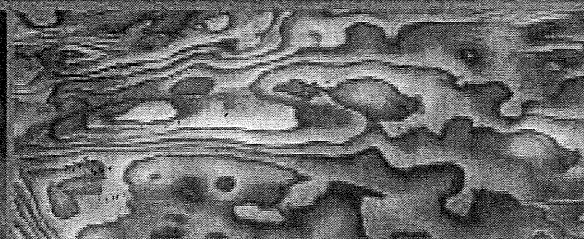


Tonkin & Taylor

ENVIRONMENTAL AND ENGINEERING CONSULTANTS



REPORT

WAITAKI DISTRICT COUNCIL

**Geotechnical Investigations
Test Street Subdivision, Oamaru**

Report prepared for:

WAITAKI DISTRICT COUNCIL

Report prepared by:

TONKIN & TAYLOR LTD

Distribution:

WAITAKI DISTRICT COUNCIL

CLARK FORTUNE MCDONALD & ASSOCIATES

TONKIN & TAYLOR LTD (FILE)

March 2005

Job no: 890917



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Appendix A: Site Plan and Cross Sections

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1. Introduction

1.1. General

This report presents the results of geotechnical investigations carried out by Tonkin & Taylor Ltd for a subdivision bounded by Test Street, Lane Street and Avon Street, Oamaru. The work was carried out for Waitaki District Council in accordance with a brief received from Clark Fortune McDonald & Associates, dated 28 January 2005. Tonkin & Taylor Ltd's proposal dated 31 January 2005 outlines the scope of work and conditions of engagement.

1.2. Development

The proposed development is for subdivision of the site into 27 allotments and associated access road, as shown in Fig 1, Appendix A. No specific plans for buildings are available at this stage, although conceptual plans indicate that many will require significant cuts (3-4 m) as a consequence of the moderate slopes on site.

2. Site Description

2.1. General

The site is legally described as SEC'S 1-23, BLK 31 and SEC'S 1-22 BLK 32 and is shown in Fig 1, Appendix A. The upper part of the site includes the eastern part of the currently unformed continuation of Avon Street.

Access to the site is currently best achieved from Test Street or from the reserve to the south, however the access road for the subdivision will feed from the current eastern termination of Avon Street.

This report also addresses geotechnical issues associated with of triangular section of land, situated directly below Test Street, as shown in Fig 1, Appendix A.

2.2. Topography and Surface Drainage

Topographic contours can be seen in Fig. 1, Appendix A. The majority of the site slopes at moderate inclination towards Oamaru Harbour, with a northerly aspect. Most slopes are no greater than 2.5:1 (horizontal : vertical), however, Lot 9 is steeper (2:1) owing to its position on the flank of an incised gully. The difference in elevation between the upper and lower parts of the site is approximately 50 m.

The triangular section of land below Test Street slopes gently towards a cliff face that is approximately 10 m high and composed entirely of loess.

There are no significant watercourses present on the site, although the eastern boundary coincides with the true left flank of an incised gully that is expected to carry surface water only at times of high rainfall.

2.3. Vegetation and Land Use

The site is currently unoccupied and is covered in scrub, mature trees, and rough pasture.

3. Investigations

An engineering geologist has conducted a site appraisal to assess the geomorphology and surficial conditions. Two test pits have been excavated in the gully area located at the eastern side of the subdivision. Fifteen additional hand dug test pits have been established to assess near-surface conditions and to enable penetrometer testing of the soils. Seventeen Scala penetrometer tests were carried out, the results of which are contained in test pit logs, Appendix B. Locations and logs of test pits are given in Appendices A and B respectively.

Although not part of the subdivision, the land below Test Street was also evaluated to assess its suitability for possible future development.

4. Subsurface Conditions

4.1. Geological Setting

The site is located adjacent to Oamaru Harbour on the northern flank of Cape Wanbrow, a volcanic promontory formed by a combination of submarine and subaerial volcanism, which was active in Eocene times. The volcanic rock types include tuffs, agglomerates and pillow lavas of basaltic composition (Waiareka Volcanics).

The volcanic rocks are overlain by thick accumulations of windblown loess and occasional remnant raised beach deposits, both of which are Pleistocene in age. The main geomorphological features of the area are steep cliffs, typical of marine headland environments.

No active fault traces were observed in the field nor have any been reported in this vicinity. Seismic hazard in East Otago is relatively low by New Zealand standards, however some potential exists for major earthquakes. Strong ground shaking throughout the South Island is likely to be associated with a rupture of the Alpine Fault, located along the West Coast of South Island. There is a high probability that an earthquake with an expected Magnitude of over 7.5 will occur along the Alpine Fault within the next 50 years.

