INITIA

GEOTECHNICAL SPECIALISTS

FLETCHER RESIDENTIAL LIMITED

THE HILL – ELLERSLIE RACECOURSE

GEOTECHNICAL REPORT – FOR PLAN CHANGE

INITIA REF 1218 REV B

SEPTEMBER 2023

Contents

1. Introduction

Auckland Thoroughbred Racing has decided to divest approximately 6.2 hectares of land from the eastern corner of the Ellerslie Racecourse Precinct. FRL has purchased this area of land and has obtained resource consent (through the fast trach process to construct approximately 357 residential dwellings. The proposed 357 dwellings comprise a mix of detached, duplex and terrace houses, market apartments, and an apartment building for active retirement use. Building heights range from 1 to 7 storeys (above any basement levels). The Precinct is located at the western end of the racecourse site and is bound by Ladies Mile and Derby Downs Place. The area of land subject to this plan change is currently part of a Special Purpose – Major Recreation Facility Zone and a plan change is now proposed to recognise the consented residential development. The precinct is to be referenced as the Remuera Precinct.

The Precinct enables housing choice including both medium to high density living opportunities with development up to 25m in height provided within the THAB zones. Development of the Precinct is defined by identified publicly accessible open spaces, areas of private open space, existing mature Pohutukawa trees (combined with a 6m setback in their vicinity) and garden streets.

Movement through the precinct is provided two new public roads, one of which connects to Ladies Mile while the other connects to Derby Downs Place. Entry markers are proposed at these locations. A series of interconnected commonly owned access lots in combination with identified pedestrian routes provide internal linkages within and through the Precinct. An existing tunnel also connects Derby Downs Place with the infield of the racecourse.

Stormwater from the precinct is managed by the adopted Stormwater Management Plan for the precinct.

With regard to archaeological matters, FRL has obtained an authorisation from Heritage New Zealand for the earthworks required to prepare the site for development. The authorisation requires – [add brief summary]

The zoning of the land within the Remuera Precinct is Residential - Terrace Housing and Apartment Buildings and Residential – Mixed Housing Urban.

This Geotechnical Interpretive Report has been prepared to summarise the investigations undertaken and outlines the key geotechnical considerations that will need to be addressed for the proposed Plan Change at The Hill, Ellerslie Racecourse.

This report has been prepared to support the proposed Plan Change at The Hill, Ellerslie Racecourse as presented in Figure 1-1.

Our scope of work to date has comprised:

- At Due Diligence Stage:
  - Review of historical geotechnical investigation data available for the site;
  - Supplementary geotechnical investigations predominantly for the purposes of assessing the feasibility for onsite soakage (for stormwater disposal);
  - Preparation of a Geotechnical Report highlighting the key geotechnical considerations to support due diligence that was being undertaken on the site.
- Resource Consent Stage:
  - Limited supplementary geotechnical investigations. These investigations were targeted south of the pond to better delineate ground conditions for the proposed multi-storey buildings in this area;
  - Review of the geohazards and mitigation measures pertinent to the conditions encountered during the investigations; and
  - Preparation of this report.

- **Plan Change Stage (Current):**
    - An assessment was previously provided for a fast track application. This assessment has been updated to address the relevant matters for a plan change to the same area of land, in order to accommodate the development envisaged in the resource consent application.

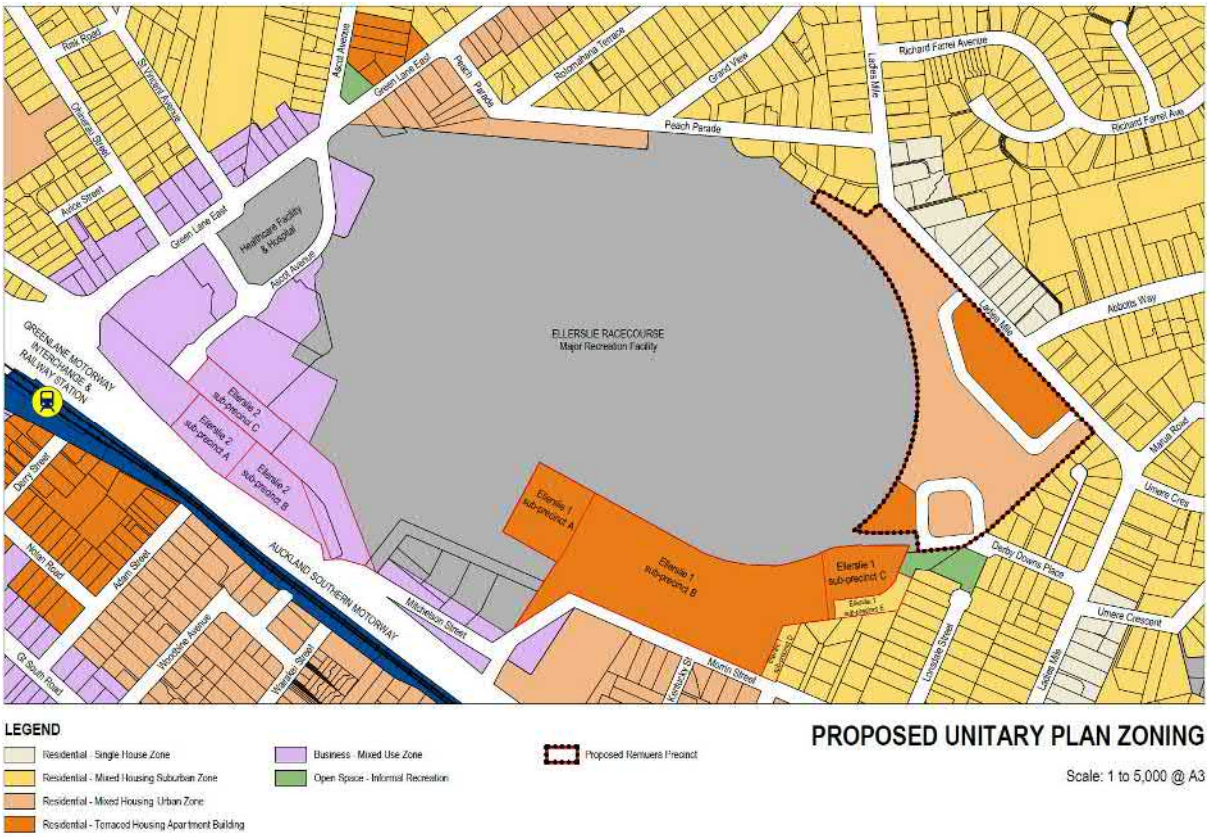

Figure 1-1: Proposed plan change

2. Site Description and Proposed Development

The site is situated on the eastern end of the Ellerslie Racecourse, bound by Ladies Mile in the north and east and Derby Downs Place to the south (refer Figure 2-1).

Contours sourced from the Auckland Council GIS indicate the site slopes from about RL55 at the northern boundary to about RL 40 at the southern boundary.

An existing pond is situated near the southern end of the site. We understand that the pond is to be decommissioned and infilled.

Figure 2-1: Indicative site location

We understand that the proposed plan change comprises a mix of zones:

- Residential - Mixed Housing Urban Zones.
- Residential - Terraced Housing Apartment Building Zones.
- Roads and associated infrastructure (storm and wastewater pipes).

Earthworks will be required to form building platforms and roads alongside a series of retaining walls. Design parameters for these walls are presented in Section 5.5, however detailed design and Building Consenting will be undertaken at a later stage.

The site is to be serviced by a series of new stormwater and wastewater pipes. It is understood that these services are to be installed using traditional battered excavations in combination with pipe jacking/thrusting techniques. The pipe jacking/thrusting methodology is outside the scope of this report and will be subject to a specific assessment. Temporary shafts that may be required are also outside the scope of this document.

An easement is proposed in the vicinity of the existing 1.9 m diameter stormwater pipe that traverses the central portion of the site.

3. Geotechnical Investigation

3.1 Historic Investigations

SKM

Based on a review of the New Zealand Geotechnical Database, a series of historic machine boreholes have been undertaken across the site by SKM Consulting between 2006 to 2008. The depths of these investigations ranged between 12 m and 30 m below ground level. These investigations have been made available to us by Auckland Racing Club (ATR) and are attached in Appendix B.

Lander Geotechnical

In addition, Lander Geotechnical were commissioned by ATR to undertake a series of investigations across the site, comprising:

- 8 No. hand auger boreholes to refusal or 5 m depth below ground level (bgl);
- 6 No. machine boreholes to between 9.5 m and 24 m bgl; and
- 12 No. test pits to between about 1 m and 4.5 m bgl.

The results of the Lander investigations are summarised in Memo ref J01709-Rev1 dated 13 July 2021 attached in Appendix B. The locations of the historical investigations are presented in the site plan in Appendix A.

We note the ground level at the time of the Lander or SKM investigations is uncertain.

3.2 Initia Site Investigations

Initia undertook additional supplementary investigations between October 2021 and February 2022 comprising:

- 8 machine boreholes were drilled using rotary techniques to between about 9 m and 27 m below existing ground level (begl). Machine boreholes were completed by DCN Drilling (October 2021) and Geotech Drilling (February 2022). In situ strength testing comprising Standard Penetration Tests (SPTs) was undertaken at regular intervals within the majority of boreholes and shear vane testing was carried out where cohesive material was encountered. Soakage testing was undertaken within 3 machine boreholes (BH01, BH02 and BH03). Standpipe piezometers were installed within the boreholes to allow ongoing measurement of groundwater;
- 5 boreholes drilled using percussion techniques to between about 5.5 m and 13.5 m for soakage testing.

The locations of the investigations are shown on Figure 1218-001 and summarised in Table 3-1 below.

Table 3-1 - Summary of Initia Investigations

Investigation ID	Investigation Type	Coordinates (NZTM)[1]		Ground Surface Elevation[2] (m RL)
		Easting (mE)	Northing (mN)	
BH01 (Red)	Machine Borehole	1761459	5915826	55.0
BH01 (Blue)	Machine Borehole	1761368	5915940	54.5
BH02	Machine Borehole	1761339	5915799	46.7
BH03	Machine Borehole	1761234	5915691	42.6
SH01	Percussion Borehole	1761368	5915697	42.6
SH02	Percussion Borehole	1761228	5915686	42.7
SH03	Percussion Borehole	1761291	5915727	39.9

Investigation ID	Investigation Type	Coordinates (NZTM)[1]		Ground Surface Elevation[2] (m RL)
		Easting (mE)	Northing (mN)	
SH04	Percussion Borehole	1761280	5915768	42.1
SH05	Percussion Borehole	1761274	5915667	42.6
BH101	Machine Borehole	1761270	5915725	41.75
BH102	Machine Borehole	1761248	5915723	40.69
BH103	Machine Borehole	1761247	5915700	41.94
BH104	Machine Borehole	1761268	5915681	42.11

Note 1: Co-ordinate system – NZTM 2000. Test location coordinates are determined via hand-held GPS Survey +/- 5 m in plan and/or measured distance from existing structures.
Note 2: Datum – AUCKHT 1946. Ground surface elevations are based on interpretation from Auckland Council Contours and are expected to be accurate + or – 0.5m.

The density and type of investigations undertaken are considered suitable for the purposes of a bulk earthworks consent. Recommendations for further investigation are outlined in Section 5.9.

4. Subsurface Conditions

4.1 General

The advice and recommendations presented in this report are based on the historic geotechnical investigations undertaken by other consultants and current geotechnical investigations undertaken by Initia. The nature and continuity of the ground conditions away from the investigation locations is inferred and it must be appreciated that actual conditions could vary from the assumed model.

4.2 Published Geology

Based on the published geological maps (refer Figure 4-1 below) and readily available geotechnical data from the New Zealand Geotechnical Database (NZGD), the site is expected to be underlain by three different geological units:

- The southern end of the site is underlain by Auckland Volcanic Field (pink unit), which was likely sourced from the nearby One Tree Hill Volcano. This material typically consists of clayey silt volcanic ash, volcanic tuff and basalt rock.
- In the centre of the site, Holocene river deposits are mapped. This material typically consists of sand, silt and clay with some local gravel and peat beds.
- In the northern portion of the site, East Coast Bays Formation (ECBF) soils and rock (orange unit) are mapped. The ECBF material typically consists of a clayey silt and sandy silt residual soils which are underlain by weathered interbedded siltstone and sandstone.

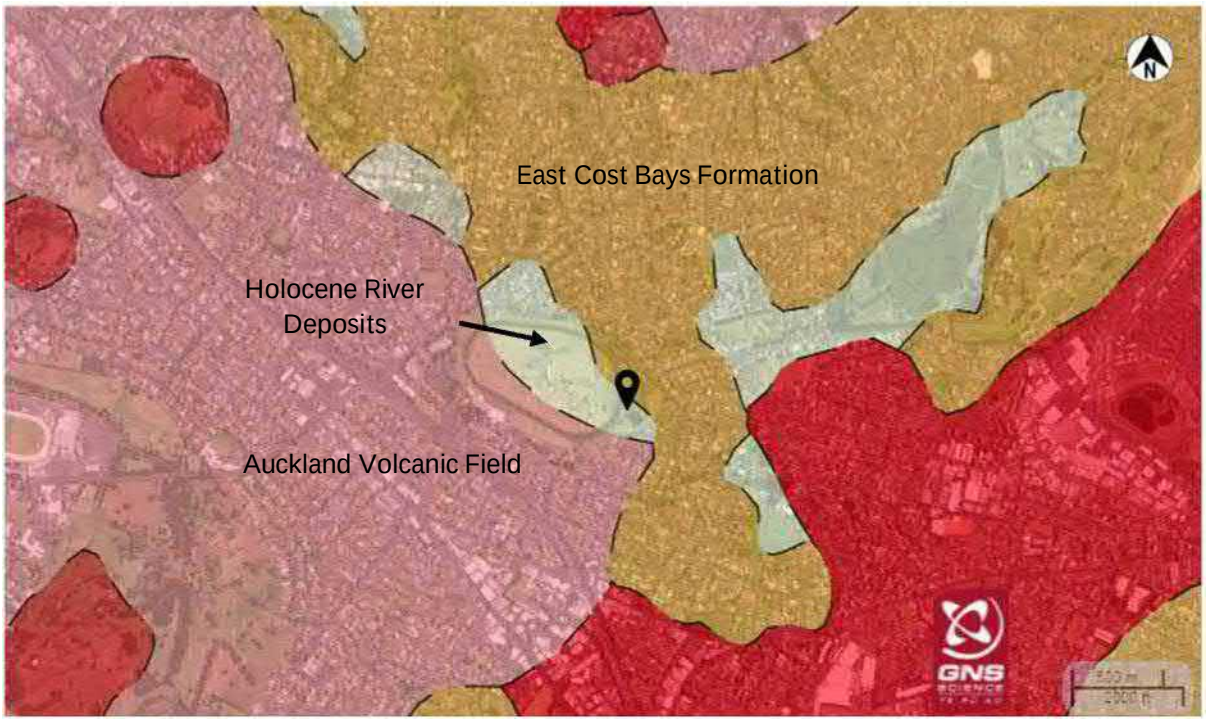

Figure 4-1: Published geological map sourced from GNS Science.

4.3 Site Stratigraphy

Based on the geotechnical investigations undertaken, subsurface conditions are generally consistent with the published geology. A transition zone in geology is apparent at/near the existing pond and therefore for the purposes of this report, the pond has been used to delineate the ground conditions.

North of the existing pond the ground conditions typically comprise:

- Topsoil;
- Non-Engineered Fill – Within the non-engineered fill, pockets of brick, concrete, wood and other unsuitable material was encountered. In localised areas the non-engineered fill is as thick as 8 m. The indicative extent of deep fill is shown on the site investigation plan in Appendix A;
- Auckland Volcanic Field – Ash (soil);
- Residually weathered ECBF soils; and
- Highly weathered to slightly weathered ECBF 'rock'

South of the existing pond the ground conditions typically comprise:

- Topsoil;
- Auckland Volcanic Field – Ash over Basalt(rock);
- Puketoka Formation sediments;
- Residually weathered ECBF;
- Highly weathered to slightly weathered ECBF

A summary of the ground conditions is presented in Table 4-1 and Table 4-2 and illustrated on cross sections Figures 1218-02 to 1218-04 in Appendix A. Indicative depths to ECBF rock encountered during the investigations are summarised on the geological sections in Appendix A.

Table 4-1 - Ground Conditions north of the existing pond

Geological Unit	Soil/Rock type	Depth to Top of Unit (m, bgl)	Layer Thickness (m)	In Situ Strength Parameters Range [Typical Value]	
				Su (kPa) (2)	SPT 'N' Value
Non-engineered Fill (1)	Very stiff to hard clayey SILT with fragments of brick,	0	0.5 - 8	Not measured	6
Auckland Volcanic Field	Very stiff to hard clayey SILT (Volcanic Ash)	0.2 - 0.5	1	197- 215 [200]	-
Residually Weathered East Coast Bays Formation	Very stiff to hard clayey SILT and sandy SILT	0.0 - 3.0	4 - 10	102 - 215+ [150]	4 - 15 [8]
East Coast Bays Formation	Highly to Slightly Weathered Interbedded Siltstone and Sandstone	4.5 - 12.5	Unproven	-	12 - 50+ [35]

Notes:

1. The approximate extent of non-engineered fill is shown on Figure 1218-001 in Appendix A. While it is expected that a large majority of the fill material will be suitable for re-use, it is recommended that supplementary test pit investigations be undertaken prior to construction.

2. Undrained shear strengths were measured at the end of the core barrel so may not be representative of in situ conditions.

Table 4-2: Ground Conditions south of the existing pond

Geological Unit	Soil/Rock type	Depth to Top of Unit (m, bgl)	Typical Layer Thickness (m)	In Situ Strength Parameters Range [Typical Value]	
				Su (kPa) (1)	SPT 'N'
Auckland Volcanic Field	Volcanic ash – Very stiff to hard clayey SILT	0.0	1 - 3	215+	6
	Basalt Rock	1 - 3	5 - 8	N/A	50+
Puketoka Formation	Stiff to very stiff silty CLAY with some organics	6 - 11	10 - 16	50 - 100 [70]	2 - 13 [6]
Residually Weathered East Coast Bays Formation	Very stiff to hard clayey SILT and sandy SILT	15.0 - 26	0.5 - 2	Not measured	7 - 17 [10]
East Coast Bays Formation	Highly to Slightly Weathered Interbedded Siltstone and Sandstone	19.0 - 23.0	Unproven	N/A	25 - 50+ [50+]

Note: Undrained shear strengths were measured at the end of the core barrel and may not be representative of in situ conditions.

4.4 Groundwater

Standpipe piezometers were installed in the four machine boreholes drilled by DCN drilling in October 2021. The standpipe piezometers have been manually measured over the course of the project to date. Groundwater was also measured in the soakage holes before the soakage tests commenced.

A summary of the groundwater readings to date is presented in Table 4-3. The lowest measured groundwater readings are also shown on geological cross sections in Appendix A.

Table 4-3 - Summary of Groundwater Levels

Investigation ID	7/10/2021 (Following Investigations) Depth below existing ground level (m)	13/10/2021 Depth below existing ground level (m)	2/11/2021 Depth below existing ground level (m)	23/11/2021 Depth below existing ground level (m)	21/01/2022 Depth below existing ground level (m)	6/04/2022 Depth below existing ground level (m)
BH01 (Red) – nested piezometer Upper screen between 3 and 6 m begl; Lower Screen between 8 and 10 m begl	Not measured	2.8, 3.7	2.46, 3.31	2.65, 3.37	4, 5.3	4.3, 5.3
BH01 (Blue)	2.9	5.8	Dry	5.85	6	6
BH02	Not measured	Not measured	1.57	1.29	2	2.1
BH03		2.15	1.63	2.28	3.5	3.7
SH01	Drilled subsequently		Not encountered	Not Measured		
SH02			1.9			
SH03			1.3			
SH04			Not measured			
SH05			2.7			

The implications on the proposed development are discussed in Section 5.7 below.

5. Geotechnical Considerations

5.1 General

Based on the encountered ground conditions the following geotechnical considerations are considered pertinent for the proposed plan change:

- Site seismicity and liquefaction potential.
- Earthworks and fill placement.
- Foundation options.
- Basement and Auckland Unitary Plan considerations.
- Slope stability and retention considerations.
- Floor slab and pavement considerations.

In addition to the above commentary is provided on site soakage (for stormwater disposal). These considerations are discussed further in the following subsections.

5.2 Soakage Testing and Considerations

Soakage testing was attempted within all boreholes undertaken in October 2021, except BH01 (Blue). However, the testing indicated very minimal soakage both in the clayey silt soils to the north of the existing pond as well as the basalt south of the existing pond. The results of testing from the rotary boreholes are attached in Appendix B.

Soakage testing was attempted in the percussion boreholes SH01 – SH05, however no soakage was possible, and the holes overtopped during the 'pre-soak' phase of the test.

Based on the testing undertaken, disposal of stormwater through onsite soakage within the basalt in the southern half of the site is not considered feasible.

5.3 Seismic Considerations

5.3.1 Subsoil Class

On the basis of the depth to East Coast Bays Formation rock encountered in the investigations, the site subsoil class can be taken as Class C – shallow soil in accordance with NZS 1170.5:2004 amended in 2016.

5.3.2 Liquefaction Potential

Liquefaction susceptibility is a fundamental physical characteristic of the soil that describes how it responds to earthquake shaking. Liquefaction typically only occurs in soils which are saturated, non-cohesive, and low to moderate permeability. This includes the following broad soil types:

- Sands and low plasticity/non-plastic silts;
- Young, typically Holocene-Age (≤12,000 years old) deposits; and
- Gravels (if they have a low permeability or are confined by less permeable layers).

From the geotechnical investigations undertaken, the soils encountered generally comprised very stiff to hard Fill, Volcanic Ash, Puketoka Formation and ECBF residual soils. Theses soils are generally considered **cohesive (moderate to high plasticity silts and clays)**. Accordingly, the soils encountered at the site are not considered susceptible to liquefaction and quantitative analyses have not been undertaken nor are they considered necessary.

No specific design or detailing will be required to address liquefaction effects for any structures proposed for the site.

5.4 Earthworks

5.4.1 General

Earthworks should be undertaken in general accordance with the recommendations outlined in NZS 4431:1989 (Earth fills for residential development) and NZS4404:2010 (Land development and subdivision infrastructure).

5.4.2 Surficial Stripping and Subgrade Preparation

The development area should be cleared of any topsoil and weak deposits at the base of the existing pond prior to placement of new engineered fill or foundation elements. Sediment and erosion controls should be implemented following topsoil stripping.

All subgrade shall be inspected by a geotechnical engineer competent in understanding the design requirements in this report. Exposed subgrade surfaces shall be protected through placement of a blinding layer and water should not be allowed to pond on the surface.

5.4.3 Re-use of Site Won Material as Engineered Fill

As outlined in Section 4.3 Based on the geotechnical investigations undertaken, non-engineered fill was encountered north-west of the existing pond (refer Figure 1218-001 in Appendix A for approximate delineation of the zone). This material is locally up to 8 m thick. This material will need to be screened for unsuitables and approved material will need to be reworked in accordance with the specification below.

In areas where deep fill was not encountered, the near surface natural materials encountered across the site generally comprised very stiff to hard Auckland Volcanic Field (AVF) ash, Puketoka Formation and Residual ECBF Soils (clayey silts/silty clays). These soils are expected to be almost entirely suitable for re-use as engineered fill without prior conditioning or treatment.

It is noted that the AVF volcanic ash soils are considered sensitive and can have a low remoulded strength when disturbed, especially when saturated. Earthworks will need to be carefully managed to preserve the strength of the material. If winter earthworks are proposed, allowance should be made to lime stabilise the volcanic material.

Prior to commencement of bulk filling, it is recommended that standard laboratory testing be undertaken to confirm optimum water contents and solid densities of the soils proposed for re-use to assist with compaction quality assurance during earthworks. Preliminary compaction criteria provided – for inclusion within an overall earthworks specification – is provided below.

5.4.4 Compaction

All new engineered fill should be placed to meet or exceed the preliminary compaction control criteria provided below.

Fill materials shall be placed in approximately 300 mm thick (loose layers) and compacted to achieve the standards defined below:

- Cohesive materials (site-won Volcanic Ash and Puketoka soils):
    - Average undrained shear strength over 10 consecutive readings shall not be less than 140 kPa with no individual reading less than 120 kPa; and
    - The air voids shall not exceed 8% (average of 5 readings).
- Cohesionless hardfill (e.g. GAP40 or GAP65) shall be placed in uniform layers not greater than 300 mm loose thickness and compacted to obtain the following standards:
    - The in-situ dry density shall be not less than 80% of the maximum solid density (95% of maximum dry density (MDD)), as determined by Test 2.7.1, NZS 4402; or

- Compaction testing shall be completed using a Clegg Hammer or other approved device. The minimum Clegg Impact Value (CIV) for any single test shall be 25 with an average of no less than 28 (5 consecutive tests).

It should be noted that prior to construction, bulk samples will need to be obtained for laboratory testing. This will allow the target for validation testing to be confirmed.

5.4.5 Settlement for Filling

Based on the strength of the underlying ground, consolidation settlement from any filling works is not expected to be significant. Nevertheless, it is recommended that where fill thicknesses exceed 3 m, that settlement pins be installed at the finished ground surface and monitored. Construction of services and buildings should only commence following a review of the settlement monitoring data by the geotechnical engineer.

5.4.6 Slope Stability

Temporary cut batter slopes are likely required to enable the construction of the basements for the buildings adjacent to Ladies Mile, up to a maximum height of about 3 m. In addition, fill batter slopes are proposed over a portion of the south-western boundary. Figure 5-1 shows the approximate locations of the proposed slopes.

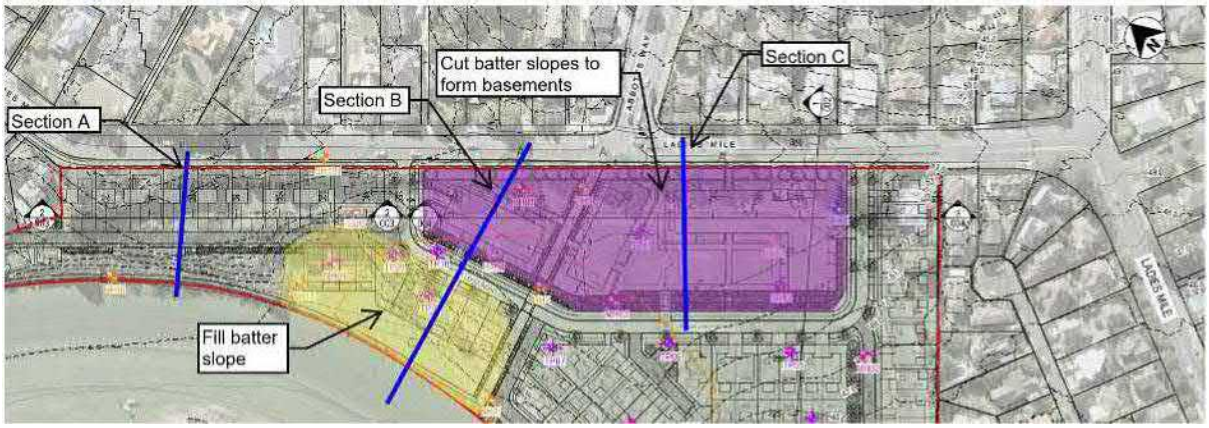

Figure 5-1: Approximate extents of proposed fill and cut batter slopes and critical stability sections considered

Analyses have been undertaken to assess current and proposed (temporary and permanent) stability using limit equilibrium software Slide. The locations of the critical sections considered in our analyses are presented in Figure 5-1.

Parameters adopted in our analyses are based on the results of recent and historical investigations undertaken at the site and are presented in Table 5-1. These parameters have been derived based on correlations with in situ testing, our experience with similar material and the recommendations in Auckland Council Code of Practice.

Table 5-1: Summary of geotechnical parameters adopted in analyses

Geological Unit	Unit weight, γ (kN/m^3)	Effective cohesion, c' (kPa)	Effective friction angle, ϕ' (degrees)
Existing Fill	17.5	5	30
Engineered fill (cohesive)	18.5	5	32
Residual East Coast Bays Formation (ECBF) Soil	17.5	6	32
ECBF rock	22	50	40

Note: No volcanic material is expected over the critical sections considered.

Stability analyses have been undertaken for the following:

Section A

- Current topography
- Proposed conditions – cut slope (permanent along northwestern boundary). Sensitivity analyses was undertaken to assess the maximum allowable slope angle.

Section B

- Current topography
- Proposed Conditions:
    - Cut batters for basements adjacent to Ladies Mile (1V:1H, temporary while the basements are constructed)
    - Lower fill slope, adjacent to the racetrack (permanent).

Section C

- Current topography not assessed – section is currently generally level
- Proposed conditions, cut batter adjacent to Ladies Mile (1V:1H, temporary while the basements are constructed)

The following target factors of safety FoS for different design cases were considered in accordance with generally accepted standard practice:

- Temporary conditions:
    - Static (normal groundwater) FoS ≥ 1.3
    - Static (elevated groundwater) FoS ≥ 1.2
- Permanent conditions:
    - Static (normal groundwater) FoS ≥ 1.5
    - Static (elevated groundwater) FoS ≥ 1.2
    - Seismic FoS ≥ 1.0

The following assumptions were adopted in our analyses:

- The static normal groundwater level has been derived based on groundwater at the site, and is below the proposed batters (ie. batters have been modelled as dry);
- For elevated groundwater conditions we have modelled a near saturated slope (piezometric line approximately 1 m below the slope surface) to simulate conditions following periods of heavy rainfall;
- A seismic load case has only been considered for current and permanent stability analyses. The seismic load has been derived based on recommendations presented in MBIE Module 1 and 6. A PGA of 0.19 g has been applied based on these recommendations.

The results of the stability analyses are presented below for the current, temporary and proposed permanent cases.

Table 5-2: Summary of stability analysis results for Section A

Analysis description	Analysis case	FoS criteria	Calculated FoS
Current conditions	Static – normal groundwater	>1.5	1.7
	Static – elevated groundwater	>1.2	1.3
	Seismic – normal groundwater	>1.0	1.3
Proposed conditions **(permanent)**: 1V:1.5H cut slope	Static – normal groundwater	>1.5	1.5
	Static – elevated groundwater	>1.2	1.2
	Seismic – normal groundwater	>1.0	1.2

Table 5-3: Summary of stability analysis for Section B

Analysis description	Analysis case	FoS criteria	Calculated FoS
Current conditions	Static – normal groundwater	>1.5	3.5
	Static – elevated groundwater	>1.2	3.5
	Seismic – normal groundwater	>1.0	2.0
Adjacent to Ladies Mile **(temporary)**: 1V:1H cut batter	Static – normal groundwater	>1.3	1.7
	Static – elevated groundwater	>1.2	1.5
Lower fill slope, adjacent to the racetrack **(permanent)**: 1V:3H slope	Static – normal groundwater	>1.5	1.6
	Static – elevated groundwater	>1.2	1.6
	Seismic – normal groundwater	>1.0	1.4

Table 5-4: Summary of stability analysis results for Section C

Analysis description	Analysis case	FoS criteria	Calculated FoS
Proposed conditions, adjacent to Ladies Mile **(temporary)**: 1V:1H cut batter	Static – normal groundwater	>1.5	1.8
	Static – elevated groundwater	>1.2	1.6

The current site meets generally acceptable factors of safety and proposed works under a proposed plan change are unlikely to exacerbate this.

Adjacent to Ladies Mile, assessed factors of safety imply negligible displacement due to proposed cuts.

Recommendations regarding slope stability on the proposed development is as follows:

Temporary Cut Slopes

Based on our understanding of the strength of the near surface soils at the site a maximum temporary batter of 1V:1H may be adopted up to a maximum height of 3 m.

Suitable drainage should be provided to all slopes and surface water diverted to a suitable outlet connection.

We note that localised frittering/instability of the batter face may occur, particularly during heavy periods of rainfall. To mitigate this risk, the following could be considered:

- Using an observational approach and providing measures to ensure the batters remain dry. This method is ideally limited to a short period (< 6 months), and when weathered is likely to be more favourable; and/or
- Installing reinforcing elements with mesh (soil nails, mantaray anchors or similar).

Permanent Cut Slopes

The permanent lower slope (Section A) may be formed to a maximum slope angle of 1V:1.5H. This slope will need to be planted with flax, kanuka, manuka or similar to prevent erosion.

Fill Slopes

Analyses undertaken on the 1V:3H slope along a portion of the north west boundary, as proposed, achieve generally acceptable factors of safety. Steeper fill slopes may be achievable, however these will require some form of reinforcement (eg. geogrids) to maintain long term stability. Supplementary, analyses should be undertaken if these are preferred.

5.5 Retaining Walls

A series of retaining walls will be required. Retaining walls are likely to comprise, masonry block (gravity) or timber pole (embedded) walls with lagging between the piles and are likely be suitable up to 4 m height. Steel UCs with timber lagging or Bored Cast in situ reinforced concrete walls could be considered for walls with larger retained heights. Walls will be subject to detailed design and building consenting prior to construction. If required, fall protection barriers will be provided. Appropriate analyses will be undertaken to demonstrate stability at Building Consent stage.

Parameters considered appropriate for use in retention analyses are presented below. These parameters can be amended on review of ground conditions and during detailed design.

Table 5-5 - Retention Parameters

Soil Type	Unit Weight (kN/m^3)	Deformation Modulus, MPa	At Rest Earth Pressure Coefficient, K_o	Active Earth Pressure Coefficient, Ka	Passive Earth Pressure Coefficient, Kp
Existing Fill	17.5	15	0.5	0.33	3
Engineered fill (cohesive)	18.5	30	0.47	0.3	3.3
Engineered Fill (granular)	18.5	30	0.42	0.27	3.7
AVF Ash	18	20	0.47	0.3	3.3
Puketoka Formation soils	18	20	0.47	0.3	3.3
Residual East Coast Bays Formation (ECBF) Soil	17.5	25	0.5	0.33	3

Note the parameters do not allow for surcharges, groundwater pressure or wall friction. Appropriate allowances should be made during detailed design.

In addition, drainage should be included behind all retaining walls.

Providing the above is undertaken, it is considered that the risk of instability can be adequately mitigated.

5.6 Foundation Considerations

5.6.1 Residential Dwellings on New Fill or Natural Ground

For lightweight dwellings (up to 2 storeys) and podium type structures across the site, shallow foundations are likely to be feasible. These foundations could comprise NZS3604 type foundations or reinforced concrete raft type foundations bearing on either natural soils or engineered fill.

Where significant thicknesses of non-engineered fill are currently present, material will need to be reworked to form a crust of engineered fill as per the recommendations in Section 5.4.

Foundations will need to detailed to accommodate seasonal volume change (soil expansivity), however this risk can be mitigated through adequate foundation embedment or suitable reinforcement (use of reinforced concrete raft type foundations). Based on our experience with similar materials the soils will like be Class H (Highly Expansive).

Bearing capacities and soil expansivity will be confirmed in the geotechnical completion report, following completion of the earthworks completion.

5.6.2 Residential Terraced Housing Apartment Buildings South of Pond

For the residential terraced housing apartment buildings south of the pond, shallow raft type foundations bearing on either very stiff to hard AVF ash or basalt are likely to be suitable. The recommended bearing capacity values to adopt for design are presented in Table 5-6 below. These values are based on the following assumptions:

- Should the foundation system be founded into the ash layer (very stiff to hard silt and clay), a minimum undrained shear strength of 120 kPa is considered for the Auckland Volcanic Field soils.
- Although higher bearing capacities, of up to 6 MPa, can usually be achieved when shallow footings are founded directly onto competent basalt rock, lower values are recommended for design as this will result in a reduced requirement to prove highly competent material during construction. If higher capacities are required, additional proof drilling during construction may be necessary to demonstrate competent basalt and a lack of cavities.
- The founding layer should be proof rolled and visually inspected prior to casting the shallow foundations to confirm the ground conditions.
- Significant inclined loading of the foundations has not been considered. Specific bearing capacity calculations in accordance with the New Zealand Building Code Verification Method B1/VM4 should be carried out for these loading scenarios, if required, to confirm capacities.
- The allowable bearing pressure values are based on a maximum foundation width of 2 m and are based on allowable long-term settlement of approximately 25 mm. Wider foundations will need to be specifically considered.

Table 5-6: Bearing Capacity Values for Shallow Foundations

Geotechnical Unit ID	Geotechnical Ultimate Bearing Capacity q_u (kPa)	Geotechnical Design Bearing Capacity[1] - For ULS design (kPa)	Allowable Bearing Capacity (kPa)
Ash (with interbedded layers of gravels and boulders)	600	300	150
Basalt (Fractured, Competent)	1,500[2]	700	500

Notes:
1. 'Geotechnical Design Bearing Capacity – For ULS design' includes a strength reduction factor of 0.5.
2. Should bearing capacities higher than recommended be required to accommodate large magnitude structural loads, proof drilling at each foundation location to 5.0 m depth below the founding level will be required during or just prior to construction. Should voids be encountered below the foundation level, the voids will need to be infilled with grout.

Preliminary spring stiffness values for use in the structural building model are presented in Table 5-7 below. These values depend on the overall foundation layout and load distribution beneath the building and may vary across the buildings' footprint. Accordingly, these values will need to be confirmed during detailed design. Specifically, design bearing pressures and spring displacements from structural model will need to be reviewed and analysed by Initia. Updated spring stiffnesses will then be provided as required.

Table 5-7: Preliminary spring stiffness values for shallow foundations (2 m width)

Geotechnical Unit ID (Founding Material)	Long term static spring value (kPa/mm)	Short term spring value (e.g. wind, seismic) (kPa/mm)
Ash	7.5 to 15	25 to 50

If the shallow foundations are required to resist uplift loads, grouted ground anchors or passive bars into the basalt could be considered.

Anchors can be sized during detailed design if required once design loads are known. Due to the nature of the basalt at the site, grout loss during anchor installation is a possibility and the contractor will need to allow for measures to limit this (e.g. grout socks, pre-grouting etc).

During construction, the ground conditions along the anchors' length should be logged and recorded during drilling of the holes in order to confirm rock thickness and quality to validate the design assumptions. Each anchor should be load tested to verify load capacity and load deformation behaviour prior to being put into service. Load test requirements can be provided at detailed design stage.

5.6.3 Residential Terraced Housing Apartment Buildings Adjacent to Ladies Mile

Deep foundations

All piling options can be considered (bored cast in situ reinforced concrete piles, screw piles or driven UC piles). However, given the relatively shallow depth to ECBF rock bored cast in situ piles are likely to be economical and provide adequate vertical and lateral load carrying capacity with negligible settlement risk. Accordingly, bored cast in situ concrete piles are recommended for the multistorey buildings to the adjacent to Ladies Mile.

The following geotechnical ultimate parameters are considered appropriate for use in preliminary design of piles embedded in ECBF rock:

- Geotechnical Ultimate End Bearing – 6 MPa;
- Geotechnical Ultimate Skin Friction (Smooth) – 500 kPa;
- Geotechnical Ultimate Skin Friction (Grooved) – 750 kPa.

A strength reduction factor of 0.5 should be adopted for ULS design.

For steel UC piles, indicative geotechnical ultimate capacities for a range of UC sections are as follows:

- 250 UC 73 – 1800 kN
- 310 UC 97 – 2350 kN
- 310 UC 137 – 3300 kN.

Final pile embedment's will be dependent on structural layouts and form.

It is recommended that supplementary investigations be undertaken to confirm the consistency of the rock profile for bored piles.

Shallow foundations with ground improvements

For the multistorey buildings adjacent to Ladies Mile, shallow raft type foundations in conjunction with ground improvements could be considered subject to checks of total and differential settlement during detailed design. Ground improvements could comprise:

- Driven timber poles;
- Rammed Aggregate Piers; or
- Rigid Inclusions (unreinforced concrete columns).

Ground improvements will be separate from the structural foundation elements and will require a gravel load transfer platform. Depending on the selected ground improvement the load transfer platform could range between 500 mm and 800 mm. Localised uplift resisting elements can be incorporated into the ground improvements if required.

Given the relatively shallow depth to ECBF rock to the north of the pond, ground improvements are unlikely to provide a reduction in risk comparable to the cost compared with deep foundations. However, it does provide a possible mechanism to expedite construction.

If preferred, ground improvements will need to be assessed in careful collaboration with the project structural engineer.

5.7 AUP – Residential Terraced Housing Apartment Buildings

It is understood that one to two level basements are proposed beneath the multi storey buildings along the northern boundary of the site, adjacent to Ladies Mile and for the Vivid living building. 'Stepped excavations' are proposed to form the basement levels, with maximum cuts about 3 m. The proposed excavations are shown on Figures 1218-002 and 1218-003 through 006 in Appendix A.

Based on groundwater monitoring between October 2021 to April 2022, the lowest measured groundwater levels (summarised in Table 5-8) are below the minimum subgrade levels for the proposed basements. Accordingly, proposed excavations to form the basements should meet the permitted activity criteria for groundwater under Section E7 of the Auckland Unitary Plan.

Table 5-8: Summary of minimum basement subgrade levels compared with minimum groundwater levels measured

Development	Relevant groundwater monitoring location	Minimum subgrade level (m RL)	Minimum measured groundwater level (m RL)
Apartment B	BH01 (red)	51.65	49.7
Apartment C1 & C2	BH01 (blue)	49.3	48.5
Vivid Living	BH03	40.95	38.9

In addition, we consider that drained basements are feasible and the effects of the proposed drained basements on the groundwater will be negligible. It is considered prudent however to allow for groundwater control such as drainage (free draining granular material, scoria or similar) behind all permanent retaining walls and beneath the floor slabs. The drainage should be connected to an open sump in the basement slab and discharged to the public stormwater system either via a gravity fed line or by pumping from the sump.

5.8 Floor Slabs and Pavements

For floor slabs and pavements bearing on the natural soils, a California Bearing Ratio (CBR) of 3% is considered suitable for use in design.

For slabs and pavements bearing on engineered fill a higher CBR will be possible. However, this will need to be assessed once the fill source is confirmed.

5.9 Further Work

The following further geotechnical inputs are recommended to support future building consent applications and construction activities on site.

Supplementary Investigations

We recommend that further investigations be considered to address the following:

- Earthworks:
  - Refine quantities of unsuitable material;
  - To develop compaction criteria for placement of engineered fill;
  - Where specific retention measures may be required for service installations
- Detailed design of the multistorey buildings adjacent to Ladies Mile:
  - Supplementary boreholes will be required to confirm the depths to ECBF rock to support the design of foundation and retention options; and

Detailed Design

- Analyses and design of permanent retaining walls;
- Additional analyses to support pile foundations, including lateral pile analyses;
- Preparation of an earthworks specification; and
- Review of the geotechnical aspects of the civil and structural drawings.

Construction Stage

Construction stage inputs will be confirmed following detailed design along with acceptance criteria. However, the geotechnical inputs in Table 5-9 are likely to be required.

Table 5-9 - Likely construction stage geotechnical inputs

Stage	Observation Point	Specification / Acceptance Criteria
Earthworks	Following topsoil stripping prior to any fill placement	Confirmation that the exposed subgrade is free of organics.
	Bulk filling	Review of compaction test results to ensure material is placed and compacted in accordance with prepared specification.
	Cut batters/Retention of trenches	Confirmation that batters are cut and retention installed in accordance with design recommendations.
Shallow Foundations	Pad and strip footing preparation	Confirmation that in situ strengths in footing excavations are consistent with design assumptions
Deep foundations	Driven Pile Installation or Observation of pile shafts	Confirmation that embedment is in accordance with the design requirements.
Other Slab on grade & Pavement	Preparation of floor slab subgrade	Confirmation that pavements are prepared and constructed in accordance with design assumptions.
	Preparation of subgrade (prior to placement of basecourse)	
	Placement of basecourse layer	

6. Conclusions and Recommendations

Based on the information obtained from the subsoil investigations, and our experience with similar materials, we consider the site can be satisfactorily and economically engineered for the proposed development.

Our conclusions and recommendations are summarised as follows:

Subsurface Conditions

1. To the north of the existing pond, ground conditions typically comprise Non Engineered Fill or Ash overlying residually weathered East Coast Bays Formation soils and rock;
2. To the south of the existing pond, ground conditions typically comprise Ash overlying basalt. Further investigations will need to be undertaken to delineate the basalt and confirm thickness/consistency below building foundations.

Seismic Considerations

3. Based on the depths to East Coast Bays Formation rock, the site subsoil class is considered to be Class C – shallow soil in accordance with NZS1170.5. This is based on estimated depths to rock.
4. The site subsoils are cohesive and accordingly not considered susceptible to liquefaction.

Earthworks

5. Non-engineered fill will need to be reworked to create a crust of material under the building platforms.
6. A large volume of existing fill is likely to be suitable for re-use on site following screening and removal of unsuitable material (bricks, concrete etc.).
7. Stability analyses for the current site development indicates that there is not an existing stability issue.
8. Temporary slopes for the formation of the proposed basements (up to 3 m high) should be limited to 1V:1H with adequate mitigation of surface runoff. Localised instability and/or surficial frittering of these slopes may occur over the temporary earthworks phase (up to 18 months). Stabilisation measures should be considered to mitigate this risk including provision of PVC facing and installation of mantaray or similar soil nail options.
9. Permanent slopes cut slopes should be limited to 1V:1.5H with adequate mitigation of surface runoff. For slopes greater than 1V:3H, these will need to be planted as opposed to topsoiled and grassed.
10. Permanent fill slopes up to 1V:3H meet actable factors of safety. Steeper slopes may be considered, however reinforcement (eg. geogrid) is likely to be required and additional analyses will need to be undertaken if these are preferred.

AUP Groundwater Considerations

11. Groundwater monitoring indicates that lowest measured levels are below proposed basement subgrade levels and as such any effects of the proposed development on the groundwater level will be negligible. Effects on adjacent services and structures (including public roads) is considered negligible based on the lowest measured groundwater levels. The proposed earthworks to form the basements are considered a permitted activity as defined by Section E7 of the Auckland Unitary Plan.

Foundations

12. For lightweight residential buildings and podium type structures, shallow foundations bearing on engineered fill or natural soils are likely to be suitable. Due to significant earthworks

proposed below these structures, bearing capacities and soil expansivity will be confirmed in the geotechnical earthworks completion report.

13. For the multi storey buildings to the south of the existing pond, raft foundations are likely to be suitable, bearing on the AVF ash or basalt.
14. For multistorey buildings adjacent to Ladies Mile, shallow foundations in conjunction with ground improvement could be considered subject to assessments of total and differential settlement. However, given the relatively shallow depth to ECBF rock, bored cast in situ reinforced piles are recommended. All piling options could also be considered.

Pavements

15. A subgrade CBR of 3% can be assumed for design of building ground floor slabs and external pavement design.
16. For slabs and pavements bearing on engineered fill a higher CBR will be possible. However, this will need to be assessed once the fill source is confirmed.

Conclusion

17. Based on the above analysis and the ongoing applicability of the AUP groundwater provisions to any development of the site that there are no specific geotechnical related specific provisions are considered to be required for this plan change.

6.1 Conditions

We have reviewed the proposed conditions. We are comfortable from a geotechnical perspective that these conditions address the recommendations contained in this report.

While these conditions relate to the resource consent and not the plan change they are relevant in ensuring the rezoning of the site is appropriate as they confirm that the residential development of the site can be undertaken in accordance with sound construction and development methodologies.

7. Applicability

This report has been prepared for our client, Fletcher Residential Limited, with respect to the brief provided to us. The advice and recommendations presented in this report should not be applied to any other project or used in any other context without prior written approval from Initia Limited.

This report was prepared to support a Resource Consent application to undertake subdivision and bulk earthworks. Further work is required to support the detailed design of multi-storey buildings.

Report prepared by:

Alex McDonald
Geotechnical Engineer

Report reviewed by:

Andy Pomfret
Senior Geotechnical Engineer, Director

Document control record

Report Title		THE HILL – ELLERSLIE RACECOURSE Geotechnical Report – For Plan Change			
Initia Project Reference		1218			
Client		FLETCHER RESIDENTIAL LIMITED			
Revision	Date	Revision detail	Author	Reviewer	Approved by
A	August 2023	For Plan Change.	A. McDonald	A. Pomfret	A. Pomfret
B	Sep 2023	Client's review	B. Souza	A. Pomfret	A. Pomfret
Current Revision		B			

Appendix A Figures

LEGEND

INITIA INVESTIGATIONS (FEB 2022)

- BH101 — MACHINE BOREHOLE
- SH05 — SOAKAGE TEST LOCATIONS (NOV 2021)

INITIA INVESTIGATIONS (OCT 2021)

- BH01 — MACHINE BOREHOLE WITH SOAKAGE TEST
- BH01 — MACHINE BOREHOLE

HISTORICAL INVESTIGATIONS

- MH03 — MACHINE BOREHOLE (LANDER - MARCH 2021)
- HA04 — HAND AUGER BOREHOLE (LANDER - MAY 2021)
- TP11 — TEST PIT (LANDER - MAY 2021)
- BH01 — MACHINE BOREHOLE (NZGD_SKM - 2006 TO 2008)
- SP09 — MACHINE BOREHOLE (SOIL & ROCK - NOV 2021)
- 0.5 — EXISTING GROUND CONTOUR (0.5m INTEVAL)
- APPROXIMATE EXTENT OF NON-ENGINEERED FILL
- APPROXIMATE EXTENT OF BASALT

NOTES

1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATE DATUM: MOUNT EDEN 2000
3. AERIAL IMAGE AND PROPERTY BOUNDARY TAKEN FROM AUCKLAND COUNCIL DATE 2017.
4. SURVEY DATA SUPPLIED BY "FLETCHER LIVING" REFERENCED "P21-440-00-0500-SU The Hills Site Survey.dwg" DATED 29 OCT 2021.
5. THE ORIGIN OF LEVELS IS IN TERMS OF THE AUCKLAND VERTICAL DATUM 1946, ORIGIN OF LEVEL IS "M 784 SO 54057" (GD CODE CCT4), RL = 49.29m, SOURCED FROM LINZ DATABASE.
6. PROPOSED LAYOUT, REFERENCE "2021-10-22_The Hill_Option 1 Drawings_Rev06.pdf", DATED 18 OCT 2021
7. PROPOSED APARTMENT BUILDING LAYOUT REFERENCED "961_PBA_The Hill Apartments_220201- Floor Plan - L00.dwg" DATED JAN FEB 2022.
8. PROPOSED SITE LEVEL SUPPLIED BY "CRANG CIVIL CONSULTING ENGINEERING" REFERENCE "ACAD-C200 PROPOSED SURFACE EARTHWORKS PLAN-RN.dwg" DATED JUNE 2022

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INFORMATION ONLY

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D	ADDED BOREHOLE INVESTIGATION (02/03/2022)	BS	JG	BS
C	UPDATED PROPOSED LAYOUT (02/02/2022)	NH	GG	NH
B	SOAKAGE TEST LOCATION (3/11/2021)	TD	JG	TD
A	INVESTIGATION LOCATION (15/10/2021)	NH	GG	NH

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GEOTECHNICAL INVESTIGATION LOCATION PLAN

Initia Project ref: P0001218

Figure Number 1218-001

Revision D

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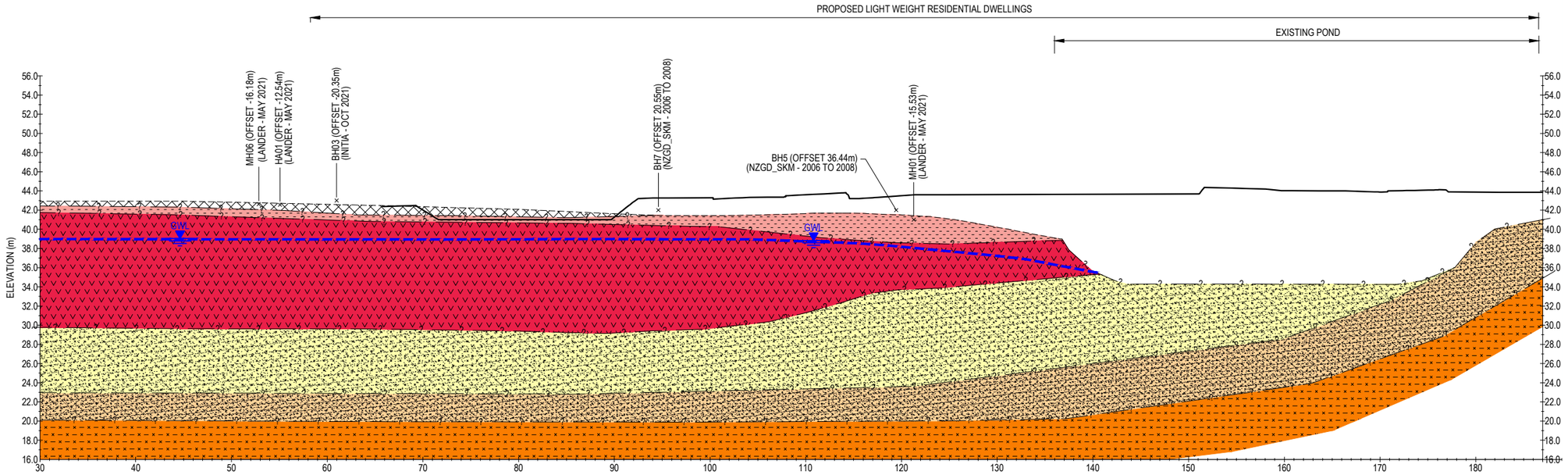
LEGEND

- EXISTING FILL
- VOLCANIC ASH - AUCKLAND FIELD
- BASALT
- CLAYEY SILT WITH ORGANIC LENSES - PUKETOKA FORMATION
- RESIDUAL SOIL - ECBF
- ECBF - INTERBEDDED SANDSTONE AND SILTSTONE
- EXISTING GROUND
- DESIGN LEVEL (PROVIDED BY CRANG CIVIL CONSULTING ENGINEERS - JUNE 2022)
- INFERRED GEOLOGICAL BOUNDARY
- GWL — GROUNDWATER LEVEL



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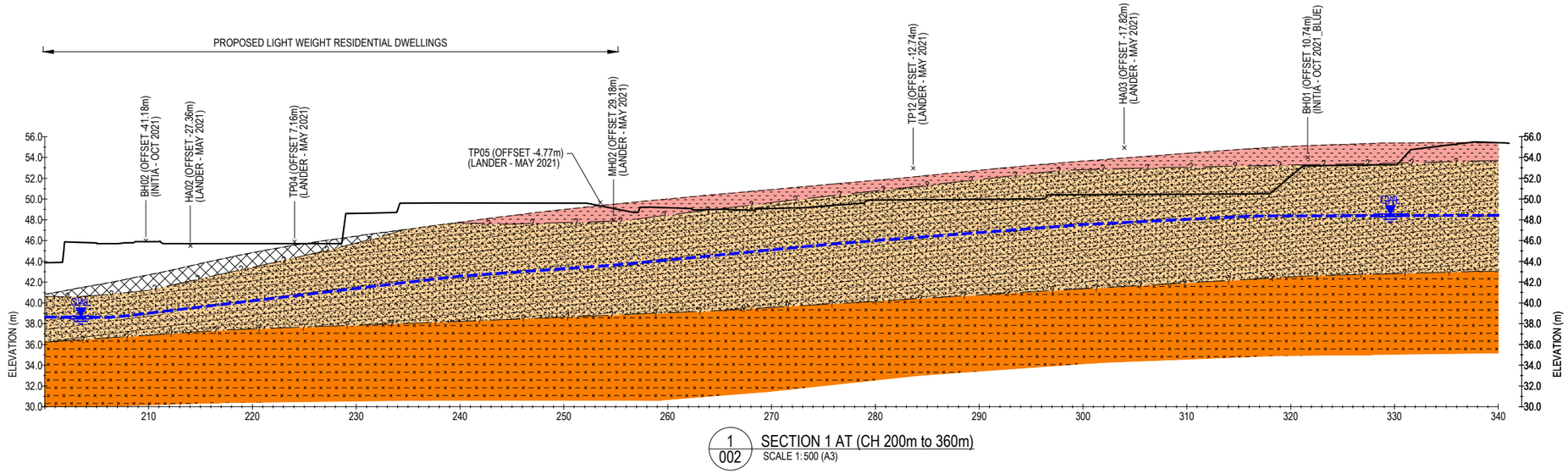

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GEOTECHNICAL INVESTIGATION
GEOLOGICAL SECTION 01

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Figure Number 1218-002
Revision A

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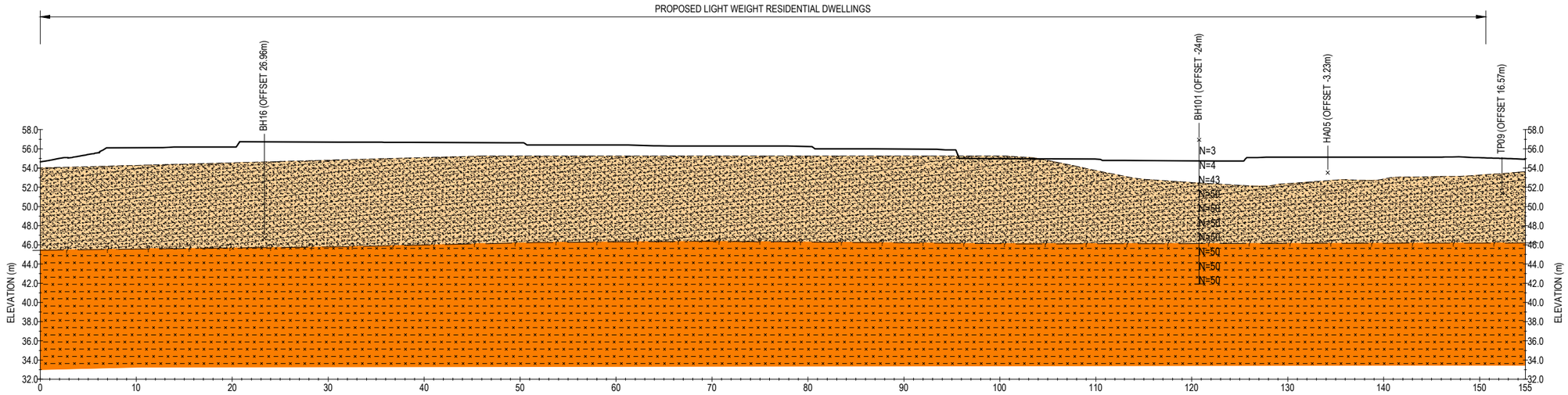
- RESIDUAL SOIL - ECBF
- ECBF - INTERBEDDED SANDSTONE AND SILTSTONE
- EXISTING GROUND
- DESIGN LEVEL (PROVIDED BY CRANG CIVIL CONSULTING ENGINEERS - JUNE 2022)
- INFERRED GEOLOGICAL BOUNDARY



