MWH

Toby.

801/006503

15 May 2003

Jeff and Jo Cowin
Reef Point, Admiralty Bay
RD 3
Rai Valley
Marlborough

Dear Sir and Madam

Opinion as to Land Stability – Proposed Building Site, Lot 6 DP 19539 Pt Sec 5 Pt Sec Blk VI Pt Sec 4 Blk X French Pass Survey District, Reef Point, Admiralty Bay, Marlborough.

Description of Work

Construction of a residence on the proposed building site as shown on the appended Site Plan by Cameron Gibson & Wells Ltd, Consulting Civil & Structural Engineers (CGWL), dated 6/12/2001. The site is on a northerly-trending, gentle section of a ridge above the Te Towaka – Port Ligar Road. An existing access road is formed to the site from the Te Towaka – Port Ligar Road. A large bench has been cut into the ridge crest to create a building site platform with adequate setbacks from surrounding slopes. The bench is formed in weathered sedimentary rock (sandstone and siltstone) and silty clay with angular rock fragments.

Proposed wastewater disposal is to dispose of sewage to a composting toilet and greywater to a series of six mulch basins site on a natural bench 70m to the north of the house site. Proposed site stormwater disposal is away from the house site via a roadside water table and culvert to a natural gully to the south of the house site. Stormwater disposal from the access road is via roadside water table and three culverts to natural gullies. The attached plan "Cowin House-Proposed Wastewater and Stormwater Disposal" illustrates these proposals. Design of the wastewater disposal has been carried out by CGWL.

Resource Consent is required as the site is within the Slope Instabilty Hazard Overlay identified in the Proposed Marlborough Sounds Resource Management Plan.

MWH New Zealand Limited
1st Floor
281 Queen Street
PO Box 3455
Richmond
Nelson
New Zealand

Telephone : 64-3-546 8728
Facsimile : 64-3-548 2016
Website : www.mwhglobal.com/nz

MWH NZ Ltd hereby confirm that:

We are experienced in the field of soils engineering and more particularly land and foundation stability and are formally recognised by the Marlborough District Council (MDC). We are familiar with and understand the purpose of the MDC geotechnical reporting standards. This professional opinion is furnished to MDC to address the requirements of the resource consent for the site.

We investigated this site for a previous owner (Mr Tim Edwards) and completed a Geotechnical Evaluation Report, dated 1 August 1995 (by Soils & Foundations Ltd). We have subsequently carried out a site specific Geotechnical Assessment Report for the proposed house site, access road and stormwater/wastewater disposal areas for the present owners, Jeff and Jo Cowin, dated March 2003. A copy of this report has already been forwarded to MDC.

Additionally we have reviewed Scala Penetrometer test results by CGWL, in the proposed foundation area of the house site. We conclude that these show "good ground" for foundations as defined by NZS 3604:1999 Timber Framed Buildings exists at depths of between 0.3 and 0.9m below cut bench surface. Foundations for the proposed house were designed by CGWL for 300 kPa ultimate ground bearing capacity conditions.

In our professional opinion, giving due regard to acceptable engineering principles and practices for land slope and foundation stability, and providing that the recommended controls as follows from our Geotechnical Assessment Report, dated March 2003 are complied with, we find the proposed building site to be suitable for the construction of a residence. The proposed setback distances from the edge of slope at the outer edge of the building platform for the building is 10m horizontally.

Provided the recommended controls are implemented and maintained, the risk of slope instability and impact from slip debris or subsidence is considered to be low for the building site, wastewater disposal area, stormwater disposal system and access road.

The design loading for the wastewater disposal is up to 5mm/day which is considered to be acceptable from a stability viewpoint for the gravelly silty clay soils.

The risk to the site due to seismic events is not considered to be greater than the rest of the outer Marlborough Sounds where strong ground shaking is expected on average every 25 years.

Nature of controls to be complied with:

All recommended control and stabilisation measures noted below shall be designed and construction supervised by a qualified civil or geotechnical engineer. Control measures shall be implemented prior to construction and occupation of the residence, and maintained continuously.

- All run off stormwater above the house site shall be directed into the existing road water table and directed away from the site.

- All roof stormwater shall be directed via suitable pipes to the water table on the road side below the house or into the culvert to the south of the site.

- It is recommended that the proposed house foundations do not encroach within 10m of the top of slopes below the site. This distance may be reduced by construction of suitably designed and engineered retaining walls.

- All excavations over 1.5m in height must be retained by suitable structures appropriately designed and with adequate drainage. Unretained excavations in weathered rock should not be steeper than ¾:1 (H:V).

- In the event that excavations at the site reveal any materials not documented in this report (particularly soft or saturated materials or slide planes) then a suitably qualified geologist or geotechnical engineer should inspect the materials before building commences.

- At the wastewater disposal area a cut-off drain shall be excavated to intercept any run-off from upslope and divert it away from the site to a well-vegetated slope.

- A setback distance of 4m horizontally shall be maintained between the soakage basins/trenches and the outside break in slope i.e. the outer edge of bench.

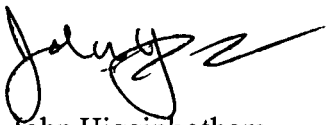
- Access road fill batters shall be vegetated in grasses and native shrubs where practical to enhance slope stability.

- Access road cut batters shall be re-vegetated in grasses where practical to reduce the risk of slips and fritter.

- All side drains, subsoil drains, cut-off drains and culverts shall be maintained and kept clear of debris to ensure that they function as required to effectively remove stormwater.

- Fill shall not be placed at batter slopes greater than 2:1 (H:V). Fill areas shall be adequately re-vegetated to prevent erosion.

Yours faithfully
MWH New Zealand LTD



John Higginbotham
Registered Engineer

P:801/006503 admin Opinion as to Land Stability.doc

Copy to: Marlborough District Council

CAMERON GIBSON & WELLS LTD

CONSULTING CIVIL & STRUCTURAL ENGINEERS

From: Barry Thomas To: MDC

Date: 3-30pm 1-5-03 Attention: Jenny Folster

Our Ref: 12014 Fax No. 03-578 6866

Subject: Cowin Dwelling No. of Pages (including this page): 1

44 HALIFAX STREET, NELSON, PHONE 03-548 8259 FAX 03-546 8412 email cgwl@xtra.co.nz

Jenny

Resource Consent Application – Cowin Family Trust, Admiralty Bay
Ref U030383

Further to your fax dated 1 May 2003 we can advise the following:

- Item 1 of your fax:
  Mr. Peter Born from our office will be in contact with you with respect to this matter.

- Items 2 and 3 of your fax:
  These matters will be addressed by MWH. We have forward a copy of your fax directly to MWH.

- Item 4 of your fax:
  Yes we agree that the 3 bed dwelling has been omitted from the Resource Consent Application form dated 7/1/03 under the "Description" heading.

  It is worthwhile noting that the reason the Marlborough District Council required the MWH soil report was because our client proposed to build a 3 bed dwelling within the Councils Hazard Zone.