4.2. Stratigraphy

A geological model for the site is presented in Figs 2a-2d, Appendix A. The stratigraphy comprises a surface layer of topsoil and roots underlain by thick loess. Locations and logs of test pits (including penetrometer results) are presented in Appendices A and B respectively.

The site is in general covered by up to 300 mm of topsoil and roots that comprise slightly moist, brown organic silt with plant fragments and roots.

The topsoil is pervasively underlain by loess. This comprises light brown to brown mottled silt with occasional roots. The loess is generally stiff to very stiff over the entire subdivision, however within the gully area on the eastern margin of the site the loess is saturated in places and is locally soft and wet. Test pit walls in this area readily collapsed.

The loess occasionally hosts under-runners as a result of its dispersive nature. The under-runners were mainly observed on the 25° east-facing slopes of Lot 9 and were

up to 1 m deep and 0.5 m wide. These are interpreted to be responsible for the weakening and high moisture content of the loess observed in Test Pit 1. Where present, under-runners tend to promote localised slope instability, with numerous minor scarps (< 1 m high) developed.

The base of the loess was not encountered, however, based on exposure in the cliff face below the site, it is interpreted to be at least 5 -10 m thick. Below this, the site is expected to be underlain by volcanic lithologies (Waireka Volcanics).

4.3. Groundwater

The soil types in the test pits are generally slightly moist across the site indicating that the regional groundwater table is not shallow.

Localised seepage was observed in Test Pit 1, where under-runners are interpreted to be focussing surface runoff. Significant under-runners were observed only on Lot 9, however they may be present elsewhere (e.g. suspected on Lot 1). The largest examples are likely to be confined to Lot 9.

The magnitude of flow in under-runners is likely to increase following periods of persistent rainfall.

4.4. Slope Stability

Minor slope instability was noted. This was mainly evident on Lot 9 where under-runners have destabilised the loess with the resulting slumping and subsidence forming scarps <1 m in height. Other minor scarps (< 0.5 m high) were apparent over the upper part of the site, however these are probably attributable to minor solifluction processes.

The area of land directly below Test Street is situated adjacent to a cliff that is up to 10 m high. The cliff has been severely eroded by under-runners and piping and large voids are apparent from below. Although the slopes are gentle to moderate in this area, major subsidence is possible and sinkholes could conceivably form at the margins of the cliff. Old concrete foundations are apparent in this area, and show evidence of subsidence.

5. Engineering Considerations

5.1. General

Recommendations and opinions in this report are based on the data sources noted above. The nature and continuity of subsoil conditions away from the exposures and test pits are inferred. However, it must be appreciated that actual conditions could vary from the assumed model.

5.2. Strength and Deformation Parameters

Design Profile

The design profile for the site is given in Table 5.1 below.

Unit	Thickness (m)	Bulk Density γ (kN/m ³)	Effective Cohesion c' (kPa)	Effective Friction ϕ' (deg)	Elastic Modulus E (kPa)	Poisson's Ratio ν
Topsoil – organic SILT.	0 - 0.3	N.A.	N.A.	N.A.	N.A.	N.A.
Loess – stiff to very stiff SILT.	5 - 10 m	17	2	33	15,000	0.3
Loess with under runners – very soft to firm SILT.	<3 m	17	0	30	3,000-8,000	0.3

Table 5-1. Preliminary Geotechnical Parameters

5.3. Site Preparation

During earthworks operations all topsoil and organic matter should be removed from beneath access pavements or building platforms in accordance with NZS 4431:1989.

Once scrub and trees have been cleared, any obvious near-surface under runners should be undercut and backfilled. This form of erosion indicates that the soils are dispersive, hence particular care will need to be taken to ensure no seepage conduits are allowed to remain to instigate further erosion. All surface water should be effectively intercepted. Should any potential for seepage be suspected to remain at existing under-runners, backfilling with loess that has been stabilised with the addition of 1-2% lime will provide an effective solution.

5.4. Excavations and Retaining

No specific excavations are indicated at this stage however the moderate slopes suggest that most dwellings will require excavations.

All excavations are expected to be in stiff to very stiff loess. Provided the loess remains well drained and cuts are less than about 2 m, temporary and permanent batters of 0.5:1 (horizontal : vertical) will be appropriate. Higher batters should be specifically designed, preferably with benching, and permanent batters should be quickly revegetated to reduce potential for rilling in these dispersive soils.

Any topsoil should be entirely removed at the crest of the cuts to ensure the temporary stability of these materials, or alternatively they could be battered suitably (flatter than 1.5:1).