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GEOTECHNICAL INVESTIGATION
GEOLOGICAL SECTION 02

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Revision A

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LEGEND

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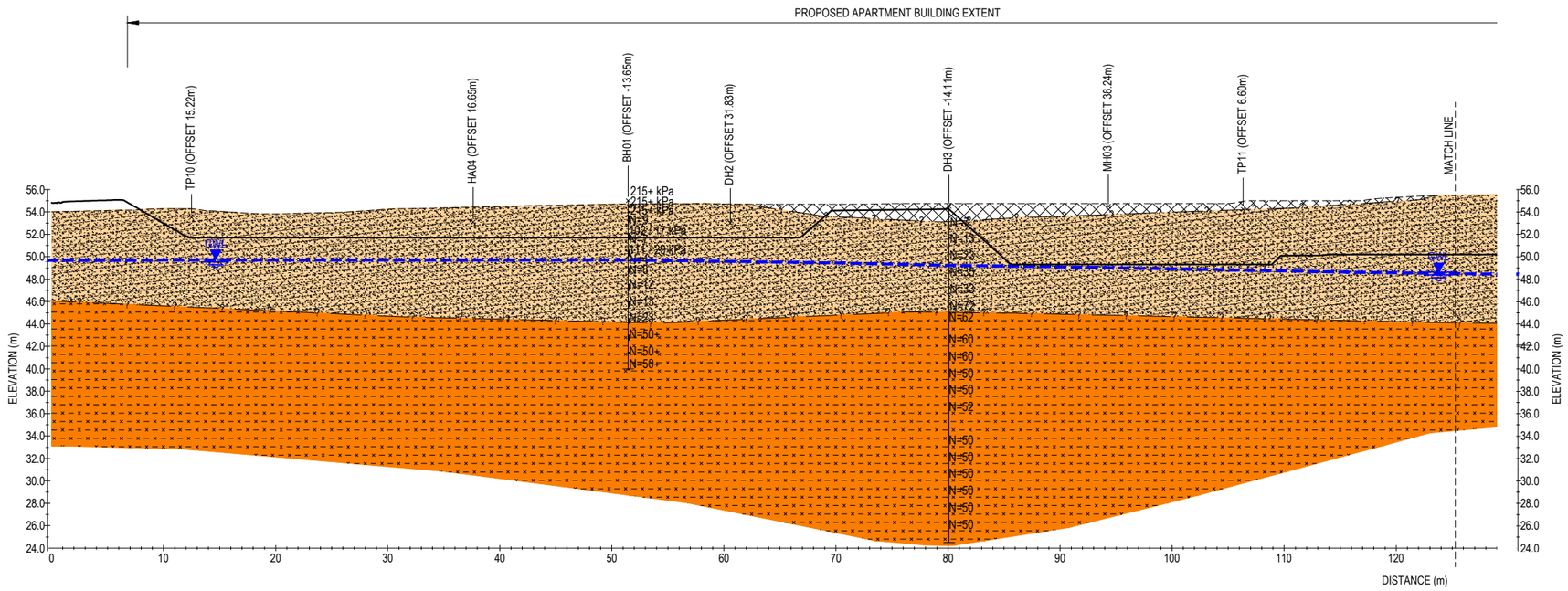
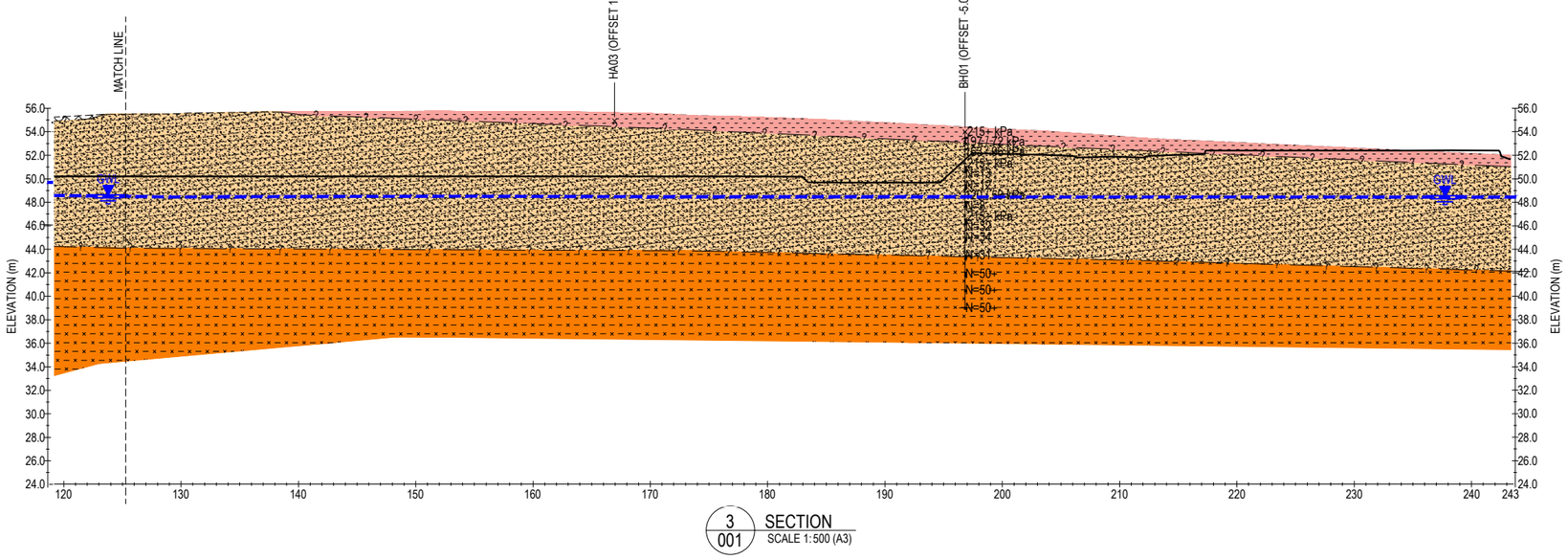
- RESIDUAL SOIL - ECBF
- ECBF - INTERBEDDED SANDSTONE AND SILTSTONE
- EXISTING GROUND
- DESIGN LEVEL (PROVIDED BY CRANG CIVIL CONSULTING ENGINEERS - JUNE 2022)
- INFERRED GEOLOGICAL BOUNDARY
- GWL GROUNDWATER LEVEL





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GEOTECHNICAL INVESTIGATION
GEOLOGICAL SECTION 03

Initia Project ref: P0001218
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Revision A

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- BASALT -AUCKLAND VOLCANIC FIELD
- PUKETOKA FORMATION VERY STIFF TO HARD CLAYEY SILT WITH LENSES OF SAND
- HARD, CLAYEY SILT -EAST COAST BAY FORMATION (RESIDUAL WEATHERED)
- SILTSTONE -EAST COAST BAY FORMATION
- EXISTING GROUND
- DESIGN LEVEL (PROVIDED BY CRANG CIVIL CONSULTING ENGINEERS - JUNE 2022)
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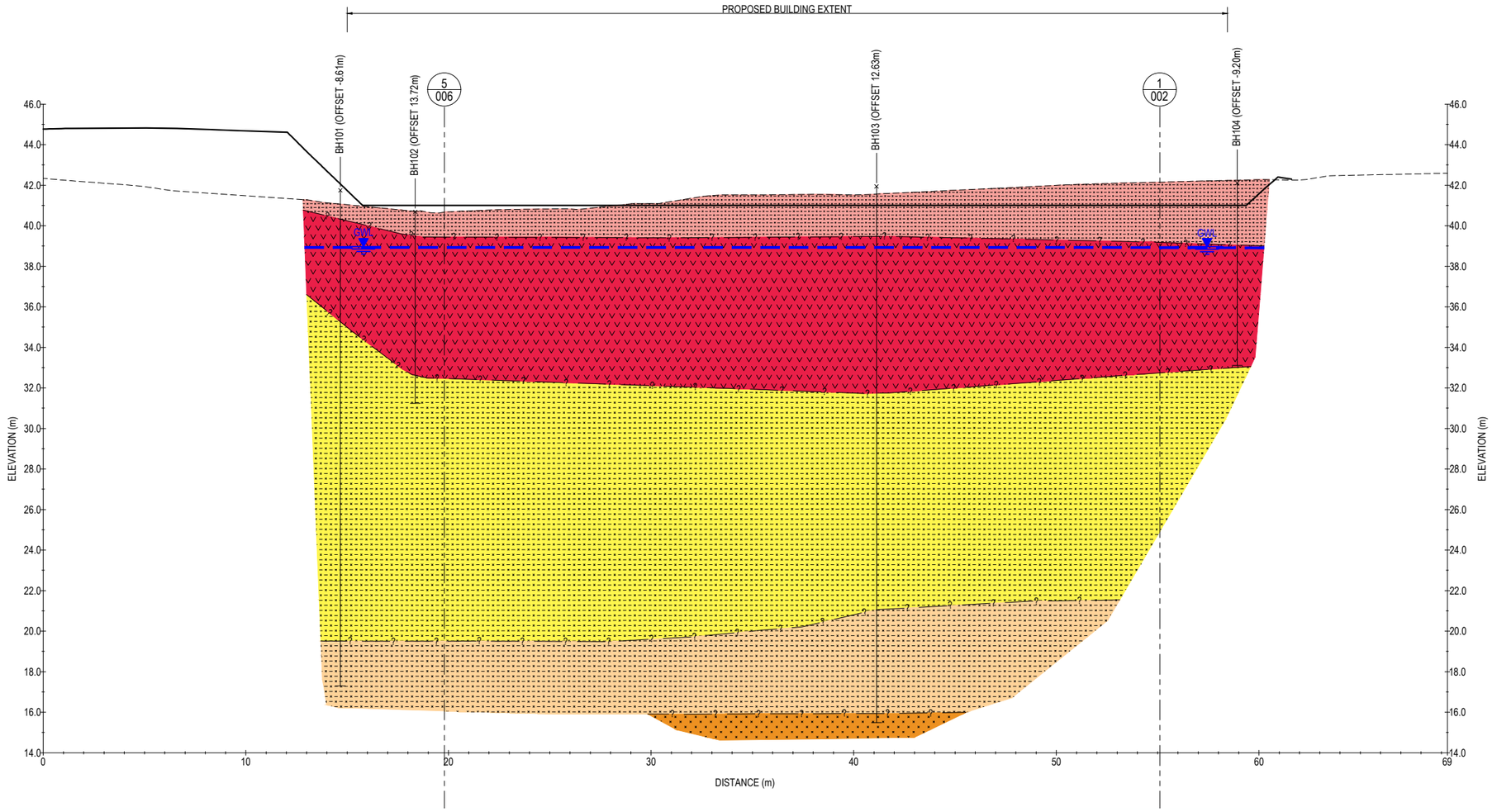
- GWL GROUNDWATER LEVEL



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GEOTECHNICAL INVESTIGATION
GEOLOGICAL SECTION 04

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Revision A

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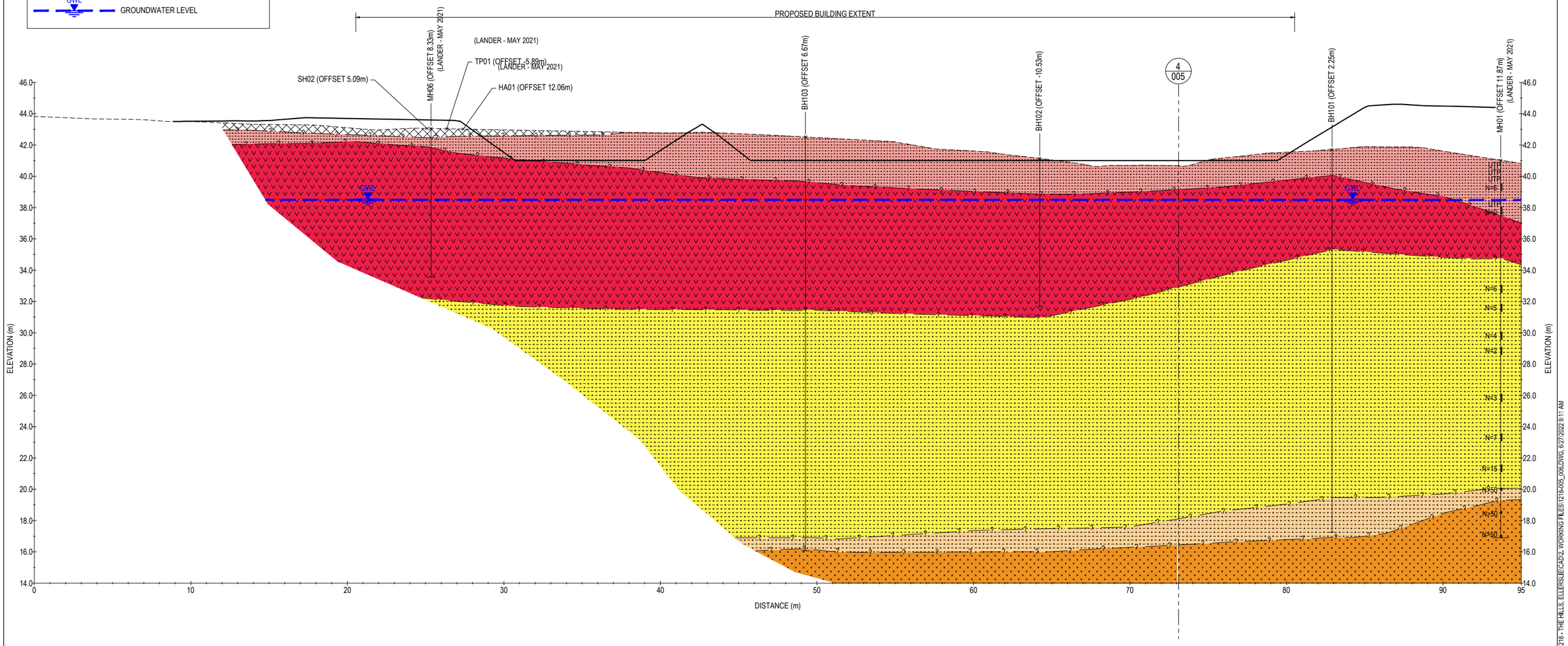
- BASALT -AUCKLAND VOLCANIC FIELD
- VERY STIFF TO HARD CLAYEY SILT WITH LENSES OF SAND -PUKETOKA FORMATION
- HARD, CLAYEY SILT -EAST COAST BAY FORMATION (RESIDUAL WEATHERED)
- SILTSTONE -EAST COAST BAY FORMATION
- EXISTING GROUND
- DESIGN LEVEL (PROVIDED BY CRANG CIVIL CONSULTING ENGINEERS - JUNE 2022)
- ?——?—— INFERRED GEOLOGICAL BOUNDARY
- GWL GROUNDWATER LEVEL



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GEOTECHNICAL INVESTIGATION
GEOLOGICAL SECTION 05

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Appendix B Site Investigation Logs

DRILLHOLE LOG

INITIA
GEOTECHNICAL SPECIALISTS

CLIENT: Fletcher Living	**SITE LOCATION:** Ellerslie Racecourse Hill	**HOLE NO.:** BH01
PROJECT: The Hills, Ellerslie		**Project Ref.:** P-001218
CO-ORDINATES: 1761459.4mE, 5915826.8mN	**ELEVATION:** 54m	**CONTRACTOR:** DCN Drilling
Co-ordinate system: NZTM	**Datum:** AUCKHT1946	**RIG:** JD tracked Rig
Location method: GPSH	**Level method:** CONTOUR	**DRILLER:** Kurt
ORIENTATION (°): Vertical	**INCLINATION (°):** 90	**START DATE:** 07/10/2021
		END DATE: 07/10/2021
		LOGGED BY: BSS
		CHECKED BY: QS

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	DEPTH	RL	SAMPLES	METHOD	TCR (%)	RQD (%)	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES DESCRIPTION	WATER	INSTALLATION	CORE BOXES
Topsoil	SILT, with trace rootlets; black. Firm; low plasticity; moist.				OB	90						
Auckland Volcanic Field	Clayey SILT; orange brown. Hard; high plasticity; moist.				OB	60		215+ kPa				
	0.8m - 1.0m: Core loss											
	Clayey SILT; orange brown with light brown and brown mottles. Very stiff; high plasticity; moist.	1	53.0		OB	100		197 / 72 kPa				
ECBF (Residually Weathered)	Clayey SILT, with trace sand; orange brown with light grey mottles and brown speckles . Very stiff; high plasticity; moist; sand, fine.							163 / 96 kPa				
	2.60m: grades to with minor sand, fine.	2	52.0		OB	100						
	3.00m: grades to hard	3	51.0		SPT	100		215+ kPa 3, 2 / 4, 3, 3, 3 N=13		07/10/2021	Bentonite 3m	
	CLAY, with some silt, with trace sand; greyish pink with light grey mottles and orange brown speckles. Hard; high plasticity; moist.				OB	90						
	Silty CLAY, with trace sand; light grey with orange brown mottles. Very stiff; high plasticity; moist; sand, fine.	4	50.0		SPT	77		2, 2 / 2, 3, 3, 4 N=12				
	4.50m - 4.90m: SILT, with some sand; light grey with geyish pink and orange brown mottles. Very stiff; non-plastic; moist; sand, fine.	5	49.0		OB	90					Sand	Box 1, 0.0-2.5m
	SILT, with some sand; light greyish brownwith orange brown mottles. Very stiff; low plasticity; moist; sand, fine.											
	5.90m - 6.00m: with greyish pink.	6	48.0		SPT	66		120 / 50 kPa 2, 2 / 2, 2, 2, 2 N=8			6m	Box 2, 2.5-5.8m
	SILT, with some sand; orange brown. Very stiff; low plasticity; moist; sand, fine.	7	47.0		OB	85						
	7.20m - 7.30m: well cemented and with trace organics.											
	Sandy SILT; light orange brown with grey mottles. Hard; low plasticity; moist; sand, fine.				SPT	100		215+ kPa 4, 4 / 6, 8, 8, 10 N=32				
	7.40m - 7.50m: CLAY, with some silt; grey with light orange brown mottles. Hard; high plasticity; moist.	8	46.0		HQTT	90					Bentonite	Box 3, 5.8-9.0m
ECBF (Highly Weathered)	Clayey SILT, with minor sand; grey. Hard; moist; sand, fine, lenses.											
	8.40m - 8.60m: Silty CLAY; grey. Hard; high plasticity; moist. - INTERBEDDED WITH - Silty CLAY; orange brown. Hard; high plasticity; moist.	9	45.0		SPT	100		4, 4 / 5, 9, 10, 10 N=34				
	8.60m - 8.80m: Sandy SILT; orange brown. Very stiff; low plasticity; moist; sand, fine.				HQTT	33						Box 4, 9.0-14.1m
	9.00m - 9.50m: Silty SAND; grey. Medium dense; non-plastic; moist; sand, fine.											
	9.8m - 10.5m: Core loss											

REMARKS:

DRILLHOLE LOG

INITIA
GEOTECHNICAL SPECIALISTS

HOLE NO.: BH01

CLIENT: Fletcher Living
PROJECT: The Hills, Ellerslie
SITE LOCATION: Ellerslie Racecourse Hill
Project Ref.: P-001218

CO-ORDINATES: 1761459.4mE, 5915826.8mN
ELEVATION: 54m
CONTRACTOR: DCN Drilling
START DATE: 07/10/2021

Co-ordinate system: NZTM
Datum: AUCKHT1946
RIG: JD tracked Rig
END DATE: 07/10/2021

Location method: GPSH
Level method: CONTOUR
DRILLER: Kurt
LOGGED BY: BSS

ORIENTATION (°): Vertical
INCLINATION (°): 90
CHECKED BY: QS

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING (UW SW MW HW CW EW)	STRENGTH (VW W MS S VS ES)	DEPTH	RL	SAMPLES	METHOD	TCR (%) (25 50 75)	RQD (%) (25 50 75)	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES DESCRIPTION	WATER	INSTALLATION	CORE BOXES
ECBF (Highly Weathered)	[CONT] 9.8m - 10.5m: Core loss							HQTT	33	0					
	Clayey SILT, with minor sand; grey. Hard; high plasticity; moist; sand, fine.		HW					SPT	100		5, 5 / 7, 7, 8, 9 N=31				
East Coast Bays Formation	Slightly weathered; grey; SILTSTONE; very weak.				11	43.0		HQTT	100	47					
					12	42.0		SPT	33		7, 13 / 14, 13, 15, 8 for 30mm N=50+ for 255mm				
	Slightly weathered; grey; SANDSTONE; very weak.		SW	VW	13	41.0		HQTT	100	38		13.30m, 1No. 20° , JT , PL , SM		Bentonite	
					14	40.0		SPT	2		24, 26 for 50mm N=50+				Box 4, 9.0-14.1m
	EOH: 15.13m				15	39.0		HQTT	100	57	19, 31 for 50mm N=50+			15.13m	Box 5, 14.1-15.1m

REMARKS:

CORE PHOTOS

HOLE NO.: BH01

JOB NO.: P-001218

Box 1, 0.0-2.5m

Box 2, 2.5-5.8m

Box 3, 5.8-9.0m

CORE PHOTOS

HOLE NO.: BH01

JOB NO.: P-001218

Box 4, 9.0-14.1m

Box 5, 14.1-15.1m

DRILLHOLE LOG

INITIA
GEOTECHNICAL SPECIALISTS

CLIENT: Fletcher Living	**SITE LOCATION:** Ellerslie Racecourse Hill	**HOLE NO.:** BH01 (Red)
PROJECT: The Hills, Ellerslie		**Project Ref.:** P-001218
CO-ORDINATES: 1761368.0mE, 5915940.3mN	**ELEVATION:** 55m	**CONTRACTOR:** DCN Drilling
Co-ordinate system: NZTM	**Datum:** AUCKHT1946	**RIG:** JD tracked Rig
Location method: GPSH	**Level method:** CONTOUR	**DRILLER:** Kurt
ORIENTATION (°): Vertical	**INCLINATION (°):** 90	**CHECKED BY:** QS
		START DATE: 08/10/2021
		END DATE: 08/10/2021
		LOGGED BY: BSS

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING (UW SW MW HW CW EW)	STRENGTH (VW W MS S VS ES)	DEPTH	RL	SAMPLES	METHOD	TCR (%) (25 50 75)	RQD (%) (25 50 75)	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES DESCRIPTION	WATER	INSTALLATION	CORE BOXES
Topsoil	SILT, with trace rootlets; black with brown speckles. Stiff; low plasticity; moist.	TS						OB	90						
ECBF (Residually Weathered)	Clayey SILT, with trace sand; light orange brown with light grey mottles. Hard; high plasticity; moist; sand, fine.							OB	90		215+ kPa				
					1	54.0		OB	60		215+ kPa				
								SPT	77		215+ kPa 2, 1 / 2, 2, 2, 3 N=9				
					2	53.0		OB	76						
	Sandy SILT, with some clay; light orange brown with light grey mottles. Very stiff; low plasticity; moist; sand, fine.												13/10/2021	Bentonite	
	2.8m - 3.0m: Core loss														
					3	52.0		SPT	77		102 / 17 kPa 1, 2 / 2, 2, 2, 1 N=7			3m	
	3.80m - 4.00m: Silty SAND; light orange brown with light grey mottles. Loose; non-plastic; moist; sand, fine to medium.												13/11/2021		Box 1, 0.0-3.6m
	4.20m - 4.30m: Clayey SILT, with trace sand; pinkish grey with light grey mottles. Hard; high plasticity; moist; sand, fine.		RS		4	51.0		OB	85					Sand	
	4.3m - 4.5m: Core loss							SPT	88		111 / 29 kPa 1, 0 / 1, 0, 1, 2 N=4				
	Silty SAND; light pinkish grey with light grey mottles. Loose; low plasticity; moist; sand, fine.				5	50.0		OB	100						
					6	49.0		SPT	88		1, 2 / 1, 2, 2, 3 N=8			6m	
	Sandy SILT; orange brown. Very stiff; low plasticity; moist; sand, fine.													Bentonite	
	Clayey SILT, with minor sand; orange brown with light grey speckles. Hard; high plasticity; moist; sand, fine.				7	48.0		OB	85						
	7.3m - 7.5m: Core loss							SPT	100		UTP 3, 3 / 4, 2, 2, 4 N=12			8m	Box 2, 3.6-8.0m
ECBF (Highly Weathered)	Clayey SILT, with trace sand; grey. Hard; high plasticity; moist; sand, fine.		HW		8	47.0		OB	100						
					9	46.0		SPT	100		UTP 2, 2 / 2, 3, 4, 4 N=13			Sand	
								OB	100					10m	Box 3, 8.0-11.0m

REMARKS:

DRILLHOLE LOG

INITIA
GEOTECHNICAL SPECIALISTS

HOLE NO.: BH01 (Red)

CLIENT: Fletcher Living
PROJECT: The Hills, Ellerslie
SITE LOCATION: Ellerslie Racecourse Hill
Project Ref.: P-001218

CO-ORDINATES: 1761368.0mE, 5915940.3mN
ELEVATION: 55m
CONTRACTOR: DCN Drilling
START DATE: 08/10/2021

Co-ordinate system: NZTM
Datum: AUCKHT1946
RIG: JD tracked Rig
END DATE: 08/10/2021

Location method: GPSH
Level method: CONTOUR
DRILLER: Kurt
LOGGED BY: BSS

ORIENTATION (°): Vertical
INCLINATION (°): 90
CHECKED BY: QS

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING (UW SW MW HW CW EW)	STRENGTH (VW W MS S VS ES)	DEPTH	RL	SAMPLES	METHOD	TCR (%) (25 50 75)	RQD (%) (25 50 75)	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES DESCRIPTION	WATER	INSTALLATION	CORE BOXES
ECBF (Highly Weathered)	[CONT] Clayey SILT, with trace sand; grey. Hard; high plasticity; moist; sand, fine.							OB	100	0					
	Sandy SILT; grey. Hard; low plasticity; moist; sand, fine.		HW					SPT	100		4, 3 / 5, 5, 6, 7 N=23				Box 3, 8.0-11.0m
East Coast Bays Formation	Slightly weathered; grey; SANDSTONE; very weak.		SW	VW	11	44.0		HQTT	100						
					12	43.0		SPT	100		5, 6 / 8, 12, 15, 15 N=50+				
					13	42.0		HQTT	100			12.50m, 1No. 20° , JT , ST , RG 12.60m, 2No. 45° , JT , ST , RG 12.90m, 1No. 45° , JT , PL , RG 13.00m, 1No. 45° , JT , PL , SM		Bentonite	
								SPT			15, 35 for 55mm N=50+				Box 4, 11.0-14.2m
					14	41.0		HQTT	96			13.90m, 1No. 30° , JT , PL , SM 14.20m, 1No. 30° , JT , PL , SM 14.40m, 2No. 10° , JT , PL , IR				
	EOH: 15.11m				15	40.0		SPT			22, 28 for 35mm N=50+	14.90m, 1No. 20° , JT , PL , SM		15.11m	Box 5, 14.2-15.1m
						39.0									
						38.0									
						37.0									
						36.0									

REMARKS:

CORE PHOTOS

HOLE NO.: BH01 (Red)
JOB NO.: P-001218

Box 1, 0.0-3.6m

Box 2, 3.6-8.0m

Box 3, 8.0-11.0m

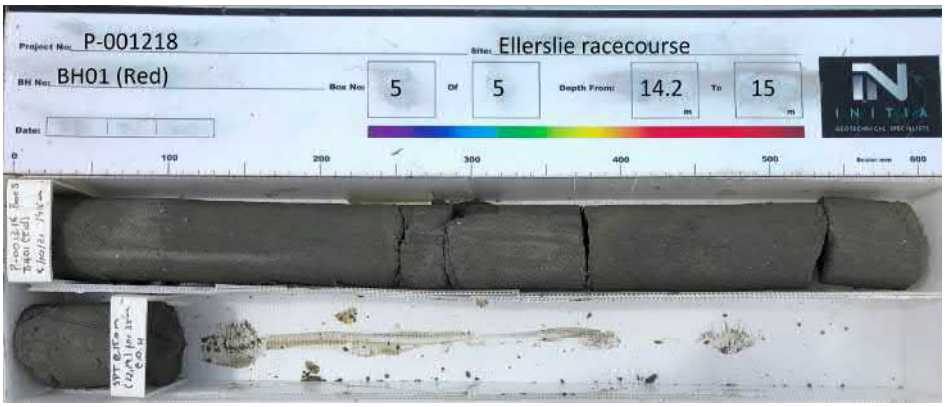
CORE PHOTOS

HOLE NO.: **BH01 (Red)**

JOB NO.: P-001218

Box 4, 11.0-14.2m

Box 5, 14.2-15.1m



DRILLHOLE LOG

INITIA
GEOTECHNICAL SPECIALISTS

HOLE NO.: BH02 (Red)		
CLIENT: Fletcher Living	**SITE LOCATION:** Ellerslie Racecourse Hill	**Project Ref.:** P-001218
PROJECT: The Hills, Ellerslie		
CO-ORDINATES: 1761339.1mE, 5915799.5mN	**ELEVATION:** 46m	**CONTRACTOR:** DCN Drilling
Co-ordinate system: NZTM	**Datum:** AUCKHT1946	**RIG:** JD tracked Rig
Location method: GPSH	**Level method:** CONTOUR	**DRILLER:** Dave
ORIENTATION (°): Vertical	**INCLINATION (°):** 90	**CHECKED BY:** QS
		START DATE: 13/10/2021
		END DATE: 13/10/2021
		LOGGED BY: BSS

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING (UW, SW, MW, HW, CW)	STRENGTH (EW, VW, W, MS, S, VS, ES)	DEPTH	RL	SAMPLES	METHOD	TCR (%)	RQD (%)	INSITU TESTING (SPT 'N' Vane shear strength)	DISCONTINUITIES DESCRIPTION	WATER	INSTALLATION	CORE BOXES
Fill	SILT, with minor rootlets; brown. GRAVEL, with minor silt; grey. Loose; moist; gravel, fine to medium. Clayey SILT, with trace sand and gravel; light brownish orange with light grey mottles and black speckles. Hard; high plasticity; moist; sand, fine to coarse, gravel, fine. 1.0m - 1.5: Core loss 1.6m - 1.95m: Core loss concrete 2.5m - 3.0m: Core loss	TS			0 1 2 3	46.0 45.0 44.0 43.0		HQTT SPT HQTT	98 22 47		1, 1 / 2, 2, 1, 1 N=6		14/10/2021	Bentonite 3m	
ECBF (Residually Weathered)	Clayey SILT, with trace sand; light orange brown with light grey mottles. Stiff; moist; sand, fine. Clayey SILT, with minor sand; grey. Hard; high plasticity; moist; sand, fine.		RS		3 4 5 6	43.0 42.0 41.0 40.0		SPT HQTT SPT HQTT SPT	100 100 100 100 100		1, 1 / 1, 1, 1, 2 N=5 1, 1 / 2, 2, 1, 2 N=7 2, 2 / 3, 4, 4, 4 N=15			Sand 6m	Box 1, 0.0-5.1m
East Coast Bays Formation	Slightly weathered; grey; SANDSTONE; very weak; with interbedded Siltstone. 8.7m - 9.0m: Core loss		SW	VW	7 8 9	39.0 38.0 37.0		HQTT SPT HQTT SPT HQTT	100 100 100 100 100	66 47	8, 8 / 9, 11, 15, 15 for 65mm N=50+ for 290mm 15, 17 / 18, 18, 14 for 50mm N=50+ for 200mm	7.40m, 1No. 45° , JT , UN , RG 9.60m, 1No. 45° , JT , PL , RG		Bentonite	Box 2, 5.1-8.7m Box 3, 8.7-10.9m

REMARKS:

DRILLHOLE LOG

INITIA
GEOTECHNICAL SPECIALISTS

HOLE NO.: BH02 (Red)

CLIENT: Fletcher Living
PROJECT: The Hills, Ellerslie
SITE LOCATION: Ellerslie Racecourse Hill

Project Ref.: P-001218

CO-ORDINATES: 1761339.1mE, 5915799.5mN
Co-ordinate system: NZTM
Location method: GPSH
ORIENTATION (°): Vertical
ELEVATION: 46m
Datum: AUCKHT1946
Level method: CONTOUR
INCLINATION (°): 90
CONTRACTOR: DCN Drilling
RIG: JD tracked Rig
DRILLER: Dave

START DATE: 13/10/2021
END DATE: 13/10/2021
LOGGED BY: BSS
CHECKED BY: QS

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING (UW SW MW HW CW EW)	STRENGTH (VW W MS S VS ES)	DEPTH	RL	SAMPLES	METHOD	TCR (%) (25 50 75)	RQD (%) (25 50 75)	INSITU TESTING (SPT 'N' Vane shear strength)	DISCONTINUITIES DESCRIPTION	WATER	INSTALLATION	CORE BOXES
East Coast	EOH: 10.91m		SW	VW		35.0 34.0 33.0 32.0 31.0 30.0 29.0 28.0 27.0		HQTT SPT	100 100	47	5, 8 / 11, 15, 16, 8 for 35mm N=50+ for 260mm	10.40m, 1No. 45° , JT , PL , RG		Bentonite 10.91m	Box 3, 8.7-10.9

REMARKS:

CORE PHOTOS

HOLE NO.: BH02 (Red)

JOB NO.: P-001218

Box 1, 0.0-5.1m

Box 2, 5.1-8.7m

Box 3, 8.7-10.9m

DRILLHOLE LOG

INITIA GEOTECHNICAL SPECIALISTS

HOLE NO.: BH03 (Red)
Project Ref.: P-001218

CLIENT: Fletcher Living
PROJECT: The Hills, Ellerslie
SITE LOCATION: Ellerslie Racecourse Hill

CO-ORDINATES: 1761234.2mE, 5915692.0mN	**ELEVATION:** 43m	**CONTRACTOR:** DCN Drilling	**START DATE:** 11/10/2021
Co-ordinate system: NZTM	**Datum:** AUCKHT1946	**RIG:** JD tracked Rig	**END DATE:** 11/10/2021
Location method: GPSH	**Level method:** CONTOUR	**DRILLER:** Dave	**LOGGED BY:** BSS
ORIENTATION (°): Vertical	**INCLINATION (°):** 90		**CHECKED BY:** QS

Columns: UNIT | MATERIAL DESCRIPTION (See Classification & Symbology sheet for details) | GRAPHIC | WEATHERING (UW SW MW HW CW EW) | STRENGTH (VW W MS S VS ES) | DEPTH | RL | SAMPLES | METHOD | TCR (%) | RQD (%) | INSITU TESTING (SPT 'N', Vane shear strength) | DISCONTINUITIES DESCRIPTION | WATER | INSTALLATION | CORE BOXES

Material description

Unit	Depth (m)	Material description
Topsoil	0.0	SILT, with minor rootlets; black. Stiff; moist.
Fill		SILT, with some clay, with trace gravel; dark brown . Hard; low plasticity; moist; gravel, fine to coarse. 0.8m - 1.0m: Core loss
Auckland Volcanic Field	1.0	Clayey SILT, with trace organics; orange brown with light grey mottles and black speckles. Hard; high plasticity; moist.
Auckland Volcanic Field	1.5	Moderately weathered; black; BASALT; moderately strong; moderately vesicular. 1.50m - 1.60m: GRAVEL; black. Very dense; moist; gravel, fine to medium.
Auckland Volcanic Field	3.0	Slightly weathered; black; BASALT; strong; slightly vesicular. 3.00m: grades to less vesicular. 3.50m: grades to slightly to no vesicular.

Weathering: MW (1.5–3.0m); SW (3.0m+). Strength: MS (1.5–3.0m); S (3.0m+).

Depth / RL

Depth	RL
1	42.0
2	41.0
3	40.0
4	39.0
5	38.0
6	37.0
7	36.0
8	35.0
9	34.0

Method / core recovery

Interval (m)	Method	TCR (%)	RQD (%)
0.0–0.5	OB	100	
0.5–1.0	OB	60	
1.0–1.5	OB	90	
1.5–1.6	SPT	100	
1.6–3.0	HQTT	100	50
3.0–4.5	HQTT	100	60
4.5–6.0	HQTT	100	86
6.0–7.5	HQTT	100	20
7.5–9.0	HQTT	100	26
9.0–10.0	HQTT	100	86

Insitu testing

- 0.5m: 140+ kPa
- 1.0m: 140+ kPa
- 1.5m: UTP; 28, 22 for 20mm N=50+

Discontinuities

- 3.70m, 1No. , JT , UN , RG , Silt
- 4.10m, 3No. 70° , JT , PL , RG , Silt
- 5.60m, 1No. 30° , JT , ST , RG
- 6.00m, 4No. 80° , JT , CRV , RG , Silt
- 6.70m, 1No. 45° , JT , PL , RG , FeO
- 6.80m, 1No. 45° , JT , PL , RG
- 6.90m, 1No. 60° , JT , PL , RG
- 7.00m, 2No. 85° , JT , CRV , RG
- 7.50m, 3No. 90° , JT , CRV , RG
- 8.10m, 1No. 45° , JT , PL , RG
- 8.20m, 1No. 45° , JT , PL , SM
- 8.30m, 1No. 45° , JT , ST
- 8.40m, 1No. 45° , JT , PL , RG
- 9.30m, 1No. 15° , JT , PL , SM
- 9.40m, 2No. 45° , JT , PL , PLSH , Silt

Water

13/10/2021 (approx. 2.1m)

Installation

- Bentonite (0–3m)
- 3m
- Sand (3–6m)
- 6m
- Bentonite (6m+)

Core boxes

- Box 1, 0.0-3.6m
- Box 2, 3.6-6.4m
- Box 3, 6.4-9.4m
- Box 4, 9.4-12.4m

REMARKS:

DRILLHOLE LOG

INITIA
GEOTECHNICAL SPECIALISTS

HOLE NO.: BH03 (Red)

CLIENT: Fletcher Living
PROJECT: The Hills, Ellerslie
SITE LOCATION: Ellerslie Racecourse Hill
Project Ref.: P-001218

CO-ORDINATES: 1761234.2mE, 5915692.0mN
ELEVATION: 43m
CONTRACTOR: DCN Drilling
START DATE: 11/10/2021

Co-ordinate system: NZTM
Datum: AUCKHT1946
RIG: JD tracked Rig
END DATE: 11/10/2021

Location method: GPSH
Level method: CONTOUR
DRILLER: Dave
LOGGED BY: BSS

ORIENTATION (°): Vertical
INCLINATION (°): 90
CHECKED BY: QS

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING (UW SW MW HW CW EW)	STRENGTH (VW W MS S VS ES)	DEPTH	RL	SAMPLES	METHOD	TCR (%) (25 50 75)	RQD (%) (25 50 75)	INSITU TESTING (SPT 'N' Vane shear strength)	DISCONTINUITIES DESCRIPTION	WATER	INSTALLATION	CORE BOXES
Auckland Volcanic Field	[CONT] Slightly weathered; black; BASALT; strong; slightly vesicular.		SW	S	11	32.0		HQTT	100	68		10.70m, 1No. 45° , JT , ST , SM 10.90m, 1No. 20° , JT , CRV , IR			
								HQTT	100	60					
	Highly weathered; black; BASALT; weak; moderately vesicular.		HW	W	12	31.0						11.50m, 1No. 30° , JT , PL , IR 11.70m, 1No. 45° , JT , PL , PLSH			Box 4, 9.4-12.4
	12.9m - 13.5m: Core loss							HQTT	60	26				Bentonite	
Puketoka Formation	12.80m - 12.90m: Clayey SILT, with trace organics; brown with black speckles. Hard; high plasticity; moist.				13	30.0									
	Clayey SILT; light grey with light brown mottles. Hard; high plasticity; moist.							HQTT	70						
					14	29.0									
					15	28.0		SPT	100		2, 2 / 3, 4, 5, 5 N=17			15.45m	Box 5, 12.4-15.5m
	EOH: 15.45m														
						27.0									
						26.0									
						25.0									
						24.0									

REMARKS:

CORE PHOTOS

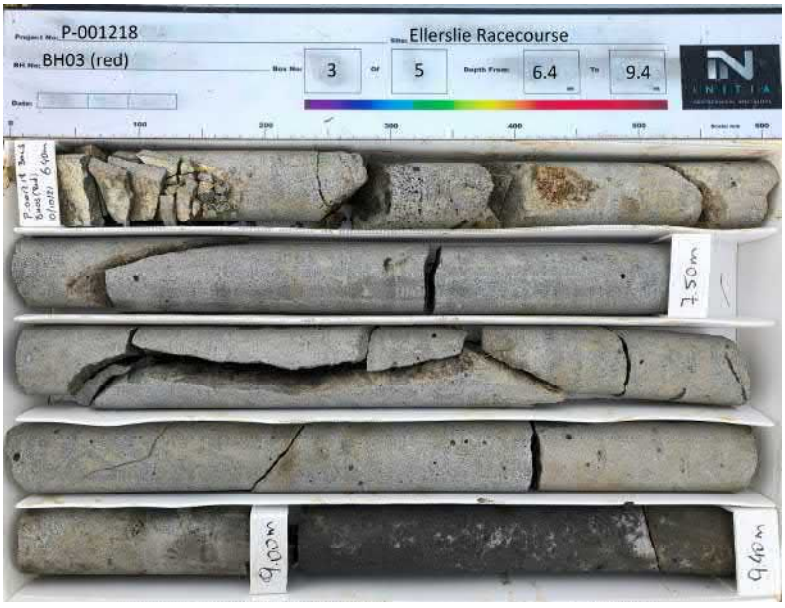
HOLE NO.: BH03 (Red)

JOB NO.: P-001218

Box 1, 0.0-3.6m

Box 2, 3.6-6.4m

Box 3, 6.4-9.4m



CORE PHOTOS

HOLE NO.: BH03 (Red)

JOB NO.: P-001218

Box 4, 9.4-12.4m

Box 5, 12.4-15.5m

DRILLHOLE LOG

INITIA
GEOTECHNICAL SPECIALISTS

HOLE NO.: BH101		
CLIENT: Fletcher Living	**SITE LOCATION:** Ellerslie Racecourse Hill	**Project Ref.:** P-001218
PROJECT: The Hills, Ellerslie		
CO-ORDINATES: 1761270.4mE, 5915725.5mN	**ELEVATION:** 41.8m	**CONTRACTOR:** Geotech Driiling
Co-ordinate system: NZTM	**Datum:** AUCKHT1946	**RIG:** Track mounted rig
Location method: GPSH	**Level method:** CONTOUR	**DRILLER:** Ben
ORIENTATION (°): Vertical	**INCLINATION (°):** 90	**CHECKED BY:** MDH
		START DATE: 21/02/2022
		END DATE: 21/02/2022
		LOGGED BY: BSS

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING (UW SW MW HW CW)	STRENGTH (EW VW W MS S VS ES)	DEPTH	RL	SAMPLES	METHOD	TCR (%) (25 50 75)	RQD (%) (25 50 75)	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES DESCRIPTION	WATER	INSTALLATION	CORE BOXES
Auckland Volcanic Field	SILT, with minor gravel; dark brown. Stiff; moist; gravel, fine, basalt.	TS			0	41.8									
	Clayey SILT, with minor gravel, with trace cobbles; dark orange brown. Hard; high plasticity; moist; gravel, basalt; cobbles, basalt.										UTP				
	0.7m - 1.3m: Core loss	C/L			1	41.0					UTP				
	Slightly weathered; black; BASALT; strong; moderately vesicular.		SW								UTP 10, 20 / 50 N=50+	1.90m, 1No. 60° , JT , CRV , RG			
	2.60m: grades to slightly vesicular.		SW	S	2	40.0						2.50m, 1No. 15° , JT , UN , RG , Oxides			
					3	39.0							22/02/2022	Bentonite	Box 1, 0.0-3.3m
					4	38.0									
					5	37.0						4.30m, 1No. 45° , JT , PL , SM			
	Highly weathered; dark grey; BASALT; weak.		HW	W	6	36.0									Box 2, 3.3-6.2m
Puketoka Formation	Clayey SILT; grey. Firm; high plasticity; moist.				7	35.0									
	7.0m - 7.5m:Core loss	C/L									0, 0 / 0, 2, 2, 2 N=6				
	7.95m - 9.0m: Core loss	C/L	RS		8	34.0									
	Clayey SILT, with minor sand; purplish grey with orange brown stainning. Firm; high plasticity; moist; sand, fine.				9	33.0					48 / 16 kPa 0, 1 / 0, 0, 0, 2 N=2				Box 3, 6.2-12.0m
						32.0									

REMARKS:

DRILLHOLE LOG

INITIA
GEOTECHNICAL SPECIALISTS

HOLE NO.: BH101		
CLIENT: Fletcher Living	**SITE LOCATION:** Ellerslie Racecourse Hill	**Project Ref.:** P-001218
PROJECT: The Hills, Ellerslie		
CO-ORDINATES: 1761270.4mE, 5915725.5mN	**ELEVATION:** 41.8m	**CONTRACTOR:** Geotech Driiling
Co-ordinate system: NZTM	**Datum:** AUCKHT1946	**RIG:** Track mounted rig
Location method: GPSH	**Level method:** CONTOUR	**DRILLER:** Ben
ORIENTATION (°): Vertical	**INCLINATION (°):** 90	**START DATE:** 21/02/2022
		END DATE: 21/02/2022
		LOGGED BY: BSS
		CHECKED BY: MDH

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING (UW SW MW HW CW)	STRENGTH (EW VW W MS S VS ES)	DEPTH	RL	SAMPLES	METHOD	TCR (%) (25 50 75)	RQD (%) (25 50 75)	INSITU TESTING (SPT 'N' Vane shear strength)	DISCONTINUITIES DESCRIPTION	WATER	INSTALLATION	CORE BOXES
Puketoka Formation	[Cont...] Clayey SILT, with minor sand; purplish grey. Firm; low plasticity; moist; sand, fine. 10.2m - 10.5m: Core loss 10.50m: grades to soft.				11	31.0					0, 0 / 0, 0, 0, 0 N=0				
	Clayey SILT, with some sand; light grey. Firm; high plasticity; moist; sand, fine.				12	30.0					0, 0 / 0, 0, 2, 2 N=4				Box 3, 6.2-12.0m
	12.50m - 13.00m: Clayey sandy SILT; grey. Stiff; moist; sand, fine.				13	29.0									
	13.95m - 15.0m: Core loss				14	28.0					0, 0 / 0, 1, 3, 4 N=8				
	Clayey SILT, with minor sand; grey. Very stiff; moist; sand, fine.		RS		15	27.0					0, 0 / 0, 0, 3, 3 N=6			Bentonite	
	Sandy SILT, with trace organics; grey with black speckles. Very stiff; low plasticity; moist; sand, fine.				16	26.0									
	Clayey SILT, with some sand; grey. Hard; high plasticity; moist; sand, fine.				17	25.0					64 / 26 kPa 0, 2 / 2, 2, 4, 4 N=12				Box 4, 12.0-17.2m
	19.00m - 19.10m: with trace organics.				18	24.0					UTP 1, 1 / 1, 2, 4, 4 N=11				
ECBF (Residually Weathered)	Sandy SILT; grey with black speckles. Very stiff; low plasticity; moist; sand, fine.				19	23.0									
						22.0					1, 2 / 3, 4, 5, 6 N=18				Box 5, 17.2-22.4m

REMARKS:

DRILLHOLE LOG

INITIA
GEOTECHNICAL SPECIALISTS

HOLE NO.: BH101		
CLIENT: Fletcher Living	**SITE LOCATION:** Ellerslie Racecourse Hill	**Project Ref.:** P-001218
PROJECT: The Hills, Ellerslie		
CO-ORDINATES: 1761270.4mE, 5915725.5mN	**ELEVATION:** 41.8m	**CONTRACTOR:** Geotech Driiling
START DATE: 21/02/2022		
Co-ordinate system: NZTM	**Datum:** AUCKHT1946	**RIG:** Track mounted rig
END DATE: 21/02/2022		
Location method: GPSH	**Level method:** CONTOUR	**DRILLER:** Ben
LOGGED BY: BSS		
ORIENTATION (°): Vertical	**INCLINATION (°):** 90	**CHECKED BY:** MDH

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING (UW SW MW HW CW)	STRENGTH (EW VW W MS S VS ES)	DEPTH	RL	SAMPLES	METHOD	TCR (%) (25 50 75)	RQD (%) (25 50 75)	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES DESCRIPTION	WATER	INSTALLATION	CORE BOXES
ECBF (Residually Weathered)	[Cont...] Sandy SILT; grey with black speckles. Very stiff; low plasticity; moist; sand, fine. 20.1m - 21.0m: Core loss				21	21.0									
ECBF (Residually Weathered)	Clayey SILT, with some sand; grey. Stiff; high plasticity; moist; sand, fine.		RS		22	20.0					0, 0 / 2, 1, 6, 5 N=14			Bentonite	Box 5, 17.2-22.4m
ECBF (Highly Weathered)	Clayey SILT, with some sand; grey. Hard; moist; sand, fine; Residual weathered.				23	19.0					53 / 21 kPa 1, 3 / 6, 6, 10, 9 N=31				
ECBF (Highly Weathered)	EOH: 24.45m				24	18.0					1, 3 / 5, 5, 7, 8 N=25			24.45m	Box 6, 22.4-24.5m
						17.0									
						16.0									
						15.0									
						14.0									
						13.0									
						12.0									

REMARKS:

CORE PHOTOS

HOLE NO.: **BH101**
JOB NO.: P-001218

Box 1, 0.0-3.3m

Box 2, 3.3-6.2m

Box 3, 6.2-12.0m

CORE PHOTOS

HOLE NO.: **BH101**
JOB NO.: P-001218

Box 4, 12.0-17.2m

Box 5, 17.2-22.4m

Box 6, 22.4-24.5m

DRILLHOLE LOG

INITIA GEOTECHNICAL SPECIALISTS

HOLE NO.: BH102	**CLIENT:** Fletcher Living	**SITE LOCATION:** Ellerslie Racecourse Hill	
Project Ref.: P-001218	**PROJECT:** The Hills, Ellerslie		
CO-ORDINATES: 1761247.9mE, 5915723.2mN	**ELEVATION:** 40.7m	**CONTRACTOR:** Geotech Driiling	**START DATE:** 22/02/2022
Co-ordinate system: NZTM	**Datum:** AUCKHT1946	**RIG:** Track mounted rig	**END DATE:** 22/02/2022
Location method: GPSH	**Level method:** CONTOUR	**DRILLER:** Ben	**LOGGED BY:** BSS
ORIENTATION (°): Vertical	**INCLINATION (°):** 90		**CHECKED BY:** MDH

Columns: UNIT | MATERIAL DESCRIPTION (See Classification & Symbology sheet for details) | GRAPHIC | WEATHERING (UW SW MW HW CW) | STRENGTH (EW VW W MS S VS ES) | DEPTH | RL | SAMPLES | METHOD | TCR (%) (25 50 75) | RQD (%) (25 50 75) | INSITU TESTING (SPT 'N', Vane shear strength) | DISCONTINUITIES DESCRIPTION | WATER | INSTALLATION | CORE BOXES

Unit	Depth (m)	Material description	Weathering	Strength
Topsoil	0.0 – 0.3	Clayey SILT, with minor rootlets, with trace sand; dark orange brown. Firm; low plasticity; moist.		
Auckland Volcanic Field	0.3 – 1.9	Clayey SILT, with trace organics and sand and gravel; orange brown with light grey mottles and black speckles. Hard; high plasticity; moist; sand, fine, gravel, fine, basalt. 1.1m - 1.5m: Core loss		
Auckland Volcanic Field	1.9 – 9.0	Slightly weathered; grey; BASALT; strong; moderately vesicular. 2.8m - 3.0m: Core loss. 4.0m - 4.5m: Core loss. 8.3m - 9.0m: Core loss	SW	S
Puketoka Formation	9.0 – 9.45	Clayey SILT; light grey. Stiff; high plasticity; moist.		
	9.45	EOH: 9.45m		

Insitu testing

Depth	Result
~0.5 m	192+ kPa
~1.0 m	192+ kPa
~1.5 m	192+ kPa
1.5 m	SPT: 1, 1 / 1, 11, 23, 15 for 50mm; N=50+ for 275mm
9.0 m	SPT: 0, 0 / 0, 1, 2, 2; N=5

Discontinuities

- 1.90m, 3No. 85° , FC , UN , RG
- 2.40m, 1No. 85° , IS , CRV , RG , Z cl
- 3.10m, 1No. 45° , JT , PL , IR
- 3.40m, 2No. 30° , JT , CRV , RG
- 3.60m, 1No. 45° , JT , PL , RG
- 3.70m, 1No. 60° , JT , ST , RG , Z cl
- 4.50m, 1No. 75° , JT , CRV , RG
- 4.60m, 1No. 85° , IS , UN , RG , Z cl
- 5.00m, 1No. 80° , IS , ST , RG , Z cl
- 5.60m, 1No. 30° , JT , ST , RG , Z cl
- 6.30m, 1No. 45° , JT , PL , SM
- 7.40m, 1No. 85° , IS , UN , IR , Z cl, Oxide
- 7.80m, , IS , Z cl

Water: 23/02/2022 (at approx. 2.4m)

Installation: Bentonite (to 9.45m)

Core boxes: Box 1, 0.0-3.6m; Box 2, 3.6-7.5m; Box 3, 7.5-9.5m

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9. RL scale: 40.0, 39.0, 38.0, 37.0, 36.0, 35.0, 34.0, 33.0, 32.0, 31.0

REMARKS:

CORE PHOTOS

HOLE NO.: **BH102**
JOB NO.: P-001218

Box 1, 0.0-3.6m

Box 2, 3.6-7.5m

Box 3, 7.5-9.5m

DRILLHOLE LOG

INITIA
GEOTECHNICAL SPECIALISTS

HOLE NO.: BH103		
CLIENT: Fletcher Living	**SITE LOCATION:** Ellerslie Racecourse Hill	**Project Ref.:** P-001218
PROJECT: The Hills, Ellerslie		
CO-ORDINATES: 1761247.5mE, 5915700.4mN	**ELEVATION:** 41.9m	**CONTRACTOR:** Geotech Driiling
Co-ordinate system: NZTM	**Datum:** AUCKHT1946	**RIG:** Track mounted rig
Location method: GPSH	**Level method:** CONTOUR	**DRILLER:** Ben
ORIENTATION (°): Vertical	**INCLINATION (°):** 90	**CHECKED BY:** MDH
		START DATE: 22/02/2022
		END DATE: 22/02/2022
		LOGGED BY: BSS

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING (UW SW MW HW CW)	STRENGTH (EW VW W MS S VS ES)	DEPTH	RL	SAMPLES	METHOD	TCR (%) (25 50 75)	RQD (%) (25 50 75)	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES DESCRIPTION	WATER	INSTALLATION	CORE BOXES
Top soil	SILT, with minor rootlets; orange brown. Firm; low plasticity; moist.	TS			0	41.9		HQTT	86		192+ kPa				
	Clayey SILT, with trace sand; orange brown with light brown mottles. Hard; high plasticity; moist.														
	Clayey SILT, with trace gravel; light brown. Very stiff; high plasticity; moist; gravel, fine, basalt.				1						192+ kPa				
	0.50m - 0.60m: Moderately weathered; dark grey; BASALT; strong; moderately vesicular.														
	1.3m - 1.5m: Core loss					40.9		SPT	100		192+ kPa				
	Slightly weathered; grey; BASALT; strong; moderately vesicular.				2			HQTT	114 >>	38					
	2.70m - 2.80m: highly weathered.		SW									2.50m, 1No. 30° , JT , PL , RG			
	3.00m - 3.10m: highly weathered.				3	39.0						3.00m, 1No. 20° , JT , PL , RG	24/02/2022		Box 1, 0.0-3.1m
	Unweathered; grey; BASALT; very strong; slightly vesicular.											3.30m, 1No. 65° , JT , PL , RG			
					4	38.0		HQTT	73	40					
			CW									4.10m, 1No. 30° , JT , PL , RG			
												4.30m, 1No. 30° , JT , CRV , IR			
					5	37.0						4.80m, 1No. 45° , JT , PL , RG			
	Slightly weathered; dark grey; BASALT; strong; slightly to non vesicular.							HQTT	100	40					
				S	6	36.0									Box 2, 3.1-6.4m
								HQTT	100	66		6.30m, 1No. 30° , JT , PL , RG			
			SW		7	35.0									
												7.80m, 1No. 50° , JT , PL , SM			
					8	34.0		HQTT	93	60		8.00m, 1No. 45° , JT , PL , SM			
												8.40m, 1No. 45° , JT , PL , SM			
												8.80m, 1No. 15° , JT , PL , SM			
					9	33.0						8.80m, 1No. 45° , JT , CRV , IR			Box 3, 6.4-9.3m
								HQTT	100	46		9.10m, 1No. 20° , JT , PL , SM			
						32.0									Box 4, 9.3-12.5m
	Auckland Volcanic Field													Bentonite	

REMARKS:

DRILLHOLE LOG

INITIA
GEOTECHNICAL SPECIALISTS

CLIENT: Fletcher Living	**SITE LOCATION:** Ellerslie Racecourse Hill	**HOLE NO.:** BH103
PROJECT: The Hills, Ellerslie		**Project Ref.:** P-001218
CO-ORDINATES: 1761247.5mE, 5915700.4mN	**ELEVATION:** 41.9m	**CONTRACTOR:** Geotech Driiling
Co-ordinate system: NZTM	**Datum:** AUCKHT1946	**RIG:** Track mounted rig
Location method: GPSH	**Level method:** CONTOUR	**DRILLER:** Ben
ORIENTATION (°): Vertical	**INCLINATION (°):** 90	**START DATE:** 22/02/2022
		END DATE: 22/02/2022
		LOGGED BY: BSS
		CHECKED BY: MDH

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING (UW SW MW HW CW EW VW W MS S VS ES)	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) (25 50 75)	RQD (%) (25 50 75)	INSITU TESTING (SPT 'N' Vane shear strength)	DISCONTINUITIES DESCRIPTION	WATER	INSTALLATION	CORE BOXES
and Volcanic	[Cont...] Slightly weathered; dark grey; BASALT; strong; slightly to non vesicular.		SW	S				HQTT	100	46		10.00m, 1No. 30° , JT , CRV , SL			
Puketoka Formation	Clayey SILT, with minor organics; greyish brown with dark grey mottles. Very stiff; high plasticity; moist.							SPT	100		42 / 16 kPa 0, 0 / 0, 1, 2, 3 N=6				
	Clayey SILT, with trace organics and sand; yellowish brown grey. Very stiff; moist; sand, fine.				11	31.0		HQTT	85						
	12.00m: grades to stiff.				12	30.0		SPT	100		50 / 18 kPa 0, 0 / 0, 2, 3, 2 N=7				Box 4, 9.3-12.5
	12.45m - 13.5m: Core loss	C/L						HQTT							
	Clayey SILT, with trace organics and sand; yellowish brown grey. Very stiff; moist; sand, fine.				13	29.0		SPT	100		106 / 29 kPa 0, 1 / 1, 1, 2, 2 N=6				
	Clayey SILT, with some organics; dark grey with black speckles. Stiff; high plasticity; moist.				14	28.0		HQTT	95						
	Clayey SILT, with trace sand; grey. Very stiff; high plasticity; moist; sand, fine.				15	27.0		SPT	100		101 / 32 kPa 0, 0 / 0, 0, 4, 2 N=6				
	16.00m - 16.30m: with some sand.				16	26.0		HQTT	100						
	16.50m: grades to stiff.							SPT	100		98 / 32 kPa 1, 5 / 3, 3, 3, 4 N=13				Box 5, 12.5-17.0m
	Sandy SILT; grey. Stiff; low plasticity; moist; sand, fine.				17	25.0		HQTT	95						
ECBF (Residually Weathered)	Silty SAND; grey. Medium dense; low plasticity; moist; sand, fine to medium.				18	24.0		SPT	100		0, 0 / 2, 3, 4, 5 N=14				
					19	23.0		HQTT	95						
								SPT	100		2, 3 / 3, 3, 6, 7 N=19				Box 6, 17.0-20.6m
					22	22.0									

Bentonite

REMARKS:

DRILLHOLE LOG

INITIA
GEOTECHNICAL SPECIALISTS

HOLE NO.: BH103

CLIENT: Fletcher Living
PROJECT: The Hills, Ellerslie
SITE LOCATION: Ellerslie Racecourse Hill
Project Ref.: P-001218