  Therefore we can advise that we are indeed making a Resource Consent Application for a 3 bed dwelling and its associated waste waster disposal system. Both of which are contained within the Councils Hazard Zone.

We trust that the above will clarify the situation sufficiently for the Resource Consent to continue.

Kind regards

Barry Thomas
CAMERON GIBSON AND WELLS LTD

Marlborough District Council
Seymour Square
PO Box 443
Blenheim
New Zealand

Telephone 00 64 3 578 5249
Facsimile 00 64 3 578 6866
Email mdc@marlborough.govt.nz
Website http://marlborough.govt.nz

MARLBOROUGH DISTRICT COUNCIL

Fax To:	**Barry Thomas**	**From:**	**Jenny Folster**
Company:	**Cameron Gibson & Wells Ltd**		**Marlborough District Council**
Fax No:	**03 546 8412**	**Fax:**	**(03) 578-6866**
Date:	**1 May 2003**		
No of Pages:	**1**	**File Ref:**	**U030383**
Subject:	**Resource Consent Application - Cowin Family Trust, Admiralty Bay**		

Barry,

Further to our conversation yesterday and my conversation with Jo Cowin this morning regarding the above application for resource consent.

Angus Laird – Discharge Planner of this office has had a preliminary look at this application and advises that:

1. The greywater system as proposed would not meet the conditions of AS/NZS 1547:2000. This aspect can be discussed with Angus.

2. The Geotech Report presented with this application has not been signed by the writer. A signed copy of the Geotech Report is required. A Supporting Professional Opinion signed is also required.

3. It appears that Montgomery Watson Harza are not on Councils list of accredited Geotech Engineers. You may wish to contact Neil Morris of this office.

4. The additional aspect to the resource consent application being Land Use-Building (building a dwellinghouse within a hazard area) can be added to this resource consent upon written advice from yourselves as the agents. Given this addition constitutes an amendment this effectively restarts the processing time clock.

These are the outstanding items. This application will be placed in pending until these matters have been resolved.

Regards,

JENNY FOLSTER
RESOURCE MANAGEMENT OFFICER-PIMS

LOVE MARLBOROUGH

CAMERON GIBSON & WELLS LTD

CONSULTING CIVIL & STRUCTURAL ENGINEERS

From: Barry Thomas
To: MDC
Date: 11-4-03
Attention: Toby May
Our Ref: 12014
Fax No. 03-578-6866
Subject: Cowin Dwelling
No. of Pages (including this page): 5

44 HALIFAX STREET, NELSON, PHONE 03-548 8259 FAX 03-546 8412 email cgwl@xtra.co.nz

Toby

I have found the Resource Consent Application on file, completed (and with cover letter) waiting for the MWH soil report. This report is now to hand and I understand that you have received your copy from MWH.

We attach

E: 2586359
N: 6028145

(1) Application form.
(2) Cover letter
(3) Site Plan.

This information shall be read in conjunction with the MWH report March 2003

Kind regards

Barry

CAMERON GIBSON & WELLS LTD

CONSULTING CIVIL & STRUCTURAL ENGINEERS

12014-4

8 January 2003

Marlborough District Council
PO Box 443
BLENHEIM

Attn: Resource Consents Officer

Dear Sir/Madam

J & J Cowin Resource Consent Application, Admiralty Bay

We have applied to the Marlborough District Council to gain Building Consent for the treatment of wastewater flows derived from the above proposed residence.

Resource Consent is also required as the site is located within the Hazard Area identified in the Proposed Marlborough Sounds Resource Management Plan, and any discharge of domestic effluent to land is a Discretionary Activity under section 1.7.2.1 of the Plan for the Rural Zone.

The specific details and site plans have already been submitted to MDC building consents department, a copy of which is enclosed.

The site is located on a ridge and there is no surface water within at least 50 m of the proposed land application site.

There are no springs or any evidence of groundwater that can be seen from the access way and building platform cuttings already present on site, which indicates that the groundwater table is more than 3 m deep.

It is unlikely there will by any adverse effects on the environment from the land application of the composted product of the composting toilet. The volume of this compost will be small and mixed into the earth by the owners on a regular basis.

CAMERON GIBSON & WELLS LTD

There is not expected to be any adverse effect on the environment of the land application of the greywater. The design loading rate of the system is less than 5 mm/day which is expected to be accepted by the soils. Plants will also be provided to assist with evapotranspiration of the greywater.

Surface water cutoff drains will be installed above the proposed mulch basins to exclude any runoff from entering the mulch basins.

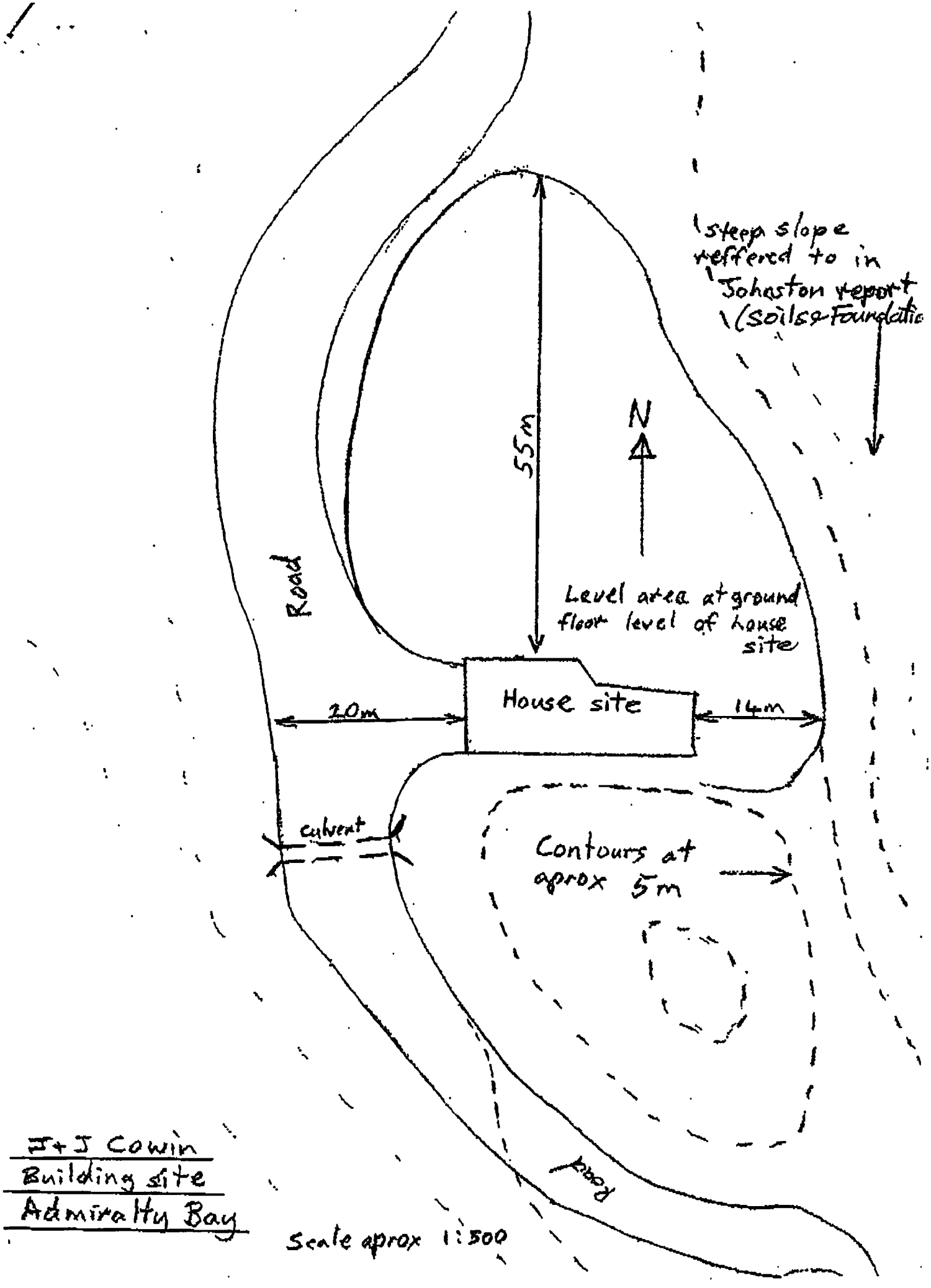
Although the greywater is discharged directly to land with no pre-treatment proposed, there is sufficient depth of soil under the land treatment area for the greywater to be filtered to a very high level. The system will require regular maintenance by the owners, such as the addition of new mulch to the system and the inspection and cleaning out of any areas where hair and other solids or greases may build up within the system.

