2.0 (m)

Water Depth vs Time



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Operator: MB

Checked:



Hand Auger Borehole Log

Test ID: **HA101**

Project ID: J01662

Sheet: 1 of 1

Method:

Client: The Bears Home Project Management Limited

Project: Muriwai Downs Golf Project

Location: Muriwai Downs Golf Project

Test Site: Refer to site plan

Coordinates: 5924959mN, 1729234mE

System: NZTM

Elevation: Ground

Located By:

Test Date: 24/02/2022

Logged By: RZ

Checked By: AT

Vane ID: 307

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing				Test Values peak / remoulded (sensitivity)	Depth (m)
					Dynamic Cone Penetrometer (blows / 50mm)					
					Shear Vane, Su (kPa)					
					2	4	6	8		
					50	100	150	200		
0.0 - 0.2	TS	TOPSOIL								
0.2 - 1.0	x	Silty CLAY; orange brown. Hard; moist; high plasticity.	ASH						201+	-0.5
1.0 - 1.4	x	Clayey SILT, with trace sand; orange grey. Very stiff; moist; low plasticity; sand, medium.							201+	-1.0
1.4 - 1.5	x	1.4m: becoming yellow mottled orange								-1.5
1.5 - 1.6	x	1.5m: with trace limonite stained fine gravel							▶ 20	-1.6
1.6 - 5.5				Groundwater Not Encountered						-2.0 to -5.5

Hole Depth: 1.50m **Termination:** Reached target depth

Remarks: End of Borehole at 1.5m. DCP found effective refusal at 1.6m.

- Vane peak
- Vane residual
- ◆ Vane UTP
- ▼ Standing water level
- ◁ Groundwater inflow
- ▷ Groundwater outflow

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

UTP = Unable to Penetrate



Hand Auger Borehole Log

Test ID: **HA102**

Project ID: J01662

Sheet: 1 of 1

Method:

Client: The Bears Home Project Management Limited

Project: Muriwai Downs Golf Project

Location: Muriwai Downs Golf Project

Test Site: Refer to site plan

Coordinates: 5924908mN, 1729305mE

System: NZTM

Elevation: Ground

Located By:

Test Date: 24/02/2022

Logged By: RZ

Checked By: AT

Vane ID: 307

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing				Test Values peak / remoulded (sensitivity)	Depth (m)
					Dynamic Cone Penetrometer (blows / 50mm)					
					Shear Vane, Su (kPa)					
		TOPSOIL			2	4	6	8		
0.5		Clayey SILT; orange brown. Hard; dry to moist; low plasticity.	ASH	Groundwater Not Encountered	50	100	150	200		201+
1.0		0.7m: becoming moist								201+
1.5										
2.0										
2.5										
3.0										
3.5										
4.0										
4.5										
5.0										
5.5										

Hole Depth: 1.00m **Termination:** Reached target depth

Remarks: End of Borehole at 1.0m. DCP found effective refusal at 1.1m.

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

● Vane peak ▼ Standing water level
 ○ Vane residual ◁ Groundwater inflow
 ◆ Vane UTP ▷ Groundwater outflow
 UTP = Unable to Penetrate

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Hand Auger Borehole Log

Test ID: **HA103**

Project ID: J01662

Sheet: 1 of 1

Method:

Client: The Bears Home Project Management Limited

Project: Muriwai Downs Golf Project

Location: Muriwai Downs Golf Project

Test Site: Refer to site plan

Coordinates: 5924808mN, 1729211mE

System: NZTM

Elevation: Ground

Located By:

Test Date: 24/02/2022

Logged By: MB

Checked By: AT

Vane ID: 1750

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing		Test Values peak / remoulded (sensitivity)	Depth (m)	
					Dynamic Cone Penetrometer (blows / 50mm) Shear Vane, Su (kPa)				
					2	4	6	8	
					50	100	150	200	
0.0 - 0.4	TS	TOPSOIL							
0.4 - 0.7	x	silty CLAY, orange and grey mottled brown. Very stiff, moist, medium plasticity, moderately sensitive, with topsoil intermixed to 0.4m	ASH						139 / 62 (2.2)
0.7 - 1.0	x	0.7m: becoming moist to wet							
1.0 - 1.2	x	1.0m: becoming insensitive							108 / 58 (1.9)
1.2 - 1.5	x	1.2m: becoming orange mottled light yellow/grey							
1.5 - 2.0	x	1.5m: becoming stiff, high plasticity, with trace fine to medium sand							85 / 46 (1.8)
2.0 - 2.0	x	clayey SILT, orange streaked grey. Hard, moist, low plasticity							UTP
2.0 - 2.5				Groundwater Not Encountered					
2.5 - 3.0									
3.0 - 3.5									
3.5 - 4.0									
4.0 - 4.5									
4.5 - 5.0									
5.0 - 5.5									

Hole Depth: 2.00m **Termination:** Reached target depth

Remarks: End of Borehole at 2.0m.

- Vane peak ▼ Standing water level
- Vane residual ◁ Groundwater inflow
- ◆ Vane UTP ▷ Groundwater outflow

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

UTP = Unable to Penetrate



Hand Auger Borehole Log

Test ID: **HA104**

Project ID: J01662

Sheet: 1 of 1

Method:

Client: The Bears Home Project Management Limited

Project: Muriwai Downs Golf Project

Location: Muriwai Downs Golf Project

Test Site: Refer to site plan

Coordinates: 5924847mN, 1729126mE

System: NZTM

Elevation: Ground

Located By:

Test Date: 24/02/2022

Logged By: MB

Checked By: AT

Vane ID: 1750

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing				Test Values peak / remoulded (sensitivity)	Depth (m)
					Dynamic Cone Penetrometer (blows / 50mm)					
					Shear Vane, Su (kPa)					
					2	4	6	8		
					50	100	150	200		
0.0 - 0.5	TOPSOIL			Groundwater Not Encountered						
0.5 - 1.0	clayey SILT, orange streaked brown/grey. Very stiff, dry to moist, low plasticity, sensitive	ASH			○		●		169 / 39 (4.3)	-0.5
1.0 - 1.1	clayey SILT, brown/red. Hard, dry to moist, low to no plasticity							◆	UTP	-1.0
1.1 - 1.15								▶20		
1.15 - 1.2										
1.2 - 1.25										
1.25 - 1.3										
1.3 - 1.35										
1.35 - 1.4										
1.4 - 1.45										
1.45 - 1.5										
1.5 - 1.55										
1.55 - 1.6										
1.6 - 1.65										
1.65 - 1.7										
1.7 - 1.75										
1.75 - 1.8										
1.8 - 1.85										
1.85 - 1.9										
1.9 - 1.95										
1.95 - 2.0										
2.0 - 2.05										
2.05 - 2.1										
2.1 - 2.15										
2.15 - 2.2										
2.2 - 2.25										
2.25 - 2.3										
2.3 - 2.35										
2.35 - 2.4										
2.4 - 2.45										
2.45 - 2.5										
2.5 - 2.55										
2.55 - 2.6										
2.6 - 2.65										
2.65 - 2.7										
2.7 - 2.75										
2.75 - 2.8										
2.8 - 2.85										
2.85 - 2.9										
2.9 - 2.95										
2.95 - 3.0										
3.0 - 3.05										
3.05 - 3.1										
3.1 - 3.15										
3.15 - 3.2										
3.2 - 3.25										
3.25 - 3.3										
3.3 - 3.35										
3.35 - 3.4										
3.4 - 3.45										
3.45 - 3.5										
3.5 - 3.55										
3.55 - 3.6										
3.6 - 3.65										
3.65 - 3.7										
3.7 - 3.75										
3.75 - 3.8										
3.8 - 3.85										
3.85 - 3.9										
3.9 - 3.95										
3.95 - 4.0										
4.0 - 4.05										
4.05 - 4.1										
4.1 - 4.15										
4.15 - 4.2										
4.2 - 4.25										
4.25 - 4.3										
4.3 - 4.35										
4.35 - 4.4										
4.4 - 4.45										
4.45 - 4.5										
4.5 - 4.55										
4.55 - 4.6										
4.6 - 4.65										
4.65 - 4.7										
4.7 - 4.75										
4.75 - 4.8										
4.8 - 4.85										
4.85 - 4.9										
4.9 - 4.95										
4.95 - 5.0										
5.0 - 5.05										
5.05 - 5.1										
5.1 - 5.15										
5.15 - 5.2										
5.2 - 5.25										
5.25 - 5.3										
5.3 - 5.35										
5.35 - 5.4										
5.4 - 5.45										
5.45 - 5.5										

Hole Depth: 1.00m **Termination:** Reached target depth

Remarks: End of Borehole at 1.0m. DCP found effective refusal at 1.1m.