CO-ORDINATES: 1761247.5mE, 5915700.4mN
Co-ordinate system: NZTM
Location method: GPSH
ORIENTATION (°): Vertical
ELEVATION: 41.9m
Datum: AUCKHT1946
Level method: CONTOUR
INCLINATION (°): 90
CONTRACTOR: Geotech Driiling
RIG: Track mounted rig
DRILLER: Ben
START DATE: 22/02/2022
END DATE: 22/02/2022
LOGGED BY: BSS
CHECKED BY: MDH

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING (UW SW MW HW CW)	STRENGTH (EW VW W MS S VS ES)	DEPTH	RL	SAMPLES	METHOD	TCR (%) (25 50 75)	RQD (%) (25 50 75)	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES DESCRIPTION	WATER	INSTALLATION	CORE BOXES
ECBF (Residually Weathered)	Clayey SILT, with trace sand; grey. Hard; moist; sand, fine.				21	21.0		SPT	100		2, 2 / 5, 6, 6, 8 N=25			Bentonite	Box 6, 17.0-20.6
	Sandy SILT; grey. Hard; low plasticity; moist; sand, fine.				22	20.0		HQTT	95						
					23	19.0		SPT	100		3, 4 / 6, 8, 8, 8 N=30				
						18.0		HQTT	100						Box 7, 20.6-24.0m
					24			SPT	100		3, 6 / 7, 7, 9, 9 N=32				
	Clayey SILT, with trace sand; grey. Hard; high plasticity; moist; sand, fine; residual soils.				25	17.0		HQTT	100						
						16.0		SPT	100		2, 4 / 5, 6, 5, 8 N=24				
East Coast Bays Formation	Slightly weathered; grey; SILTSTONE; very weak.		SW	VW	26			HQTT	100						Box 8, 24.0-26.5m
	EOH: 26.95m					15.0		SPT	100	66	10, 10 / 11, 13, 15, 11 for 50mm N=50+ for 275mm			26.95m	
						14.0									
						13.0									
						12.0									

REMARKS:

CORE PHOTOS

HOLE NO.: **BH103**
JOB NO.: P-001218

Box 1, 0.0-3.1m

Box 2, 3.1-6.4m

Box 3, 6.4-9.3m

Box 4, 9.3-12.5m

Box 5, 12.5-17.0m

Box 6, 17.0-20.6m

CORE PHOTOS

HOLE NO.: **BH103**
JOB NO.: P-001218

Box 7, 20.6-24.0m

Box 8, 24.0-26.5m

DRILLHOLE LOG

INITIA
GEOTECHNICAL SPECIALISTS

HOLE NO.: BH104		
CLIENT: Fletcher Living	**SITE LOCATION:** Ellerslie Racecourse Hill	**Project Ref.:** P-001218
PROJECT: The Hills, Ellerslie		
CO-ORDINATES: 1761268.2mE, 5915681.2mN	**ELEVATION:** 42.1m	**CONTRACTOR:** Geotech Driiling
Co-ordinate system: NZTM	**Datum:** AUCKHT1946	**RIG:** Track mounted rig
Location method: GPSH	**Level method:** CONTOUR	**DRILLER:** Ben
ORIENTATION (°): Vertical	**INCLINATION (°):** 90	**START DATE:** 22/02/2022
		END DATE: 22/02/2022
		LOGGED BY: BSS
		CHECKED BY: MDH

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING (UW SW MW HW CW)	STRENGTH (EW VW W MS S VS ES)	DEPTH	RL	SAMPLES	METHOD	TCR (%) (25 50 75)	RQD (%) (25 50 75)	INSITU TESTING (SPT 'N' Vane shear strength)	DISCONTINUITIES DESCRIPTION	WATER	INSTALLATION	CORE BOXES
Topsoil	SILT, with minor rootlets and gravel; black. Firm; low plasticity; moist; gravel, medium to coarse, basalt.	TS			0	42.0									
	0.35m - 1.5m: Core loss	C/L						HQTT	23		UTP				
					1	41.0					192+ kPa				
	Clayey SILT, with trace gravel; light orange brown. Hard; high plasticity; moist; gravel, fine, basalt.							SPT	100		192+ kPa 1, 3 / 3, 3, 3, 3 N=12				
					2	40.0		HQTT	80						
	2.8m - 3.0m: Core loss	C/L													
Auckland Volcanic Field	Moderately weathered; dark grey; BASALT; moderately strong; highly fractured, moderately vesicular.		MW	MS	3	39.0		SPT	100		UTP 17, 14 / 15, 35 N=50+ for 150mm				
	3.9m - 4.5m: Core loss	C/L			4	38.0		HQTT	50			3.50m, 1No. 45° , JT , CRV , RG			
	Slightly weathered; dark grey; BASALT; strong; moderately vesicular.														
					5	37.0		HQTT	93	53		4.80m, 2No. 30° , JT , PL , RG			
												5.20m, 1No. 45° , JT , PL , SL			
	6.50m - 6.80m: with greenish grey, clayey Silt infill, moderately weathered.		SW	S	6	36.0		HQTT	100	26		6.10m, 1No. 85° , JT , ST , RG 6.30m, 1No. 45° , JT , PL , RG			
	7.40m: with greenish grey, clayey Silt infill.				7	35.0						7.20m, 1No. 30° , JT , PL , RG			
	7.60m - 7.80m: with greenish grey, clayey Silt infill.											7.60m, 1No. 30° , JT , CRV , RG 7.70m, 1No. 45° , JT , PL , RG			
	8.00m - 8.10m: with greenish grey, clayey Silt infill, moderately weathered.				8	34.0		HQTT	46	30					
	8.2m - 9.0m: Core loss	C/L													
	8.60m - 8.80m: with greenish grey, clayey Silt infill.														
	EOH: 9.00m					33.0								9m	

Bentonite

Box 1, 0.0-5.1m

Box 2, 5.1-9.0m

REMARKS:

CORE PHOTOS

HOLE NO.: **BH104**
JOB NO.: P-001218

Box 1, 0.0-5.1m

Box 2, 5.1-9.0m

Lander Geotechnical Consultants Limited
Level 3, 3 Osterley Way, P O Box 97 385,
Manukau, Auckland 2241
Phone: (09) 262 1528
www.landergeotechnical.co.nz

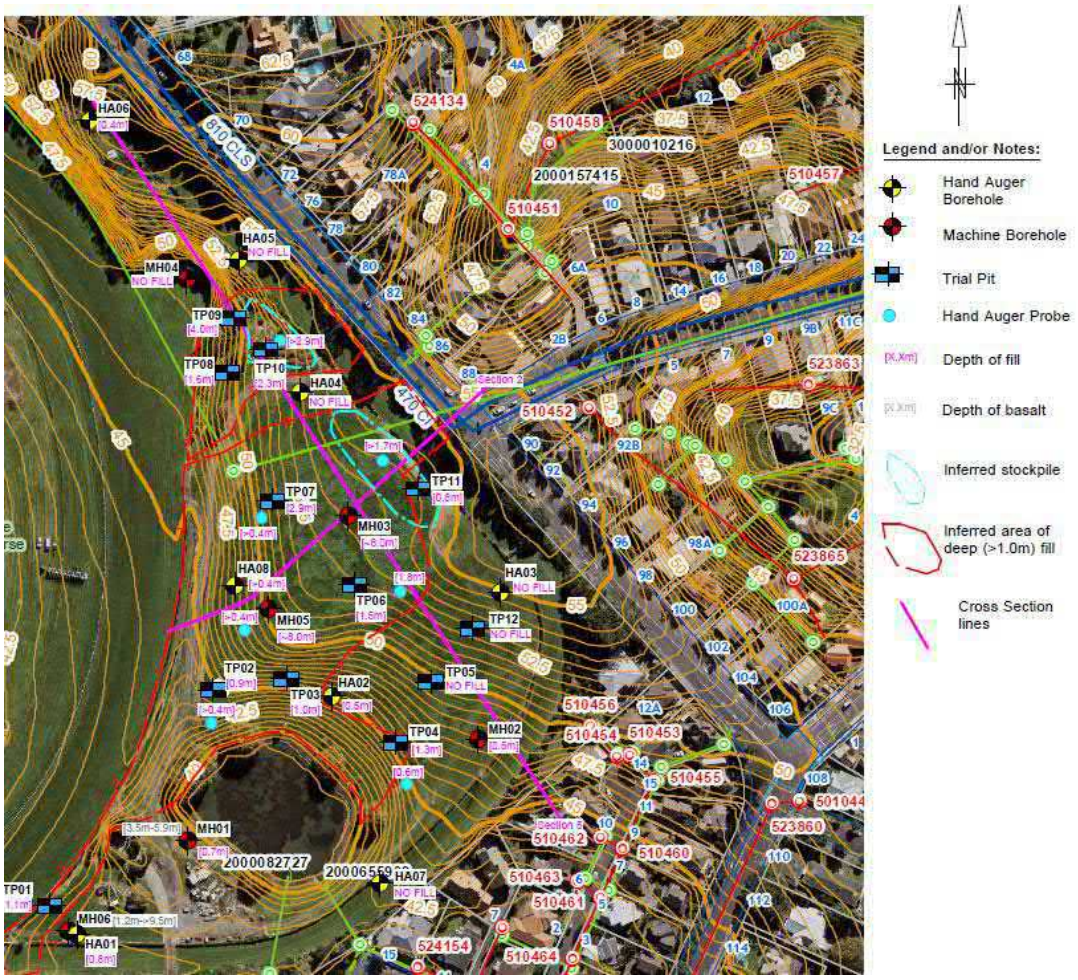
Memorandum

To	**Don Greenaway**	From	**Chris Edwards**
Email	**Don.G@ellerslie.co.nz**	Date	**13 July 2021**
Company	**Auckland Racing Club**	Reference	**J01706-Rev1**
cc	**Vijay.Lala@tattico.co.nz**	Pages	**1 of 7, plus attachments**
Subject	**Preliminary Geotechnical Data – Ellerslie Racecourse ('The Hills Area')**		

1 INTRODUCTION

The purpose of this memo is to provide the geotechnical data to date for the site referenced above and provide some preliminary geotechnical comments regarding the key perceived geotechnical considerations for the future development of the site for residential purposes.

As shown on the below plan (Insert A), considerable field testing has been undertaken between March and May 2021 for Auckland Racing Club of 'The Hills' area. Our field logs, cross-section profiles with interpreted geological units and site plan are attached for reference for the machine borehole, hand auger borehole and trial pit testing.

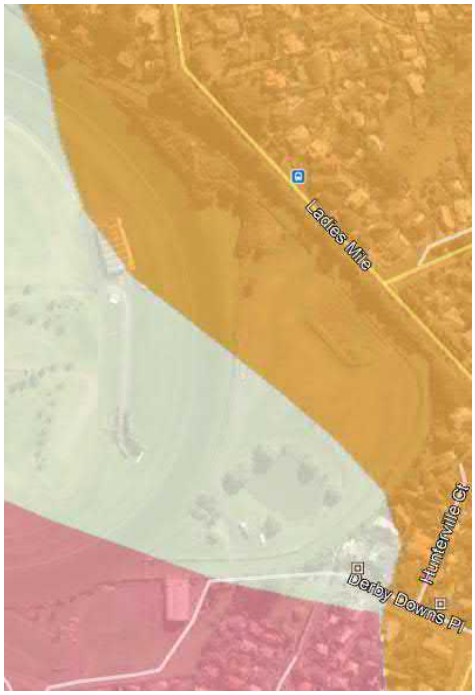


Insert A: Site Investigation Plan

2 DESKTOP REVIEW

2.1 Geology Maps

A review of GNS digital QMAPs indicates that the site is located at a geologic boundary between the East Coast Bays Formation, Tauranga Group Holocene alluvial and colluvial deposits and Auckland Volcanic Field tuff, shown on Insert B (right). Our borehole logs also identified the presence of Auckland Volcanic Field basalt (lava flows) within the southern portion of the site.

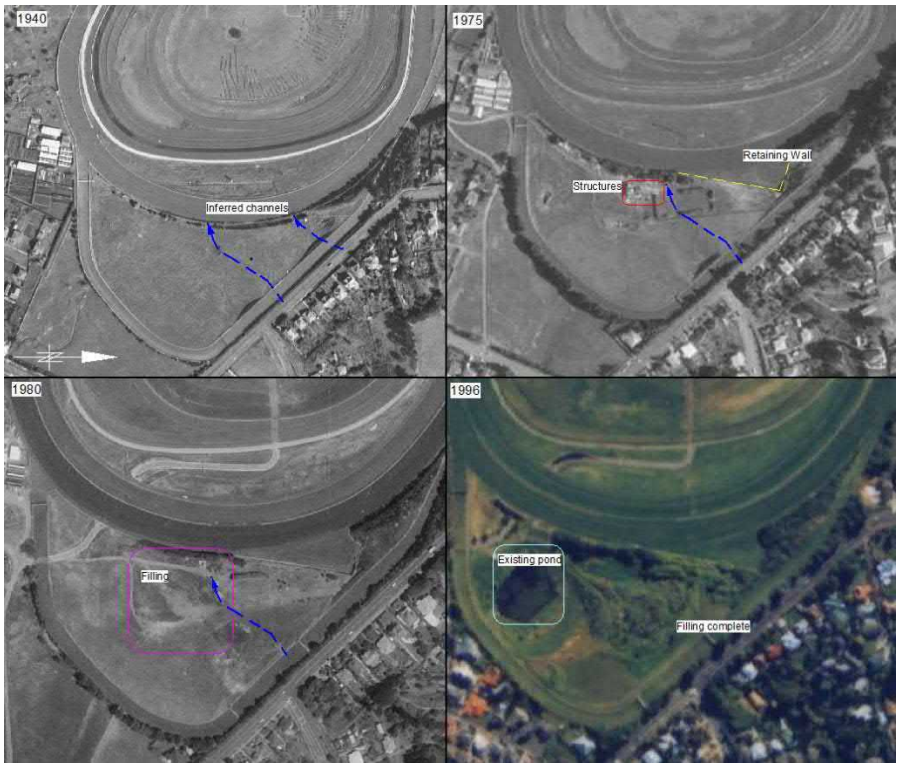


Insert B: Geological boundaries between East Coast Bays Formation (orange), Tauranga Group (White) and tuff (red).

2.2 Retrolens and Auckland Council Historic Image Database

A review of Retrolens' historic image database (since 1940-1980) and Auckland Council database (1940-1996) indicates that two channels (depressions/gullies) had previously existed towards the northern end of the site. By 1975 the western most channel appears to have been filled in, and a retaining wall constructed within its flow path. Some small structures are also visible on the site in the 1975 image.

Historic imagery from 1988 indicates that the small structures have been removed, and infilling had begun on the second (eastern) channel. By 1996 the Auckland council imagery shows that the pond had been formed and the filling of the second channel mostly completed.



Insert C: Retrolens images showing the change in land use of the site over the last 80 years.

3 FIELDWORK AND FINDINGS

3.1 Fieldwork Programme

Our fieldwork was commenced on 29 March 2021 and involved the drilling of eight hand auger boreholes and six machine boreholes to depths of up to 24 metres and the supervision of the excavation of twelve trial pits to depths of up to 4.4 metres in the positions indicated on the appended site plan. Soil samples were recovered from between 0.5 and 1.0m depth within HA02 and HA05 for subsequent laboratory examination and expansive soil testing.

To help assess the strength and consistency of the strata beyond the reach of the boreholes, we also carried out base penetration resistance tests (scalas) in HA01 and HA08.

Results of all insitu soil tests and groundwater monitoring, together with detailed descriptions and depths of strata encountered during the drilling of the boreholes, and during the excavation of the trial pits are appended.

Our findings are summarised as follows:

3.2 Findings

3.2.1 Topsoil

Topsoil was encountered within each borehole and trial pit location between 0.1 and 0.4m depth.

3.2.2 Fill

Non-engineered fill was identified within HA02, HA06 and HA08, MH01, MH02, MH03, MH05 and MH06, and TP01 TP02, TP03 TP04, TP06, TP07, TP08, TP09, TP10 and TP11, between depths of 0.4m and approximately 8.0m depth. This material was described as orange, brown, grey, blue, white and black clays, silts, sands and gravels and included blocks of non-insitu basalt, concrete, wood, asbestos, brick, asphalt, piping and metal wiring along and other various building debris. Undrained shear strengths ranged between 54kPa (stiff) and 171kPa (very stiff).

3.2.3 Recent Alluvium

Recent Alluvium was identified within TP06 underlying the fill to a depth of 1.8m. This deposit comprised of orange and dark grey organic stained clays and silts. The shear vane blade was unable to penetrate this soil.

3.2.4 Ash

Ash was described within HA01, HA03, HA04, HA07, MH01, MH02, MH06, TP01, TP05 and TP12 underlying the surficial topsoil and/or fill to between 0.15m and 3.5m depth. These soils comprised orange, grey, brown and red clays, silts and scoriacous and basaltic gravels. Undrained shear strengths ranged between 108kPa (stiff) and greater than 215kPa (hard), with the shear vane blade unable to penetrate the soil in some instances.

3.2.5 Basalt

Basalt was identified within MH01 (3.5m to 5.9m) and MH06 (1.2m to >9.5m). HA01 terminated at 0.15m depth and base penetration (scala) testing found hammer bouncing on inferred basalt at 0.4m depth.

3.2.6 Tauranga Group Alluvium

Alluvium was described within HA05 (0.4m to >5m), MH01 (5.9m to 21m) and MH04 (0.2m to >22m) at 5.9m and 0.4m depth, respectively. These soils were described as grey, green, black, brown and

orange, clays silts and sands with some organic inclusions and organic stained layers. SPT ‘N’ values were between 2 (very loose) and greater than 50 (very dense).

3.2.7 Residual East Coast Bays Formation

Residual East Coast Bays Formation soils were noted within HA02, HA03, HA04, HA06, HA07, MH02, MH03, TP02, TP03, TP04, TP06, TP07, TP08, TP09, TP10 and TP11 at between 0.4m and 8.0m depth. These deposits comprised orange and grey silts, clays and sands and undrained shear strength values were between 89kPa and greater than 215kPa (hard), with the shear vane blade unable to penetrate the soil in come instances.

3.2.8 Transitional East Coast Bays Formation

Transitional East Coast Bays Formation soils were described within HA06, MH02, MH03 and MH05 at between 4.9m and 10.6m depth. These deposits consisted of dark grey clays, silts and sands. SPT ‘N’ values ranged between 23 (medium dense) and greater than 50 (very dense).

3.2.9 East Coast Bays Formation Bedrock

East Coast Bays Formation bedrock was identified within MH01, MH03 and MH05 at 21.0m, 11.8m and 10.5m depth, respectively. SPT ‘N’ values within this material were all greater than 50. (very dense).

3.2.10 Groundwater Monitoring

During our time onsite, no groundwater was encountered within the hand auger boreholes or trial pit excavations. Piezometers were installed within HA05, HA06, MH01, MH02, MH03 and MH04 for subsequent groundwater monitoring. Table 1 below shows the depths of groundwater encountered within each borehole:

Table 1: Groundwater levels measured within piezometers in m below existing ground level.

Date Measured	HA03	HA06	MH01	MH02	MH03	MH04
06.04.21	No groundwater encountered	No groundwater encountered	3.05m	4.70m	Not yet drilled	3.66m
13.04.21	No groundwater encountered	No groundwater encountered	2.86m	4.77m	6.02m	3.70m
16.04.21	No groundwater encountered	No groundwater encountered	2.80m	4.83m	6.19m	3.74m

3.2.11 Laboratory Results

The Atterberg Limits laboratory testing undertaken from samples from HA02 and HA05 (0.5m to 1m depth) returned liquid limits of 109 and 75 respectively and linear shrinkages of 22% and 19% respectively. In terms of NZS3604, this classifies the soils outside the definition of ‘Good Ground’ on account of their expansive nature (as is common of most clayey soils in the Auckland Region).

4 OTHER GEOTECHNICAL DATA FOR THE SITE

A previous geotechnical investigation and assessment report encompassing ‘The Hills’ area was prepared by Harrison Grierson Consultants Limited (reference 1015-126669-01, dated May 2008). This

report included the drilling of 2 machine boreholes (MB01 and MB02) and 3 hand auger boreholes (HA1 to HA3) within the subject site. A copy of this report is appended for reference and as supplementary information. The boreholes found natural soils similar to those encountered within our boreholes (mostly East Coast Bays Formation soils and rock and/or Puketoka Formation alluvium) with HA2 encountering existing fill deposits to greater than 0.8m depth (which was drilled in a similar location to our HA08 which found similar filled ground).

5 KEY GEOTECHNICAL CONSIDERATIONS

5.1 Existing (Non-Engineered) Fill

The attached site investigation plan (Figure 01) shows the depth that existing (non-engineered) fill was found at each borehole and trial pit location. These deposits were up to 8m depth (inferred as core recovery within MH03 and MH05 were poor from 6m to 8m depth) and comprised of variable materials.

These deposits will not be suitable to construct buildings on (unless a fully piled and suspended foundation system can be designed for) or associated infrastructure and roading. Depending on final development proposals for the site, it is most likely that these deposits will need to be removed (where within development areas) to stiff inorganic natural ground, underfill drainage installed (where deemed necessary) and the areas backfilled with engineer certified materials to design levels.

Given the variable materials within the fill deposits (including refuse materials and organic deposits), from a geotechnical perspective there will be a portion of these deposits that will not be suitable for reuse as engineered fill on site. If re-use of the fill deposits as engineered fill on site is proposed, then that would be subject to further geotechnical assessment (and subject to environmental engineering assessment by the environmental consultant for the development) and would likely require sorting ‘suitable’ inorganic clay materials from ‘unsuitable’ refuse and organic deposits onsite (subject to the practicalities of this) and mixing the ‘suitable’ existing fill deposits on site with imported fill products.

5.2 Foundations

From review of the borehole records, most of the site is underlain by inorganic stiff to very stiff East Coast Bays Residual Soils or stiff to very stiff Alluvium (excluding the existing fill deposits discussed above). A Geotechnical Ultimate Bearing Capacity of 300kPa should be available for foundation design purposes for light weight (i.e. NZS3604 style, timber framed, one to two story) dwellings constructed on the natural ground or engineered fill. However, some softer areas were identified at depth within some of the machine boreholes at depth and confirmation of a preliminary bearing capacity for the site will need to be determined once earthworks proposals are known.

The design of heavy/ large buildings foundation (i.e. if multi story apartment blocks are proposed) will require further assessment and will be subject to final building loads/ foundation requirements. Bridging pile requirements for any foundations within the 45-deg zone of influence of any public service lines will also be required.

From the preliminary laboratory testing undertaken and review of the borehole logs, the preliminary expansive site class classification of the site in accordance with MBIE Acceptable Solutions and Verifications Methods (for NZ Building Code Clause B1 Structure, effective 28 November 2019) is H (High) with a characteristic soil movement (ys) of up to 78mm. This preliminary assessment can be reassessed on site after earthworks are undertaken by shrink-swell laboratory testing as recommended in the above-mentioned document.

5.3 Slope Stability

Most of the site is gently sloping, however steeper slopes (i.e. greater than 1(v) in 4(h)) exist within the northern corner of the site. If/where slopes steeper than 1(v) in 4(h) exist within the proximity of proposed development areas, these will need assessment for slope stability and/or the effects of any shallow soil creep that can occur on such slopes and their potential effects on any nearby building platforms. This will also be the case for any proposed cuts/retaining walls proposed near site boundaries.

Re-assessment of this can be made once development and earthworks proposals are finalised.

5.4 Groundwater

Table 1 above shows that the highest groundwater level measured was 2.8m deep below existing ground level (MH01 – situated near the pond in the lower lying area of site). The other boreholes measured groundwater at greater than 3.5m below existing ground level (or did not encounter the groundwater table).

Once final earthworks and building development proposals are known, assessment of the proposals to AUP E7 guidelines will need to be made (especially if cuts greater than 2.5m are proposed, dependant on location on site).

5.5 Earthworks

5.5.1 Existing Pond

We understand that the existing pond on site will likely be decommissioned and backfilled. Prior to backfilling the pond, any sediments/organic materials within the base of the pond will need to be removed to expose stiff natural ground (we currently do not have any data as to the depth of such deposits on site). Installation of sumps and pumping of ground water and/or underfill drainage may be necessary while the pond is being backfilled.

5.5.2 Undercut of Existing Fills

Following topsoil stripping from site, assessment of areas requiring undercutting of existing fills will be made by the certifying engineer (subject to the final development proposals for the site). During undercutting of the existing fills, assessment can be made regarding their suitability for re-use on site/ what materials could be suitable to be re-used as engineered fill on site with sorting or mixing with imported fill products and what materials are unsuitable for re-use on site and will need removal.

5.5.3 Filling

The use of natural inorganic cut ground (typically being cohesive silty clays and clayey silts) on site as fill should be relatively straight forward using conventional earthmoving equipment. However, some degree of conditioning, mixing and drying is expected would be required subject to time of year that earthworks are undertaken.

Assessment of materials to be imported to site for use as fill will be required to determine their suitability for use as engineered fill.

5.5.4 Underfill Drainage

Underfill drainage is likely will be necessary within the areas on site where deep undercut of existing fill is required and within the existing pond area. But this will need to be further assessed once earthworks plans are finalised.

5.5.5 Basalt

Basalt was encountered within the southern corner of the site (MH01 and MH06). If cuts are proposed within this area of site, then these deposits may be encountered (likewise for any underground services or foundations within this portion of site). Rock breaking to excavate these deposits where encountered will likely be required.

5.5.6 Settlement

Subject to final earthworks proposals (i.e. fill heights) and final building loads proposed, assessment of the settlement characteristics (consolidation settlement) of placement of fills upon the natural ground on site may be required. This will need to be assessed once development proposals are known.

6 CLOSURE

It is reiterated that this preliminary geotechnical data memo is intended to inform you on the general ground conditions and key geotechnical considerations for the site. Once detailed development proposals and earthworks plans are known these considerations will need to be re-assessed and there may by other considerations to be made that have not been outlined above. A full and detailed Geotechnical Investigation Report will need to be prepared to accommodate any Resource Consent application for the site.

This memorandum has been prepared solely for the use of our client, Auckland Racing Club and their professional advisers. No liability is accepted in respect of its use for any other purpose or by any other person or entity. All future owners of this property should seek professional geotechnical advice to satisfy themselves as to its ongoing suitability for their intended use.

The opinions, recommendations and comments given in this report result from the application of normal methods of site investigation. As factual evidence has been obtained solely from boreholes and trial pits which by their nature only provide information about a relatively small volume of subsoils, there may be special conditions pertaining to this site which have not been disclosed by the investigation and which have not been taken into account in the report.

For and on behalf of Lander Geotechnical Consultants Limited

Chris Edwards

Senior Engineering Geologist

Attachments: Harrison Grierson Cross-Sections and Plan
Lander Geotechnical Site Plan and Geological Cross-Sections 2 and 5
Lander Geotechnical Borehole Records and Trial Pit Records
Geotechnics Laboratory Testing
Supplementary Data: Harrison Grierson 2008 Geotechnical Investigation and Assessment Report

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NOTES

1. COORDINATES ARE IN TERMS OF NZ GEODETIC DATUM 2000 MT EDEN CIRCUIT.
2. REFER DRAWINGS 2010464-SK1-120 TO SK1-122 FOR EXISTING CROSS SECTIONS.

LEGEND:

PROJECT BOUNDARY

0 20 24

EXISTING SECTION LINE

AUCKLAND AIRPORT OFFICE
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A	CLIENT ISSUE	NJS	10.05.21
REF	REVISIONS	BY	DATE

PROJECT:

AUCKLAND RACING CLUB
ELLERSLIE RACECOURSE
ELLERSLIE

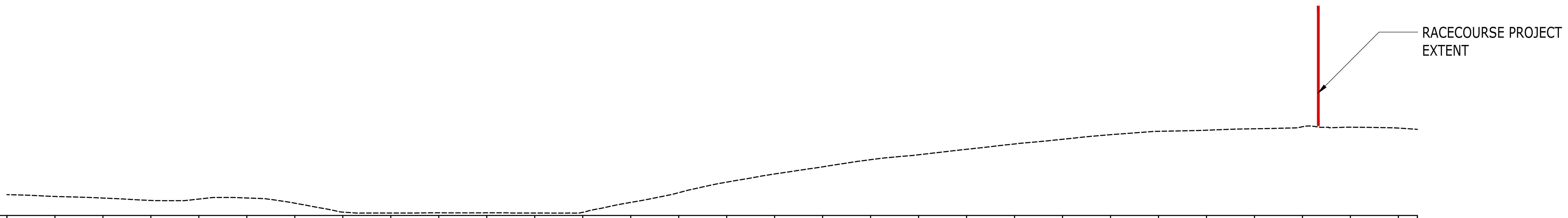
TITLE:

EXISTING SECTIONS LOCATION PLAN

ORIGINATOR: DVS	DATE: 05.2021	SIGNED:	PLOT BY: DVS
DRAWN: JXA	DATE: 05.2021	SIGNED:	PLOT DATE: 10.05.21
CHECKED: DVS	DATE: 05.2021	SIGNED:	SURVEY BY:
APPROVED: NJS	DATE: 05.2021	SIGNED:	SURVEY DATE:

ISSUE STATUS: CLIENT ISSUE

PROJECT No: A2010464.00	SCALES: 1:750 - A1 1:1500 - A3	A1
DRAWING No: 2010464-SK1-110		REV A



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CHAINAGE	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00	160.00	170.00	180.00	190.00	200.00	210.00	220.00	230.00	240.00	250.00	260.00	270.00	280.00	290.00	293.94

SECTION 1
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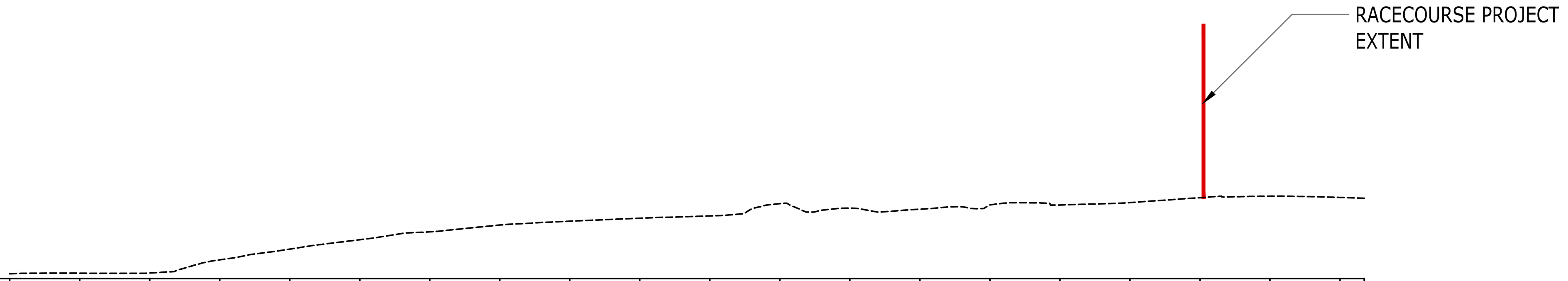

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CHAINAGE	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00	160.00	170.00	180.00	190.00	193.49

SECTION 2
SECTION BETWEEN CH: 0.00 AND 193.49
x1 VERTICAL EXAGGERATION

NOTES

1. REFER DRAWING 2010464-SK1-110 FOR LOCATION DETAILS.

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REF	REVISIONS	BY	DATE
B	AMENDMENT IN PROFILE VERTICAL EXAGGERATION	NJS	20.05.21
A	CLIENT ISSUE	NJS	10.05.21

PROJECT:
AUCKLAND RACING CLUB
ELLERSLIE RACECOURSE
ELLERSLIE

TITLE:
EXISTING CROSS SECTIONS
SHEET 1 OF 3

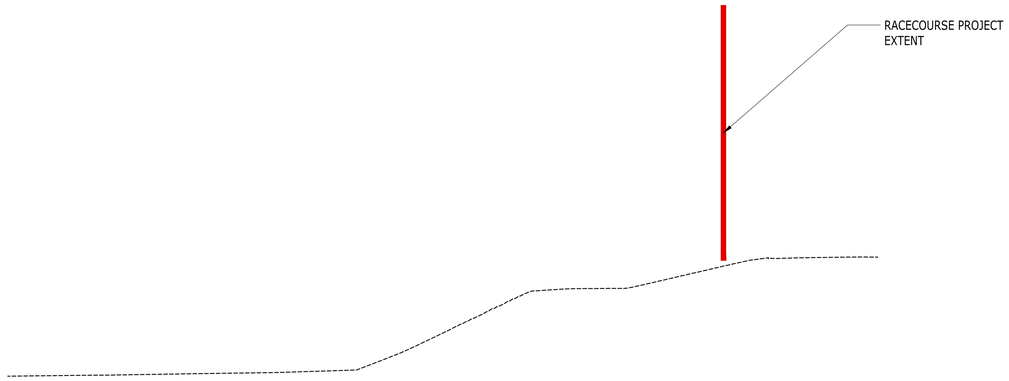
ORIGINATOR: DVS	DATE: 05.2021	SIGNED:	PLOT BY: DVS
DRAWN: JXA	DATE: 05.2021	SIGNED:	PLOT DATE: 20.05.21
CHECKED: DVS	DATE: 05.2021	SIGNED:	SURVEY BY:
APPROVED: NJS	DATE: 05.2021	SIGNED:	SURVEY DATE:

ISSUE STATUS: CLIENT ISSUE

PROJECT No: A2010464.00
SCALES: 1:750 H; 1:750 V - A1
1:1500 H; 1:1500 V - A3
A1

DRAWING No: 2010464-SK1-120
REV B

DRAFT ONLY



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SECTION 3
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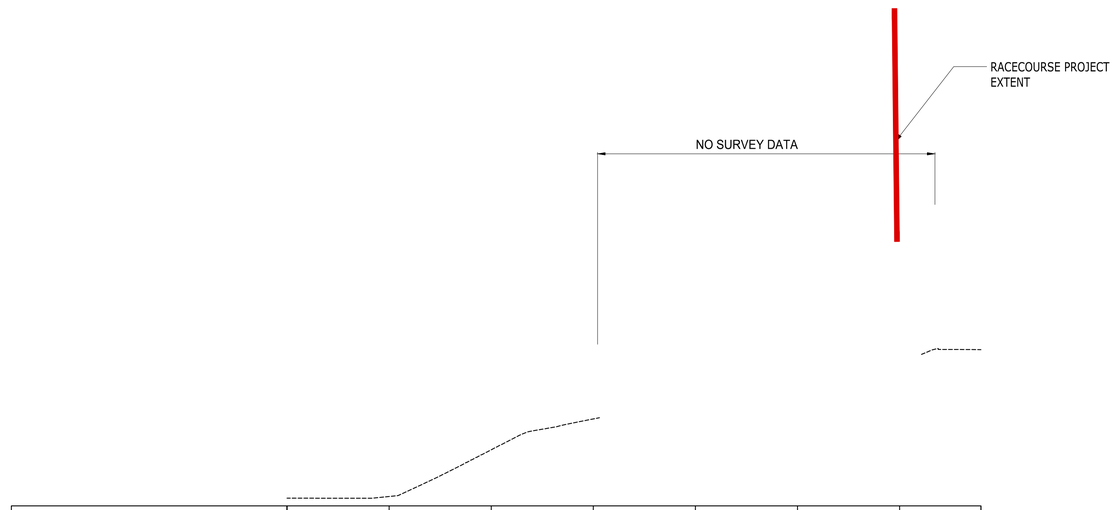
x1 VERTICAL EXAGGERATION



EXISTING LEVEL	46.75	46.91	51.49	54.51				61.29
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SECTION 4
SECTION BETWEEN CH: 0.00 AND 67.96
x1 VERTICAL EXAGGERATION

DRAFT ONLY

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NOTES

1. REFER DRAWING 2010464-SK1-110 FOR LOCATION DETAILS.

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B	AMENDMENT IN PROFILE VERTICAL EXAGGERATION	NJS	20.05.21
A	CLIENT ISSUE	NJS	10.05.21

PROJECT:

AUCKLAND RACING CLUB
ELLERSLIE RACECOURSE
ELLERSLIE

TITLE:

EXISTING CROSS SECTIONS
SHEET 2 OF 3

ORIGINATOR: DVS	DATE: 05.2021	SIGNED:	PLOT BY: DVS
DRAWN: JXA	DATE: 05.2021	SIGNED:	PLOT DATE: 20.05.21
CHECKED: DVS	DATE: 05.2021	SIGNED:	SURVEY BY:
APPROVED: NJS	DATE: 05.2021	SIGNED:	SURVEY DATE:

ISSUE STATUS: CLIENT ISSUE

PROJECT No:	SCALES:	
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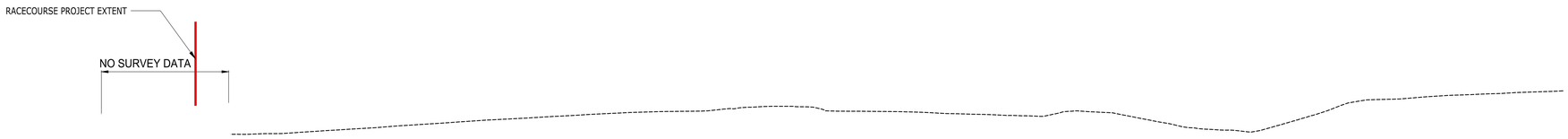

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EXISTING LEVEL					46.86	47.10	47.77	48.38	49.07	49.71	50.38	50.98	51.51	52.06	52.59	52.97	53.14	53.71	54.37	54.39	53.21	53.13	53.00	52.58	52.31	51.99	52.25	53.04	52.04	50.12	48.43	47.94	48.75	51.62	55.04	56.37	56.89	57.53	57.92	58.35	58.72

SECTION 5
SECTION BETWEEN CH: 0.00 AND 399.86
x1 VERTICAL EXAGGERATION

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NOTES

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B	AMENDMENT IN PROFILE VERTICAL EXAGGERATION	NJS	20.05.21
A	CLIENT ISSUE	NJS	10.05.21

PROJECT:

AUCKLAND RACING CLUB
ELLERSLIE RACECOURSE
ELLERSLIE

TITLE:

EXISTING CROSS SECTIONS
SHEET 3 OF 3

ORIGINATOR: DVS	DATE: 05.2021	SIGNED:	PLOT BY: DVS
DRAWN: JXA	DATE: 05.2021	SIGNED:	PLOT DATE: 20.05.21
CHECKED: DVS	DATE: 05.2021	SIGNED:	SURVEY BY:
APPROVED: NJS	DATE: 05.2021	SIGNED:	SURVEY DATE:

ISSUE STATUS: CLIENT ISSUE

PROJECT No:	SCALES:	
A2010464.00	1:750 H; 1:750 V - A1 1:1500 H; 1:1500 V - A3	A1

DRAWING No: 2010464-SK1-122 REV B

DRAFT ONLY

Legend and/or Notes:

- Hand Auger Borehole
- Machine Borehole
- Trial Pit
- Hand Auger Probe
- [X.Xm] Depth of fill
- [X.Xm] Depth of basalt
- Inferred stockpile
- Inferred area of deep (>1.0m) fill
- Cross Section lines

BASEPLAN FROM AUCKLAND COUNCIL GIS. RETIREVED 09.04.21

revision	description	drawn	approved	date

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Horizontal Scale (metres)
0 30.0 60.0 90.0 120.0
Vertical Scale (metres)

drawn	RG
approved	CE
date	13.05.21
scale	1:2000
original size	A3

LANDER geotechnical

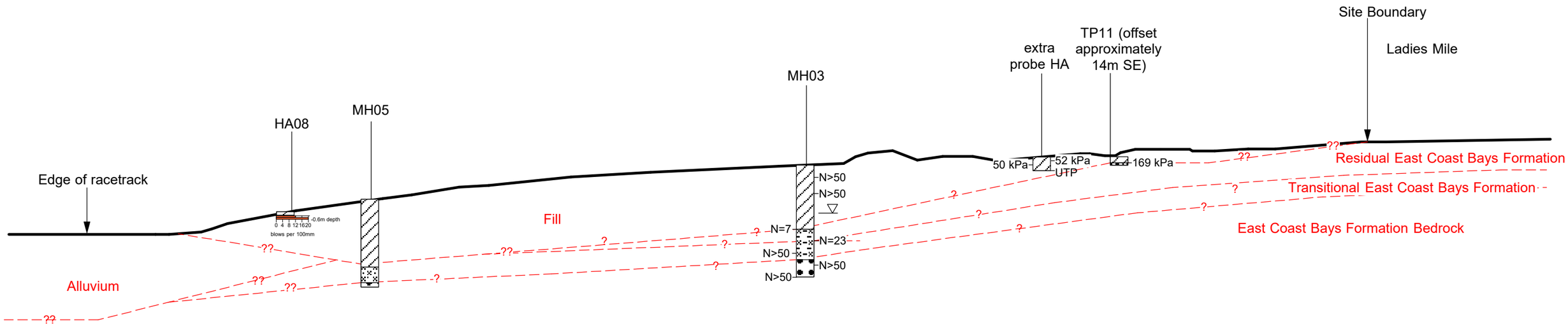
client: AUCKLAND RACING CLUB

project: ELLERSLIE RACECOURSE, ELLERSLIE

title: SITE INVESTIGATION PLAN

project no: J01706 figure no: 01

Template revision: 1:2000 (10/12/14)



Legend and/or Notes:

- Fill
- Silty sand
- Silty clay
- Sandstone

revision	description	drawn	approved	date

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Horizontal Scale (metres)
0 10.0 20.0 30.0
Vertical Scale (metres)

drawn	RG
approved	CE
date	20.05.21
scale	1:500
original size	A3

LANDER geotechnical

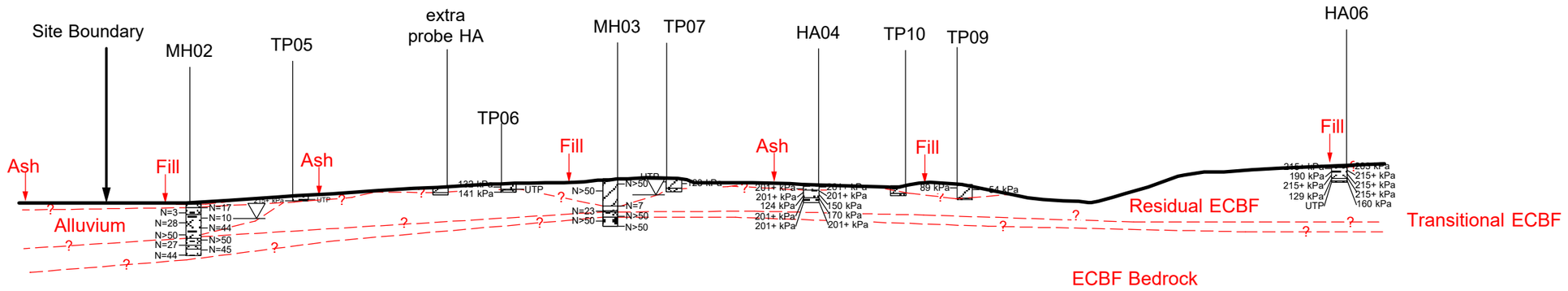
client: AUCKLAND RACING CLUB

project: ELLERSLIE RACECOURSE, ELLERSLIE

title: CROSS SECTION 2

project no: J01706 figure no: 02

Template revision: 1:500 (10/12/14)



Legend and/or Notes:

- Fill
- Clayey silt
- Silty clay
- Organic clayey silt
- Sandy silt
- Sandstone

revision	description	drawn	approved	date

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Horizontal Scale (metres)
0 25.0 50.0 75.0 100.0
Vertical Scale (metres)

drawn	RG
approved	CE
date	26.05.21
scale	1:1500
original size	A3

LANDER geotechnical

client: AUCKLAND RACING CLUB

project: ELLERSLIE RACECOURSE, ELLERSLIE

title: CROSS SECTION 5

project no: J01706 figure no: 03

Template revision: 1:2000 (10/12/14)

Client : AUCKLAND RACING CLUB

Project Location : ELLERSLIE RACECOURSE, ELLERSLIE

Job Number: J01706

Auger Borehole No. HA1

Vane Head:	Logged By:	Processor :	Date:
307	RZ	RZ	29.03.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION

Legend	Depth (m)	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL					5
clayey SILT, brown. Hard, dry, no plasticity [ASH]					9
EOB at 0.15m. Too hard to auger further. Scala pentrometer test commenced and found effective refusal (ER) at 0.4m.	0.5				10 (ER, HB)
	1.0				Scala Pentrometer Test (blows/100mm)
	1.5				HB = Hammer Bouncing
	2.0				
	2.5				
	3.0				
	3.5				
	4.0				
	4.5				
	5.0				
	5.5				
	6.0				

LANDER geotechnical

Comments:
Groundwater not encountered.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: RG

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : ELLERSLIE RACECOURSE, ELLERSLIE

Job Number: J01706

Auger Borehole No. HA2

Sheet 2 of 8

Vane Head:	Logged By:	Processor :	Date:
307	RZ	RZ	29.03.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION

Depth (m)	Soil Description	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
	TOPSOIL				
	silty CLAY, grey and brown mottled orange and light grey. Hard, moist, medium plasticity [FILL]				
0.5	silty CLAY with trace fine sand, orange and light grey mottled. Hard, moist, medium plasticity [RESIDUAL EAST COAST BAYS FORMATION]		201+		Sample 1 Disturbed 0.5-1.0m
1.0			201+		
1.5	becoming very stiff, insensitive		150/98	1.5	
2.0			150/89	1.7	
2.5			124/100	1.2	
	silty CLAY, grey. Stiff, moist, high plasticity, insensitive, with trace black carbonaceous inclusions				
3.0			89/66	1.3	
3.5	becoming very stiff		115/83	1.4	
4.0			121/86	1.4	
	clayey SILT, grey. Very stiff, moist, low plasticity, insensitive				
4.5			130/104	1.3	
5.0	EOB at 5.0m. Target depth		135/98	1.4	
5.5					
6.0					

LANDER geotechnical

Comments:
Groundwater not encountered.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: RG

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : RESIDENTIAL DEVELOPMENT ELLERSLIE RACECOURSE

Job Number: J01706

Auger Borehole No. HA03

Vane Head:	Logged By:	Processor :	Date:
1900	RZ	RG	29.03.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION

Depth (m)	Soil Description	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
0.0	TOPSOIL				
	clayey SILT, orange/brown. Hard, moist, medium plasticity [ASH]				
0.5			215+		
	becoming light brown/orange mottled orange/brown, low plasticity, with trace limonite				
1.0			215+		
	slightly clayey SILT with trace fine sand, light grey mottled light orange/brown. Hard, moist, low plasticity, with trace limonite [RESIDUAL EAST COAST BAYS FORMATION]				
1.5			215+		
	silty CLAY, orange streaked light grey. Very stiff, moist, high plasticity, insensitive, with trace limonite				
2.0			200/117	1.7	
2.5	becoming very stiff, moderately sensitive		160/80	2.0	
3.0			135/61	2.2	
	becoming light grey, without limonite				
3.5			160/77	2.1	
	becoming hard				
4.0			215+		
4.5			215+		
	at 5.0m, becoming very stiff, insensitive				
5.0			154/108	1.4	
	EOB at 5.0m. Target Depth.				
5.5					
6.0					

LANDER geotechnical

Comments:
Groundwater not encountered. Measured on 6.04.21, 13.04.21 and 16.04.21
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: RG

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : ELLERSLIE RACECOURSE, ELLERSLIE

Job Number: J01706

Auger Borehole No. HA4

Sheet 4 of 8

Vane Head:	Logged By:	Processor :	Date:
307	RZ	RZ	29.03.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION

Depth (m)	Soil Description	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
	TOPSOIL				
	clayey SILT, orange/brown. Hard, moist, low plasticity [ASH]				
0.5			201+		Sample 1 Disturbed 0.5-1.0m
1.0			201+		
	silty CLAY, orange and light grey mottled. Hard, moist, medium plasticity [RESIDUAL EAST COAST BAYS FORMATION]				
1.5			201+		
2.0			201+		
	becoming very stiff, insensitive				
2.5			150/104	1.4	
3.0			124/72	1.7	
3.5			170/112	1.5	
	clayey SILT, orange and light grey mottled. Hard, moist, low plasticity				
4.0			201+		
4.5			201+		
5.0			201+		
	EOB at 5.0m. Target depth				
5.5					
6.0					

LANDER geotechnical

Comments:
Groundwater not encountered.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: RG

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : RESIDENTIAL DEVELOPMENT ELLERSLIE RACECOURSE

Job Number: J01706

Auger Borehole No. HA5

Sheet 5 of 8

Vane Head:	Logged By:	Processor :	Date:
1900	RG	RZ	29.03.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION	Depth (m)	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL					
silty CLAY, orange streaked light grey. Very stiff, moist, medium plasticity, with trace limonite [ALLUVIUM]	0.5		193+		
clayey SILT, light grey mottled orange/brown. Very stiff, moist, low to medium plasticity					Sample 1 Disturbed 0.5-1.0m
becoming brown, low plasticity	1.0		193+		
becoming very stiff, moderately sensitive	1.5		110/41	2.7	
	2.0		113/39	2.9	
silty CLAY, orange/grey mottled grey. Very stiff, moist, medium to high plasticity, moderately sensitive	2.5		130/61	2.1	
becoming orange/brown					
becoming insensitive	3.0		130/69	1.9	
silty CLAY, black speckled dark brown. Very stiff, moist, medium to high plasticity, with trace organic inclusions	3.5		193+		
	4.0		193+		
	4.5		193+		
at 5.0m, becoming insensitive					
EOB at 5.0m. Target depth	5.0		180/102	1.8	
	5.5				
	6.0				

LANDER geotechnical

Comments:
Groundwater not encountered.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: RG

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : RESIDENTIAL DEVELOPMENT ELLERSLIE RACECOURSE

Job Number: J01706

Auger Borehole No. HA6

Sheet 6 of 8

Vane Head:	Logged By:	Processor :	Date:
1900	RG	RZ	01.04.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION

Depth (m)	Soil Description	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
	TOPSOIL				
	clayey SILT, dark brown. Stiff, moist, medium plasticity, with trace fine gravel [FILL]				
0.5	silty CLAY, orange streaked light grey. Very stiff, moist, high plasticity, moderately sensitive [RESIDUAL EAST COAST BAYS FORMATION]		203/61	3.3	
	clayey SILT, orange streaked light grey. Hard, moist, medium plasticity				
1.0			215+		
	becoming light grey				
1.5			215+		
	becoming orange streaked light grey, with trace limonite				
2.0			190/68	2.8	
2.5			215+		
	becoming light grey with trace fine sand				
3.0			215+		
3.5			215+		
	becoming orange, with minor limonite				
4.0	silty CLAY, light grey and orange streaked grey. Very stiff, moist, medium to high plasticity, moderaely sensitive, with trace limonite		129/55	2.4	
4.5	becoming insensitive		160/95	1.7	
	clayey SILT, orange. Very stiff, moist, medium plasticity, with some limonite				
5.0	clayey SILT with trace fine sand, dark grey. Hard, moist, low to medium plasticity [TRANSITIONAL EAST COAST BAYS FORMATION]		UTP		
	EOB at 5.0m. Target Depth.				
5.5					
6.0					

LANDER geotechnical

Comments:
Groundwater not encountered. Measured on 6.04.21, 13.04.21 and 16.04.21
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: RG

Topsoil	Sand	Sandstone	Plutonic	
Fill	Gravel	Siltstone	No Core	
Clay	Organic	Limestone		
Silt	Pumice	Volcanic		

Client : AUCKLAND RACING CLUB

Project Location : ELLERSLIE RACECOURSE, ELLERSLIE

Job Number: J01706

Auger Borehole No. HA7

Sheet 7 of 8

Vane Head:	Logged By:	Processor :	Date:
307	RZ	RZ	29.03.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION

Depth (m)	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL				
clayey SILT, brown. Hard, dry to moist, low plasticity [ASH]				
becoming brown/orange	0.5	201+		Sample 1 Disturbed 0.5-1.0m
becoming moist, medium plasticity	1.0	201+		
	1.5	201+		
silty CLAY, orange and light grey mottled. Hard, moist, medium plasticity [RESIDUAL EAST COAST BAYS FORMATION]				
	2.0	201+		
becoming high plasticity				
becoming very stiff, insensitive	2.5	184/138	1.3	
becoming wet				
	3.0	173/118	1.5	
	3.5	178/130	1.4	
clayey SILT, grey. Hard, moist, low plasticity	4.0	201+		
	4.5	201+		
EOB at 5.0m. Target depth	5.0	201+		
	5.5			
	6.0			

LANDER geotechnical

Comments:
Groundwater not encountered.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: RG

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : ELLERSLIE RACECOURSE, ELLERSLIE

Job Number: J01706

Auger Borehole No. HA8

Vane Head:	Logged By:	Processor :	Date:
307	RZ	RZ	29.03.21

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION

Legend	Depth (m)	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL clayey SILT, orange and grey mottled brown. Hard, moist, medium plasticity [FILL]	0.0				Scala Pentrometer Test (blows/100mm)
EOB at 0.4m. Too hard to auger further. Scala pentrometer test commenced and found effective refusal (ER) at 0.6m.	0.5				10 20+ (ER, HB) HB = Hammer Bouncing
	1.0				
	1.5				
	2.0				
	2.5				
	3.0				
	3.5				
	4.0				
	4.5				
	5.0				
	5.5				
	6.0				

LANDER geotechnical

Comments:
Groundwater not encountered.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: RG

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : ELLERSLIE RACECOURSE, ELLERSLIE

Job Number: J01706

Machine Borehole No. MH01

Sheet 1 of 4

Vane Head:	Logged By:	Processor :	Start Date:	Finish Date:
1900	RG	RG	30.03.21	31.03.21

Borehole Location: mN mE

Description: Refer to site plan

Ground R.L.

Orientation: vertical

Stratigraphy	CORE DESCRIPTION	Depth (m)	DEFECTS	Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
	TOPSOIL	0.0	Bentonite		Open Barrel	74			
Fill	clayey SILT, orange, dark grey and light brown/grey streaked. Hard, moist, medium plasticity, with occasional fine gravel inclusions	0.5				90			UTP
Ash	clayey SILT, light brown mottled dark brown/red. Hard, moist, medium plasticity, with minor fine basaltic gravel								
	fine to medium scoriaceous GRAVEL with some silt, dark brown/red. Loose, moist, no plasticity	1.0	Gravel backfill			54			UTP
	silty CLAY, dark brown/red. Very stiff, moist, medium plasticity, with minor basaltic inclusions up to 70mm diameter	1.5	Piezometer screened from 1.0m to base			SPT			UTP SPT at 1.5-1.95m 6/2/4 N=6
		2.0	Groundwater at 2.8m. Measured on 16.04.21			76			
	clayey SILT, orange/red and orange mottled red/brown. Hard, moist, medium plasticity at 2.6m, becoming red/brown, low plasticity	2.5	Groundwater at 2.86m. Measured on 13.04.21						
	slightly clayey SILT, orange/brown streaked dark green. Very stiff, moist, low plasticity	3.0	Groundwater at 3.05m. Measured on 06.04.21		Triple Tube	SPT			UTP SPT at 3.0-3.45m 0/0/0 N=0
Auckland Volcanic Field Basalt	slightly weathered, black, vesicular BASALT; Strong	3.5				36	36		
		4.0	at 3.8-4.0m, Chaotically fractured			100	36		
		4.5	1JN, ST, R4, 30° 1JN, UN-PL, R4, 30° Chaotically fractured, with clay infill at 4.6m, 1JN, PL, R4, 90°, clay			100	36		
	VOID	5.0	at 4.8m-5.2m Void			0	0		
	slightly weathered, black, vesicular BASALT; Strong	5.5	Chaotically fractured Chaotically fractured			86	36		
Alluvium	fine to medium basaltic GRAVEL with minor clay, light grey mottled black. Loose, moist, no plasticity	6.0							
	clayey SILT, orange streaked light grey. Stiff, moist, medium plasticity, with trace limonite	6.5				100			
	with trace black organic inclusions	7.0							
		7.5							
		8.0							

LANDER geotechnical

Comments:

Driller: Pro-Drill Rig: Tractor

Drilling Fluid: water

Checked: RP

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : ELLERSLIE RACECOURSE, ELLERSLIE

Job Number: J01706

Machine Borehole No. MH01

Sheet 2 of 4

Vane Head:	Logged By:	Processor :	Start Date:	Finish Date:
1900	RG	RG	30.03.21	31.03.21

Borehole Location: mN mE

Description: Refer to site plan

Ground R.L.

Orientation: vertical

Stratigraphy	CORE DESCRIPTION	Legend	Depth (m)	DEFECTS	Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
Alluvium	with trace fine sand with trace black medium gravel sized basaltic inclusions to 8.6m, without fine sand		8.5 9.0 9.5			Triple Tube	SPT 100			SPT at 8.0-8.45m 1/2/4 N=6
	organic stained silty CLAY, dark grey/brown. Stiff, moist, medium to high plasticity with trace black organic inclusions		10.0 10.5				SPT 100			SPT at 9.2-9.65m 0/2/3 N=5
	silty CLAY, orange mottled light grey/brown. Stiff, moist, medium to high plasticity, with trace limonite		11.0 11.5				SPT 100			SPT at 11.0-11.45m 0/2/2 N=4
	organic stained silty CLAY, black mottled brown/grey. Stiff, moist, high to medium plasticity, with trace black organic inclusions		12.0 12.5 13.0 13.5				SPT 42			SPT at 12.0-12.45m 0/1/1 N=2
	silty CLAY with trace fine sand, black mottled light grey/brown. Stiff, moist, high plasticity, with trace organic inclusions with very thin layer black wood with some black organic inclusions at 15.0m, becoming light grey, with minor fine sand, without organic inclusions becoming dark grey		14.0 14.5 15.0 15.5 16.0			Open Barrel	SPT 68			SPT at 15.0-15.45m 0/1/2 N=3

LANDER geotechnical

Comments:

Driller: Pro-Drill Rig: Tractor

Drilling Fluid: water

Checked: RP

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : ELLERSLIE RACECOURSE, ELLERSLIE

Job Number: J01706

Machine Borehole No. MH01

Sheet 3 of 4

Vane Head:	Logged By:	Processor :	Start Date:	Finish Date:
1900	RG	RG	30.03.21	31.03.21

Borehole Location: mN mE

Description: Refer to site plan

Ground R.L.

Orientation: vertical

Stratigraphy	CORE DESCRIPTION	Depth (m)	DEFECTS	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
Alluvium	with very thin bed of organic stained silty CLAY	16.5		Open Barrel				
	clayey SILT with trace fine sand, dark grey. Stiff, moist, medium plasticity	17.0			68			
		17.5			SPT			SPT at 17.5-17.95m 1/3/4 N=7
	silty CLAY, dark grey. Stiff, moist, high plasticity	18.0						
		18.5			63			
		19.0						
		19.5		Triple Tube	SPT			0/0 SPT at 19.5-19.95m 7/7/8 N=15
	becoming hard	20.0						
		20.5			84			
East Coast Bays Formation Bedrock	highly weathered, dark grey, fine SANDSTONE; Weak with very thin black extremely closely to closely spaced carbonaceous bands	21.0	at 21.3m-22.0m, 5JN, PL, R4, 80-90°		SPT	SPT		SPT at 21.0-21.15m 50 for 130mm N>50
	becoming medium SANDSTONE, with some black carbonaceous inclusions, with minor fine gravel sized dark green hardened silt clast inclusions at 22.0m, without hardened silt clast inclusions	21.5			100	100		
		22.0						
		22.5			SPT	SPT		SPT at 22.5-22.95m 50 for 110mm N>50
	becoming medium to course SANDSTONE, with trace fine gravel sized hardened dark green, dark red and dark grey silt clast inclusions, with trace black carbonaceous inclusions	23.0						
		23.5			90	100		
		24.0						

LANDER geotechnical

Comments:

Driller: Pro-Drill Rig: Tractor

Drilling Fluid: water

Checked: RP

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : ELLERSLIE RACECOURSE, ELLERSLIE

Job Number: J01706

Machine Borehole No. MH01

Sheet 4 of 4

Vane Head:	Logged By:	Processor :	Start Date:	Finish Date:
1900	RG	RG	30.03.21	31.03.21

Borehole Location: mN mE

Description: Refer to site plan

Ground R.L.