If any placement of fill is proposed (e.g. to form flat platforms or road batters), this should be undertaken in accordance with NZS 4431: 1989. All topsoil will need to be removed from the fill subgrade.

If cuts greater than 2 m are proposed then specific geotechnical comment is recommended for each structure. Any retaining and/or backfill operations should be timed to commence as soon as practical after any section of cut is completed.

5.5. Roading

No specific plans are yet available for the access road. Cuts in loess should be formed as discussed above, with subsoil interception drains at their toes where seepage is indicated. Underdrained fill batters may be formed at 2:1. Particular care will need to be taken for the steep sidling horseshoe bend at the eastern side of the site, as under-runners are known to be present here.

Design CBR for the loess can be about 7 or more for well drained conditions, but will reduce to about 2 where seepage can develop. Visual assessment after the subgrade is formed, should be undertaken, noting drainage and consequent potential for seasonal moisture variations, for adoption of final design CBR.

5.6. Settlement and Foundations

Upon removal of topsoil, all foundations on natural in situ ground are expected to be on stiff to very stiff loess, which will provide good bearing for conventional spread footings (100 kPa allowable bearing on footings 300 mm wide and not less than 300 mm deep). Any foundation areas affected by seepage will require specific assessment.

The building platform for Lot 9 is likely to be in a region where under-runners have been observed to 1 m depth. Most of these should be removed by excavations, however if present beneath the excavation, they will need to be undercut and replaced as discussed above. It is recommended that a specific geotechnical evaluation of Lot 9 be undertaken, once scrub has been removed and the building footprint decided.

Minor under-runners should also be expected over the remainder of the site, and earthworks supervisors should be briefed to note and report any features uncovered.

Site-specific investigations should be carried out in accordance with NZS 3604 for individual lot developments when foundation layouts are available.

5.7. Seismic Design

The site is classified as Subsoil Category (b) ie, Intermediate seismic rating in terms No significant reduction in bearing capacity is expected for earthquake loading.

5.8. Slope Stability

The under-runners observed on the 25° east-facing slopes of Lot 9 are up to 1 m deep and 0.5 m wide. These are interpreted to be responsible for the weakening and high moisture content of the loess observed in Test Pit 1. Where present, under-runners tend to promote localised slope instability, with numerous minor scarps (< 1 m high) developed.

Small scarps (< 0.5 m high) are present elsewhere on the property, however no under-runners were observed in association with these and they are likely to be the result of minor solifluction.

The area of land directly below Test Street is situated adjacent to a 10 m high cliff that has been severely eroded by under-runners and piping. Large voids are apparent from below. No buildings are currently proposed in this area, however if they are planned in future they could be at risk from sinkhole development as a result of subsidence into voids below. This risk is likely to be most pronounced within 5 m of the cliff crest, however the persistence of these features will need to be properly assessed (possibly with drilling). Although the slopes are gentle to moderate in this area sinkholes could conceivably form at the margins of the cliff, and safety factors for slope stability are low. There is potential for substantial regression of the cliffline with a strong seismic event. Old concrete foundations are apparent in this area, and these show evidence of subsidence. A nominal building setback line is recommended so that any structure remains beyond a 1.75:1 line drawn from the cliff base but not closer than 10 m from the cliff top. The setback line is nominated as a precautionary guide only and could possibly be reduced if further site-specific geotechnical investigations are carried out.

5.9. Neighbouring Structures/Hazards

Distances to adjoining structures: There are no neighbouring structures within close proximity of any of the site boundaries. The only buildings adjacent to the site are located some 15-20 m beyond the western boundary. Test Street is located directly down slope of the northern boundary.

Aquifers: No aquifer resource will be adversely affected by the development.

Erosion and Sediment Control: Owing to the silt-rich composition of loess, sediment control measures should be implemented. Effective systems for erosion control are runoff diversion drains and contour drains, while for sediment control, options are earth bunds, silt fences, hay bales, vegetation buffer strips and sediment ponds. Only the least amount of subsoil should be exposed at any stage and vegetation re-established as soon as practicable, or mulch applied. Details for implementation are given in Appendix B within the following link

<http://www.aucklandcity.govt.nz/council/documents/district/Ann14.pdf>

with further detail related to construction sites in

http://www.itd.idaho.gov/manuals/Online_Manuals/BMP/

Dust: The site contains fine-grained sediments with the potential to generate dust. Regular dampening with sprinklers should be effective.

Natural Hazards:

The subdivision is located in an area with potential for under-runners and appropriate supervision of all earthworks and treatment is required.

