11 February 2021 Ref No: J01662 (Rev A)

The Bears Home Project Management Limited
C/- The Golf Strategy Group

Attention: Mr D Moore

Dear David

RE: INTERIM ADVICE - Preliminary Geotechnical Appraisal Report and Groundwater Standpipe Installations at the Muriwai Downs Farm.

1 EXECUTIVE SUMMARY

The attached conceptual drawings show a possible golf routing and location of key buildings and water storage options for a new golf course at Muriwai Farms, namely:

- Clubhouse (nominally 1,500m2);
- Golf academy building (nominally 600m2); and
- Luxury lodge area;
- Golf maintenance facilities (nominally 2,300m2);
- The current preferred general locations for private residences; and
- Water storage pond (Option J preferred)

Lander Geotechnical have executed a Preliminary Geotechnical Appraisal Report (PGAR) involving a desktop review of geology maps, aerial photographs, council GIS contours, and a site walkover to observe geomorphology with respect to the above concept. In addition, 6 standpipes were installed to depths of up to 5m to facilitate measurement of the near surface groundwater table in the vicinity of preferred water storage Option J.

Pertinent findings that are present in the body of this report in relation to the key buildings and water storage options are summarised as follows:

- Clubhouse / Golf Academy / Golf Maintenance Buildings: The observed landform is gently rolling and has **no perceived geotechnical constraints** for buildings in this area (in terms of ground instability), provided they are set back from the edges of steep sided tributary gullies that are presence.

- Luxury Lodge / Private Residences: The landform here contains significant areas of **steeper ground exhibiting soil creep / shallow seated slope instability, and there are perceived geotechnical constraints to development upon or close to these features**. With appropriate engineering this does not preclude development upon or close to such areas. It will need to be assessed via ground proving site investigations and slope stability analysis to determine safe set back from the steeper ground. This is dependent on the earthworks proposals to provide building platforms and the platform final locations, but if safe set back distances cannot be achieved, then foundations may need to be specific designed and/ or

ground stabilisation measures employed to accommodate laterals loads associated with steep ground. These are outlined in the body of the report (Section 3.4.1).

- Water Storage Options: The geology encompassing most of the site is likely to be of sandy composition, such that any water storage ponds will need consideration to piping erosion failure / leakage induced by a head of impounded water / high hydraulic gradients. This can be overcome by impermeable liners (e.g. highly plastic clay liners, geosynthetics liners, PE liners, etc).

  However, preferred Option J is located in a different geology and will likely comprise less sands and predominantly clays and silts (i.e. as evidenced by the attached boreholes records for the installed standpipes). The groundwater table is likely to be high here (refer attached standpipe records) and an 'in ground; pond excavated below current levels may be inundated by groundwater, thereby providing less live storage. Conversely, 'above ground' ponds in this terrain may impose loads onto potentially compressible deposits leading to impoundment 'dam; bund instability, or pond batter slope instability. Liquefaction potential will also be required for Option J. All these issues can be accessed via further site investigations and then addressed through engineering design.

- Fairway Routing: There are **no perceived geotechnical constraints** that would prevent the fairway routes, however where large scale earthworks may be required to change the landform to suit desired fairway / green geometric design, geotechnical analyses for adverse effects as a result of such works on land stability should be undertaken. This is a matter to address as part of the earthworks design process.

Ground proving site investigations will need to be commensurate with the golf course concept(s) and will likely involve several phases, which are outlined in the report (refer Section 3.5).

2 SCOPE OF SERVICES

The Principal (The Bears Home Project Management Limited) has commenced a project for development of an 18 hole golf course at Muriwai Downs Farm. The project extends to augmenting the golf course with buildings, practice facilities and any other amenities necessary or desired to produce an exceptional quality of outcome including club rooms, accommodation and associated infrastructure. The current preliminary concept of basic fairway alignments (as they currently stand) is shown in the attached drawings (as supplied to us). These will likely change as the concept evolves.

Lander Geotechnical have been engaged to provide a Preliminary Geotechnical Appraisal Report (PGAR) in relation to the Principal's land holding specifically included in records of title NA117B/168, NA134D/135, NA125C/442, NA125C/443, NA117B/171 and NA117B/172, known as Muriwai Downs Farm (the 'Site'). The extent of the Site is shown approximately on Council GIS plans Figure1 to 4 (attached).

Our primary scope of work for the PGAR comprises the following primary service objectives:

a) A desktop study of available geological maps/ geotechnical data, site walkover of the locations of the proposed infrastructure (Clubhouse, golf academy building, lodge area, maintenance facilities, preferred private residence areas and water storage pond Option J area);
b) Preliminary geomorphic observation of the proposed infrastructure areas and preparation of a preliminary geotechnical advice report, summarise the outcomes of the desktop/ walkover

assessment and provide key geotechnical considerations for development of the golf course site and likely subsequent geotechnical investigations that will be necessary as part of the resource/earthworks and building consent phases of the project.

A secondary (additional) scope of work was also commissioned as follows:

c) Install 6 No. (5m deep) PVC standpipes (Piezometers). Undertake 1 No. subsequent monitoring round approximately 7 days following installation. Prepare technical memorandum (incorporated within the PGAR) presenting boreholes logs with vane shear strength profiling and measured groundwater levels to inform preliminary foundation conditions for Pond J concept in this area.

3 GEOTECHNICAL DESKTOP APPRAISAL

3.1 Published Geology

There are five geological units beneath the Site which are briefly described below. Refer Figure 5 (attached) for delineation of each unit and more comprehensive descriptions.

- Awhitu Group: Fixed dune sands; prevails over most of the Site.
- Kariotahi Group: Mobile sand dunes; confined to the western extremity of the Site.
- Nihotupu Formation (Waitakere Group): Sandstones and siltstones; isolated to small portions of the northern and southern extremities of the Site.
- Tauranga Group: Alluvial deposits; prevails over the majority of the eastern (lower lying) portion of the site.
- Waiatarua Formation (Waitakere Group): Basalt flows and pillow lava; confined to a small, isolated area in the central - eastern region of the site.

3.2 Site Walkover and Preliminary Geomorphic Observations

The Site is characterised by rolling terrain dipping in elevation from more elevated terrain in the south, towards lower lying terrain in the north, where a main dividing gully system defines the northern boundary. A number of incising features (watercourses and wetlands) form tributaries to the main dividing gully, with these features being far more significant and pronounced over the western half of the Site. Terrain relief and associated contours best illustrated this as shown on Figures 3 and 4 (attached).

Figure 6 (attached) presents oblique views across the Site sourced from Google Earth (displaying 3x vertical exaggeration), with photographs superimposed to illustrate certain typical geomorphic features from our site walkover (on 14/12/20). Detailed geomorphic mapping is recommended focussing on the golf course layout once the concept(s) is firmed up. From a preliminary sense the main geomorphic observations are summarised as follows:

- Soil Creep: shallow seated slope instability (also known as sheep tracks), commonly occurring on areas where slope gradients exceed 1(v) in 4(h). More prevalent over the western half of the site where the terrain is more severe than the central and eastern portions.
- Basalt Rock outcrops: isolated to a small area in the central region of the site (red shaded area on Figure 5 geology map).

- Sandstone Rock outcrops: isolated to the waterfall features within in the main dividing gully defining the central region of the northern boundary of the Site (orange shaded area on Figure 5 geology map). Unlikely to be developed over so is probably of little consequence.
- Low lying ground / wetland: generally located in the base of various incised watercourse / gully features, typically flanked by areas displaying soil creep (e.g. over the western half of the site where the gullies are more incised than the central / eastern portions). Low lying ground in the eastern part of the site may be prone to flooding (subject to confirmation by a specialist).
- Gently Rolling to Flat Terrain: The majority of the central and eastern portions of the Site and offers easy contours to develop over, but this terrain is less common over the western half of the site where the landform is more severe.

3.3 Existing Geotechnical Information

The New Zealand Geotechnical Database shows there is no existing geotechnical information held within the area encompassed by the Site, however there is data nearby as illustrated on Figure 7 (attached). This shows the locations of water bores and a shallow hand auger borehole. The logs of these tests are attached, and in particular the water bore information may be of interest to supplement any other water bore information held for the Site (i.e. not in the NZGS database).

3.4 Preliminary Geotechnical Considerations

3.4.1 Slope Stability Hazards

The western half of the site contains steep ground defined by significant incised gully systems forming tributaries to the main dividing gully on the northern boundary. There were no large geomorphic features observed, or apparent on the aerial photographs reviewed for this report, that would suggest deep seated slope instability prevails in this area, however there is much evidence of soil creep where slope gradients typically exceed 1(v) in 4(h). These are shallow seated modes of slope failure that occur slowly over time, as a result of seasonal wetting and drying of the surficial soils and gravity, exacerbated by livestock to form minor slump terraces (i.e. ‘sheep tracks’). This may affect the luxury lodges and residences.

Earthworks in this area will require slope stability consideration to ensure the stability of the slopes are not compromised and achieve a minimum acceptable factor of safety commensurate for the proposed end use. The required minimum factors of safety are more stringent where infrastructure and buildings are to be sited, and less so where parklands / reserves (and arguably fairways) are sited. Where there is room, it is often best to adequately set back development areas from slopes where factors of safety do not meet minimum requirements (or slope showing signs of existing movement), thereby avoiding what can be expensive slope stabilisation engineering (e.g. palisade shear piles, retaining walls, bulk earthworks shear keys, counterfort / horizontally bored drainage, etc).

The central and eastern portions of the Site are gentler and do not appear to present the same inherent slope stability risks than the western side does.

3.4.2 Liquefaction Potential

The Tauranga Group alluvial deposits over the eastern side of the Site (refer Figure 5 geology map) may contain soft / weak ground with a high ground water table, which may be susceptible to liquefaction under earthquake shaking. Liquefaction can manifest at the surface as sand boils,

subsidence and/ or lateral spreading. This is a matter for consideration as part of further ground proving geotechnical investigations and analysis, if infrastructure, ponds, golf course, and/ or buildings are to be sited over this area.

The central and western portions of the sites are inferred from geology maps to contain predominantly fixed dune deposits (Awhitu Group), and a deeper groundwater regime is anticipated when compared to the lower lying eastern portion. Based on experience Awhitu Group is anticipated to have low susceptibility to liquefaction under seismic loadings.

3.4.3 Compressible Ground

The Tauranga Group alluvial deposits over the eastern side of the Site (refer Figure 5 geology map) may contain soft / weak ground that is prone to consolidation settlements under imposed loadings (e.g. from bulk fills and/ or building surcharges, etc). This is a matter for further investigation and analyses commensurate with a development proposal over such areas.

Consolidation settlements can be mitigated (where they cannot be tolerated) by preloading of the ground (with wick drainage to reduce the preloading time), ground improvement (e.g. undercutting and replacement, or deep stabilisation via lime/ cement soil mixing, etc), and/ or specific foundation design (e.g. pile foundations for buildings, etc).