Orientation: vertical

Stratigraphy	CORE DESCRIPTION	Legend	Depth (m)	DEFECTS	Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
East Coast Bays Formation Bedrock	EOB at 24.12m. Target Depth.		24.5				SPT 90	SPT 100		SPT at 24.0-24.12m 50 for 120mm N>50

Comments:

Driller: Pro-Drill Rig: Tractor

Drilling Fluid: water

Checked: RP

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

LANDER geotechnical	client:	AUCKLAND RACING CLUB	project no:	figure no:
	project:	ELLERSLIE RACECOUSE	J01706	Figure MH01a
		ELLERSLIE	compiled:	date:
	title:	PHOTO SUMMARY	RG	30.03.21-31.03.21

LANDER geotechnical	client:	AUCKLAND RACING CLUB	project no:	figure no:
	project:	ELLERSLIE RACECOUSE	J01706	Figure MH01b
		ELLERSLIE	compiled:	date:
	title:	PHOTO SUMMARY	RG	30.03.21-31.03.21

Client : AUCKLAND RACING CLUB

Project Location : ELLERSLIE RACECOURSE, ELLERSLIE

Job Number: J01706

Machine Borehole No. MH02

Sheet 1 of 2

Vane Head:	Logged By:	Processor :	Start Date:	Finish Date:
1900	RG	RG	31.03.21	01.04.21

Borehole Location: mN mE

Description: Refer to site plan

Ground R.L.

Orientation: vertical

Stratigraphy	CORE DESCRIPTION	Depth (m)
	TOPSOIL	
Fill	clayey SILT, orange, grey and light brown/yellow mottled. Hard, moist, medium plasticity, with trace fine gravel	0.5
Ash	clayey SILT, black specked dark brown. Very stiff, moist, medium plasticity, with trace organic inclusions	
	becoming dark brown specked orange/brown, with trace fine gravel sized dark red/brown hardened silt clast inclusions	1.0
	fine to medium scoriaceous gravel, red/brown. Loose, moist, no plasticity	1.5
Alluvium	silty CLAY, light grey streaked light orange. Stiff, moist, high plasticity	2.0
		2.5
		3.0
	clayey SILT with minor fine sand, orange streaked light grey. Very stiff, moist, medium to low plasticity	3.5
	clayey SILT with minor fine sand, dark grey. Stiff, moist, medium to low plasticity	4.0
		4.5
		5.0
	with moderately thin bed organic stained clayey SILT	
	with very closely spaced, laminated grey silty CLAY beds	5.5
		6.0
		6.5
		7.0
	without silty CLAY bands	7.5
		8.0

DEFECTS

Bentonite

Gravel backfill

Piezometer screened from 1.0m to base

Groundwater at 4.7m. Measured on 06.04.21

Groundwater at 4.77m. Measured on 13.04.21

Groundwater at 4.83m. Measured on 16.04.21

Drilling Method & Casing: Open Barrel

Triple Tube

Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
72			UTP
100			215+
100			UTP
SPT			SPT at 1.5-1.95m 8/9/8 N=17
48			
SPT			86/61 - 1.4 SPT at 3.0-3.45m 1/1/2 N=3
100			
SPT			77/31 - 2.5 SPT at 4.5-4.95m 2/4/6 N=10
100			
SPT			UTP SPT at 6.0-6.45m 8/10/18 N=28
76			
SPT			UTP SPT at 7.5-7.95m 1/1/2 N=44

LANDER geotechnical

Comments:

Drilling Fluid: water

Checked: RP

Driller: Pro-Drill

Rig: Tractor

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : ELLERSLIE RACECOURSE, ELLERSLIE

Job Number: J01706

Machine Borehole No. MH02

Sheet 2 of 2

Vane Head:	Logged By:	Processor :	Start Date:	Finish Date:
1900	RG	RG	31.03.21	01.04.21

Borehole Location: mN mE

Description: Refer to site plan

Ground R.L.

Orientation: vertical

Stratigraphy	CORE DESCRIPTION	Legend	Depth (m)	DEFECTS	Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
Alluvium			8.5			Triple Tube	40			
			9.0							
			9.5				SPT			SPT at 9.5-9.91m 14/50 for 260mm N>50
			10.0							
			10.5				35			
Transitional East Coast Bays Formation	silty CLAY, dark grey. Hard, moist, medium to high plasticity		11.0				SPT			SPT at 11.0-11.4m 15/50 for 250mm N>50
			11.5							
			12.0				0			
	clayey SILT with trace fine sand, dark grey. Very stiff, moist, medium plasticity		12.5				SPT			SPT at 12.5-12.95m 10/11/16 N=27
			13.0							
			13.5				69			
	silty CLAY, dark grey. Hard, moist, high to medium plasticity		14.0				SPT			SPT at 14.0-14.45m 11/19/26 N=45
			14.5							
			15.0				0			
			15.5				SPT			SPT at 15.5-15.95m 14/18/26 N=44
	EOB at 15.95m. Target Depth.		16.0							

LANDER geotechnical

Comments:

Driller: Pro-Drill Rig: Tractor

Drilling Fluid: water

Checked: RP

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

LANDER geotechnical	client:	AUCKLAND RACING CLUB	project no:	figure no:
	project:	ELLERSLIE RACECOUSE	J01706	Figure MH02
		ELLERSLIE	compiled:	date:
	title:	PHOTO SUMMARY	RG	31.03.21-01.04.21

Client : AUCKLAND RACING CLUB

Project Location : ELLERSLIE RACECOURSE, ELLERSLIE

Job Number: J01706

Machine Borehole No. MH03

Sheet 1 of 2

Vane Head:	Logged By:	Processor :	Start Date:	Finish Date:
1900	RG	RG	06.04.21	07.04.21

Borehole Location: mN mE

Description: Refer to site plan

Ground R.L.

Orientation: vertical

Stratigraphy	CORE DESCRIPTION	Legend	Depth (m)	DEFECTS	Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
Fill	clayey SILT, light orange and light grey mottled brown. Very stiff, moist, medium plasticity, with minor fine gravel at 0.1m, with 70mm diameter concrete block at 0.15m, with 60mm diameter basaltic gravel with 100mm diameter basaltic gravel with moderately thin bed basalt		0.5 1.0 1.5	Bentonite Gravel backfill Piezometer screened from 1.0m to base		Open Barrel Triple Tube	100 44 60 SPT 17			UTP UTP UTP SPT at 1.5-1.58m 1,5 for 0mm (HB) N>50
	coarse to medium basaltic GRAVEL, black. Loose, moist, no plasticity		2.0 2.5 3.0				10			
	silty fine GRAVEL, dark grey specked dark brown. Loose, wet, no plasticity, with minor medium gravel slightly weathered black vesicular BASALT; Strong						94			
	silty CLAY, black and grey mottled light brown. Stiff, moist, high plasticity, with minor fine gravel, with 40mm diameter brick at 3.45m		3.5 4.0				SPT 39			SPT at 3.5-3.73m 3,6 for 75mm (HB) N>50
	CONCRETE		4.5							
	slightly weathered, black, vesicular BASALT; Strong						48			
	clayey SILT, dark brown. Very stiff, moist, medium plasticity, with trace fine to medium gravel with 90mm diameter basaltic gravel without fine gravel		5.0 5.5	Groundwater at 6.02m. Measured on 13.04.21						
	with 45mm diameter wood block at 6.35m, with 70mm diamater can at 6.4m, with woodchips up to 30mm diameter at 6.43m, with 70mm diameter basaltic gravel		6.0 6.5 7.0 7.5 8.0	Groundwater at 6.19m. Measured on 16.04.21			11 0			

LANDER geotechnical

Comments:

Driller: Pro-Drill Rig: Tractor

Drilling Fluid: water

Checked: RP

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : ELLERSLIE RACECOURSE, ELLERSLIE

Job Number: J01706

Machine Borehole No. MH03

Sheet 2 of 2

Vane Head: 1900 | Logged By: RG | Processor : RG | Start Date: 06.04.21 | Finish Date: 07.04.21

Borehole Location: mN mE | Ground R.L.

Description: Refer to site plan | Orientation: vertical

Stratigraphy	CORE DESCRIPTION	Legend	Depth (m)	DEFECTS	Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
Alluvium	silty CLAY, orange streaked light grey/brown. Stiff, moist, medium to high plasticity		8.5			Triple Tube	SPT			SPT at 8.0-8.45m 2/3/4 N=7
			9.0				0			
Transitional East Coast Bays Formation	fine sandy SILT with minor clay, white specked dark grey. Medium dense, moist, low to no plasticity		9.5				SPT			SPT at 9.5-9.95m 4/9/14 N=23
	silty CLAY, dark grey, Hard, moist, medium to high plasticity		10.0				84			
	with trace fine sand		10.5							
	without fine sand									
	with minor black carbonaceous inclusions		11.0				SPT			SPT at 11.0-11.24m 27, 50 for 90mm N>50
			11.5							
East Coast Bays Formation Bedrock	highly to moderately weathered white specked dark grey, medium SANDSTONE; Very weak		12.0	Chaotically fractured at 12,.0-12.3m, 3JN, PL, R4, 90°			57	60		
			12.5	at 12.4-12.45m, 2JN, PL, R4, 45°			SPT	SPT		SPT at 12.5-12.75m 30,50 for 95mm N>50
	moderately weathered, dark grey, fine SANDSTONE; Weak		13.0				58	66		
			13.5	1JN, PL, R4, 90° at 13.7-13.8m, 2JN, PL, R4, 80°						
			14.0	at 13.95m, 1JN, PL-UN, R4, 80-90°			SPT	SPT		SPT at 14.0-14.28m 37, 50 for 130mm N>50
	EOB at 14.28m. Target Depth.		14.5							
			15.0							
			15.5							
			16.0							

LANDER geotechnical

Comments:

Driller: Pro-Drill | Rig: Tractor

Drilling Fluid: water | Checked: RP

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

LANDER geotechnical	client:	AUCKLAND RACING CLUB	project no:	figure no:
	project:	ELLERSLIE RACECOUSE	J01706	Figure MH03
		ELLERSLIE	compiled:	date:
	title:	PHOTO SUMMARY	RG	06.04.21-07.04.21

Client : AUCKLAND RACING CLUB

Project Location : ELLERSLIE RACECOURSE, ELLERSLIE

Job Number: J01706

Machine Borehole No. MH04

Sheet 1 of 3

Vane Head:	Logged By:	Processor :	Start Date:	Finish Date:
1900	RG	RG	29.03.21	29.03.21

Borehole Location: mN mE

Description: Refer to site plan

Ground R.L.

Orientation: vertical

Stratigraphy	CORE DESCRIPTION	Depth (m)	DEFECTS	Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
	TOPSOIL	0.0	Bentonite		Open Barrel	100			
Alluvium	clayey SILT, light orange mottled light grey/brown. Very stiff, moist, medium plasticity at 0.4m, with minor limonite at 0.5m, with thin bed dark orange/brown limonite SILT at 40° at 0.6m, with extremely closely spaced laminated beds hardened limonite SILT, to 0.65m at 0.7m, with trace fine sand, with moderately thin bed dark grey organic stained silty CLAY at 0.9m, with laminated bed orange hardened limonite SILT at 1.0m, becoming grey at 1.2m, with moderately thin bed limonite SILT	0.5				100			UTP
		1.0	Gravel backfill			100			UTP
		1.5	Piezometer screened from 1.0m to base			100			UTP
	slightly clayey SILT with minor fine sand, orange streaked dark grey. Hard, moist, low plasticity, with minor limonite	2.0				SPT			SPT at 1.5-1.95m 13/19/17 N=36
	becoming dark green and orange stained dark grey	2.5				100			
	becoming medium plasticity, with without fine sand	3.0	Groundwater at 3.66m. Measured on 06.04.21			SPT			UTP SPT at 3.0-3.45m 9/12/16 N=28
	becoming dark grey, without limonite staining	3.5	Groundwater at 3.7m. Measured on 13.04.21			100			
		4.0	Groundwater at 3.74m. Measured on 16.04.21						
	with moderately thin bed with minor black carbonaceous inclusions	4.5				SPT			UTP SPT at 4.5-4.95m 15/50 for 180mm N>50
	becoming orange and dark green mottled	5.0				100			
	becoming orange streaked dark green/grey	5.5							
		6.0							
		6.5				SPT			SPT at 6.5-6.95m 23, 50 for 225mm N>50
		7.0				94			
	becoming green/grey, without limonite	7.5							
		8.0							

LANDER geotechnical

Comments:

Driller: Pro-Drill Rig: Tractor

Drilling Fluid: water

Checked: RP

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : ELLERSLIE RACECOURSE, ELLERSLIE

Job Number: J01706

Machine Borehole No. MH04

Sheet 2 of 3

Vane Head:	Logged By:	Processor :	Start Date:	Finish Date:
1900	RG	RG	29.03.21	29.03.21

Borehole Location: mN mE

Description: Refer to site plan

Ground R.L.

Orientation: vertical

Stratigraphy	CORE DESCRIPTION	Legend	Depth (m)	DEFECTS	Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
Alluvium	becoming orange mottled green/grey with moderately thin bed highly weathered orange mottled dark grey, fine SANDSTONE; Extremely to very weak at 40° at 10.9m, becoming dark grey becoming clayey SILT, medium plasticity,with laminated black organic band, without fine sand at 11.6m, with minor black organic inclusions at 11.7m, becoming low plasticity, with minor fine sand, with very closely spaced laminted bed grey silty CLAY with thin bed dark red/brown fine limonite gravel clayey SILT with trace fine sand, dark brown/orange mottled light brown/orange. Very stiff, moist, low to medium plasticity, with trace limonite at 13.2m, with very thin layer dark orange/brown limonite band at 20° interbedded very thin to thin clayey SILT, orange mottled light brown/grey. Hard, moist, medium plasticity beds with very thin to thin silty CLAY, grey. Hard, moist, medium plasticity slightly clayey SILT with trace fine sand, dark orange mottled light orange. Very stiff, moist, low plasticity at 13.7m, with very thin bed hardened dark red/brown limonite at 20°, with black mottles fine sandy SILT with trace clay, light grey and black mottled light orange/brown. Dense, moist, no to low plasticity, with trace manganese oxidation with orange streaks at 10° becoming orange streaked light orange/brown with moderately thin bed with light grey silty CLAY mottles up to 10mm diameter intermixed becoming black specked and light orange mottled light grey		8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5 15.0 15.5 16.0			Triple Tube	SPT 94 SPT 95 SPT 100 SPT 90 SPT 67 SPT		SPT at 8.0-8.41m 19, 50 for 228mm N>50 SPT at 9.5-9.45m 22/22/28 N=50 SPT at 11.0-11.44m 13, 50 for 290mm N>50 SPT at 12.5-12.95m 10/20/28 N=48 SPT at 14.0-14.45m 8/15/25 N=40 SPT at 15.5-15.95m 13/11/15 N=26

LANDER geotechnical

Comments:

Driller: Pro-Drill Rig: Tractor

Drilling Fluid: water

Checked: RP

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : ELLERSLIE RACECOURSE, ELLERSLIE

Job Number: J01706

Machine Borehole No. MH04

Sheet 3 of 3

Vane Head:	Logged By:	Processor :	Start Date:	Finish Date:
1900	RG	RG	29.03.21	29.03.21

Borehole Location: mN mE

Description: Refer to site plan

Ground R.L.

Orientation: vertical

Stratigraphy	CORE DESCRIPTION	Legend	Depth (m)	DEFECTS	Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
Alluvium	becoming dark orange and light grey specked light orange/brown, with trace limonite		16.5			Triple Tube	86			
	irregularly interbedded thin beds of fine sandy SILT with minor clay, orange and light grey specked light orange. Medium dense, moist, low plasticity, with laminated bands of silty CLAY, light orange/brown. Very stiff, moist, medium plasticity		17.0				SPT			SPT at 17.0-17.45m 7/11/16 N=27
	slightly clayey SILT with minor fine sand, light orange/brown. Very stiff, moist, low plasticity at 18.6m, becoming light grey		17.5				90			
	becoming orange streaked light grey, with trace black organic inclusions		18.0				SPT			SPT at 18.5-18.95m 7/10/16 N=26
	becoming orange becoming orange streaked light grey		18.5				100			
	becoming light grey, with occasional light orange streaks		19.0				SPT			SPT at 20.0-20.45m 11/16/24 N=40
	becoming black mottled and orange streaked light grey		19.5				88			
	EOB at 21.95m. Target Depth.		20.0				SPT			SPT at 21.5-21.95m 11/14/23 N=37
			20.5							
			21.0							
			21.5							
			22.0							
			22.5							
			23.0							
			23.5							
			24.0							

LANDER geotechnical

Comments:

Driller: Pro-Drill Rig: Tractor

Drilling Fluid: water

Checked: RP

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

LANDER geotechnical	client:	AUCKLAND RACING CLUB	project no:	figure no:
	project:	ELLERSLIE RACECOUSE	J01706	Figure MH04
		ELLERSLIE	compiled:	date:
	title:	PHOTO SUMMARY	RG	29.03.21

Client : AUCKLAND RACING CLUB

Project Location : ELLERSLIE RACECOURSE, ELLERSLIE

Job Number: J01706

Machine Borehole No. MH05

Sheet 1 of 2

Vane Head:	Logged By:	Processor :	Start Date:	Finish Date:
1900	RG	RG	07.04.21	07.04.21

Borehole Location: mN mE

Ground R.L.

Description: Refer to site plan

Orientation: vertical

Stratigraphy	CORE DESCRIPTION	Legend	Depth (m)	DEFECTS	Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
	TOPSOIL		0.0			Open Barrel	40			
Fill	clayey SILT, light grey, brown and orange streaked light orange/brown. Very stiff, moist, medium plasticity		0.5							
	clayey SILT, orange and grey mottled dark brown. Very stiff, moist, medium plasticity, with minor fine gravel		1.0			Triple Tube	90			
	medium scoriaceous and basaltic GRAVEL, with brick									
	clayey SILT with minor fine gravel, dark brown. Stiff, moist, low to medium plasticity		1.5							
	orange brick									
	clayey SILT, red and orange mottled dark grey/blue. Very stiff, moist, medium plasticity		2.0				33			
			2.5							
			3.0							
	silty CLAY, black and orange mottled light grey/blue, very stiff, moist, high plasticity									
	at 3.2m, becoming light grey/blue and black mottled dark grey/black		3.5							
	clayey SILT, red and light brown mottled dark brown. Stiff, moist, medium plasticity, with minor fine to medium basaltic gravel inclusions		4.0				13			
			4.5							
	clayey SILT, orange mottled light grey/blue. Very stiff, moist, medium plasticity, with minor fine gravel		5.0				100			
	clayey SILT with tarce fine gravel, dark brown. Very stiff, moist, low to medium plasticity with trace rootlets		5.5							
	slightly weathered, black, vesicular BASALT; Strong, infilled with clayey SILT, brown. Stiff, moist, medium plasticity, with trace fibrous inclusions		6.0				42			
			6.5							
			7.0							
			7.5				0			
			8.0							

LANDER geotechnical

Comments:

Driller: Pro-Drill Rig: Tractor

Drilling Fluid: water

Checked: RP

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : ELLERSLIE RACECOURSE, ELLERSLIE

Job Number: J01706

Machine Borehole No. MH05

Sheet 2 of 2

Vane Head:	Logged By:	Processor :	Start Date:	Finish Date:
1900	RG	RG	07.04.21	07.04.21

Borehole Location: mN mE

Description: Refer to site plan

Ground R.L.

Orientation: vertical

Stratigraphy	CORE DESCRIPTION	Legend	Depth (m)	DEFECTS	Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
	silty CLAY, light grey streaked orange. Stiff, moist, medium plasticity		8.5			Triple Tube	27			
	with 50mm diameter basaltic inclusion									
Transitional East Coast Bays Formation	silty fine to medium SAND with minor clay, white speckled dark grey. Medium dense, moist, no to low plasticity, with minor white course sand sized inclusions		9.0							
			9.5							
			10.0				40			
			10.5					0		
Bedrock	highly weathered, grey, fine SANDSTONE; Very weak to weak									
	with minor black carbonaceous inclusions		11.0							
East Coast Bays Formation	EOB at 11.0m. Target Depth.		11.5							
			12.0							
			12.5							
			13.0							
			13.5							
			14.0							
			14.5							
			15.0							
			15.5							
			16.0							

LANDER geotechnical

Comments:

Driller: Pro-Drill Rig: Tractor

Drilling Fluid: water

Checked: RP

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

LANDER geotechnical	client:	AUCKLAND RACING CLUB	project no:	figure no:
	project:	ELLERSLIE RACECOUSE	J01706	Figure MH05
		ELLERSLIE	compiled:	date:
	title:	PHOTO SUMMARY	RG	07.04.21

Client : AUCKLAND RACING CLUB

Project Location : ELLERSLIE RACECOURSE, ELLERSLIE

Job Number: J01706

Machine Borehole No. MH06

Sheet 1 of 6

Vane Head:	Logged By:	Processor :	Start Date:	Finish Date:
1900	RG	RG	13.04.21	13.04.21

Borehole Location: mN mE

Description: Refer to site plan

Ground R.L.

Orientation: vertical

Stratigraphy	CORE DESCRIPTION	Depth (m)	DEFECTS	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
	TOPSOIL	0.0		Open Barrel	72			
Fill	clayey SILT, brown. Hard, moist, medium plasticity, with fine gravel inclusions	0.5			100			UTP
	clayey SILT with trace fine sand, orange mottled light grey/brown. Hard, moist, medium plasticity at 0.65m, with thin bed basaltic GRAVEL				67			UTP
Ash	clayey SILT, dark orange/brown. Very stiff, moist, low plasticity, with black fine gravel inclusions	1.0		Triple Tube	100	100		UTP
	at 1.0m, becoming orange mottled orange/brown							
Auckland Volcanic Field Basalt	slightly weathered, black, vesicular BASALT; Strong	1.5	at 1.4-1.6m, 2JN, PL-UN, R4, 30°, LM, rootlets at 1.55m, 1JN, PL-UN, R4, 80° at 1.7m, 1JN, PL-UN, R4, 85°, LM, A		73	64		
					100	100		
		2.0						
		2.5			100	80		
		3.0	at 3.2m, 1JN, PL, R4, 0-10°, dark brown SILT infill Chaotically fractured					
	becoming less vesicular	3.5						
		4.0			100	87		
		4.5	1JN, PL, R4, 10-20°, LM					
		5.0						
		5.5	1JN, PL, R4, 80°, LM at 5.65m, 8JN, PL, R4, 10°, light brown SILT infill at 5.9-5.95m, 2JN, PL, R4, 90°, light brown SILT infill		95	55		
		6.0						
	with little to no vesicles	6.5						
			1JN, PL, R4, 40-50°, LM					
		7.0						
		7.5			100	80		
		8.0	1JN, PL, R4, 30-40°					

LANDER geotechnical

Comments:

Driller: Pro-Drill Rig: Tractor

Drilling Fluid: water

Checked: RP

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : ELLERSLIE RACECOURSE, ELLERSLIE

Job Number: J01706

Machine Borehole No. MH06

Sheet 2 of 2

Vane Head:	Logged By:	Processor :	Start Date:	Finish Date:
1900	RG	RG	13.04.21	13.04.21

Borehole Location: mN mE

Description: Refer to site plan

Ground R.L.

Orientation: vertical

Stratigraphy	CORE DESCRIPTION	Legend	Depth (m)	DEFECTS	Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
Auckland Volcanic Field	with white quartz inclusion up to 60mm diameter		8.5	1JN, PL, R4, 80-85°		Triple Tube	100	92		
			9.0							
			9.5	1JN, PL-UN, R4, 90°						
	EOB at 9.5m. Target Depth.		10.0							
			10.5							
			11.0							
			11.5							
			12.0							
			12.5							
			13.0							
			13.5							
			14.0							
			14.5							
			15.0							
			15.5							
			16.0							

LANDER geotechnical

Comments:

Driller: Pro-Drill

Rig: Tractor

Drilling Fluid: water

Checked: RP

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

LANDER geotechnical	client:	AUCKLAND RACING CLUB	project no:	figure no:
	project:	ELLERSLIE RACECOUSE	J01706	Figure MH06
		ELLERSLIE	compiled:	date:
	title:	PHOTO SUMMARY	RG	13.04.21

Client : AUCKLAND RACING CLUB

Project Location : RESIDENTIAL DEVELOPMENT ELLERSLIE RACECOURSE

Job Number: J01706

Trial Pit No. TP 01

Sheet 1 of 12

Vane Head:	Logged By:	Processor :	Date:
1900	RG	PL	06.05.21

Pit Location: mN | mE | Ground R.L.

Description: Refer to site plan

Stratigraphy	SOIL DESCRIPTION	Depth (m)	Vane Dial Reading	Soil Sensitivity
FILL	TOPSOIL			
	clayey SILT, orange and light grey mottled dark brown. Very stiff, moist, medium plasticity, moderately sensitive, with trace rootlets at 0.3m, with minor fine gravel inculsions	0.5		
	with trace medium to coarse basaltic gravel inculsions	1.0	111/49	2.3
	BURIED TOPSOIL			
ASH	clayey SILT with trace fine sand, orange/brown. Very stiff, moist, medium to low plasticity	1.5		
	EOTP at 1.6m. Target Depth.		UTP	

2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0

LANDER geotechnical

Comments:
groundwater inflow not encountered

Excavator Used:

Checked: RG

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : RESIDENTIAL DEVELOPMENT ELLERSLIE RACECOURSE

Job Number: J01706

Trial Pit No. TP 02

Sheet 2 of 12

Vane Head:	Logged By:	Processor :	Date:
1900	RG	RG	06.05.21

Pit Location: mN | mE | Ground R.L.

Description: Refer to site plan

Stratigraphy	SOIL DESCRIPTION	Legend	Depth (m)	Groundwater	Vane Dial Reading	Soil Sensitivity	Sample and Laboratory Test Details
	TOPSOIL						
FILL	clayey SILT with trace fine sand, orange and light grey mottled brown. Very stiff, moist, low to medium plasticity, with wood, basaltic, gravel, pipe, asphalt and brick fragments up to 30mm diameter		0.5				
RESIDUAL ECBF	clayey SILT, orange mottled light grey. Hard, moist, medium plasticity, with trace limonite at 1.1m, becoming moderately sensitive		1.0		UTP UTP 200/65	3.1	
	EOB at 1.1m. Target Depth.		1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0				

LANDER geotechnical

Comments: groundwater inflow not encountered

Excavator Used:

Checked: PL

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : RESIDENTIAL DEVELOPMENT ELLERSLIE RACECOURSE

Job Number: J01706

Trial Pit No. TP 03

Sheet 3 of 12

Vane Head:	Logged By:	Processor :	Date:
1900	RG	RG	06.05.21

Pit Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION

Stratigraphy	Soil Description	Depth (m)	Vane Dial Reading	Soil Sensitivity	Sample and Laboratory Test Details
	TOPSOIL				
FILL	clayey SILT, orange, brown, grey and black mottled. Very stiff, moist, medium plasticity, moderately sensitive, with asphalt, brick and basaltic fragments up to 150mm diameter		132/52	2.5	
	becoming light grey, orange and black mottled dark brown	0.5			
RESIDUAL ECBF	clayey SILT, orange mottled light grey. Hard, moist, medium plasticity	1.0	UTP		
			UTP		
	EOB at 1.3m. Target depth.		UTP		
		1.5			
		2.0			
		2.5			
		3.0			
		3.5			
		4.0			
		4.5			
		5.0			
		5.5			
		6.0			

LANDER geotechnical

Comments: groundwater inflow not encountered

Excavator Used:

Checked: PL

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : RESIDENTIAL DEVELOPMENT ELLERSLIE RACECOURSE

Job Number: J01706

Trial Pit No. TP 04

Sheet 4 of 12

Vane Head:	Logged By:	Processor :	Date:
1900	RG	PL	06.05.21

Pit Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION

Stratigraphy	Legend	Depth (m)	Groundwater	Vane Dial Reading	Soil Sensitivity	Sample and Laboratory Test Details
TOPSOIL						
FILL: clayey SILT, orange, brown and light grey mottled. Very stiff, moist, medium plasticity, insensitive, with trace asphalt, concrete, gravel, scoria, brick, turf, plastic and wood		0.5		171/92	1.9	
becoming dark grey/brown, with minor scoria inculsions		1.0				
RESIDUAL ECBF: clayey SILT with minor fine sand, orange mottled light grey. Hard, moist, low to medium plasticity, with trace limonite				215+		
				215+		
EOTP at 1.4m. Target Depth.		1.5				
		2.0				
		2.5				
		3.0				
		3.5				
		4.0				
		4.5				
		5.0				
		5.5				
		6.0				

LANDER geotechnical

Comments: groundwater inflow not encountered

Excavator Used:

Checked: RG

Topsoil | Fill | Clay | Silt | Sand | Gravel | Organic | Pumice | Sandstone | Siltstone | Limestone | Volcanic | Plutonic | No Core

Client : AUCKLAND RACING CLUB

Project Location : RESIDENTIAL DEVELOPMENT ELLERSLIE RACECOURSE

Job Number: J01706

Trial Pit No. TP 05

Sheet 5 of 12

Vane Head:	Logged By:	Processor :	Date:
1900	RG	RG	06.05.21

Pit Location: mN | mE | Ground R.L.

Description: Refer to site plan

Stratigraphy	SOIL DESCRIPTION	Legend	Depth (m)	Groundwater	Vane Dial Reading	Soil Sensitivity	Sample and Laboratory Test Details
	TOPSOIL		0.0				
ASH	clayey SILT with trace fine sand, orange/brown. Hard, moist, low plasticity, with trace rootlets		0.5		UTP 215+		
	EOTP at 1.2m. Target Depth.		1.0				
			1.5				
			2.0				
			2.5				
			3.0				
			3.5				
			4.0				
			4.5				
			5.0				
			5.5				
			6.0				

LANDER geotechnical

Comments: groundwater inflow not encountered

Excavator Used:

Checked: PL

Topsoil	Sand	Sandstone	Plutonic	
Fill	Gravel	Siltstone	No Core	
Clay	Organic	Limestone		
Silt	Pumice	Volcanic		

Client : AUCKLAND RACING CLUB

Project Location : RESIDENTIAL DEVELOPMENT ELLERSLIE RACECOURSE

Job Number: J01706

Trial Pit No. TP 06

Sheet 6 of 12

Vane Head:	Logged By:	Processor :	Date:
1900	RG	PL	06.05.21

Pit Location: mN | mE | Ground R.L.

Description: Refer to site plan

Stratigraphy	SOIL DESCRIPTION	Depth (m)	Vane Dial Reading	Soil Sensitivity
	TOPSOIL			
FILL	clayey SILT with trace fine sand, brown. Very stiff, moist, low to medium plasticity, sensitive, with trace fine gravel, with trace brick, concrete, scoria and wood, with old hydrant	0.5		
	becoming sensitive, with plastic pipe, metal rod and rebar	1.0	132/28	4.7
ALLUVIUM	organic clayey SILT, orange mottled dark grey. Hard, moist, medium plasticity, with minor rootlets, with trace limonite	1.5	UTP	
RESIDUAL ECBF	clayey SILT, orange mottled light grey. Very stiff, moist, medium plasticity, moderately sensitive, with trace limonite	2.0		
	EOTP at 2.4m. Target Depth.	2.5	141/55	2.6
		3.0		
		3.5		
		4.0		
		4.5		
		5.0		
		5.5		
		6.0		

LANDER geotechnical

Comments: groundwater inflow not encountered

Excavator Used:

Checked: RG

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : RESIDENTIAL DEVELOPMENT ELLERSLIE RACECOURSE

Job Number: J01706

Trial Pit No. TP 07

Sheet 7 of 12

Vane Head:	Logged By:	Processor :	Date:
1900	RG	PL	06.05.21

Pit Location: mN | mE | Ground R.L.

Description: Refer to site plan

Stratigraphy	SOIL DESCRIPTION	Depth (m)	Groundwater	Vane Dial Reading	Soil Sensitivity	Sample and Laboratory Test Details
	TOPSOIL					
FILL	clayey SILT with trace fine sand, orange, brown and light grey mottled. Very stiff, moist, low to medium plasticity, with minor fine to coarse gravel, with wood, asphalt, concrete blocks, scoria, brick, metal wire	0.5				
	becoming grey mottled dark brown, with basaltic blocks, asbestos, glass	1.0		UTP		
	becoming very stiff, moderately sensitive	1.5		123/34	3.6	
	with concrete piles and metal wires	2.0				
		2.5				
RESIDUAL ECBF	clayey SILT with trace fine sand, orange mottled light grey. Very stiff, moist, medium plasticity, with trace limonite	3.0				
		3.5				
	EOTP at 4.0m. Target Depth.	4.0				
		4.5				
		5.0				
		5.5				
		6.0				

LANDER geotechnical

Comments: groundwater inflow not encountered

Excavator Used:

Checked: RG

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : RESIDENTIAL DEVELOPMENT ELLERSLIE RACECOURSE

Job Number: J01706

Trial Pit No. TP 08

Sheet 8 of 12

Vane Head:	Logged By:	Processor :	Date:
1750	PL	PL	06.06.21

Pit Location: mN | mE | Ground R.L.

Description: Refer to site plan

Stratigraphy	SOIL DESCRIPTION	Depth (m)	Vane Dial Reading	Soil Sensitivity
	TOPSOIL, with trace boulders			
FILL	silty CLAY, orange streaked light grey. Very stiff, moist, high plasticity, moderately sensitive, with fabric inculsions	0.5	162/54	3.0
	clayey SILT, dark grey. Very stiff, moist, low plasticity			
	clayey SILT, black mottled orange/brown. Very stiff, moist, low plasticity, sensitive, with trace fine to medium gravel	1.0	131/31	4.2
		1.5		
RESIDUAL ECBF	silty CLAY, orange streaked light grey/white. Very stiff, moist, medium to high plasticity	2.0		
	EOTP at 2.0m. Target Depth.	2.5		
		3.0		
		3.5		
		4.0		
		4.5		
		5.0		
		5.5		
		6.0		

LANDER geotechnical

Comments:
groundwater inflow at :

Excavator Used:

Checked: RG

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : RESIDENTIAL DEVELOPMENT ELLERSLIE RACECOURSE

Job Number: J01706

Trial Pit No. TP 09

Sheet 9 of 12

Vane Head:	Logged By:	Processor :	Date:
1750	PL	PL	07.05.21

Pit Location: mN | mE | Ground R.L.

Description: Refer to site plan

Stratigraphy	SOIL DESCRIPTION	Depth (m)	Vane Dial Reading	Soil Sensitivity
	clayey SILT, dark brown. Stiff, moist, low plasticity, moderately sensitive, with trace fine to medium gravel, with trace concrete, boulders, golf balls, with trace inclusions of silty CLAY, light grey streaked orange	0.5		
		1.0	89/35	2.5
	becoming grey/blue, with trace coarse sand to fine gravel sized scoria inculsions	1.5	54/23	2.3
		2.0		
	silty CLAY, orange streaked light grey/blue. Very stiff, moist, medium to high plasticity	2.5		
	clayey SILT, dark brown/blue. Very stiff, moist, low plasticity, with trace fine gravel	3.0		
		3.5		
RESIDUAL ECBF	silty CLAY, orange streaked grey. Very stiff, moist, medium to high plasticity	4.0		
	EOTP at 4.4m. Target Depth.	4.5		
		5.0		
		5.5		
		6.0		

LANDER geotechnical

Comments: groundwater inflow not encountered

Excavator Used:

Checked: RG

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : RESIDENTIAL DEVELOPMENT ELLERSLIE RACECOURSE

Job Number: J01706

Trial Pit No. TP 10

Sheet 10 of 12

Vane Head:	Logged By:	Processor :	Date:
1750	PL	RG	07.05.21

Pit Location: mN | mE | Ground R.L.

Description: Refer to site plan

Stratigraphy	SOIL DESCRIPTION	Depth (m)	Groundwater	Vane Dial Reading	Soil Sensitivity	Sample and Laboratory Test Details
FILL	slightly clayey SILT, dark brown. Very stiff, moist, low to no plasticity, with some coarse gravel inclusions with trace red coarse sand	0.5				
	silty CLAY, orange streaked light grey. Very stiff, moist, medium plasticity, moderately sensitive, with trace boulders, with trace rubbish	1.0		116/54	2.1	
	slightly clayey SILT, dark brown. Hard, dry, no plasticity	1.5		UTP		
	silty CLAY, orange streaked white. Very stiff, moist, medium plasticity					
	clayey SILT, dark brown. Very stiff, moist, low plasticity	2.0				
RESIDUAL ECBF	clayey SILT, orange/brown. Very stiff, moist, low plasticity becoming light grey streaked orange	2.5				
	EOTP at 2.9m. Target depth.	3.0				
		3.5				
		4.0				
		4.5				
		5.0				
		5.5				
		6.0				

LANDER geotechnical

Comments: groundwater inflow not encountered

Excavator Used:

Checked: PL

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : RESIDENTIAL DEVELOPMENT ELLERSLIE RACECOURSE

Job Number: J01706

Trial Pit No. TP 11

Sheet 11 of 12

Vane Head:	Logged By:	Processor :	Date:
1900	RG	PL	06.05.21

Pit Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION

Stratigraphy	Legend	Depth (m)	Groundwater	Vane Dial Reading	Soil Sensitivity	Sample and Laboratory Test Details
TOPSOIL						
FILL: clayey SILT with trace fine sand, orange and light grey mottled dark brown. Very stiff, moist, medium plasticity, moderately sensitive, with minor fine gravel inculsions, with concrete, brick and glass fragments		0.5				
RESIDUAL ECBF: silty CLAY, orange mottled light grey. Very stiff, moist, medium plasticity, moderately sensitive, with trace limonite		1.0		169/46	3.7	
				151/43	3.5	
EOTP at 1.1m. Target Depth.		1.5				
		2.0				
		2.5				
		3.0				
		3.5				
		4.0				
		4.5				
		5.0				
		5.5				
		6.0				

LANDER geotechnical

Comments: groundwater inflow not encountered

Excavator Used:

Checked: RG

Topsoil	Sand	Sandstone	Plutonic		
Fill	Gravel	Siltstone	No Core		
Clay	Organic	Limestone			
Silt	Pumice	Volcanic			

Client : AUCKLAND RACING CLUB

Project Location : RESIDENTIAL DEVELOPMENT ELLERSLIE RACECOURSE

Job Number: J01706

Trial Pit No. TP 12

Sheet 12 of 12

Vane Head:	Logged By:	Processor :	Date:
1900	RG	RG	06.05.21

Pit Location: mN | mE | Ground R.L.

Description: Refer to site plan

Stratigraphy	SOIL DESCRIPTION	Legend	Depth (m)	Groundwater	Vane Dial Reading	Soil Sensitivity	Sample and Laboratory Test Details
	TOPSOIL						
ASH	clayey SILT with trace fine sand, orange/brown. Very stiff, moist, low to medium plasticity, moderately sensitive, with trace rootlets		0.5		108/46	2.4	
	at 1.0m, becoming sensitive		1.0		141/31	4.6	
	EOTP at 1.0m. Target Depth.		1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0				

LANDER geotechnical

Comments: groundwater inflow not encountered

Excavator Used:

Checked: PL

Topsoil	Sand	Sandstone	Plutonic	
Fill	Gravel	Siltstone	No Core	
Clay	Organic	Limestone		
Silt	Pumice	Volcanic		

GEOTECHNICS

Our Ref: 1009521.1145.0.0/Rep1
Customer Ref: J01706
23 April 2021

Lander Geotechnical Consultants Limited
Level 3, 3 Osterley way
Manukau
Auckland 2104

Attention: Rosie Garrill

Dear Rosie

Ellerslie Racecourse

Laboratory Test Report

The samples we collected from the above mentioned site have been tested according to your instructions and the results are included in this report. Results apply only to the sample(s) tested.

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 Lander Geotechnical Consultants Limited , 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.

This report may be reproduced only in full.

Samples not destroyed during testing will be retained for one month from the date of this report before being discarded. If we can be of any further assistance, feel free to get in touch. Contact details are provided at the bottom of this page.

GEOTECHNICS LTD

Report prepared by:

.....
Tylah Wardrope
Laboratory Technician

Authorised for Geotechnics by:

.....
Corey Papu-Gread
Project Director

Report checked by:

.....
Ryan Milligan
Project Manager
Approved Signatory
22-Apr-21
t:\geotechnicsgroup\projects\1009521\1009521.1145\workingmaterial\20210422.ellerslie racecourse .tywa.docx

ACCREDITED IANZ TESTING LABORATORY

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

GEOTECHNICS

15C Amber Crescent
Judea
Tauranga 3110
New Zealand
p +64 7 571 0280

Geotechnics Project Number	1009521.1145.0.0
QESTLab Work Order ID	W21TG-0052
Customer Project ID	J01706

Determination of Liquid & Plastic Limit, Plasticity Index - NZS 4402: 1986 Tests 2.2 (4 Point), 2.3 & 2.4

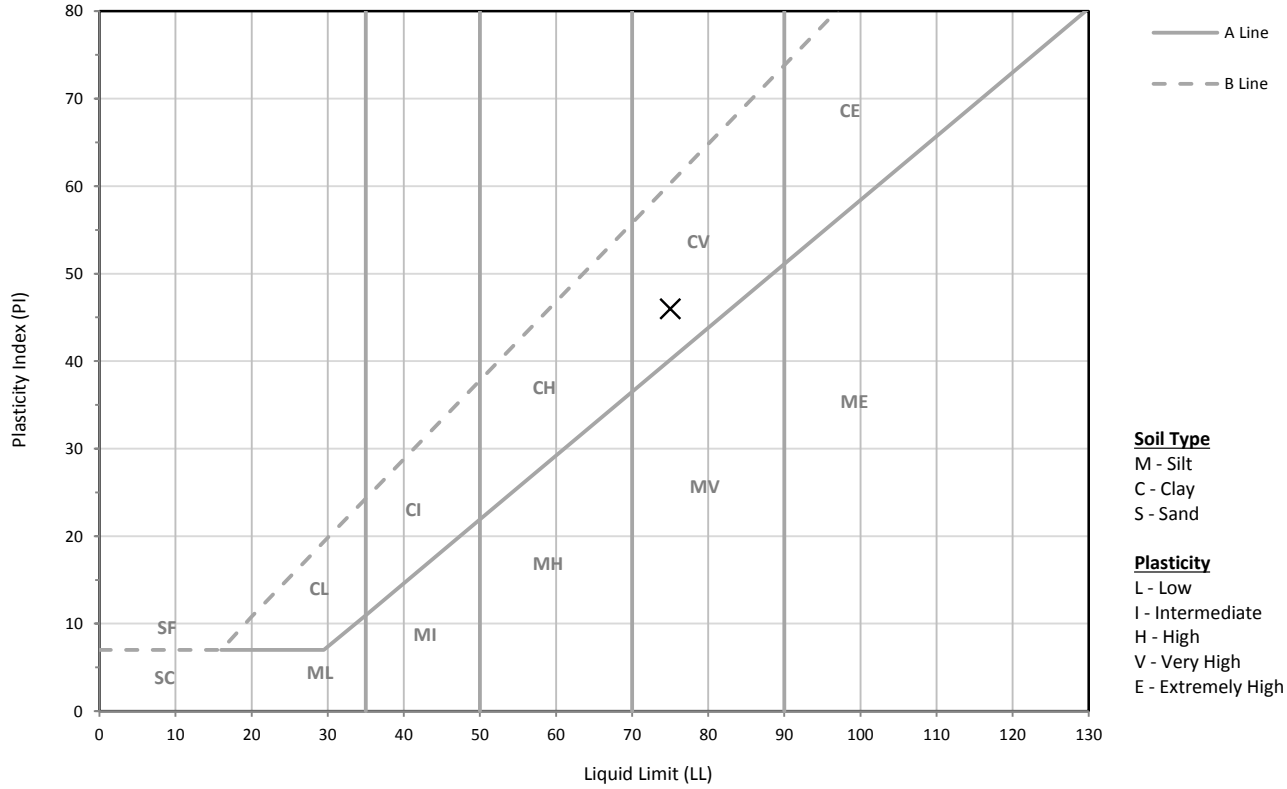
TEST DETAILS

LOCATION	**Description**	Ellerslie Racecourse		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S21TG000098		
	Reference	HA05	**Top Depth**	0.5m
	Sampled By	Others, Tested As Received	**Bottom Depth**	1.0m
	Description	Clayey SILT with some sand, trace rootlets; brown. Moist, very high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

Liquid Limit	**75**
Plastic Limit	**29**
Plasticity Index	**46**

Plasticity Chart - BS 5930:1999



TEST REMARKS

• The material used for testing was natural, fraction passing a 425um sieve. • This test result is IANZ accredited.•Date tested 20/04/2021

Approved Signatory Ryan Milligan

Date 23/04/2021

GEOTECHNICS

15C Amber Crescent
Judea
Tauranga 3110
New Zealand
p +64 7 571 0280

Geotechnics Project Number	1009521.1145.0.0
QESTLab Work Order ID	W21TG-0052
Customer Project ID	J01706

Determination of the Linear Shrinkage - NZS 4402:1986 Test 2.6

TEST DETAILS

LOCATION	**Description**	Ellerslie Racecourse		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S21TG000098		
	Reference	HA05	**Top Depth**	0.5m
	Sampled By	Others, Tested As Received	**Bottom Depth**	1.0m
	Description	Clayey SILT with some sand, trace rootlets; brown. Moist, very high plasticity.		
SPECIMEN	**Reference**		**Depth**	
	Description			

Linear Shrinkage **19%**

TEST REMARKS

• This test result is IANZ accredited.•Date tested 21/04/2021

Approved Signatory Ryan Milligan

Date 23/04/2021

GEOTECHNICS

Tauranga
15C Amber Crescent
Judea
Tauranga 3110
New Zealand

p +64 7 571 0280

Report No: MAT:S21TG000098

Material Test Report

Customer: Lander Geotechnical
Address: Level 3, 3 Osterley Way
Manukau, 2104
Project: Ellerslie Racecourse
Project No.: 1009521.1145.0.0
Customer Reference No.: J01706
Report Authorised By : RWM 23/04/2021

Sample Details

Location	Ellerslie Racecourse
Geotechnics ID	S21TG000098
Sample Reference	HA05
Sample Description	Clayey SILT with some sand, trace rootlets; brown. Moist, very high plasticity.
Sample Depth	0.5m
Bottom Depth	1.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		32.5	
Date Tested		19/04/2021	

Comments

This test result is IANZ accredited.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

GEOTECHNICS
15C Amber Crescent
Judea
Tauranga 3110
New Zealand
p +64 7 571 0280

Geotechnics Project Number	1009521.1145.0.0
QESTLab Work Order ID	W21TG-0052
Customer Project ID	J01706

Determination of Liquid & Plastic Limit, Plasticity Index - NZS 4402: 1986 Tests 2.2 (4 Point), 2.3 & 2.4

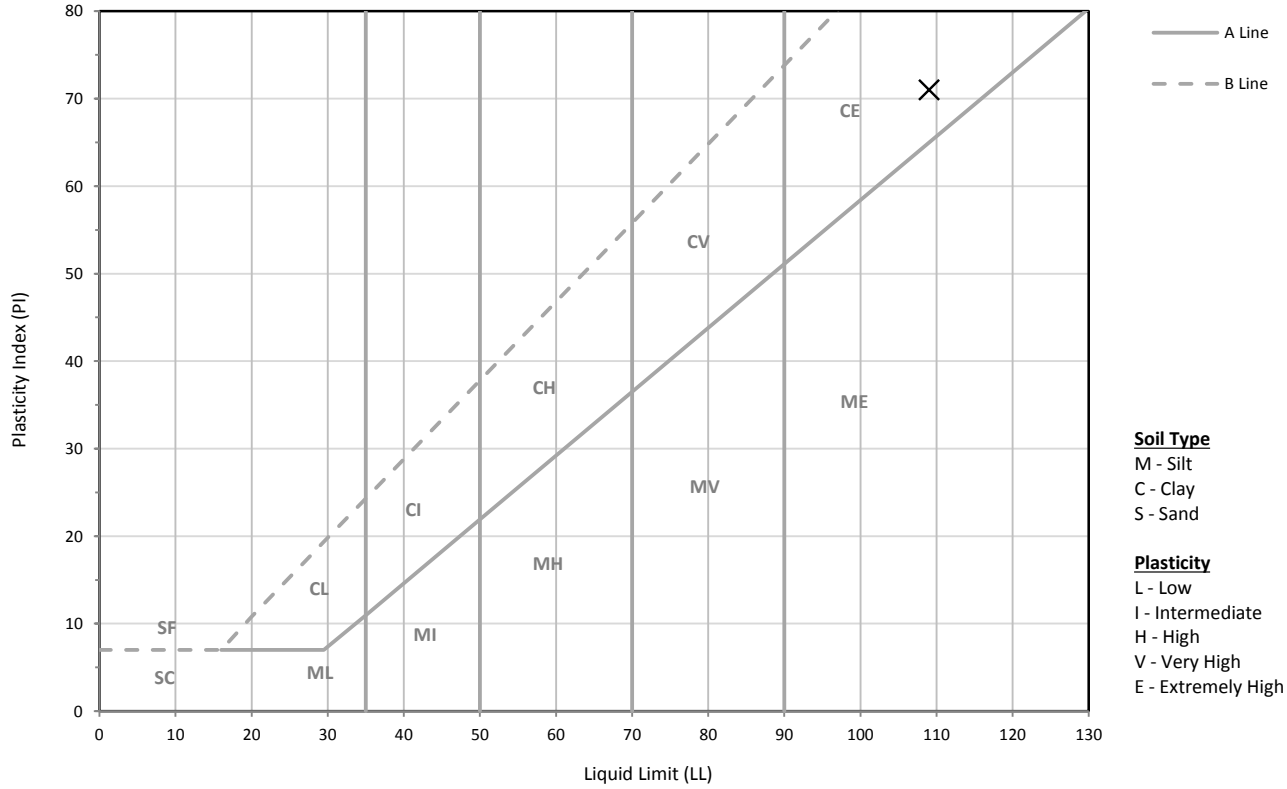
TEST DETAILS

LOCATION	**Description**	Ellerslie Racecourse		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S21TG000099		
	Reference	HA02	**Top Depth**	0.5m
	Sampled By	Others, Tested As Received	**Bottom Depth**	1.0m
	Description	silty CLAY, trace rootlets and trace gravel; orange brown mixed light brown. Moist, extremely high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

Liquid Limit	**109**
Plastic Limit	**38**
Plasticity Index	**71**

Plasticity Chart - BS 5930:1999



TEST REMARKS

• The material used for testing was natural, fraction passing a 425um sieve. • This test result is IANZ accredited.•Date tested 20/04/2021

Approved Signatory Ryan Milligan

Date 23/04/2021

GEOTECHNICS

15C Amber Crescent
Judea
Tauranga 3110
New Zealand
p +64 7 571 0280

Geotechnics Project Number	1009521.1145.0.0
QESTLab Work Order ID	W21TG-0052
Customer Project ID	J01706

Determination of the Linear Shrinkage - NZS 4402:1986 Test 2.6

TEST DETAILS

LOCATION	**Description**	Ellerslie Racecourse		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S21TG000099		
	Reference	HA02	**Top Depth**	0.5m
	Sampled By	Others, Tested As Received	**Bottom Depth**	1.0m
	Description	silty CLAY, trace rootlets and trace gravel; orange brown mixed light brown. Moist, extremely high plasticity.		
SPECIMEN	**Reference**		**Depth**	
	Description			

Linear Shrinkage **22%**

TEST REMARKS

• This test result is IANZ accredited.•Date tested 21/04/2021

Approved Signatory Ryan Milligan

Date 23/04/2021

GEOTECHNICS

Tauranga
15C Amber Crescent
Judea
Tauranga 3110
New Zealand

p +64 7 571 0280

Report No: MAT:S21TG000099

Material Test Report

Customer: Lander Geotechnical
Address: Level 3, 3 Osterley Way
Manukau, 2104
Project: Ellerslie Racecourse
Project No.: 1009521.1145.0.0
Customer Reference No.: J01706
Report Authorised By : RWM 23/04/2021

Sample Details

Location	Ellerslie Racecourse
Geotechnics ID	S21TG000099
Sample Reference	HA02
Sample Description	silty CLAY, trace rootlets and trace gravel; orange brown mixed light brown. Moist, extremely high plasticity.
Sample Depth	0.5m
Bottom Depth	1.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		31.4	
Date Tested		19/04/2021	

Comments

This test result is IANZ accredited.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

HARRISON GRIERSON

OPTIMAX PROPERTY ADVISORY LTD

Ellerslie Racecourse

Geotechnical Investigation and Assessment

May 2008
HG Ref 1015-126669-01
Doc Ref rep-opal-126669-GE01-rcs-mmk

HARRISON GRIERSON CONSULTANTS LIMITED

Document Control Record

Client	Optimax Property Advisory Limited
Project	Ellerslie Racecourse
Project No.	1015-126669-01
Doc. Ref.	rep-opal-126669-GE01-rcs-mmk
Document	Geotechnical Investigation and Assessment

ISSUE AND REVISION RECORD

Status/Revision No.	
Set No.	__ of __
Date of Issue	May 2008
Originator	M. Kiryakos - Geotechnical Engineering Manager
Co-Author	R. Smith - Geotechnical Engineering Technician
Approved	P. Williams - Director

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OPTIMAX PROPERTY ADVISORY LTD

Ellerslie Racecourse

Geotechnical Investigation

May 2008
HG Ref 1015-126669-01
Doc Ref rep-opal-126669-GE01-rcs-mmk

CONTENTS

APPENDICES

DRAWINGS

1.0 INTRODUCTION

Harrison Grierson Consultants Limited (HGCL) has undertaken a geotechnical investigation in April 2008 at the Ellerslie Racecourse, in Ellerslie, for the purpose of proposed upgrades.

The geotechnical investigation was requested by Optimax Advisory Ltd, on behalf of Auckland Racing Club.

The investigation was undertaken in order to assess the subsurface conditions and to identify potential geotechnical issues for the two areas of interest within the racecourse compound. These areas are shown on an overall concept plan prepared by Boffa Miskell Limited, referenced 02296A-029 and dated November 2004.

The investigation by HGCL comprised drilling of machine and hand augered boreholes. This was followed by assessment of the results from a geotechnical perspective for the purpose of resource consent.

This report presents the results of a geotechnical investigation and assessment undertaken.

2.0 SITE DESCRIPTION

The two areas under this investigation are under one title, namely Lot 2, DP 200256. The areas described as Area 2 and Area 5 as shown in Figure 1 below.

Figure 1: Site Location Plan (Map reproduced from Google Earth)

2.1 AREA 2

Area 2 is in the proximity of Ellerslie Convention Centre and is on a relatively flat ground that slopes slightly towards the north-northwest. The ground is generally covered in well-kept grass with a single large tree approximately 20m in height, located at the western end of the area.

For Area 2 the drainage channels are present with cesspits and roading drainage along the carriageway.

Power poles were observed through the middle of the site as well as an electrical junction box. An old aerial photo of the site indicates a building was present in the area nearest to the existing Ellerslie Convention Centre.

2.2 AREA 5

Area 5 is located to the east of the racecourse near Ladies Mile road. The site is on sloping ground. The ground slopes moderately downwards (at approximately 12°) to the southwest towards an existing stormwater retention pond and to the west towards the racecourse.

Area 5 is also covered in well-kept grass with medium to large sized shrubs surrounding most of the boundary. A strand of medium sized trees up to 15m tall is located near the stormwater retention pond.

There were no visible drainage channels present onsite within Area 5. However, due to the relatively steep topography of the site, it is logical to assume that most of the surface water will flow towards the stormwater retention pond at the bottom of the slope. At least two inlet pipes were observed within the pond.

3.0 PROPOSED DEVELOPMENT

No detailed information of the proposed development was available at the time of writing. However, we understand that the future development, in concept, would comprise the following:

- Area 2: A multi story building with possible underground (basement) level.
- Area 5: Earthworks resulting in a cut to fill platform. The cut will require more than 2.5m high permanent retaining walls.

4.0 GEOLOGY

In assessing the geology of the site we have referred to the following geological map:

- Edbrooke, SW (Compiler) 2001: Geology of the Auckland Area, Institute of Geological and Nuclear Sciences (IGNS), 1:250,000 Geological Map 3, Lower Hutt, New Zealand, IGNS Ltd.

According to the geological map:

- Area 2 is located within an area underlain by soils and rocks of the Auckland Volcanic Field.
- Area 5 is located within an area underlain by residual soils and rocks of the East Coast Bays Formation as well as alluvial soils of the Puketoka Formation in the low laying area.

The Auckland Volcanic Field belongs to the Kerikeri Volcanic Group. This in turn has three sub groups that are lava, scoria and pyroclastics, which are all of the late Pleistocene to the Holocene age.

The East Coast Bays Formation belongs to the Waitemata Group of the Early Miocene age. These rocks are an alternating sequence of sandstones and mudstones (flysch deposits) interpreted as a turbidite/inter-turbidite sequence. These rocks are generally very weak to weak, greenish grey or grey when fresh and weathered to light brown or brown soils comprising silts, clays and sand mixtures. The sandstones are often graded, laminated or the bedding is convoluted. These rocks weather to form residual clays and silts up to 10m thick.

The Puketoka Formation belongs to the Tauranga Group of the Pliocene age. These soils are described as undifferentiated, mainly pumiceous deposits, consisting of bedded mud to gravel sized rhyolite pumice clasts and weathered rock fragments. Minor beds comprise pumicite, organic rich clay and peat.

5.0 FIELDWORK

The fieldwork phase of the geotechnical investigation was carried out in April 2008. It comprised of a site walkover assessment, slope measurement and drilling of five machine boreholes and three hand augered boreholes together with Scala Penetrometer testing from the base of some of the hand augered boreholes.

An approximate exploratory test location plan can be found on the HGCL drawing No. 126669-GE01 attached. The materials encountered in the boreholes are summarised on the borelogs attached in Appendix 1.

Machine boreholes MB01 and MB02, together with hand auger boreholes HA1 to HA3 inclusive, were drilled within Area 5. Machine boreholes MB03 to MB06 inclusive, were drilled within Area 2.

The fieldwork was carried out under the direction of a Geotechnical Engineering Technician, who nominated sampling and testing depths, and logged the recovered subsurface conditions. The descriptions of the boreholes were logged in accordance with the New Zealand Geotechnical Society (NZGS) Guidelines for Soil and Rock Descriptions.

The machine drilled exploratory boreholes were advanced using rotary auger techniques, with in-situ testing by Standard Penetration Test (SPT) in MB01 and MB02 only. Due to the basalt encountered in MB03 to MB05, no SPT testing was carried out in the boreholes. The drilling in these boreholes was by wash drilling in the soils and HQ triple tube coring in the rock.

The hand augered boreholes were to be drilled to a target depth of 5.0m below ground level (bgl), where practicable, with in-situ shear vane tests made on undisturbed cohesive soils at nominal intervals of 0.5m. The shear vane values obtained from in-situ testing are shown on the attached exploratory borehole logs in Appendix 1.