The subdivision is located well upslope of a cliff face that is up to approximately 10 m high and shows evidence of slope failure and potential for sinkhole development as described above. This feature is located well away from the proposed subdivision and no adverse consequences are anticipated. However, if future development is planned for the land below Test Street, then the considerations outlined in Section 5.8 will apply.

6. Conclusions and Recommendations

- Subsurface materials at the Test Street Subdivision site consist of shallow topsoil overlying stiff to very stiff loess, with bedrock at considerable depth.
- The loess is dispersive. Siltation control is required with revegetation recommended at the earliest practical opportunity. Effective interception of surface water is required and groundwater seepage should be cut off with subsoil drains.
- Excavations in well-drained loess are expected to perform satisfactorily at batters of 0.5:1 to at least 2 m. Specific designs for higher cuts are recommended.
- Compacted fills should be formed at 2:1.
- Good bearing for conventional spread footings is available for most of the subdivision area.
- Where under-runners are developed, these will need to be undercut and replaced by certified fill, lime stabilised where seepage cannot be positively intercepted.

7. Applicability

This report has been prepared for the benefit of Waitaki District Council with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

During construction, excavations should be examined by an inspector or engineer competent to confirm that subsurface conditions encountered are compatible with the inferred conditions on which this report has been based and assess any support requirements. It is important that we be contacted if there is any variation in subsoil conditions from those described in this report.

TONKIN & TAYLOR LTD

Environmental and Engineering Consultants

Report prepared by:

Authorised for Tonkin & Taylor by:



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Mark Walrond

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Graham Salt

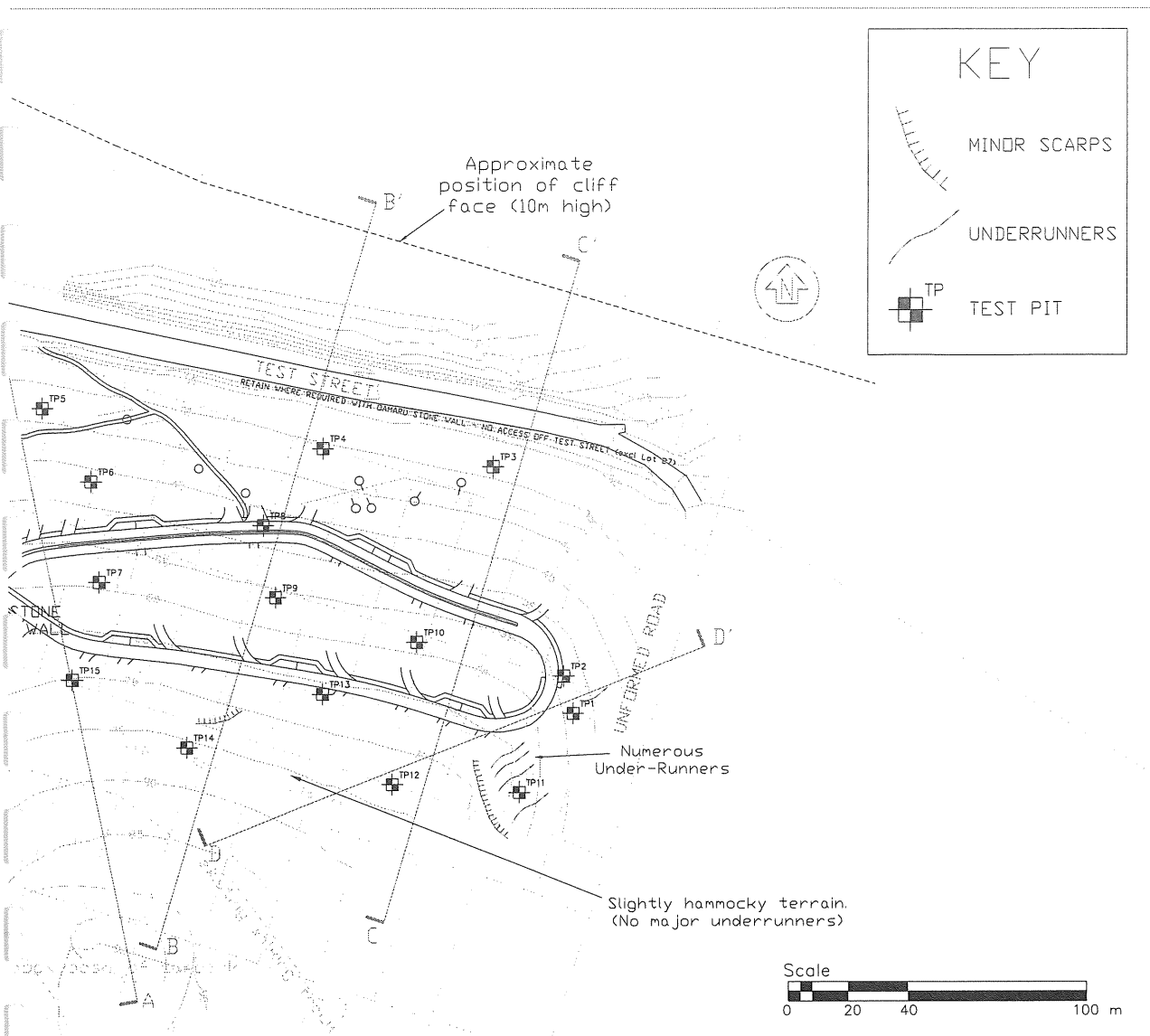
ENGINEERING GEOLOGIST

GEOTECHNICAL GROUP COORDINATOR

MTW

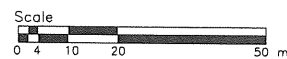
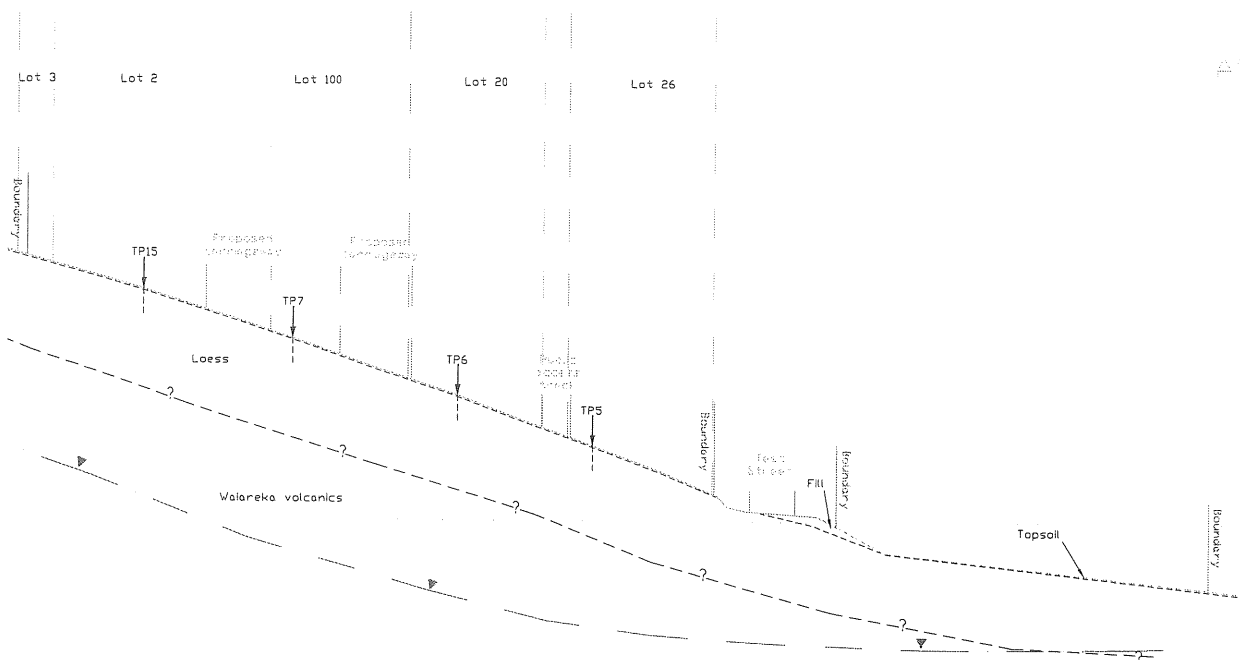
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Appendix A: Site Plan and Cross Sections



	DRAWN	KAB	22/03/05
	DRAFTING CHECKED		
	APPROVED		
	CADFILE :		
IKIN & TAYLOR LTD. GEOTECHNICAL & ENGINEERING CONSULTANTS ■ DUNEDIN ■ CHRISTCHURCH ■ WHANGAREI	SCALES (AT A4 SIZE)		
	PROJECT No	890917	FIG. No. Fig. 1a
			REV. 0

WAITAKI DISTRICT COUNCIL
 Geotechnical Investigations
 TEST STREET SUBDIVISION, OAMARU
 Site Plan