- Vane peak
- Vane residual
- ◆ Vane UTP
- ▼ Standing water level
- ◁ Groundwater inflow
- ▷ Groundwater outflow

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

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Test ID: **HA105**

Project ID: J01662

Sheet: 1 of 1

Method:

Client: The Bears Home Project Management Limited

Project: Muriwai Downs Golf Project

Location: Muriwai Downs Golf Project

Test Site: Refer to site plan

Coordinates: 5925879mN, 1728572mE

System: NZTM

Elevation: Ground

Located By:

Test Date: 23/02/2022

Logged By: MB/RZ

Checked By: AT

Vane ID: 1750

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing		Test Values peak / remoulded (sensitivity)	Depth (m)
					Dynamic Cone Penetrometer (blows / 50mm)	Shear Vane, Su (kPa)		
0.0 - 0.5	TOPSOIL							
0.5 - 1.0	silty CLAY, red streaked orange/brown. Very stiff, moist, medium plasticity	FILL		Groundwater Not Encountered	50	100	131 / 19 (6.9)	-0.5
1.0 - 1.5	clayey SILT, orange/brown. Very stiff, moist, low to medium plasticity	ASH			50	100	123 / 39 (3.2)	-1.0
1.5 - 2.0	1.6m: with trace fine to medium sand				150	200	212 / 112 (1.9)	-1.5
2.0 - 2.5					150	200	196 / 92 (2.1)	-2.0
2.5 - 3.0								-2.5
3.0 - 3.5								-3.0
3.5 - 4.0								-3.5
4.0 - 4.5								-4.0
4.5 - 5.0								-4.5
5.0 - 5.5								-5.0
5.5 - 6.0								-5.5

Hole Depth: 2.00m Termination: Reached target depth

Remarks: End of Borehole at 2.0m.

- Vane peak
- Vane residual
- ◆ Vane UTP
- ▼ Standing water level
- ◁ Groundwater inflow
- ▷ Groundwater outflow

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

UTP = Unable to Penetrate



Hand Auger Borehole Log

Test ID: **HA106**

Project ID: J01662

Sheet: 1 of 1

Method:

Client: The Bears Home Project Management Limited

Project: Muriwai Downs Golf Project

Location: Muriwai Downs Golf Project

Test Site: Refer to site plan

Coordinates: 5926255mN, 1729911mE

System: NZTM

Elevation: Ground

Located By:

Test Date: 24/02/2022

Logged By: RZ

Checked By: AT

Vane ID: 307

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing				Test Values peak / remoulded (sensitivity)	Depth (m)
					Dynamic Cone Penetrometer (blows / 50mm)					
					Shear Vane, Su (kPa)					
					2	4	6	8		
					50	100	150	200		
0.0 - 0.5	TS	TOPSOIL								
0.5 - 1.2	x	Silty CLAY; brown orange. Very stiff; moist; high plasticity.	ASH						201+	-0.5
1.2 - 1.5	x	1.2m: becoming orange brown							201+	-1.0
1.5 - 2.0	x	Silty CLAY, with trace gravel; orange mottled light grey. Hard; moist; low plasticity; gravel, fine, Pumiceous.							201+	-1.5
2.0 - 2.0	x								201+	-2.0
2.0 - 5.5				Groundwater Not Encountered						-2.5
										-3.0
										-3.5
										-4.0
										-4.5
										-5.0
										-5.5

Hole Depth: 2.00m **Termination:** Reached target depth

Remarks: End of Borehole at 2.0m.

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

● Vane peak ▼ Standing water level
 ○ Vane residual ◁ Groundwater inflow
 ◆ Vane UTP ▷ Groundwater outflow
 UTP = Unable to Penetrate

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Hand Auger Borehole Log

Test ID: **Perc01**

Project ID: J01662

Sheet: 1 of 1

Method:

Client: The Bears Home Project Management Limited

Project: Muriwai Downs Golf Project

Location: Muriwai Downs Golf Project

Test Site: Refer to site plan

Coordinates: 5925136mN, 1728913mE

System: NZTM

Elevation: Ground

Located By:

Test Date: 23/02/2022

Logged By: MB/RZ

Checked By: AT

Vane ID: 1750

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing				Test Values peak / remoulded (sensitivity)	Depth (m)
					Dynamic Cone Penetrometer (blows / 50mm)					
					Shear Vane, Su (kPa)					
					2	4	6	8		
					50	100	150	200		
0.0 - 0.5	TS	clayey SILT with trace fine sand, light brown. Hard, dry to moist, low plasticity	ASH	Groundwater Not Encountered					UTP	-0.5
0.5 - 0.6		0.6m: with trace fine to medium gravel inclusions								
0.6 - 0.8		0.8m: becoming orange mottled brown								
0.8 - 1.5		silty CLAY with trace fine sand, red streaked brown/orange. Hard, moist, medium plasticity, insensitive							270+	-1.0
1.5 - 2.0		clayey SILT, dark brown/orange. Hard, moist, low plasticity							220 / 135 (1.6)	-1.5
2.0 - 2.0									UTP	-2.0
2.0 - 2.5										-2.5
2.5 - 3.0										-3.0
3.0 - 3.5										-3.5
3.5 - 4.0										-4.0
4.0 - 4.5									-4.5	
4.5 - 5.0									-5.0	
5.0 - 5.5									-5.5	

Hole Depth: 2.00m **Termination:** Reached target depth

Remarks: End of Borehole at 2.0m.

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

● Vane peak ▼ Standing water level
 ○ Vane residual ◁ Groundwater inflow
 ◆ Vane UTP ▷ Groundwater outflow
 UTP = Unable to Penetrate

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Hand Auger Borehole Log

Test ID: **Perc02**

Project ID: J01662

Sheet: 1 of 1

Method:

Client: The Bears Home Project Management Limited

Project: Muriwai Downs Golf Project

Location: Muriwai Downs Golf Project

Test Site: Refer to site plan

Coordinates: 5925418mN, 1728665mE

System: NZTM

Elevation: Ground

Located By:

Test Date: 23/02/2022

Logged By: MB/RZ

Checked By: AT

Vane ID: 1750

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing				Test Values peak / remoulded (sensitivity)	Depth (m)	
					Dynamic Cone Penetrometer (blows / 50mm)						
					Shear Vane, Su (kPa)						
					2	4	6	8			
					50	100	150	200			
0.5		clayey SILT with trace fine sand, brown. Hard, dry to moist, low plasticity, with trace basalt gravel inclusions	ASH	Groundwater Not Encountered					◆	UTP	
0.7		0.7m: becoming brown/red streaked orange/brown, low to medium plasticity									
1.0		1.0m: becoming red streaked light grey mottled dark brown/orange, with trace medium sand								◆	UTP
1.5		1.5m: becoming brown/orange, dry to moist, no plasticity, with trace medium to coarse sand, with hardened silt clasts									◆
1.8		1.8m: becoming moist, low to medium plasticity								◆	UTP
2.0										◆	UTP
2.5											
3.0											
3.5											
4.0											
4.5											
5.0											
5.5											

Hole Depth: 2.00m **Termination:** Reached target depth

Remarks: End of Borehole at 2.0m.

- Vane peak ▼ Standing water level
- Vane residual ◁ Groundwater inflow
- ◆ Vane UTP ▷ Groundwater outflow

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

UTP = Unable to Penetrate



Hand Auger Borehole Log

Test ID: **Perc03**

Project ID: J01662

Sheet: 1 of 1

Method:

Client: The Bears Home Project Management Limited

Project: Muriwai Downs Golf Project

Location: Muriwai Downs Golf Project

Test Site: Refer to site plan

Coordinates: 5925383mN, 1729122mE

System: NZTM

Elevation: Ground

Located By:

Test Date: 23/02/2022

Logged By: MB/RZ

Checked By: AT

Vane ID: 1750

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing				Test Values peak / remoulded (sensitivity)	Depth (m)
					Dynamic Cone Penetrometer (blows / 50mm)					
					Shear Vane, Su (kPa)					
					2	4	6	8		
					50	100	150	200		
0.5		clayey SILT, brown. Hard, moist, low plasticity	ASH	Groundwater Not Encountered					UTP	-0.5
0.7m		becoming medium plasticity								
0.8m		becoming orange mottled brown								
1.0									270+	-1.0
1.3m		becoming brown/orange, with trace medium sand								
1.5									UTP	-1.5
1.6m		becoming dry to moist, no plasticity								
2.0		becoming insensitive							239 / 158 (1.5)	-2.0
2.5										
3.0										
3.5										
4.0										
4.5										
5.0										
5.5										

Hole Depth: 2.00m **Termination:** Reached target depth

Remarks: End of Borehole at 2.0m.