If you have any questions, please do not hesitate to contact the writer.

Yours sincerely

Leanne Reeve
Environmental Engineer
CAMERON GIBSON & WELLS LTD

Approved by
Simon Cameron
CAMERON GIBSON & WELLS LTD



J+J Cowin
Building site
Admiralty Bay

Scale aprox 1:500

MWH
MONTGOMERY WATSON HARZA

Jeff and Jo Cowin

Geotechnical Assessment for House Site, Access Road, Effluent and Stormwater Disposal Areas at Reef Point, Admiralty Bay

March 2003

This report has been prepared solely for the benefit of Jeff and Jo Cowin and Marlborough District Council. No liability is accepted by this company or any employee or sub-consultant of this company with respect to its use by any other person.

This disclaimer shall apply notwithstanding that the report may be made available to other persons for an application for permission or approval or to fulfil a legal requirement.

If conditions are exposed during construction that are not as indicated in this report, please contact this office immediately. Unusual conditions may include signs of seepage, cracking or slumping.

This report must be reviewed for applicability in the event that any substantial modifications are made to the site or adjacent properties such that site conditions are changed substantially from current site conditions. Other time limitations may be imposed by regulatory authorities.

Quality Assurance Statement	
Jeff and Jo Cowin **Geotechnical Assessment for House Site, Access Road, Effluent and Stormwater Disposal Areas, Reef Point, Admiralty Bay**	**Prepared by:** Paul Wopereis **Reviewed by:** John Higginbotham
Project Manager: John Higginbotham	**Approved for issue by:**

MWH New Zealand Ltd
First Floor, 281 Queen Street
P O Box 3455
Richmond, Nelson
Tel: 64-3-546 8728
Fax: 64-3-548 2016

Jeff and Jo Cowin

Geotechnical Assessment for House Site, Access Road, Effluent and Stormwater Disposal Areas, Reef Point, Admiralty Bay

Contents

Attachments:

- Geotechnical Investigation Site Plan 801/006503
- Plan of Proposed Wastewater and Stormwater Disposal
- Test Pit Logs (1 sheets)
  Scala Penetrometer Test Results (1 sheet)
- Soil Exploration Terminology Sheet

SECTION A: SYNOPSIS

1. Scope of Investigations

This geotechnical assessment was primarily undertaken to assess and report on land stability for a proposed two storey house located on a prominent ridge above Reef Point overlooking Admiralty Bay in the outer Marlborough Sounds. The legal description of the property is Lot 6 DP 19539 Pt Sec 5 Pt Sec 12 Blk VI Pt Sec Blk X French Pass Survey District. Additionally we were required to assess the land stability of the new access road up to the house site and the proposed wastewater and stormwater disposal areas. A geotechnical assessment is a requirement for resource consent in order to address the "Slope Instability Hazard Overlay" over the area as shown on Marlborough District Council (MDC) planning maps. The work was carried out for the owners (Jeff and Jo Cowin) under the terms of a Short Form Agreement for Consultant Engagement (IPENZ approved) dated 17th February 2003.

Prior to visiting the site, we reviewed available geotechnical data and literature available, including a geotechnical report by Soils & Foundations Ltd (dated August 1995) for a previous owner. We also determined the requirements of MDC. At the time of our site investigations (13th March 2003) we undertook the following work:

- Walk-over inspection of the site including examination of the nature of exposed soils and rock, building foundation excavations, general surface features related to land stability, ground water, drainage, wastewater and stormwater disposal areas.
- Subsurface investigation consisting of two investigative test pits, one Scala penetrometer test and examination of exposures in road cut batters and excavations.
- Site survey by tape, compass and inclinometer.
  Photographic log of test pits and other significant site features.

The scope did not include review of the detailed road design or road construction records

The results of these investigations are contained within this report in standard MDC geotechnical report format. A geotechnical site plan is attached showing the building site, proposed house site (pegged), test investigation locations and domestic effluent soakage area.

2. Summary and Conclusions

2.1 The house site is positioned on a broad ridge underlain by competent rock and in our opinion has a very low risk of slope instability for the location of the intended dwelling. The slopes

above and below the house site also have a low risk of slope instability as determined from field observations.

2.2 The house foundation (footprint) area is entirely within competent rock and the nearest point of the proposed house has a setback of at least 10m from the top of nearby slopes, thereby meeting recommendation 6.1 of the August 1995 Geotechnical Evaluation report (Soils & Foundations Ltd) regarding setback distance. Scala penetrometer testing confirms that the weathered rock is a suitable foundation for the proposed house. The testing showed that bearing pressures of greater than 150kPa allowable (450kPa ultimate) are obtainable at depths of approximately 0.5m or less. This ground meets the "good ground" definition of NZ 3604:1999, *Standard for Timber Framed Buildings*

2.3 The stormwater disposal system at the house site directs run-off water away from the site and would also collect any seepage water from the back of the house, thereby adequately mitigating the risk of slope instability from this factor.

2.4 The formed access road has been designed by a registered engineer (refer to report to MDC by Mr Richard Walker, dated 5 January 2000). Construction of roadside cut batters, fill batters, culverts and the control of runoff appears to have been carried out in an appropriate manner. We believe that the slopes have a low risk of instability and that the new access road does not adversely affect slope stability at the house site. Minor soil and rock fritter is expected on cut batters and will be a normal part of road maintenance. There is no evidence of slips, slumps or deep-seated slope instability along the access road, although localised soil creep is to be expected in the gravelly clay soils during periods of wet ground conditions.