 TJT ANKIN & TAYLOR LTD. GEOTECHNICAL & ENGINEERING CONSULTANTS 40 TON <div> <div>DUNEDIN</div> <div>CHRISTCHURCH</div> <div>WHANGAREI</div> </div>	DRAWN	KAB	23/03/05	WAITAKI DISTRICT COUNCIL Geotechnical Investigations TEST STREET SUBDIVISION, OAMARU Section A - A'	
	DRAFTING CHECKED				
	APPROVED				
	CADFILE :				
	SCALES (AT A4 SIZE)				
PROJECT No.		890917	FIG. No	Fig. 2a	REV. 0

5

Lot 100

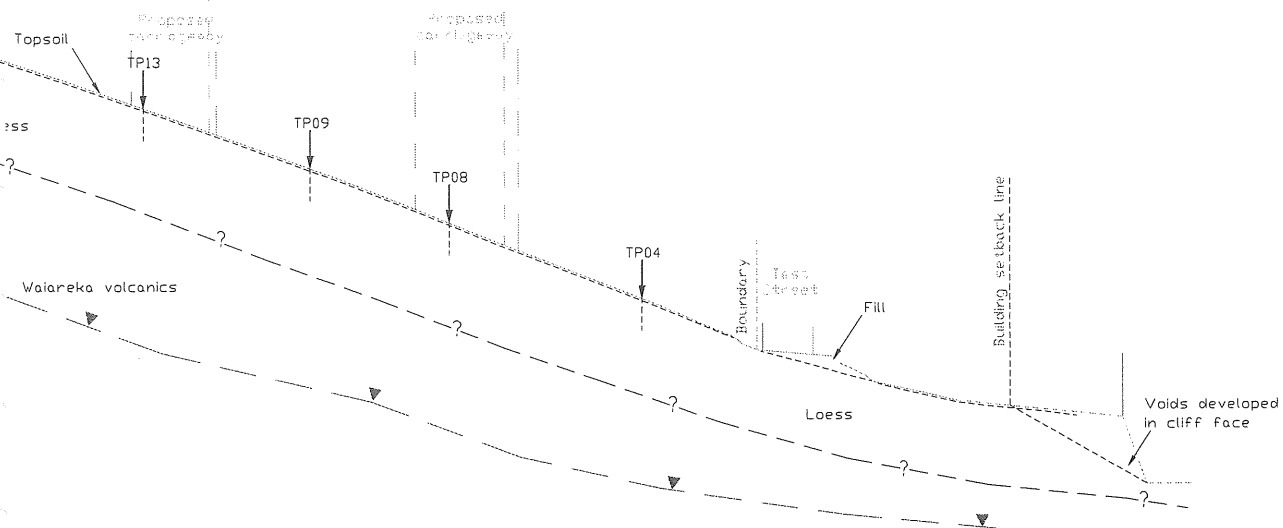
Lot 22

Lot 100

Lot 16

Lot 200

B'



Scale



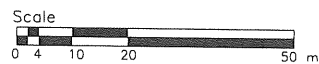
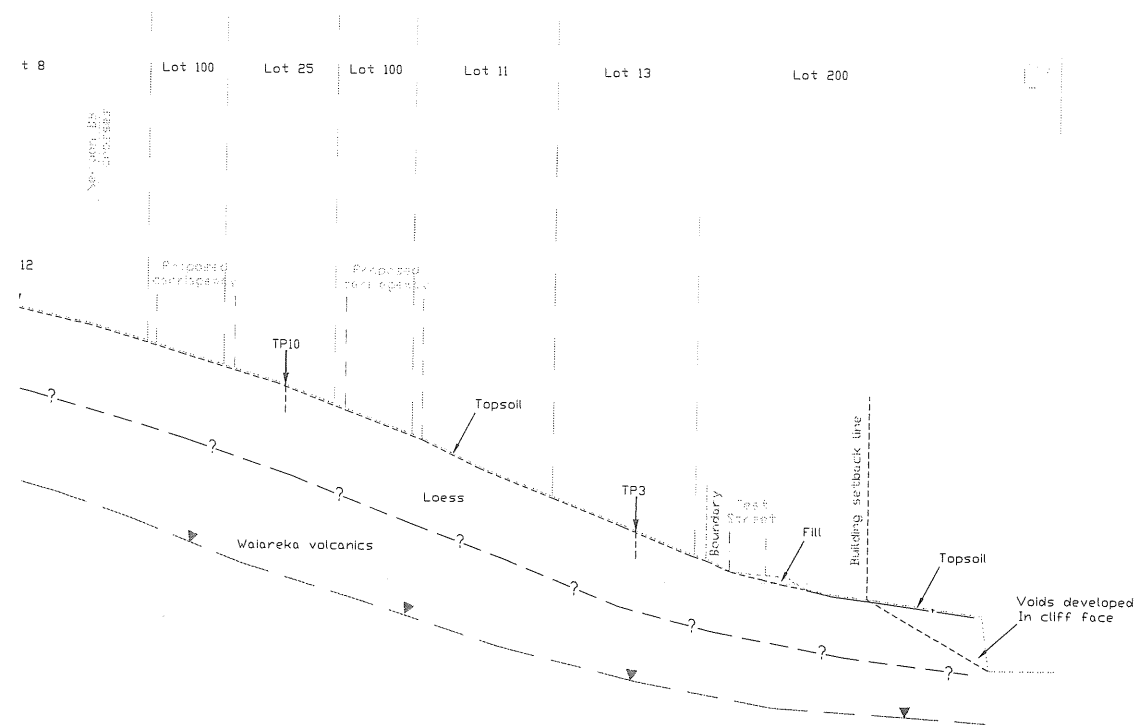
TAIT & TAYLOR LTD.
 GEOTECHNICAL & ENGINEERING CONSULTANTS
 ■ DUNEDIN
 □ CHRISTCHURCH
 □ WHANGAREI