- Vane peak
- Vane residual
- ◆ Vane UTP
- ▼ Standing water level
- ◁ Groundwater inflow
- ▷ Groundwater outflow

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

UTP = Unable to Penetrate



Hand Auger Borehole Log

Test ID: **Perc04**

Project ID: J01662

Sheet: 1 of 1

Method:

Client: The Bears Home Project Management Limited

Project: Muriwai Downs Golf Project

Location: Muriwai Downs Golf Project

Test Site: Refer to site plan

Coordinates: 5925523mN, 1729615mE

System: NZTM

Elevation: Ground

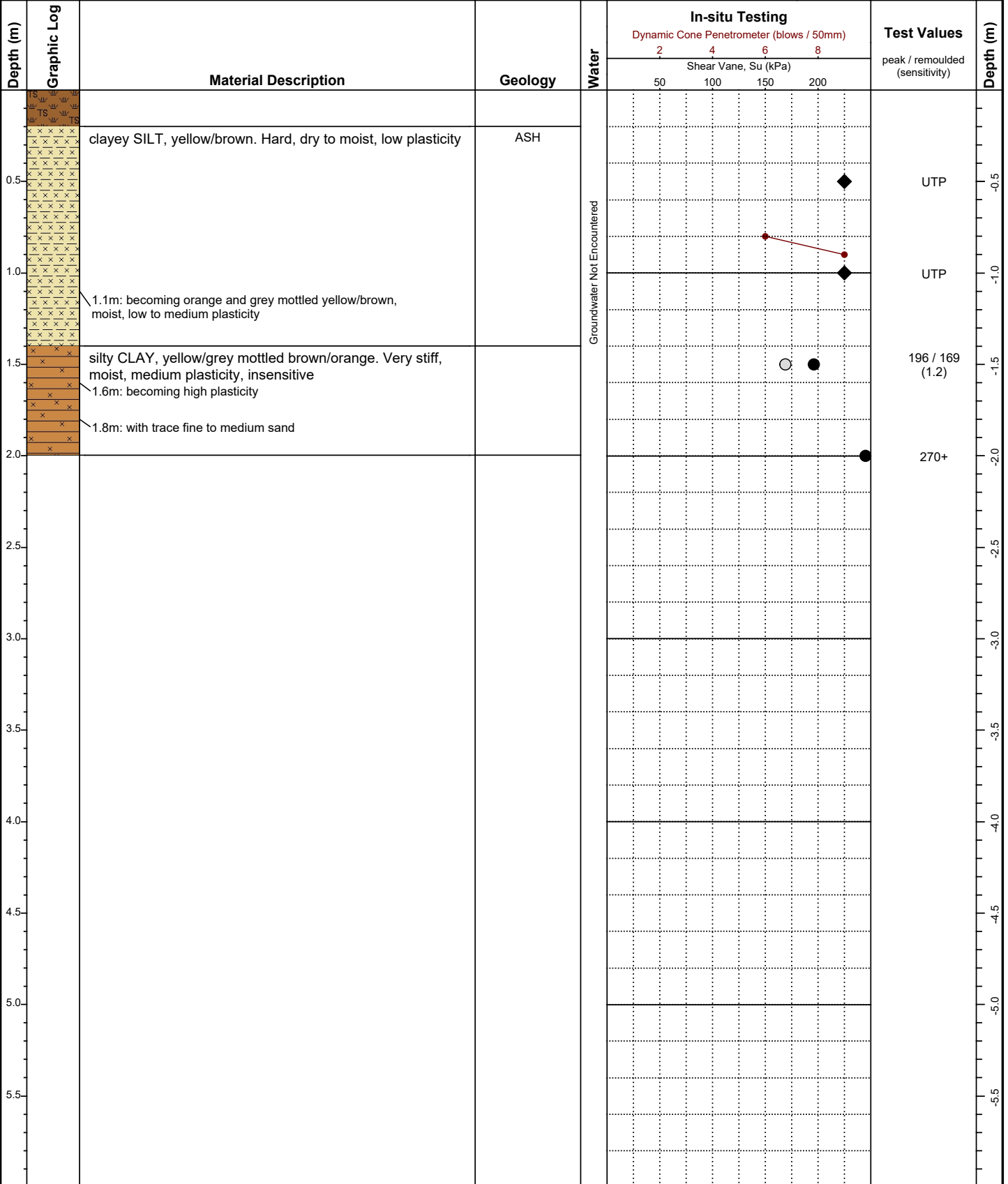
Located By:

Test Date: 23/02/2022

Logged By: MB/RZ

Checked By: AT

Vane ID: 1750



Hole Depth: 2.00m **Termination:** Reached target depth

Remarks: End of Borehole at 2.0m.

- Vane peak
- Vane residual
- ◆ Vane UTP
- ▼ Standing water level
- ◁ Groundwater inflow
- ▷ Groundwater outflow

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

UTP = Unable to Penetrate



Hand Auger Borehole Log

Test ID: **Perc05**

Project ID: J01662

Sheet: 1 of 1

Method:

Client: The Bears Home Project Management Limited

Project: Muriwai Downs Golf Project

Location: Muriwai Downs Golf Project

Test Site: Refer to site plan

Coordinates: 5925781mN, 1729785mE

System: NZTM

Elevation: Ground

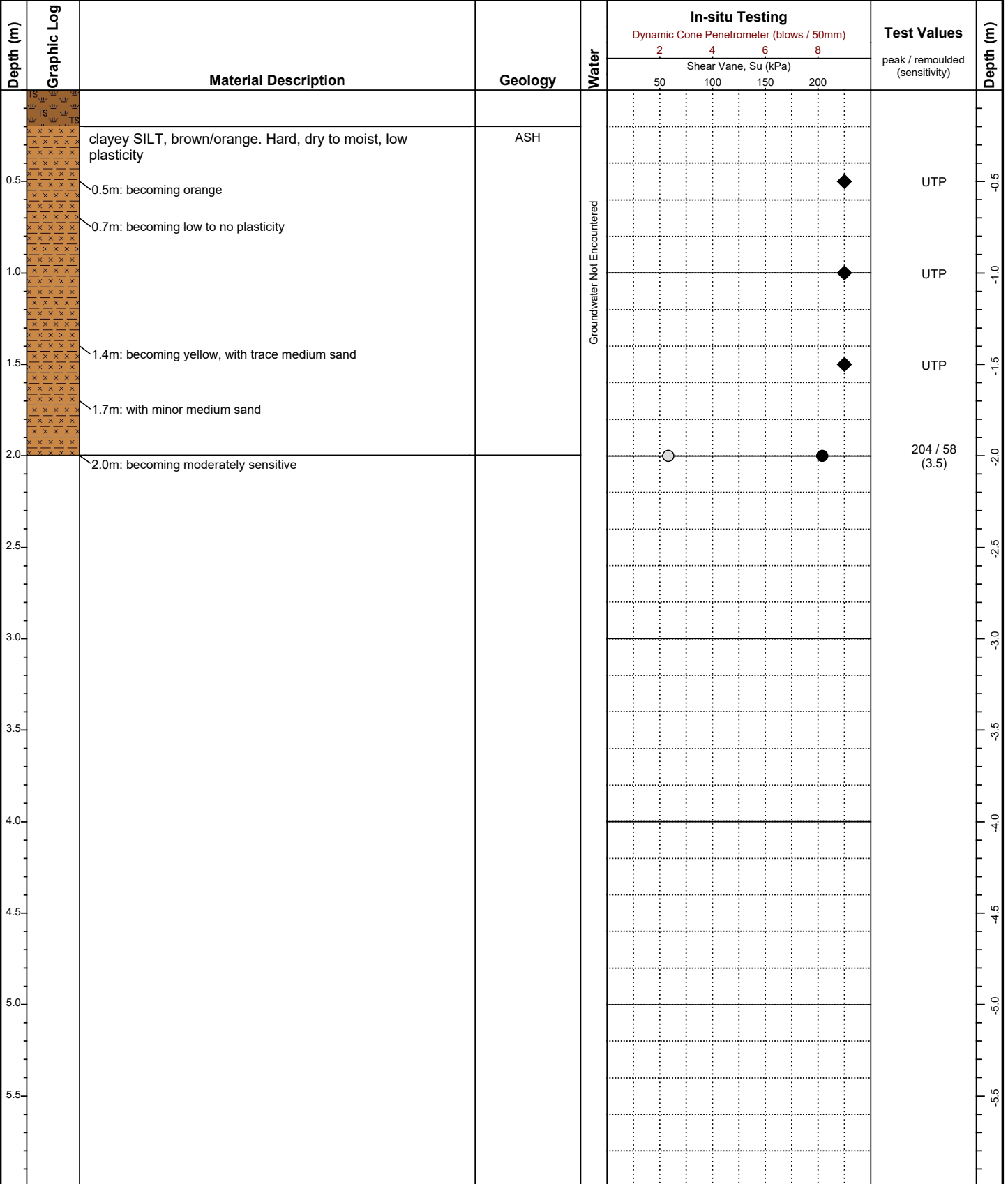
Located By:

Test Date: 23/02/2022

Logged By: MB/RZ

Checked By: AT

Vane ID: 1750



Hole Depth: 2.00m **Termination:** Reached target depth

Remarks: End of Borehole at 2.0m.