2.5 The wastewater disposal area (located on a natural bench northwest of the proposed house site) and the proposed disposal methods would not in our opinion increase the risk of slope instability because the slope gradient is gentle (6°) and the proposed wastewater application rates are low (less than 5mm/day). This area does not in our opinion impact land stability at the house site.

3. Recommendations

3.1 All run off stormwater above the house site shall be directed into the existing road water table and directed away from the site.

3.2 All roof stormwater shall be directed via suitable pipes to the water table on the road side below the house or into the culvert to the south of the site.

3.3 It is recommended that the proposed house foundations do not encroach within 10m of the top of slopes below the site. This distance may be reduced by construction of suitably designed and engineered retaining walls.

3.4 All excavations over 1.5m in height must be retained by suitable structures appropriately designed and with adequate drainage. Unretained excavations in weathered rock should not be steeper than ¾:1 (H:V).

3.5 In the event that excavations at the site reveal any materials not documented in this report (particularly soft or saturated materials or slide planes) then a suitably qualified geologist or geotechnical engineer should inspect the materials before building commences.

3.6 At the wastewater disposal area a cut-off drain shall be excavated to intercept any run-off from upslope and divert it away from the site to a well-vegetated slope.

3.7 A setback distance of 4m horizontally shall be maintained between the soakage basins/trenches and the outside break in slope i.e. the outer edge of bench.

3.8 Access road fill batters shall be vegetated in grasses and native shrubs where practical to enhance slope stability.

3.9 Access road cut batters shall be re-vegetated in grasses where practical to reduce the risk of slips and fritter.

3.10 All side drains, subsoil drains, cut-off drains and culverts shall be maintained and kept clear of debris to ensure that they function as required to effectively remove stormwater.

3.11 Fill shall not be placed at batter slopes greater than 2:1 (H:V). Fill areas shall be adequately re-vegetated to prevent erosion.

SECTION B: REPORT

4. Introduction

Our geotechnical assessment was primarily undertaken to assess and report on slope stability for a proposed two-storey house located at Reef Point, Admiralty Bay, Marlborough Sounds. Additionally we were required to assess the land stability of the new access road up to the house site and the proposed wastewater and stormwater disposal areas. The work was carried out for the owners (Jeff and Jo Cowin) under the terms of a Short Form Agreement for Consultant Engagement (IPENZ approved) dated 17th February 2003.

The legal description of the property is Lot 6 DP 19539 Pt Sec 5 Pt Sec 12 Blk VI Pt Sec Blk X French Pass Survey District.

Soils & Foundations Ltd carried out a previous geotechnical investigation of the general site in August 1995 (see Appendix). This work found no evidence of slope instability along the ridge crest, which is the location for the proposed house. The investigations for the 1995 report were general in nature and did not investigate a specific house site, access road of wastewater disposal areas. Our 2003 Geotechnical Assessment has investigated these specific areas and was targeted to address MDC requirements for resource consent for the proposed development.

We have made recommendations, which if followed, we consider will assist in maintaining the existing slope stability.

5. Site Description

The site is located on a broad northwesterly-trending ridge at Reef Point, Admiralty Bay, Marlborough Sounds. The elevation of the house site is approximately 120 m above sea level. Vegetation cover is a mixture of manuka / kanuka / tawhine native vegetation with some eucalyptus plantings. Slopes on the flanks of the ridge are between 24° and 33° (as measured below horizontal) to the west and between 32° and 38° to the west. The ridgeline up-slope of the house site has a gradient of 16° and the ridge line down-slope of the house site has a gradient of 8°.

The Marlborough District Council (MDC) has released a proposed Marlborough Sounds Resource Management Plan (1995). Accompanying the plan is a natural hazards map (Volume 3, Map 1) which shows the site and the general Admiralty Bay area as being in a zone classified "US"- area of known instability. The zonings on this MDC document are of a general nature only and more site specific geotechnical investigation was required for building consent and for resource consent for the domestic effluent disposal area.

6. Geotechnical Investigations

Our geotechnical investigation was primarily undertaken to provide suitable geotechnical slope stability assessment for a building consent for the proposed Cowin house and for building and resource consent for the proposed domestic effluent disposal area. Prior to visiting the site we carried out a desk-top study which reviewed the following:

- Available geological maps and geotechnical reports on the area.
- Site plans and photographs provided by the client.
- Aerial photographs, topographic and geological maps of the area.
- Engineers Report by Mr Richard Walker on access road, building platform and flood protection works
- Foundation plans provided by Cameron, Gibson & Wells Ltd, consulting civil and structural engineers.
- Architects plans by Peter Olorenshaw, architect.

- MDC Conditions of Marlborough Sounds Resource Management Plan Section 1.9 Discharges (domestic effluent disposal, onsite sewage disposal and stormwater drainage).
- Australia/NZ Standard AS/NZS 1547:2000 On Site Domestic Wastewater Management.

At the time of our site visit on 13th March 2003 we undertook the following work:

- Walk over inspection of the site including examination of the nature of exposed soils and rock, building foundation excavations, general surface features related to land stability, ground water, drainage, wastewater and stormwater disposal areas.
- Subsurface investigation consisting of two investigative test pits, one Scala penetrometer test, one percolation test and examination of exposures in road cut batters and excavations.
- Site survey by tape, compass and inclinometer.
- Photographic log of test pits and other significant site features.

The results of the sub-surface investigations are:

- The test pits were excavated with a 2-tonne digger using a 350mm wide bucket. Test pit TP-1 was excavated to a depth of 1.7m in the centre of the wastewater disposal area and encountered stiff, slightly gravelly CLAY (CL) beneath 0.25m of slightly gravelly silty topsoil. Test pit TP-2 was excavated to a depth of 1.3m at the house site (northeast corner) and encountered moderately weathered SILTSTONE bedrock for the full depth. The soil and weathered rock material were generally tight digging and the test pits stood vertical without collapsing.
- Four Scala penetrometer tests were previously carried out at the house site by CGWL during foundation investigations to a maximum depth of 0.9m and revealed stiff to very stiff ground conditions in weathered rock. Foundations have been designed by CGWL for 300 kPA ultimate ground bearing conditions. An additional Scala penetrometer test (SP-1) was carried out during our investigations to verify the ground conditions at the point nearest to steep slopes on the northeast side. This test revealed "good ground " as defined by NZS 3604 is present at surface and the ground to a depth of 1.9m increases in stiffness.
- A percolation test at the wastewater disposal area recorded rapid percolation into the relatively permeable gravelly topsoil and very slow percolation into the underlying stiff gravelly clay. Holes excavated for timber poles showed stiff gravelly clay is present throughout the wastewater disposal area to a depth of 1m to 2m. Moderately strong siltstone bedrock is exposed at shallow depth (0.5m) in an excavation at the down-slope end of the disposal area.
- Examination of excavations in the footprint area of the house site revealed the entire area of the footprint is in weathered siltstone rock, which has stood in near vertical cuts since being excavated in late 2002.
- The access road excavations revealed appropriately constructed cut batters generally between 1:1 and ¾:1 gradient (H:V) in gravelly clay and ½:1 and ¼:1 in siltstone rock. Fill batters are generally constructed at 2:1. The road is adequately drained with a 1m wide side drain and 300mm dia. culverts (spaced about 100m apart) to direct the water into gullies and minimise the impact on slope stability.