6.0 SUBSURFACE CONDITIONS

The natural soils encountered at the site were consistent with the published geology. The borehole data are depicted on the attached geotechnical cross section A-A', which is established along Area 2, and B-B' and C-C', which are established across Area 5. The following is a summary of the materials encountered at each area:

6.1.1 Area 2

- The site is underlain with about 0.2m thickness of topsoil.
- The natural soils underlying the topsoil comprise silts, which are possibly volcanic ash deposits interbeded with alluvial soils.
- Basalt rock was encountered at depths varying from 3.0 to 6.0m bgl. A thin layer of basalt was encountered at approximately 1.5m bgl in MB04, which is located at the south-eastern end of Area 2. This layer could be a boulder. The depth of the basalt appears to be greater near the south-eastern end of Area 2. The Rock Quality Designation (RQD) of the cores recovered in all the three boreholes, ranged from 30 to 60%.

6.1.2 Area 5

Topsoil was encountered in all the boreholes drilled within this area. The following is a summary of the subsurface conditions encountered within the area at the top and the toe of the hill.

Top of the Hill

Boreholes MB01 and HA3 were drilled on top of the hill. Additional hand auger boreholes were drilled at the target location of HA3 (HA3A, B and C).

The subsurface conditions encountered in MB01, which was drilled in this area comprised the following:

- A thin mantle of volcanic silts to approximately 1.0m bgl.
- Residual soils of the East Coast Bays formation were encountered underlying the volcanic deposit to approximately 9.7m bgl. The material consisted of generally firm to stiff silt to approximately 7.3m bgl. The SPT N values ranged from 4blows/300mm penetration at 3.0m bgl to 12 blows/300mm penetration at 6.0m bgl. The silts are underlain by medium dense to dense sand to approximately 9.7m bgl. The SPT N values measured in the sand at 7.5m and 9.0m bgl were 23 and 30blows/300mm respectively.
- The bedrock, comprising siltstone and sandstone, was encountered at 9.7m bgl. The SPT N values measured ranged from 44 to greater than 50 blows/300mm. The RQD was low in the upper siltstone, increasing to approximately 60% in the underlying sandstone at 11.7m bgl.

Several attempts were made to drill deeper than 1.5m bgl in the area near the western boundary of Area 5 (HA3A, B and C). Drilling was difficult at 1.5m bgl in these boreholes and testing by shear vane was not possible due to the hard consistency of the soils at that depth. However, Scala Penetrometer testing was successful in the two boreholes (HA3A and B) where it was possible to probe to up to 3.5m bgl. The Scala Penetrometer test results indicate a weak zone between 2.0 and 2.5m bgl where the soils are inferred to be generally soft to firm (1-2 blows/50mm penetration).

Toe of the Hill

Machine borehole MB02 was drilled at the toe of the hill near the existing pond. Hand auger borehole HA2 was drilled near the western boundary of Area 5, while HA1 was drilled near the eastern boundary of Area 5. The following is a summary of the materials encountered in these boreholes.

- Fill was encountered in HA1 and HA2 to depths of 0.4m and 0.8m respectively. The fill comprised of clayey silt, with quantities of fine to medium grained sub angular scoriaceous gravels in HA1 and some fine to course grained gravels in HA2. Shear vane testing was not conducted in the fill due to the presence of the gravels.
- The results of Scala Penetrometer testing carried out in HA1 indicate increase in the soils stiffness with depth. The Scala values were 2

blows/50mm penetration at 5.15m bgl increasing to 16 blows/50mm at 5.85m bgl.

- The results of Scala Penetrometer testing carried out in HA2 indicate a weak zone between 1.35 and 2.25m bgl where the soils are inferred to be generally firm (2-3 blows/50mm).

- Alluvial soils of the Puketoka Formation were encountered in MB02 and HA1 overlying residual soils of East Coast Bays Formation soils. The alluvial soils comprised interbeded silts, clays and sands. Trace organic inclusions were encountered in HA1 at 2.4m until 3.2m. The measured undrained shear strength in the alluvial soils ranged from 82kPa to 200kPa (inferred due to the difficulty in soil penetration by the shear vane), indicating a firm to hard consistency.

- East Coast Bays Formation soils were encountered in MB02 and HA1 underlying the above-mentioned alluvial soils. These soils comprised a thin mantle of stiff to very stiff silts and clays (shear strength from 148kPa to 200kPa) overlying sandstone. The SPT N values measured ranged from 36 to greater than 50 blows/300mm. The RQD was 0% in the upper layers of the sandstone, increasing to approximately 67% at 4.5m bgl.

6.1.3 Groundwater

In Area 2, water level was measured at depths varying from 1.1m in borehole MB05 to 3.8m in borehole MB04.

In Area 5, water level was measured at approximately 1.8m bgl in borehole MB01, which is located uphill, and at 0.9m bgl in borehole MB02, which is located near the toe of the hill.

Groundwater was not encountered in any of the hand augered boreholes.

It should be noted that the water levels encountered in the machine boreholes have probably been influenced by the water used during drilling. Although care should be taken in the use of the groundwater levels, it would be reasonable to consider shallow water levels in Area 2 and the toe of hill in Area 5 (near the pond).

It should also be noted, however, that groundwater levels and flows are transient, and are affected by such factors as soil and rock permeability, integrity of buried services and preceding climatic conditions.

7.0 GEOTECHNICAL ASSESSMENT

The site geotechnical conditions were assessed based on the results of the investigation and with the reference to the concepts of the proposed developments.

The following is a summary of the main geotechnical issues assessed together with the appropriate design and construction considerations assessed for each area.

7.1 AREA 2

This area is suitable for the proposed development in general. The geotechnical issues are mainly related to the basalt encountered at varying depths and the possible presence of groundwater at shallow depth. The following are the geotechnical considerations required for the design and construction of the foundations and the basement.

- For most of the area, basalt rock appears to be at 3 metres depth bgl. It would therefore seem to be convenient to found the building basement on or in the basalt layer. Towards the eastern end, the basalt appears to drop to 6 metres bgl, so in that area, short bored piles may be required, socketed into the basalt for improved lateral resistance. [Alternatively, undercut to the basalt layer and backfill to floor level with compacted hardfill]. Once a firm building footprint is decided, it would be prudent to wash drill at specific points to more precisely locate the top of the basalt layer.

- Permanent ground retention systems, such as concrete block or pre-cast concrete panel walls, will be required for the basement excavation. Drainage measures behind the walls will also be required.

- Temporary retention may also be required if a steep cut angle was selected. Otherwise a battered slope at 1v:1h ratio will likely be acceptable in the short term.

- If the actual groundwater level is higher than the excavation depth, then considerations should be given during the design stage to avoid the potential of groundwater drawdown during construction. Significant groundwater drawdown could cause settlement in the areas surrounding the excavation. However, this risk can be minimised if careful planning and construction was undertaken using measures such as groundwater recharge wells or trenches.

- Detailed geotechnical assessment will be required to establish the design parameters for the basement walls and the foundations in accordance with the current legislations (The New Zealand Building Code and the Australian/ New Zealand Standards 1170). Verification of the groundwater level by simplified methods such as test pitting or hand auger drilling during the detailed design stage is recommended.

- Due to the fractured nature of the basalt encountered ripping the basalt with the standard rock breaking equipment is assessed as feasible.

7.2 AREA 5

Area 5 is suitable for the proposed development in general. The geotechnical issues are mainly related to the thickness of the residual and alluvial soils encountered, as well as the possible presence of groundwater at shallow depth. The following are the geotechnical considerations required for the design and construction of the foundations and retaining walls.

- An embedded pile retaining wall (semi-contiguous) will likely to be the optimum option in terms of stability and cost for the proposed cut. The piles may require strutting by ground anchors if significant wall deflection is predicted. Drainage measures behind the walls will be required.

- The earthworks are envisaged to result in reasonably flat or terraced building platforms. The weak layer encountered in boreholes HA3A and B will be most likely be excavated as part of the earthworks. Therefore, slope stability should not be a critical issue. It is recommended that the slope stability of the proposed earthworks levels be verified by analysis once the earthworks concept is finalised. Specific attention should be made for the western toe of slope if any filling is proposed within that area.

- The subsurface soils are generally suitable for development using a shallow foundation system with a Geotechnical Ultimate Bearing Capacity of 300kPa. However, it should be noted that the residual soils of the East Coast Bays formation are generally described to be 'Moderately Reactive" (Class M) as defined in AS2870: 1996 "Residential slabs and footings" (as referenced in Section 17 of NZS 3604: 1999). These soils have characteristic free surface movement of up to 40mm. The building foundations will therefore be required to be designed to comply with AS2870 for the relevant building design.

- The areas where fill and alluvial soils were encountered may require further assessment. Undercutting and replacement with compacted hardfill may also be required for the building development. Alternatively, a deep foundation system (piles) will be required.

- Detailed geotechnical assessment will be required to establish the design parameters for the retaining walls and the foundations in accordance with the current legislations (The New Zealand Building Code and the Australian/ New Zealand Standards 1170). Verification of the groundwater level by simplified methods such as test pitting or hand auger drilling during the detailed design stage is recommended.

8.0 CONCLUSIONS

Areas 2 and 5 are both suitable for the proposed developments in general.

For most of Area 2, basalt appears to be at 3 metres depth bgl. The geotechnical issues are mainly related to the variation of the depth to basalt and the possible presence of groundwater at shallow depth. Concrete block or precast concrete panels can be used for the basement walls and will require adequate drainage measures behind the walls. A convenient construction method for the foundations would be to found on or in the basalt layer. Where the basalt is deep, short bored piles may be required, socketed into the basalt for improved lateral resistance. Alternatively, a cost effective option would be undercutting to the basalt layer and backfilling to floor level with compacted hardfill. The potential for significant groundwater drawdown, as a result of excavation, is envisaged to be low. However, careful design and planning together with verification of the depth the groundwater is recommended. Recharge wells and trenches may be required as precautionary measures against effects of drawdown.

The geotechnical issue within Area 5 are mainly related to the thickness of the residual soils and the depth of groundwater level. A retaining wall such as embedded semi-contiguous pile wall will be required to support the cut resulting from earthworks. As the earthworks will likely result in reasonably flat or terraced building platforms slope instability is not envisaged to be potential. However, verification of stability of the proposed earthworks levels by analysis is recommended once the earthworks concept is finalised. Specific attention should be made for the western toe of slope if any filling is proposed within that area. Shallow foundations of the proposed buildings are assessed to require a specific design in accordance with AS2870: 1996 "Residential slabs and footings" (as referenced in Section 17 of NZS 3604: 1999). The areas near the toe of the slope (underlain by fill and alluvial soils) may require further assessment. Undercutting and replacement with compacted hardfill, or piled foundations, mayo be required for buildings within those areas.

To enable the design of the proposed development in accordance with the current legislations (The New Zealand Building Code and the Australian/ New Zealand Standards 1170), detailed geotechnical assessment will be required to provide design parameters for the foundations and retaining walls including the site seismic classification and seismic design parameters.

9.0 LIMITATIONS

This report has been prepared for the particular project described to us and the scope of work agreed between the client and Harrison Grierson Consultants Limited. No responsibility is accepted by Harrison Grierson Consultants Limited or its directors, servants, agents, staff or employees for the accuracy of

information provided by third parties and the use of any part of this report in any other context or for any other purposes.

The recommendations and opinions contained in this report are based on our visual reconnaissance of the site, information from geological maps, and the data from the field investigation. Inferences about the nature and continuity of sub surface conditions away from and beyond the exploratory borehole logs are made, but cannot be guaranteed. The descriptions detailed on the exploratory borehole logs are based on the NZ Geotechnical Society Guidelines for the Field Description of Soils and Rocks for Engineering Purposes.

During construction, an engineer competent to judge whether the conditions are compatible with the assumptions made in this report should examine the site. In all circumstances, if variations in the sub surface condition occur which differ from those described or assumed to exist, and then the matter should be referred back to Harrison Grierson Consultants Limited.

This report has been prepared for the particular project described to us, and no responsibility is accepted by Harrison Grierson Consultants Limited or its directors, servants, agents, staff, or employees for the use of any part of this report in any other context or for any other purposes.

This report is for the use by Optimax Property Advisory Ltd only, and should not be used or relied upon by any other person or entity or for any other project.

Harrison Grierson Consultants Limited

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APPENDIX 1

Exploratory Borehole and Scala Penetrometer Test Results

geolab
air, soil & water laboratory services

CLIENT: Optimax Property Advisory Ltd

PROJECT: Geotechnical Investigation, Ellerslie Racecourse, Ellerslie

BOREHOLE No: MB01

Sheet 1 of 2

Drill Type:	KUBOTA STV 40	Project No:	1015-126669-01	Logged By:	ROBERT SMITH
Drilled By:	PRO DRILL (AUCK) LTD	Coordinates:		Shear Vane No:	DR4531
Date Started:	08:00am 14/4/08	Ground Elevation:		Checked By:	FBK
Date Finished:	12:00pm 14/4/08	Water Level:	1.8m 04:30pm 14/04/2008		

STRATIGRAPHY	GRAPHIC LOG	SOIL DESCRIPTION / ROCK DESCRIPTION	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SPT / C_u (kPa) (blows/300mm)	DRILLING METHOD	RECOVERY (%)	TCR SCR RQD	If	WATER CONTENT	OTHER
EAST COAST BAYS FORMATION		**SILT**, trace clay; dark brown. "Hard", moist, low plasticity, trace rootlets present (TOPSOIL)		0								
		SILT, trace to minor clay; brown. "Hard", moist, low plasticity				V,229+ UTP V,229+ UTP P,135 V,229+ UTP						
		becomes light brown becomes minor clay. Low to moderately plastic becomes mottled light grey	04:30pm 14/04/2008	1		3 5 7 N=12						
		becomes brown and light grey		2		P,37						
		becomes minor to some clay. Stiff				P,25						
		becomes firm to stiff		3		V,35 VR,9						
		becomes trace medium grained sand and minor clay. Stiff				2 2 2 N=4						
		becomes grey, mottled orange brown		4		P,25						
		becomes firm to stiff				P,25						
		becomes minor to some clay; stained and mottled orange brown		5		2 3 4 N=7	OPEN BARRELL					
						P,25						
		becomes stiff		6		V,80 VR,16 3 5 7 N=12						
		becomes trace clay; orange brown, mottled grey becomes dark grey becomes very stiff				P,110 P,172						
		becomes **sandy**		7		P,220						
		becomes hard				V,229+ UTP						
		fine to medium grained **SAND**, minor to some silt; dark grey. Loosely packed; moist; uniformly graded		8		6 10 13 N=23						
		becomes fine to course grained sand; well graded		9		10 12 18 N=30	HQ TRIPPLE TUBE					
		highly weathered, dark grey, fine fabric, **SILTSTONE**; extremely weak		10					100			

ROCK 126669-GINT-MB-HA-RCS.GPJ GEOLAB_JAN06.GDT 20/5/08

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CLIENT: Optimax Property Advisory Ltd

PROJECT: Geotechnical Investigation, Ellerslie Racecourse, Ellerslie

BOREHOLE No: MB01

Sheet 2 of 2

Drill Type:	KUBOTA STV 40	Project No:	1015-126669-01	Logged By:	ROBERT SMITH
Drilled By:	PRO DRILL (AUCK) LTD	Coordinates:		Shear Vane No:	DR4531
Date Started:	08:00am 14/4/08	Ground Elevation:		Checked By:	PBF
Date Finished:	12:00pm 14/4/08	Water Level:	1.8m 04:30pm 14/04/2008		

STRATIGRAPHY	GRAPHIC LOG	SOIL DESCRIPTION (MAIN\minor components, strength, colour structure, weathering) / ROCK DESCRIPTION (ROCK NAME, weathering, strength, colour discontinuities)	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SPT / c_u (kPa) (blows/300mm)	DRILLING METHOD	RECOVERY (%)	TCR / SCR / RQD	If	WATER CONTENT	OTHER
EAST COAST BAYS FORMATION		highly weathered, dark grey, fine fabric, **SILTSTONE**; extremely weak		10					100 / 0			
				11		18 / 40 / 10 for 30mm N = 50+			100 / 100 / 2			
		moderately to highly weathered, dark grey, fine fabric, **SANDSTONE** ; weak		12		10 / 19 / 25 N=44	HQ TRIPPLE TUBE					
				13					100 / 100 / 60			
				14		19 / 30 / 20 for 80mm N = 50+			80 / 100 / 55			
				15		23 / 50 for 40mm N = 50+						
		END OF BORE. 15.19 METRES. (TARGET DEPTH ACHIEVED)		16								
				17								
				18								
				19								
				20								

ROCK 126669-GINT-MB-HA-RCS.GPJ GEOLAB_JAN06.GDT 20/6/08

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CLIENT: Optimax Property Advisory Ltd

PROJECT: Geotechnical Investigation, Ellerslie Racecourse, Ellerslie

BOREHOLE No: MB02

Sheet 1 of 1

Drill Type:	KUBOTA STV 40	Project No:	1015-126669-01	Logged By:	ROBERT SMITH
Drilled By:	PRO DRILL (AUCK) LTD	Coordinates:		Shear Vane No:	DR4531
Date Started:	12.45pm 14/4/08	Ground Elevation:		Checked By:	PBE
Date Finished:	4:15pm 14/4/08	Water Level:	0.9m 04:30pm 14/04/2008		

STRATIGRAPHY	GRAPHIC LOG	SOIL DESCRIPTION / ROCK DESCRIPTION	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SPT / C_u (kPa)	DRILLING METHOD	RECOVERY (%)	TCR / SCR / RQD	If	WATER CONTENT	OTHER
PUKETOKA FORMATION		**SILT**, trace to minor clay; dark brown, mottled orange brown. "Hard", moist, low plasticity, trace rootlets present (TOPSOIL)	0.9m 04:30pm 14/04/2008	0		V,229+ UTP						
		SILT, minor clay; brown. "hard", moist, low plasticity				P,123						
		becomes light brown		1		P,34						
		becomes trace coarse grained angular gravel and trace course grained sand				P,44						
		becomes light brown, light grey and light orange, mottled creamy grey. Moist to wet				P,98						
		becomes greyish brown and light brown. Firm		2		5 7 8 N=15	OPEN BARRELL					
		(SAMPLE FELL OUT, DRILLED TO 2.0M)				P,49						
		CLAY, some silt; grey. Firm, moist, highly plastic				P,123						
		SILT, minor fine to course grained sand and trace clay; grey, mottled brown. stiff, moist, low plasticity				V,229+ UTP						
		becomes stiff		3		10 17 19 N=36						
		becomes **sandy**; sand is fine to medium grained										
		becomes brown and dark orange brown layers, bedded										
		becomes firm							100 53 0			
		becomes very stiff		4		V,229+ UTP						
		highly weathered, dark grey, fine fabric, **SANDSTONE**; weak				50 for 120mm N = 50+						
EAST COAST BAYS FORMATION		becomes slightly weathered		5			HQ TRIPPLE TUBE		100 97 67			
				6		50 for 100mm N = 50+						
				7					100 93 87			
						50 for 90mm N = 50+						
		END OF BORE. 7.59 METRES. (TARGET DEPTH ACHIEVED)		8								
				9								
				10								

ROCK 126669-GINT-MB-HA-RCS.GPJ GEOLAB_JAN06.GDT 20/5/08

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CLIENT: Optimax Property Advisory Ltd

PROJECT: Geotechnical Investigation, Ellerslie Racecourse, Ellerslie

BOREHOLE No: MB03

Sheet 1 of 1

Drill Type:	KUBOTA STV 40	Project No:	1015-126669-01	Logged By:	ROBERT SMITH
Drilled By:	PRO DRILL (AUCK) LTD	Coordinates:		Shear Vane No:	DR4531
Date Started:	15/4/08	Ground Elevation:		Checked By:	PBT
Date Finished:	15/4/08	Water Level:	1.8m 15/04/2008		

STRATIGRAPHY	GRAPHIC LOG	SOIL DESCRIPTION (MAIN\minor components, strength, colour structure, weathering) / ROCK DESCRIPTION (ROCK NAME, weathering, strength, colour discontinuities)	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SPT / c_u (kPa) (blows/300mm)	DRILLING METHOD	RECOVERY (%)	TCR / SCR / RQD	If	WATER CONTENT	OTHER
		TOPSOIL		0								
		"SILT"	15/04/2008	1			WASH DRILL					
KERIKERI VOLCANIC GROUP		slightly weathered, dark grey, massive, **BASALT**, moderately strong to strong, tabular		2 3 4 5 6 7			HQ TRIPPLE TUBE		90 83 17 100 100 43 100 100 40			
		END OF BORE. 7.50 METRES. (TARGET DEPTH ACHIEVED)		8 9 10								

ROCK 126669-GINT-MB-HA-RCS.GPJ GEOLAB_JAN06.GDT 20/5/08

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air, soil & water laboratory services

CLIENT: Optimax Property Advisory Ltd

PROJECT: Geotechnical Investigation, Ellerslie Racecourse, Ellerslie

BOREHOLE No: MB04

Sheet 1 of 1

Drill Type:	KUBOTA STV 40	Project No:	1015-126669-01	Logged By:	ROBERT SMITH
Drilled By:	PRO DRILL (AUCK) LTD	Coordinates:		Shear Vane No:	DR4531
Date Started:	15/4/08	Ground Elevation:		Checked By:	PBK
Date Finished:	15/4/08	Water Level:	3.8m 15/04/2008		

STRATIGRAPHY	GRAPHIC LOG	SOIL DESCRIPTION (MAIN\minor components, strength, colour structure, weathering) / ROCK DESCRIPTION (ROCK NAME, weathering, strength, colour discontinuities)	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SPT / c_u (kPa) (blows/300mm)	DRILLING METHOD	RECOVERY (%)	TCR / SCR / RQD	If	WATER CONTENT	OTHER
		TOPSOIL		0								
		"SILT"		1			WASH DRILL					
KVG		slightly weathered, dark grey, massive, **BASALT**; moderately strong to strong, tabular		2			HQ TRIPPLE TUBE		73 17 13			
ASH/TUFF		**SILT**, trace to minor medium to coarse grained sand, trace clay and minor fine grained sub rounded gravel; dark brown. "Firm", moist, low plasticity		3								
		"SILT"	15/04/2008	4			WASH DRILL					
				5								
				6								
KVG		slightly weathered, dark grey, massive, **BASALT**; moderately strong to strong, tabular		7			HQ TRIPPLE TUBE		100 100 60			
		END OF BORE. 7.50 METRES. (TARGET DEPTH ACHIEVED)		8								
				9								
				10								

ROCK 126669-GINT-MB-HA-RCS.GPJ GEOLAB_JAN06.GDT 20/5/08

geolab
air, soil & water laboratory services

CLIENT: Optimax Property Advisory Ltd

PROJECT: Geotechnical Investigation, Ellerslie Racecourse, Ellerslie

BOREHOLE No: MB05

Sheet 1 of 1

Drill Type:	KUBOTA STV 40	Project No:	1015-126669-01	Logged By:	ROBERT SMITH
Drilled By:	PRO DRILL (AUCK) LTD	Coordinates:		Shear Vane No:	DR4531
Date Started:	15/4/08	Ground Elevation:		Checked By:	PBK
Date Finished:	15/4/08	Water Level:	1.1m 15/04/2008		

STRATIGRAPHY	GRAPHIC LOG	SOIL DESCRIPTION (MAIN/minor components, strength, colour, structure, weathering) / ROCK DESCRIPTION (ROCK NAME, weathering, strength, colour, discontinuities)	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SPT / c_u (kPa) (blows/300mm)	DRILLING METHOD	RECOVERY (%)	TCR / SCR / RQD	If	WATER CONTENT	OTHER
		TOPSOIL		0								
		"SILT"	15/04/2008	1			WASH DRILL					
KVG		slightly weathered, dark grey, massive, **BASALT**; moderately strong to strong, tabular		2			HQ TRIPPLE TUBE		80 67 30			
		END OF BORE. 4.50 METRES. (TARGET DEPTH ACHIEVED)		3								
				4								
				5								
				6								
				7								
				8								
				9								
				10								

ROCK 126669-GINT-MB-HA-RCS.GPJ GEOLAB_JAN06.GDT 20/5/08

geolab
air, soil & water laboratory services

CLIENT: Optimax Property Advisory Ltd

PROJECT: Geotechnical Investigation, Ellerslie Racecourse, Ellerslie

BOREHOLE No: HA1

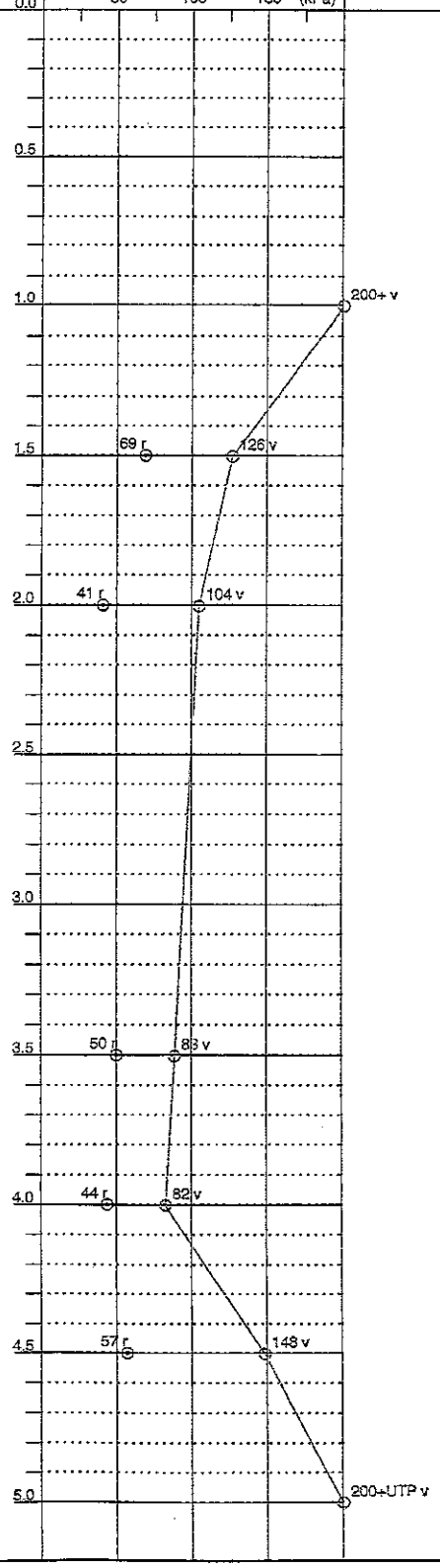
Sheet 1 of 1

Drill Type:	50mm HAND AUGER	Project No:	1015-126669-01	Logged By:	PBK
Drilled By:	PBK	Coordinates:		Shear Vane No:	DR2871
Date Started:	15/4/08	Ground Elevation:		Checked By:	KCS.
Date Finished:	15/4/08	Water Level:	Groundwater not encountered		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION (MAIN\minor components, strength, colour structure, weathering)	WATER LEVEL (m)
FILL	0.0		**TOPSOIL**	
			TOPSOIL/FILL : clayey SILT, abundant topsoil content; dark brown. "firm", moist, low to moderate plasticity, with common fine to medium sub-angular scoria	
PUKETOKA FORMATION	0.5		**clayey SILT** ; white and light orange. "stiff", moist, moderately plastic	
			becomes with trace clay	
	1.0		becomes with some clay, light orange with common white streaks, hard	
	1.5		becomes very stiff	
			becomes with trace clay, orange with common white mottles	
	2.0		**sandy SILT** , sand is fine grained; brownish light grey. stiff, moist, none to low plasticity	
	2.5		**silty SAND** , sand is fine grained; brownish light grey with occasional orange streaks. loose, moist, with common mottles of amorphous organic inclusions	
	3.0		**clayey SILT**; light orange and grey. "stiff", moist, moderately plastic	
	3.5		becomes stiff	
			becomes fine sandy, with occasional mottles of amorphous organic inclusions	
	4.0		**silty CLAY** ; dark grey. very stiff, moist moderately plastic	
ECBF	4.5		**clayey SILT** ; dark grey. very stiff, moist, moderately plastic	
	5.0		END OF BORE. 5.00 METRES. (Target Depth)	

NATURAL WATER CONTENT △
LIQUID LIMIT ×
PLASTIC LIMIT □
50 100 150 (%)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
POCKET PENETROMETER ○ p
50 100 150 (kPa)



LABORATORY TESTS

SOIL 126669-GINT-MB-HA-RCS.GPJ GEOLAB_JAN06.GDT 20/5/08

geolab
air, soil & water
laboratory services

CLIENT: Optimax Property Advisory Ltd

PROJECT: Geotechnical Investigation, Ellerslie Racecourse, Ellerslie

BOREHOLE No: HA2

Sheet 1 of 1

Drill Type:	50mm HAND AUGER	Project No:	1015-126669-01	Logged By:	PBK
Drilled By:	PBK	Coordinates:		Shear Vane No:	DR2871
Date Started:	16/4/08	Ground Elevation:		Checked By:	pcs.
Date Finished:	16/4/08	Water Level:	Groundwater not encountered		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION MAIN\minor components, strength, colour structure, weathering	WATER LEVEL (m)
FILL	0.0		**TOPSOIL**	
			FILL : SILT, some clay; light orange, light grey and brown. "stiff", moist, moderately plastic, with abundant fine to coarse sized sub-angular gravel (volcanic)	
	0.5		**FILL** : SAND, sand is coarse; dark brown and grey. loose, moist	
			gravelly SILT , gravel is fine to coarse, angular, volcanic; brown and light grey. "stiff", moist, moderately plastic	
	1.0		END OF BORE. 0.80 METRES. (Possible basalt cobble/boulder. Too hard to auger. Other attempts ended with the same result)	
	1.5			
	2.0			
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

DEPTH (m)	NATURAL WATER CONTENT △ LIQUID LIMIT × PLASTIC LIMIT □ 50 100 150 (%) SHEAR STRENGTH ○ v REMOULDED SHEAR ⊙ r POCKET PENETROMETER ○ p 50 100 150 (kPa)	LABORATORY TESTS
0.0		
0.5		
1.0		
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		
4.5		
5.0		

SOIL 126669-GINT-MB-HA-RCS.GPJ GEOLAB_JAN06.GDT 20/5/06

geolab
air, soil & water laboratory services

CLIENT: Optimax Property Advisory Ltd

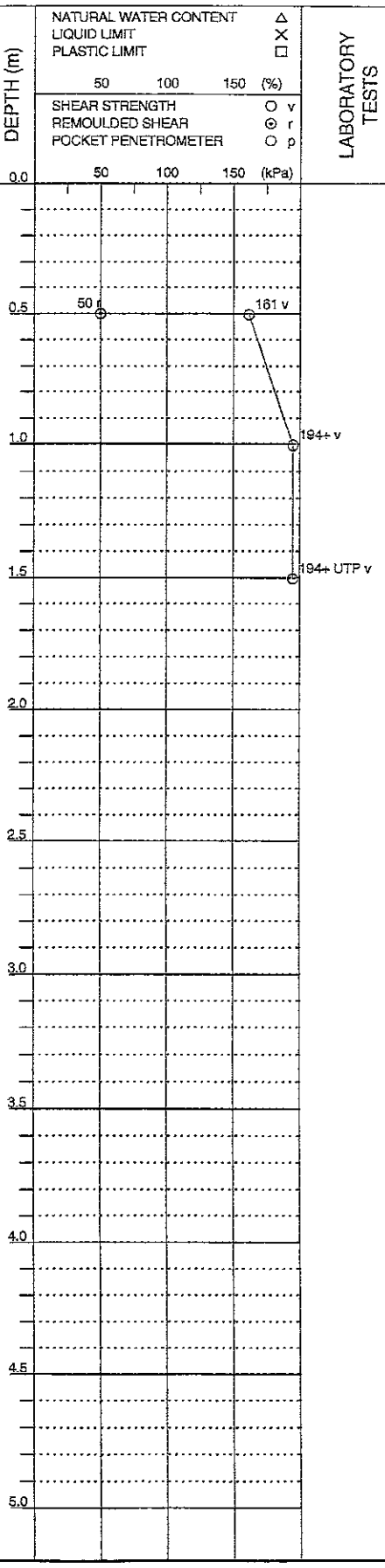
PROJECT: Geotechnical Investigation, Ellerslie Racecourse, Ellerslie

BOREHOLE No: HA3 (A)

Sheet 1 of 1

Drill Type:	50mm HAND AUGER	Project No:	1015-126669-01	Logged By:	ROBERT SMITH
Drilled By:	ROBERT SMITH	Coordinates:		Shear Vane No:	DR1768
Date Started:	16/4/08	Ground Elevation:		Checked By:	PBE
Date Finished:	16/4/08	Water Level:	Dry At End Of Drilling		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION MAIN\minor components, strength, colour structure, weathering	WATER LEVEL (m)
	0.0		**SILT**, trace clay; dark brown. "Very stiff", moist, low plasticity, "moderately sensitive", trace rootlets present (TOPSOIL)	
EAST COAST BAYS FORMATION	0.5		**SILT**, trace to minor clay; brown. "Very stiff", moist, low to moderately plastic, "moderately sensitive"	
	1.0		becomes reddish brown	
	1.5		becomes reddish brown and brown	
			END OF BORE. 1.50 METRES. (DIFFICULT TO PENETRATE, HARD)	
	2.0			
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			



LABORATORY TESTS

SOIL 126669-GINT-MB-HA-RCS.GPJ GEOLAB_JAN06.GDT 2/5/08

geolab
air, soil & water laboratory services

CLIENT: Optimax Property Advisory Ltd

PROJECT: Geotechnical Investigation, Ellerslie Racecourse, Ellerslie

BOREHOLE No: HA3 (B)

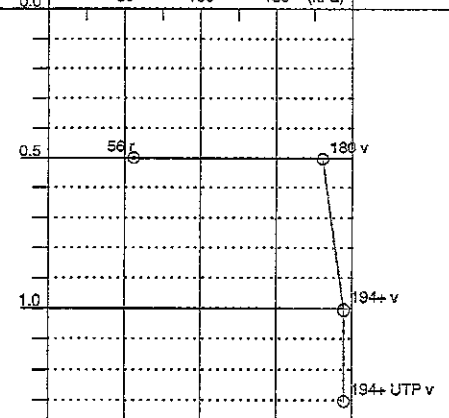
Sheet 1 of 1

Drill Type:	50mm HAND AUGER	Project No:	1015-126669-01	Logged By:	ROBERT SMITH
Drilled By:	ROBERT SMITH	Coordinates:		Shear Vane No:	DR1768
Date Started:	16/4/08	Ground Elevation:		Checked By:	
Date Finished:	16/4/08	Water Level:	Dry At End Of Drilling		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION MAIN\minor components, strength, colour structure, weathering	WATER LEVEL (m)
EAST COAST BAYS FORMATION	0.0		**SILT**, trace clay; dark brown. "Very stiff", moist, low plasticity, "moderately sensitive", trace rootlets present (TOPSOIL)	
	0.5		**SILT**, trace to minor clay; brown. "Very stiff", moist, low to moderately plastic, "moderately sensitive"	
	1.0		becomes reddish brown and brown	
	1.5		END OF BORE. 1.30 METRES. (DIFFICULT TO PENETRATE, HARD)	
	2.0			
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

NATURAL WATER CONTENT △
LIQUID LIMIT ×
PLASTIC LIMIT □
50 100 150 (%)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ⊙ r
POCKET PENETROMETER ○ p
50 100 150 (kPa)



LABORATORY TESTS

SOIL 126669-GINT-MB-HA-RCS.GPJ GEOLAB_JAN06.GDT 2/5/08

geolab
air, soil & water laboratory services

CLIENT: Optimax Property Advisory Ltd

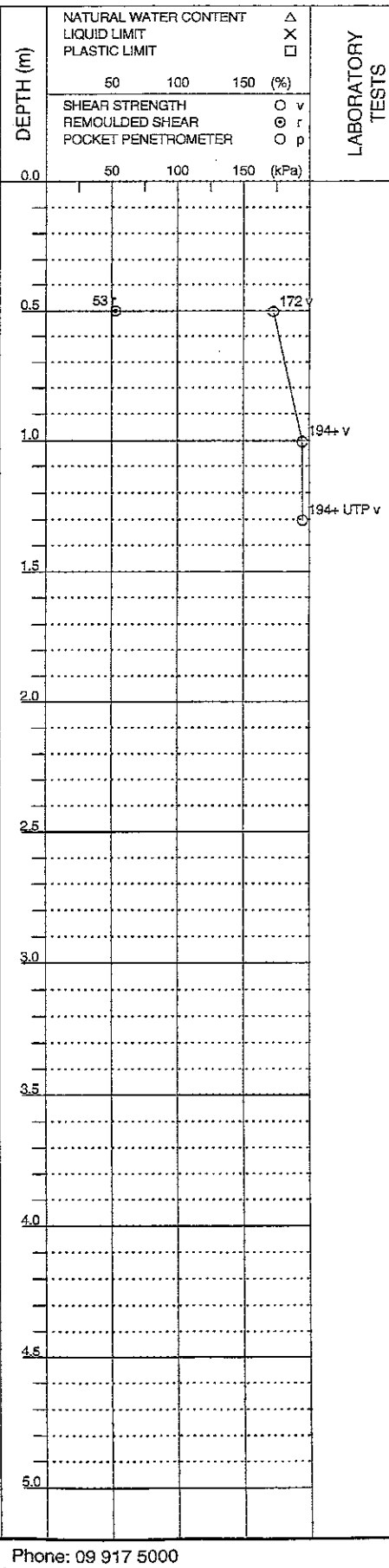
PROJECT: Geotechnical Investigation, Ellerslie Racecourse, Ellerslie

BOREHOLE No: HA3 (C)

Sheet 1 of 1

Drill Type:	50mm HAND AUGER	Project No:	1015-126669-01	Logged By:	ROBERT SMITH
Drilled By:	ROBERT SMITH	Coordinates:		Shear Vane No:	DR1768
Date Started:	16/4/08	Ground Elevation:		Checked By:	PBK
Date Finished:	16/4/08	Water Level:	Dry At End Of Drilling		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION MAIN\minor components, strength, colour structure, weathering	WATER LEVEL (m)
	0.0		**SILT**, trace clay; dark brown. "Very stiff", moist, low plasticity, "moderately sensitive", trace rootlets present (TOPSOIL)	
EAST COAST BAYS FORMATION	0.5		**SILT**, trace to minor clay; brown. "Very stiff", moist, low to moderately plastic, "moderately sensitive"	
	1.0			
	1.5		END OF BORE. 1.30 METRES. (DIFFICULT TO PENETRATE, HARD)	
	2.0			
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			



LABORATORY TESTS

SOIL 126669-GINT-MB-HA-RCS.GPJ GEOLAB_JAN06.GDT 2/5/08

geolab
air, soil & water laboratory services

CLIENT: Optimax Property Advisory Ltd

PROJECT: Geotechnical Investigation, Ellerslie Racecourse, Ellerslie

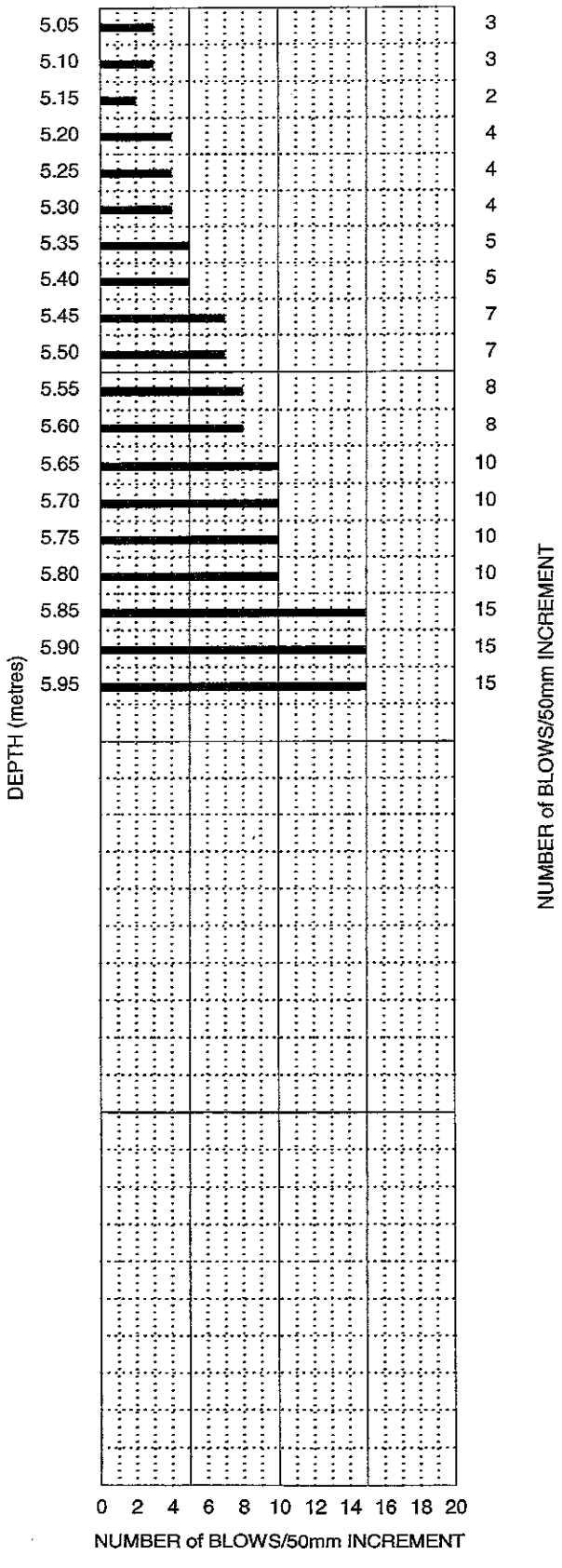
SCALA PENETROMETER TEST RESULTS

Sheet 1 of 2

Date Tested: 15/4/08 Project No: 1015-126669-01 Logged By: PBK

Checked By: R.C.S.

SCALA No: HA1



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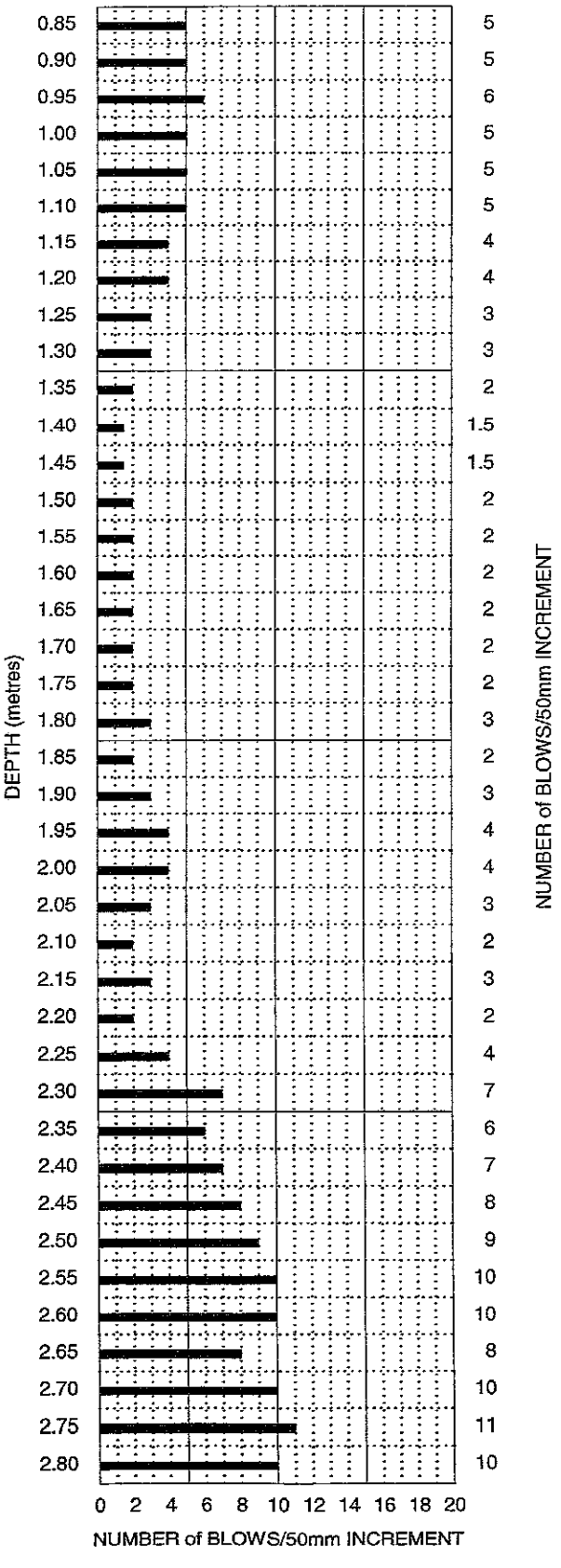


SCALA_126669-GINT-MB-HA-RCS.GPJ GEOLAB_JAN06.GDT 20/5/08

geolab
air, soil & water laboratory services

CLIENT: Optimax Property Advisory Ltd

PROJECT: Geotechnical Investigation, Ellerslie Racecourse, Ellerslie

SCALA PENETROMETER TEST RESULTS

Sheet 2 of 2

Date Tested: 16/4/08 Project No: 1015-126669-01 Logged By: ROBERT SMITH

Checked By: PBK

SCALA No: HA3 (A)

DEPTH (metres)	NUMBER of BLOWS/50mm INCREMENT
1.55	5
1.60	8
1.65	8
1.70	7
1.75	7
1.80	6
1.85	5
1.90	5
1.95	4
2.00	2
2.05	2
2.10	2
2.15	2
2.20	2
2.25	2
2.30	2
2.35	3
2.40	3
2.45	4
2.50	5
2.55	9
2.60	8
2.65	9
2.70	8
2.75	8
2.80	8
2.85	7
2.90	8
2.95	8
3.00	8
3.05	8
3.10	7
3.15	8
3.20	8
3.25	9
3.30	8
3.35	9
3.40	9
3.45	10
3.50	12

0 2 4 6 8 10 12 14 16 18 20

NUMBER of BLOWS/50mm INCREMENT

SCALA No: HA3 (B)

DEPTH (metres)	NUMBER of BLOWS/50mm INCREMENT
1.35	4
1.40	2
1.45	5
1.50	4
1.55	4
1.60	5
1.65	7
1.70	6
1.75	7
1.80	7
1.85	6
1.90	6
1.95	4
2.00	3
2.05	2
2.10	2
2.15	1
2.20	2
2.25	2
2.30	2
2.35	2
2.40	3
2.45	2
2.50	3
2.55	4
2.60	8
2.65	7
2.70	8
2.75	7
2.80	9
2.85	8
2.90	8
2.95	9
3.00	8
3.05	9
3.10	9
3.15	9
3.20	10
3.25	11
3.30	12

0 2 4 6 8 10 12 14 16 18 20

NUMBER of BLOWS/50mm INCREMENT

SCALA 126669-GINT-MB-HA-RCS.GPJ GEOLAB_JAN08.GDT 20/5/08

DRAWINGS

Borehole Location Plan

LEGEND

MB MACHINE BOREHOLE LOCATION

HA HAND AUGERED BOREHOLE LOCATION

AREA 5

AREA 2

HA2

MB01

HA3

MB02

HA1

MB05

MB03

MB04

C

C'

B

B'

MITCHELSON STREET

SOUTHERN MOTORWAY

HUNTERVILLE COURT

DERBY DOWNS PLACE

UMERE CRESCENT

LONSDALE STREET

ROSA COURT

REF	AMENDMENT	BY	DATE

DESIGNED:	DATE:	SIGNATURE:	PLOT DATE:
DRAWN: WSL	DATE: 20/05/08	SIGNATURE:	CAD REF: 14443-RC07
CHECKED:	DATE:	SIGNATURE:	CAD XREF: 14443-XREF
APPROVED:	DATE:	SIGNATURE:	SURVEY BY:
			SURVEY DATE:
			SDR REF:

ACENZ ASSOCIATION OF CONSULTING ENGINEERS NEW ZEALAND

ISO 9001 QUALITY ASSURED

HARRISON GRIERSON

CONSULTING ENGINEERS SURVEYORS PLANNERS

71 Great South Road Auckland Ph 09 917 5000 Fax 09 917 5001

PROJECT:

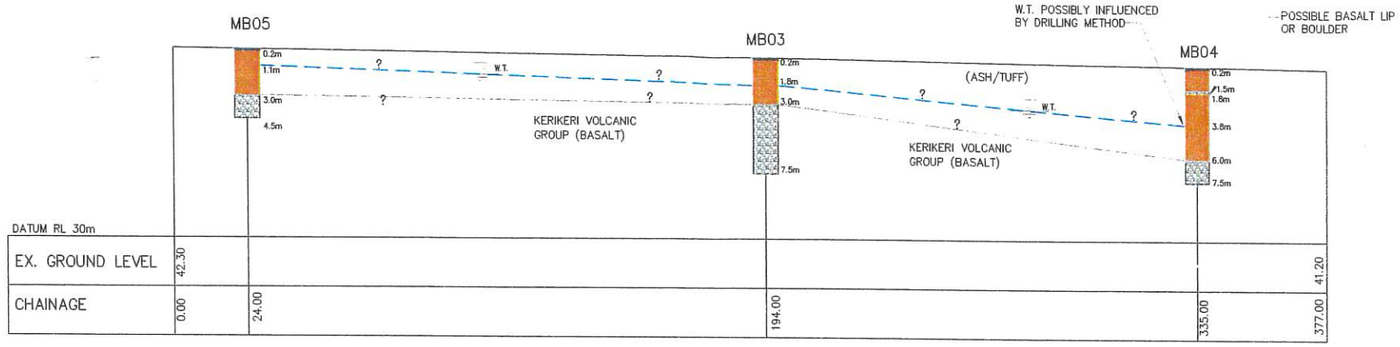
OPTIMAX PROPERTY ADVISORY LTD
ELLERSLIE RACECOURSE

TITLE:

GEOTECHNICAL BOREHOLE LOCATION PLAN

PLOT STATUS:

HG REF: 1015.126669.01	SCALES: 1:2500 (A3)	A1
DRAWING No: 126669-GE001		REV



LONGITUDINAL SECTION A–A'

LEGEND

	BASALT		SAND
	TOPSOIL		SANDSTONE
	SILT		FILL
	INFERRED WATER TABLE		SILTSTONE
	SANDY	N=	SPT VALUE

REV	AMENDMENT	BY	DATE

DESIGNED: | DATE: | SIGNATURE:
DRAWN: WSL | DATE: 20/05/08 | SIGNATURE:
CHECKED: | DATE: | SIGNATURE:
APPROVED: | DATE: | SIGNATURE:

PLOT DATE:
CAD REF: 14443-RC07
CAD XREF: 14443-XREF
SURVEY BY:
SURVEY DATE:
SDR REF:

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HARRISON GRIERSON
CONSULTING ENGINEERS SURVEYORS PLANNERS
71 Great South Road Auckland Ph 09 917 5000 Fax 09 917 5001

PROJECT:
OPTIMAX PROPERTY ADVISORY LTD
ELLERSLIE RACECOURSE

TITLE:
GEOTECHNICAL BOREHOLE SECTION A-A'

PLOT STATUS:
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SCALES: 1:2000 (A3)
A1
DRAWING No: 126669-GE002
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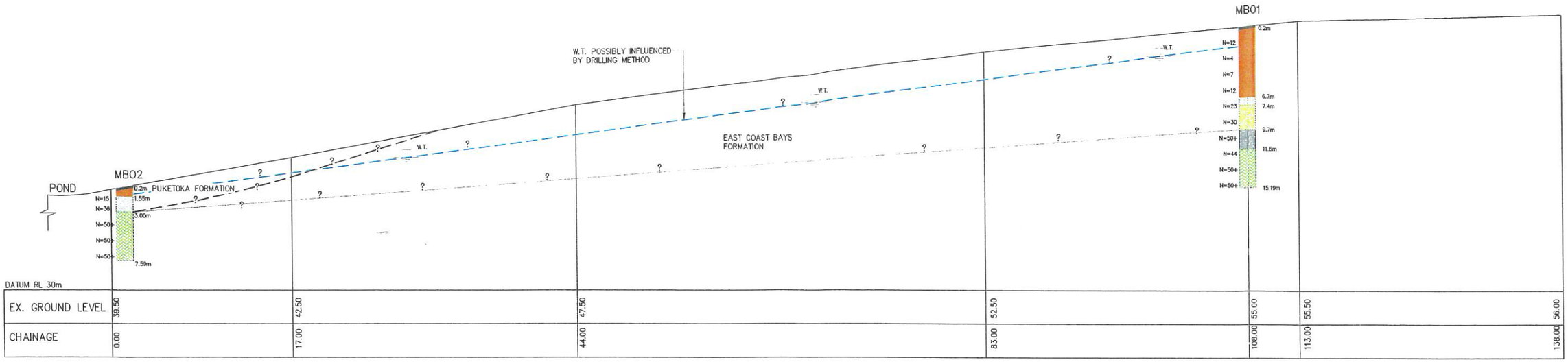

LONGITUDINAL SECTION B–B'

SCALE 1: 400 @A3

LEGEND

	BASALT		SAND
	TOPSOIL		SANDSTONE
	SILT		FILL
	INFERRED WATER TABLE		SILTSTONE
	SANDY	N=	SPT VALUE

REV	AMENDMENT	BY	DATE

DESIGNED: DATE: SIGNATURE:
DRAWN: WSL DATE: 20/05/08 SIGNATURE:
CHECKED: DATE: SIGNATURE:
APPROVED: DATE: SIGNATURE:

PLOT DATE:
CAD REF: 14443-RC07
CAD XREF: 14443-XREF
SURVEY BY:
SURVEY DATE:
SDR REF:

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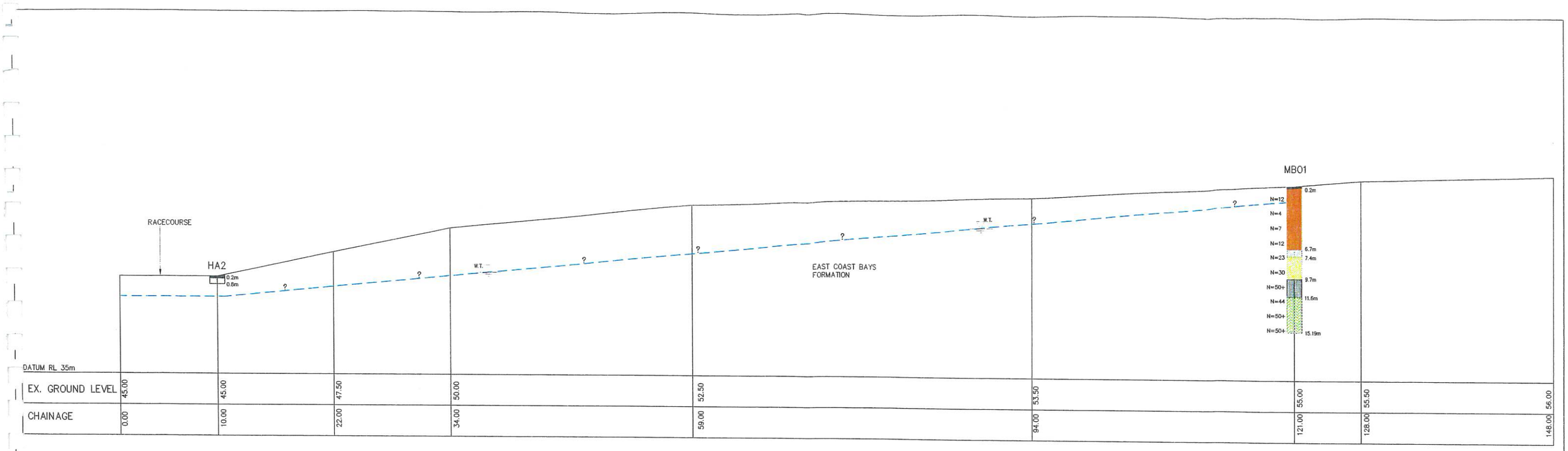
HARRISON GRIERSON
CONSULTING ENGINEERS SURVEYORS PLANNERS
71 Great South Road Auckland Ph 09 917 5000 Fax 09 917 5001

PROJECT: OPTIMAX PROPERTY ADVISORY LTD ELLERSLIE RACECOURSE

TITLE: GEOTECHNICAL BOREHOLE SECTION B-B'

PLOT STATUS:
HG REF: 1015.126669.01
SCALES: 1:400 (A3)
A1
DRAWING No: 126669-GE003
REV



LONGITUDINAL SECTION C–C'
SCALE 1:400 @A3

LEGEND

	BASALT		SAND
	TOPSOIL		SANDSTONE
	SILT		FILL
	INFERRED WATER TABLE		SILTSTONE
	SANDY	N=	SPT VALUE

REV	AMENDMENT	BY	DATE

DESIGNED: | DATE: | SIGNATURE:
DRAWN: WSL | DATE: 20/05/08 | SIGNATURE:
CHECKED: | DATE: | SIGNATURE:
APPROVED: | DATE: | SIGNATURE:

PLOT DATE:
CAD REF: 14443-RC07
CAD XREF: 14443-XREF
SURVEY BY:
SURVEY DATE:
SDR REF:

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HARRISON GRIERSON
CONSULTING ENGINEERS SURVEYORS PLANNERS
71 Great South Road Auckland Ph 09 917 5000 Fax 09 917 5001

PROJECT:
OPTIMAX PROPERTY ADVISORY LTD
ELLERSLIE RACECOURSE

TITLE:
GEOTECHNICAL BOREHOLE
SECTION C-C'

PLOT STATUS:
HG REF: 1015.126669.01
SCALES: 1:400 (A3)
A1
DRAWING No: 126669-GE004
REV

Log of Investigation

Project: **Abbotts Way Stormwater Upgrade**	**Drillhole**
Location: **Ellerslie Racecourse** Project No: **AE02819.12**	Hole ID: **DH2**
Client: **Auckland City Council**	Date: **29/09/2006**

R.L. (m)	Depth (m)	Drilling Method	Drilling Flush Return (%)	TCR (%)	RQD	Spacing of Natural Defects (mm)	In-Situ Testing	Relative Strength	Sampling	Weathering Grade	Geology Legend	GroundWater	Description of Strata	Geological Unit	Backfill / Installation
52.0	1.0	HQ3		33									Sandy SILT, abundant grass at the top 50mm. (FILL)		
													Gravelly CLAY, minor fine to coarse sand and silt; dark brownish grey, mottled yellow brown. Stiff, moist, medium plasticity. Gravel; fine to coarse, angular, poorly graded, Included is a basalt cobble (75mm) vesicular, moderately weathered and strong (FI		
		SPT		22			S 0,4,4 N=8						Sandy CLAY, dark brown, orange brown streaked. Soft, medium plasticity. (FILL)		
51.0	2.0	HQ3		100			150.0*pp*						Silty CLAY, minor fine to coarse sand and gravel, greyish dark brown. Very stiff, moist, medium plasticity. Gravel, fine to coarse, basalt, angular. (FILL)		
													Clayey SILT, brown, mottled brownish grey. Stiff to very stiff, moist, low plasticity. **(East Coast Bays Formation)**	Mwe	
50.0	3.0	SPT		45			S 1,3,3 N=6 60.0*pp*						Silty CLAY, grey, mottled brown. Stiff, moist, high plasticity. **(East Coast Bays Formation)**		
		HQ3		67			I_{VP}75+ I_{VP}100+		C1			1		Mwe	
49.0	4.0	SPT		89			S 3,4,5 N=9						Clayey SILT, brownish grey. Stiff, moist, low plasticity. **(East Coast Bays Formation)**	Mwe	
48.0	5.0														

Started: 27/09/2006
Finished: 28/09/2006
Driller: Drillwell
Plant: TD 150
Logged: TPA
Checked: CG