- Vane peak ▼ Standing water level
- Vane residual ◁ Groundwater inflow
- ◆ Vane UTP ▷ Groundwater outflow

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

UTP = Unable to Penetrate



Our Ref: 2021000.0565R/LabRep1
18 March 2022

Land Development & Engineering Ltd
LDE Ltd
320 Ti Rakau Drive
Burswood
Auckland 2013

Attention: Jasmine Lam

Dear Jasmine

Muriwai Downs – Hydrometer PSD and Liquid & Plastic Limit, Plasticity Index Laboratory Test Report

Customer's Instructions

We were instructed to complete the Determination of the Particle Size Distribution - Hydrometer Method and the Determination of the Liquid & Plastic Limit, Plasticity Index on cohesive material.

Sampling Procedure

Samples have been tested as received from the customer on the 28th February 2022.

Test Methods

NZS 4402:1986 Test 2.2 – Liquid limit

NZS 4402:1986 Test 2.3 – Plastic limit

NZS 4402:1986 Test 2.4 – Plasticity index

NZS 4402:1986 Test 2.8.4 – Particle size distribution (Hydrometer)

Test Results

Test results are attached.

General Remarks

Samples not destroyed during testing, will be retained for one month from the date of this report before being discarded.

Descriptions are enclosed for your information, but are not covered under the IANZ endorsement of this report.

This report has been prepared for the benefit of Land Development & Engineering Ltd, with respect to the particular brief given to us and it cannot be relied upon in other contexts or for any other purpose without our prior review and agreement.

Please reproduce this report in full when transmitting to others or including in internal reports.

If we can be of any further assistance, feel free to get in touch. Contact details are provided at the bottom of the letterhead page.

GEOTECHNICS LTD

Report prepared by:



.....
Caitlyn Gillard
Laboratory Technician

Authorised for Geotechnics by:

.....
Anthony Gilliland
Project Director
Approved Signatory

Report checked by:



.....
Fergus Goldie
Laboratory Technician



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

18-Mar-22

t:\geotechnicsgroup\projects\2021000\2021000.0565 - Ide muriwai downs - lab testing\issueddocuments\ LabRep1

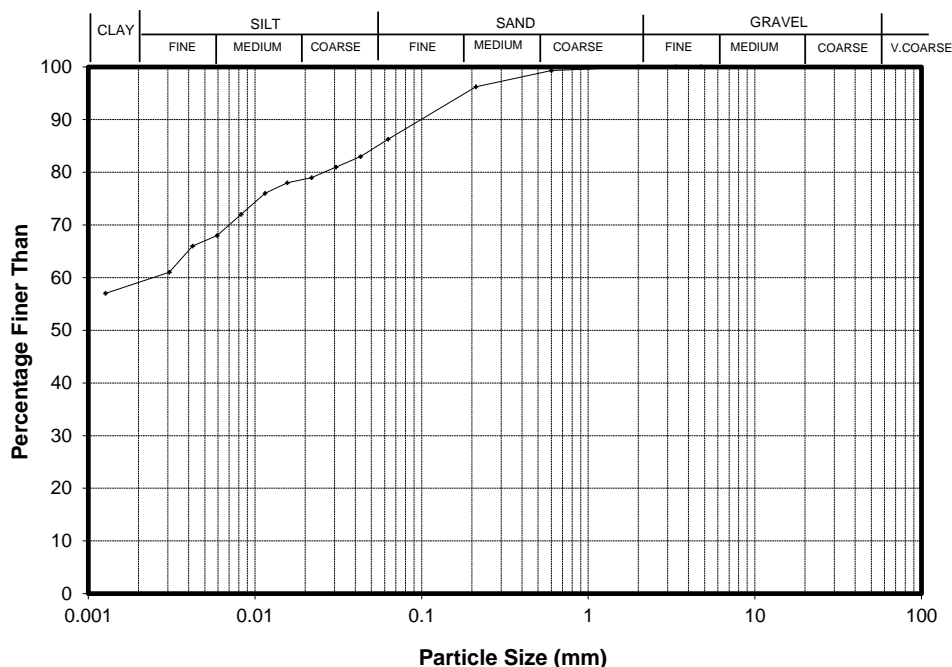


1 Hill Street, Onehunga Auckland
New Zealand
P 64 09 356 3510
www.geotechnics.co.nz

Site: **Muriwai Downs**BH No.: **HA102**Sample ID.: **AKL45.1**Your Job No.: **JO1662**Our Job No.: **2021000.0565**Depth: **0.2-1 m**

Test Method Used : NZS 4402:1986 Test 2.8.4 Subsidiary method for fine soils (Hydrometer)

PARTICLE SIZE ANALYSIS



Sieve (mm)	Total % Passing	Sieve (mm)	Total % Passing
4.75	-		
3.35	-		
2.00	100		
0.600	99		
0.212	96		
0.063	86		

Equivalent Particle Diameter D (mm)	% of Particles Finer than D
0.0430	83
0.0307	81
0.0219	79
0.0156	78
0.0115	76
0.0083	72
0.0059	68
0.0042	66
0.0031	61
0.0013	57

Sample history : Tested as recived
Description: Silty CLAY with some sand, brownish orange, high plasticity

Remarks : A sub sample was split from the original sample for hydrometer analysis. This sample was soaked with a dispersing agent (~2 hrs), then the mechanical shaker was used, until the material was brought into suspension, before proceeding with the test.
Suspension pH 8.0
The classification of gravel-sand-silt-clay components were described on the basis of particle size analysis.
Sample description is not IANZ accredited.
Results was obtained in accordance with NZS 4402:1986 Test 2.8.4 Subsidiary method for fine soils (Hydrometer)

Entered by : GEGO

Date : 18/03/2022 Checked b CAGI

Date : 18/03/2022



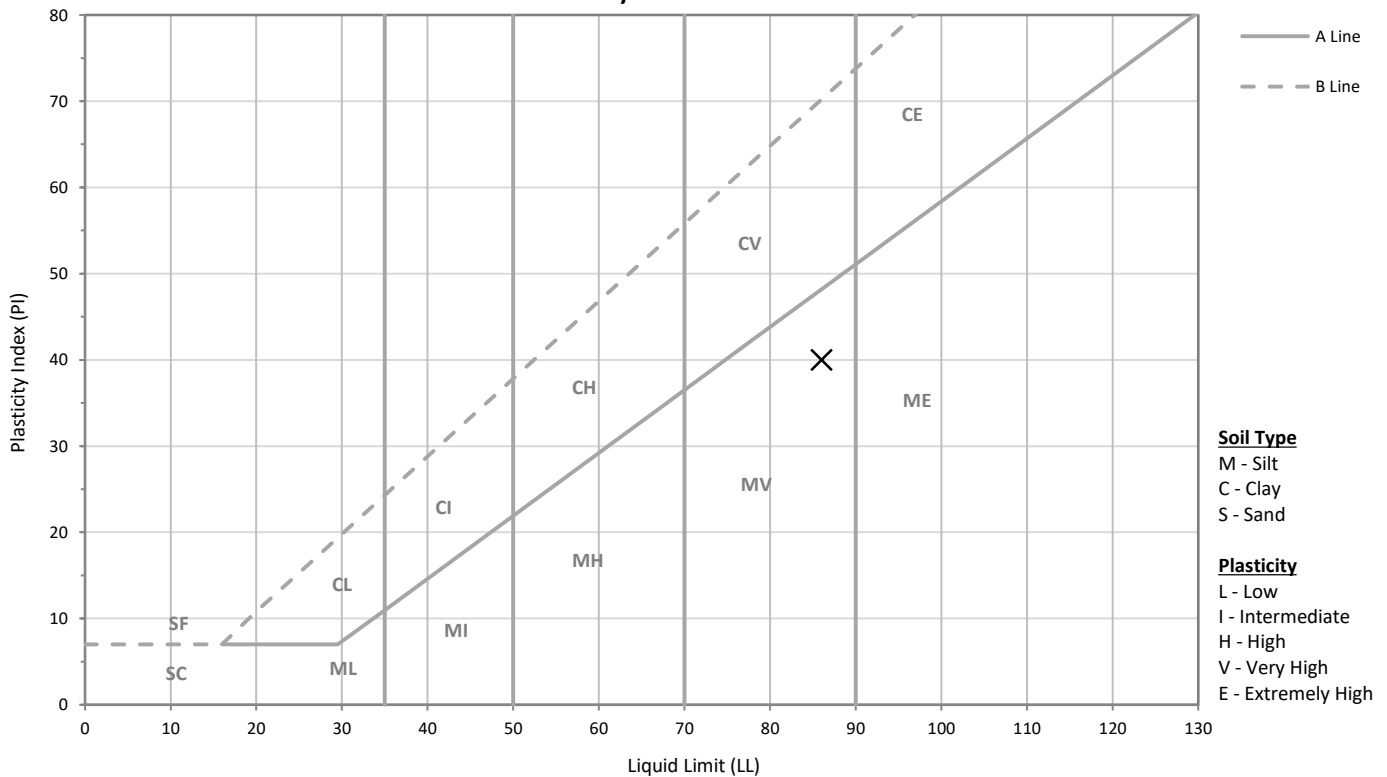
DETERMINATION OF LIQUID & PLASTIC LIMIT, PLASTICITY INDEX - NZS 4402: 1986 Tests 2.2 (4 Point), 2.3 & 2.4

