



**THE LAKES DEVELOPMENT
STAGE 2B
PYES PA, TAURANGA**

Report on Earthworks and
Recommendations for Development

Our ref: 20180
April 2012

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1.0 Introduction

Approval for the Lakes Development was initially granted jointly by the Tauranga City Council and Western Bay of Plenty District Council on 24 May 2004 based on subdivision plan 16916 dated 20 April 2004 that was prepared by S&L Consultants Ltd.

The Stage 2 development is broken down into a number of sub stages. On 3 December 2011 the Tauranga City Council issued resource consent RC15266 for the further subdivision of development blocks 2B, 2F, 2Ga and 2Gb to create 53 residential lots.

The distribution of the 27 residential lots within Stage 2B is shown on subdivision scheme plan 129843-RC02 prepared by Harrison Grierson Consultants. A copy of that plan is included in Appendix 1 of this report. Access to the Stage 2B development is by the major subdivision road, Lakes Boulevard, from the subdivision entrance at Takitimu Drive.

The Stage 2B area is located on the western side of Lakes Boulevard on the lower lying areas formerly within the flood plain of the Kopurererua stream which flows past the subdivision to the west.

This report describes the earthworks undertaken in the formation of Stage 2B of The Lakes development and summarises the suitability of the prepared ground in cut and fill for future urban housing development. The report states the relevant standards adopted for the placement of filling to support residential buildings and recommendations for developing building sites.

During the report reference is made to drawings 20180-AB3 and 20180-AB4 which are also in Appendix 1 of this report.

Appended drawing AB3 indicates the finished ground contours as the result of the completed earthworks and the positions of compaction tests undertaken during the earthworks and post construction settlement control markers. Drawing AB4 shows the depths of the filling that was placed and depths of cut that were made.

2.0 Original Landform and Geology

The landform prior to the commencement of the subdivision construction comprised:

- Elevated areas along the eastern side as a central plateau described locally as the Te Ranga Tablelands. These areas have been variously used for farming and horticultural cropping. The existing Pyes Pa residential area further to the east had been established on similar level areas of the same elevation.
- Lower lying areas mainly along and adjacent to the Kopurererua Stream to the west and extending eastwards.
- Transitional slopes of varying steepness between the lower lying areas and the elevated central plateau. Re entrant erosion gullies were present on some of these slopes but most were uniform in slope gradient, albeit steep in some locations.

The geological setting for the development area can be derived from the publication: Occasional Report 22 – Department of Earth Sciences University of Waikato “Geology of the Tauranga Area” by Briggs et al – 1996

The geology within the Stage 2B area can be described as:

- (i) On the steeper ground that is present and extends to the east of Lakes Boulevard, volcanic ash derivative soils present as coarse grained silts and sandy silts and sands (younger ashes) underlain by more highly weathered finer grained silty clays (older ashes) and terrestrial and estuarine deposits of the Matua subgroup of the Tauranga formation. Te Ranga ignimbrite is the base rock under the soil cover and is present as white-grey pumiceous sands and coarse silts.
- (ii) At the lower areas within Stage 2B and leading out to the Kopurererua Stream:
 - Alluvial silts, sands and gravels transported by the stream.
 - Organic peat at the existing ground surfaces or overlaid by alluvial soils at depth.
 - Eroded sections of the more elevated Taupo volcanic zone tephra that have been reduced to the levels of the stream plain or rise above these levels as mounds or ridges that extend in to the stream plain area.

3.0 Presubdivision Investigations

Prior to obtaining subdivision approval on 24 May 2004 a comprehensive geotechnical assessment was undertaken by S&L Consultants Ltd. The subsequent report that accompanied the consent application was titled "Pyes Pa West Urbanisation Development, Geotechnical Assessment Report, reference 16944" and was dated October 2003.

Fifty two machine drilled boreholes and twenty six excavated pits were used to identify the subsoils that are present on the development area. Machine drilled boreholes 16, 18 to 20, 31, 32 and 48 were located within or close to the Stage 2B area, at locations shown on 20180-AB3. Each of these boreholes showed the presence of similar subsoils being:

- Peat (organic silt) to depths ranging from zero (borehole 32) to 4.5m (borehole 19). On the Stage 2B area the depths of peat were identified as 0.6m (borehole 16) to 1.7m (borehole 31).
- Grey sandy silts and sands underlying the surface peat. These inorganic soils were found to be of varying densities and strengths with uncorrected SPT N values in the range of 1 to 6. The borehole depths varied from 6.0 to 18.5m. No further organic soils were encountered below the surface cover of peat.

The presubdivision investigations concluded that:

- The soils to be obtained in areas of cut on the higher ground to the north of adjacent stage 2C and on the upper plateau of Stages 2K and 2L would be suitable for placement as filling to support future houses although some conditioning may be required so that placement would be near optimum moisture contents.

- Variations in soil type may be encountered in road subgrades and in situ testing would be required to determine pavement depths applicable to the subgrade conditions present.
- The peat soils can be removed to depths governed by the capability of the earthmoving machinery on the site and the cost effectiveness of removing the peat and undertaking its replacement with filling obtained from elsewhere within the subdivision development area.

4.0 Scope of Subdivision Earthworks

The earthworks undertaken in the Stage 2B area and as shown on 20180-AB4 comprised:

- (a) The removal of the surface peats and the replacement of the peat with filling obtained from borrow areas within The Lakes development. This work was undertaken in lots 487 to 493, 498 to 510 and 512 and 513.
- (b) The excavation to lower ground levels in cut within lots 493 to 501 and 511 and 512 where minor trimming took place at the base of a hill that rose beyond Lakes Boulevard and into the subdivision borrow pit to the north of Stage 2C.
- (c) The placement of additional filling over parts of Stage 2B to the west to elevate ground levels above potential flood levels

The depths of cut and filling shown on 20180-AB4 were derived from surveyed contours of the finished surface taken on completion of the earthworks compared with topographical surveys undertaken by S&L Consultants Ltd prior to the subdivision construction and also after the removal of the unsuitable surface soils and prior to the placement of the replacement filling.

The earthworks were undertaken by Hick Bros Earthmoving during the 2006-2007 earthworks season in compliance with consent 62387 issued by Environment Bay of Plenty.

5.0 Earthworks Standards

The performance specification required of the Contractor for the earthworks was based on the guidelines contained in NZS 4431:1989 "Code of Practice for Earthfill for Residential Development". Compliance with the compaction requirements listed below satisfies the standards listed in Section 7 of the NZS 4431.

Air voids percentage (as defined in NZS 4402: Part 1:1980)

- Average value less than 10% (any 10 tests)
- Maximum single value 12%

Undrained shear strength (measured by in situ vane)

- Average value not less than 150kPa (any 10 tests)
- Minimum single value 100kPa

The calculation of air voids percentages is dependant on the determination of the solid densities of the soils used in the filling. The soils in the filling mainly comprised mixed silts,

clayey silts, sandy silts and sands depending on the depths below the original ground surfaces that the cuts were made for obtaining fill materials. For cohesive silt/clay soil mixtures a value of solid density of 2.65 T/m^3 was used in the calculation of air voids. Where the sample taken for laboratory determination of insitu water content comprised pumiceous sands and was indicative of the soils in which the nuclear densometer test was undertaken, a lower value of solid density was used in the calculation based on specific tests for solid density.

The earthworks were supervised by site engineering technicians employed by the developer and observed by engineering staff from S&L Consultants Ltd during specific site inspections.

Compaction and strength control testing was undertaken by IANZ accredited Opus International Consultants Ltd both on site and in their Tauranga laboratory.

61 compaction tests were undertaken within the areas of filling within the Stage 2B area at locations shown on 20180-AB3. The results of these tests are summarised in Appendix 3.

The test results meet the specification criteria.

6.0 Summary and Recommendations

6.1 Building on Subdivision Construction Filling

Supervised structural filling as shown on drawing 20180-AB3 and AB4 was placed in accordance with the methods and standards quoted in NZS 4431 under the management of S & L Consultants Ltd. Compaction testing on site confirmed that a high and uniform degree of compaction had been achieved suitable for the support of buildings.

After placement of the filling in Stage 2B settlement markers were installed at locations shown on 20180-AB3 immediately to the south of the stage as any markers installed within the stage area may have been damaged or disturbed during the topsoiling and grassing operations, if they were placed in the centres of the stage areas. The levels on these markers had been surveyed at regular intervals. The results of these surveys are within Appendix 3 and show that no significant settlements did occur.

For all of the lots which will be located in the areas of fill the ultimate ground bearing capacity in the limit state may be taken at 300kPa and this capacity meets the definition of "good ground" as defined in NZS 3604 : 2011. Future buildings may therefore be detailed in accordance with NZS 3604.

A statement in support of the suitability of the filled areas for building development is contained in Appendix 2 of this report.

However, within areas of structural filling on which buildings may be erected, the possibility of variations of soil type and strength may exist away from observation or compaction tests locations. The normal inspections of foundation conditions during construction of buildings by competent tradesmen as described in NZS 3604 and by building inspectors would still be

undertaken. If for any reason areas of low soil strength are found professional geotechnical advice should then be sought.

6.2 Building On Areas of Cut or Undisturbed Ground

Areas of cut exist on Stage 2B as shown on 18264-AB3. These occur where the former ridgeline that ran from north east to south west into Stage 2B was reduced for the use of the cut material in the subdivision filling on Stage 2B and elsewhere on the subdivision.