3.4.4 Near Surface Rock

There is a relatively small area in the centre of the Site shown to contain Basalt Rock (refer Figure 5). This was observed to be outcropping during the site walkover (refer Figure 6) and appears to have the relict workings of a minor quarrying operation. Near surface rock presents constraints to bulk earthworks (e.g. cuts) using conventional prime movers (e.g. motor scrapers, bull dozers, excavators, etc) and may require blasting to remove, if this is a requirement. Deep pond excavations may also encounter rock (e.g. 'Pond J', in light of the borehole findings presented in Section 3 below) , and will be subject to specific design to help assess any design conflicts in this regard.

3.4.5 Foundations for Buildings and Infrastructure

Most buildings and Infrastructure at the locations shown in concept are anticipated to be located predominantly upon Awhitu Group geology, which should be suitable for NZS3604 shallow foundation systems having a geotechnical ultimate bearing capacity of 300 kPa. This subject to ground proving and soil strength profiling as part of future investigations.

The MBIE expansive site class of the foundation soils is likely to be Class S (slight) to H (High) and is subject to site investigations and specific laboratory testing. This is a matter for detailed structural design of foundations at a later stage, but would not preclude the use of shallow foundation solutions.

3.4.6 Pond Infrastructure

Ponds for irrigation / stormwater attenuation are likely to be required. Awhitu geology encompasses most of the site and is likely to be predominantly sandy, such that any ponds here will need consideration to piping erosion failure induced by a head of impounded water / high hydraulic leakage gradients. This can be overcome by impermeable liners (e.g. highly plastic clay liners, geosynthetics liners, PE liners, etc).

Tauranga Group deposits (e.g. the eastern end of the site , where Option J may be sited) will likely comprise more clays and silts (i.e. as evidenced by the attached boreholes records for the installed standpipes). The groundwater table is likely to be high here (refer attached standpipe records) and

an ‘in ground; pond excavated below current levels may be inundated by groundwater, thereby providing less live storage. Conversely, ‘above ground’ ponds in this terrain may impose loads onto potentially compressible deposits leading to impoundment ‘dam; bund instability, or pond batter slope instability.

Of relevance for all ponds is consideration of conduits through pond impoundment structures (e.g. earth bunds) which will need to minimise the potential for seepages and piping erosion (e.g. cut off collars, seepage filters, etc).

All ponds will need site investigations, flow net analysis (or similar, depending on size) and specific design.

3.4.7 Bulk Earthworks

Earthworks in Awhitu Group geology are anticipated to comprise mainly sands, and should be relatively straightforward to execute using conventional earthworks machinery (e.g. motor scrapers, tipper trucks, compactors, graders, bull dozers, etc). In Awhitu group fixed dune deposits, cut slopes in sands when left unprotected from the elements can be prone to erosion and runnelling when exposed to rainfall and overland flows. Slopes here often perform best when cut near vertical (subject to their height / slope stability analysis) as this exposes a lesser face area to the elements.

Tauranga Group alluvial materials are situated in a lower lying area, and as such are likely to be wet of an optimum moisture content (e.g. of concern if ponds are excavated here and the materials borrowed for use as engineered filling elsewhere). They would likely require conditioning by air during or lime addition / mixing with dryer materials. Heavy earthworks machinery may also cause pumping of the subgrade (i.e. subgrade shear failure) on haul roads / in cut areas where the groundwater table is naturally high, and therefore find it difficult to repeatedly traffic over.

Once an earthworks model for the concept(s) is developed, areas requiring engineered filling can be determined and laboratory samples collected from borrow areas / insitu testing performed, in order to determine compaction control criteria for the specific materials (e.g. a sand will have a different criteria to clay).

3.5 Further Geotechnical Work

Further site investigations will be commensurate with the golf course concept(s) and will likely involve several phases, such as (but not limited to):

1. Preliminary investigations of preferred golf course, building / infrastructure and pond areas – to inform concept / preliminary design and determine general land suitability, assess liquefaction potential, slope instability potential, consolidation settlement potential, etc
2. Detailed investigations once an earthworks model is developed – for Resource / Earthworks Consent, and should inform compaction control criteria, detailed slope stability analysis, detailed settlement analyses, etc.
3. Detailed investigations of ponds once their locations, geometry and typology have been determined – for specialist dam design and associated Consent(s), if required.
4. Detailed investigations of future building platforms – to confirm bearing capacity, expansive site class, foundation type and inform structural design for Building Consent(s).

4 STANDPIPE INSTALLATIONS AND GROUNDWATER

In the vicinity of Pond J, six (6) PVC standpipes were installed (on 12/01/21) to depths of up to 5 mbgl in the locations shown on Figure 8 (attached). The standpipes were sleeved with geotextile filter sock and bentonite seal to facilitate long term monitoring (e.g. between summer and winter) should that be desired. One groundwater monitoring round was undertaken on 20/01/21. To the best of our knowledge the standpipes have been protected since our monitoring round by post and wire fences to minimise interference / destruction from farm livestock.

Full boreholes records containing descriptions of the materials encountered are also attached together with measured groundwater levels, which ranged from approximately 0.9 to 3.9m mbgl. The logged materials indicated a softer (more compressible) soil profile in the vicinity of P6. The other boreholes typically display firm to stiff soils. No peat or highly organic soils were identified. P1 and P5 encountered refusal conditions prior to reaching target depth and this may infer the top of the Nihotupu Formation (sandstone and siltstone) unit, at depths of 1.3 and 2.5m respectively. Deep ponds may encounter these inferred deposits, and this issue is subject to ground proving investigations.

5 LIMITATIONS

This report has been prepared solely for the use of our client, The Bears Home Project Management Limited, and its professional advisers in relation to the specific project described herein. 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.

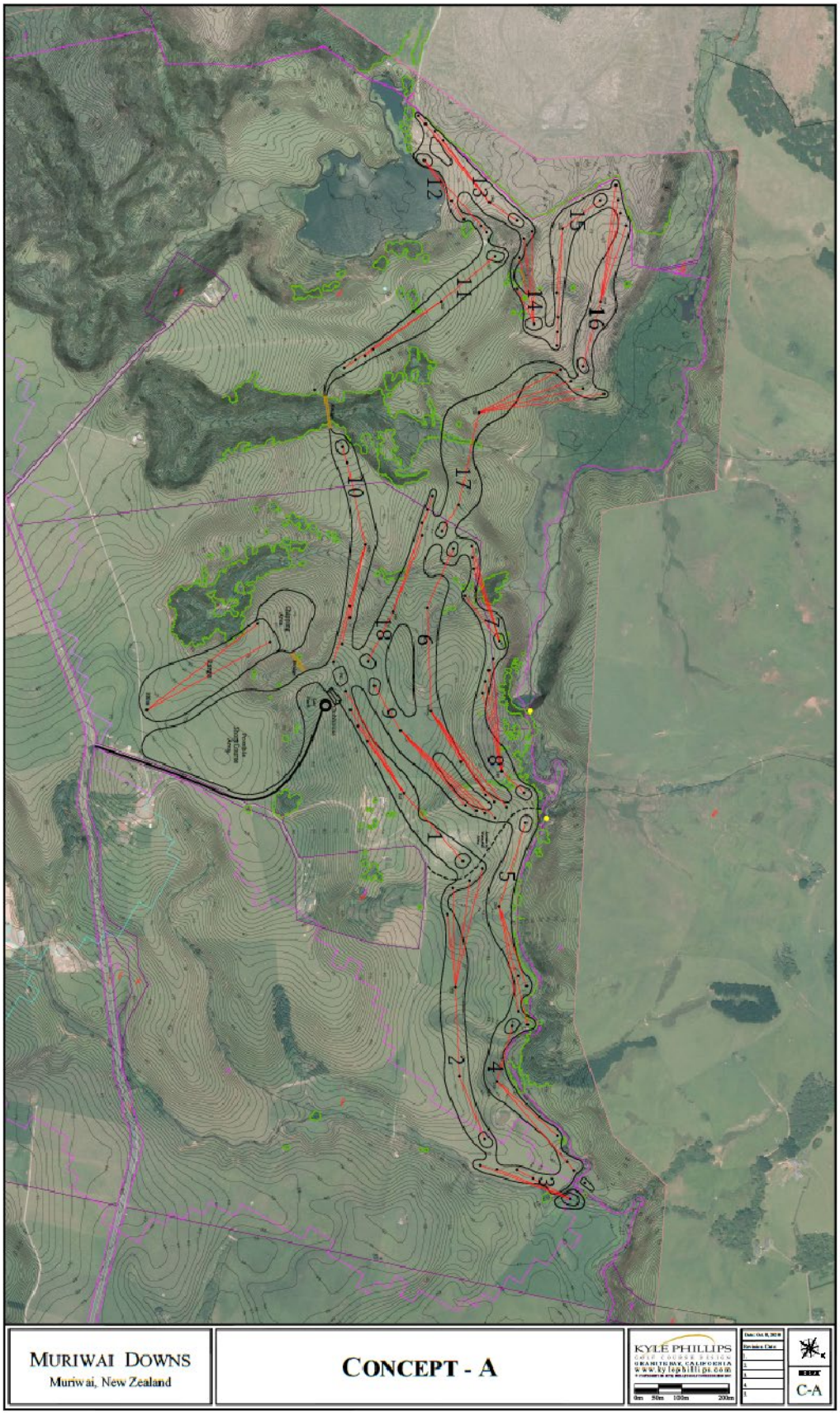
For and on behalf of Lander Geotechnical Consultants Limited