TEST DETAILS			
LOCATION	ID	HA102	
	Description	N/A	
	Data	Level: 0.2- 1.0 m	
SAMPLE	Geotechnics ID	AKL_202203010	Date Received 1/03/2022
	Reference	Sample 1	Depth 0.20m - 1.00m
	Description	N/A	
SPECIMEN	Reference	3	Depth -
	Description	Silty CLAY with some sand, brownish orange; high plasticity	

TEST RESULTS

Liquid Limit 86
Plastic Limit 46
Plasticity Index 40

Plasticity Chart - BS 5930:1999



The plasticity chart is provided for your inference only and is not covered under our scope of IANZ accreditation. Due to the nature of classifications it is possible to have discrepancies between observational behaviour descriptions and measured parameters

TEST REMARKS

- The material used for testing was natural, fraction passing a 425um sieve.

This test result is IANZ accredited.

Approved By AJFG

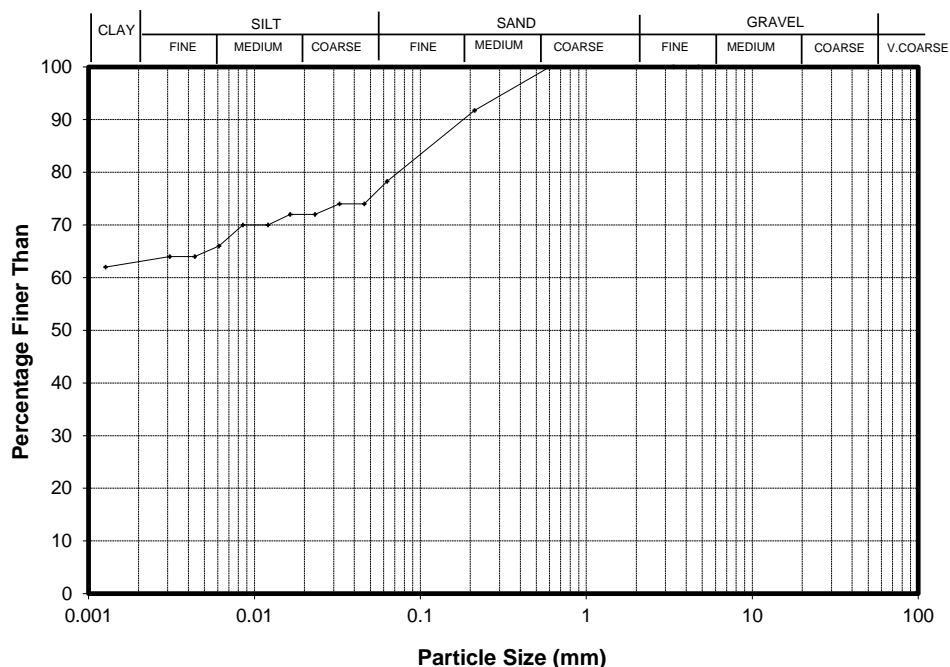
Date 21/03/2022



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New Zealand
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www.geotechnics.co.nz

Site: **Muriwai Downs** Your Job N **JO1662**
BH No.: **HA103** Our Job Nc **2021000.0565**
Sample ID.: **AKL45.2** Depth: **0.3-1.5 m**
Test Method Used : NZS 4402:1986 Test 2.8.4 Subsidiary method for fine soils (Hydrometer)

PARTICLE SIZE ANALYSIS



Sieve (mm)	Total % Passing	Sieve (mm)	Total % Passing
4.75	-		
3.35	-		
2.00	-		
0.600	100		
0.212	92		
0.063	78		

Equivalent Particle Diameter D (mm)	% of Particles Finer than D
0.0460	74
0.0325	74
0.0232	72
0.0164	72
0.0121	70
0.0085	70
0.0061	66
0.0044	64
0.0031	64
0.0013	62

Sample history : Tested as recived
Description: sandy CLAY, brownish grey, high plasticity

Remarks : A sub sample was split from the original sample for hydrometer analysis. This sample was soaked with a dispersing agent (~2 hrs), then the mechanical shaker was used, until the material was brought into suspension, before proceeding with the test.
Suspension pH 8.1
The classification of gravel-sand-silt-clay components were described on the basis of particle size analysis.
Sample description is not IANZ accredited.
Results was obtained in accordance with NZS 4402:1986 Test 2.8.4 Subsidiary method for fine soils (Hydrometer)

Entered by : GEGO

Date : 18/03/2021 Checked by : CAGI

Date : 18/03/2022

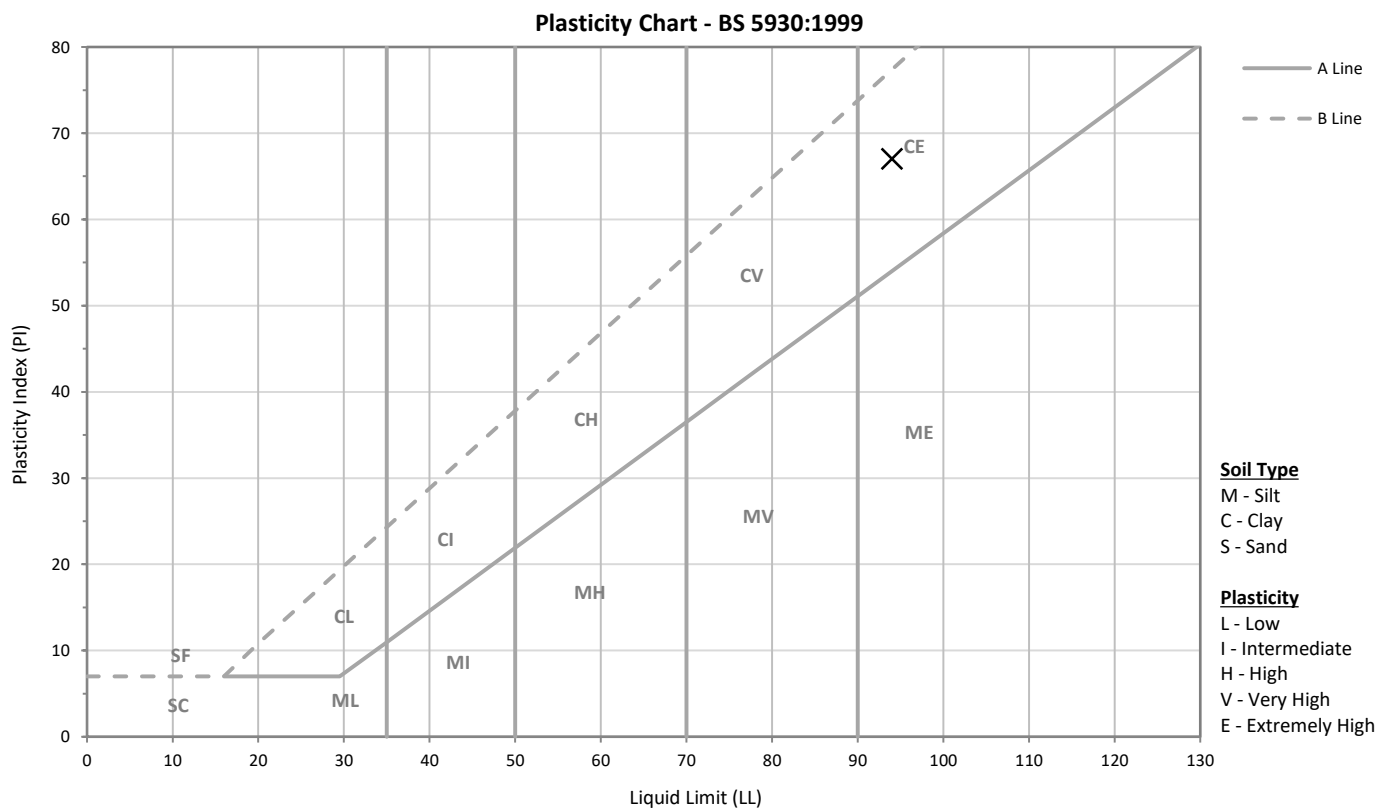


DETERMINATION OF LIQUID & PLASTIC LIMIT, PLASTICITY INDEX - NZS 4402: 1986 Tests 2.2 (4 Point), 2.3 & 2.4

TEST DETAILS			
LOCATION	ID	HA103	
	Description	N/A	
	Data	Level: 0.3-1.5 m	
SAMPLE	Geotechnics ID	AKL_202203070	Date Received 1/03/2022
	Reference	Sample 2	Depth 0.30m - 1.50m
	Description	N/A	
SPECIMEN	Reference	2	Depth -
	Description	Sandy CLAY, brownish grey, high plasticity	