Post construction boreholes were put down on lots 493 to 500 and lots 511 and 512 to identify the soils types that would be present at the levels of shallow house foundations. In all boreholes very stiff to hard sandy silts and pumiceous sands are present with undrained shear strengths in excess of 150kPa. Where the sands were present on lots 493 and 494, blow counts with a Scala penetrometer were in excess of 5 per 100mm of penetration. The soils present have sufficient in situ strength to be considered as good ground as defined in NZS 3604. The areas of this stage of subdivision in cut are therefore considered suitable to support buildings on shallow surface foundations.

6.3 Land Stability

The only land stability issues relevant to Stage 2B are those relating to the replacement filling for the peat that was present and the potential for liquefaction during seismic activity. The liquefaction potential is discussed in section 7.0 of this report.

The extent of the structural filling shown on 20180-AB3 along the south western and north western margins of Stage 2B was determined by the practical limits to which the surface peat soils could be removed. The extent of the filling shown was determined by survey as being at the base of the excavation. For stability purposes during construction the excavations were battered into the remaining peat before the controlled backfilling took place. Additional filling was placed over the peat beyond the replacement filling areas to raise ground levels above potential flooding inundation levels.

A building restriction line is applicable to limit future buildings so that they are located on the structural filling where reliable ground will be present to support conventional buildings with surface foundations. Beyond the restriction lines similar filling will be present but this will not be suitable to support buildings as ground settlement may occur where this filling has been placed over organic soils which were not removed during the subdivision earthworks.

It is possible to cantilever floor slabs beyond the building restriction lines with the cantilevered span being determined by the structural strength of the slab beyond the building restriction line. The structural designer shall assume a fulcrum line for the cantilever at the building restriction line. With the

cantilever in place the property owner could expect the ground to subside below the cantilevered section of the building.

To confirm that the building restriction lines identified by survey are in the correct places, additional boreholes were machine drilled along the building restriction lines in February 2008. The test positions are shown on 20180-AB3 and the summary logs are in Appendix 5. Each borehole showed the depths of filling present and that the absence of any former peat indicates that the correctly filled ground extends beyond the building restriction lines.

The building restriction lines are shown on DP 454399.

6.4 Stormwater Disposal

As the subsoils present on all lots comprise stiff natural soils or well compacted filling using cohesive soils, the disposal of stormwater runoff from roofs and hard stand areas by on site ground soakage methods is unlikely to be successful. Reticulation to capture stormwater on individual lots is to be run to the stormwater service outfalls provided for each lot.

7.0 **Assessment of Liquefaction Potential**

As a result of the ground damage caused by liquefaction from significant earthquakes in Christchurch in September 2010 and February 2011, the policy of the Tauranga City Council is to require a report on the effects of liquefaction on all greenfields subdivisions developed since the 2011 earthquake.

For the study on the liquefaction potential in the Stage 2B area, 2 cone penetrometer (CPT) tests were undertaken by Perry Drilling at locations shown on 20180-AB3. At each probe position the static groundwater level depths were recorded as

CPT 2B1	3.70m
CPT 2B2	3.50m

Liquefaction can occur in saturated sands or low plasticity silts during intense cyclic seismic loadings when porewater pressures reduce effective strengths and drainage takes place so that soil particles are resorted to a more dense state with subsequent reductions in soil volumes. The main effects of liquefaction are that ground settlement can occur with some settlement being differential. Where slopes or watercourses are present lateral spread may also take place.

The liquefaction assessment methodology adopted is that described by the New Zealand Geotechnical Society, July 2010 "Geotechnical Earthquake Engineering Practice – Module 1, Guidelines for the Identification, Assessment and Mitigation of Liquefaction Hazards". NZS 1170.0.2004 "Structural Design Actions" requires that two seismic events be considered namely

- In the ultimate limit state (ULS) with a 1 in 500 year return period event whereby buildings should not collapse but may be beyond economic repair, and

- In the serviceability limit state (SLS) with a 1 in 25 year return period event whereby buildings should remain functional and not require significant repair

Specific liquefaction analyses have been undertaken for each CPT position using the software package CLig (Geologismiki 2011). The factors input into this software were

- an earthquake magnitude of 7.5 Richter
- class D – Deep Soil subsoil class condition as described in NZS 1170.5:2004
- a site response factor of 1.12 (class D soil)
- a return period factor of 1.0 for the ULS and 0.25 for SLS
- a base peak ground acceleration of 0.2g (Tauranga)
- an importance level of 2 applicable to domestic buildings

From this data the design peak ground accelerations are:

- in the ULS, 0.22g
- in the SLS, 0.06g

The results of the analysis are shown on the summary sheets in Appendix 5. The results for Stage 2B, as based on data at CPT 2B1 and CPT 2B2, show that some of the deeper layers are expected to be potentially susceptible to liquefaction in the ULS, especially those layers at the depth range immediately below the groundwater level. At depth, additional liquefaction may take place where factors of safety are less than 1.0.

Total settlements are estimated to be 50mm at CPT 2B1 and 53mm at CPT 2B2. As there is a consistent stiff raft of subdivision filling present it is probable that differential settlements would be minimal.

As a result of the seismic events in Christchurch the Department of Building and Housing has prepared guidelines for the repairing or rebuilding of houses in Christchurch. For vertical settlements in the ULS of up to 100 mm, as may be the case in Stage 2B, the use of rib raft or waffle slab type foundation is appropriate as specified in Christchurch. It is recommended that such foundation details are incorporated for all houses constructed in Stage 2B.

8.0 Topsoil Thickness

During the subdivision earthworks, areas of cut or fill were initially stripped of topsoil and this was then replaced to target depths of up to 300mm. No guarantee is implied or given that the topsoil on any part of any lot is 300mm deep or less and it is recommended that future owners or builders check topsoil depths when preparing site development plans and cost schedules

9.0 Professional Opinion

A producer statement in the format of Form G2 of Council's Infrastructure Development Code is attached in Appendix 2 of this report as confirmation that all of the lots in Stage 2B of The Lakes Development are suitable for residential building construction.

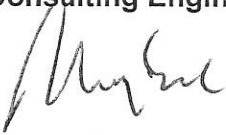
A Summary of Geotechnical Data for Individual Lots in the format of G3 of the Code is also in Appendix 2.

10.0 Applicability

Recommendations contained in this report are based on data from boreholes, observations of soil exposures during earthworks, and results of testing in the filling placed. Inferences about the nature and continuity of subsoils away from these locations are made but cannot be guaranteed.

This report has been prepared specifically for the proposed subdivision development in Stage 2B of the Lakes Development and no responsibility is accepted by S & L Consultants Ltd for the use of any part of this report for other development sites without their written approval.

S & L Consultants Ltd
Consulting Engineers, Surveyors, Planners



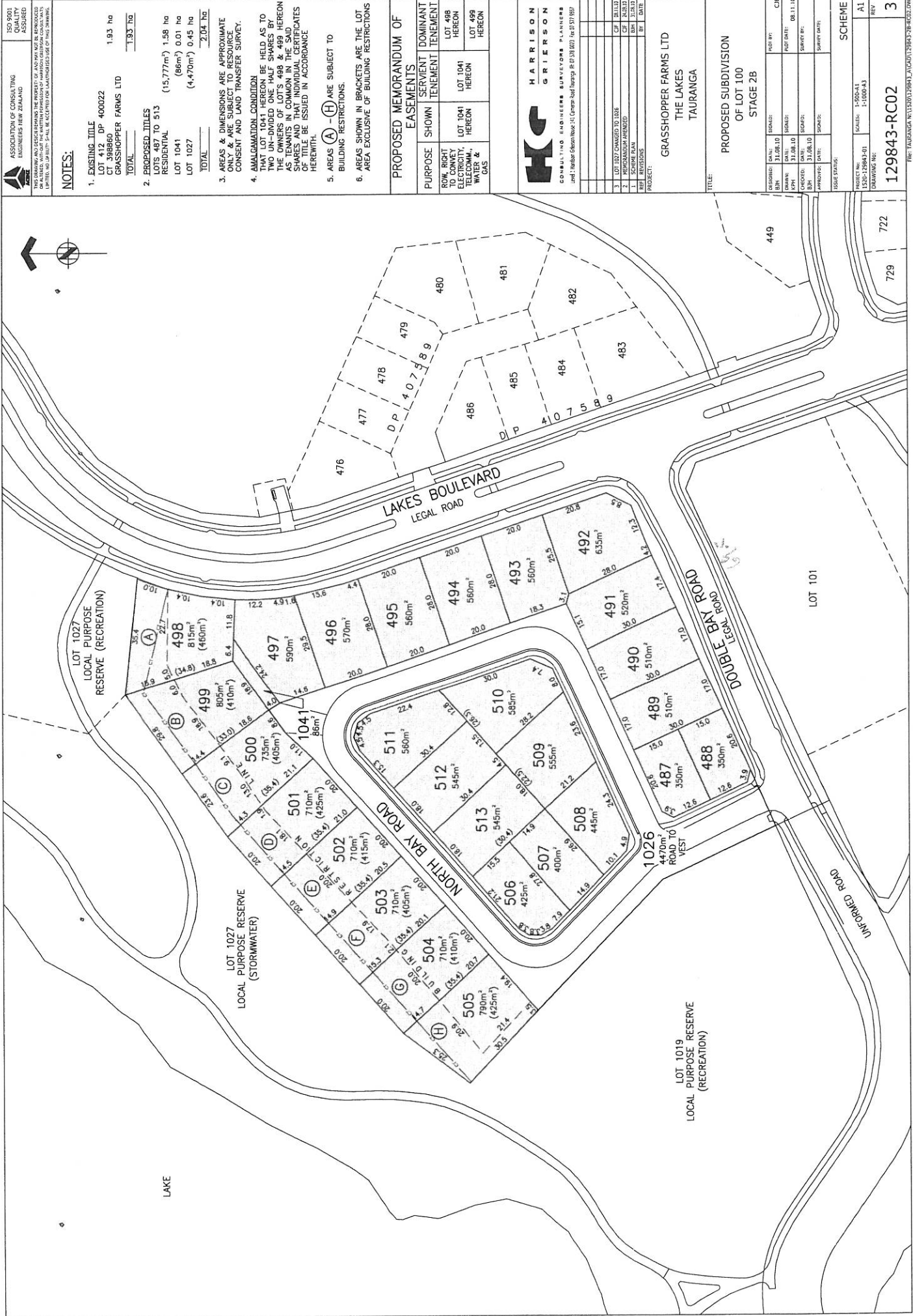
Prepared by
M W Hughes CPEng MIPENZ
Geotechnical Engineer