S.G. Lander
Principal Geotechnical Engineer

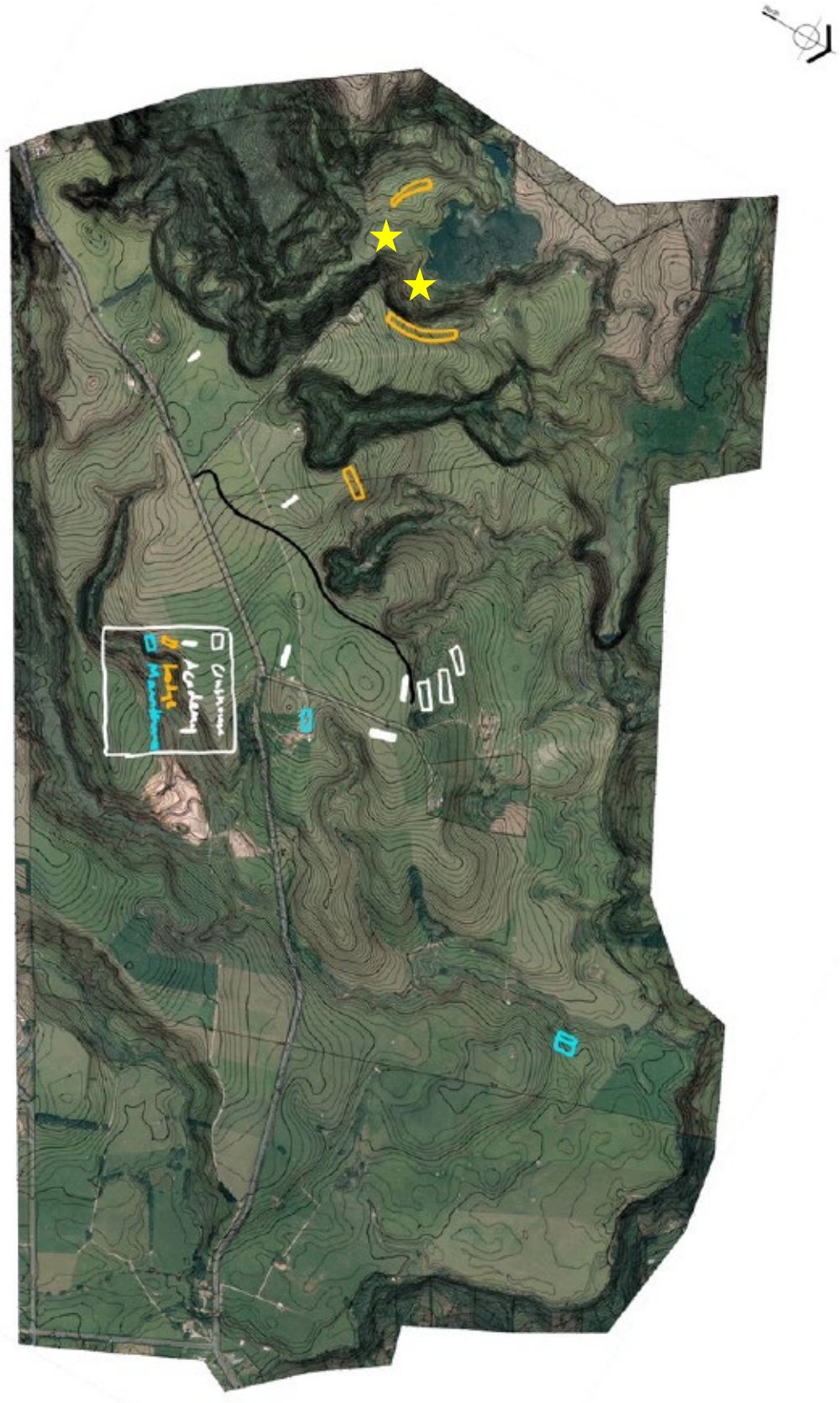
Attachments:

- Current Preliminary Concept Plans (as supplied to us)
- Figures 1 to 4 (Various Auckland Council GIS plans)
- Figure 5 (Geology Overlay)
- Figure 6 (Geomorphic Features Plan)
- Figure 7 (NZGD Existing Test Location Plan)
- NZGD Existing Borehole Records
- Figure 8 (Standpipe Location Plan)
- Standpipe Borehole Records and Groundwater Measurements (taken on 12/01/21)

APPENDIX 1: Preliminary DRAFT Golf Routing Plan



APPENDIX 2: Building Location Options (White Outlined Areas = Clubhouse, White Solid Areas = Golf Academy, Orange = Lodge Locations, Blue = Golf Maintenance, Stars = Dwellings



MURIWAI DOWNS

Muriwai, New Zealand

CONCEPT - A

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www.kylephillips.com

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Date: Oct. 8, 2020

Revision Date:

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2.

3.

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5.

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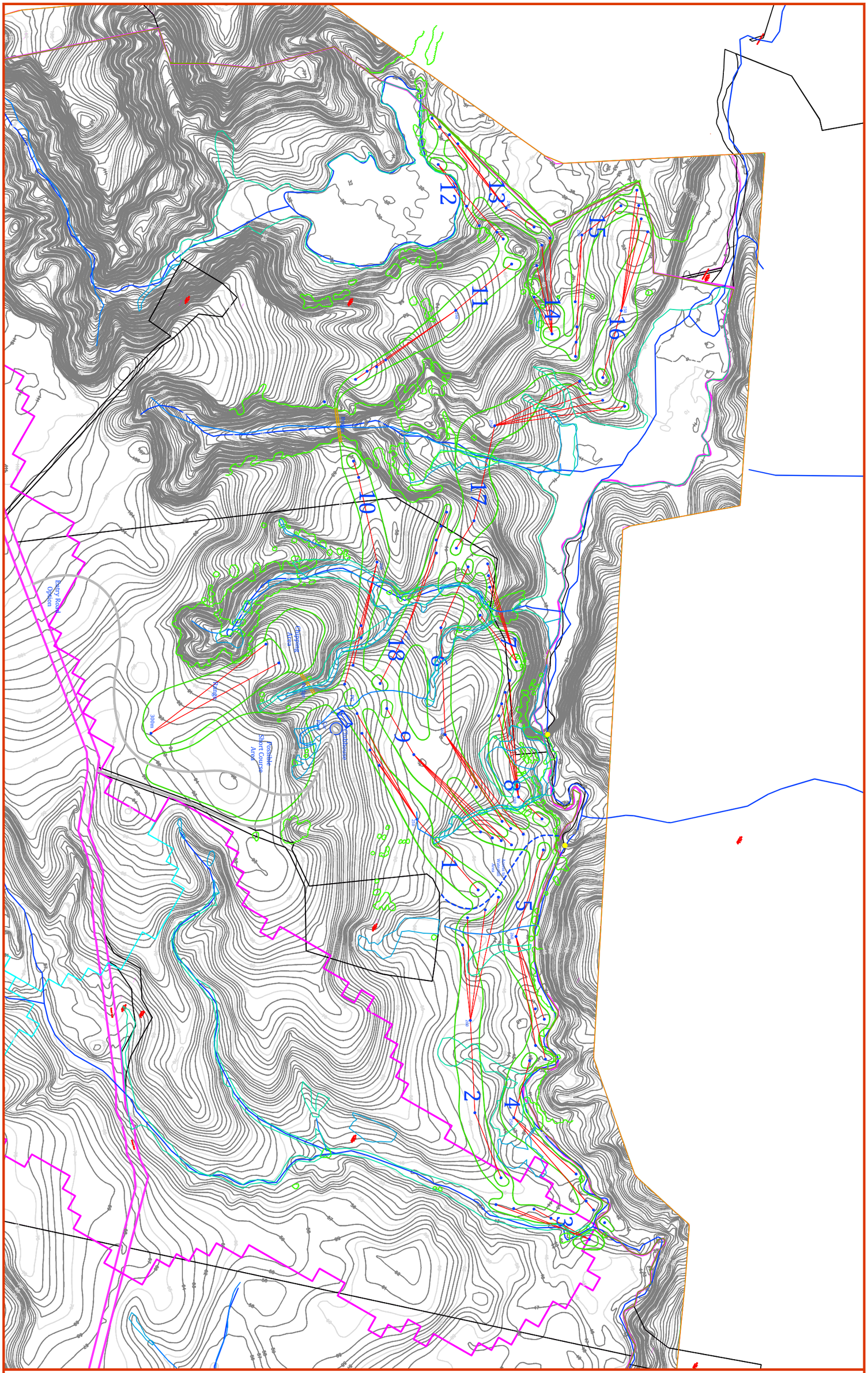
SHEET

C-A



MURIWAI DOWNS

Muriwai, New Zealand

CONCEPT - A

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GRANITE BAY, CALIFORNIA
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Date: Oct. 8, 2020

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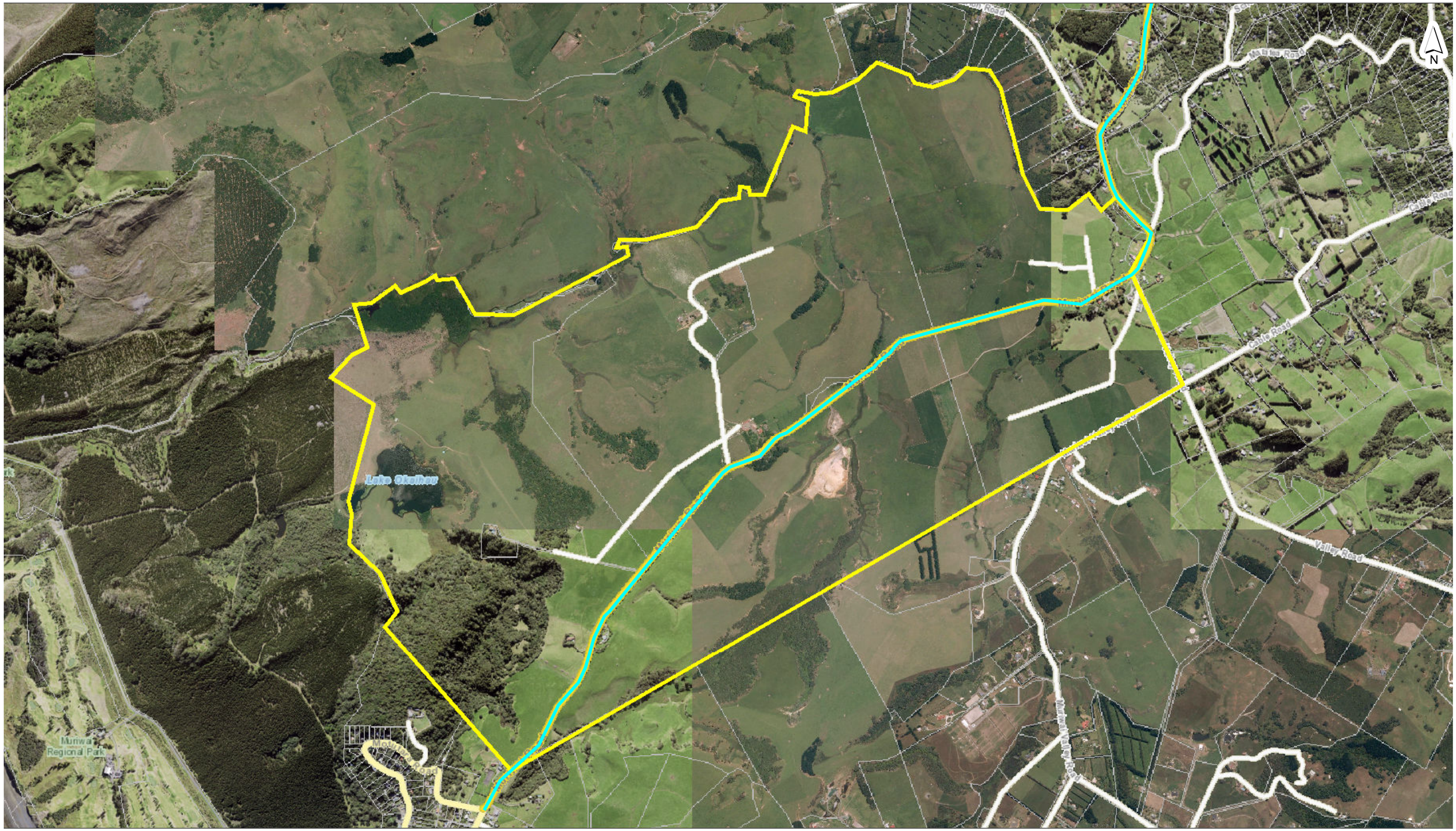