TEST RESULTS

Liquid Limit 94
Plastic Limit 27
Plasticity Index 67



The plasticity chart is provided for your inference only and is not covered under our scope of IANZ accreditation. Due to the nature of classifications it is possible to have discrepancies between observational behaviour descriptions and measured parameters

TEST REMARKS

- The material used for testing was natural, fraction passing a 425um sieve.

This test result is IANZ accredited.

Approved By AJFG

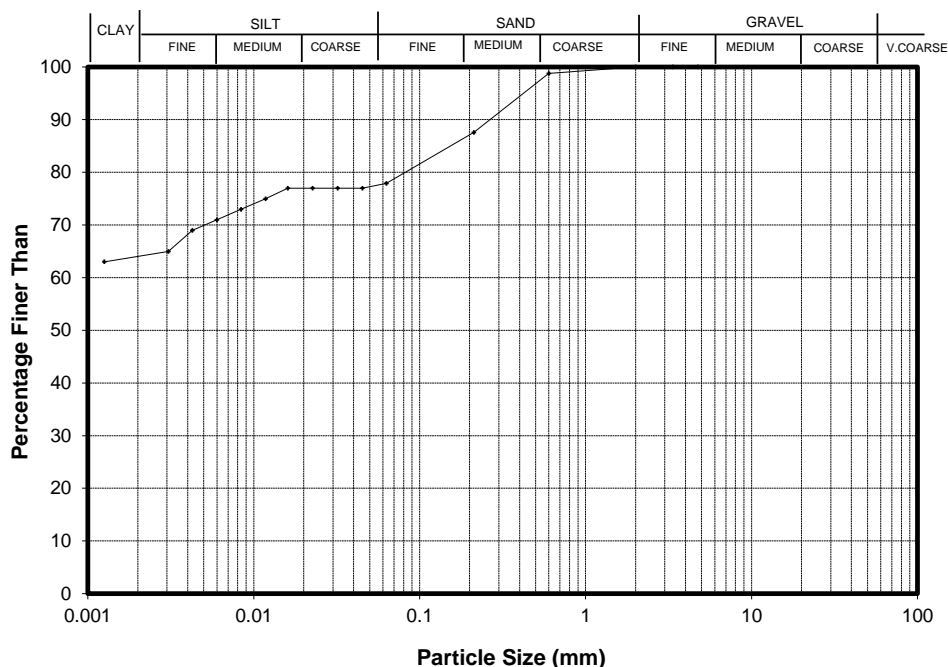
Date 21/03/2022



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New Zealand
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www.geotechnics.co.nz

Site: **Muriwai Downs**BH No.: **HA105**Sample ID.: **AKL45.3**

Test Method Used : NZS 4402:1986 Test 2.8.4 Subsidiary method for fine soils (Hydrometer)

Your Job No.: **JO1662**Our Job No.: **2021000.0565**Depth: **0.5-2 m****PARTICLE SIZE ANALYSIS**

Sieve (mm)	Total % Passing	Sieve (mm)	Total % Passing
4.75	-		
3.35	-		
2.00	100		
0.600	99		
0.212	88		
0.063	78		

Equivalent Particle Diameter D (mm)	% of Particles Finer than D
0.0452	77
0.0320	77
0.0226	77
0.0160	77
0.0118	75
0.0084	73
0.0060	71
0.0043	69
0.0031	65
0.0013	63

Sample history : Tested as recived
Description: sandy CLAY with some silt, dark brown orange with light brownish orange, high plasticity

Remarks : A sub sample was split from the original sample for hydrometer analysis. This sample was soaked with a dispersing agent (~2 hrs), then the mechanical shaker was used, until the material was brought into suspension, before proceeding with the test.
Suspension pH 8.98
The classification of gravel-sand-silt-clay components were described on the basis of particle size analysis.
Sample description is not IANZ accredited.
Results was obtained in accordance with NZS 4402:1986 Test 2.8.4 Subsidiary method for fine soils (Hydrometer)

Entered by : GEGO

Date : 18/03/2022 Checked by : CAGI

Date : 18/03/2022



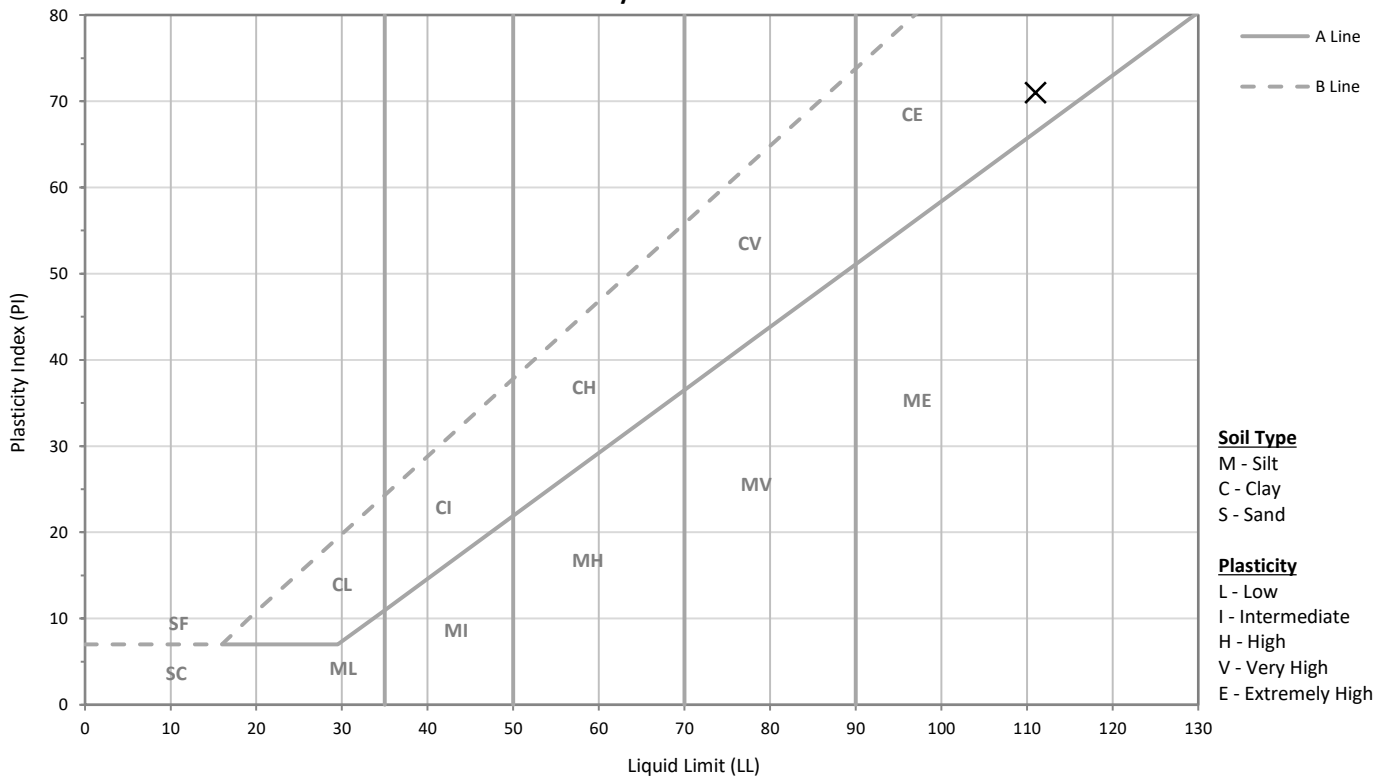
DETERMINATION OF LIQUID & PLASTIC LIMIT, PLASTICITY INDEX - NZS 4402: 1986 Tests 2.2 (4 Point), 2.3 & 2.4

TEST DETAILS			
LOCATION	ID	HA105	
	Description	N/A	
	Data	Level: 0.5-2.0 m	
SAMPLE	Geotechnics ID	AKL_202203071	Date Received 1/03/2022
	Reference	Sample 3	Depth 0.50m - 2.00m
	Description	N/A	
SPECIMEN	Reference	3	Depth -
	Description	sandy CLAY with some silt, dark brownish orange with light brownish orange, high plasticity	

TEST RESULTS

Liquid Limit 111
Plastic Limit 40
Plasticity Index 71

Plasticity Chart - BS 5930:1999



The plasticity chart is provided for your inference only and is not covered under our scope of IANZ accreditation. Due to the nature of classifications it is possible to have discrepancies between observational behaviour descriptions and measured parameters

TEST REMARKS

- The material used for testing was natural, fraction passing a 425um sieve.