26 April 2012

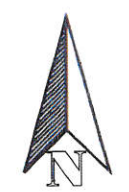
Appendix One

Drawings

Subdivision Scheme Plan by Harrison Grierson
Reference Plan - 20180-AB3
 - 20180-AB4



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NOTES:		
1. EXISTING TITLE LOT 100 DP 400022 CT 398660 GRASSHOPPER FARMS LTD TOTAL 1.93 ha 1.93 ha		
2. PROPOSED TITLES LOTS 487 TO 513 RESIDENTIAL LOT 1041 (15,777m ²) 1.58 ha LOT 1027 (86m ²) 0.01 ha LOT 1027 (4,470m ²) 0.45 ha TOTAL 2.04 ha		
3. AREAS & DIMENSIONS ARE APPROXIMATE ONLY & ARE SUBJECT TO RESOURCE CONSENT AND LAND TRANSFER SURVEY.		
4. AMALGAMATION CONDITION THAT LOT 1041 HEREON BE HELD AS TO TWO UN-DIVIDED ONE HALF SHARES BY THE OWNERS OF LOT'S 488 & 499 HEREON AS TENANTS IN COMMON IN THE SAID SHARED AND UN-DIVIDED ONE HALF SHARES OF TITLE BE ISSUED IN ACCORDANCE HERewith.		
5. AREAS (A) - (H) ARE SUBJECT TO BUILDING RESTRICTIONS.		
6. AREAS SHOWN IN BRACKETS ARE THE LOT AREA EXCLUSIVE OF BUILDING RESTRICTIONS		
PROPOSED MEMORANDUM OF EASEMENTS		
PURPOSE	SHOWN	SERVIENT TENEMENT
ROW, RIGHT OF WAY, EASEMENT, ELECTRICITY, TELECOMM., WATER & GAS	LOT 1041 HEREON	LOT 488 HEREON
	LOT 1041 HEREON	LOT 489 HEREON
		LOT 499 HEREON
HARRISON GRIFFIN CONSULTING ENGINEERS PLANNERS Level 1, Market Square House 141, Green Road Tauranga, PO Box 8023, Te Pahi 3107 9897		
1. LOT 1027 CHANGED TO 1028	CFP	BN 11.10
2. MEMORANDUM AMENDED	CFP	BN 11.10
1. SCHEME PLAN	BNH	31.08.10
REV. REVISIONS	BY	DATE
PROJECT: GRASSHOPPER FARMS LTD THE LAKES TAURANGA		
TITLE: PROPOSED SUBDIVISION OF LOT 100 STAGE 2B		
DESIGNED BY: BNH	DRAWN BY: BNH	DATE: 31.08.10
CHECKED BY: BNH	DATE: 31.08.10	SCALE: 1:1000
APPROVED BY: BNH	DATE: 31.08.10	SCALE: 1:1000
ISSUE STATUS:		
PROJECT No. 129843-RC02	SCALES: 1:500-A-1	SCHEME
DRAWING No. 129843-RC02	1:500-A-1	A1
129843-RC02		REV
3		



FILL Subdivision Cut and
CUT Fill Areas

1 ——— Fill Contour

-1 ——— Cut Contour

----- Building
Restriction Line

CKD BY	REV No	DESCRIPTION	DATE
	1	Issued with Report	04/12
Surveyed		NAME	SIGNED
Designed			
Drawn	NP	4/12	
Checked			
Approved			
REFERENCES			



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Email: slconsultants@sltga.co.nz



TITLE

THE LAKES

Stage 2B

Earthworks Asbuilt
Depth of Cut / Fill

ORIGINAL SCALES		DATE
1:1000 @ A3		4/12
DRAWING No		
20180 - AB4		
REVISION:	1	





Notes:
1) Contours are in terms of Moturiki Datum

Key

- Fill Compaction Test
- ⊕ Pre-subdivision Test Site
- ⊠ Settlement Control Marker
- ⊕ Post Construction Borehole 4/12
- Post Earthwork Borehole 02/08
- Building Restriction Line
- ▲ CPT 2012

1		Issued with Report	04/12
CHKD BY	REV No	DESCRIPTION	DATE
Surveyed		NAME	SIGNED
Designed			
Drawn	NP	4/12	
Checked			
Approved			
REFERENCES			

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TITLE
THE LAKES
Stage 2B
**Geotechnical
Report
Reference Plan**

Copyright on this drawing is reserved	
ORIGINAL SCALES	DATE
1:1000 @ A3	4/12
DRAWING No	
20180 - AB3	
REVISION: 1	



Appendix Two

Producer Statement - Suitability of
Land for Building Development

Summary of Geotechnical Data for Individual Lots

CERTIFICATION

G2

STATEMENT OF PROFESSIONAL OPINION AS TO THE GEOTECHNICAL SUITABILITY OF LAND FOR BUILDING

NAME OF SUBDIVISION	The Lakes – Stage 2B
COUNCIL FILE NUMBER RC No:	15266
ENGINEER RESPONSIBLE FOR DEVELOPMENT:	M W Hughes of S & L Consultants Ltd
QUALIFICATIONS:	BE(Civil)CPEng MIPENZ Int PE

I **Michael William Hughes**..... of **S & L Consultants Ltd**,
(Full Name) (Name & Address of Firm)

Hereby confirm that;

1. I am a professional person, appropriately qualified with experience in geotechnical engineering to ascertain the suitability of the land for building development and was retained as the Soils Engineer to the above development.
2. An appropriate level of site investigation and construction supervision has been carried out under my direction and is described in my development evaluation report dated: **26 April 2012**
3. In my professional opinion, not to be construed as a guarantee, I consider that;
 - a) The areas shown in my report dated **26 April 2012** of each new allotment are suitable for the erection thereon of the building types appropriate to the zoning of the land, provided that: **building restriction lines are observed.**

- c) The earth fills shown on the attached Plan No. 20180-AB4 have been placed in accordance with the requirements of the Infrastructure Development Code.
- d) The completed works give due regard to all land slope and foundation stability considerations.
- e) The filled ground is suitable for the erection thereon of residential buildings not requiring specific design in terms of NZS 3604: 2011 and related documents

- b) The original ground not affected by filling is suitable for the erection thereon of residential buildings not requiring specific design in terms of NZS 3604: 2011 and related documents

4. This professional opinion is furnished to the Council and the owner for their purpose alone, on the express condition that it will not be relied upon by any other person and does not remove the necessity for the normal inspection of foundation conditions at the time of erection for any dwelling.

Signed Date **26 April 2012**



TaurangaCity

PRODUCER STATEMENT
SUITABILITY OF LAND FOR BUILDING DEVELOPMENT

INFRASTRUCTURE DEVELOPMENT CODE

G2

VERSION 1
 July 2011

1

DP NO	Property Address:	Lakes Subdivision Stage 2B	RC: 15266													
The Lakes Stage 2G																
Lot No	Subsurface Data			Foundations			Specific Design	Building Restriction Line	S/W Specific Design	S/W Soakage	S/W Reticulate	Designated Building Platform	Minimum Building Platform	Compressible Soils	On-Site Effluent Disposal	Consent Notice
	Area (m²)	Shear Strength (kPa)	Subdivision Filling	Natural Topography Unworked	Natural Topography Earthworked	Conventional Shallow Foundation to NZS 3604:2011										
			Depth (m)	Y/N	Depth (m)	Y/N/NA	Y/N/NA									
487	350	150	4-5	Y	3	Y	Y	N	N	N	N	N	N	N	N	Y
488	350	150	4-5	Y	3	Y	Y	N	N	N	N	N	N	N	N	Y
489	510	150	4-5	Y	3	Y	Y	N	N	N	N	N	N	N	N	Y
490	510	150	3-4	Y	3	Y	Y	N	N	N	N	N	N	N	N	Y
491	520	150	2-3	Y	3	Y	Y	N	N	N	N	N	N	N	N	Y
492	635	150	0-3	Y	3	Y	Y	N	N	N	N	N	N	N	N	Y
493	560	150	0-1	Y	0-1.5	Y	Y	N	N	N	N	N	N	N	N	Y
494	560	150		N	0-1.5	Y	Y	N	N	N	N	N	N	N	N	Y
495	560	150		N	1-2	Y	Y	N	N	N	N	N	N	N	N	Y
496	570	150		N	1-2	Y	Y	N	N	N	N	N	N	N	N	Y
Comments																
Consent Notices refer to Geotechnical Completion Reports of 26 April 2012																
* subdivision filling as replacement of peat. Earthworks depths for lots 487 to 492 relate to peat removed.																
Rib raft or waffle slab floor systems are to be adopted for all buildings - refer to Section 7.0																
Consent Notice																
On-Site Effluent Disposal																
Compressible Soils																
Minimum Building Platform																
Designated Building Platform																
S/W Reticulate																
S/W Soakage																
S/W Specific Design																
Building Restriction Line																