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approved	SGL
date	26/01/21
scale	1:15,000
original size	A3

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project: MURIWAI DOWNS FARM

title: AUCKLAND COUNCIL GIS AERIAL

project no: J01662 | figure no: 1

Template revision: 1:1000 (10/12/14)

Legend and/or Notes:

revision	description	drawn	approved	date

drawn	sl
approved	SGL
date	26/01/21
scale	1:15,000
original size	A3

LANDER geotechnical

client: **THE BEARS HOME PROJECT MANAGEMENT LTD**

project: **MURIWAI DOWNS FARM**

title: **AUCKLAND COUNCIL GIS AERIAL with CONTOURS**

project no: **J01662** figure no: **2**

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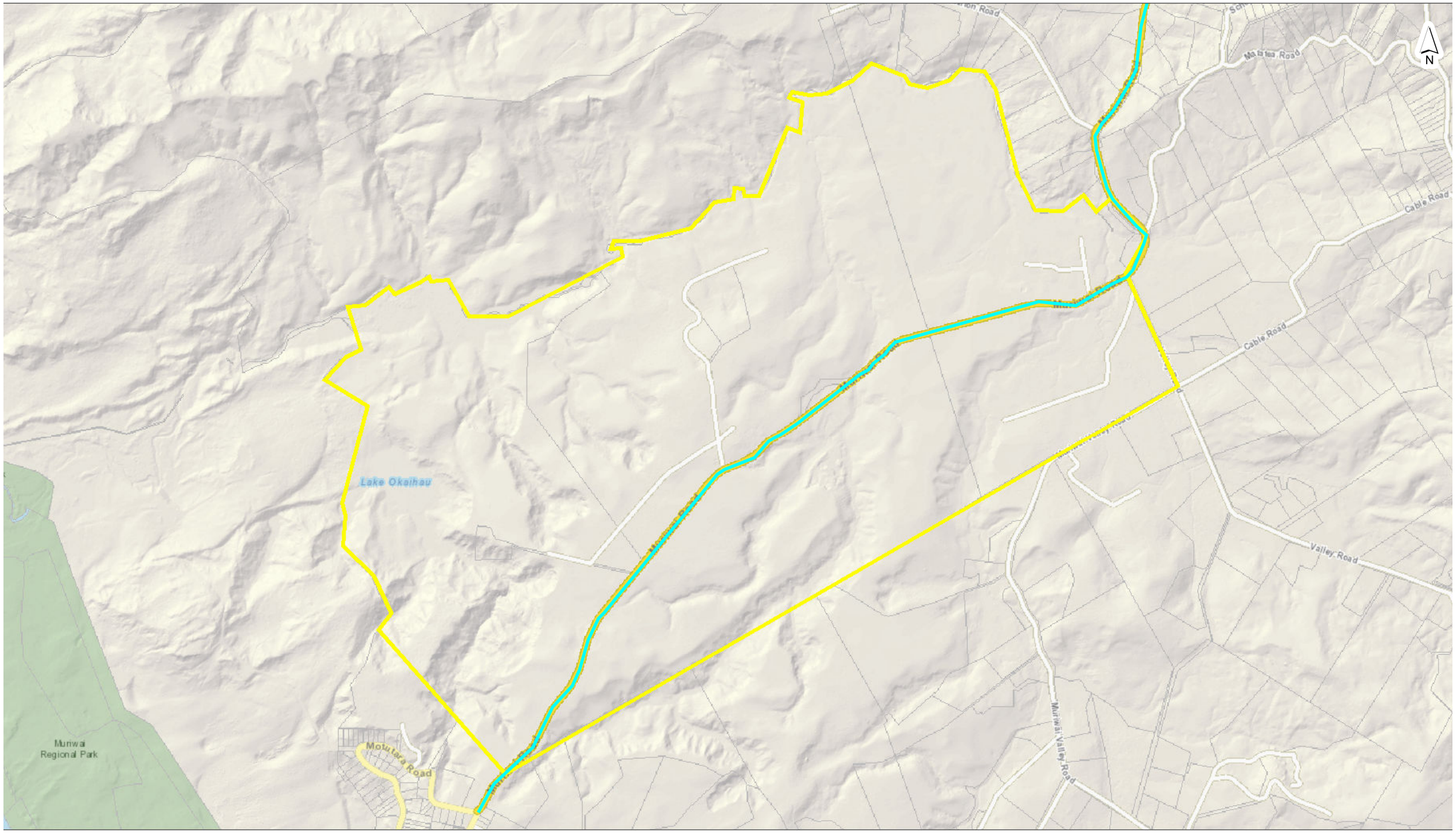

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approved	SGL
date	26/01/21
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LANDER geotechnical

client: THE BEARS HOME PROJECT MANAGEMENT LTD

project: MURIWAI DOWNS FARM

title: AUCKLAND COUNCIL GIS TERRAIN

project no: J01662 | figure no: 3

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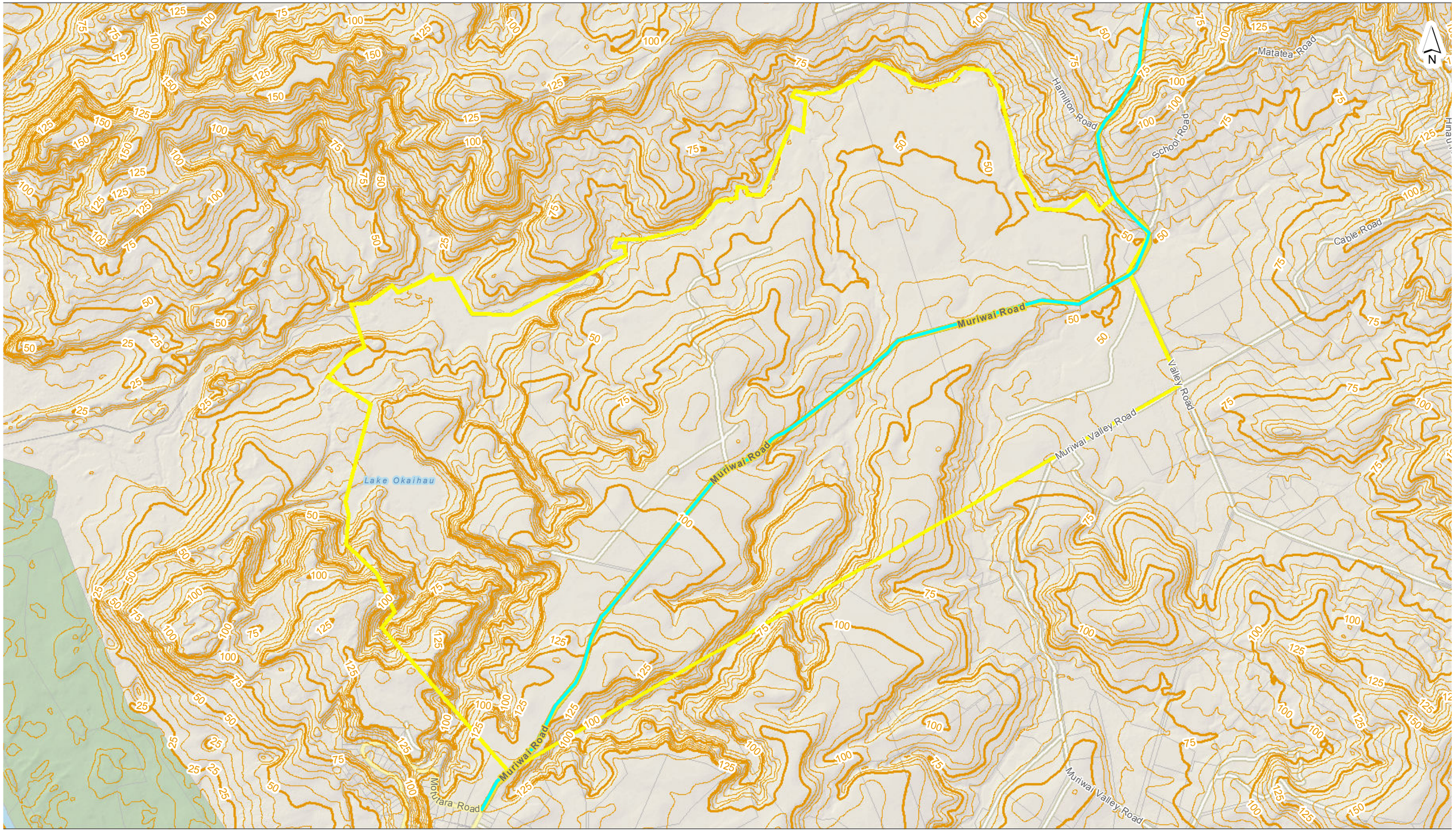

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approved	SGL
date	26/01/21
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LANDER geotechnical

client: THE BEARS HOME PROJECT MANAGEMENT LTD

project: MURIWAI DOWNS FARM

title: AUCKLAND COUNCIL GIS TERRAIN with CONTOURS

project no: J01662 | figure no: 4

Template revision: 1:1000 (10/12/14)