This test result is IANZ accredited.

Approved By AJFG

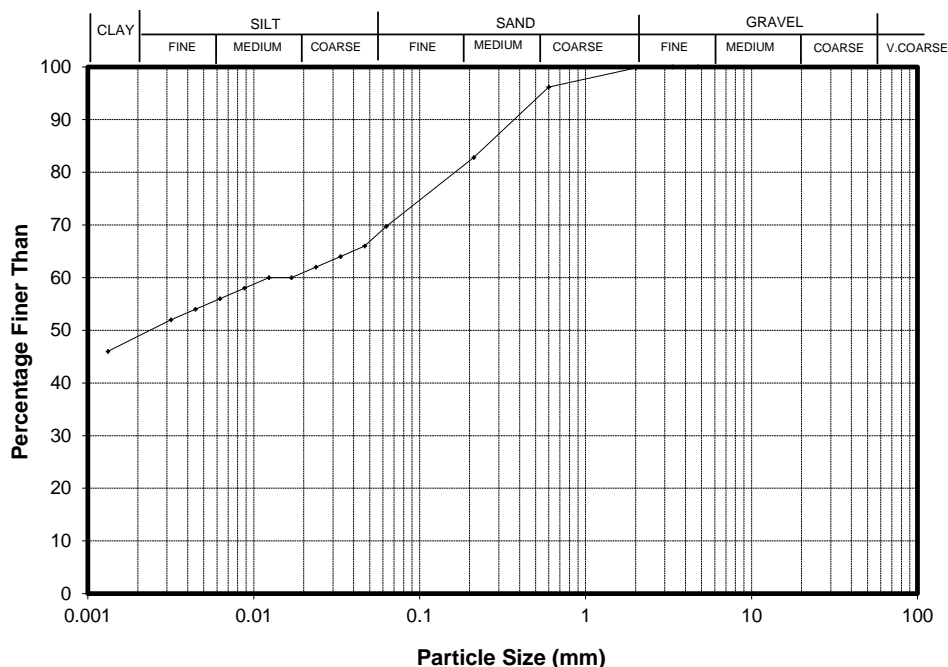
Date 21/03/2022



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New Zealand
P 64 09 356 3510
www.geotechnics.co.nz

Site: **Muriwai Downs** Your Job No.: **JO1662**
BH No.: **HA106** Sample ID.: **AKL45.4** Our Job No.: **20212000.0565**
Test Method Used : NZS 4402:1986 Test 2.8.4 Subsidiary method for fine soils (Hydrometer) Depth: **0.3-1.2 m**

PARTICLE SIZE ANALYSIS



Sieve (mm)	Total % Passing	Sieve (mm)	Total % Passing
4.75	100		
3.35	100		
2.00	100		
0.600	96		
0.212	83		
0.063	70		

Equivalent Particle Diameter D (mm)	% of Particles Finer than D
0.0467	66
0.0333	64
0.0237	62
0.0169	60
0.0123	60
0.0088	58
0.0063	56
0.0045	54
0.0032	52
0.0013	46

Sample history : Tested as recived
Description: sandy CLAY with silt, dark brown, high plasticity

Remarks : A sub sample was split from the original sample for hydrometer analysis. This sample was soaked with a dispersing agent (~2 hrs), then the mechanical shaker was used, until the material was brought into suspension, before proceeding with the test.
Suspension pH 8.0
The classification of gravel-sand-silt-clay components were described on the basis of particle size analysis.
Sample description is not IANZ accredited.
Results was obtained in accordance with NZS 4402:1986 Test 2.8.4 Subsidiary method for fine soils (Hydrometer)

Entered by : GEGO

Date : 18/03/2022 Checked by : CAGI

Date : 18/03/2022



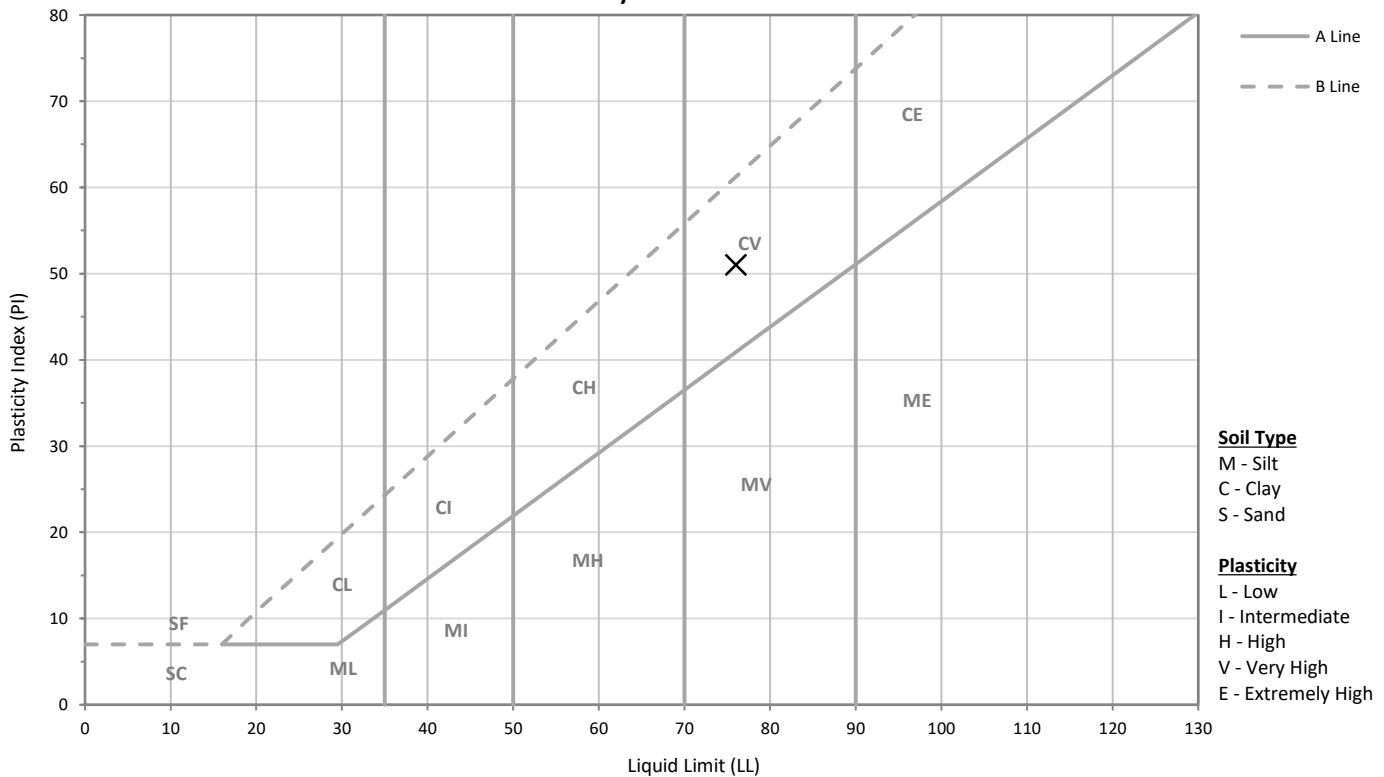
DETERMINATION OF LIQUID & PLASTIC LIMIT, PLASTICITY INDEX - NZS 4402: 1986 Tests 2.2 (4 Point), 2.3 & 2.4

TEST DETAILS			
LOCATION	ID	HA106	
	Description	N/A	
	Data	Level: 0.3-1.2 m	
SAMPLE	Geotechnics ID	AKL_202203072	Date Received 1/03/2022
	Reference	Sample 4	Depth 0.30m - 1.20m
	Description	N/A	
SPECIMEN	Reference	4	Depth N/A
	Description	sandy CLAY with silt, dark brown, high plasticity	

TEST RESULTS

Liquid Limit **76**
Plastic Limit **25**
Plasticity Index **51**

Plasticity Chart - BS 5930:1999



Soil Type
M - Silt
C - Clay
S - Sand

Plasticity
L - Low
I - Intermediate
H - High
V - Very High
E - Extremely High

The plasticity chart is provided for your inference only and is not covered under our scope of IANZ accreditation. Due to the nature of classifications it is possible to have discrepancies between observational behaviour descriptions and measured parameters

TEST REMARKS

- The material used for testing was natural, whole soil.