DP NO	Property Address:	The Lakes Stage 2B	RC: 15266															
Lot No	Area (m ²)	Subsurface Data					Foundations			Building Restriction Line	S/W Specific Design	S/W Soakage	S/W Reticulate	Designated Building Platform	Minimum Building Platform	Compressible Soils	On-Site Effluent Disposal	Consent Notice
		Shear Strength (kPa)	Subdivision Filling	Natural Topography Unworked	Natural Topography Earthworked	Conventional Shallow Foundation to NZS 3604:2011	Specific Design											
		Y/N	Depth (m)	Y/N	Depth (m)	Y/N/NA	Y/N/NA											
497	590	150	N		Y	1-2	Y	Y	N									Y
498	815	150	Y	0-1	Y	0-2	Y	Y	N									Y
499	805	150	Y	0-3	Y	0-2	Y	Y	N									Y
500	735	150	Y	0-3	Y	0-2	Y	Y	N									Y
501	710	150	Y	0-3	Y	0-3	Y	Y	N									Y
502	710	150	Y	0-3	Y	0-1	Y	Y	N									Y
503	710	150	Y	3-4	Y	3	Y	Y	N									Y
504	710	150	Y	4-5	Y	3	Y	Y	N									Y
505	790	150	Y	3-5	Y	3	Y	Y	N									Y
506	425	150	Y	4-6	Y	3	Y	Y	N									Y
Consent notices refer to Geotechnical Completion Reports of 26 April 2012																		
* Subdivision filling as replacement of peat. Earthworks depths for lots 498 to 506 inclusive relate to depths of peat removed																		
Rib raft or waffle slab floor systems are to be adopted for all buildings - refer to Section 7.0																		

SUMMARY OF GEOTECHNICAL DATA FOR INDIVIDUAL LOTS

INFRASTRUCTURE DEVELOPMENT CODE

G3

 VERSION 1
July 2011

1

DP NO	Property Address:	Lakes Subdivision Stage 2B	RC: 15266														
Lot No	Area (m ²)	Subsurface Data			Foundations			Specific Design									
		Shear Strength (kPa)	Subdivision Filling	Natural Topography Unworked	Natural Topography Earthworked	Conventional Shallow Foundation to NZS 3604:2011	Building Restriction Line		S/W Specific Design	S/W Soakage	S/W Reticulate	Designated Building Platform	Minimum Building Platform	Compressible Soils	On-Site Effluent Disposal	Consent Notice	
			Y/N	Depth (m)	Y/N	Depth (m)	Y/N/NA										
507	400	150	*	4-5	N	3	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
508	445	150	Y	5	N	3	N	Y	Y	Y	Y	N	N	N	N	N	N
509	555	150	Y	3-4	N	3	N	Y	Y	Y	Y	N	N	N	N	N	N
510	585	150	Y	0-3	N	0-2	N	Y	Y	Y	Y	N	N	N	N	N	N
511	560	150	N		N	1-2	N	Y	Y	Y	Y	N	N	N	N	N	N
512	545	150	Y	0-2	N	0-2	N	Y	Y	Y	Y	N	N	N	N	N	N
513	545	150	Y	0-4	N	0-3	N	Y	Y	Y	Y	N	N	N	N	N	N
Comments																	
Consent Notices refer to Geotechnical Completion Reports of 26 April 2012																	
* subdivision filling as replacement of peat. Earthworks depths for lots 507 to 509 relate to peat removed.																	
rib raft or waffle slab floor systems are to be adopted for all buildings - refer to Section 7.0																	

Appendix Three

Compaction Test Results
Settlement Monitoring Results

**Summary of Compaction Test Results
Stage 2B**

Test No.	Date	Soil Type	Percentage Air Voids	Undrained Shear Strength (kPa)
126	08.01.07	Silt/clay	4.4	UTP
127	08.01.07	Silt/clay	6.2	UTP
186	14.02.07	Silt/clay	2.0	UTP
187	14.02.07	Silt/clay	0.4	155
188	14.02.07	Silt/clay	4.0	UTP
189	14.02.07	Silt/clay	0.3	152
190	14.02.07	Silt/clay	4.7	V
191	14.02.07	Silt/clay	4.9	UTP
192	14.02.07	Silt/clay	7.1	188+
204	20.02.07	Silt/clay	3.1	UTP
205	20.02.07	Silt/clay	5.8	UTP
206	20.02.07	Silt/clay	4.2	UTP
217	27.02.07	Silt/clay	7.7	180+
218	27.02.07	Silt/clay	0.4	176+
219	27.02.07	Silt/clay	3.0	157
241	06.03.07	Silt/clay	6.3	UTP
242	06.03.07	Silt/clay	6.2	UTP
243	06.03.07	Silt/clay	0.0	158+
244	06.03.07	Silt/clay	4.2	UTP
245	07.03.07	Silt/clay	3.1	UTP
247	07.03.07	Silt/clay	8.6	179+
248	07.03.07	Silt/clay	4.0	179+
249	07.03.07	Silt/clay	5.2	180+
253	21.03.07	Silt/clay	1.1	167+
254	21.03.07	Silt/clay	7.0	168
255	21.03.07	Silt/clay	3.3	166
256	21.03.07	Silt/clay	3.9	172+
257	21.03.07	Silt/clay	2.8	152
258	21.03.07	Silt/clay	0.0	167+
259	21.03.07	Silt/clay	0.0	UTP
260	21.03.07	Silt/clay	2.5	169+
262	21.03.07	Silt/clay	0.0	163+
263	21.03.07	Silt/clay	5.0	UTP
290	27.03.07	Silt/clay	5.5	164+
291	27.03.07	Silt/clay	7.2	180+
292	27.03.07	Silt/clay	2.1	146
293	27.03.07	Silt/clay	7.6	168+
294	27.03.07	Silt/clay	6.3	159+
295	12.04.07	Silt/clay	2.5	180+
295	12.04.07	Silt/clay	4.4	152
297	12.04.07	Silt/clay	2.3	180+
298	12.04.07	Silt/clay	1.7	162
299	12.04.07	Silt/clay	7.0	UTP
300	12.04.07	Silt/clay	5.4	165
301	12.04.07	Silt/clay	6.1	176+

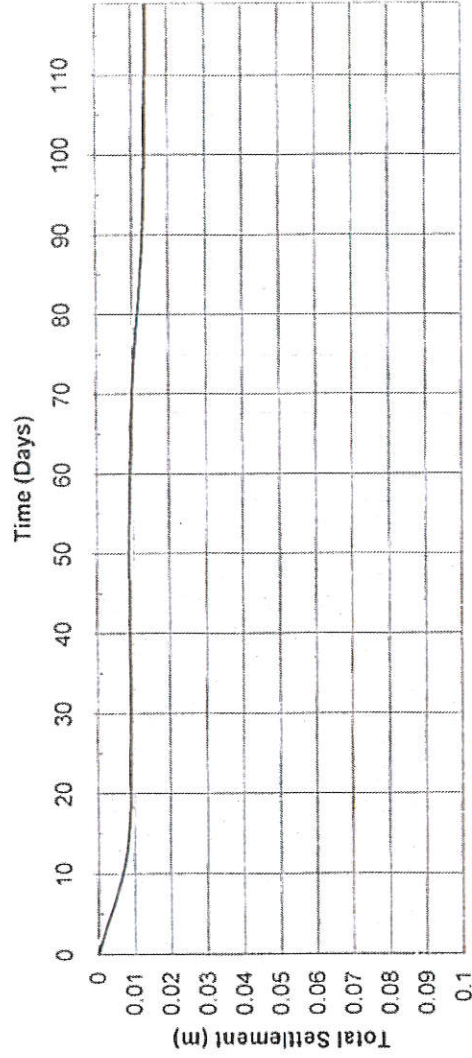
302	12.04.07	Silt/clay	2.4	180+
303	12.04.07	Silt/clay	3.8	164+
304	12.04.07	Silt/clay	0.8	164+
305	12.04.07	Silt/clay	4.1	173+
306	12.04.07	Silt/clay	0.8	160
307	12.04.07	Silt/clay	0.0	168+
308	12.04.07	Silt/clay	3.6	UTP
309	12.04.07	Silt/clay	0.0	UTP

Notes:

UTP Unable to penetrate with vane head

Settlement Mark	Date	Warratah RL	Settlement	Total Settlement	Days Between readings	Total Days	Comments	Equipment
SM32	13 June 2007	9.183	0	0	0	0	Warratah	Level
SM32	26 June 2007	9.175	0.008	0.008	13	13	Warratah	Level
SM32	11 July 2007	9.174	0.001	0.009	15	28	Warratah	Level
SM32	26 July 2007	9.174	0	0.009	15	43	Warratah	Level
SM32	7 August 2007	9.174	0	0.009	12	55	Warratah	Level
SM32	24 August 2007	9.173	0.001	0.01	17	72	Warratah	Level
SM32	12 September 2007	9.17	0.003	0.013	19	91	Warratah	Level
SM32	10 October 2007	9.169	0.001	0.014	28	119	Warratah	Level
SM32	13 December 2007						Destroyed	