Depth Related Remarks
From *Remarks*

Groundwater Observations
No. *Struck (m)* *Date* *Observations* *Standing (m)*
1. 3.6m 28/09/2006

Remarks

Co-ordinates:
5915912.46mN
1761335.88mE
Elevation: 53.00mRL
Inclination: -90°

Data Template: DATA TEMPLATE.GDT Output Form: DRILLHOLE Project File Name: ABBOTS_WAY03.GPJ 23/11/06

Version 1.6 28/08/2006 - S.Humphreys

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

NZGD ID: BH_67982

Log of Investigation

Project: **Abbotts Way Stormwater Upgrade**	**Drillhole**
Location: **Ellerslie Racecourse** Project No: **AE02819.12**	Hole ID: **DH2**
Client: **Auckland City Council**	Date: **29/09/2006**

R.L. (m)	Depth (m)	Drilling Method	Drilling Flush Return (%)	TCR (%)	RQD	Spacing of Natural Defects (mm)	In-Situ Testing	Relative Strength	Sampling	Weathering Grade	Geology Legend	GroundWater	Description of Strata	Geological Unit	Backfill / Installation
														Mwe	
		HQ3		76									Silty SAND, orange brown, mottled grey. Medium dense, very fine to fine grained. **(East Coast Bays Formation)**		
47.0	6.0													Mwe	
		SPT		89			S 2,4,6 N=10						*6m to 6.45m: Becomes grey and orange brown lamination.*		
		HQ3		55					C2				Sandy SILT, brownish grey. Stiff, wet, non plastic. Sand is fine. **(East Coast Bays Formation)**		
46.0	7.0													Mwe	
													7.2m to 7.3m: With a 100mm layer of browwnish grey silt		
		SPT		89			S 3,6,8 N=14						SILT, orange brown. Stiff, moist, low plasticity. **(East Coast Bays Formation)**	Mwe	
45.0	8.0								C3				Silty CLAY, orange brown. Stiff to very stiff, medium plasticity. **(East Coast Bays Formation)**	Mwe	
		HQ3		100									Sandy SILT, orange brown. Very stiff, moist, non plastic. Sand; fine grained. **(East Coast Bays Formation)**	Mwe	
44.0	9.0														
		SPT		100			S 5,8,12 N=20						Silty SAND, orangey brownish grey, reddish brown stained. Medium dense, moist, fine grained. **(East Coast Bays Formation)**		
													9.1m to 9.45m: Becomes greenish grey.	Mwe	
43.0	10.0	HQ3											*9.45m: Becomes light greenish grey.*		

Started: 27/09/2006
Finished: 28/09/2006
Driller: Drillwell
Plant: TD 150
Logged: TPA
Checked: CG

Depth Related Remarks
From *Remarks*

Groundwater Observations
No. *Struck (m)* *Date* *Observations* *Standing (m)*
1. 3.6m 28/09/2006

Remarks

Co-ordinates:
5915912.46mN
1761335.88mE
Elevation: 53.00mRL
Inclination: -90°

Data Template: DATA TEMPLATE.GDT Output Form: DRILLHOLE Project File Name: ABBOTS_WAY03.GPJ 23/11/06

Version 1.6 28/08/2006 - S.Humphreys

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

NZGD ID: BH_67982

Log of Investigation

Project: **Abbotts Way Stormwater Upgrade**	**Drillhole**
Location: **Ellerslie Racecourse** Project No: **AE02819.12**	Hole ID: **DH2**
Client: **Auckland City Council**	Date: **29/09/2006**

R.L. (m)	Depth (m)	Drilling Method	Drilling Flush Return (%)	TCR (%)	RQD	Spacing of Natural Defects (mm)	In-Situ Testing	Relative Strength	Sampling	Weathering Grade	Geology Legend	GroundWater	Description of Strata	Geological Unit	Backfill / Installation
				100										Mwe	
													Sandy SILT, medium grey. Stiff to very stiff, moist, non plastic. **(East Coast Bays Formation)**	Mwe	
		SPT		100			S 5,11,16 N=27						Moderately weathered, medium grey, homogenous SILTSTONE, extremely weak. **(East Coast Bays Formation)**		
42.0	11.0	HQ3		100	100								*10.95m to 11.4m: Becomes very weak.*	Mwe	
													Moderately weathered, medium grey SANDSTONE, extremely weak, fine grained. **(East Coast Bays Formation)**	Mwe	
41.0	12.0												*11.55m: Joint (Dipping 45°), smooth, planar, tight*	Mwe	
		SPT		44			S 8,12,17 N=29						Slightly weathered to unweathered, medium grey sandy SILTSTONE, very weak to weak. **(East Coast Bays Formation)**		
		HQ3		100	100								Unweathered, medium grey interbedded SILTSTONE and SANDSTONE, very weak. The beds are moderately thin (100mm) to moderately thick (300mm). **(East Coast Bays Formation)**	Mwe	
40.0	13.0														
		SPT		50			S 13,30,30 N=60\185						Unweathered, medium grey sandy (fine) SILTSTONE, very weak. **(East Coast Bays Formation)**	Mwe	
39.0	14.0								C4						
		HQ3		100	100								Unweathered, medium grey SANDSTONE, extremely weak to very weak, fine to medium grained. **(East Coast Bays Formation)**	Mwe	
38.0	15.0														

Started: 27/09/2006
Finished: 28/09/2006
Driller: Drillwell
Plant: TD 150
Logged: TPA
Checked: CG

Depth Related Remarks
From *Remarks*

Groundwater Observations

No.	*Struck (m)*	*Date*	*Observations*	*Standing (m)*
1.	3.6m	28/09/2006		

Remarks

Co-ordinates:
5915912.46mN
1761335.88mE
Elevation: 53.00mRL
Inclination: -90°

Data Template: DATA TEMPLATE.GDT Output Form: DRILLHOLE Project File Name: ABBOTS_WAY03.GPJ 23/11/06

Version 1.6 28/08/2006 - S.Humphreys

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NZGD ID: BH_67982

Log of Investigation

Project: **Abbotts Way Stormwater Upgrade**	**Drillhole**
Location: **Ellerslie Racecourse** Project No: **AE02819.12**	Hole ID: **DH2**
Client: **Auckland City Council**	Date: **29/09/2006**

R.L. (m)	Depth (m)	Drilling Method	Drilling Flush Return (%)	TCR (%)	RQD	Spacing of Natural Defects (mm)	In-Situ Testing	Relative Strength	Sampling	Weathering Grade	Geology Legend	GroundWater	Description of Strata	Geological Unit	Backfill / Installation
		SPT		100			S 18,31,19 N=50\215						*14.9m: Becomes weak.*	Mwe	
													15m: Becomes very weak.	Mwe	
													Unweathered, medium grey SILTSTONE, very weak. **(East Coast Bays Formation)**		
37.0	16.0	HQ3		100									*15.37m: Joint (Dipping 35°), smooth, planar, tight*	Mwe	
													Unweathered, medium grey, slabby SANDSTONE, extremely weak to weak, fine grained. **(East Coast Bays Formation)**		
		SPT		100			S 18,38,12 N=50\170						Becomes very weak easily split into thin 10mm-20mm slabs.	Mwe	
36.0	17.0								C5				*16m: Joint (Dipping 60°), smooth, planar, tight*		
		HQ3		100	80								Unweathered, medium grey, homogenous sandy (fine) SILTSTONE; very weak. **(East Coast Bays Formation)**	Mwe	
													16.5m: Becomes grey, weak.		
													Unweathered, medium grey SANDSTONE, extremely weak to very weak, fine grained. **(East Coast Bays Formation)**	Mwe	
35.0	18.0						C 50 N=50\150						Unweathered, medium grey SILTSTONE, very weak. **(East Coast Bays Formation)**		
									C6				Unweathered, medium grey, massive SILTSTONE, very weak to weak. **(East Coast Bays Formation)**		
		SPT		100	100									Mwe	
34.0	19.0												*18.8m to 19.4m: With very weak silty sandstone beds @18.8m (70mm), 18.97m (30mm), 19.3m (100mm).*		
													18.84m: With a 30mm thick sheared zone.		
							C 50 N=50\150						Unweathered, medium grey, cemented, moderately thick bedded SANDSTONE, weak to very weak, fine grained. **(East Coast Bays Formation)**	Mwe	
33.0	20.0														

Started: 27/09/2006
Finished: 28/09/2006
Driller: Drillwell
Plant: TD 150
Logged: TPA
Checked: CG

Depth Related Remarks
From *Remarks*

Groundwater Observations
No. *Struck (m)* *Date* *Observations* *Standing (m)*
1. 3.6m 28/09/2006

Remarks

Co-ordinates:
5915912.46mN
1761335.88mE
Elevation: 53.00mRL
Inclination: -90°

Data Template: DATA TEMPLATE.GDT Output Form: DRILLHOLE Project File Name: ABBOTS_WAY03.GPJ 23/11/06

Version 1.6 28/08/2006 - S.Humphreys

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

NZGD ID: BH_67982

Log of Investigation

Project: **Abbotts Way Stormwater Upgrade**	**Drillhole**
Location: **Ellerslie Racecourse** Project No: **AE02819.12**	Hole ID: **DH2**
Client: **Auckland City Council**	Date: **29/09/2006**

R.L. (m)	Depth (m)	Drilling Method	Drilling Flush Return (%)	TCR (%)	RQD	Spacing of Natural Defects (mm)	In-Situ Testing	Relative Strength	Sampling	Weathering Grade	Geology Legend	GroundWater	Description of Strata	Geological Unit	Backfill / Installation
32.0	21.0	HQ3		100	100								Unweathered, medium grey, homogenous SILTSTONE, very weak. **(East Coast Bays Formation)**	Mwe	

DH2 terminated at 21.00m. Target Depth

Started: 27/09/2006
Finished: 28/09/2006
Driller: Drillwell
Plant: TD 150
Logged: TPA
Checked: CG

Depth Related Remarks
From *Remarks*

Groundwater Observations

No.	*Struck (m)*	*Date*	*Observations*	*Standing (m)*
1.	3.6m	28/09/2006		

Remarks

Co-ordinates:
5915912.46mN
1761335.88mE
Elevation: 53.00mRL
Inclination: -90°

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

Data Template: DATA TEMPLATE.GDT Output Form: DRILLHOLE Project File Name: ABBOTS_WAY03.GPJ 23/11/06

Version 1.6 28/08/2006 - S.Humphreys

NZGD ID: BH_67982

Log of Investigation

Project: **Abbotts Way Stormwater Upgrade**	**Drillhole**
Location: **Ellerslie Racecourse** Project No: **AE02819.12**	Hole ID: **DH3**
Client: **Auckland City Council**	Date: **29/09/2006**

R.L. (m)	Depth (m)	Drilling Method	Drilling Flush Return (%)	TCR (%)	RQD	Spacing of Natural Defects (mm)	In-Situ Testing	Relative Strength	Sampling	Weathering Grade	Geology Legend	GroundWater	Description of Strata	Geological Unit	Backfill / Installation
54.0	0	HQ3		27									Clayey SILT with minor fine to medium sand; dark grey. Soft, moist, medium plasticity, lots of grass roots. (FILL)		
	1.0												Sandy GRAVEL with minor silt, dark grey. Loose, wet, fine to medium, angular to sub angular, poorly graded, sand; fine to coarse, silt is non plastic. (FILL)		
													Clayey SILT, minor fine gravel; brown grey, red brown streaked. Firm, moist, medium plasticity. (FILL)		
53.0		SPT		100			I_{VF}44 I_{VR}10 S 1,3,4 N=7						Silty CLAY, orange brown, white grey streaked. Firm to stiff, moist, medium plasticity. **(East Coast Bays Formation)**	Mwe	
	2.0												SILT with trace clay; light greenish grey, mottled pink. Firm, moist, low plasticity. **(East Coast Bays Formation)**	Mwe	
52.0		HQ3		100			55.0*pp*		C1				Clayey SILT, light greenish grey, mottled orange brown. Firm to stiff, moist. **(East Coast Bays Formation)**	Mwe	
	3.0	SPT		100			S 2,6,7 N=13						Silty SAND, orange brown. Loose, moist, fine grained. **(East Coast Bays Formation)** *3m: Becomes orange brown, light grey streaked.*	Mwe	
51.0		HQ3		100									Sandy SILT, orange brown, light grey streaked. Stiff, wet, non plastic. **(East Coast Bays Formation)**	Mwe	
	4.0											1	Silty SAND, light grey, mottled brown. Medium dense, wet, fine grained. **(East Coast Bays Formation)**	Mwe	
50.0		SPT		100			S 4,8,15 N=23						SAND with minor silt, grey, mottled orange brown. Medium dense, wet, fine grained. **(East Coast Bays Formation)**	Mwe	
	5.0													Mwe	

Started: 25/09/2006
Finished: 27/09/2006
Driller: Drillwell
Plant: TD 150
Logged: TPA
Checked: CG

Depth Related Remarks
From *Remarks*

Groundwater Observations
No. *Struck (m)* *Date* *Observations* *Standing (m)*
1. 4.3m 27/09/2006

Remarks

Co-ordinates:
5915918.81mN
1761370.28mE
Elevation: 54.50mRL
Inclination: -90°

Data Template: DATA TEMPLATE.GDT Output Form: DRILLHOLE Project File Name: ABBOTS_WAY03.GPJ 23/11/06

Version 1.6 28/08/2006 - S.Humphreys

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

NZGD ID: BH_67983

Log of Investigation

Project: **Abbotts Way Stormwater Upgrade**	**Drillhole**
Location: **Ellerslie Racecourse** Project No: **AE02819.12**	Hole ID: **DH3**
Client: **Auckland City Council**	Date: **29/09/2006**

R.L. (m)	Depth (m)	Drilling Method	Drilling Flush Return (%)	TCR (%)	RQD	Spacing of Natural Defects (mm)	In-Situ Testing	Relative Strength	Sampling	Weathering Grade	Geology Legend	GroundWater	Description of Strata	Geological Unit	Backfill / Installation
49.0	6.0	HQ3		100			200.0*pp*		C2				Sandy SILT, grey, mottled orange brown. Stiff, wet, non plastic. Sand, fine grained. **(East Coast Bays Formation)**	Mwe	
													5.05m: Becomes orange brown	Mwe	
													Silty CLAY, grey. Very stiff, moist, medium plasticity. **(East Coast Bays Formation)**		
		SPT		100			S 3,14,21 N=35						Silty SAND, grey, mottled orange. Dense, moist, fine grained. **(East Coast Bays Formation)**	Mwe	
48.0							I_{VP}60 I_{VR}20								
	7.0	HQ3		73									Highly weathered, grey orange brown stained SILTSTONE, extremely weak. **(East Coast Bays Formation)**	Mwe	
													Silty SAND, orange brown. Dense, wet, fine grained. **(East Coast Bays Formation)**	Mwe	
47.0		SPT		100			S 10,15,18 N=33						*7.3m: Becomes medium grey, mottled orange brown. Very dense, moist to wet.*		
	8.0												*7.5m: Becomes wet, fine to medium grained.*	Mwe	
46.0		HQ3		67									Moderately weathered, medium grey, homogenous SILTSTONE, very weak. **(East Coast Bays Formation)**		
													7.95m: With a 50mm thick extremely weak sandstone bed.		
	9.0	SPT		100			S 12,32,40 N=72						Moderately weathered, medium grey, homogenous SANDSTONE, extremely weak, fine grained. **(East Coast Bays Formation)**	Mwe	
45.0													*9m: Becomes weakly cemented*		
	10.0	HQ3											*9.4m to 9.7m: With a few 2mm to 6mm thick, 45° inclined organic layers.*		

Started: 25/09/2006
Finished: 27/09/2006
Driller: Drillwell
Plant: TD 150
Logged: TPA
Checked: CG

Depth Related Remarks
From *Remarks*

Groundwater Observations
No. *Struck (m)* *Date* *Observations* *Standing (m)*
1. 4.3m 27/09/2006

Remarks

Co-ordinates:
5915918.81mN
1761370.28mE
Elevation: 54.50mRL
Inclination: -90°

Data Template: DATA TEMPLATE.GDT Output Form: DRILLHOLE Project File Name: ABBOTS_WAY03.GPJ 23/11/06

Version 1.6 28/08/2006 - S.Humphreys

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

NZGD ID: BH_67983

Log of Investigation

Project: **Abbotts Way Stormwater Upgrade**	**Drillhole**
Location: **Ellerslie Racecourse** Project No: **AE02819.12**	Hole ID: **DH3**
Client: **Auckland City Council**	Date: **29/09/2006**

R.L. (m)	Depth (m)	Drilling Method	Drilling Flush Return (%)	TCR (%)	RQD	Spacing of Natural Defects (mm)	In-Situ Testing	Relative Strength	Sampling	Weathering Grade	Geology Legend	GroundWater	Description of Strata	Geological Unit	Backfill / Installation
44.0				86			S 17,43,19 N=62\180							Mwe	
		SPT		100									Slightly weathered, medium grey, thinly bedded, sandy (fine) SILTSTONE, very weak. **(East Coast Bays Formation)**	Mwe	
43.0	11.0	HQ3		10									Significant core lost. Poorly cemented, very weak SANDSTONE with carbonised organic laminations. **(East Coast Bays Formation)**	Mwe	
42.0	12.0	SPT		100			S 14,60 N=60\150						Slightly weathered, medium grey, poorly cemented SANDSTONE, extremely weak, fine grained with a 50mm thick sandy siltstone @12.1m. **(East Coast Bays Formation)**	Mwe	
		HQ3		100	61								Slightly weathered, medium grey, homogenous SILTSTONE; very weak. **(East Coast Bays Formation)**	Mwe	
41.0	13.0												Slightly weathered, medium grey, poorly cemented SANDSTONE; extremely weak, with crushed zones @ 12.75m (20mm), 12.85m (50mm), 13m (100mm) and 13.15m (50mm). **(East Coast Bays Formation)**	Mwe	
		SPT		100			S 30,23,37 N=60\180						Unweathered, medium grey, well cemented, SANDSTONE, weak, fine grained. **(East Coast Bays Formation)**		
40.0	14.0	HQ3		100										Mwe	
	15.0														

Started: 25/09/2006
Finished: 27/09/2006
Driller: Drillwell
Plant: TD 150
Logged: TPA
Checked: CG

Depth Related Remarks
From *Remarks*

Groundwater Observations
No. *Struck (m)* *Date* *Observations* *Standing (m)*
1. 4.3m 27/09/2006

Remarks

Co-ordinates:
5915918.81mN
1761370.28mE
Elevation: 54.50mRL
Inclination: -90°

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

NZGD ID: BH_67983

SKM

Log of Investigation

Project: **Abbotts Way Stormwater Upgrade**

Drillhole

Location: **Ellerslie Racecourse** Project No: **AE02819.12**

Hole ID: **DH3**

Client: **Auckland City Council**

Date: **29/09/2006**

R.L. (m)	Depth (m)	Drilling Method	Drilling Flush Return (%)	TCR (%)	RQD	Spacing of Natural Defects (mm)	In-Situ Testing	Relative Strength	Sampling	Weathering Grade	Geology Legend	GroundWater	Description of Strata	Geological Unit	Backfill / Installation
		SPT		100			S 43,50 N=50\150						Unweathered, medium grey, homogenous SILTSTONE, weak. **(East Coast Bays Formation)**	Mwe	
39.0									C3				*15.45m: With a 100mm sandy siltstone, medium strong.*		
	16.0	HQ3		95	100								Unweathered, medium grey, well cemented, homogenous SANDSTONE, moderately strong, fine grained. **(East Coast Bays Formation)**	Mwe	
38.0													*16.15m: Becomes poorly to moderately cemented, very weak to weak.*		
	17.0	HQ3		77	55		C 50 N=50\150						Unweathered, medium grey, well cemented, homogenous sandy SILTSTONE, medium strong. **(East Coast Bays Formation)**	Mwe	
37.0													*17.1m: Becomes weak, includes organic laminations and a thin (40mm) fine sandstone bed.*	Mwe	
													17.22m to 17.23m: Crushed zone.		
	18.0												Unweathered, medium grey, poorly cemented SANDSTONE, very weak, fine grained with 20mm crushed zones. **(East Coast Bays Formation)**	Mwe	
							C 35,45,7 N=52\165						*17.6m: Becomes well cemented, moderately strong.*		
									C4				Unweathered, medium grey, homogenous SANDSTONE, weak to very weak, fine grained, occasional sub horizontal organic layers (2mm). 50mm crushed zone @17.7m. **(East Coast Bays Formation)**		
36.0		HQ3		100	100									Mwe	
	19.0												Unweathered, medium grey, homogenous SILTSTONE, weak. **(East Coast Bays Formation)**		
35.0													*19.5m: Becomes sandy.*		
	20.0												Unweathered, medium grey, homogenous silty SANDSTONE, weak, fine grained. **(East Coast Bays**	Mwe	

Started: 25/09/2006

Finished: 27/09/2006

Driller: Drillwell

Plant: TD 150

Logged: TPA

Checked: CG

Depth Related Remarks

From *Remarks*

Groundwater Observations

No.	*Struck (m)*	*Date*	*Observations*	*Standing (m)*
1.	4.3m	27/09/2006		

Remarks

Co-ordinates:

5915918.81mN

1761370.28mE

Elevation: 54.50mRL

Inclination: -90°

Data Template: DATA TEMPLATE.GDT Output Form: DRILLHOLE Project File Name: ABBOTS_WAY03.GPJ 23/11/06

Version 1.6 28/08/2006 - S.Humphreys

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

NZGD ID: BH_67983

Log of Investigation

Project: **Abbotts Way Stormwater Upgrade**	**Drillhole**
Location: **Ellerslie Racecourse** Project No: **AE02819.12**	Hole ID: **DH3**
Client: **Auckland City Council**	Date: **29/09/2006**

R.L. (m)	Depth (m)	Drilling Method	Drilling Flush Return (%)	TCR (%)	RQD	Spacing of Natural Defects (mm)	In-Situ Testing	Relative Strength	Sampling	Weathering Grade	Geology Legend	GroundWater	Description of Strata	Geological Unit	Backfill / Installation
		HQ3		93	93				C5				**Formation)**		
34.0														Mwe	
	21.0						C 50 N=50\150						Unweathered, medium grey sandy SILTSTONE, weak to very weak. **(East Coast Bays Formation)**		
33.0		HQ3		73	73								*21.4m: With a 50mm sandstone bed & extremely thin sandstone layers split into thin slabs.*	Mwe	
	22.0												*22m: With some 60mm thick organic layers inclined @20^0-25^0.*		
32.0													Unweathered, medium grey, homogenous silty SANDSTONE, weak to very weak, fine grained. **(East Coast Bays Formation)**		
	23.0						C 50 N=50\150						*22.5m: Becomes slabby, extremely weak to very weak, easily split into 10mm to 20mm slabs.*		
		HQ3		47										Mwe	
31.0															
	24.0						C 50 N=50\150						*24m: Becomes extremely weak to weak, fine to medium grained.*		
30.0													*24.2m: 20mm crushed zone retrieved as sandy fine to medium gravel.*		
		HQ3		73	60										
	25.0												Unweathered, medium grey sandy SILTSTONE, very weak to weak. **(East Coast Bays Formation)**	Mwe	

Started: 25/09/2006
Finished: 27/09/2006
Driller: Drillwell
Plant: TD 150
Logged: TPA
Checked: CG

Depth Related Remarks
From *Remarks*

Groundwater Observations

No.	*Struck (m)*	*Date*	*Observations*	*Standing (m)*
1.	4.3m	27/09/2006		

Remarks

Co-ordinates:
5915918.81mN
1761370.28mE
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Inclination: -90°

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

Data Template: DATA TEMPLATE.GDT Output Form: DRILLHOLE Project File Name: ABBOTS_WAY03.GPJ 23/11/06

Version 1.6 28/08/2006 - S.Humphreys

Log of Investigation

Project: **Abbotts Way Stormwater Upgrade**	**Drillhole**
Location: **Ellerslie Racecourse** Project No: **AE02819.12**	Hole ID: **DH3**
Client: **Auckland City Council**	Date: **29/09/2006**

R.L. (m)	Depth (m)	Drilling Method	Drilling Flush Return (%)	TCR (%)	RQD	Spacing of Natural Defects (mm)	In-Situ Testing	Relative Strength	Sampling	Weathering Grade	Geology Legend	GroundWater	Description of Strata	Geological Unit	Backfill / Installation
													25m: With a 70mm sandstone bed. Becomes less sandy with depth.	Mwe	
29.0															
	26.0	HQ3		67			C 50 N=50\150						Unweathered, medium grey, interbedded extremely weak SANDSTONE and very weak sandy SILTSTONE. Siltstone beds are moderately thin (150mm to 250mm) and includes few <10mm thick sandstone layers. Occasional organic lamination in siltstone. **(East Coast Bays Formation)**	Mwe	
28.0															
	27.0	HQ3		73			C 50 N=50\150						Unweathered, medium grey, very poorly cemented SANDSTONE (very dense sand like), extremely weak, fine grained. **(East Coast Bays Formation)**	Mwe	
27.0															
	28.0												*28.4m to 28.5m: With a 100mm thick sandy siltstone bed containing a few dark grey organic laminations.*		
26.0															
	29.0	HQ3		50			C 50 N=50\150						*29.5m to 29.6m: With a weak cemented sandstone bed.*		
25.0															
	30.0												DH3 terminated at 30.00m. Target Depth		

Started: 25/09/2006
Finished: 27/09/2006
Driller: Drillwell
Plant: TD 150
Logged: TPA
Checked: CG

Depth Related Remarks
From *Remarks*

Groundwater Observations
No. *Struck (m)* *Date* *Observations* *Standing (m)*
1. 4.3m 27/09/2006

Remarks

Co-ordinates:
5915918.81mN
1761370.28mE
Elevation: 54.50mRL
Inclination: -90°

Data Template: DATA TEMPLATE.GDT Output Form: DRILLHOLE Project File Name: ABBOTS_WAY03.GPJ 23/11/06

Version 1.6 28/08/2006 - S.Humphreys

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

NZGD ID: BH_67983

AE03390_SKM07_BH01

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25 Teed Street, Newmarket
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Borehole Logging Form

Bore: BH01

Project Name: Ellerslie Racecourse SW Upgrade
Drilling Date: 15/11/2007
Location: Ellerslie Racecourse
Project Number: AE03390.3

Drilling Company: Boart Longyear
Drilled Depth: 15m
Logged by: NDM
Drilling Method:
Bore Diameter: 100mm
Checked by: TPA
Co-ordinates: 2671704.00mE 6477579.00mN
Ground Elevation: 45.10mRL

Depth (m BGL)	TCR (%) (SCR (%))	RQD	Fracture Index	Sampling	Geology Legend	Description of Strata	Defect Description	Elevation (m)	Backfill / Installation	Comments
0.5	100	N/A	N/A	HA		Clayey SILT, dark brown. Firm, moist, moderate plasticity. Minor grass rootlets. **(Fill)** 0.32m: Becomes mottled yellow brown. Stiff. 0.60m: Absence of mottling. 0.75m: Becomes reddish brown. Very stiff, slightly plastic.		45.0 44.5		
1.0								44.0		
1.5	100	N/A	N/A	HQ3		Clayey SILT with minor fine grained sand, light yellow brown mottled yellow brown. Stiff, moist, moderate plasticity. **(East Coast Bays Formation)** 1.40m: Becomes mottled grey white. Very stiff, slightly plastic.				
2.0	100	N/A	N/A	SPT		Silty CLAY, light yellow brown mottled grey white. Very stiff, moist, moderate plasticity. **(East Coast Bays Formation)**		43.5 43.0		SPT=1,1,2N=3 (Open nose)
2.5	91	N/A	N/A	HQ3		Clayey SILT, orange brown. Very stiff, moist, slight plasticity. **(East Coast Bays Formation)** 2.70m: Becomes mottled brown white flecked dark brown. With highly weathered, extremely weak rock fragments. 2.80m: Becomes brown white mottled orange brown. Moderate plasticity.		42.5		
3.0	100	N/A	N/A	SPT		3.00m: With a moderately thin layer of stiff, grey white mottled orange silty clay. 3.12m: Becomes grey white mottled orange, firm, slightly plastic.		42.0		SPT=1,2,2N=4 (Open nose)
3.5						Sandy SILT, grey white mottled orange. Firm, moist, slight plasticity. Sand is fine grained. With occasional subhorizontal laminations. **(East Coast Bays Formation)** 3.45m: With a moderately thin layer of grey white, clayey silt. Trace fine to medium grained sand. 3.55m: Becomes orange brown. Sand is fine to medium grained. Minor clay. 3.68m: Becomes grey white mottled light brown. With trace fine, angular gravel fragments.		41.5		
4.0	72	17	N/A	HQ3		Moderately weathered, grey mottled orange, SILTSTONE. Extremely weak. **(East Coast Bays Formation)**				

Remarks
Groundwater not recorded during the investigation.

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

NZGD ID: BH_68054

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Borehole Logging Form — Bore: BH01

Project Name: Ellerslie Racecourse SW Upgrade **Drilling Date:** 15/11/2007
Location: Ellerslie Racecourse **Project Number:** AE03390.3

Drilling Company: Boart Longyear **Drilled Depth:** 15m **Logged by:** NDM
Drilling Method: **Bore Diameter:** 100mm **Checked by:** TPA
Co-ordinates: 2671704.00mE 6477579.00mN **Ground Elevation:** 45.10mRL

Depth (m BGL)	TCR (%) (SCR (%))	RQD	Fracture Index	Sampling	Geology Legend	Description of Strata	Defect Description	Elevation (m)	Backfill / Installation	Comments
	(36)					3.95m to 3.99m: Becomes orange. Unweathered, grey, SILTSTONE. Extremely weak. **(East Coast Bays Formation)** 4.15m: Siltstone becomes extremely weak to very weak.		41.0		
4.5										
	100	N/A	N/A	SPT		4.50m: With a moderately thin layer of very weak, fine to medium grained sandstone. 4.68m: Siltstone becomes very weak.		40.5		SPT=12,19,24N=43 (Open nose)
5.0						4.95m: With a thin layer of very weak, fine to medium grained sandstone. 4.98m: Bedding dips 60°. 5.10m: With a moderately thin layer of very weak, fine to medium grained sandstone (20° bedding dip).	5.03m to 5.07m: Joint (40°) smooth, planar, clean.	40.0		
5.5	53 (53)	11	4	HQ3		Unweathered, grey, fine to medium grained SANDSTONE. Very weak. **(East Coast Bays Formation)**	5.30m to 5.31m: Joint (10°) smooth, planar, clean. 5.32m to 5.34m: Joint (20°) smooth, planar, clean. 5.39m to 5.41m: Joint (25°) smooth, planar, clay coating.	39.5		
6.0										SPT=18,50N=50/90 (Solid nose)
						6.15m: Sandstone becomes fine grained. 6.21m: With a 4mm thick carbonaceous band, 45° dip. 6.26m: With minor carbonaceous flecks at 6.26m and some carbonaceous flecks at 6.28m. 6.37m: With moderately thin layers of very weak, siltstone at 6.37m-6.48m and at 6.54m-6.67m (30-40° bedding dip).	6.24m to 6.26m: Joint (30°) undulating. 6.31m to 6.32m: Joint (20°) rough, planar, clean.	39.0		
6.5							6.56m to 6.58m: Joint (30°) rough, planar, clean.	38.5		
	87 (85)	63	3	HQ3		6.67m: Bedding dips 20°. 6.79m: Sandstone becomes very fine grained.				
7.0						Unweathered, grey, SILTSTONE. Extremely weak to very weak. **(East Coast Bays Formation)**				
						7.05m: With a moderately thin layer of extremely weak to very weak, fine grained sandstone.	7.03m to 7.04m: Joint (10°) rough, planar, orange surface staining. 7.17m to 7.18m: Joint (10°) rough, planar, clean.	38.0		
						7.27m to 7.28m: Siltstone becomes extremely weak.				
7.5						Unweathered, grey, fine to medium grained SANDSTONE. Extremely weak to very weak. **(East Coast Bays Formation)**		37.5		SPT=43,50N=50/145 (Solid nose)
8.0										

Remarks
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Borehole Logging Form — Bore: BH01

Project Name: Ellerslie Racecourse SW Upgrade **Drilling Date:** 15/11/2007
Location: Ellerslie Racecourse **Project Number:** AE03390.3

Drilling Company: Boart Longyear **Drilled Depth:** 15m **Logged by:** NDM
Drilling Method: **Bore Diameter:** 100mm **Checked by:** TPA
Co-ordinates: 2671704.00mE 6477579.00mN **Ground Elevation:** 45.10mRL

Depth (m BGL)	TCR (%) (SCR (%))	RQD	Fracture Index	Sampling	Geology Legend	Description of Strata	Defect Description	Elevation (m)	Backfill / Installation	Comments
8.5	88 (87)	81	0	HQ3		8.10m: Sandstone becomes fine grained, extremely weak. 8.11m: Sandstone becomes extremely weak to very weak. 8.20m: With a 4mm thick carbonaceous band at 8.20m and a 6mm thick carbonaceous band at 8.21m, 45° dip. 8.35m: With a moderately thin layer of extremely weak to very weak siltstone. 8.52m: Sandstone becomes extremely weak at 8.52m and fine to medium grained at 8.57m. 8.61m: Sandstone becomes extremely weak to very weak. 8.75m: Sandstone becomes fine to coarse grained.		37.0 36.5		
9.0						9.00m: Sandstone becomes very weak.		36.0		SPT=50N=50/130 (Solid nose)
9.5	87 (87)	87	1	HQ3		9.33m to 9.36m: Sandstone becomes extremely weak.	9.19m to 9.20m: Joint (5°) rough, planar, clean.	35.5		
10.0						10.13m: Sandstone becomes fine grained, extremely weak to very weak.	9.86m to 9.88m: Joint (15°) rough, planar, clean.	35.0		
10.5						10.50m: With a moderately thin layer of very weak siltstone. 10.64m: Sandstone becomes very weak. Bedding dips 45°. 10.80m: Sandstone becomes extremely weak to very weak.		34.5		SPT=50N=50/150 (Solid nose)
11.0							10.92m to 10.96m: Joint (50°) rough, planar, orange surface staining. 10.94m to 10.95m: Joint (45°) rough, planar, clean.	34.0		
11.5	96 (93)	93	1	HQ3		11.39m: With a thin layer of very weak siltstone at 11.39m and a moderately thin layer at 11.43m (30° bedding dip). 11.41m: Sandstone becomes very weak at 11.41m and fine grained at 11.52m.		33.5		
12.0										

Remarks
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Borehole Logging Form — Bore: BH01

Project Name: Ellerslie Racecourse SW Upgrade
Drilling Date: 15/11/2007
Location: Ellerslie Racecourse
Project Number: AE03390.3

Drilling Company: Boart Longyear
Drilled Depth: 15m
Logged by: NDM
Drilling Method:
Bore Diameter: 100mm
Checked by: TPA
Co-ordinates: 2671704.00mE 6477579.00mN
Ground Elevation: 45.10mRL

Depth (m BGL)	TCR (%) (SCR (%))	RQD	Fracture Index	Sampling	Geology Legend	Description of Strata	Defect Description	Elevation (m)	Backfill / Installation	Comments
						12.00m: Sandstone becomes fine to medium grained, extremely weak to very weak.		33.0		SPT=36,50N=50/50 (Solid nose)
12.5						12.26m: With a thin layer of very weak siltstone. 12.30m: Sandstone becomes fine grained, very weak.		32.5		
	52 (52)	45	0	HQ3		12.72m: Sandstone becomes fine to coarse grained.				
13.0								32.0		
13.5						13.50m: Sandstone becomes fine grained, extremely weak to very weak.		31.5		SPT=50N=50/125 (Solid nose)
						Unweathered, grey, SILTSTONE. Very weak. **(East Coast Bays Formation)**				
14.0						Unweathered, grey, fine grained SANDSTONE. Extremely weak. **(East Coast Bays Formation)** 13.98m: Sandstone becomes fine to medium grained, very weak. 14.07m: With some carbonaceous flecks		31.0		
	91 (91)	83	1	HQ3		Unweathered, grey, SILTSTONE. Very weak. **(East Coast Bays Formation)**	14.44m to 14.46m: Joint (20°) rough, planar, clean.			
14.5								30.5		
						Unweathered, grey, fine grained SANDSTONE. Very weak. **(East Coast Bays Formation)**				
15.0						BH01 terminated at 15.00m. Target Depth				SPT=50N=50/110 (Solid nose)

Remarks
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Borehole Logging Form

Bore: BH06

Project Name: Ellerslie Racecourse SW Upgrade
Drilling Date: 19/11/2007
Location: Ellerslie Racecourse
Project Number: AE03390.3

Drilling Company: Boart Longyear
Drilled Depth: 26m
Logged by: VK
Drilling Method:
Bore Diameter: 100mm
Checked by: TPA
Co-ordinates: 2671225.00mE 6477788.00mN
Ground Elevation: 42.90mRL

Depth (m BGL)	TCR (%) (SCR (%))	RQD	Fracture Index	Sampling	Geology Legend	Description of Strata	Defect Description	Elevation (m)	Backfill / Installation	Comments
0.5	100	N/A	N/A	HA		SILT with minor fine grained sand, dark brown. Stiff, moist, non plastic. **(Topsoil / Fill)**		42.5		
						Silty CLAY, dark brown, Very stiff, moist, moderate plasticity. **(Fill)**				
1.0	100	N/A	N/A	HQ3		Clayey SILT, greyish white intermixed brownish orange. Very stiff, moist, slight plasticity. **(Fill)**		42.0		
						0.70m: Becomes dark orange brown, hard, moderate plasticity.				
1.5	88	N/A	N/A	HQ3		1.00m: With minor medium to coarse, angular to subangular, strong basalt gravel, gap graded, max. size 40mm and trace fine sand.		41.5		
						Slightly weathered, BASALT, grey. Strong, highly vesicular (max 50mmØ). **(Basalt Lava)**	1.63m to 1.66m: Joint (8°) rough, planar.			
2.0	92 (92)	92	3	HQ3			1.76m to 1.77m: Joint (5°) rough, planar.	41.0		
							2.04m to 2.08m: Joint (50°) rough, planar.			
2.5							2.27m to 2.29m: Joint (5°) rough, planar.	40.5		
3.0							2.98m to 3.00m: Joint rough, stepped, infilled brown silt.	40.0		
						3.28m: Becomes less vesicular (max 12mmØ).	3.28m to 3.30m: Joint (15°) rough, planar, clean.	39.5		
3.5							3.55m: Joint (0°) rough, planar, clean.			
4.0	100 (100)	100	3	HQ3			3.75m to 3.78m: Joint (10°) rough, planar, clean. 3.77m: Joint (0°) rough, planar, clean.	39.0		

Remarks
Groundwater not recorded during the investigation.

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Borehole Logging Form — Bore: BH06

Project Name: Ellerslie Racecourse SW Upgrade
Drilling Date: 19/11/2007
Location: Ellerslie Racecourse
Project Number: AE03390.3

Drilling Company: Boart Longyear
Drilled Depth: 26m
Logged by: VK
Drilling Method:
Bore Diameter: 100mm
Checked by: TPA
Co-ordinates: 2671225.00mE 6477788.00mN
Ground Elevation: 42.90mRL

Depth (m BGL)	TCR (%) (SCR (%))	RQD	Fracture Index	Sampling	Geology Legend	Description of Strata	Defect Description	Elevation (m)	Backfill / Installation	Comments
4.5							4.01m to 4.03m: Joint rough, planar, stained orange brown.	38.5		
5.0	100 (95)	95	1	HQ3		5.10m: With occasional vesicles (max 4mmØ).	4.65m to 4.67m: Joint (30°) rough, planar, clean.	38.0		
5.5							5.20m to 5.30m: Joint (15°) smooth, planar, clean.	37.5		
6.0								37.0		
6.5	70 (55)	35	5	HQ3		6.20m: Becomes moderately weathered, dark grey; with lesser strength, max vesicle 15mmØ. Very closely fractured from 6.2 - 6.27m, recovered as medium to coarse gravel size fragments with brown staining. 6.27m to 6.70m: Closely fractured.	6.45m: Joint (0°) rough, planar, brown staining. 6.49m to 6.53m: Joint (35°) rough, planar, brown staining. 6.60m to 6.63m: Joint (40°) smooth, planar, brown staining. 6.67m to 6.78m: Joint (60°) smooth, planar, brown staining. 6.80m to 6.91m: Joint (50°) smooth, planar, brown staining.	36.5 36.0		
7.0								35.5		
7.5						7.50m to 7.62m: Highly fractured, recovered as fine to coarse gravel sized fragments with reddish brown staining.	7.50m to 7.62m: Fracture zone. 7.62m to 7.78m: Joint (85°) rough, planar, brown staining.			
8.0						7.90m to 8.16m: Highly fractured, recovered as fine to coarse gravel sized fragments with reddish	7.80m to 7.82m: Joint (30°) rough, planar, brown staining. 7.90m to 8.16m: Fracture zone.	35.0		

Remarks
Groundwater not recorded during the investigation.

Data Template: DATA TEMPLATE.GDT Output Form: VPT DRILLHOLE LOG Project File Name: BORE LOGS.GPJ 18/2/08

Version 1.6 28/08/2006 - S.Humphreys

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Borehole Logging Form — Bore: BH06

Project Name: Ellerslie Racecourse SW Upgrade **Drilling Date:** 19/11/2007
Location: Ellerslie Racecourse **Project Number:** AE03390.3

Drilling Company: Boart Longyear **Drilled Depth:** 26m **Logged by:** VK
Drilling Method: **Bore Diameter:** 100mm **Checked by:** TPA
Co-ordinates: 2671225.00mE 6477788.00mN **Ground Elevation:** 42.90mRL

Depth (m BGL)	TCR (%) (SCR (%))	RQD	Fracture Index	Sampling	Geology Legend	Description of Strata	Defect Description	Elevation (m)	Backfill / Installation	Comments
8.5	69 (35)	35	5	HQ3		brown staining.	7.90m to 8.16m: Fracture zone. 8.16m to 8.26m: Joint (50°) smooth, planar, clean. 8.39m to 8.49m: Joint (85°) smooth, planar, silt coating. 8.39m to 8.52m: Joint (75°) rough, planar, trace tiny mineral (?) flecks.	34.5		
9.0								34.0		
9.5	95 (88)	68	5	HQ3		9.30m to 9.40m: Highly fractured, recovered as fine to coarse gravel sized fragments with reddish brown staining.	9.00m to 9.06m: Joint (50°) rough, planar, clean. 9.30m to 9.40m: Fracture zone. 9.40m: Joint (0°) rough, planar, silty sand coating. 9.49m: Joint (0°) rough, planar, clean. 9.54m to 9.57m: Joint (20°) rough, stepped. 9.64m: Joint (10°) rough, planar. 9.72m to 10.32m: Joint (85°) rough, undulating, trace silt.	33.5		
10.0								33.0		
10.5						10.50m: Becomes stronger with fine vesicles.	10.32m to 10.36m: Joint (30°) smooth, planar, clean.	32.5		
11.0	100 (100)	100	2	HQ3		10.90m: Becomes less vesicular.	11.21m to 11.22m: Joint (5°) smooth, planar, clean. 11.35m: Joint (0°) rough, undulating, clean.	32.0		
11.5								31.5		
12.0							11.84m: Joint (0°) rough, planar, clean. 11.90m.	31.0		

Remarks
Groundwater not recorded during the investigation.

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Borehole Logging Form — Bore: BH06

Project Name: Ellerslie Racecourse SW Upgrade
Drilling Date: 19/11/2007
Location: Ellerslie Racecourse
Project Number: AE03390.3

Drilling Company: Boart Longyear
Drilled Depth: 26m
Logged by: VK
Drilling Method:
Bore Diameter: 100mm
Checked by: TPA
Co-ordinates: 2671225.00mE 6477788.00mN
Ground Elevation: 42.90mRL

Depth (m BGL)	TCR (%) (SCR (%))	RQD	Fracture Index	Sampling	Geology Legend	Description of Strata	Defect Description	Elevation (m)	Backfill / Installation	Comments
12.5								30.5		
	100 (100)	100	2	HQ3			12.45m to 12.48m: Joint (15°) rough, planar, clean.			
13.0							12.73m: rough, planar, clean.	30.0		
							13.31m to 13.33m: Joint rough, planar, stained orange.			
13.5								29.5		
14.0								29.0		
	100 (100)	100	0	HQ3						
14.5								28.5		
						14.82m to 15.02m: Becomes highly vesicular.				
15.0								28.0		
								27.5		
15.5							15.46m: Joint (0°) smooth, planar, clean.			
	97 (97)	97	3	HQ3		15.79m: Becomes less vesicular.				
16.0							15.89m to 15.95m: Joint (50°) smooth, planar, infilled yellowish brown clay.	27.0		

Remarks
Groundwater not recorded during the investigation.

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Borehole Logging Form — Bore: BH06

Project Name: Ellerslie Racecourse SW Upgrade
Location: Ellerslie Racecourse
Drilling Date: 19/11/2007
Project Number: AE03390.3

Drilling Company: Boart Longyear
Drilling Method:
Co-ordinates: 2671225.00mE 6477788.00mN
Drilled Depth: 26m
Bore Diameter: 100mm
Ground Elevation: 42.90mRL
Logged by: VK
Checked by: TPA

Depth (m BGL)	TCR (%) (SCR (%))	RQD	Fracture Index	Sampling	Geology Legend	Description of Strata	Defect Description	Elevation (m)	Backfill / Installation	Comments
16.5							16.05m to 16.23m: Joint (85°) rough, planar, infilled yellowish brown clay. 16.23m to 16.25m: Joint (20°) smooth, planar, infilled yellowish brown clay.	26.5		
						16.50m: Absence of vesicles.				
							16.69m to 16.78m: Joint (60°) smooth, planar, coated greyish brown clay.	26.0		
17.0										
	100 (90)	80	3	HQ3				25.5		
17.5							17.45m to 17.56m: Joint (70°) smooth, planar, clean. 17.75m to 17.81m: Joint.			
							17.90m to 18.00m: Joint smooth, planar, stained orange.	25.0		
18.0										
							18.11m to 18.16m: Joint (60°) smooth, planar, clean. 18.16m to 18.19m: Joint (60°) smooth, planar, clean.	24.5		
18.5										
	93 (86)	82	1	HQ3				24.0		
19.0										
								23.5		
19.5										
								23.0		
20.0										

Remarks
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Borehole Logging Form — Bore: BH06

Project Name: Ellerslie Racecourse SW Upgrade
Drilling Date: 19/11/2007
Location: Ellerslie Racecourse
Project Number: AE03390.3

Drilling Company: Boart Longyear
Drilled Depth: 26m
Logged by: VK
Drilling Method:
Bore Diameter: 100mm
Checked by: TPA
Co-ordinates: 2671225.00mE 6477788.00mN
Ground Elevation: 42.90mRL

Depth (m BGL)	TCR (%) (SCR (%))	RQD	Fracture Index	Sampling	Geology Legend	Description of Strata	Defect Description	Elevation (m)	Backfill / Installation	Comments
20.5	100 (100)	100	0	HQ3		20.23m: Moderate vesicularity at 20.3m-20.46 and at 20.58m-20.9m.		22.5		
21.0								22.0		
21.5	100 (100)	100	0	HQ3		22.00m: Becomes moderately to highly vesicular (max 16mmØ).		21.5		
22.0								21.0		
22.5						BASALT GRAVEL in a silty clay matrix, dark grey. Loose, moist, fine. Trace medium grains. **(Transition Zone)**		20.5		
23.0	100	N/A	N/A	HQ3		Silty CLAY, dark brown black. Stiff, moist, moderate plasticity. With trace carbonaceous material. **(Puketoka Formation)**		20.0		
23.5	100	N/A	N/A	SPT		23.70m: With a small piece of organic material. 23.75m: Becomes grey. With occasional carbonaceous flecks.		19.5		
24.0						Sandy SILT, some clay, light grey. Stiff, moist, non plastic. **(Puketoka Formation, ?)**		19.0		

Remarks
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Borehole Logging Form — Bore: BH06

Project Name: Ellerslie Racecourse SW Upgrade
Drilling Date: 19/11/2007
Location: Ellerslie Racecourse
Project Number: AE03390.3

Drilling Company: Boart Longyear
Drilled Depth: 26m
Logged by: VK
Drilling Method:
Bore Diameter: 100mm
Checked by: TPA
Co-ordinates: 2671225.00mE 6477788.00mN
Ground Elevation: 42.90mRL

Depth (m BGL)	TCR (%) (SCR (%))	RQD	Fracture Index	Sampling	Geology Legend	Description of Strata	Defect Description	Elevation (m)	Backfill / Installation	Comments
						24.00m: With minor orange brown mottles.		18.5		SPT=8,12,17N=29 (Open nose)
24.5	100	N/A	N/A	HQ3		Clayey SILT, some fine grained sand, grey with occasional orange brown mottles. Stiff, moist, low plasticity. **(Puketoka Formation, ?)**				
						Silty SAND, minor clay, grey. Medium dense, moist, fine grained. **(Puketoka Formation, ?)**		18.0		
25.0										
						Silty CLAY, minor fine grained sand, grey. Stiff, moist, moderate plasticity. **(Puketoka Formation, ?)**		17.5		
25.5	100	N/A	N/A	HQ3		Silty SAND, minor clay, greyish brown. Medium dense, moist, fine grained. **(Puketoka Formation, ?)**				
						Sandy SILT, trace clay, greyish brown. Firm, moist, non plastic. With trace carbonaceous material. **(Puketoka Formation, ?)**		17.0		
26.0						BH06 terminated at 26.00m. Target Depth				

Remarks
Groundwater not recorded during the investigation.

NZGD ID: BH_68058

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Borehole Logging Form

Bore: BH15

Project Name: Ellerslie Racecourse SW Upgrade
Drilling Date: 15/11/2007
Location: Ellerslie Racecourse
Project Number: AE03390.3

Drilling Company: Boart Longyear
Drilled Depth: 12m
Logged by: NDM
Drilling Method:
Bore Diameter: 100mm
Checked by: TPA
Co-ordinates: 2671561.00mE 6477807.00mN
Ground Elevation: 47.40mRL

Depth (m BGL)	TCR (%) (SCR (%))	RQD	Fracture Index	Sampling	Geology Legend	Description of Strata	Defect Description	Elevation (m)	Backfill / Installation	Comments
0.5	100	N/A	N/A	HA		Clayey SILT, dark brown. Very stiff, moist, slight plasticity. With trace grass rootlets. **(Fill)**		47.0		
1.0						Clayey SILT with some fine grained sand, grey white mottled orange. Stiff, moist, slight plasticity. **(East Coast Bays Formation)**				
1.5	100	N/A	N/A	HQ3		0.89m: Becomes light orange, slight to non plasticity.		46.5		
2.0	89	N/A	N/A	SPT		Silty SAND with minor clay, light orange mottled grey white. Loose, moist, fine to medium grained. **(East Coast Bays Formation)** 1.64m: Becomes grey white. With trace clay.		46.0		SPT=2,2,4N=6 (Open nose)
2.5	87	N/A	N/A	HQ3		Clayey SAND with minor silt, grey white mottled light orange. Loose, moist, fine to medium grained. **(East Coast Bays Formation)** 2.42m to 2.56m: With thin, subhorizontal laminations.		45.5		
3.0	100	N/A	N/A	SPT		Moderately weathered, grey, fine to medium grained SANDSTONE. Extremely weak. **(East Coast Bays Formation)**		45.0		SPT=3,7,9N=16 (Open nose)
3.5								44.5		
4.0	71	71	N/A	HQ3				44.0		
								43.5		

Remarks
Groundwater not recorded during the investigation.

NZGD ID: BH_68066

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Borehole Logging Form — Bore: BH15

Project Name: Ellerslie Racecourse SW Upgrade
Drilling Date: 15/11/2007
Location: Ellerslie Racecourse
Project Number: AE03390.3

Drilling Company: Boart Longyear
Drilled Depth: 12m
Logged by: NDM
Drilling Method:
Bore Diameter: 100mm
Checked by: TPA
Co-ordinates: 2671561.00mE 6477807.00mN
Ground Elevation: 47.40mRL

Depth (m BGL)	TCR (%) (SCR (%))	RQD	Fracture Index	Sampling	Geology Legend	Description of Strata	Defect Description	Elevation (m)	Backfill / Installation	Comments
	(71)							43.0		
4.5	100	N/A	N/A	SPT						SPT=6,9,14N=23 (Open nose)
								42.5		
5.0						4.95m: Sandstone becomes fine grained, extremely weak to very weak.				
								42.0		
5.5	30 (30)	30	0	HQ3						
								41.5		
6.0						6.00m to 6.20m: With a moderately thin layer of extremely weak to very weak siltstone.				SPT=11,16,17N=33 (Solid nose)
						6.21m to 6.25m: With a 10 mm thick carbonaceous band; 45° dip.		41.0		
6.5										
	33 (33)	33	0	HQ3				40.5		
7.0										
								40.0		
7.5										SPT=12,20,30N=50/275 (Solid nose)
								39.5		
8.0										

Remarks
Groundwater not recorded during the investigation.

NZGD ID: BH_68066

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Borehole Logging Form — Bore: BH15

Project Name: Ellerslie Racecourse SW Upgrade
Drilling Date: 15/11/2007
Location: Ellerslie Racecourse
Project Number: AE03390.3

Drilling Company: Boart Longyear
Drilled Depth: 12m
Logged by: NDM
Drilling Method:
Bore Diameter: 100mm
Checked by: TPA
Co-ordinates: 2671561.00mE 6477807.00mN
Ground Elevation: 47.40mRL

Depth (m BGL)	TCR (%) (SCR (%))	RQD	Fracture Index	Sampling	Geology Legend	Description of Strata	Defect Description	Elevation (m)	Backfill / Installation	Comments
8.5	27 (19)	19	0	HQ3				39.0		
9.0								38.5		SPT=13,29,21N=50/265 (Solid nose)
9.5	73 (73)	73	0	HQ3				38.0		
10.0	100 (100)	100	0	HQ3		9.99m: Sandstone becomes extremely weak.		37.5		
10.5	96 (96)	96	0	HQ3		10.50m: Sandstone becomes extremely weak to very weak.		37.0		SPT=22,35,15N=50/210 (Solid nose)
11.0								36.5		
11.5	100 (100)	100	0	HQ3		Unweathered, fine to medium grained, SANDSTONE, grey. Very weak. **(East Coast Bays Formation)**		36.0		
12.0								35.5		

Remarks
Groundwater not recorded during the investigation.

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

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Borehole Logging Form — Bore: BH15

Project Name: Ellerslie Racecourse SW Upgrade
Drilling Date: 15/11/2007
Location: Ellerslie Racecourse
Project Number: AE03390.3

Drilling Company: Boart Longyear
Drilled Depth: 12m
Logged by: NDM
Drilling Method:
Bore Diameter: 100mm
Checked by: TPA
Co-ordinates: 2671561.00mE 6477807.00mN
Ground Elevation: 47.40mRL

Depth (m BGL)	TCR (%) (SCR (%))	RQD	Fracture Index	Sampling	Geology Legend	Description of Strata	Defect Description	Elevation (m)	Backfill / Installation	Comments
						BH15 terminated at 12.00m. Target Depth				SPT=26,44,6N=50/175 (Solid nose)

Remarks
Groundwater not recorded during the investigation.

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Borehole Logging Form

Bore: BH16

Project Name: Ellerslie Racecourse SW Upgrade
Drilling Date: 14/11/2007
Location: Ellerslie Racecourse
Project Number: AE03390.3

Drilling Company: Boart Longyear
Drilled Depth: 15m
Logged by: NDM
Drilling Method:
Bore Diameter: 100mm
Checked by: TPA
Co-ordinates: 2671644.00mE 6477734.00mN
Ground Elevation: 46.70mRL

Depth (m BGL)	TCR (%) (SCR (%))	RQD	Fracture Index	Sampling	Geology Legend	Description of Strata	Defect Description	Elevation (m)	Backfill / Installation	Comments
0.5	100	N/A	N/A	HA		Clayey SILT, dark brown. Stiff, moist, slight plasticity. With trace grass rootlets. **(Fill)**		46.5		
						GRAVEL, dark orange brown. Loose, fine to coarse. Gravel is completely weathered to highly weathered, subangular basalt; extremely weak to very weak. **(Fill)**				
						Clayey SILT, orange brown. Firm, moist, low plasticity. **(Fill)**		46.0		
						Highly weathered, basalt COBBLE. Weak, moderately vesicular (max. vesicle size 1mmØ) **(Fill)**				
1.0	25	N/A	N/A	HQ3		No core recovery.		45.5		
1.5						Moderately weathered, grey, fine to medium grained SANDSTONE. Very weak. **(East Coast Bays Formation)**				
							1.71m to 1.74m: Joint (10°) rough, planar, stained orange. 1.77m to 1.79m: Joint (20°) rough, planar, stained orange.	45.0		
						1.84m: Sandstone becomes extremely weak.				
2.0						1.99m: Sandstone becomes extremely weak to very weak.	1.98m to 2.03m: Joint (45°) rough, planar, clean.			
	94 (94)	0	9	HQ3		2.28m: Sandstone becomes very weak.		44.5		
2.5						2.35m: Very closely jointed between 2.35m and 2.78m. Three rough, planar, clean, joint sets inclined @ 20°, 45° and 70°.				
						Moderately weathered, grey, SILTSTONE. Very weak. **(East Coast Bays Formation)**				
3.0						2.68m: Siltstone becomes extremely weak at 2.68m-2.71m and at 2.74m-2.76m.		44.0		
										SPT=10,20,30N=50 (Solid nose)
3.5						Unweathered, grey, SILTSTONE. Extremely weak. **(East Coast Bays Formation)**		43.5		
						3.45m: Siltstone becomes extremely weak to very weak. 3.53m: With a moderately thin layer of very weak, fine grained sandstone (45° bedding dip). 3.63m: Siltstone becomes very weak.				
4.0	71 (71)	40	5	HQ3			3.63m to 3.65m: Joint (20°) rough, planar, clean. 3.76m to 3.78m: Joint (20°) rough, planar, clean. 3.81m to 3.83m: Joint (20°) rough, undulating, clean. 3.89m to 3.90m: Joint (10°) rough,	43.0		

Remarks
Groundwater not recorded during the investigation.