The test pit logs are attached in the appendix. These indicate the materials and conditions in the test pit sites on the date of investigation and may not represent conditions at other locations on site. Soil classifications shown are field classifications based on the Unified Soils Classification System.

7. Geotechnical Assessment

7.1 Geology

The Admiralty Bay area comprises indurated sedimentary rocks of sandstone and siltstone of the Pelorus Group which are extensively overlain by gravelly clay deposits (Beck 1964, Johnson 1996). The basement rocks are exposed on the shoreline and in road cuttings.

The gravelly clay deposits comprise residual soils and fan and slope wash deposits (colluvium) derived from the Pelorus Group rocks. In the test pits and in exposures they consist of angular to sub-angular rock fragments (up to 200mm diam.) in a tight, slightly silty clay matrix. The gravelly silty CLAY is described as firm to stiff, generally cohesive, non-plastic and is moderately weathered, yellow/brown to orange/brown in colour with some grey mottling indicative of fluctuating groundwater conditions within the deposits. At the time of our investigations the material was found to be dry to slightly damp.

7.2 Slope Stability Assessment

The slopes at the house site and the wastewater disposal area and the slopes immediately above and below these sites appear to have satisfactory slope stability. Our walk-over investigation and subsurface investigations showed no evidence of significant slope failure, apart from minor localised superficial soil creep, which is typical of slopes in the Marlborough Sounds. The underlying rock, although weathered in places, is generally competent on the ridge and its flanks. The Geotechnical Site Plan shows areas of landslides on over-steepened slopes above the shoreline east of Reef Point where toe support has been lost due to erosion, however these do not impact on the house site or wastewater disposal areas.

The route of the access road has avoided steep ground, is generally formed over relatively stable moderately-angled slopes and does not cut through any known slip areas.

The stormwater from the house site is directed away from the site to the south via a drain and culvert to a vegetated, relatively stable slope where there is no impact on the house site or access road.

7.3 Seismic Hazard

Although no active faults are known in the Admiralty Bay area, the Marlborough Sounds are within the seismically active zone near to the active Alpine (Wairau) Fault. This fault, located 45km to the southeast of the site is considered to be capable of producing an earthquake in excess of 8.0 Richter magnitude. The site, along with the general Marlborough Sounds area, can expect moderate to strong ground shaking (MM VII as measured on the Modified Mercalli Scale) resulting from earthquakes centred some distance away on an average every 25-30 years.

Anticipated levels of ground shaking are not expected to induce significant settling at the site because of the presence of competent rock and the absence of water saturated materials. The nature of the site materials is not expected to result in amplification of ground shaking from a seismic event.

7.4 Flooding Hazard

The house site is on a prominent ridge and there is no risk of flooding. The wastewater disposal area is on a slope and also has no risk of flooding because it is situated close to the ridge.

7.5 Drainage and Groundwater

Groundwater was not encountered in the test pits at the site, nor is it indicated from nearby road cuttings or water tables. The area has a rainfall of approximately 2,000mm annually. Although the subsurface materials at the site are gravelly clays, these appear to have low drainage capability and runoff is relatively rapid. The creeks and gullies to the north and south of the site are normally dry except in periods of rainfall. No seepages were noted on the site. Any seepage from the cut batter behind the house should be directed to drains set lower than floor level and exited well clear of the house.

7.6 General Foundation Conditions

Five Scala penetrometer tests have been made at the house site. The results showed that, at the locations tested, bearing pressures greater than 150 kPa allowable (450 kPa ultimate) were obtained at depths of 0.3m or less. In some of the tests the penetrometer was stopped by rock fragments or hard bedrock. In our opinion, sufficient Scala penetrometer tests have been carried out to indicate "good ground" as defined by New Zealand Standard 3604:1999 exists for the proposed house within the building site defined on the site plan.

7.7 Stormwater Disposal

An existing intercept drain and the diversion by a culvert under the road to the south adequately diverts run off water from the ridge above the site away from the building site. Stormwater from roofing should be directed by stormwater pipes into this drain or to the side drain beside the access road below the site.

7.8 Domestic Effluent Disposal

Proposed domestic effluent disposal is by a no-flush composting toilet at the house and a greywater disposal area on a grassed bench approximately 50m northwest of the house site. We have investigated the soils and slope stability in the proposed effluent soakage area (the area for discharged and soakage of the grey water). Within this area slope gradients were measured between 6° and 7° below the horizontal. The nearby slopes are in manuka vegetation cover. Brown TOPSOIL in the area is between 0.2 and 0.3m thick and becomes clayey towards the base in transitional contract with the gravelly silty CLAY. The subsoil materials of gravelly silty CLAY are

mottled indicating they are poorly drained as confirmed from the percolation test. It is considered that the soil properties are suitable for the proposed disposal by sprinkler irrigation or trickle soakage at surface or within the topsoil in shallow basin or trenches. We have not carried out design or specific investigations for the disposal field as this has been carried out by CGWL.

We have assessed the slope stability of the site. No weak layers, soft areas, slumps, slide planes or seepages were observed. We consider the area to has a very low risk of slope instability and that the proposed disposal of wastewater at application rates of up to 5mm/day would not have a detrimental impact on slope stability.

We recommend a cutoff drain should be excavated down to the top of the clay subsoil at the upslope end of the disposal area to divert any run-off water away from the site. Also we recommend a setback of 4m horizontal distance for the soakage basins or trenches away from the outer edge of the bench.

7.9 Access

The new access road diverts from the St Kilda Road up to the ridge at the proposed house site. It is 3m to 4m in width with a 1m wide shoulder and a 1m wide side drain. The average gradient of the access road is 7:1. Natural slopes in the vicinity of the access road were measured at between 15° and 35° below horizontal. The route of the access road has avoided steep ground, is generally formed over relatively stable slopes and does not cut through any known slip areas. We consider that the road has been constructed according to the design by Richard Walker, has been adequately drained and does not impact significantly on general slope stability. Some minor localised slips and soil or rock fritter are to be expected (as on any road in the Marlborough Sounds) and should be considered a normal part or road maintenance.

We recommend that grass and native shrubs be established on the fill batters and grass established in the cut batters where practical.