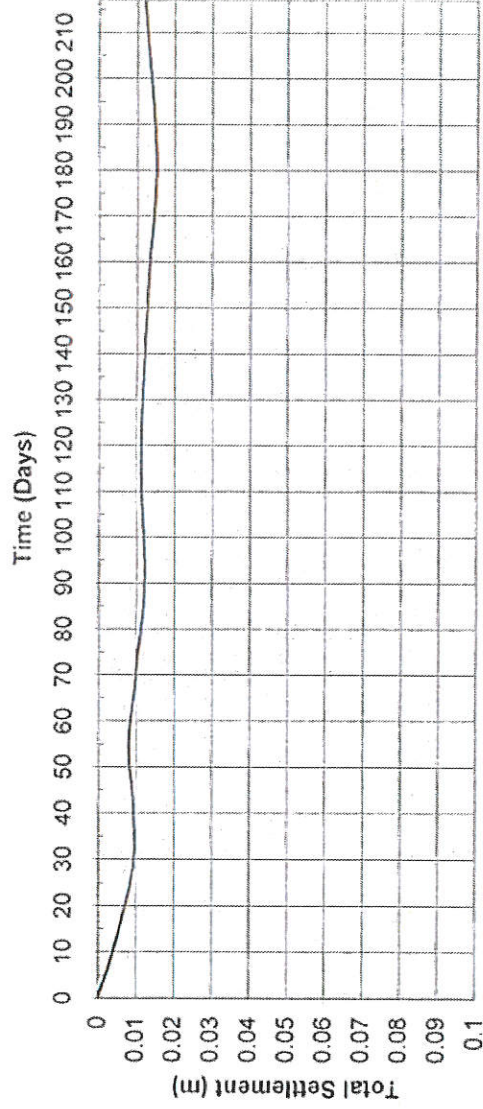
SM 32



— SM 32

Settlement Mark	Date	Warratah RL	Settlement	Total Settlement	Days Between readings	Total Days	Comments	Equipment
SM33	13 June 2007	9.672	0	0	0	0	Warratah	Level
SM33	26 June 2007	9.667	0.005	0.005	13	13	Warratah	Level
SM33	11 July 2007	9.663	0.004	0.009	15	28	Warratah	Level
SM33	26 July 2007	9.663	0	0.009	15	43	Warratah	Level
SM33	7 August 2007	9.664	-0.001	0.008	12	55	Warratah	Level
SM33	24 August 2007	9.662	0.002	0.01	17	72	Warratah	Level
SM33	12 September 2007	9.66	0.002	0.012	19	91	Warratah	Level
SM33	10 October 2007	9.661	-0.001	0.011	28	119	Warratah	Level
SM33	15 November 2007	9.659	0.002	0.013	36	155	Warratah	Level
SM33	13 December 2007	9.657	0.002	0.015	28	183	Warratah	Level
SM33	16 January 2008	9.66	-0.003	0.012	34	217	Warratah	Level

SM 33

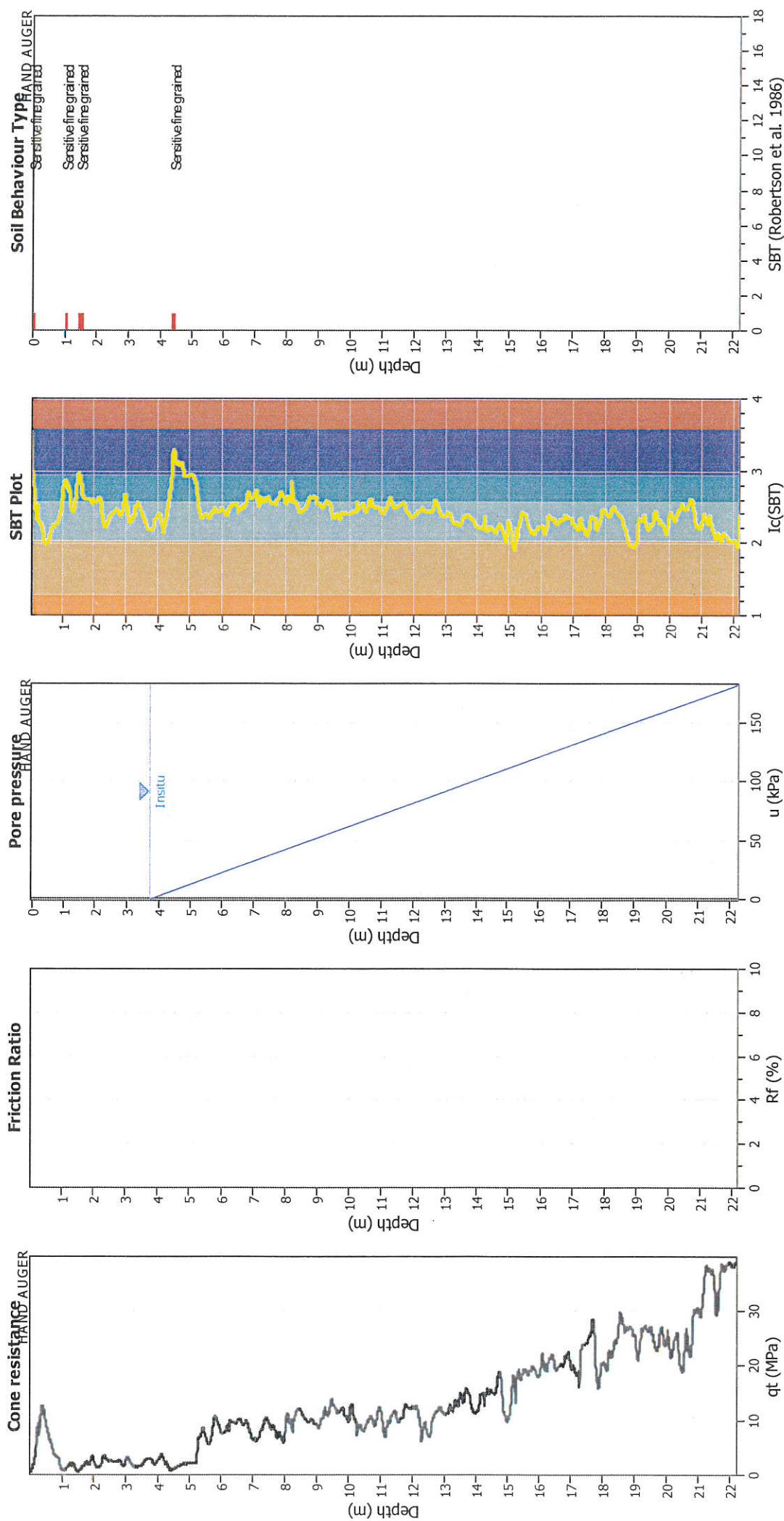


— SM 33

Appendix Four

Liquefaction Analyses Plots

CPT basic interpretation plots



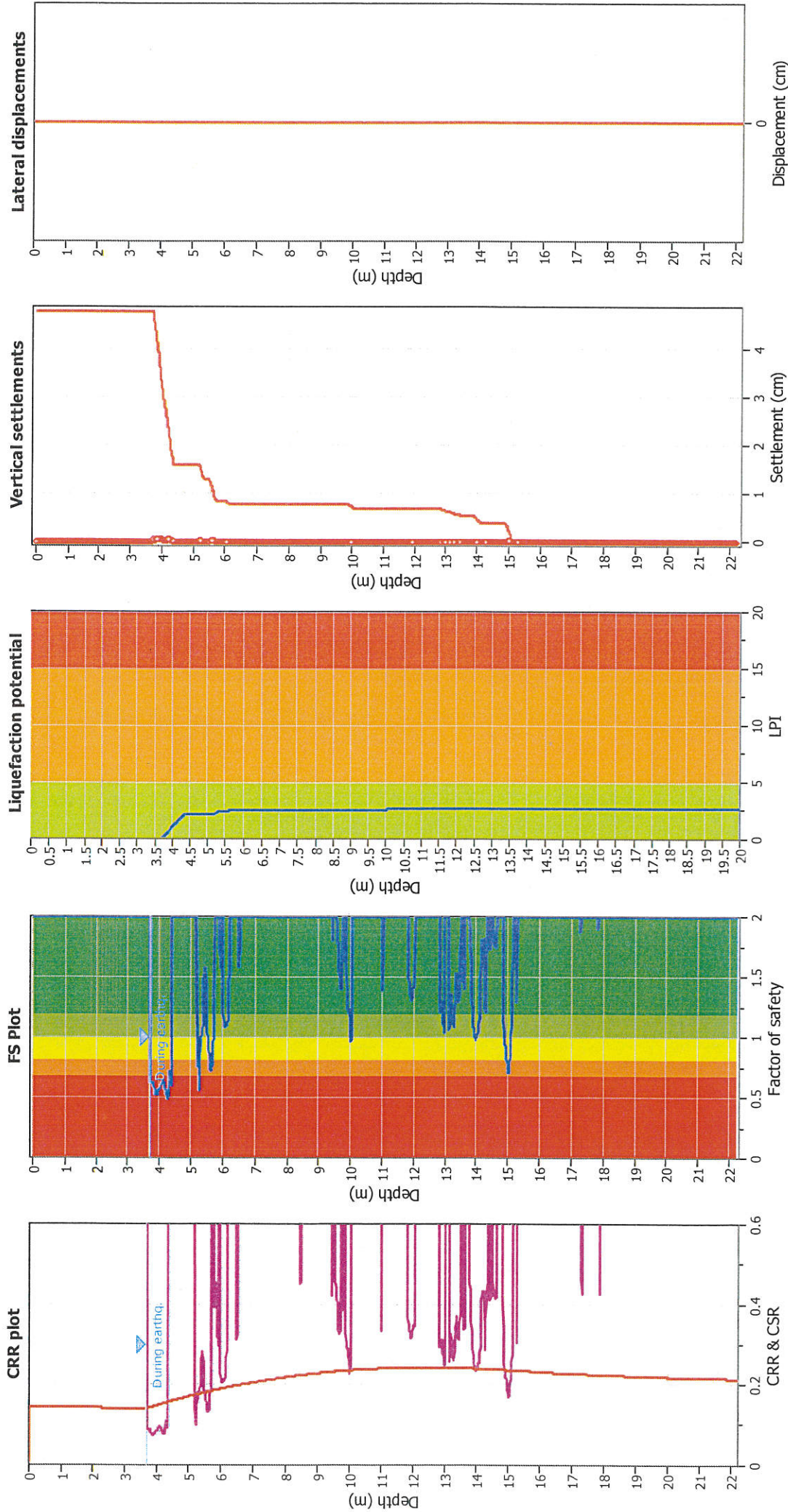
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	3.70 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.22	Use fill:	No	Limit depth applied:	Yes
Depth to water table (Insitu):	3.70 m	Fill height:	N/A	Limit depth:	22.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: NCEER (1998)
Fines correction method: NCEER (1998)
Points to test: Based on Ic value
Earthquake magnitude M_w : 7.50
Peak ground acceleration: 0.22
Depth to water table (insitu): 3.70 m