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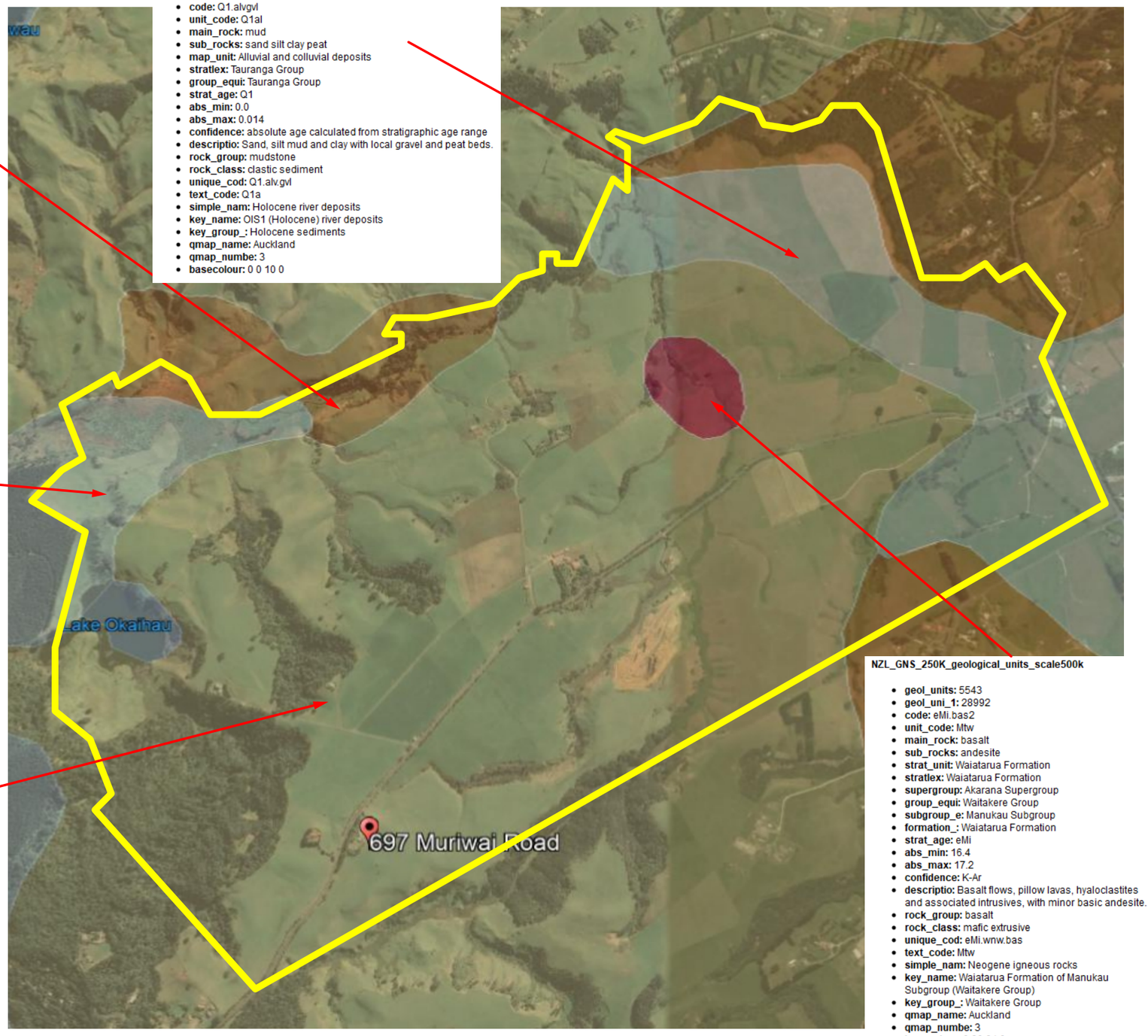

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original size	A3

LANDER geotechnical

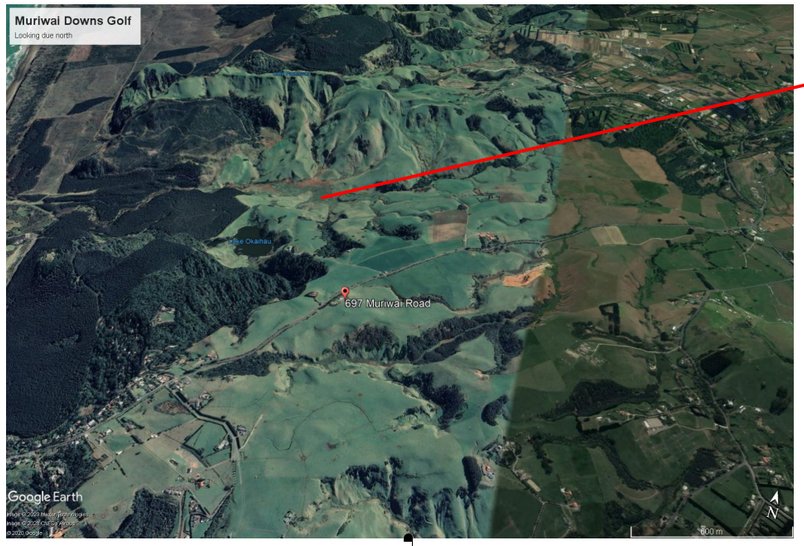
client: THE BEARS HOME PROJECT MANAGEMENT LTD

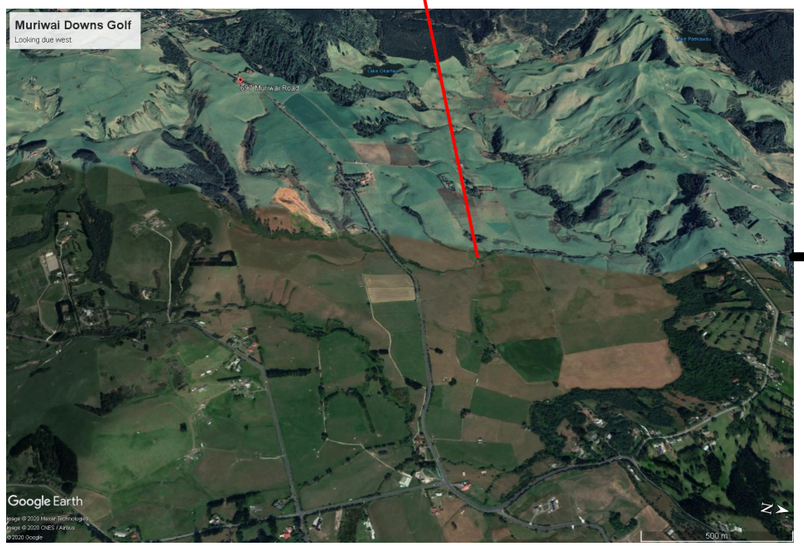
project: MURIWAI DOWNS FARM

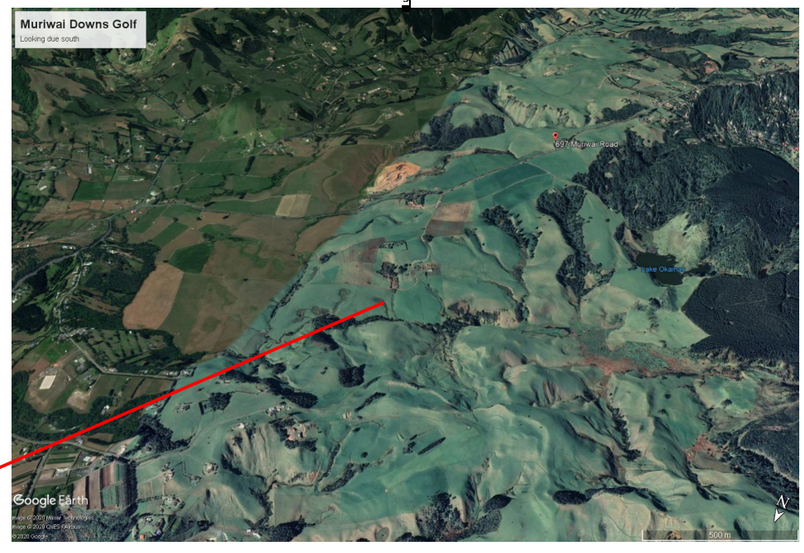
title: GEOLOGY OVERLAY

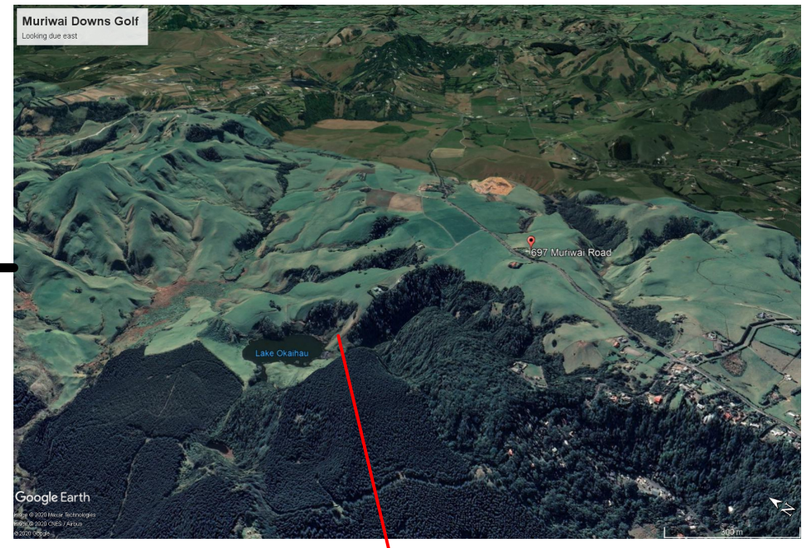
project no: J01662 | figure no: 5

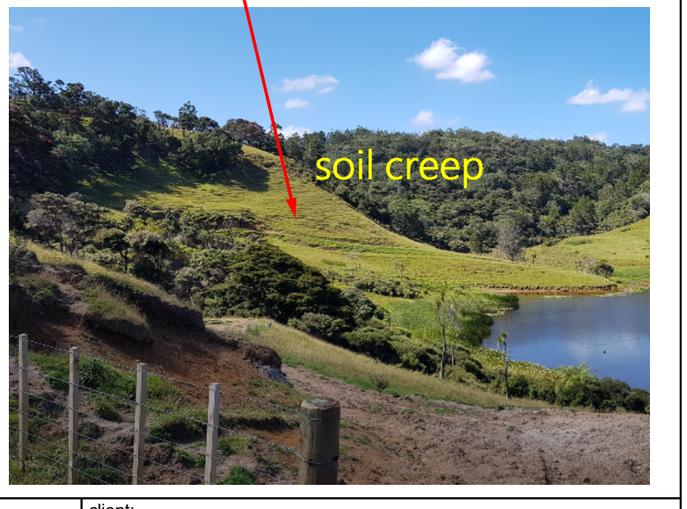
Template revision: 1:1000 (10/12/14)











revision	description	drawn	approved	date

drawn	sl
approved	SGL
date	26/01/21
scale	NTS
original size	A3

LANDER geotechnical

client: THE BEARS HOME PROJECT MANAGEMENT LTD

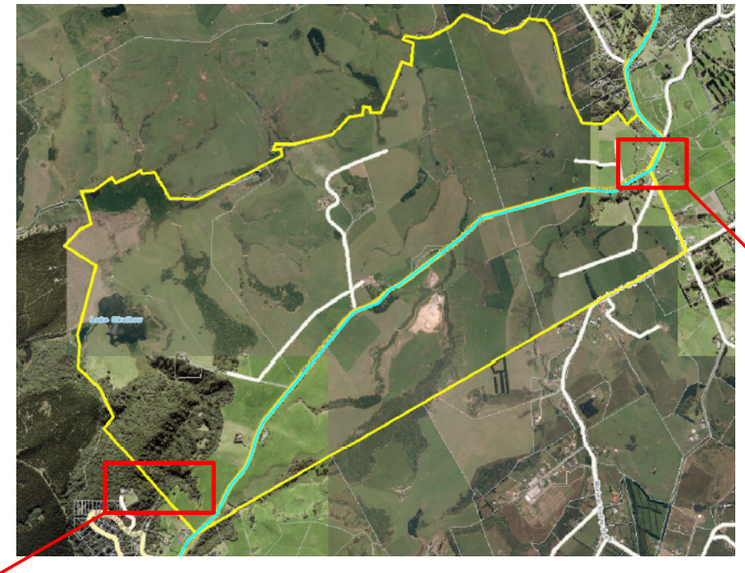
project: MURIWAI DOWNS FARM

title: PRELIMINARY GEOMORPHIC FEATURES PLAN

project no: J01662 figure no: 6

Template revision: 1:1000 (10/12/14)