8. Development Impact

The proposed house should, in our opinion, result in no adverse impact on land stability provided the recommendations herein are followed. The results of our investigation indicate that the proposed wastewater disposal area would not compromise the stability of the site or nearby slopes. The establishment of the proposed wastewater disposal area in the area shown on the site plan would not appreciably impact on the stability of road batters provided the indicated set backs are observed. Stormwater disposal has been constructed in such a manner so as to minimise impact on slope stability and soil erosion.

9. Control or Implementation Measures

9.1 All run off stormwater above the house site shall be directed into the existing road water table and directed away from the site.

9.2 All roof stormwater shall be directed via suitable pipes to the water table on the road side below the house or into the culvert to the south of the site.

9.3 It is recommended that the proposed house foundations do not encroach within 10m of the top of slopes below the site. This distance may be reduced by construction of suitably designed and engineered retaining walls.

9.4 All excavations over 1.5m in height must be retained by suitable structures appropriately designed and with adequate drainage. Unretained excavations in weathered rock should not be steeper than ¾:1 (H:V).

9.5 In the event that excavations at the site reveal any materials not documented in this report (particularly soft or saturated materials or slide planes) then a suitably qualified geologist or geotechnical engineer should inspect the materials before building commences.

9.6 At the wastewater disposal area a cut-off drain shall be excavated to intercept any run-off from upslope and divert it away from the site to a well-vegetated slope.

9.7 A setback distance of 4m horizontally shall be maintained between the soakage basins/trenches and the outside break in slope i.e. the outer edge of bench.

9.8 Access road fill batters shall be vegetated in grasses and native shrubs where practical to enhance slope stability.

9.9 Access road cut batters shall be re-vegetated in grasses where practical to reduce the risk of slips and fritter.

9.10 All side drains, subsoil drains, cut-off drains and culverts shall be maintained and kept clear of debris to ensure that they function as required to effectively remove stormwater.

9.11 Fill shall not be placed at batter slopes greater than 2:1 (H:V). Fill areas shall be adequately re-vegetated to prevent erosion.

10. Management Plans

Provided the recommendations listed in Section 3 of this report are implemented, no additional management plans will be required by Council.

11. References

BECK, A C 1964: Sheet 14 – Marlborough Sounds, Geological Map of New Zealand, 1:250,000. NZ Department of Scientific and Industrial Research, Wellington

BEGG, J G and JOHNSTON, M R (2001): Geology of Wellington Region, Institute of Geological and Nuclear Sciences 1:250 000 Geological Map 10. Lower Hutt New Zealand.

SOILS & FOUNDATIONS LTD (1995): Geotechnical Evaluation, House Site, Admiralty Bay.

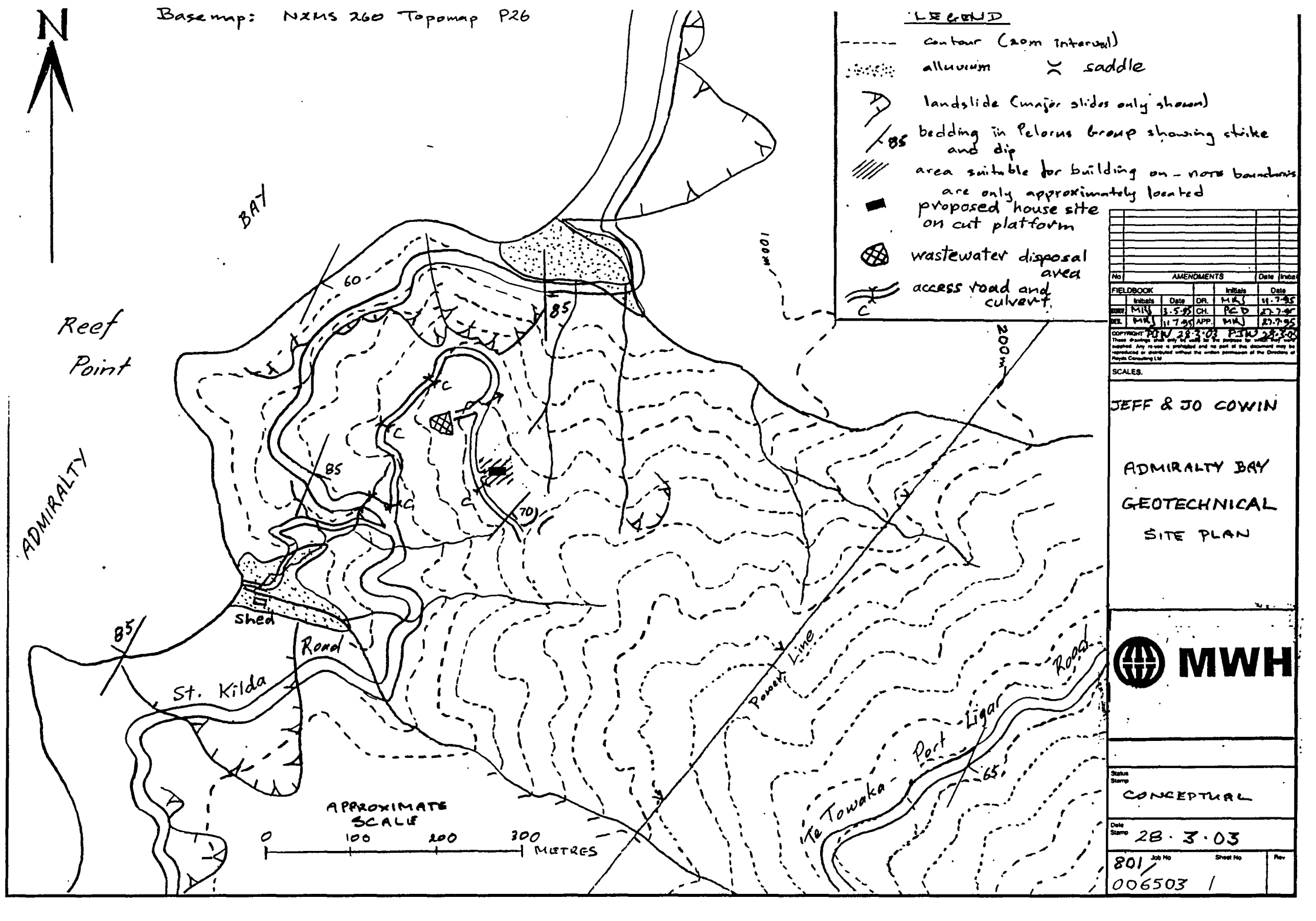
SECTION C: MAPS AND PLANS

12. Location Map

For the location of Admiralty Bay and Reef Point see Marlborough Sounds InfoMap 366-07, Scale 1:100,000.

13. Detailed Plans

For the location of the proposed house site and proposed wastewater disposal area see the attached Geotechnical Site Plan.