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

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Borehole Logging Form — Bore: BH16

Project Name: Ellerslie Racecourse SW Upgrade **Drilling Date:** 14/11/2007
Location: Ellerslie Racecourse **Project Number:** AE03390.3

Drilling Company: Boart Longyear **Drilled Depth:** 15m **Logged by:** NDM
Drilling Method: **Bore Diameter:** 100mm **Checked by:** TPA
Co-ordinates: 2671644.00mE 6477734.00mN **Ground Elevation:** 46.70mRL

Depth (m BGL)	TCR (%) (SCR (%))	RQD	Fracture Index	Sampling	Geology Legend	Description of Strata	Defect Description	Elevation (m)	Backfill / Installation	Comments
4.5						Unweathered, grey, fine grained SANDSTONE. Very weak. **(East Coast Bays Formation)**	planar, clean. 4.00m to 4.02m: Joint (20°) rough, planar, clean.	42.5		
						Very thin interbeds of unweathered, grey, SILTSTONE and fine grained SANDSTONE. Very weak (40° bedding dip). **(East Coast Bays Formation)**	4.21m to 4.22m: Joint (5°) rough, planar, clean. 4.33m to 4.34m: Joint (10°) rough, planar, clean. 4.41m to 4.42m: Joint (10°) rough, planar, clean.			SPT=10,30,20N=50/200 (Solid nose)
5.0						Unweathered, grey, SILTSTONE. Extremely weak. **(East Coast Bays Formation)** 4.78m: Siltstone becomes very weak. Very closely fractured between 4.78m to 5.85m.	4.78m to 4.82m: Joint (40°) rough, planar, clean. 4.89m to 5.20m: Joint. Highly fractured. 4.90m to 4.95m: Joint (45°) smooth, planar, clean. 4.97m to 5.01m: Joint (40°) rough, planar, clean. 4.97m to 4.98m: Joint (30°) smooth, planar, clean.	42.0		
5.5	91 (69)	25	9	HQ3		Unweathered, grey, very fine grained SANDSTONE. Very weak. **(East Coast Bays Formation)** 5.46m: Sandstone becomes fine to medium grained. 5.54m: With a moderately thin layer of very weak siltstone. 5.63m: Sandstone becomes fine grained.	5.01m to 5.10m: Joint (60°) smooth, planar, clean. 5.11m to 5.17m: Joint (45°) smooth, planar, clean. 5.17m to 5.20m: Joint (50°) rough, planar, clean. 5.26m to 5.30m: Joint (45°) rough, planar, clean. 5.38m to 5.40m: Joint (30°) rough, planar, clean. 5.47m to 5.55m: Joint (60°) rough, planar, clean.	41.5		
6.0						Unweathered, grey, SILTSTONE. Very weak. **(East Coast Bays Formation)** 5.92m: Siltstone becomes extremely weak. 6.00m: Siltstone becomes very weak. 6.10m: With a thin layer of extremely weak to very weak, fine grained, sandstone at 6.1m, 6.23m and 6.54m (20-30° bedding dip).	5.50m to 5.53m: Joint (45°) rough, planar, clean. 5.71m to 5.82m: Joint (20°) rough, planar, clean. 5.77m to 5.79m: Joint (30°) rough, planar, clean. 5.81m to 5.85m: Joint (45°) smooth, planar, clean.	41.0		
6.5								40.5		SPT=16,30,20N=50/250 (Solid nose)
7.0	80 (80)	80	0	HQ3		Unweathered, grey, fine grained SANDSTONE. Very weak. **(East Coast Bays Formation)** 6.65m to 6.72m: With a 10mm thick carbonaceous band; 60° dip. 6.74m: With a moderately thin layer of very weak siltstone. 6.77m to 6.84m: With a very thin layer of fine grained sandstone and 3mm thick carbonaceous band; 60° dip. 6.96m to 7.10m: Sandstone become extremely weak to very weak.		40.0		
7.5								39.5		
8.0						Unweathered, grey, SILTSTONE. Extremely weak. **(East Coast Bays Formation)**		39.0		SPT=21,42,8N=50/180 (Solid nose)

Remarks
Groundwater not recorded during the investigation.

NZGD ID: BH_68067

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Borehole Logging Form

Bore: BH16

Project Name: Ellerslie Racecourse SW Upgrade
Drilling Date: 14/11/2007
Location: Ellerslie Racecourse
Project Number: AE03390.3

Drilling Company: Boart Longyear
Drilled Depth: 15m
Logged by: NDM
Drilling Method:
Bore Diameter: 100mm
Checked by: TPA
Co-ordinates: 2671644.00mE 6477734.00mN
Ground Elevation: 46.70mRL

Depth (m BGL)	TCR (%) (SCR (%))	RQD	Fracture Index	Sampling	Geology Legend	Description of Strata	Defect Description	Elevation (m)	Backfill / Installation	Comments
8.5	80 (80)	80	1	HQ3		Unweathered, grey, very fine grained SANDSTONE. Extremely weak. **(East Coast Bays Formation)** 8.42m: Sandstone becomes fine grained. 8.47m: Sandstone becomes fine to medium grained.	8.11m to 8.12m: Joint (10°) rough, planar, clean.	38.5 38.0		
9.0						Unweathered, grey, SILTSTONE. Extremely weak to very weak. **(East Coast Bays Formation)** 9.23m: Siltstone becomes very weak.		37.5		SPT=21,37,13N=50/170 (Solid nose)
9.5	80 (76)	57	3	HQ3		Unweathered, grey, very fine grained, SANDSTONE. Very weak. **(East Coast Bays Formation)** 9.58m: Sandstone becomes fine grained. 9.66m: Sandstone becomes fine to medium grained.	9.29m to 9.36m: Joint (40°) smooth, planar, clean. 9.35m to 9.39m: Joint (45°) rough, planar, clean. 9.41m to 9.42m: Joint (20°) rough, planar, clean. 9.92m to 9.95m: Joint (40°) rough, planar, clean.	37.0 36.5		
10.5						Unweathered, grey, SILTSTONE. Very weak. **(East Coast Bays Formation)** 10.86m: With a moderately thin layer of very weak, very fine grained sandstone.		36.0		SPT=20,33,17N=50/175 (Solid nose)
11.0	91 (81)	57	1	HQ3		11.15m: With a thin layer of extremely weak, fine grained sandstone. 11.18m: Siltstone becomes extremely weak.	11.18m to 11.19m: Joint (20°) rough, planar, clean. 11.28m to 11.45m. Highly fractured. 11.29m to 11.30m: Joint (20°) rough, planar, clean.	35.5		
11.5						Unweathered, grey, fine to medium grained SANDSTONE. Extremely weak. **(East Coast Bays Formation)** 11.45m: Sandstone becomes very weak.		35.0		
12.0										

Remarks
Groundwater not recorded during the investigation.

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

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Borehole Logging Form — Bore: BH16

Project Name: Ellerslie Racecourse SW Upgrade
Drilling Date: 14/11/2007
Location: Ellerslie Racecourse
Project Number: AE03390.3

Drilling Company: Boart Longyear
Drilled Depth: 15m
Logged by: NDM
Drilling Method:
Bore Diameter: 100mm
Checked by: TPA
Co-ordinates: 2671644.00mE 6477734.00mN
Ground Elevation: 46.70mRL

Depth (m BGL)	TCR (%) (SCR (%))	RQD	Fracture Index	Sampling	Geology Legend	Description of Strata	Defect Description	Elevation (m)	Backfill / Installation	Comments
12.5	98 (93)	67	3	HQ3		Unweathered, grey, SILTSTONE. Very weak to weak. **(East Coast Bays Formation)** 12.16m: With thin layers of very weak, fine grained sandstone at 12.16m, 12.31m and extremely weak to very weak at 12.42m. 12.20m: Siltstone becomes very weak. 12.70m: With a very thin layer of very weak, fine grained sandstone. 12.72m: Siltstone becomes very weak. 12.84m: With a moderately thin layer of very weak, fine grained sandstone.	12.10m to 12.13m: Joint (20°) rough, planar, clean. 12.35m to 12.38m: Joint (45°) rough, planar, clean. 13.09m to 13.10m: Joint (10°) rough, planar, clean. 13.24m to 13.28m: Joint (45°) rough, planar, clean.	34.5 34.0 33.5		SPT=50N=50/50 (Solid nose)
13.0										
13.5						Unweathered, grey, fine to medium grained SANDSTONE. Very weak. **(East Coast Bays Formation)** 13.50m: Sandstone becomes very weak to weak.		33.0		SPT=35,50N=50/50 (Solid nose)
14.0	90 (90)	62	3	HQ3		Unweathered, grey, SILTSTONE. Very weak (15° bedding dip). **(East Coast Bays Formation)** 13.93m: Siltstone becomes very weak to weak. 14.10m: Siltstone becomes weak. 14.19m: Siltstone becomes very weak to weak. 14.31m: With thin layers of very weak to weak, fine grained sandstone at 14.31m (40° bedding dip) and very weak at 14.5m (45° bedding dip). 14.36m: Siltstone becomes very weak to weak. 14.56m: Siltstone becomes weak. Bedding becomes subhorizontal.	13.97m to 14.00m: Joint (45°) rough, planar, clean. 14.18m to 14.20m: Joint (20°) rough, undulating, clean. 14.61m to 14.63m: Joint (10°) rough, planar, clean. 14.67m to 14.69m: Joint (30°) rough, planar, clean.	32.5 32.0		
14.5										
15.0						BH16 terminated at 15.00m. Target Depth				SPT=50N=50/80 (Solid nose)

Remarks
Groundwater not recorded during the investigation.

NZGD ID: BH_68067

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Borehole Logging Form

Bore: BH17

Project Name: Ellerslie Racecourse SW Upgrade
Drilling Date: 12/11/2007
Location: Ellerslie Racecourse
Project Number: AE03390.3

Drilling Company: Boart Longyear
Drilled Depth: 15m
Logged by: VWW
Drilling Method:
Bore Diameter: 100mm
Checked by: TPA
Co-ordinates: 2671706.00mE 6477664.00mN
Ground Elevation: 46.20mRL

Depth (m BGL)	TCR (%) (SCR (%))	RQD	Fracture Index	Sampling	Geology Legend	Description of Strata	Defect Description	Elevation (m)	Backfill / Installation	Comments
0.0						Silty CLAY, trace fine sand, brown. Firm, moist, high plasticity. Trace rootlets. **(Topsoil / Fill)**		46.0		
0.5	73	N/A	N/A	HQ		Silty CLAY, minor fine to medium gravel, light grey mottled orange brown with dark brownish red. Stiff, moist, high plasticity. Gravel is subangular scoria. Trace rootlets. **(Fill)** 0.32m: Trace carbonaceous material. Absence of scoria gravel. Becomes light greenish grey mottled orange brown. 0.53m to 0.55m: With a fine sandy clay lense. 0.79m: With some greyish green flecks. 0.87m: With a 50mm thick light brownish grey, loose, moist, fine to medium grained, silty sand layer @ 0.87m.		45.5		
1.0						Sandy SILT, trace fine gravel (scoria), trace clay, orange brown mottled light grey. Stiff, moist, slight plasticity. Sand is fine. **(Fill)**		45.0		
1.5						Silty SAND, orange brown. Very loose, moist. Fine to medium grained. **(Fill)**				
2.0	100	N/A	N/A	SPT		Silty CLAY, grey with greyish green flecks. Firm, moist, moderate plasticity. Minor organic material and rootlets. **(Fill)** Moderately weathered TUFF, weakly to moderately weakly welded, dark green mixed with greyish brown. Very weak, fine grained. **(Lithic Tuff)** 1.95m: Becomes extremely weak. 2.05m: Becomes strongly welded.		44.5		SPT=5,10,8N=18 (Open nose)
2.5	100	N/A	N/A	HQ		2.50m: Becomes greenish grey.		44.0		
3.0						Moderately weathered SILTSTONE, grey. Very weak **(East Coast Bays Formation)** 2.53m: Becomes grey.		43.5		
3.5	81 (81)	79	1	HQ		Silty CLAY, grey. Very stiff, moist, high plasticity. (Completely Weathered Siltstone). **(East Coast Bays Formation)** Moderately weathered SILTSTONE, grey. Very weak. **(East Coast Bays Formation)** 3.58m: Trace tiny carbonaceous flecks.	3.26m to 3.28m: Joint (25°) closed, planar, clean. 3.29m to 3.30m: Joint (15°) closed, planar, clean.	43.0		SPT=13,17,21N=38 (Solid nose)
4.0						3.87m: Absence of carbonaceous flecks.		42.5		

Remarks
Groundwater not recorded during the investigation.

NZGD ID: BH_68068

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Borehole Logging Form — Bore: BH17

Project Name: Ellerslie Racecourse SW Upgrade **Drilling Date:** 12/11/2007

Location: Ellerslie Racecourse **Project Number:** AE03390.3

Drilling Company: Boart Longyear **Drilled Depth:** 15m **Logged by:** VWW

Drilling Method: **Bore Diameter:** 100mm **Checked by:** TPA

Co-ordinates: 2671706.00mE 6477664.00mN **Ground Elevation:** 46.20mRL

Depth (m BGL)	TCR (%) (SCR (%))	RQD	Fracture Index	Sampling	Geology Legend	Description of Strata	Defect Description	Elevation (m)	Backfill / Installation	Comments
4.5								42.0		
5.0	95 (95)	95	3	HQ		Unweathered SANDSTONE, grey. Very weak. Fine grained. **(East Coast Bays Formation)**	4.56m to 4.60m: Joint (90°) rough, planar, clean.	41.5		SPT=40,50N=50/45 (Solid nose)
5.5						5.41m: Becomes fine to medium grained.	4.73m to 4.79m: Joint (55°) smooth, planar, clean.	41.0		
6.0						Unweathered SILTSTONE, grey. Very weak. **(East Coast Bays Formation)**	5.28m to 5.33m: Joint (50°) smooth, planar, clean.	40.5		
6.5	85 (76)	76	4	HQ		6.00m: Becomes sandy (fine). 6.17m: With carbonaceous laminations at 30 to 50mm intervals, with a 30° dip. 6.27m: Absence of sand and carbonaceous laminations.	5.48m to 5.54m: Joint (60°) smooth, planar, clean.	40.0		SPT=35,50N=50/35 (Solid nose)
7.0						Unweathered SANDSTONE, grey. Weak. Fine to medium grained. **(East Coast Bays Formation)**	6.44m to 6.46m: Joint (25°) smooth, planar, clean. 6.47m: Joint (0°) rough, planar, minor carbonaceous material; possibly drilling induced. 6.58m to 6.64m: Joint (45°) smooth, planar, clean.	39.5		
7.5						Unweathered SILTSTONE, grey. Weak. **(East Coast Bays Formation)** 6.93m to 6.98m: Highly fractured, recovered as coarse gravel sized pieces. 7.03m to 7.04m: Trace carbonaceous material. 7.15m to 7.24m: Very closely fractured, recovered as medium to coarse gravel sized pieces.	7.15m to 7.24m: Fracture zone.	39.0		
8.0							7.91m to 7.94m: Joint (30°) smooth, planar, clean.	38.5		SPT=20,50N=50/140 (Solid nose)

Remarks
Groundwater not recorded during the investigation.

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

NZGD ID: BH_68068

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Borehole Logging Form — Bore: BH17

Project Name: Ellerslie Racecourse SW Upgrade **Drilling Date:** 12/11/2007
Location: Ellerslie Racecourse **Project Number:** AE03390.3

Drilling Company: Boart Longyear **Drilled Depth:** 15m **Logged by:** VWW
Drilling Method: **Bore Diameter:** 100mm **Checked by:** TPA
Co-ordinates: 2671706.00mE 6477664.00mN **Ground Elevation:** 46.20mRL

Depth (m BGL)	TCR (%) (SCR (%))	RQD	Fracture Index	Sampling	Geology Legend	Description of Strata	Defect Description	Elevation (m)	Backfill / Installation	Comments
8.5	97 (97)	97	3	HQ			8.15m to 8.19m: Joint (30°) smooth, planar, clean.	38.0		
							8.74m to 8.76m: Joint (25°) rough, planar, clean.	37.5		
9.0							8.86m to 8.89m: Joint (30°) rough, planar, clean.			SPT=30,45,5N=50/170 (Solid nose)
							9.29m to 9.34m: Joint (40°) smooth, planar, clean.	37.0		
9.5							9.34m to 9.38m: Joint (40°) smooth, planar, clean.			
	98 (98)	94	3	HQ			9.74m to 9.84m: Joint (70°) slickensided, planar, clean.	36.5		
10.0							9.91m to 9.97m: Joint (35°) rough, planar, clean.			
						Unweathered SANDSTONE, grey. Weak. Fine grained. **(East Coast Bays Formation)**		36.0		
10.5						Shear zone containing SAND, minor clay, orange yellow brown. Loose, moist. With a coarse gravel sized piece of extremely weak, orange yellow brown sandstone. **(East Coast Bays Formation)**				SPT=50N=50/125 (Solid nose)
						10.34m: With a 70mm thick greenish grey, iron oxide stained, moderately weathered, weak, layer of siltstone @ 10.34m.		35.5		
11.0						Highly weathered SANDSTONE, yellowish brown and greenish grey. Extremely weak. Fine grained. **(East Coast Bays Formation)** 10.59m to 11.01m: With brownish yellow, high plasticity, subhorizontal, clay layers (3 - 12mm thick) at regular spacings (10 - 50mm). 10.65m: With a grey, high plasticity, 20° dip, clay layer (4mm thick) @ 10.65m. 11.02m: Becomes light grey. 11.04m to 11.29m: With grey, high plasticity, subhorizontal, clay layers (3 - 9mm thick) at regular spacings (30 - 70mm).				
	93 (93)	93	0	HQ				35.0		
11.5							11.51m to 11.75m: With grey, high plasticity, subhorizontal, clay layers (3 - 9mm thick) at regular spacings (40 - 100mm).			
								34.5		
12.0										

Remarks
Groundwater not recorded during the investigation.

NZGD ID: BH_68068

Sinclair Knight Merz
25 Teed Street, Newmarket
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Tel: +64 9 913 8900
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Borehole Logging Form — Bore: BH17

Project Name: Ellerslie Racecourse SW Upgrade
Location: Ellerslie Racecourse
Drilling Date: 12/11/2007
Project Number: AE03390.3

Drilling Company: Boart Longyear
Drilling Method:
Co-ordinates: 2671706.00mE 6477664.00mN
Drilled Depth: 15m
Bore Diameter: 100mm
Ground Elevation: 46.20mRL
Logged by: VWW
Checked by: TPA

Depth (m BGL)	TCR (%) (SCR (%))	RQD	Fracture Index	Sampling	Geology Legend	Description of Strata	Defect Description	Elevation (m)	Backfill / Installation	Comments
						Silty CLAY, greyish green. Stiff, moist, high plasticity. **(East Coast Bays Formation)**				SPT=44,50N=50/120 (Solid nose)
						Highly weathered SANDSTONE, light brownish yellow mottled light greenish grey. Extremely weak. Fine grained. **(East Coast Bays Formation)**		34.0		
12.5	66 (66)	66	1	HQ		12.96m: With a 10mm thick grey, subhorizontal, clay layer @ 12.96m. 12.97m to 12.99m: Orange brown iron oxide staining.	12.80m to 12.87m: Joint (50°) rough, undulating, clean.	33.5		
13.0								33.0		
13.5						Highly weathered SANDSTONE, light greenish grey. Extremely weak. Fine grained. **(East Coast Bays Formation)**				SPT=16,28,22N=50/225 (Solid nose)
						13.71m: With a 4mm thick grey, subhorizontal, high plasticity, clay layer @ 13.71m.		32.5		
14.0						13.87m: Laminations of orange brown iron oxide staining. Layers dip 20°. 14.00m: Absence of iron oxide laminations.				
	72 (72)	72	0	HQ		14.06m: With a 3mm thick grey, high plasticity, clay layer @ 14.06m. 14.11m: Laminations of orange brown iron oxide staining. 14.12m to 14.44m: With grey, high plasticity, subhorizontal, clay layers (3 - 9mm thick) at regular spacings (30 - 60mm).		32.0		
14.5								31.5		
15.0						BH17 terminated at 15.00m. Target Depth				SPT=24,50N=50/140 (Solid nose)

Remarks
Groundwater not recorded during the investigation.

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

NZGD ID: BH_68068

SKM

Log of Investigation

Project: **Ellerslie Southern Route**	**Drillhole**
Location: **Racecourse** Project No: **AE03624**	Hole ID: **BH101**
Client: **Auckland City Council**	Date: **21/10/2008**

R.L. (m)	Depth (m)	Drilling Method (Shift Details / Casing Diameter (mm))	TCR (%) (SCR (%))	RQD	In-Situ Testing	Sampling	Geology Legend	GroundWater	Description of Strata	Defect Description	Comments	Backfill / Installation
	0.5	VAC EX		N/A		ES			NO CORE RECOVERY (Vacuum Excavation).		0m: Backfill: Bag-boys gravel	
	1.0											
	1.5	SPT	56	N/A	SPT_s=1,3,2 N=5	ES			Clayey SILT with some gravel and minor sand, grey, intermixed dark brown, yellowish brown and brownish orange. Stiff, moist, highly plastic. Gravel is fine, subrounded to subangular; sand is fine grained. **(Fill)**			
	2.0											
	2.5	HQ3	74	N/A					*2.40m to 2.50m: Concrete.* *2.50m: Becomes very stiff.* *2.60m: Becomes stiff.*			
	3.0	SPT	67	N/A	SPT_s=1,2,3 N=5				Clayey SILT, brownish orange, intermixed grey. Stiff, moist, highly plastic. **(Alluvium)**			
	3.5											
	4.0	HQ3	86	N/A					*3.75m: With ferrous stains.* *3.80m: Becomes hard, non plastic; blocky to 3.9 m.*			

Started: 21/10/2008
Finished: 28/10/2008
Driller: Boart Longyear
Plant: TD200
Logged: VK
Checked: RCR

Groundwater Observations

No.	Struck (m)	Date	Observations	Standing (m)
0	0			

Remarks
Groundwater not recorded during the investigation.

Co-ordinates:
6477704.00mN
2671740.00mE

Inclination: -90°

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

Data Template: DATA TEMPLATE.GDT Output Form: COMPILATION BOREHOLE Project File Name: ELLERSLIE ADD. HOLES.GPJ 24/4/09

Version 1.6 28/08/2006 - S.Humphreys

Log of Investigation

Project: **Ellerslie Southern Route**	**Drillhole**
Location: **Racecourse** Project No: **AE03624**	Hole ID: **BH101**
Client: **Auckland City Council**	Date: **21/10/2008**

R.L. (m)	Depth (m)	Shift Details / Drilling Method / Casing Diameter (mm)	TCR (%) (SCR (%))	RQD	In-Situ Testing	Sampling	Geology Legend	GroundWater	Description of Strata	Defect Description	Comments	Backfill / Installation
	4.5	SPT	100	N/A	SPT_4=0,2,3 N=5				*3.90m: Becomes orange brown mottled black; stiff, highly plastic.* *4.10m: Becomes greyish white intermixed orange.* *4.25m: Becomes orange brown.* *4.50m: Becomes greyish white mottled brown.*			
	5.0											
	5.5	HQ3	67	N/A					*5.15m: Absence of mottles.*			
	6.0	SPT	98	N/A	SPT_5=2,4,7 N=11				CLAY, grey. Hard, moist, highly plastic. **(Residual East Coast Bays Formation)**		6m: Backfill: Bentonite	
	6.5								Sandy CLAY, grey. Stiff, moist, slightly plastic. Sand is fine grained. **(Residual East Coast Bays Formation)**			
	7.0	HQ3	48	N/A					Clayey fine SAND, grey. Medium dense, wet. **(Residual East Coast Bays Formation)**			
	7.5	SPT	100	N/A	SPT_5=4,10,14 N=24							
	8.0											

Started: 21/10/2008
Finished: 28/10/2008
Driller: Boart Longyear
Plant: TD200
Logged: VK
Checked: RCR

Groundwater Observations

No.	Struck (m)	Date	Observations	Standing (m)
0	0			

Remarks
Groundwater not recorded during the investigation.

Co-ordinates:
6477704.00mN
2671740.00mE

Inclination: -90°

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

NZGD ID: BH_68073

Log of Investigation

Project: **Ellerslie Southern Route**	**Drillhole**
Location: **Racecourse** Project No: **AE03624**	Hole ID: **BH101**
Client: **Auckland City Council**	Date: **21/10/2008**

R.L. (m)	Depth (m)	Shift Details / Drilling Method / Casing Diameter (mm)	TCR (%) (SCR (%))	RQD	In-Situ Testing	Sampling	Geology Legend	GroundWater	Description of Strata	Defect Description	Comments	Backfill / Installation
	8.5	HQ3	100	N/A								
	9.0				SPT_c=13,30,20 N=50				Slightly weathered, grey SILTSTONE; extremely weak to very weak. **(East Coast Bays Formation)** *8.90m: A carbonaceous lamination (5 mm), dipping 30°.*		9m: Backfill: Bag-boys gravel	
		SPT		N/A								
	9.5								Slightly weathered, grey, fine grained SANDSTONE; extremely weak. **(East Coast Bays Formation)**			
	10.0	HQ3	100	N/A					*9.95m: Becomes very weak.*			
	10.5				SPT_c=30,50 N=50/90							
		SPT		N/A								
	11.0								SIGNIFICANT CORE LOSS. Recovered: Unweathered, grey SILTSTONE; very weak.			
	11.5	HQ3	36 (29)	19								
	12.0				SPT_c=3,20,30							

Started: 21/10/2008
Finished: 28/10/2008
Driller: Boart Longyear
Plant: TD200
Logged: VK
Checked: RCR

Groundwater Observations

No.	Struck (m)	Date	Observations	Standing (m)
0	0			

Remarks
Groundwater not recorded during the investigation.

Co-ordinates:
6477704.00mN
2671740.00mE

Inclination: -90°

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

Log of Investigation

Project: **Ellerslie Southern Route**	**Drillhole**
Location: **Racecourse** Project No: **AE03624**	Hole ID: **BH101**
Client: **Auckland City Council**	Date: **21/10/2008**

R.L. (m)	Depth (m)	Shift Details / Drilling Method / Casing Diameter (mm)	TCR (%) (SCR (%))	RQD	In-Situ Testing	Sampling	Geology Legend	GroundWater	Description of Strata	Defect Description	Comments	Backfill / Installation
		SPT	100	N/A	N=50/250				Unweathered, grey, fine grained SANDSTONE; extremely weak to very weak. **(East Coast Bays Formation)**			
	12.5								*12.40m: A thin interbed of unweathered, grey, siltstone; very weak.* *12.45m: Becomes very weak.*			
	13.0	HQ3	100 (100)	33					Unweathered, grey, SILTSTONE; very weak. **(East Coast Bays Formation)** Unweathered, grey, fine grained SANDSTONE; very weak. **(East Coast Bays Formation)** *13.00m: A patch of carbonaceous matter.* *13.20m: A thin lense of white, gritty, coarse sand sized material.*	12.75m to 12.80m: Joint (45°) smooth, planar, clean. 12.80m: Joint (15°) smooth, planar, clean. 12.85m: Joint (30°) smooth, planar, clean. 13.00m: Joint (0°) smooth, planar, clean. x5.		
	13.5	SPT	100	N/A	SPT_s=12,50 N=50/150				*13.30m: A thin interbed of unweathered, grey, siltstone; very weak.* Unweathered, grey SILTSTONE; very weak. **(East Coast Bays Formation)**			
	14.0	HQ3	88 (61)	38					Unweathered, grey, fine grained SANDSTONE; extremely weak to very weak. **(East Coast Bays Formation)** *13.85m: Becomes very weak.* *14.00m: A moderately thin interbed of unweathered, grey, siltstone; very weak.* *14.20m: Becomes fine to medium grained, extremely weak to very weak. With some white, gritty, coarse sand sized material.*	13.85m: Joint (0°) rough, undulating, clean. 13.90m: Joint (15°) rough, undulating, clean. 14.00m to 14.05m: Joint (45°) smooth, planar, clean. 14.20m: Joint (30°) smooth, planar, clean.	14.05m: Becomes highly fractured. Recovered as medium to coarse gravel sized clasts, angular to subangular.	
	15.0	SPT	100	N/A	SPT_s=29,50 N=50/120							
	15.5	HQ3	100 (100)	93						15.55m: Joint (5°) rough, undulating, clean. 15.80m: Joint (0°) smooth, planar, soil infilling of silt.		
	16.0											

Started: 21/10/2008
Finished: 28/10/2008
Driller: Boart Longyear
Plant: TD200
Logged: VK
Checked: RCR

Groundwater Observations

No.	Struck (m)	Date	Observations	Standing (m)
0	0			

Remarks
Groundwater not recorded during the investigation.

Co-ordinates:
6477704.00mN
2671740.00mE

Inclination: -90°

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

Log of Investigation

Project: **Ellerslie Southern Route**	**Drillhole**
Location: **Racecourse** Project No: **AE03624**	Hole ID: **BH101**
Client: **Auckland City Council**	Date: **21/10/2008**

R.L. (m)	Depth (m)	Shift Details / Drilling Method / Casing Diameter (mm)	TCR (%) (SCR (%))	RQD	In-Situ Testing	Sampling	Geology Legend	GroundWater	Description of Strata	Defect Description	Comments	Backfill / Installation
	16.5	SPT	100	N/A	SPT_s=15,50 N=50/80				Unweathered, grey, SILTSTONE; very weak. **(East Coast Bays Formation)** *16.35m: A carbonaceous lamination (3 mm), dipping 5°.*	16.00m: Joint (0°) smooth, planar, soil infilling of silt. 16.15m: Joint (0°) smooth, planar, soil infilling of silt. 16.25m: Joint (0°) smooth, planar, clean. 16.40m: Joint (10°) smooth, planar, clean.		
	17.0	HQ3	95 (95)	88					Unweathered, grey, fine to medium grained SANDSTONE; extremely weak to very weak. **(East Coast Bays Formation)** *17.25m to 17.30m: Extremely closely spaced carbonaceous laminations, dipping 5°.* *17.30m: A moderately thin interbed of unweathered, grey, siltstone; very weak.* *17.45m: Becomes fine grained grading to fine and medium grained.*			
	17.5									17.75m to 17.90m: Joint (45°) smooth, undulating, clean. 17.95m: Joint (0°) smooth, undulating, clean.		
	18.0	SPT	100	N/A	SPT_s=42,50 N=50/90				*18.10m: A moderately thin interbed of unweathered, grey, siltstone; very weak.* *18.25m: Becomes fine grained; very weak.*			
	18.5	HQ3	100 (100)	84						18.55m: Joint (0°) rough, undulating, clean. 18.65m: Joint (0°) rough, undulating, clean. 18.80m: Joint (0°) smooth, undulating, clean.		
	19.0									19.15m: Joint (15°) smooth, undulating, clean. 19.30m: Joint (15°) smooth, planar, clean.		
	19.5	HQ3	100 (100)	100					Unweathered, grey SILTSTONE; very weak. **(East Coast Bays Formation)** *19.50m: Becomes weak.* *19.60m: A thin interbed of unweathered, grey, fine sandstone; very weak.* Unweathered, grey, fine grained SANDSTONE; very weak. **(East Coast Bays Formation)**	19.40m: Joint (15°) smooth, planar, clean.		
	20.0				SPT_s=36,50							

Started: 21/10/2008
Finished: 28/10/2008
Driller: Boart Longyear
Plant: TD200
Logged: VK
Checked: RCR

Groundwater Observations

No.	Struck (m)	Date	Observations	Standing (m)
0	0			

Remarks
Groundwater not recorded during the investigation.

Co-ordinates:
6477704.00mN
2671740.00mE

Inclination: -90°

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

Log of Investigation

Project: **Ellerslie Southern Route**	**Drillhole**
Location: **Racecourse** Project No: **AE03624**	Hole ID: **BH101**
Client: **Auckland City Council**	Date: **21/10/2008**

R.L. (m)	Depth (m)	Drilling Method (Shift Details / Casing Diameter (mm))	TCR (%) (SCR (%))	RQD	In-Situ Testing	Sampling	Geology Legend	GroundWater	Description of Strata	Defect Description	Comments	Backfill / Installation
		SPT	100	N/A	N=50/120				BH101 terminated at 20.27m. Target Depth			

Started: 21/10/2008
Finished: 28/10/2008
Driller: Boart Longyear
Plant: TD200
Logged: VK
Checked: RCR

Groundwater Observations

No.	Struck (m)	Date	Observations	Standing (m)
0	0			

Remarks
Groundwater not recorded during the investigation.

Co-ordinates:
6477704.00mN
2671740.00mE

Inclination: -90°

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

PROJECT: **Ellerslie Racecourse Stormwater Pond Investigation**

CLIENT: **Auckland City Council**

LOCATION: **Ellerslie Racecourse**

JOB No.: **51/22379/02**

LOGGED BY: **BY**

CHECKED BY: **TD**

COMMENCED: **6/10/06**

COMPLETED: **6/10/06**

Borehole No.: BH5

CONTRACTOR: **Drillwell**

EQUIPMENT: **Newholland TD150**

INCLINATION (deg): **0**

DIAMETER (mm): **80 mm (PQ)**

X-COORDINATE: **304033**

Y-COORDINATE: **698555**

R.L. SURFACE (m): **42.00**

TOTAL DEPTH (m): **14.0 m**

Depth (m)	Geological Group	DESCRIPTION OF CORE Geological Formation: (weathering, cement, mineralogy, etc)	SPT Blow Count	Test Result SPT 'N' Value --- Shear Strength (kPa)	Core Loss (%)	Spacing of Natural Defects (m)	Graphic Log	SOIL DESCRIPTION (subordinate, minor MAJOR, colour, structure, strength / relative density, moisture cont., grading, bedding, plasticity, sensitivity) DEFECT DESCRIPTION (orientation, spacing, persistence, roughness, wall strength, aperture, infill, seepage, sets, block size)	Piezometer Details and Water Levels	Water Loss (%)	Drilling Method
0	Fill	Fill- recent, non-engineered						TOPSOIL	Concrete		PQ wire line drilling- Open SPT.
1								Silty CLAY, dark brown, stiff, moist, moderately plastic with much fine to coarse sand and coarse gravel (basalt, scoria).	Steel Well Cover		
2	Auckland Volcanic Field	Extremely weathered tuff or airfall deposits	1-2-3 N= 5					Silty CLAY, light brown and orange, stiff to very stiff, moist, moderately plastic with trace fine sand and coarse gravel (scoria, basalt)			
3		Slightly weathered to unweathered, extremely strong to strong, light grey, highly vesicular BASALT with closely spaced fractures. Below 3.0 m becomes slightly vesicular.	bouncing					Sub-horizontal and orthogonal fractures, closely spaced, continuous, planar, tight, with trace to some clay in-fill.	Bentonite Seal		
4											
5									0.5 mm slot Screen		
6									2 mm washed gravel		
7											
8											
9									Bentonite Seal		
10											
11											
12											

Core Boxes : 6

Comments : -

Shear Vane G357

Factor (as per NZGS Guideline) 1.41

Core will be stored for 3 months only unless alternative arrangements are made

NZGD ID: BH_71531

PROJECT: **Ellerslie Racecourse Stormwater Pond Investigation**

CLIENT: **Auckland City Council**

LOCATION: **Ellerslie Racecourse**

JOB No.: **51/22379/02**

LOGGED BY: **BY**

CHECKED BY: **TD**

COMMENCED: **6/10/06**

COMPLETED: **6/10/06**

Borehole No.: BH5

CONTRACTOR: **Drillwell**

EQUIPMENT: **Newholland TD150**

INCLINATION (deg): **0**

DIAMETER (mm): **80 mm (PQ)**

X-COORDINATE: **304033**

Y-COORDINATE: **698555**

R.L. SURFACE (m): **42.00**

TOTAL DEPTH (m): **14.0 m**

Depth (m)	Geological Group	DESCRIPTION OF CORE Geological Formation: (weathering, cement, mineralogy, etc)	SPT Blow Count	Test Result SPT 'N' Value / Shear Strength (kPa)	Core Loss (%) (0 25 75 100)	Spacing of Natural Defects (m) (0 0.1 0.3 0.5)	Graphic Log	SOIL DESCRIPTION (subordinate, minor MAJOR, colour, structure, strength / relative density, moisture cont., grading, bedding, plasticity, sensitivity) / DEFECT DESCRIPTION (orientation, spacing, persistence, roughness, wall strength, aperture, infill, seepage, sets, block size)	Piezometer Details and Water Levels	Water Loss (%) (0 25 75 100)	Drilling Method
13	Tauranga Group	Alluvial Deposits, Puketoka Formation	0-3-5 N= 8	53/19				Silty CLAY (organic), black, stiff, moist, moderately to highly plastic trace fibrous organics (tree roots)		
14								End of borehole at 14.0 m. Target depth.		
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Core Boxes : 6

Comments : -

Shear Vane G357

Factor (as per NZGS Guideline) 1.41

Core will be stored for 3 months only unless alternative arrangements are made

PROJECT: **Ellerslie Racecourse Stormwater Pond Investigation**

CLIENT: **Auckland City Council**

LOCATION: **Ellerslie Racecourse**

JOB No.: **51/22379/02**

LOGGED BY: **BY**

CHECKED BY: **TD**

COMMENCED: **9/10/06**

COMPLETED: **10/10/06**

Borehole No.: BH7

CONTRACTOR: **Drillwell**

EQUIPMENT: **Newholland TD150**

INCLINATION (deg): **0**

DIAMETER (mm): **80 mm (PQ)**

X-COORDINATE: **304095**

Y-COORDINATE: **698535**

R.L. SURFACE (m): **42.00**

TOTAL DEPTH (m): **13.5 m**

Depth (m)	Geological Group	DESCRIPTION OF CORE Geological Formation: (weathering, cement, mineralogy, etc)	SPT Blow Count	Test Result SPT 'N' Value --- Shear Strength (kPa)	Core Loss (%) (0 25 75 100)	Spacing of Natural Defects (m) (0 0.1 0.3 0.5)	Graphic Log	SOIL DESCRIPTION (subordinate, minor MAJOR, colour, structure, strength / relative density, moisture cont., grading, bedding, plasticity, sensitivity) DEFECT DESCRIPTION (orientation, spacing, persistence, roughness, wall strength, aperture, infill, seepage, sets, block size)	Piezometer Details and Water Levels	Water Loss (%) (0 25 75 100)	Drilling Method
0	Auckland Volcanic Field	Fractured basalt mantle						Silty CLAY, dark brown, moist, moderately plastic with much coarse gravel to cobbles (BASALT)	Concrete; Steel Well Cover		HQ wire line drilling 0 m to 6.0 m, PQ 6.0 m to 13.5 m
1		Unweathered to slightly weathered light grey, massive highly vesicular BASALT, moderately strong with closely spaced, tight, orthogonal, planar, continuous, fractures with trace to some clay in-fill.	2-2-50+ N= 50+					Closely spaced fractures, tight, orthogonal, planar, continuous, fractures with trace to some clay in-fill.			
2											
3		Below 3.0 m becomes slightly vesicular.									
4											
5									Bentonite Seal		
6											
7									2 mm washed gravel; 0.5 mm slot Screen		
8											
9											
10											
11											
12		Extreamly weathered tuff or airfall									

Core Boxes : 4

Comments : -

Shear Vane G357

Factor (as per NZGS Guideline) 1.41

Core will be stored for 3 months only unless alternative arrangements are made

NZGD ID: BH_71532

PROJECT: **Ellerslie Racecourse Stormwater Pond Investigation**

CLIENT: **Auckland City Council**

LOCATION: **Ellerslie Racecourse**

JOB No.: **51/22379/02**

LOGGED BY: **BY**

CHECKED BY: **TD**

COMMENCED: **9/10/06**

COMPLETED: **10/10/06**

Borehole No.: BH7

CONTRACTOR: **Drillwell**

EQUIPMENT: **Newholland TD150**

INCLINATION (deg): **0**

DIAMETER (mm): **80 mm (PQ)**

X-COORDINATE: **304095**

Y-COORDINATE: **698535**

R.L. SURFACE (m): **42.00**

TOTAL DEPTH (m): **13.5 m**

Depth (m)	Geological Group	DESCRIPTION OF CORE Geological Formation: (weathering, cement, mineralogy, etc)	SPT Blow Count	Test Result SPT 'N' Value --- Shear Strength (kPa)	Core Loss (%) 0 25 75 100	Spacing of Natural Defects (m) 0 0.1 0.3 0.5	Graphic Log	SOIL DESCRIPTION (subordinate, minor MAJOR, colour, structure, strength / relative density, moisture cont., grading, bedding, plasticity, sensitivity) DEFECT DESCRIPTION (orientation, spacing, persistence, roughness, wall strength, aperture, infill, seepage, sets, block size)	Piezometer Details and Water Levels	Water Loss (%) 0 25 75 100	Drilling Method
		deposits At 12.5m scoriaceous layer.						Silty SAND (coarse), light brown, loose, moist, normal.			
13	Waitemata Group	Slightly weathered, weak, bluish grey, horizontally bedded, weakly cemented, alternating SANDSTONE and MUDSTONE (East Coast Bays Formation).						Inter-bedded SANDSTONE and MUDSTONE.			
14			13-35-15+ N= 50+					End of borehole at 13.5 m. Target depth.			
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											

Core Boxes : 4

Comments : -

Shear Vane G357

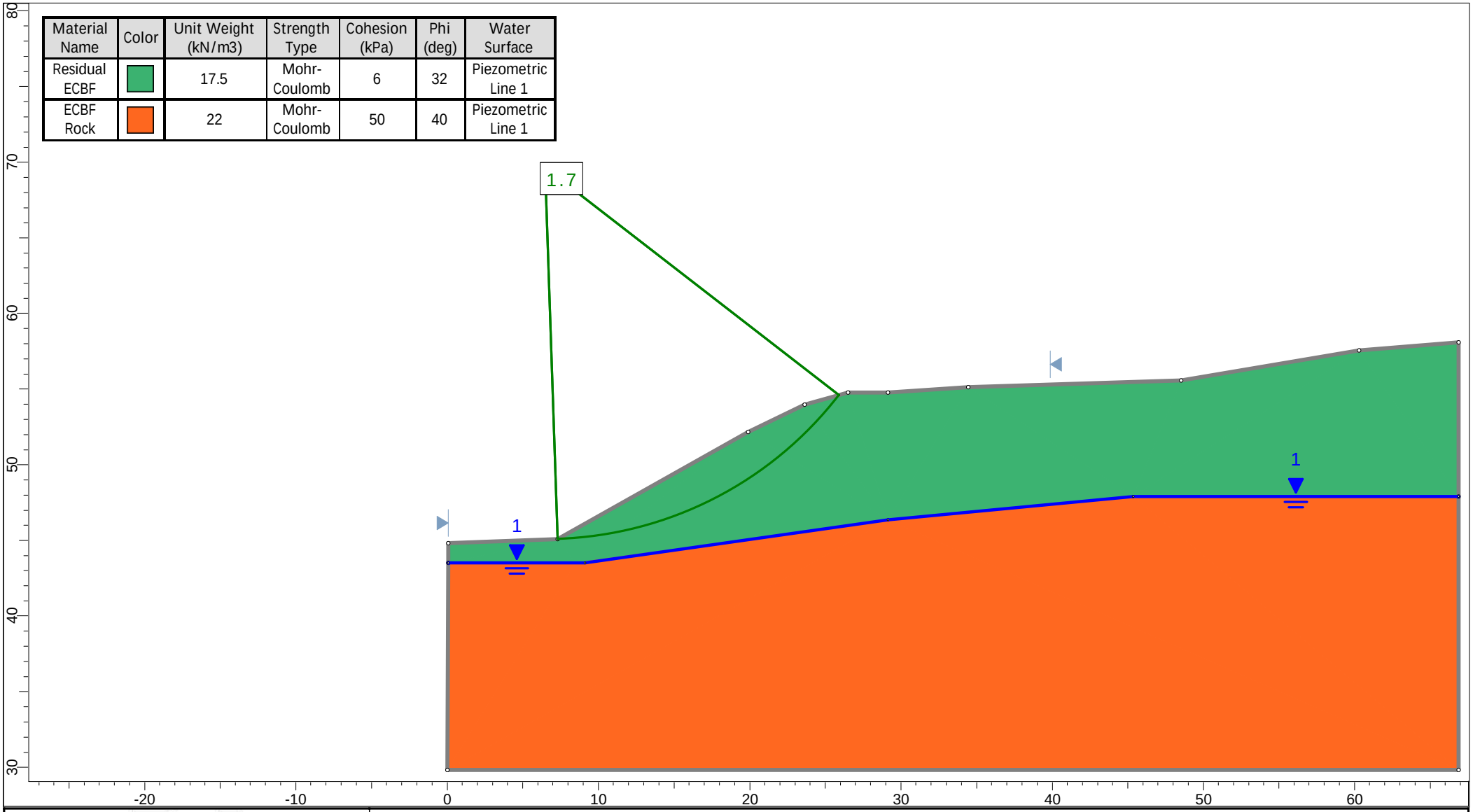
Factor (as per NZGS Guideline) 1.41

Core will be stored for 3 months only unless alternative arrangements are made

NZGD ID: BH_71532

Appendix C Slope Stability Analyses

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface
Residual ECBF		17.5	Mohr-Coulomb	6	32	Piezometric Line 1
ECBF Rock		22	Mohr-Coulomb	50	40	Piezometric Line 1

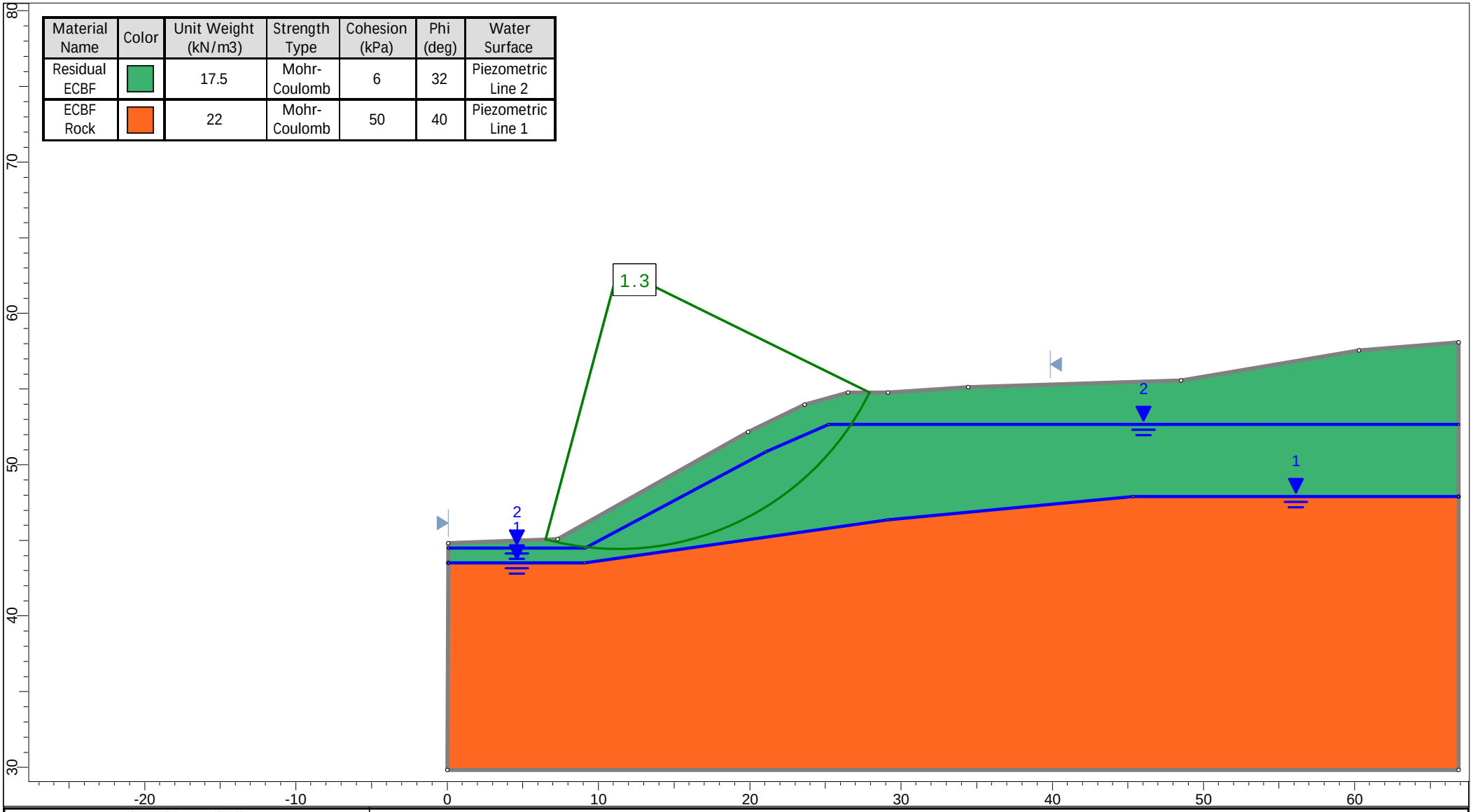


INITIA GEOTECHNICAL SPECIALISTS

SLIDEINTERPRET 9.018

Project	The Hill, Ellerslie		
Analysis Description	Current conditions - Section A		
Project No.	P-001218	Scale 1:350	Company Initia
Description	Static normal groundwater	Date 26/05/2022	

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface
Residual ECBF		17.5	Mohr-Coulomb	6	32	Piezometric Line 2
ECBF Rock		22	Mohr-Coulomb	50	40	Piezometric Line 1

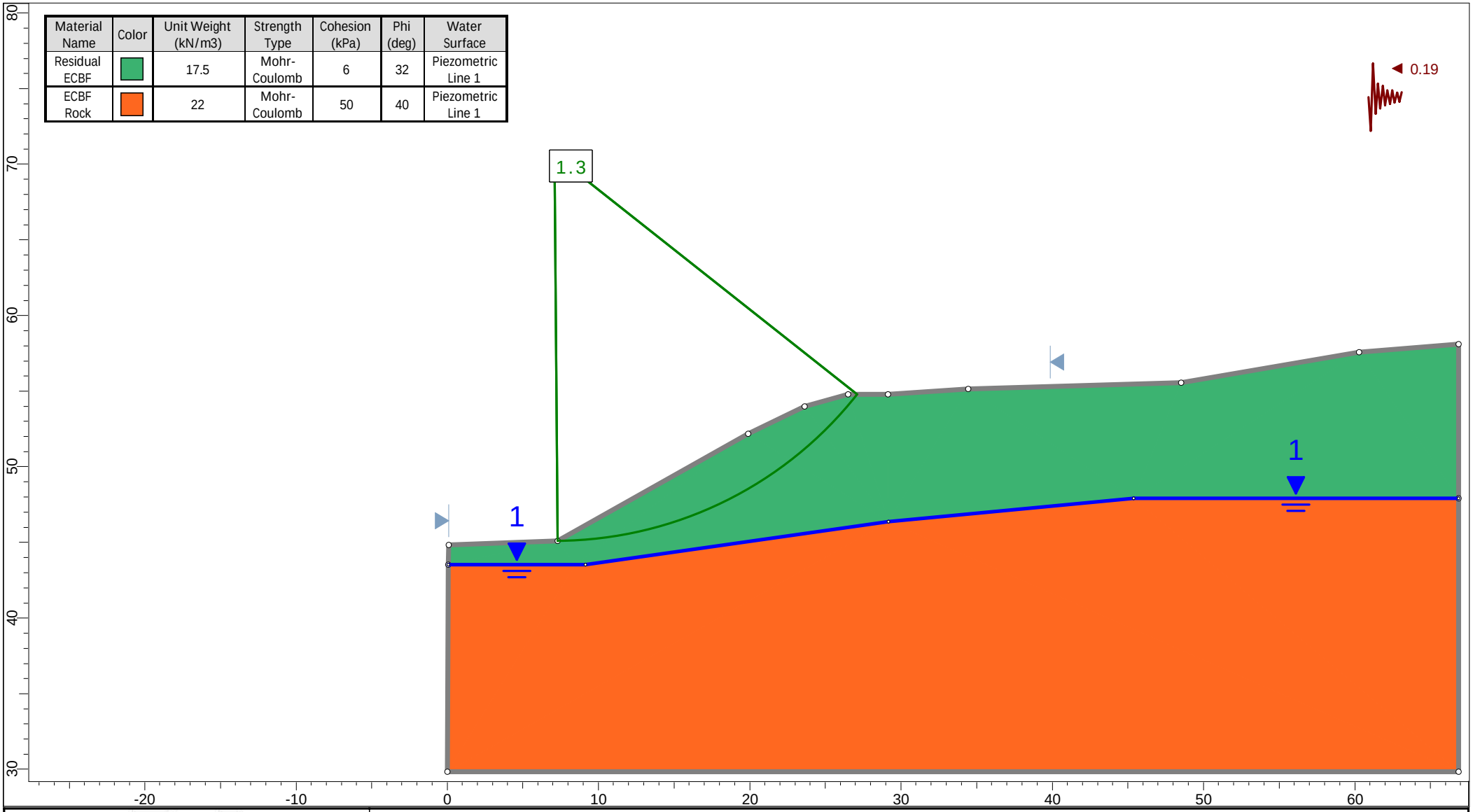


INITIA GEOTECHNICAL SPECIALISTS

SLIDEINTERPRET 9.018

Project	The Hill, Ellerslie		
Analysis Description	Current conditions - Section A		
Project No.	P-001218	Scale 1:350	Company Initia
Description	Static elevated groundwater	Date 26/05/2022	

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface
Residual ECBF		17.5	Mohr-Coulomb	6	32	Piezometric Line 1
ECBF Rock		22	Mohr-Coulomb	50	40	Piezometric Line 1

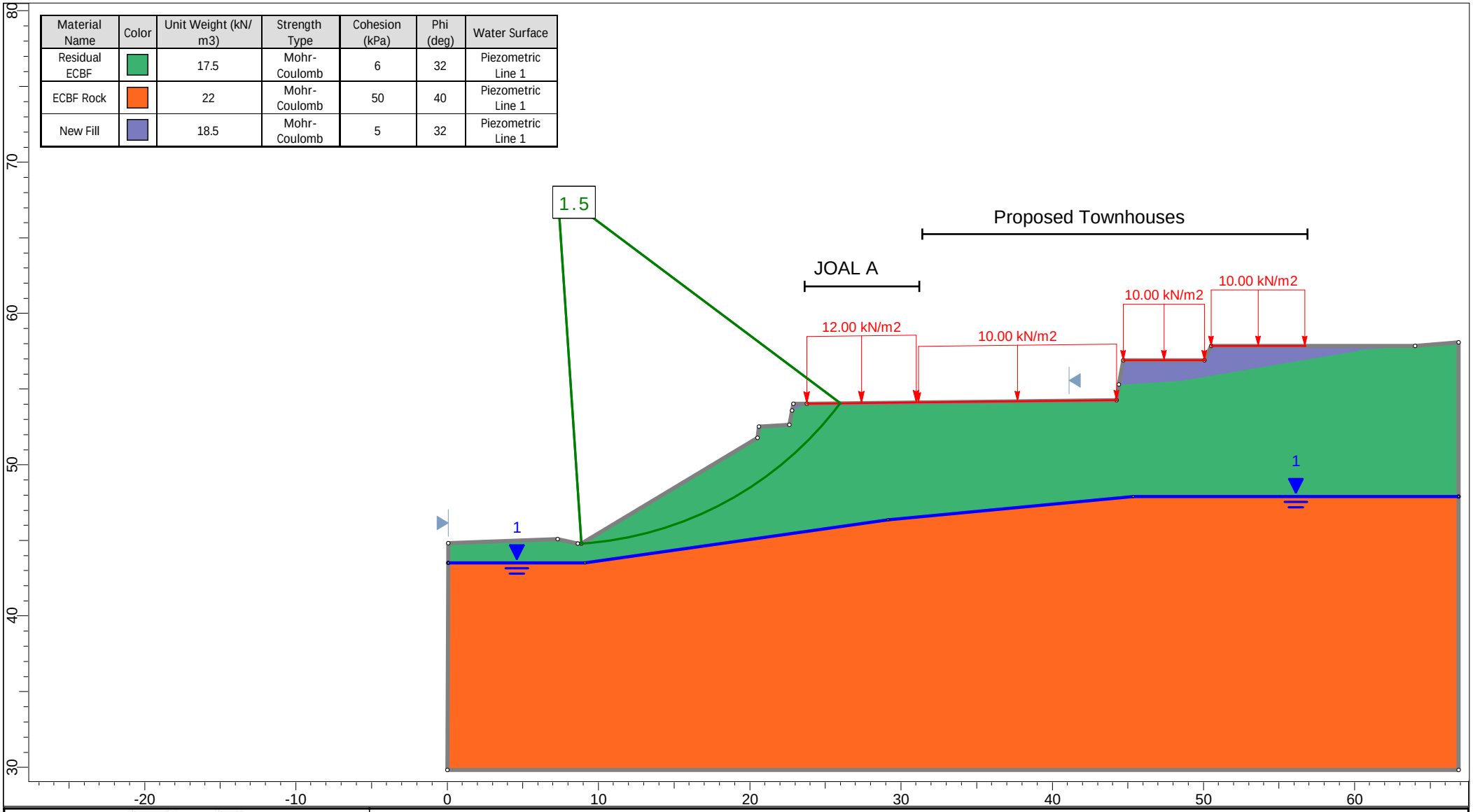


INITIA
GEOTECHNICAL SPECIALISTS

SLIDEINTERPRET 9.018

Project	The Hill, Ellerslie		
Analysis Description	Current conditions - Section A		
Project No.	P-001218	*Scale* 1:350	*Company* Initia
Description	Seismic	*Date*	27/06/2022

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface
Residual ECBF		17.5	Mohr-Coulomb	6	32	Piezometric Line 1
ECBF Rock		22	Mohr-Coulomb	50	40	Piezometric Line 1
New Fill		18.5	Mohr-Coulomb	5	32	Piezometric Line 1

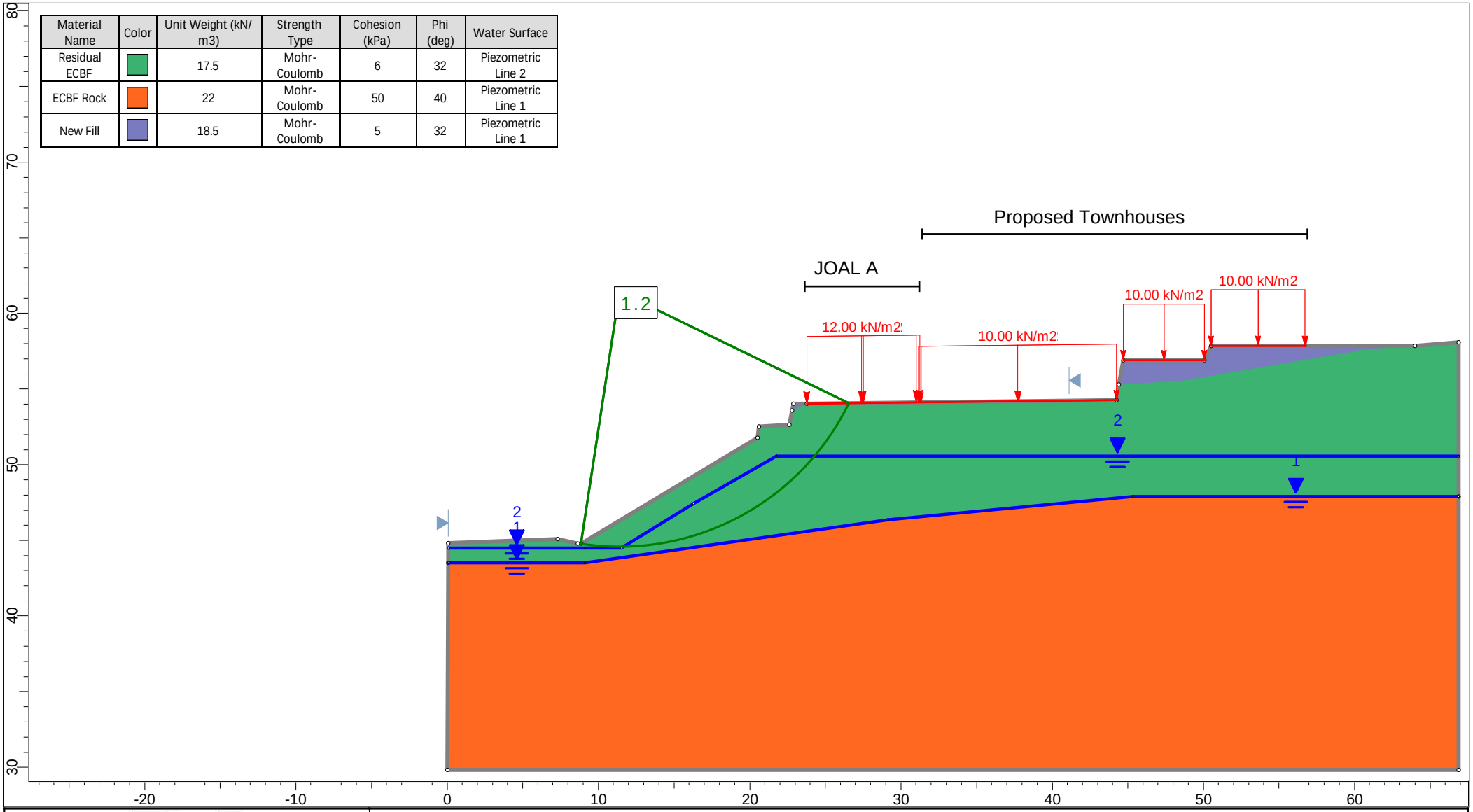


INITIA GEOTECHNICAL SPECIALISTS

SLIDEINTERPRET 9.018

Project	The Hill, Ellerslie		
Analysis Description	Proposed Conditions: 1V:1.5H batter - Section A		
Project No.	P-001218	Scale 1:350	Company Initia
Description	Static normal groundwater	Date 26/05/2022	