Legend and/or Notes:



revision	description	drawn	approved	date

drawn	sl
approved	SGL
date	26/01/21
scale	NTS
original size	A3

LANDER geotechnical

client: THE BEARS HOME PROJECT MANAGEMENT LTD

project: MURIWAI DOWNS FARM

title: EXISTING NZGD DATA LOCATIONS & I.D.

project no: J01662 | figure no: 7

Template revision: 1:1000 (10/12/14)

Engineering Geology Ltd

BOREHOLE Nº. 1

Sheet 1 of 1

SITE: 103 Motutara Place, Muriwai

REF. 2545

REDUCED LEVEL STRATA INTERP.	DESCRIPTION OF SOIL	SOIL SYMBOL	DEPTH (m)	SAMPLES	WATER LEVEL
Awhitu Sands	SILT, sandy, firm, moist, friable, non-cohesive, dk brown				
	SAND(m), sl.silty, compact, occ. hard layer, moist, lt yellowish grey with occ. orange layers		1		
	sl.clayey				
	SILT, sandy, sl.clayey, stiff, moist, lt yellow				
	lt yellowish grey		2		Dry 7-4-95
	SAND(m), sl.silty, compact, moist, lt yellow				
	SAND(m), clayey, compact, moist, sl.plastic, lt yellowish grey		3		
	no clay, very compact layer		4		
	SAND(m), clayey, compact, dry, sl.cohesive, lt yellowish grey				
	SILT/CLAY, sandy, stiff, moist, sl.cohesive, lt yellowish grey		5		
	E.O.B. 5.1 m				

UNDRAINED SHEAR STRENGTH (kPa)
● Field vane (BS1377)
○ Lab. vane
50 100 150

Scala Penetrometer Blows/100 mm

Notes:

DRILL METHOD: 50mm Hand auger
DATE DRILLED: 7 April 1995

Engineering Geology Ltd

BOREHOLE Nº. 2

SITE: 103 Motutara Road, Muriwai

REF. 2545

Sheet 1 of 1

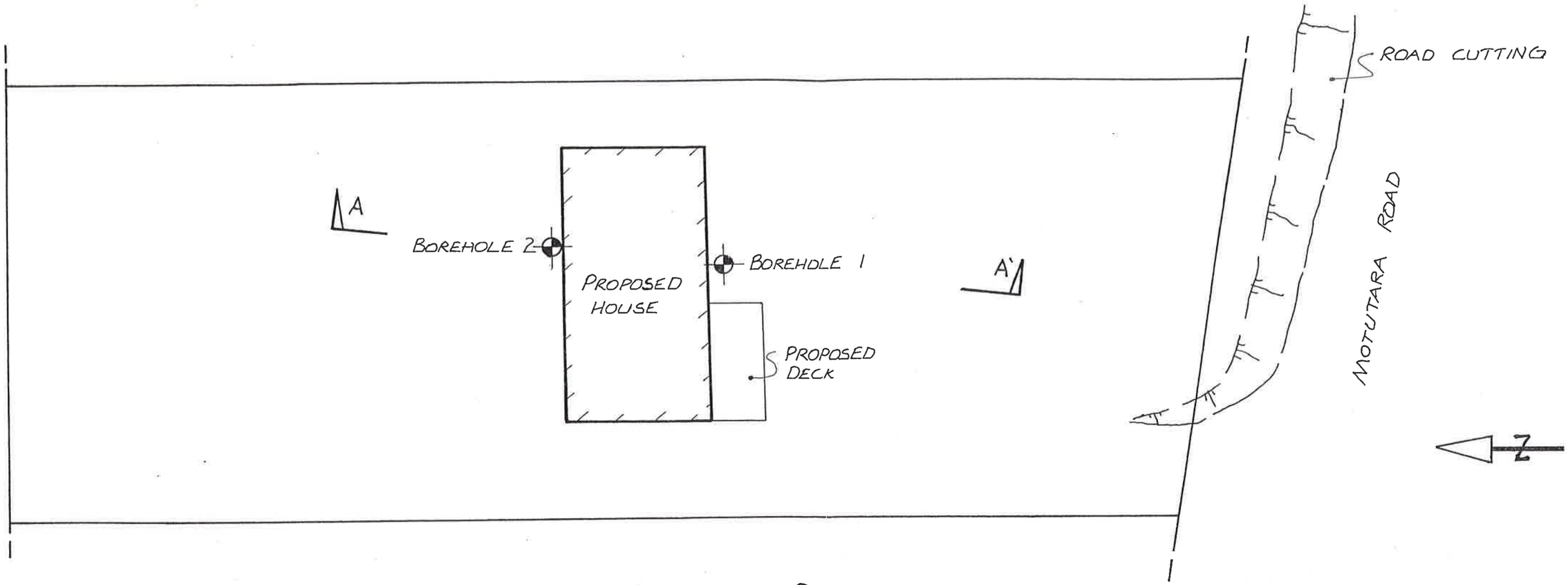
REDUCED LEVEL STRATA INTERP.	DESCRIPTION OF SOIL	SOIL SYMBOL	DEPTH (m)	SAMPLES	WATER LEVEL
Awhitu Sands	TOPSOIL, silt, sandy, firm, moist, friable, non-cohesive, dk brown with many rootlets				
	SAND(m), sl.silty,compact, moist, lt yellowish grey, occ.hard sand nodules(15 mm ϕ max)				
	sl.clayey		1		
	SAND(m-c), very compact, dry, lt yellow				
	SILT, sl.clayey, stiff, dry, friable, non-cohesive, lt yellowish grey		2		Dry 7-4-95
	SAND(m-c), sl.silty, compact, dry, lt yellowish grey				
	E.O.B. 2.7 m U.T.P.		3		
			4		
			5		

UNDRAINED SHEAR STRENGTH (kPa)
● Field vane (BS1377)
○ Lab. vane
50 100 150

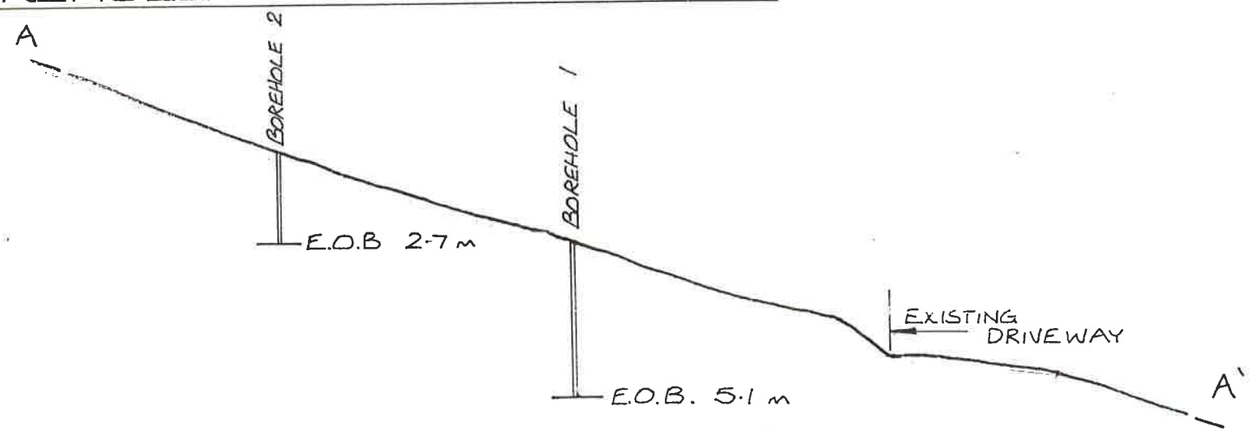
Scala Penetrometer Blows/100 mm

Notes:

DRILL METHOD: 50mm Hand auger
DATE DRILLED: 7 April 1995



BOREHOLE LOCATION PLAN



SECTION A-A'

Engineering Geology Ltd
2 Esmonde Rd, PO Box 33-426 Takapuna
Ph (09)486-2546 Fax 486-2556

103 MOTUTARA ROAD MURIWAI

BOREHOLE LOCATION PLAN & SECTION A-A'

Dwg. No. 2545-1
Date APRIL 1995
Drawn S.J.G.
Scale 1:200

BC 1758

ON GTGS

SHEET No.	GRID REF.	G.S. WELL No.	AREA
Q11	419 879		Mariwai.

CATCHMENT	WATER AUTHORITY	WATER USE	PERMIT No.

Well depth (m)	Measured Reported	Well diameter (mm)	Wellhead altitude (m) a.m.s.l.
158m.			

Yield m^3/day	Drawdown (m)	Specific l/min/metre capacity m^2/day

Driller	Drilling date	Well status
Bob Patterson	Nov. 1983	

Owner	Address
Paulson	Mariwai Valley Rd

Pump Type	Well Type	Type of development

Screen Type	Slot sizes	Set at

Source of information on well location, log, etc.	Date

LOCATION SKETCH

STATIC WATER LEVELS (m below surface)

HIGHEST	LOWEST	MEAN	RANGE	FREQUENCY OF MEASUREMENT	PERIOD OF MEASUREMENT

AQUIFER CHARACTERISTICS

Transmissivity (m^2/day)	Storage coefficient	Water Temperature(°C)

Permeability (m^2/day) Specific yield

TEST PUMPING		RECOVERY	
Drawdown (metres)	After time (min)	Residual Drawdown (m)	After time (min)

REMARKS

Bore abandoned - no water.