This test result is IANZ accredited.

Approved By AJFG

Date 21/03/2022

APPENDIX B – Engineering Wastewater Drawings

- Prepared by MCCL (1976-500)

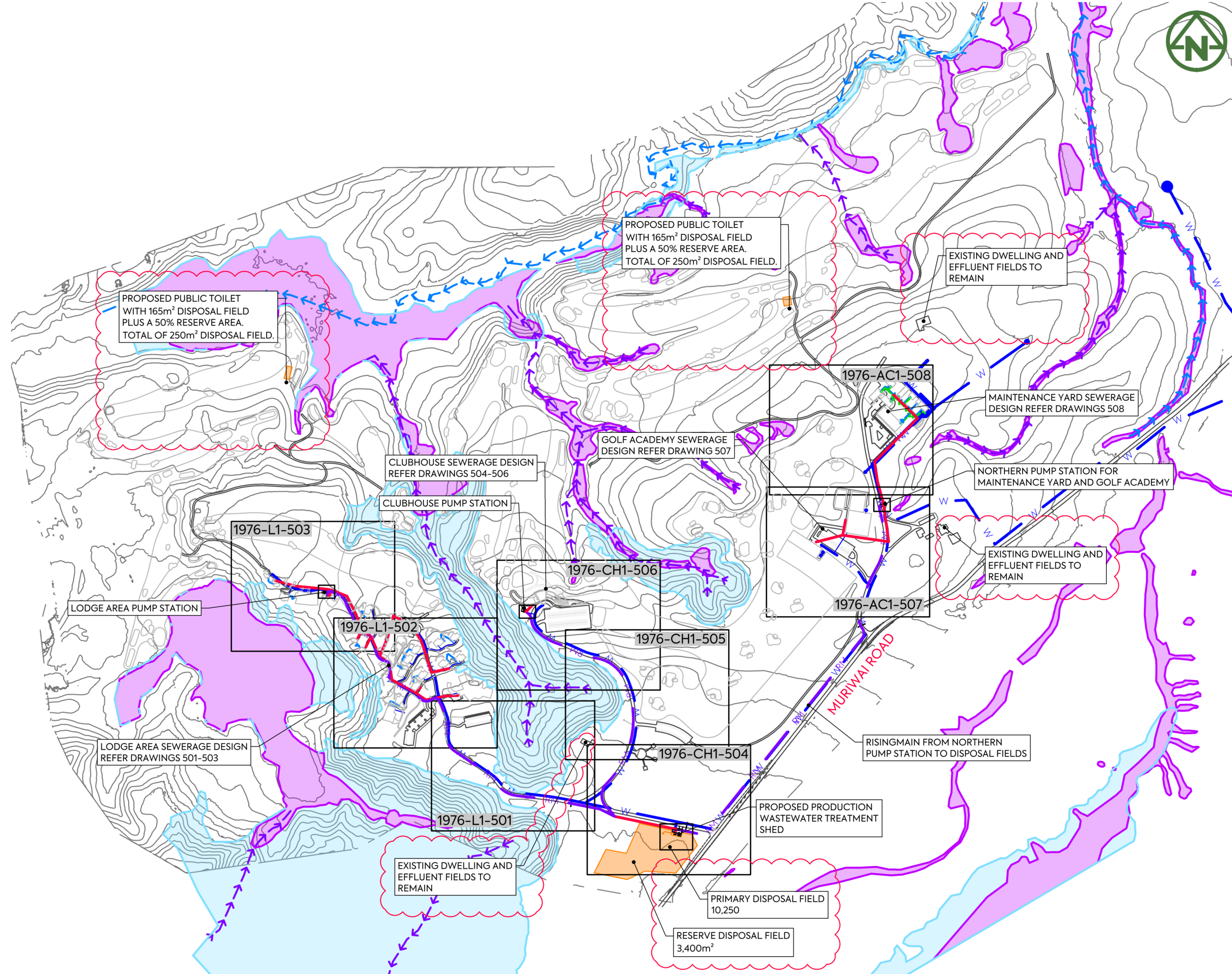


NOTES:

1. ALL WORKS AND MATERIALS ARE TO COMPLY WITH WATERCARE SERVICES LIMITED'S CODE OF PRACTICE FOR LAND DEVELOPMENTS AND SUBDIVISION.
2. ALL WASTEWATER LINE SIZES AND MATERIALS ARE SHOWN ON LONGSECTIONS IN THE 520-524 DRAWINGS.
3. ALL MANHOLES ARE TO BE 1050mm DIAMETER WITH HEAVY DUTY LIDS AND COVERS UNLESS SHOWN OTHERWISE ON THE LONGSECTIONS IN THE 520-524 DRAWINGS.
4. ALL PIPE CROSSINGS UNDER CARRIAGEWAYS/TRAFFIC AREAS TO BE HARDFILL BACKFILLED 1.0m BEYOND THE EXTENT OF THE CARRIAGEWAY.
5. ALL PIPE CROSSOVERS ARE TO BE HARDFILLED BACKFILLED 1.0m EITHER SIDE OF THE CROSSOVER.
6. PIPE CROSSOVERS ARE TO COMPLY WITH WATERCARE CODE OF PRACTICE TABLE 5.6. WHERE CROSSOVERS BETWEEN 150mm AND 300mm THE GAP IS TO BE POLYSTYRENE PACKED, IN ADDITION TO HARDFILLING CROSSOVERS. CROSS OVERS LESS THAN 150mm ARE NOT PERMITTED.
7. IT IS THE CONTRACTOR'S RESPONSIBILITY TO LOCATE AND ACCURATELY CONFIRM INVERT AND LID LEVELS OF EXISTING STORMWATER AND WASTEWATER MANHOLES PRIOR TO COMMENCING CONSTRUCTION. WHERE LEVELS DIFFER TO THOSE SHOWN THE CONTRACTOR SHALL ADVISE THE ENGINEER ACCORDINGLY.
8. THESE DRAWINGS DO NOT NECESSARILY SHOW ALL EXISTING SERVICES. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ACCURATELY LOCATE AND PROTECT ALL EXISTING SERVICES DURING THE CONSTRUCTION PERIOD.
9. ALL LOT CONNECTIONS ARE TO BE 100mm DIAMETER uPVC SN16 UNLESS SHOWN OTHERWISE, AND DIMENSIONED FROM THE DOWNSTREAM MANHOLE. ALL LOT CONNECTIONS TO EXTEND INTO THE LOT AT MINIMUM GRADE AND EXTEND VERTICALLY TO TERMINATE 1.0m BELOW FINISHED GROUND LEVEL AND STAKED. THE CONNECTION DEPTH SHOULD BE SET THAT THERE IS 1200mm COVER BELOW THE LOWEST LOT PLATFORM LEVEL. REFER TO DRAWING WSL STANDARD DRAWINGS FOR DETAILS.
10. CONNECTIONS ARE TO BE AS-BUILT PRIOR TO TRENCH BACKFILLING.

LEGEND:

- PROPOSED WASTEWATER GRAVITY NETWORK — WW —
- PROPOSED RISING MAIN — RM —
- PROPOSED DISPOSAL FIELD
- PROPOSED STORMWATER PIPED NETWORK — SW —
- PROPOSED STORMWATER CULVERT ROAD CROSSING —><—
- PROPOSED WATER SUPPLY — W —
- PROPOSED WATER CONNECTION —
- FINISHED (5m) MAJOR CONTOUR — 75.0 —
- FINISHED (1m) MINOR CONTOUR —
- EXISTING WETLANDS
- MAPPED SEA/ONF (BY ECOLOGIST)



REV	DESCRIPTION	DRN BY	CHK BY	APP BY	DATE
E	DISPOSAL FIELD UPDATED	SM	CH	JD	01/04/22
D	S92 RESPONSE	MO	CIM	JSD	04/03/22
C	ISSUED FOR CONSENT	MO	CIM	JSD	26/11/21
B	SECOND ISSUE	MO	CIM	JSD	05/11/21
A	FIRST ISSUE	MO	CIM	JSD	24/08/21



CLIENT: THE BEARS HOME PROJECT MANAGEMENT LTD PROJECT: MURIWAI DOWNS GOLF PROJECT TITLE: PROPOSED DRAINAGE WASTEWATER NETWORK OVERALL PLAN PURPOSE OF ISSUE: FOR CONSENT

610 & 697 MURIWAI ROAD MURIWAI VALLEY

SCALE: 1:7500 @ A3 DO NOT SCALE

DRAWING NO: 1976-1-500 REV: E