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface
Residual ECBF		17.5	Mohr-Coulomb	6	32	Piezometric Line 2
ECBF Rock		22	Mohr-Coulomb	50	40	Piezometric Line 1
New Fill		18.5	Mohr-Coulomb	5	32	Piezometric Line 1

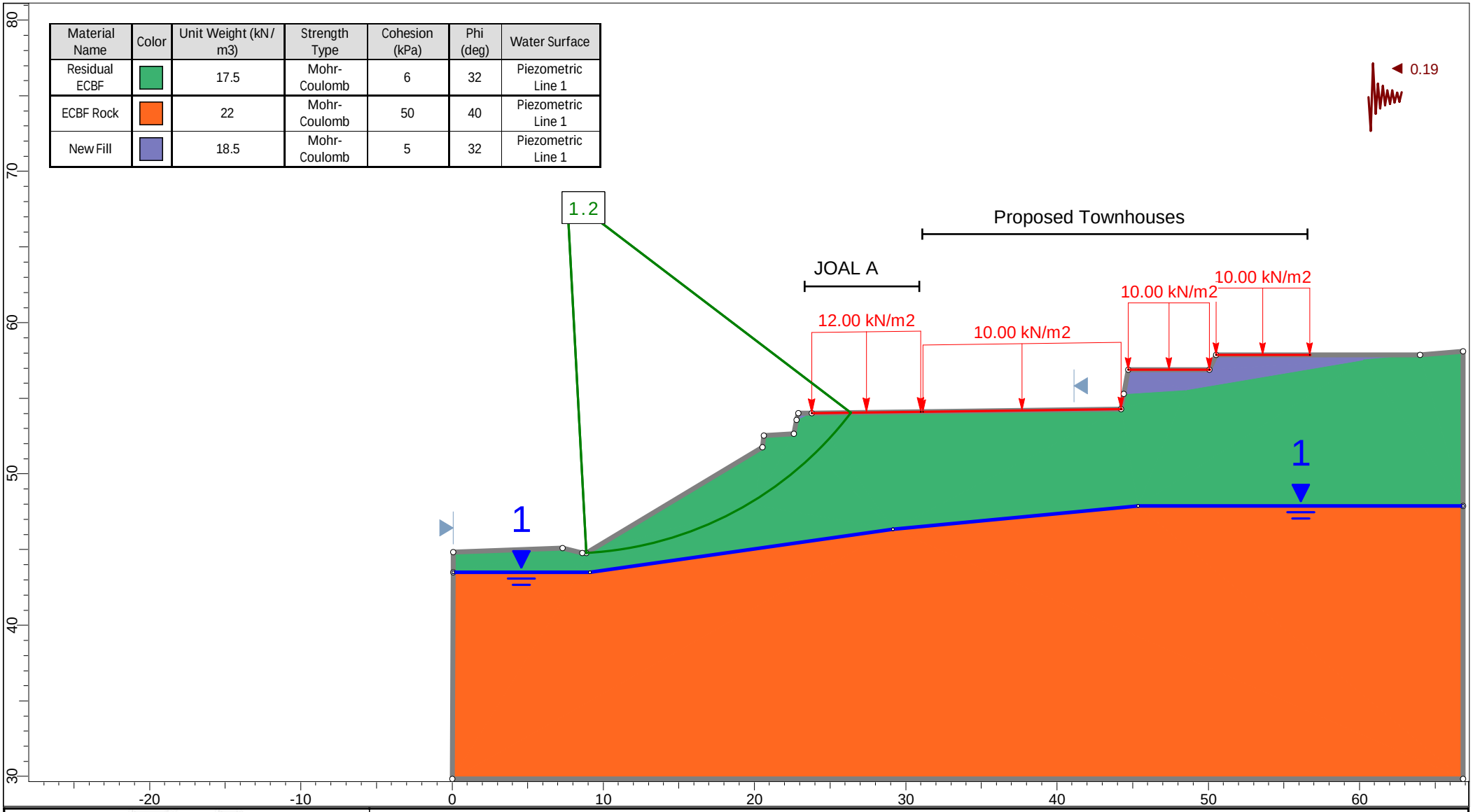


INITIA GEOTECHNICAL SPECIALISTS

SLIDEINTERPRET 9.018

Project	The Hill, Ellerslie		
Analysis Description	Proposed Conditions: 1V:1.5H batter - Section A		
Project No.	P-001218	Scale 1:350	Company Initia
Description	Static elevated groundwater	Date 26/05/2022	

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface
Residual ECBF		17.5	Mohr-Coulomb	6	32	Piezometric Line 1
ECBF Rock		22	Mohr-Coulomb	50	40	Piezometric Line 1
New Fill		18.5	Mohr-Coulomb	5	32	Piezometric Line 1



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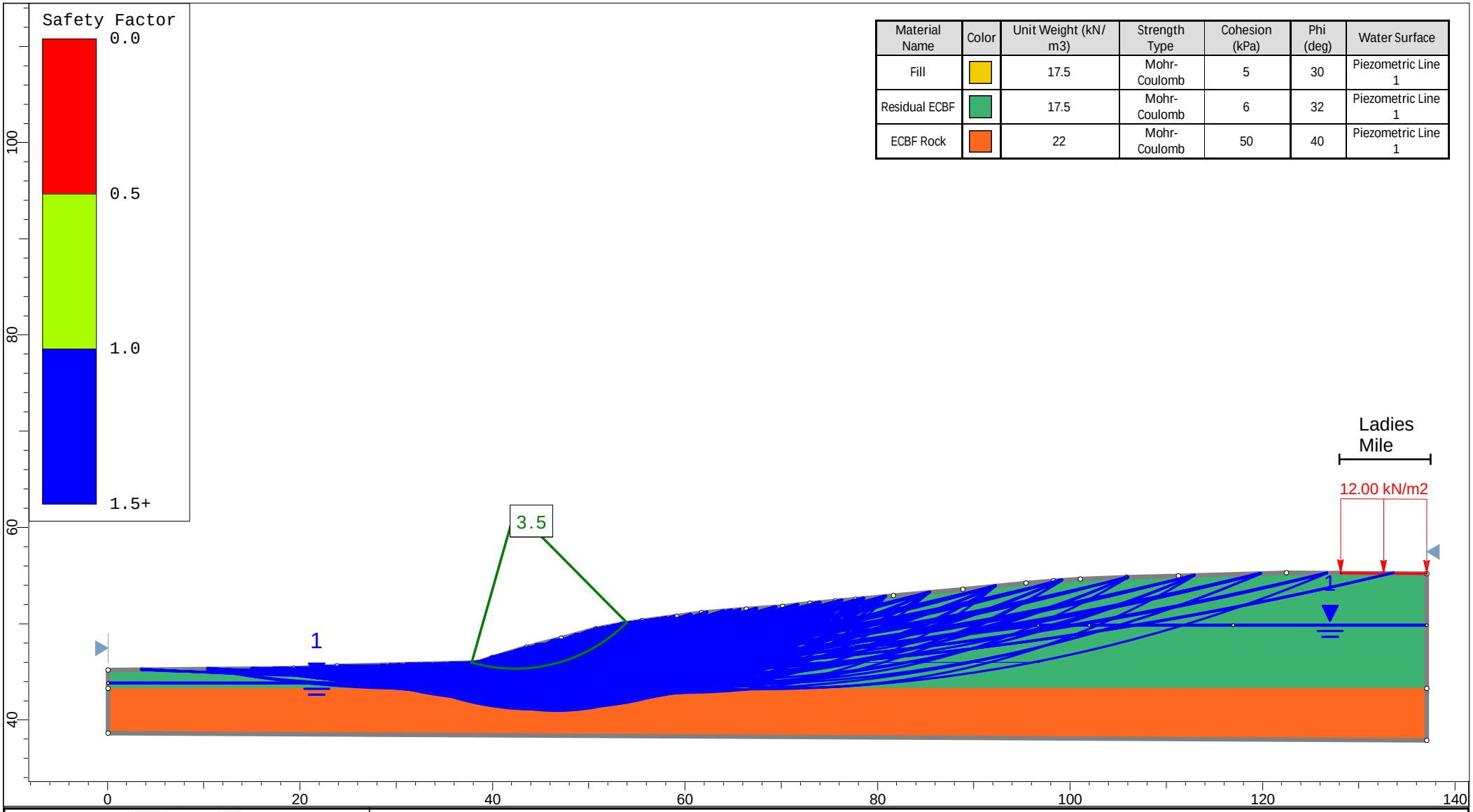
SLIDEINTERPRET 9.018

Project	The Hill, Ellerslie		
Analysis Description	Proposed Conditions: 1V:1.5H batter - Section A		
Project No.	P-001218	*Scale* 1:350	*Company* Initia
Description	Seismic	*Date*	27/06/2022



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface
Fill		17.5	Mohr-Coulomb	5	30	Piezometric Line 1
Residual ECBF		17.5	Mohr-Coulomb	6	32	Piezometric Line 1
ECBF Rock		22	Mohr-Coulomb	50	40	Piezometric Line 1

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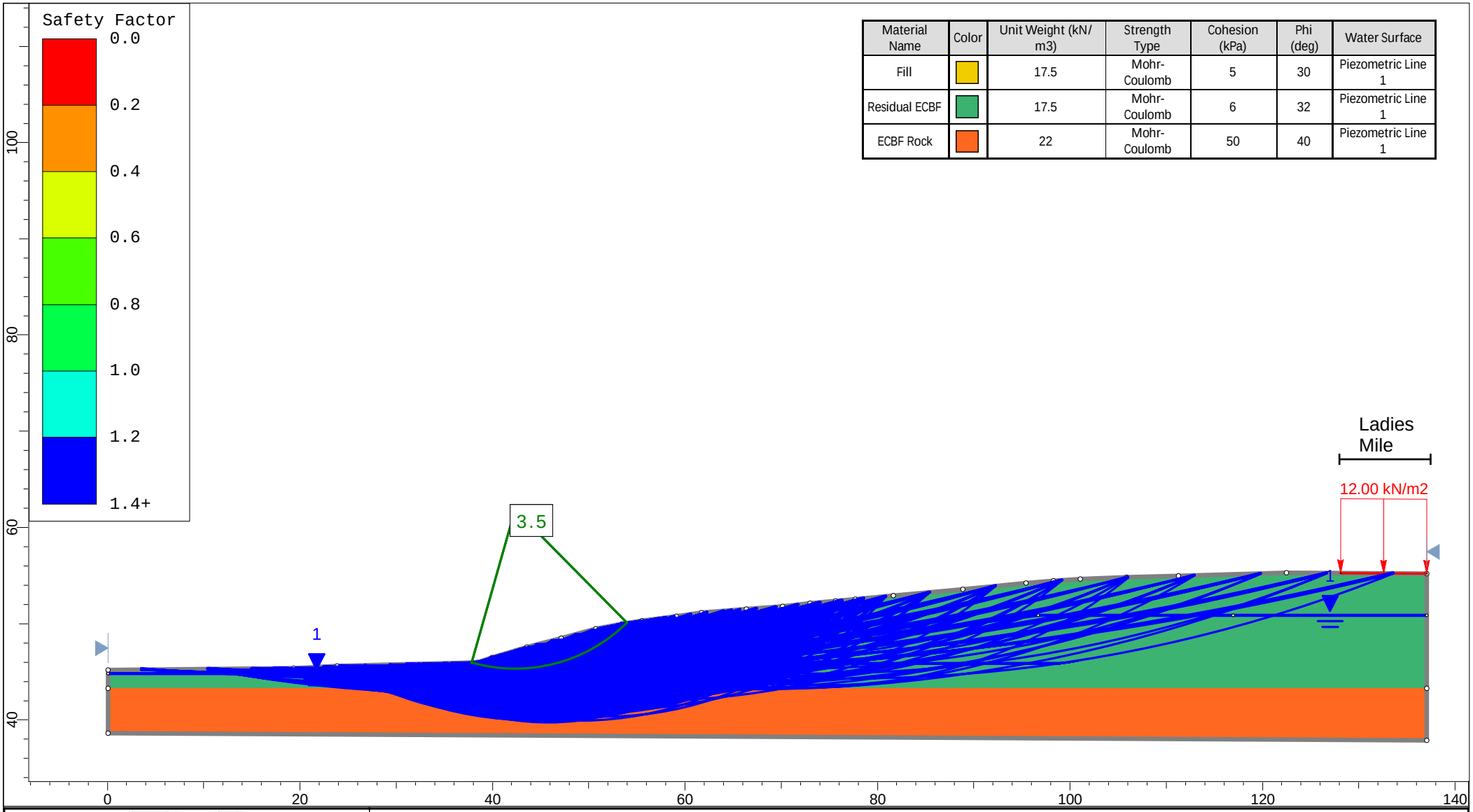
SLIDEINTERPRET 9.018

Project	The Hill, Ellerslie		
Analysis Description	Existing Conditions - Section B		
Project No.	P-001218	*Scale* 1:550	*Company* Initia
Description	Normal Groundwater	*Date*	30/05/2022



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface
Fill		17.5	Mohr-Coulomb	5	30	Piezometric Line 1
Residual ECBF		17.5	Mohr-Coulomb	6	32	Piezometric Line 1
ECBF Rock		22	Mohr-Coulomb	50	40	Piezometric Line 1

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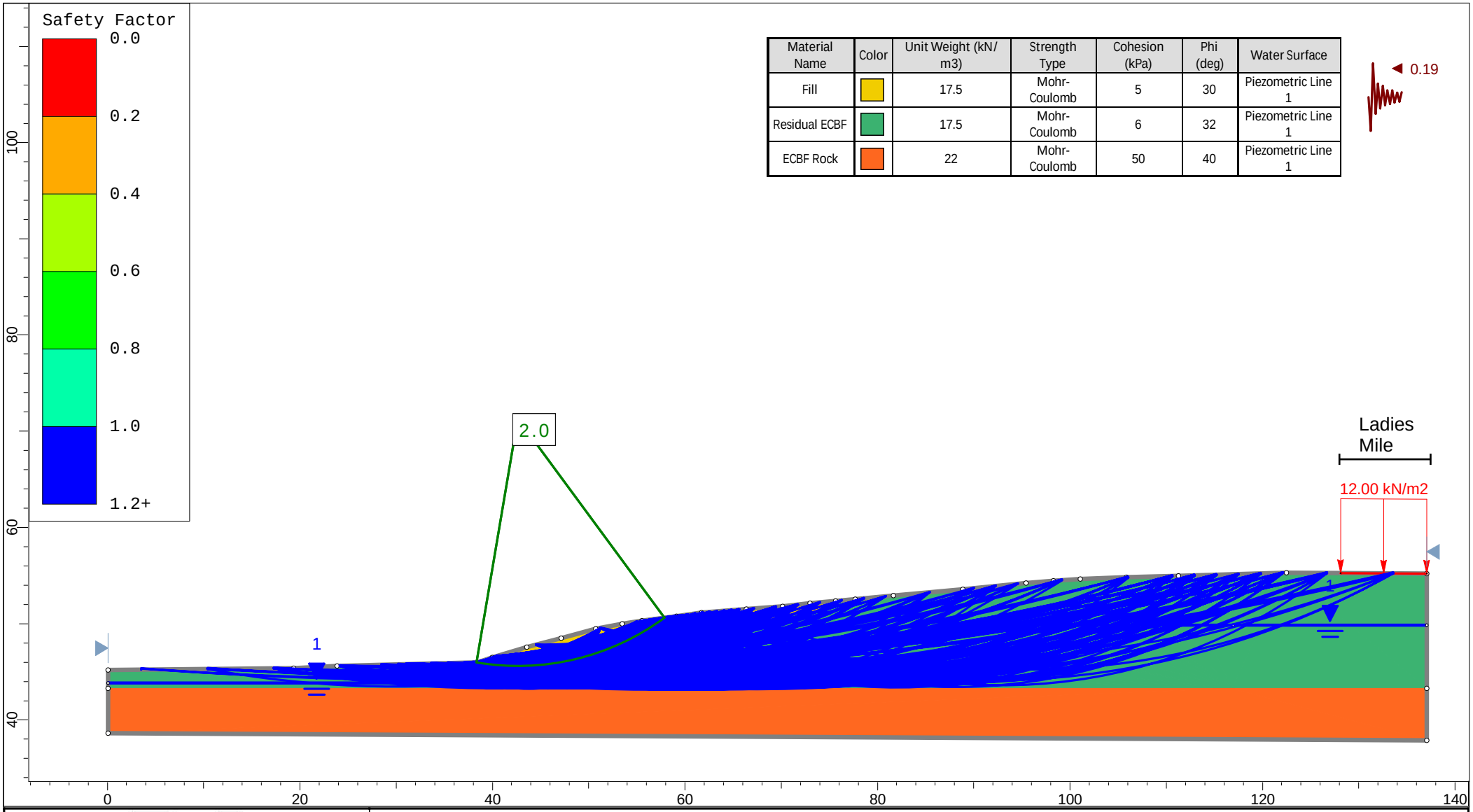
Project	The Hill, Ellerslie		
Analysis Description	Existing Conditions - Section B		
Project No.	P-001218	*Scale* 1:550	*Company* Initia
Description	Elevated Groundwater	*Date*	30/05/2022



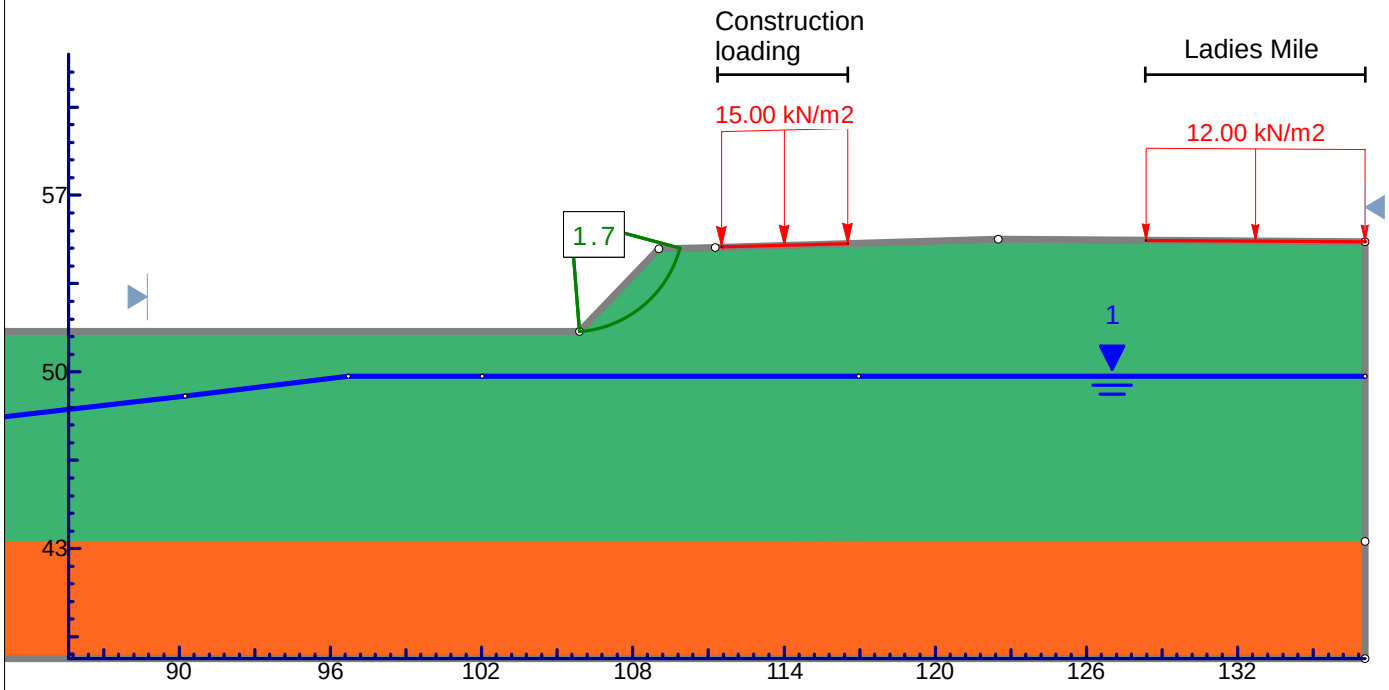
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface
Fill		17.5	Mohr-Coulomb	5	30	Piezometric Line 1
Residual ECBF		17.5	Mohr-Coulomb	6	32	Piezometric Line 1
ECBF Rock		22	Mohr-Coulomb	50	40	Piezometric Line 1

INITIA
GEOTECHNICAL SPECIALISTS

SLIDEINTERPRET 9.018

Project	The Hill, Ellerslie		
Analysis Description	Existing Conditions - Section B		
Project No.	P-001218	*Scale*	1:550
Company	Initia		
Description	Sesimic	*Date*	30/05/2022

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface
Fill		17.5	Mohr-Coulomb	5	30	Piezometric Line 1
Residual ECBF		17.5	Mohr-Coulomb	6	32	Piezometric Line 1
ECBF Rock		22	Mohr-Coulomb	50	40	Piezometric Line 1
New Fill		18.5	Mohr-Coulomb	5	32	Piezometric Line 1

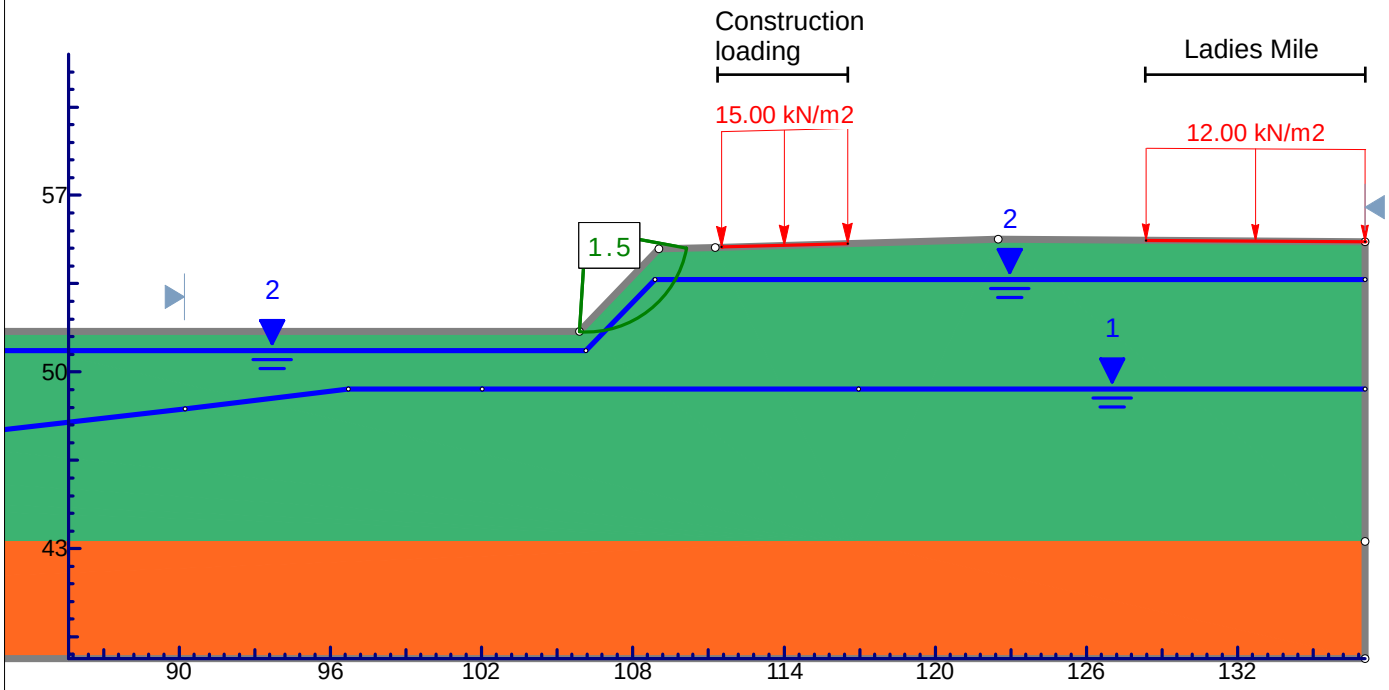


INITIA GEOTECHNICAL SPECIALISTS

SLIDEINTERPRET 9.018

Project	The Hill, Ellerslie		
Analysis Description	Temporary Batter for Basement Construction - Section B		
Project No.	P-001218	*Scale* 1:300	*Company* Initia
Description	Normal Groundwater	*Date*	30/05/2022

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface
Fill		17.5	Mohr-Coulomb	5	30	Piezometric Line 1
Residual ECBF		17.5	Mohr-Coulomb	6	32	Piezometric Line 2
ECBF Rock		22	Mohr-Coulomb	50	40	Piezometric Line 1
New Fill		18.5	Mohr-Coulomb	5	32	Piezometric Line 1

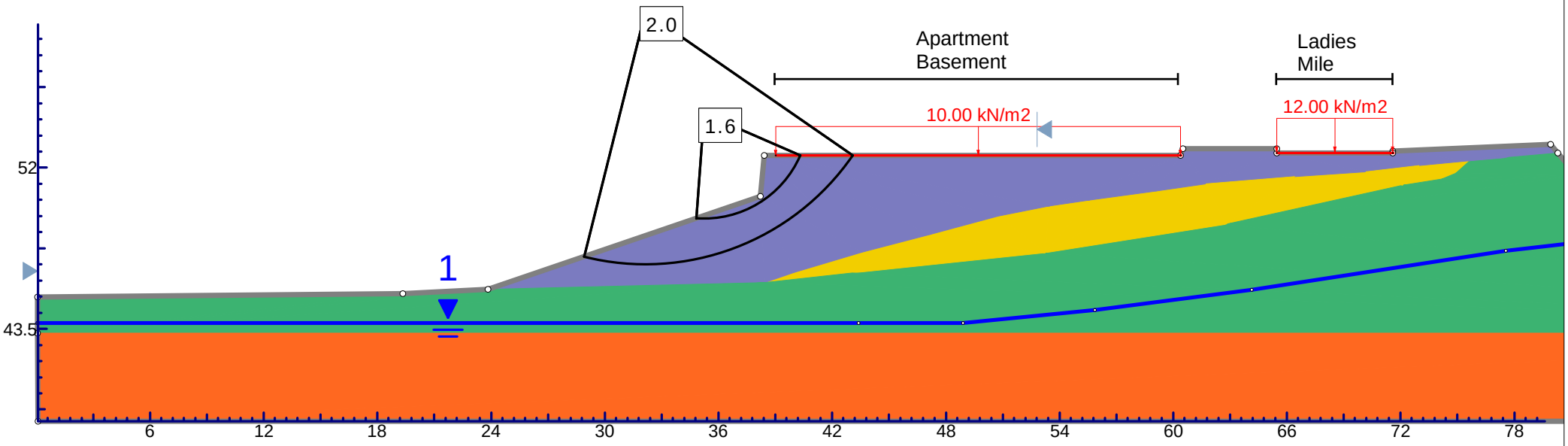


INITIA
GEOTECHNICAL SPECIALISTS

SLIDEINTERPRET 9.018

Project	The Hill, Ellerslie		
Analysis Description	Temporary Batter for Basement Construction - Section B		
Project No.	P-001218	*Scale* 1:300	*Company* Initia
Description	Elevated Groundwater	*Date*	30/05/2022

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface
Fill		17.5	Mohr-Coulomb	5	30	Piezometric Line 1
Residual ECBF		17.5	Mohr-Coulomb	6	32	Piezometric Line 1
ECBF Rock		22	Mohr-Coulomb	50	40	Piezometric Line 1
New Fill		18.5	Mohr-Coulomb	5	32	Piezometric Line 1

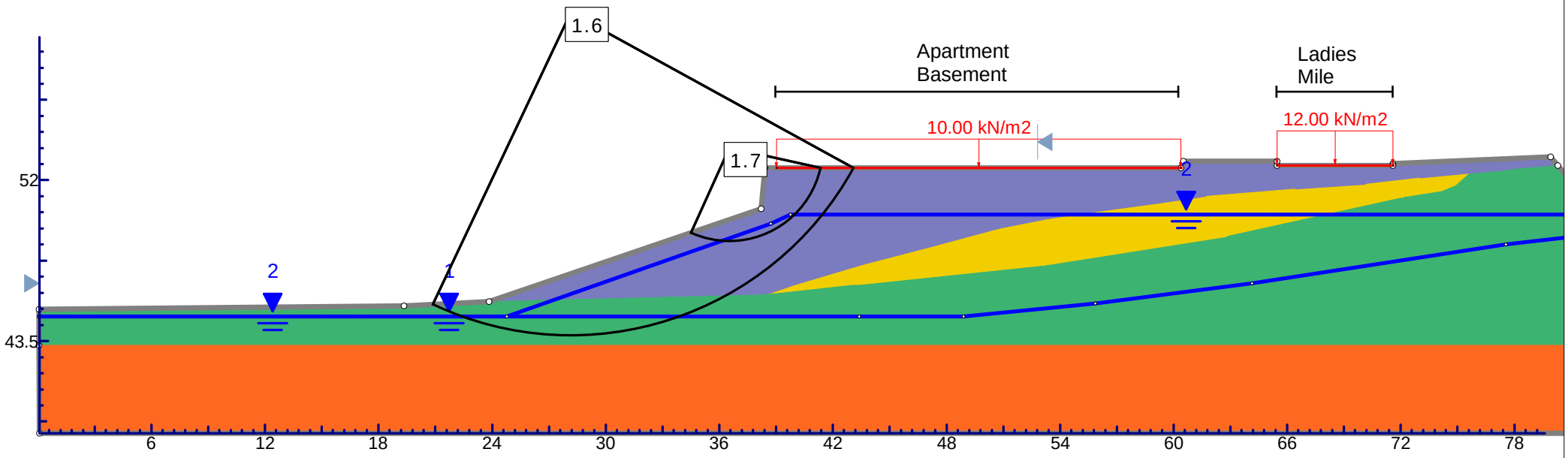


INITIA
GEOTECHNICAL SPECIALISTS

SLIDEINTERPRET 9.018

Project	The Hill, Ellerslie		
Analysis Description	Proposed Conditions - Permanent Lower Slope - Section B		
Project No.	P-001218	*Scale* 1:300	*Company* Initia
Description	Normal Groundwater	*Date*	30/05/2022

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface
Fill		17.5	Mohr-Coulomb	5	30	Piezometric Line 2
Residual ECBF		17.5	Mohr-Coulomb	6	32	Piezometric Line 2
ECBF Rock		22	Mohr-Coulomb	50	40	Piezometric Line 1
New Fill		18.5	Mohr-Coulomb	5	32	Piezometric Line 2

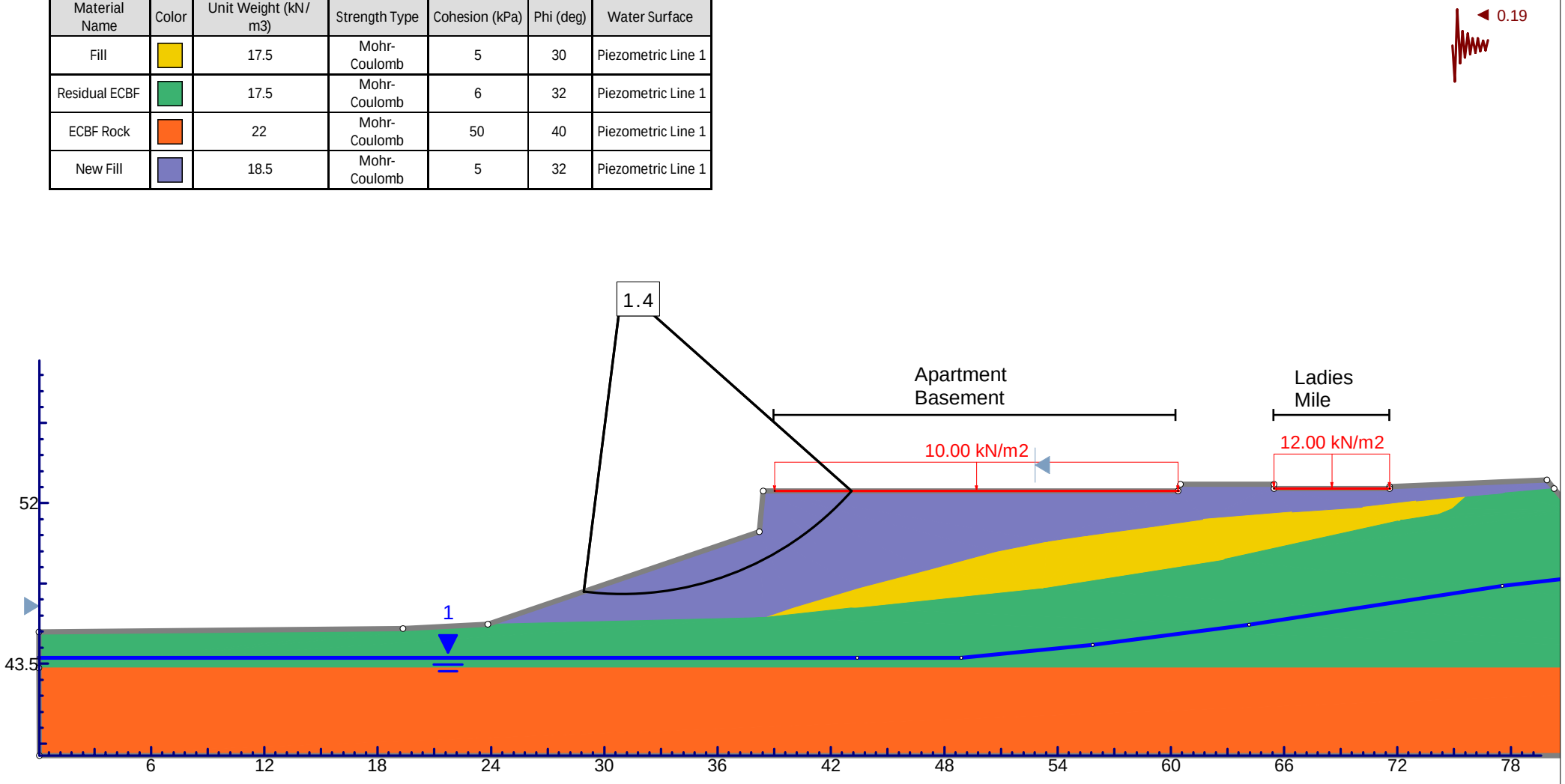


INITIA
GEOTECHNICAL SPECIALISTS

SLIDEINTERPRET 9.018

Project	The Hill, Ellerslie		
Analysis Description	Proposed Conditions - Permanent Lower Slope - Section B		
Project No.	P-001218	*Scale* 1:300	*Company* Initia
Description	Elevated Groundwater	*Date*	30/05/2022

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface
Fill		17.5	Mohr-Coulomb	5	30	Piezometric Line 1
Residual ECBF		17.5	Mohr-Coulomb	6	32	Piezometric Line 1
ECBF Rock		22	Mohr-Coulomb	50	40	Piezometric Line 1
New Fill		18.5	Mohr-Coulomb	5	32	Piezometric Line 1

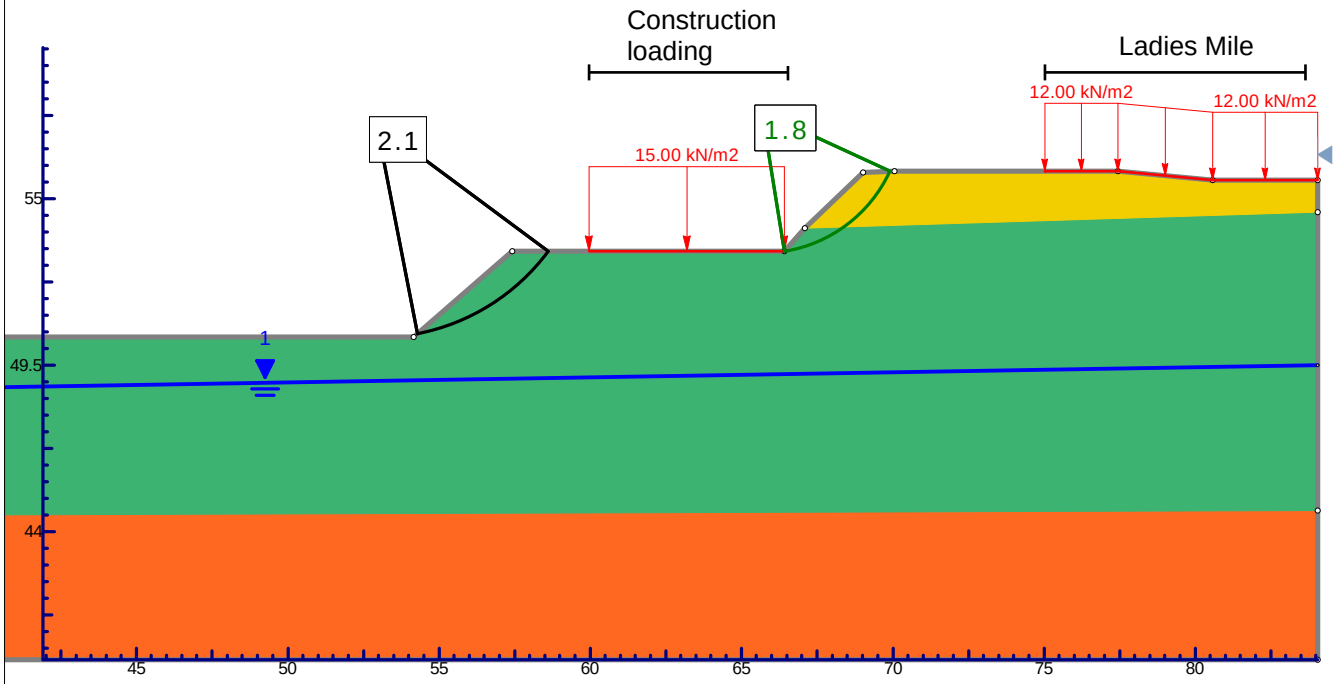


INITIA
GEOTECHNICAL SPECIALISTS

SLIDEINTERPRET 9.018

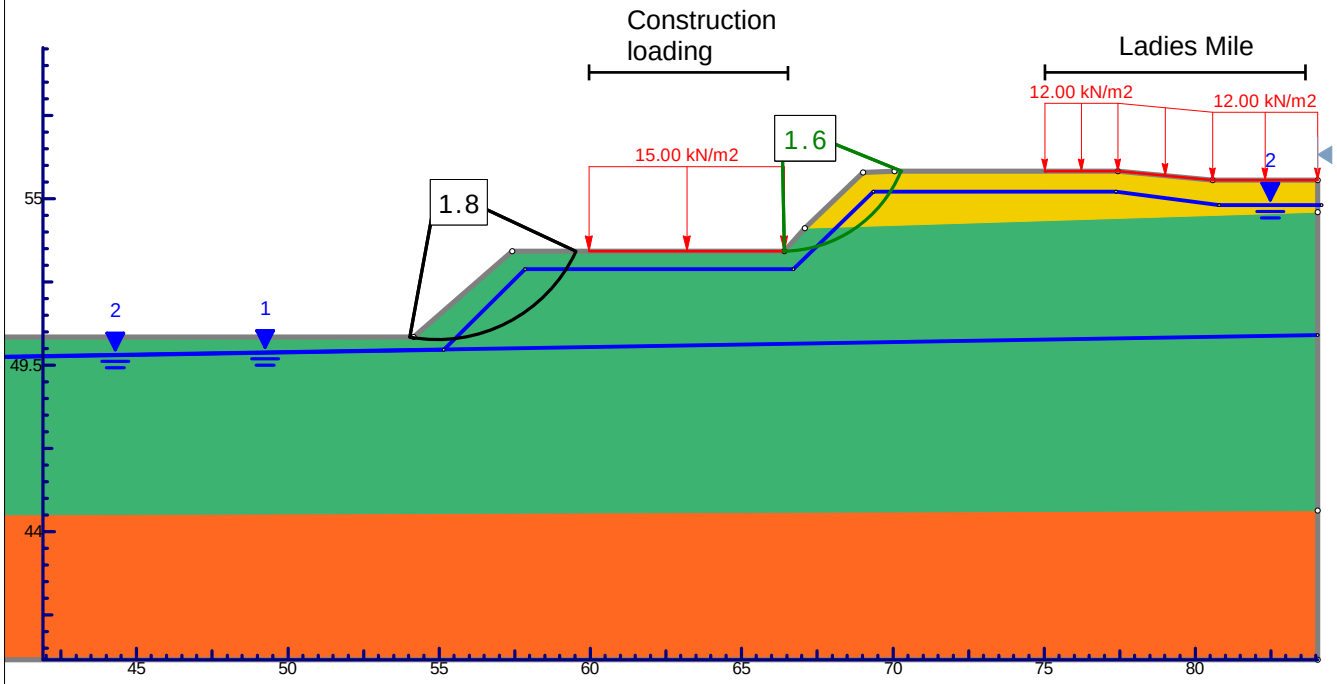
Project	The Hill, Ellerslie		
Analysis Description	Proposed Conditions - Permanent Lower Slope - Section B		
Project No.	P-001218	*Scale* 1:300	*Company* Initia
Description	Sesimic	*Date*	30/05/2022

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface
Fill		17.5	Mohr-Coulomb	5	30	Piezometric Line 1
Residual ECBF		17.5	Mohr-Coulomb	6	32	Piezometric Line 1
ECBF Rock		22	Mohr-Coulomb	50	40	Piezometric Line 1



INITIA GEOTECHNICAL SPECIALISTS	*Project*	The Hill, Ellerslie	
	Analysis Description	Temporary Batter for Basement Construction - Section C	
	Project No. P-001218	*Scale* 1:250	*Company* Initia
	Description Normal Groundwater	*Date* 30/05/2022	

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface
Fill		17.5	Mohr-Coulomb	5	30	Piezometric Line 2
Residual ECBF		17.5	Mohr-Coulomb	6	32	Piezometric Line 2
ECBF Rock		22	Mohr-Coulomb	50	40	Piezometric Line 1

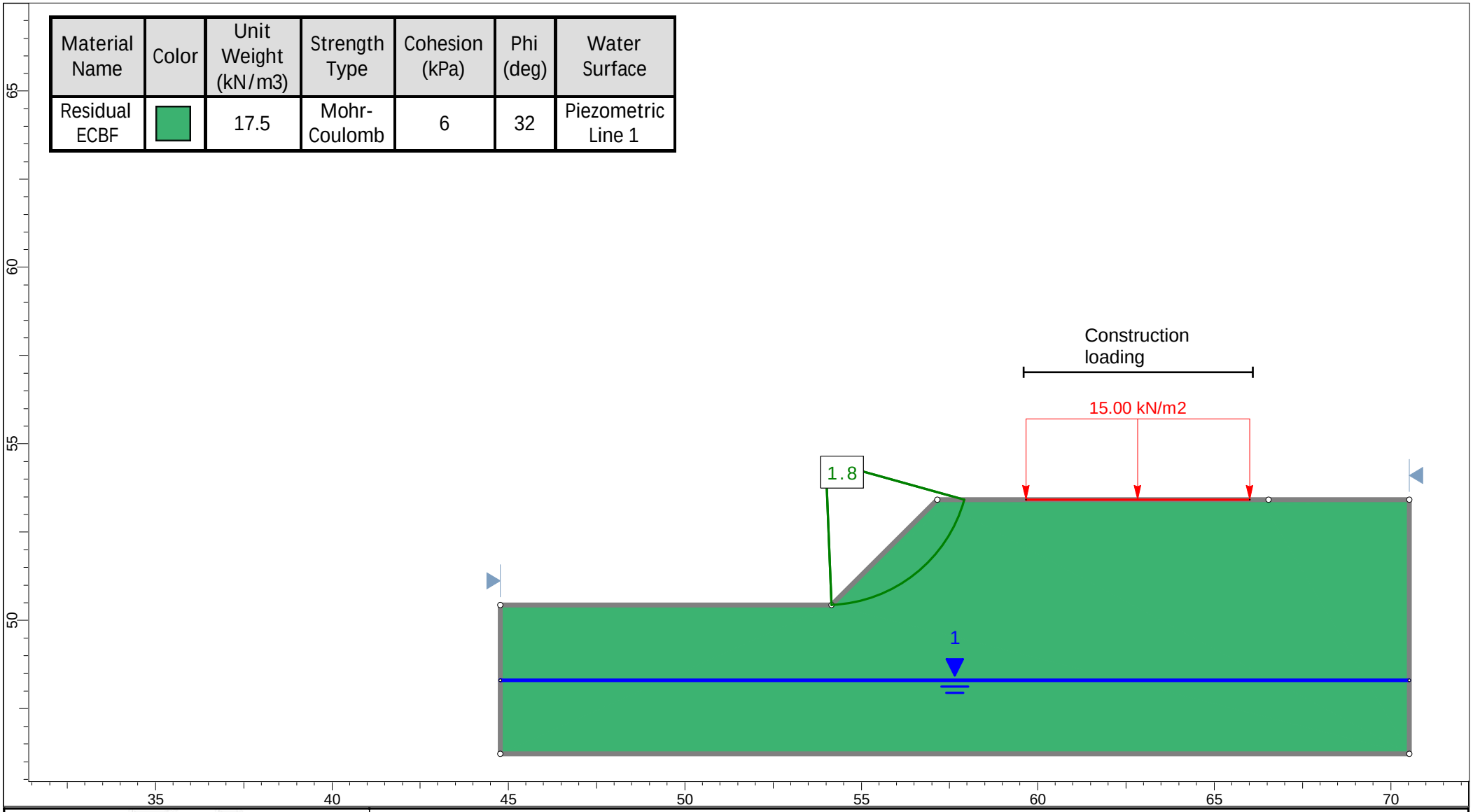


Project	The Hill, Ellerslie		
Analysis Description	Temporary Batter for Basement Construction - Section C		
Project No.	P-001218	Scale 1:250	Company Initia
Description	Elevated Groundwater	Date 30/05/2022	

INITIA GEOTECHNICAL SPECIALISTS

SLIDEINTERPRET 9.018

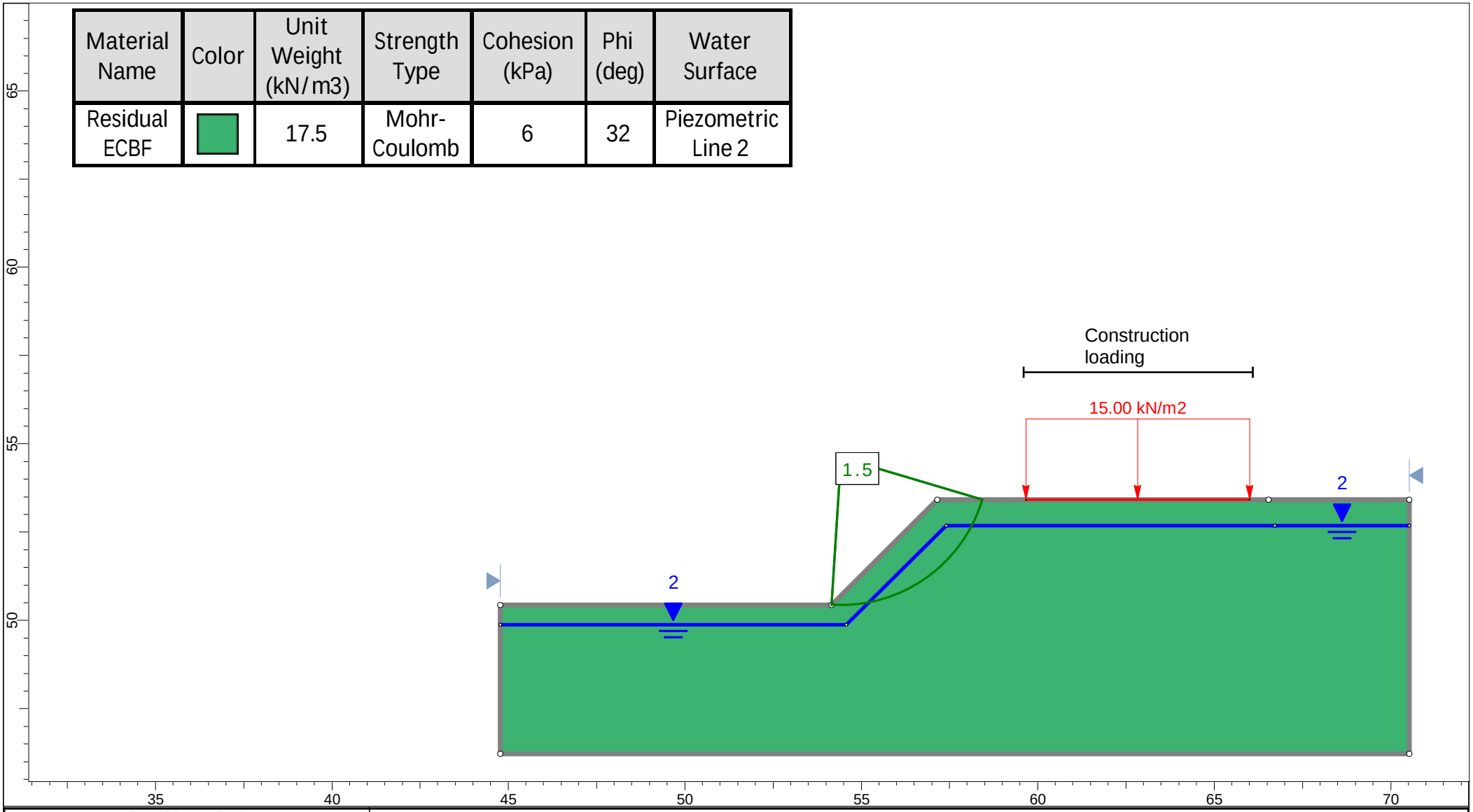
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface
Residual ECBF		17.5	Mohr-Coulomb	6	32	Piezometric Line 1



INITIA
GEOTECHNICAL SPECIALISTS

Project	The Hill, Ellerslie		
Analysis Description	1. Temporary Batter for Basement Construction (3 m high)		
Project No.	P-001218	Scale 1:150	Company Initia
Description	Normal Groundwater	Date 30/05/2022	

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface
Residual ECBF		17.5	Mohr-Coulomb	6	32	Piezometric Line 2

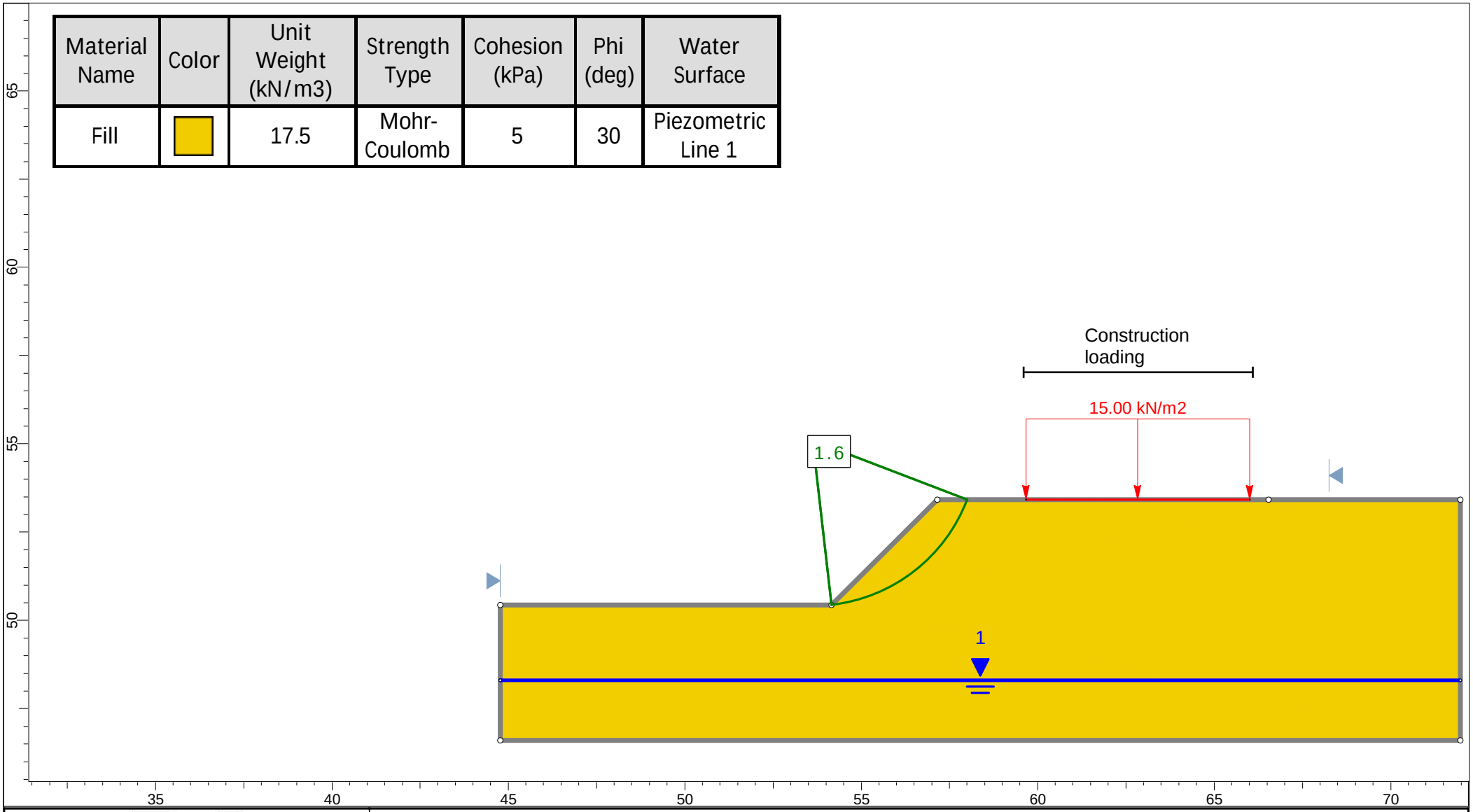


INITIA GEOTECHNICAL SPECIALISTS

SLIDEINTERPRET 9.018

Project	The Hill, Ellerslie		
Analysis Description	1. Temporary Batter for Basement Construction (3 m high)		
Project No.	P-001218	Scale 1:150	Company Initia
Description	Elevated Groundwater	Date 30/05/2022	

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface
Fill		17.5	Mohr-Coulomb	5	30	Piezometric Line 1

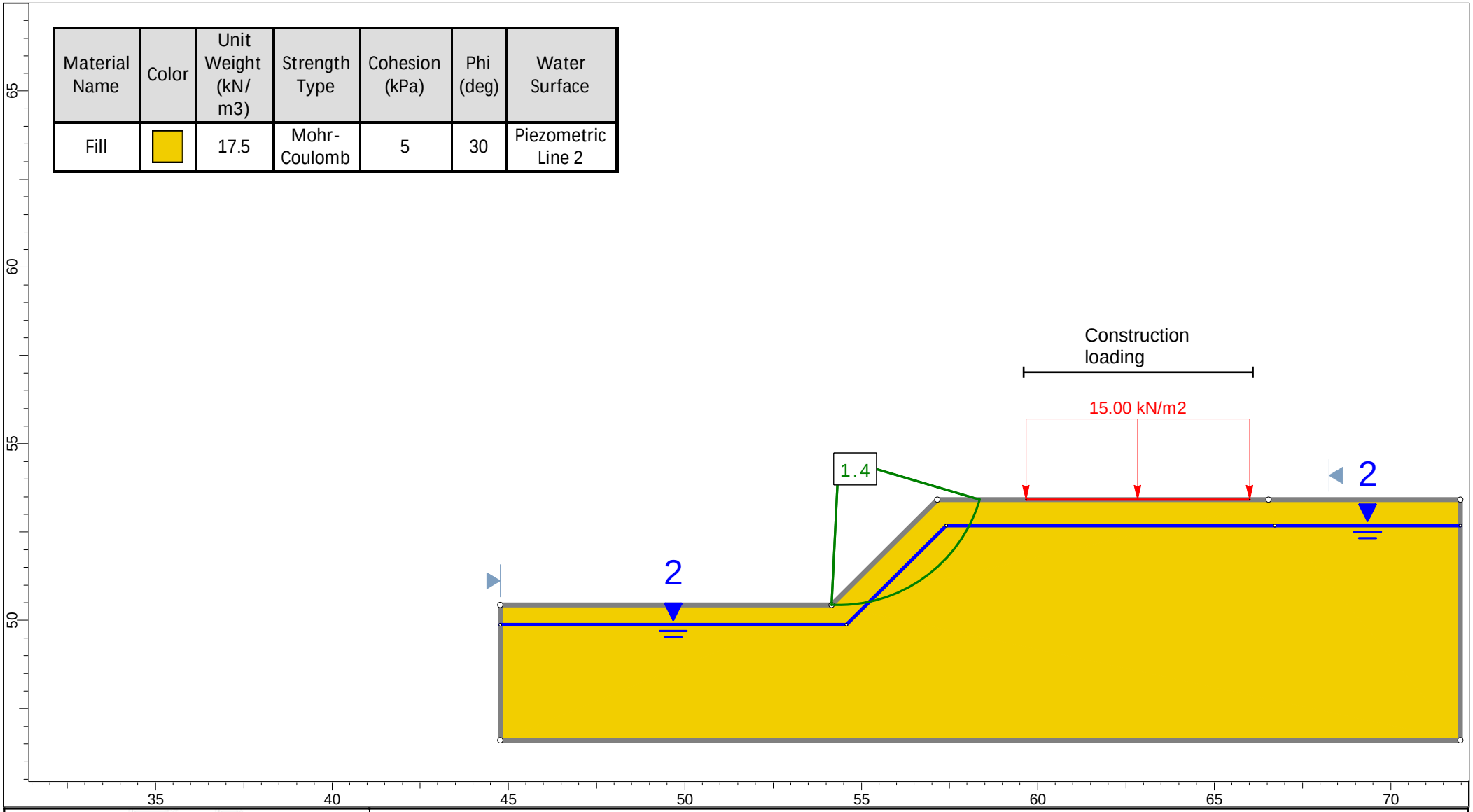


INITIA GEOTECHNICAL SPECIALISTS

SLIDEINTERPRET 9.018

Project	The Hill, Ellerslie		
Analysis Description	2. Temporary Batter for Basement Construction (3 m high)		
Project No.	P-001218	Scale 1:150	Company Initia
Description	Normal Groundwater	Date	30/05/2022

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface
Fill		17.5	Mohr-Coulomb	5	30	Piezometric Line 2



INITIA
GEOTECHNICAL SPECIALISTS

SLIDEINTERPRET 9.018

Project	The Hill, Ellerslie		
Analysis Description	2. Temporary Batter for Basement Construction (3 m high)		
Project No.	P-001218	Scale 1:150	Company Initia
Description	Elevated Groundwater	Date 30/05/2022	