OTHER DATA

Pump Test

Chemical Analysis

Geophysical Data

Lithological Log

Isotope Date

Card Type

REDUCED LEVEL IN METRES above+ below – m.s.l.	GRAPHIC LOG	DEPTH IN METRES Below ground surface	LITHOLOGY < = drillwater gain > = drill water loss Reduced level of surface	COLOUR	STATIC WATER LEVEL (a) Related to ground surface	STATIC WATER LEVEL (b) Related to m.s.l.	CASING	SCREEN	Approximate yield (litres/min) m^3/day	Specific capacity (litres/min/metre) m^2/day
			Very Soft. Green-grey / white Clay.							
		24	Soft green grey silty Clay. with limonite staining							
		36	Soft calc. dark grey silty clay							
		42	soft grey calc. siltstone.							
		49	Soft green-grey fine silty clay.							
		72	light calc. siltstone with layers of darker grey volanogenic calc. Sandy siltsone -high mafic content shows secondary alteration							
		96	light grey calc. siltstone with less volcanogenic calc. sandy siltstone							
		103	Med. grey calc. fine sandy siltstone							
		109	layers of dark grey mudstone.							
			light grey calc. sandy siltstone with less sandy layers							

SHEET No.	GRID REF.	G.S. WELL No.	AREA
3	11	15	

CATCHMENT	WATER AUTHORITY	WATER USE	PERMIT No.
16	17	18	24

Well depth (m)	Measured Reported	Well diameter (mm)	Wellhead altitude (m) a.m.s.l.
28		29	33

Yield m^3/day	Drawdown (m)	Specific 1/min/metre capacity m^2/day
39	42	

Driller	Drilling date	Well status
	48	49

Owner	Address

Pump Type	Well Type	Type of development
50	51	

Screen Type	Slot sizes	Set at
		52

Source of information on well location, log, etc.	Date

LOCATION SKETCH

STATIC WATER LEVELS (m below surface)

HIGHEST	LOWEST	MEAN	RANGE	FREQUENCY OF MEASUREMENT	PERIOD OF MEASUREMENT
		57		53	61

AQUIFER CHARACTERISTICS

Transmissivity (m^2/day)	Storage coefficient	Water Temperature(°C)
66	72	

Permeability (m^2/day)	Specific yield
	73

TEST PUMPING		RECOVERY		REMARKS	OTHER DATA
Drawdown (metres)	After time (min)	Residual Drawdown (m)	After time (min)		Pump Test 74
					Chemical Analysis 75
					Geophysical Data 76
					Lithological Log 77
					Isotope Date 78
					79
					Card Type 80

NZGD ID: Other_79735

REDUCED LEVEL IN METRES above + below — m.s.l.	GRAPHIC LOG	DEPTH IN METRES Below ground surface	LITHOLOGY < = drillwater gain > = drill water loss Reduced level of surface	COLOUR	STATIC WATER LEVEL (a) Related to ground surface	STATIC WATER LEVEL (b) Related to m.s.l.	CASING	SCREEN	Approximate yield (litres/min) m^3/day	Specific capacity (litres/min/metre) m^2/day
			light grey calc. sandy siltstone with less sandy layers (finer). ↓ getting more dark grey mudstone layers.							
		140	light grey, very fine, calc. Sandstone with light tan/ brown non-calc. mudstone (siliceous?)							
		152	Dark grey calc. mudstone/light grey calc. sandy-siltstone.							
		158	EOB.							

418878

BC 1756

ON GTGS

SHEET No.	GRID REF.	G.S. WELL No.	AREA
P11			Kaipara

CATCHMENT	WATER AUTHORITY	WATER USE	PERMIT No.
	ARC98		

Well depth (m)	Measured Reported	Well diameter (mm)	Wellhead altitude (m) a.m.s.l.
152		100	

Yield m^3/day	Drawdown (m)	Specific 1/min/metre capacity m^2/day
1 or 2		

Driller	Drilling date	Well status
B. Paterson	8.3.1.1.2.0	

Owner	Address
Atchison	Cnr Waimauku Kaipara & Valley Rd

Pump Type	Well Type	Type of development

Screen Type	Slot sizes	Set at

Source of information on well location, log, etc.	Date

LOCATION SKETCH

STATIC WATER LEVELS (m below surface)

HIGHEST	LOWEST	MEAN	RANGE	FREQUENCY OF MEASUREMENT

PERIOD OF MEASUREMENT

AQUIFER CHARACTERISTICS

Transmissivity (m^2/day)

Storage coefficient

Water Temperature(°C)

Permeability (m^2/day)

Specific yield

TEST PUMPING		RECOVERY	
Drawdown (metres)	After time (min)	Residual Drawdown (m)	After time (min)

REMARKS

OTHER DATA

Pump Test

Chemical Analysis

Geophysical Data

Lithological Log

Isotope Date

Card Type

REDUCED LEVEL IN METRES above + below – m.s.l.	GRAPHIC LOG	DEPTH IN METRES Below ground surface	LITHOLOGY < = drillwater gain > = drill water loss Reduced level of surface	COLOUR	STATIC WATER LEVEL (a) Related to ground surface	STATIC WATER LEVEL (b) Related to m.s.l.	CASING	SCREEN	Approximate yield (litres/mm) m³/day	Specific capacity (litres/mm/metre) m²/day
		30	No Record							
		60.9	Lt Grey calc sst & dk blue grey mst							
		67.	Grey calc sandy zst. Dk b/gr mst							
		73.1	Lt Gr calc dirty sst, occas scoria, grey calc sdy zst. Dk grey/blue mst.							
		79.2	Same.							
		85.3	Same, but decreases mst.							
		91.4	V. Dk Gry (volc?) agglom sst Lt Gry calc sdy zst Dk Grey mst.							
		97.53	V. Dk Gry agglom/sst. Lt Grey calc sdy zst.							
		103.6	Same							
		109.7								
		115.8	Lt Grey calc zst, med grey calc zst							
		121.9	Dk Grey non calc mst							
		128								
			ISE EOB							

BROWN BROS (N.Z.) LTD

Client Houghtons Bush Camp Date 18/11/83

Address Murawai

RIG. No 4

Size & purpose of boro hole 4" Water Bore Client's boro No.

Bore Log.

0 - .2 M	Silty Clays
2 - 15.4	Pumice Silty Sand
15.4 - 19.00	Pumice
19 - 42.48	Silty Clays Sands
42.48 - 65.88	Silty Green Clay Sands
6588 - 72.98	Green Silty Clay
72.98 - 134.2	Red Clay Silt
134.2 - 140.25	Gravels.
↑ Water Lost	water level @ 105.9m

UNSURE IF THIS IS ABANDONED BORE BUT IS CASED TO 134.2 M - 100 mm.

Contract rates today

Rig hours chargeable today

Total rig hours worked today

No. of loads of water carted today

MATERIALS USED (or REMARKS)

134 M 4" Pipe
2 Rolls Tape

Driller's Signature

ph 4TR8570

Q11 389862

BC 1730

ON GTGS

26379

KIWI WELLDRILLERS N.Z.

ISO 9002 CERTIFED

KEVIN BROWN LTD.

MEMBER NZ. DRILLERS FED

PH. 0800 822 822

BRANCHES:

BAY OF ISLANDS
WARKWORTH
GLENBROOK

PO BOX 400 OREWA
FAX 09 425 0228
E-Mail kiwinz@.xtra.co.nz

BORE LOG FORM

Client PRESBYTERIAN CHURCH OF AOTEAROA
HOUGHTONS BUSH CAMP Ph. 09 411 8570
Address 75 MOTUTARA RD. MURIWAI
Grid Reference Q11 3897 8612
Permit C512 12 2856 Bore I.D.21616

Driller PETER BECK
Drilling Method ROT.- MUD
Purpose of Bore CAMP
Date 21.2.2002

Consent Holder PRESBYTERIAN CHURCH
Bore Permit No: C512-12-2856
Bore ID 21616
Water Permit No:
Date Consents D-base Updated 16/4/02
Date Bore Log D-base Updated 17/4/02.
Airline Result (75% of Test) 36 L/min.

BORE LOG

Depth from Surface Top	Bottom	Description of Ground Passed Through
0..	1.0	TOPSOIL YELLOW BROWN SILTY CLAY
1.0	2.0	YELLOW BROWN SANDY SILT
2.0	6.0	FIRM BROWN SAND
6.0	19.0	MULTI COLOUR TUFF SAND
19.0	44.0	MED. BROWN TUFF
44.0	50.0	GREY MUDST. & BR. SANDS
50.0	60.0	BR. YELLOW FINE SANDS
60.0	70.0	SOFT CONGLOMERITES
70.0	72.0	MED. GREY SANDSTONE
72.0	90.0	FIRM RED GREY MUDSTONE
90.0	98.0	YELLOW GREY MUDSTONE
98.0	110.0	MULTI COLOUR MUDST. S/S
110.0	118.0	COARSE GREY SANDSTONE EMERALD GREEN CHIPS
118	204.0	COARSE GREEN SANDSTONE

WELL CONSTRUCTION

All measurements from the top of the casing

Depth of bore (M) 204.00
Depth of casing (M) 88.00
Diameter of Casing PVC 100 (mm)
Screens: N/R
From m to m
Slot size and type
Grouting 12 Bags

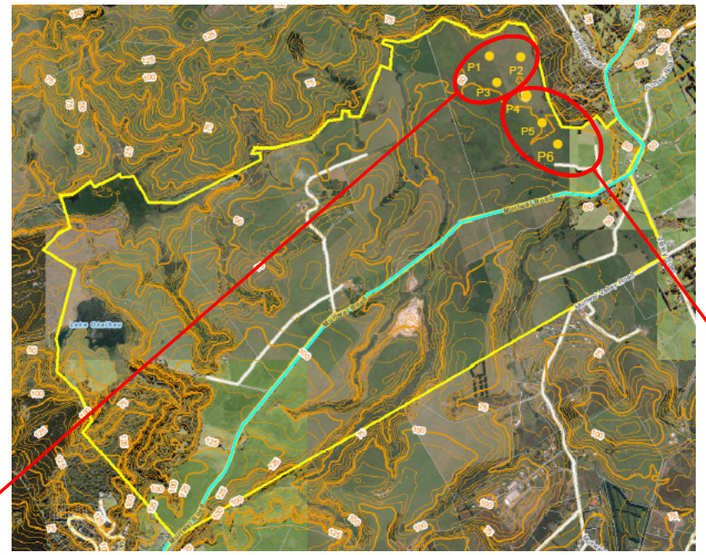
Pump Tests:

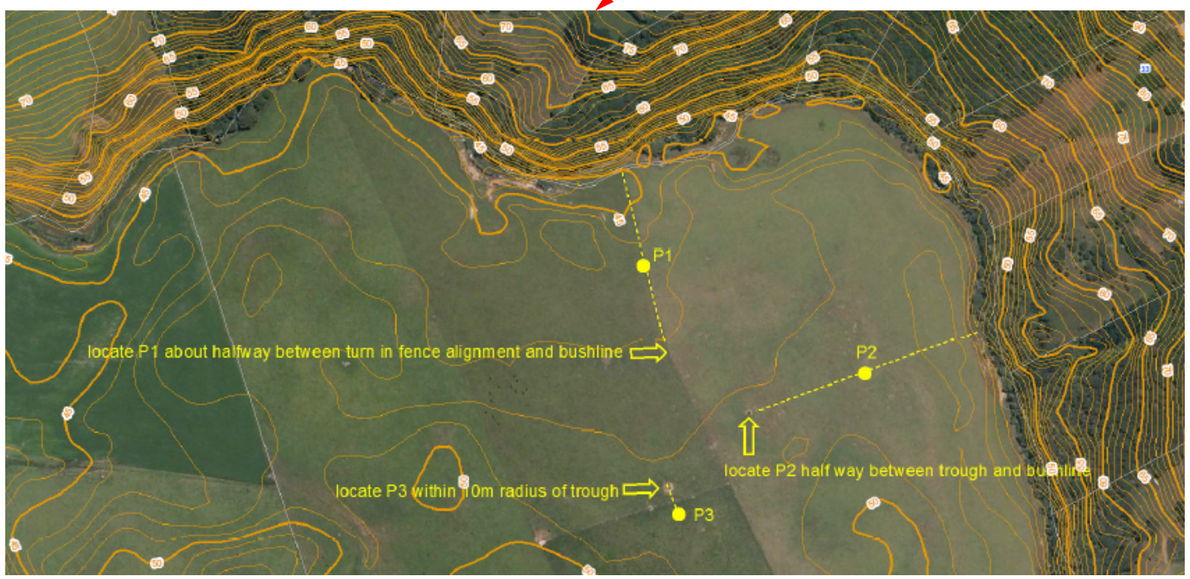
Method of development AIR & SUBMER. PUMP
Static water level 100.00+ m
Duration of test 10 HOURS
Max 2000 ltrs p/hr
Test discharge (m^3/hr) 1.3
Drawdown level 124.00 m
PUMP DEPTH 130.00 m
PUMP VOLUME up to 1300 ltrs p/hr
Type pump to suit construction of bore for client
GRUNDFOS SP 2A.27
100mm SUBMERSIBLE PUMP SET
AT 130.00 m. FOR 1300 lph
Water Quality Basic on site taste test
GOOD - SWEET TASTE

REMARKS

CIRULATION LOSS 30% @ 45m 88.m
100% @ 137.0m 50% @ 150 - 204m
PUT PACKER TO 69.m AND GROUTED
FULLY TO THE SURFACE OF THE OLD
BORE, HAD 60m OF CASING, IRON HAD BEEN COMING IN FROM 24m

Legend and/or Notes:





revision	description	drawn	approved	date

drawn	sl
approved	SGL
date	26/01/21
scale	NTS
original size	A3

LANDER geotechnical

client: THE BEARS HOME PROJECT MANAGEMENT LTD

project: MURIWAI DOWNS FARM

title: STANDPIPE BOREHOLE LOCATION PLAN

project no: J01662 figure no: 8

Template revision: 1:1000 (10/12/14)

Client : THE BEARS HOME COMPANY LIMITED

Project Location : MURIWAI DOWNS GOLF PROJECT

Job Number: J01662

Auger Borehole No. P01

Sheet 1 of 6

Vane Head:	Logged By:	Processor :	Date:
2784	PL	PL	12.01.21

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				Piezometer Details
	clayey SILT with trace fine sand, orange/brown streaked dark grey. Stiff, moist, low plasticity, moderately sensitive [ALLUVIUM]				Clay Seal - 0.0m-0.5m
0.5			64/27	2.4	Screened - 0.5m-1.3m
	silty CLAY, orange streaked dark grey. Stiff, moist, medium plasticity				
	becoming wet, high plasticity				Standing Groundwater Level as on 20.01.21 (0.94m)
1.0	becoming very stiff, saturated, with trace fine gravel		188+		Scala Penetrometer Test (Blows/100mm)
	clayey SILT, dark grey. Very stiff, saturated, low plasticity				
	EOB at 1.3m. Too hard to auger further. Attempted in 3 seperate locations. Scala penetrometer test commenced and found effective refusal (ER) immediately.				20+ (ER)
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					
6.0					

LANDER geotechnical

Comments:
Groundwater encountered at 1.0m.
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 : THE BEARS HOME COMPANY LIMITED

Project Location : MURIWAI DOWNS GOLF PROJECT

Job Number: J01662

Auger Borehole No. P02

Sheet 2 of 6

Vane Head:	Logged By:	Processor :	Date:
1900	RG	PL	12.01.21

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				Piezometer Details
	clayey SILT, orange streaked light grey/brown. Very stiff, moist, medium plasticity, moderately sensitive, with trace limonite [ALLUVIUM]				Clay Seal - 0.0m-0.5m
0.5			171/69	2.5	Screened - 0.5m-5.0m
1.0	with trace fine sand		163/72	2.3	
1.5			108/50	2.2	
2.0			109/28	3.9	
	becoming orange, without trace fine sand				Standing Groundwater Level as on 20.01.21 (2.43m)
2.5			133/52	2.6	
	becoming dark grey, saturated				
3.0			130/39	3.3	Standing Groundwater Level as on 12.01.21 (3.20m)
3.5			160/41	3.9	
4.0			193+		
4.5			138/41	3.4	
	at 5.0m, becoming sensitive				
5.0	EOB at 5.0m. Target Depth.		133/28	4.8	
5.5					
6.0					

LANDER geotechnical

Comments:
Groundwater encountered at 2.8m.
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 : THE BEARS HOME COMPANY LIMITED

Project Location : MURIWAI DOWNS GOLF PROJECT

Job Number: J01662

Auger Borehole No. P03

Sheet 3 of 6

Vane Head:	Logged By:	Processor :	Date:
2784	PL	PL	12.01.21

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				Piezometer Details
	clayey SILT with trace fine sand, orange streaked light brown. Very stiff, moist, low plasticity, moderately sensitive [ALLUVIUM]				Clay Seal - 0.0m-0.5m
0.5			180/46	3.9	Screened - 0.5m-5.0m
	silty CLAY, orange and brown streaked grey. Very stiff, moist, medium plasticity, insensitive				
	becoming high plasticity				
1.0			137/86	1.6	
1.5			105/64	1.6	
2.0			118/73	1.6	
2.5			129/67	1.9	
	becoming light grey, orange streaked brown/orange, wet, with trace fine sand	▼			Standing Groundwater Level as on 12.01.21 (2.7m)
	becoming moderately sensitive				
3.0			124/35	3.5	
	clayey SILT, grey streaked grey/blue. Very stiff, saturated, low plasticity, with trace fine gravel sized hardened silt clast inculsions, with trace fine sand				
3.5			188+		
	becoming sensitive	▼			Standing Groundwater Level as on 20.01.21 (3.91m)
4.0			134/30	4.5	
	becoming moderately sensitive				
4.5			177/70	2.5	
5.0	EOB at 5.0m. Target Depth.		188+		
5.5					
6.0					

LANDER geotechnical

Comments:
Groundwater encountered at 3.1m.
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 : THE BEARS HOME COMPANY LIMITED

Project Location : MURIWAI DOWNS GOLF PROJECT

Job Number: J01662

Auger Borehole No. P04

Sheet 4 of 6

Vane Head:	Logged By:	Processor :	Date:
1900	RG	PL	12.01.21

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				Piezometer Details
	SILT, orange. Medium dense, dry, no plasticity [ALLUVIUM]				Clay Seal - 0.0m-0.5m
0.5	clayey SILT, orange streaked light brown/grey. Very stiff, moist, medium plasticity, moderately sensitive, with trace limonite		168/52	3.2	Screened - 0.5m-5.0m
1.0	silty CLAY, orange streaked light grey. Stiff, moist, medium to high plasticity, insensitive, with trace limonite		83/58	1.4	
1.5	clayey SILT, with trace fine sand, orange mottled light grey. Stiff, moist, medium plasticity		91/52	1.8	
2.0			69/36	1.9	
2.5	becoming orange, wet	▽	69/44	1.6	Standing Groundwater Level as on 20.01.21 (2.68m)
3.0	becoming moderately sensitive		64/28	2.3	
3.5	becoming insensitive		66/47	1.4	
	becoming dark grey				
4.0			52/30	1.7	
4.5	becoming dark grey/blue, very stiff, saturated		193+		
	at 5.0m, becoming hard	▽			Standing Groundwater Level as on 12.01.21 (4.9m)
5.0	EOB at 5.0m. Target Depth.		UTP		
5.5					
6.0					

LANDER geotechnical

Comments:
Groundwater encountered at 4.4m.
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 : THE BEARS HOME COMPANY LIMITED

Project Location : MURIWAI DOWNS GOLF PROJECT

Job Number: J01662

Auger Borehole No. P05

Sheet 5 of 6

Vane Head:	Logged By:	Processor :	Date:
1900	RG	PL	12.01.21

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				Piezometer Details
	clayey SILT, brown/orange. Very stiff, moist, medium plasticity [ALLUVIUM]				Clay Seal - 0.0m-0.5m
0.5			193+		Screened - 0.5m-2.5m
	becoming grey mottled brown/orange, with trace fine sand				
1.0			193+		
	becoming low plasticity				Standing Groundwater Level as on 20.01.21 (2.3m)
	becoming insensitive		124/94	1.3	Note: Standpipe was damaged and level may be affected through surface water infiltration
1.5					
	becoming stiff, moderately sensitive		69/30	2.3	
2.0					
	slightly clayey SILT with trace fine sand, brown. Very stiff, moist, low plasticity				Scala Penetrometer Test (Blows/100mm)
2.5	EOB at 2.5m. Too hard to auger further. Scala penetrometer test commenced and found effective refusal (ER) at 2.9m.		UTP		5 10 13 20+ (ER)
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 : THE BEARS HOME COMPANY LIMITED

Project Location : MURIWAI DOWNS GOLF PROJECT

Job Number: J01662

Auger Borehole No. P06

Sheet 6 of 6

Vane Head:	Logged By:	Processor :	Date:
2784	PL	PL	12.01.21

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				Piezometer Details Clay Seal - 0.0m-0.5m Screened - 0.5m-5.0m
0.5	clayey SILT, orange and brown streaked grey. Very stiff, moist, low plasticity, sensitive [ALLUVIUM]		140/35	4.0	
1.0	silty CLAY, orange mottled brown/grey. Stiff, moist, medium plasticity, moderately sensitive		94/38	2.5	
	becoming orange, brown streaked brown/grey, high plasticity				
1.5	becoming insensitive		67/56	1.2	
	becoming wet, with trace black carbonaceous inculsions, with trace orgainic staining				
2.0	becoming firm		30/24	1.3	
2.5	becoming moderately sensitive becoming dark grey/blue		46/19	2.4	
3.0	becoming stiff		99/27	3.7	Standing Groundwater Level as on 12.01.21 (3.0m) Standing Groundwater Level as on 20.01.21 (3.17m)
3.5	clayey SILT, blue/grey streaked dark grey. Very stiff, wet, low plasticity, with minor fine gravel sized silt clast inculsions		188+		
	becoming saturated				
4.0			188+		
4.5			188+		
5.0	EOB at 5.0m. Target Depth.		188+		
5.5					
6.0					

LANDER geotechnical

Comments:
Groundwater encountered at 3.7m.
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			