Basemap: NZMS 260 Topomap P26
N
LEGEND
contour (20m interval)
alluvium
saddle
landslide (major slides only shown)
85 bedding in Pelorus Group showing strike and dip
area suitable for building on - note boundaries are only approximately located
proposed house site on cut platform
wastewater disposal area
access road and culvert
BAY
Reef Point
ADMIRALTY
60
85
100
200
70
C
Shed
Road
St. Kilda
Power Line
Te Towaka
Port Ligar Road
65
APPROXIMATE SCALE
0 100 200 300 METRES
No AMENDMENTS Date Init
FIELDBOOK
Initials Date
DR. MRJ 14.7.95
CH. PCD 17.7.95
APP. MRJ 17.7.95
COPYRIGHT PJW 28.3.03 PJW 28.3.03
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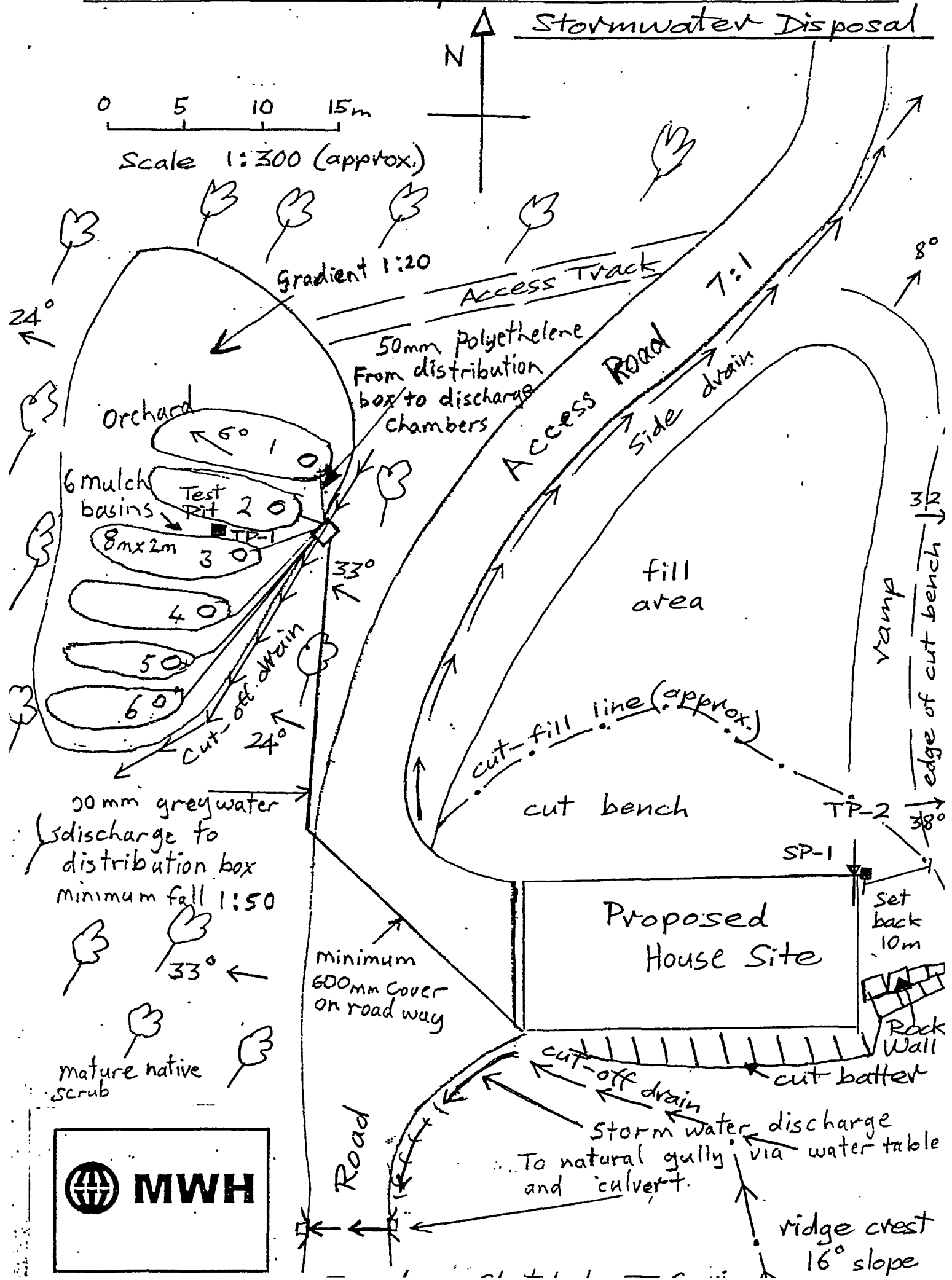
SCALES.
JEFF & JO COWIN
ADMIRALTY BAY
GEOTECHNICAL
SITE PLAN
MWH
Status Stamp
CONCEPTUAL
Date Stamp 28.3.03
801 Job No
006503 Sheet No 1
Rev

Cowin House – Proposed Wastewater and Stormwater Disposal



SHEET No. 1 of 1	DATE LOGGED 13/3/03	LOGGED BY : PJW	PIT WIDTH 350 mm
RIG 2 tonne digger		NOTES Reef Point, Admiralty Bay	

PIT No.	DEPTH (IN METERS)	SOIL TYPE CLASS	SOIL TYPE GRAPHIC	DESCRIPTION	SAMPLE No.	PENET'R TEST	Slope
TP-1	0.0-0.25	CL		Dark brown slightly gravelly silty CLAY (CL) - TOPSOIL : dry; friable; soft - firm.			6°
	0.25-1.7	CL		Yellow brown, mottled grey slightly gravelly CLAY (CL) - stiff; slightly damp; slightly plastic; homogenous; no cracks or soft layers			
TP-2	0.0-1.3			Red brown, highly weathered SILTSTONE (PELORUS GROUP) - weak inc. mod. strong with depth; closely spaced fractures (jointing); dry; weathering has partly decomposed rock to gravelly silty clay.		SP-1	0°

Note:

- TP-1 located on upper part of bench at waste-water disposal area.
- TP-2 located at NE corner of proposed house on cut bench.