DRAWN	KAB	23/03/05
DRAFTING CHECKED		
APPROVED		
CADFILE :		
SCALES (AT A4 SIZE)		
PROJECT No.	890917	

WAITAKI DISTRICT COUNCIL
 Geotechnical Investigations
 TEST STREET SUBDIVISION, OAMARU
 Section B - B'

FIG No. Fig. 2b

REV. 0



	DRAWN	KAB	23/03/05	WAITAKI DISTRICT COUNCIL Geotechnical Investigations TEST STREET SUBDIVISION, OAMARU Section C - C'	
	DRAFTING CHECKED				
	APPROVED				
	CADFILE :				
T. J. & T. LTD. GEOTECHNICAL & ENGINEERING CONSULTANTS 10 TON 1/1	SCALES (AT A4 SIZE)			PROJECT No. 890917 FIG No. Fig. 2c	REV. 0

Lot 7

Lot 8

Lot 9

Lot 100

Lot 9 Lot 10

TP12

Topsoil

TP11

Processed
carriageway

TP1

Loess

Boundary

Under
runnersPosition of
Gully

Waiaireka volcanics

Scale



T. J. & T. L. LTD.
 GEOTECHNICAL & ENGINEERING CONSULTANTS
 ■ DUNEDIN
 ■ CHRISTCHURCH
 ■ WHANGAREI

DRAWN KAB 23/03/05
 DRAFTING CHECKED
 APPROVED
 CADFILE :

SCALES (AT A4 SIZE)

PROJECT No. 890917

FIG. No. Fig. 2d

REV. 0

WAITAKI DISTRICT COUNCIL
 Geotechnical Investigations
 TEST STREET SUBDIVISION, OAMARU
 Section D - D'

Appendix B: Test Pit Logs

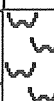
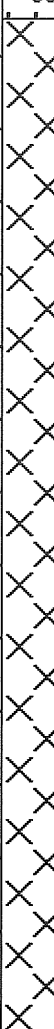
TONKIN & TAYLOR LTD

EXCAVATION LOG

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













TP 1

PROJECT: CFM Test		Job Number: 890917	
LOCATION: Lot 9-10		Inclination:	Direction:
CO-ORDINATES:	See site plan mE	EQUIPMENT: Hitachi 14 tonne	OPERATOR: Steve McLeod
Method:	See site plan mN	INFOMAP NO.	COMPANY: Whitestone Ltd
ELEVATION:	m	DIMENSIONS:	HOLE STARTED: 15-Feb-05
Method:	N/A	EXCAV. DATUM:	HOLE FINISHED: 15-Feb-05

PENETRATION					ENGINEERING DESCRIPTION				GEOLOGICAL	
PENETRATION (N)	GROUNDWATER / SEEPAGE	INSTALLED INSTRUMENTS	SAMPLES	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION	
NO SEEPAGE BUT SOILS WET TO MOIST				0.2		pt	organic SILT with plant fragments and roots	moist to wet	TOPSOIL	
				0.4		ML	light brown to yellow-brown, mottled clayey SILT, dilatant, very soft to soft (sticking to bucket), test pit walls gradually fall in, decreased water at 3 m (moist), rare hardened nodules (20 mm max) at 2.5 m - 3.1 m, Scale: 57mm/blow		LOESS	
				0.6						
				0.8						
				1.0						
				1.2						
				1.4						
				1.6						
				1.8						
				2.0						
				2.2						
				2.4						
				2.6						
				2.8						
				3.0						
				3.2			Total Depth = 3.1 m			