Depth to water table (earthq.): 3.70 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: No
 K_0 applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 22.00 m

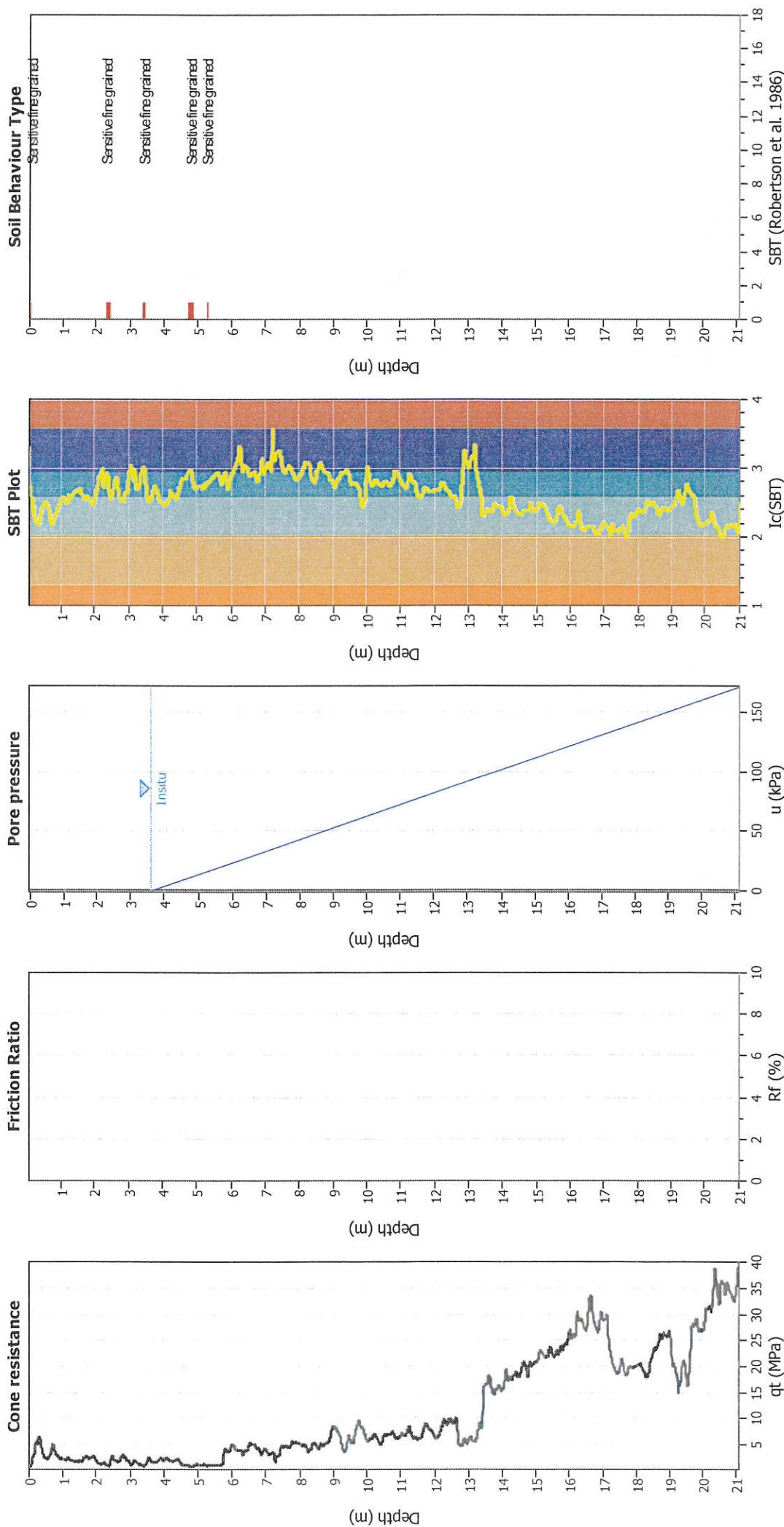
F.S. color scheme

Almost certain it will liquefy
Very likely to liquefy
Liquefaction and no liquefaction are equally likely
Unlike to liquefy
Almost certain it will not liquefy

LPI color scheme

Very high risk
High risk
Low risk

CPT basic interpretation plots



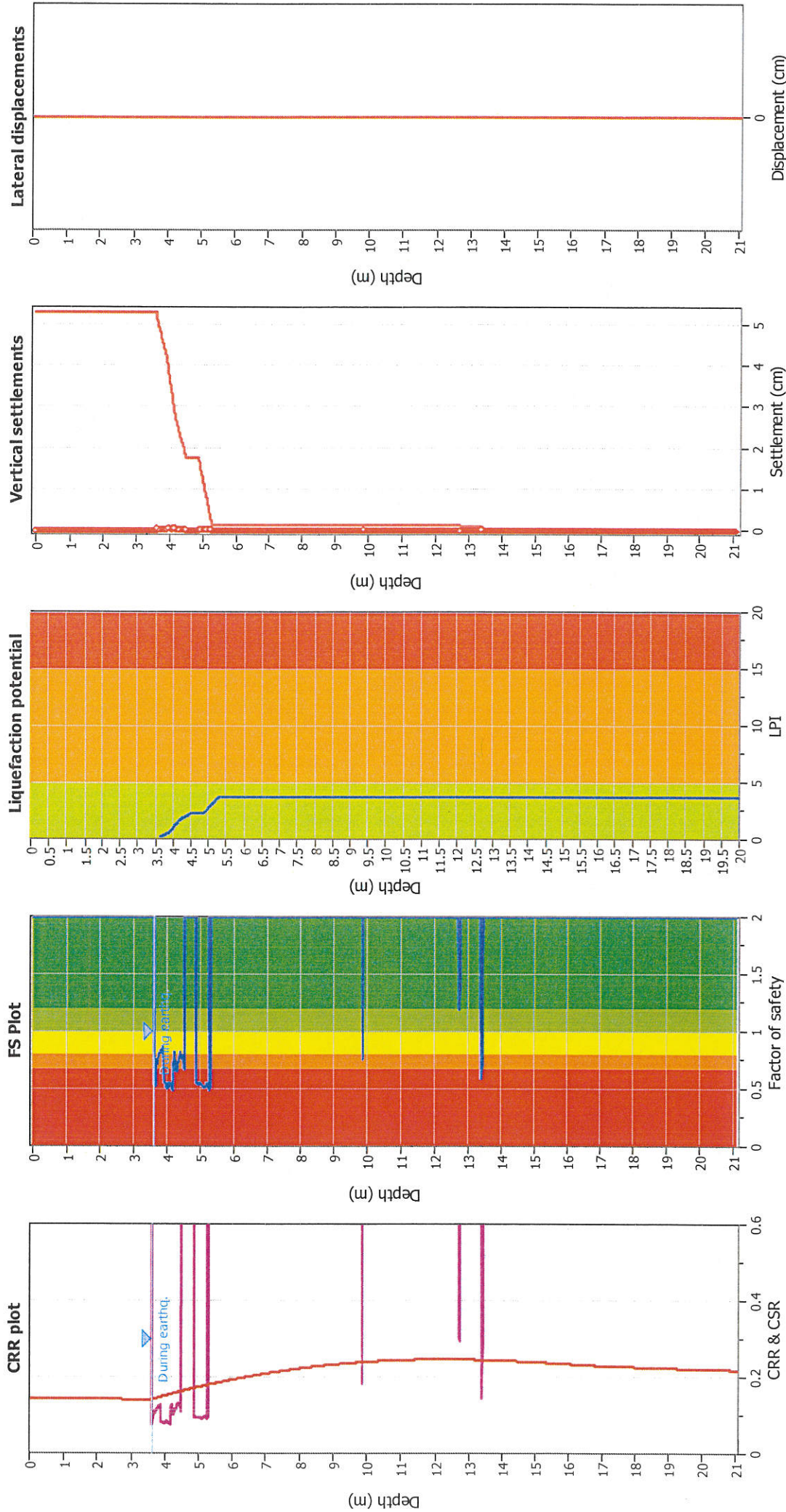
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	3.60 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _v applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.22	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	3.60 m	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: NCEER (1998)
Fines correction method: NCEER (1998)
Points to test: Based on I_c value
Earthquake magnitude M_w : 7.50
Peak ground acceleration: 0.22
Depth to water table (insitu): 3.60 m

Depth to water table (earthq.): 3.60 m
Average results interval: 3
 I_c cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: No
 K_0 applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: No
Limit depth: N/A

F.S. color scheme

Almost certain it will liquefy
Very likely to liquefy
Liquefaction and no liquefaction are equally likely
Unlike to liquefy
Almost certain it will not liquefy