PURPOSE:	Logged By: MTW
PHOTO REF.:	Checked Date:
	Sheet: 1 of 1

PROJECT: CFM Test				Job Number: 890917			
LOCATION: Lot 9-10				Inclination:		Direction:	
CO-ORDINATES:		See site plan mE		EQUIPMENT: Hitachi 14 tonne		OPERATOR: Steve McLeod	
Method:		See site plan mN		INFOMAP NO.		COMPANY: Whitestone Ltd	
ELEVATION:		m		DIMENSIONS:		HOLE STARTED: 15-Feb-05	
Method:		N/A		EXCAV. DATUM:		HOLE FINISHED: 15-Feb-05	

PENETRATION				ENGINEERING DESCRIPTION			GEOLOGICAL		
PENETRATION (N)	GROUNDWATER / SEEPAGE	INSTALLED INSTRUMENTS	SAMPLES	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
NO SEEPAGE				0.2		pt	organic SILT with plant fragments and roots	moist	TOPSOIL
				0.4		ML	light brown to brown, mottled SILT with occasional roots, upper 200 mm soft, firm beyond 0.5 m, excavation difficult beneath 1.5 m, sides stand well, some hardened nodules (< 20 mm) at 2.5 to 3 m, Scala: 22 mm/blow		LOESS
				0.6					
				0.8					
				1.0					
				1.2					
				1.4					
				1.6					
				1.8					
				2.0					
				2.2					
				2.4					
				2.6					
				2.8					
				3.0					
				3.2			Total Depth = 3 m		

PURPOSE:	Logged By: MTW
PHOTO REF.:	Checked Date:
	Sheet: 1 of 1

EXCAVATION LOGS (hand-dug test pits)

See Fig 1 for locations.

Date: 15 Feb 2005
Job No. 890917

TP 3

0 – 0.2 m TOPSOIL (organic silt with plant fragments).
0.2 m + LOESS (**Scala = <13 mm/blow**) – light brown to yellow brown
very stiff SILT with occasional roots.

TP 4

0 – 0.3 m TOPSOIL (organic silt with plant fragments)
0.3 m + LOESS (**Scala = 19 mm/blow**) – light brown to yellow brown stiff
SILT with occasional roots.

TP 5

0 – 0.25 m TOPSOIL (organic silt with plant fragments)
0.25 m + LOESS (**Scala = <11 mm/blow**) – light brown to yellow brown
very stiff SILT with occasional roots.

TP 6

0 – 0.2 m TOPSOIL (organic silt with plant fragments)
0.2 m + LOESS (**Scala = <12 mm/blow**) – light brown to yellow brown
very stiff SILT with occasional roots.

TP 7

0 – 0.1 m TOPSOIL (organic silt with plant fragments)
0.1 m + LOESS (**Scala = <8 mm/blow**) – light brown to yellow brown
very stiff SILT with occasional roots.

TP 8

0 – 0.3 m TOPSOIL (organic silt with plant fragments)
0.3 m + LOESS (**Scala = <13 mm/blow**) – light brown to yellow brown
very stiff SILT with occasional roots.

TP 9

0 – 0.2 m TOPSOIL (organic silt with plant fragments)
0.2 m + LOESS (**Scala = <13 mm/blow**) – light brown to yellow brown
very stiff SILT with occasional roots.

TP 10

0 – 0.2 m TOPSOIL (organic silt with plant fragments)
0.2 m + LOESS (**Scala = <12 mm/blow**) – light brown to yellow brown
very stiff SILT with occasional roots.

TP 11	
0 – 0.3 m	TOPSOIL (organic silt with plant fragments)
0.3 m +	LOESS (Scala = <16 mm/blow) – light brown to yellow brown stiff SILT with occasional roots. Loess in this vicinity contains under-runners observed to 1m deep and 0.5m wide.
TP 12	
0 – 0.25 m	TOPSOIL (organic silt with plant fragments)
0.25 m +	LOESS (Scala = <16 mm/blow) – light brown to yellow brown stiff SILT with occasional roots.
TP 13	
0 – 0.2 m	TOPSOIL (organic silt with plant fragments)
0.2 m +	LOESS (Scala = <13 mm/blow) – light brown to yellow brown very stiff SILT with occasional roots.
TP 14	
0 – 0.25 m	TOPSOIL (organic silt with plant fragments)
0.25 m +	LOESS (Scala = <13 mm/blow) – light brown to yellow brown very stiff SILT with occasional roots.
TP 15	
0 – 0.25 m	TOPSOIL (organic silt with plant fragments)
0.25 m +	LOESS (Scala = <12 mm/blow) – light brown to yellow brown very stiff SILT with occasional roots.



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