LPI color scheme

Very high risk
High risk
Low risk

Appendix Five

Pre and Post Construction Borehole Logs



Stage 2B
Lot 503A
Stake Ref No 210

Site: The Lakes Residential Subdivision

Sheet: 1 Of: 1

Job No: 18264

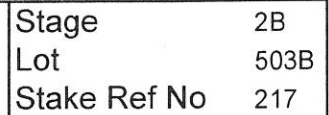
Date Excavated: W.20/2/08

RL Ground:

Logged By: MH

Description of Soil	Soil Symbol	Depth (m)	Groundwater	Core Recovery			
					50	100	150
No topsoil Clean sandy SILT; friable, brown yellow very stiff, dry, uniform	Subdivision Filling	1.0	Borehole Dry	1.5m Runs with 100% Recovery			
		2.0					
Silt: Friable, cream, firm, very moist, sensitive, dilatent (Natural Insitu Subsoils)	x x	3.0					
	x x	4.0					
	x x	4.5					
EOB @ 4.5m							

EXCAVATION METHOD: Machine Rotary



Logged By: MH

Logged By: MH

50 100 150

EOB @ 1.5m

EXCAVATION METHOD: Machine Rotary

Site: The Lakes Residential Subdivision

Job No: 18264

Date Excavated: W.20/2/08

RL Ground:

Logged By: MH

[illegible]

EXCAVATION METHOD: Machine Rotary

Stage	2B
Lots	506/507
Stake Ref No	207

Sheet: 1 Of: 1

Logged By: MH

Site: The Lakes Residential Subdivision

Job No: 18264

Date Excavated: W.20/2/08

RL Ground:

[illegible]

EXCAVATION METHOD: Machine Rotary

Stage	2B
Lots	508/509
Stake Ref No	224
Sheet: 1	Of: 1

Site: The Lakes Residential Subdivision

Job No: 18264

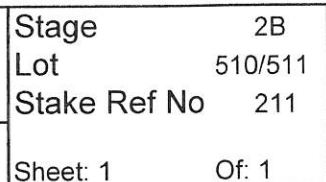
Date Excavated: W.20/2/08

RL Ground:

Logged By: MH

Description of Soil	Soil Symbol	Depth (m)	Groundwater	Core Recovery			
					50	100	150
No topsoil Clean, clayey, SILT; cohesive, dark orange, very stiff, slightly moist, uniform		1.0	Borehole Dry	1.5m Runs with 100% Recovery			
Mixed cream sandy and pale brown silt		2.0					
		3.0					
		4.0					
		5.0					
Silt: Sandy, grey, medium dense (Natural Insitu Subsoils)	X X						
		6.0					
EOB @ 6.0m							

EXCAVATION METHOD: Machine Rotary



Logged By: MH

EXCAVATION METHOD: Machine Rotary



Stage 2B
Lots 512
Stake Ref No 223

Site: The Lakes Residential Subdivision

Sheet: 1 Of: 1

Job No: 18264

Date Excavated: W.20/2/08

RL Ground:

Logged By: MH

Description of Soil	Soil Symbol	Depth (m)	Groundwater	Core Recovery			
					50	100	150
No topsoil Clean, clayey, SILT; cohesive, dark orange, very stiff, slightly moist, uniform Minor grey and cream patches	Subdivision Filling	1.0	Borehole Dry	1.5m Runs with 100% Recovery			
Sand: Coarse, blue grey, medium dense, damp (Natural Insitu Subsoils)		2.0					
EOB @ 6.0m		3.0					
		4.0					
		5.0					
		6.0					

EXCAVATION METHOD: Machine Rotary

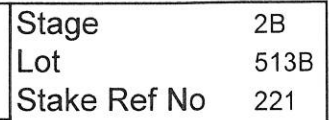
Stage	2B
LOT	513A
Stake Ref No	220

Sheet: 1 Of: 1

Logged By: MH

Description of Soil	Soil Symbol	Depth (m)	Groundwater	Core Recovery			
					50	100	150
<p>No topsoil</p> <p>Clean, clayey, SILT; cohesive, dark orange, very stiff, damp, uniform</p> <p>Minor grey and cream silt patches stiff, moist</p> <p>Very moist</p>	Subdivision Filling	1.0	Borehole Dry	1.5m Runs with 100% Recovery			
<p>Silt: Clayey, dark orange mixed grey sandy silt, stiff very moist (Natural Insitu Subsoils)</p> <p>EOB @ 6.0m</p>	x	6.0					

EXCAVATION METHOD: Machine Rotary



Site: The Lakes Residential Subdivision

Logged By: MH

EXCAVATION METHOD: Machine Rotary



Borehole Log. MB 16

Site: Pyes Pa West Urbanisation

Sheet: 1 Of: 3

Job No. 16944

Date Excavated: 16/4/03

RL Ground:

Logged By: MMA

Description of Soil	Soil Symbol	Depth (m)			Undrained Shear Strength (kPa)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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SILT : Slightly (5-10%) organic, dark brown, firm : organic material is amorphous and soils do not have peaty smell	{	0-5																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					



Borehole Log. MB 16

Site: Pyes Pa West Urbanisation

Sheet: 2 Of: 3

Job No. 16944

Date Excavated: 16/4/03

RL Ground:

Logged By: MA

Description of Soil	Soil Symbol	Depth (m)	SPT	CORE RECOVERY	Undrained Shear Strength (kPa)		
					50	100	150
SPT NO RECOVERY		0	1				
SAND: Fine grained, Silty, pale grey loose, Sensitive		1	2				
		2	3				
		3	4				
		4	5				
		5	6				
		6	7				
		7	8				
		8	9				
		9	10				
MILL CUTTINGS BLOCKING HOLE		11					
FLUSH HOLE TO SEAT SPT SPT NO RECOVERY		12					
Loose sands Very Silty pale brown yellow sand, medium Dense		13	2				
		14					
		15					
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Borehole Log. MB 46

Site: Pyes Pa West Urbanisation

Sheet: 3 Of: 3

Job No. 6944

Date Excavated: 06/4/03

RL Ground:

Logged By: *MA*

Description of Soil	Soil Symbol	Depth (m)	SPT	RECOVERY	CORE RECOVERY	Undrained Shear Strength (kPa)		
						50	100	150
SPT 230 RECOVERY	GRAVEL Grey Dense Sand	0-12	8	12/100	100			
SAND: Silty, pale grey, Dense/compact		0-5		N>12				
i) very good core recovery		5-10						
ii) Material recovered very good condition		10-15						
EOB @ 10.5m: TARGET DEPTH		15-20						

EXCAVATION METHOD: 100mm ϕ Machine Auger Et Hollow spv



Borehole No. MB 18

Site:

Pyes Pa West Urbanisation

Sheet: 1 Of: 3

Job No. 16944

Date Excavated: 29/4/03

RL Ground:

Logged By: MAA

Description of Soil	Soil Symbol	Depth (m)	SPT	GROUNDWATER	CORE RECOVERY	Undrained Shear Strength (kPa)		
						50	100	150
SILT : Grey brown with 20-30% spongy wood 10% stringy poorly decomposed wood soft, highly compressible	{	{	{	{	{	{	{	{
PEAT : Youthfull spongy fibrous brown, soft, compressible core recovered in very good condition	{	{	{	{	{	{	{	{
SILT: Pumiceous, very clayey, slightly cohesive, cream, soft: core recovered in excellent condition	{	{	{	{	{	{	{	{

EXCAVATION METHOD: 100mm ϕ Machine Auger Et Hollow SPT.



Borehole No. MB18

Site:

Pyes Pa West Urbanisation

Sheet: 2 Of: 3

Job No. 16944

Date Excavated: 29/4/03

RL Ground:

Logged By: MH

Description of Soil

Soil Symbol

Depth (m)

Undrained Shear Strength (kPa)

50 100 150

SPT NO RECOVERY AND
FALLS UNDER WEIGHT OF
RODS

0
N=0

CLAY: puriceous, silty, cohesive
greasy texture, cream, soft
Excellent recovery in Auger with
core in excellent condition.

100 g

100 g

SPT 450 : Very silty clay, cohesive
RECOVERY grey, firm but sensitive

SPT FALLS
UNDER
HAMMER
WEIGHT
N=0

CLAY: Very silty, cohesive, grey, firm
sensitive

30-40 g

Driller notes that Densities
increase

EXCAVATION METHOD: 100mm ϕ Machine Auger Et Hollow SPT



Borehole No. MB 18

Site:

Pyes Pa West Urbanisation

Sheet: 3 Of: 3

Job No.

Date Excavated:

RL Ground:

Logged By:

Description of Soil

Soil Symbol

Depth (m)

SPT

CORE RECOVERY

Undrained Shear Strength (kPa)

50 100 150

SPT 450 : Slightly silty pumice
RECOVERY Sand, cream, Dense

SAND: pumice, silty, cream, Dense
Driller notes from Drilling

SPT 450 : Pumice sand, Dense
RECOVERY pale grey with horizontal
orange band @ 10.8m

EOB @ 11.0m

EXCAVATION METHOD: 100mm ϕ Machine Auger & Hollow SPT



Borehole No. MB 19

Site:

Pyes Pa West Urbanisation

Sheet: 1 Of: 2

Job No. 16944

Date Excavated: 29/4/03

RL Ground:

Logged By: MAA

Description of Soil

Soil Symbol

Depth (m)

SPT

GROUNDWATER

CORE RECOVERY

Undrained Shear Strength (kPa)

50

100

150

PEAT: Youthfull, spongy, fibrous
Dark brown, soft, highly
compressible: Core in excellent
condition

ORGANIC / PEAT SEDIMENTS & LOGS

DURING DRILLING

100%

100%

20-30%

spongy fibrous peat. Some
large wood objects possibly
logs obstructing Auger

NON ORGANIC

SAND: Silty, cream, loose

EXCAVATION METHOD: 100mm ϕ Machine Auger & Hollow SPT

EXCAVATION METHOD: 100mm ϕ Machine Auger Et Hollow SPT



Borehole No. MB20

Site: Pyes Pa West Urbanisation

Sheet: 1 Of: 2

Job No. 16944

Date Excavated: 29/4/03

RL Ground:

Logged By: MAA

Description of Soil

Soil Symbol

Depth (m)

SPT

GROUNDWATER

CORE RECOVERY

Undrained Shear Strength (kPa)

50 100 150

PEAT: Youthful, Spongy, Dark brown
highly compressible

ORGANIC SEDIMENTS

SAND: Pumiceous, Very silty, pale brown
yellow, loose, sensitive, Dilatant

NON ORGANIC LOOSE

very silty pale cream
grey loose sandSPT 450 Slightly silty, pale brown
RECOVERY yellow pumice sand, Dense

SAND: Silty, grey cream, Dense

DENSE

DURING DRILLING #

100%

N=0

0

60-80%

N=9

100%

10-20%

EXCAVATION METHOD: 100mm ϕ Machine Auger Et Hollow SPT



Borehole No. MB 20

Site:

Pyes Pa West Urbanisation

Sheet:

2 Of: 2

Job No. 16944

Date Excavated: 29/4/03

RL Ground:

Logged By: MAA

Description of Soil

Soil Symbol

Depth (m)

Undrained Shear Strength
(kPa)

50 100 150

SPT 450
RECOVERYpumice sand, medium
brown, pale grey, Dense

4

5

7

N=12

100%

SAND : Silty, pumice, pale brown
yellow, Dense

5.0

5.5

10%

SPT 450
RECOVERYpumice sand, pale brown
some gravels, Dense

2

3

8

N=11

100%

DENSE

Silty sand, Dense
pale brown yellow

6.5

7.0

10-15%

FOR @ 7.5m : TARGET DEPTH

7.5

EXCAVATION METHOD: 100 mm ϕ Machine Auger & Hollow SPT.



Borehole No. MB 31

Site:

Pyes Pa West Urbanisation

Sheet: 1 Of: 3

Job No. 16944

Date Excavated: F. 2/5/03

RL Ground:

Logged By: MA

Description of Soil

Soil Symbol

Depth (m)

SPT

GROUNDWATER

CORE RECOVERY

Undrained Shear Strength (kPa)

50 100 150

SILT: Highly organic, Dark brown
soft, highly compressible

ORGANICS:

20-30% amorphous matrix

20-25% poorly decomposed wood

ORGANIC

DURING DRILLING

100%

SILT: Sandy, cream, soft

NON ORGANIC

N=2

SAND: Dry Silty, cream, Dense

EXCAVATION METHOD: 100mm Ø MACHINE AUGER Et Hollow SPT



Borehole No. MB 31

Sheet: 2 of 3

Site:

Pyes Pa West Urbanisation

Job No. 16944

Date Excavated: 6.2/5/03

RL Ground:

Logged By: MAA

Description of Soil	Soil Symbol	Depth (m)	SPT	CORRECTION	Undrained Shear Strength (kPa)		
					50	100	150
pumice sand, very silty, grey, loose		5.0	1	N=2	0.00		
SPT 450 . Grey pumice sand, loose RECOVERY	PP	6.0	2	N=4	100		
firm pumice	2	6.5	3		60-70		
pumice sand, grey, medium dense		7.0					
MEDIUM DENSE DENSE		7.5	1		0.00		
		8.0	4	N=11	50		
		8.5	7				
		9.0					

EXCAVATION METHOD: 100mm ϕ MACHINE AUGER & Hollow SPT

EXCAVATION METHOD: 100mm ϕ MACHINE AUGER & HOLLOW SPT



Borehole No. MB 32

Site:

Pyes Pa West Urbanisation

Sheet: 1 Of: 5

Job No. 16944

Date Excavated: Tu. 13/5/03

RL Ground:

Logged By: MA

Description of Soil	Soil Symbol	Depth (m)	SPT	GROUNDWATER	CORE RECOVERY	Undrained Shear Strength (kPa)		
						50	100	150
SILT: Very clayey, cohesive, brown yellow, stiff, moist. Located on cut track ie no topsoil post core recovery	X X	0.0			100%			
	X X	0.5						
	X X	1.0						
	X X	1.5						
	X X	2.0						
	X X	2.5						
	X X	3.0						
	X X	3.5						
	X X	4.0						
	X X	4.5						
	X X	5.0						
	X X	5.5						
	X X	6.0						
	X X	6.5						
	X X	7.0						
	X X	7.5						
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	X X	104.0						
	X X	104.5						
	X X	105.0						



Borehole No. MB 32

Site:

Pyes Pa West Urbanisation

Sheet: 2 Of: 5

Job No. 16944

Date Excavated: Tu 13/5/03

RL Ground:

Logged By: MA

Description of Soil	Soil Symbol	Depth (m)	SPT	CORE RECOVERY	Undrained Shear Strength (kPa)		
					50	100	150
SPT 300 : Very clayey, cohesive silt RECOVERY Dark brown orange, Very stiff	x x	3	3	100%			
	/	4	4				
	x	5	3				
clayey cohesive dark brown orange silt	x	5.0	N=7	100%			
	x x	5.5					
	/	6.0					
SPT 450 : Very clayey, cohesive silt RECOVERY brown orange, Very stiff slightly moist	x x	6.5	1	100%			
	/	7.0	2				
	x x	7.5	5				
Brown orange grey brown	x	7.5	N=7	100%			
	/	8.0					
	x x	8.5					
SPT 450 : Moderately cohesive grey brown RECOVERY silt stiff brown orange cohesive silt, Very stiff	x	9.0	0	100%			
	/	9.5	2				
	x	10.0	3				
	/	10.5	N=5	100%			
	x	11.0					
	/	11.5					
	x x	12.0		100%			
	/	12.5					
	x x	13.0					

EXCAVATION METHOD: 75 mm ϕ MACHINE AUGER Et Hollow SPT



Borehole No. MB 32

Sheet: 3 Of: 5

Site:

Pyes Pa West Urbanisation

Job No. 16944

Date Excavated: Tu 13/5/03

RL Ground:

Logged By: MMA

Description of Soil	Soil Symbol	Depth (m)	SPT	RECOVERY	Undrained Shear Strength (kPa)		
					50	100	150
SPT 450 RECOVERY Very clayey moderately cohesive brown orange silt stiff (medium Dense)	xx	9.5	1	N=5			
		10.0	2				
		10.5	3				
SPT 450 RECOVERY pale yellow silt cream grey silt	xx	11.0	1	N=5			
		11.5	2				
		12.0	3				
SILT: clayey, moderately cohesive pale grey mottled pale yellow and flecks of black manganese stiff, sensitive, moist	xx	12.5		100%			
		13.0					
		13.5					
SPT 450 RECOVERY Grey clayey, moderately cohesive silt, stiff Dark Brown orange cohesive clayey silt, very stiff.	xx	14.0	3	N=12			
		14.5	5				
		15.0	7				
	xx	15.5		100%			
		16.0					
		16.5					

EXCAVATION METHOD: 75 mm ϕ MACHINE AUGER & HOLLOW SPT



Borehole No. MB32

Site:

Pyes Pa West Urbanisation

Sheet: 4 Of: 5

Job No. 16944

Date Excavated: Tu 13/5/03

RL Ground:

Logged By: MTA

Description of Soil	Soil Symbol	Depth (m)			Undrained Shear Strength (kPa)		
					50	100	150
SPT 450 : Slightly gritty pale grey RECOVERY Silt, slightly cohesive, stiff moist	xx	2					
		3					
	x	4	N=7				
SILT: Very clayey, moderately cohesive cream grey, stiff, moist	x	4.0					
	xx	4.5		100g			
	x	5.0					
SPT 450 : Gritty clayey silt, some sand RECOVERY brown grey, stiff (medium Dense)	xx	5.5	N=4.5				
	x	6.0		100g			
Brown grey clayey silt medium Dense	xx	6.5					
	x	7.0					
SPT 450 : Very clayey silt, slightly RECOVERY cohesive, brown grey, stiff medium Dense	xx	7.5	N=6				
	x	8.0					
pale brown grey	xx	8.5		100g			
	x	9.0					
very moist							
Dense							
Medium Dense	x	10.0					

EXCAVATION METHOD: 75mm ϕ MACHINE AUGER & HOLLOW SPT



Borehole No. MB 32

Sheet: 5 of 5

Site:

Pyes Pa West Urbanisation

Job No. 16944

Date Excavated: Tu 13/5/03

RL Ground:

Logged By:

Description of Soil

Soil Symbol

Depth (m)

Undrained Shear Strength
(kPa)

50 100 150

SPT NO RECOVERY: 1

N < 1

EOB @ 18.5m: TARGET DEPTH

EXCAVATION METHOD: 75mm ϕ MACHINE AUGER Et Hollow SPT

Description of Soil	Soil Symbol	Depth (m)	SPC	GROUNDWATER	CORE RECOVERY	Undrained Shear Strength (kPa)		
						50	100	150
SILT: Cream brown, soft, occasional wood		0.0						
10% stringy poorly decomposed wood	ORGANIC	0.5						
SAND: Very silty, cream, medium dense.	NON ORGANIC SANDS	1.0						
		1.5						
		2.0						
		2.5						
		3.0						
		3.5						
		4.0						
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