MWH

TEST PIT LOGS

DATE 13/3/03

PROJECT 801/006503

S:\SOILS\LOGS\new logs\Test Pit LogMWH.dwg

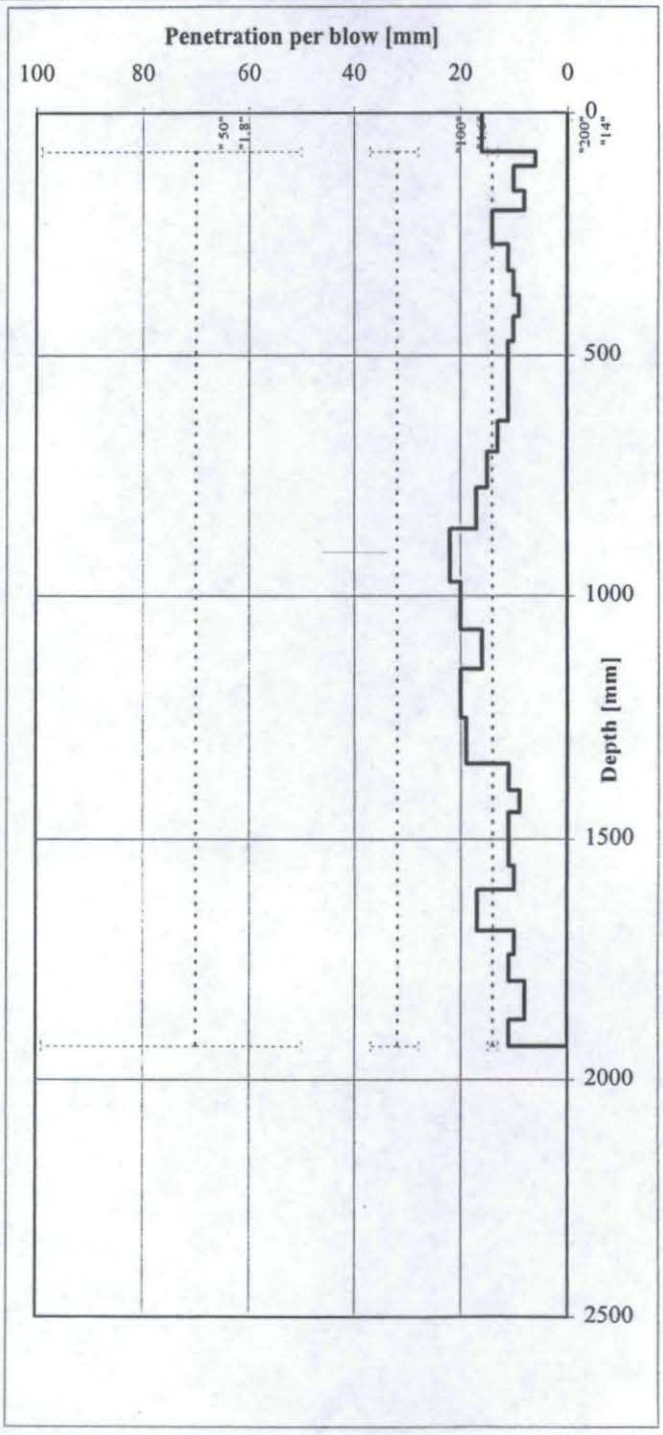
JOB	Admiralty Bay Geotechnical Investigtion			
LOCATION	1m NE of NE corner			
WEATHER	Fine and Dry			
BY:	PJW	DATE:	Thu 13 Mar 2003	FILE: 801/006503

MWH

SCALA PENETROMETER TESTS

TEST: **SP - 1** *Refer to SITE PLAN for location*

No. blows	Depth [mm]	SP - 1 Penetration per blow [mm]	Comments
5	80	16.0	Highly weathered siltstone, partly decomposed to silty clay
5	110	6.0	
5	160	10.0	
5	200	8.0	
5	270	14.0	
5	325	11.0	
5	375	10.0	
5	420	9.0	
5	470	10.0	
5	525	11.0	
5	580	11.0	
5	635	11.0	
5	700	13.0	
5	775	15.0	
5	860	17.0	
5	970	22.0	
5	1070	20.0	
5	1150	16.0	
5	1250	20.0	
5	1345	19.0	
5	1400	11.0	
5	1445	9.0	
5	1500	11.0	
5	1555	11.0	
5	1605	10.0	
5	1690	17.0	
5	1740	10.0	
5	1795	11.0	
5	1835	8.0	
5	1875	8.0	
5	1930	11.0	Rods Dry



FIELD IDENTIFICATION PROCEEDURES (Excluding particles larger than 3 inches and basing fractions on estimated weights)						GROUP SYMBOL	TYPICAL NAMES
COARSE GRAINED SOILS More than half of the material is larger than No 200 sieve size (The No. 200 sieve size is about the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size (For visual classification the size may be used as the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes			GW	Well graded gravels, gravel–sand mixtures, little or no fines
			Predominantly one size or a range of sizes with some intermdiate sizes missing			GP	Poorly graded gravels, gravel–sand mixtures, little or no fines
		GRAVELS WITH FINES (Appreciable amount of fines)	Non–plastic fines (for identification proceedures see ML below)			GM	Silty gravels, poorly graded gravel–sand–clay mixtures
			Plastic fines (for identification proceedures see CL below)			GC	Clayey gravels, poorly graded gravel–sand–clay mixtures
	SANDS More than half of coarse fraction is smaller than No 4 sieve size (For visual classification the size may be used as the No. 4 sieve size)	CLEAN SANDS (Little or no fines)	Wide range of grain sizes and substantial amounts of all intermediate particle sizes			SW	Well graded sands, gravelly sands,, little or no fines
			Predominantly one size or a range of sizes with some intermediate sizes missing			SP	Poorly graded sands, gravelly sands, little or no fines
		SANDS WITH FINES (Appreciable amount of fines)	Non–plastic fines (for identification proceedures see ML below)			SM	Silty sands, poorly graded sand–silt mixtures
			Plastic fines (for identification proceedures see CL below)			SC	Clayey sands, poorly graded sand–clay mixtures
FINE GRAINED SOILS More than half of material is smaller than No. 200 sieve size (The No. 200 sieve size is about the smallest particle visible to the naked eye)	IDENTIFICATION PROCEEDURES ON FRACTION SMALLER THAN No. 40 SIEVE SIZE		DRY STRENGTH (CRUSHING CHARACTERISTIC)	DILATENCY (REACTION TO SHAKING)	TOUGHNESS (CONSISTENCY NEAR PLASTIC LIMIT)		
	SILTS AND CLAYS Liquid limit less than 50		None to slight	Quick to slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity
			Medium to high	None to very slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, Lean clays
			Slight to medium	Slow	Slight	OL	Organic silts and organic silt–clays of low plasticity
	SILTS AND CLAYS Liquid limit greater than 50		Slight to medium	Slow to none	Slight to Medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			High to very high	None	High	CH	Inorganic clays of high plasticity, fat clays
			Medium to high	None to very slow	Slight to medium	OH	Organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS			Readily identified by colour odour, spongy feel and frequently by fibrous texture			Pt	Peat and other highly organic soils

MOISTURE CONDITION

Increasing moisture →

Dry Slightly Damp Damp Moist Wet Saturated

PLASTICITY

Plasticity of clays and silts is determined from the results of Atterburg limit tests. In the field the characteristics of fine grained soils are identified using dilatancy (reaction to Shaking) dry strength (crushing) and toughness (consistency near the plastic limit) behaviour – see USBR chart. The most characteristic test of plasticity in a soil is dilatency where on rapid shaking water appears and similar shaking gives no reaction for a plastic soil.

PARTICLE SIZE TERMINOLOGY AND GRAPHIC SYMBOLS

SOIL FRACTION		PARTICLE SIZE RANGE mm		
CLAY SIZE			<	0.002
SILT SIZE		0.002	–	0.06
SAND	Fine	0.06	–	0.2
	Med	0.2	–	0.6
	Course	0.6	–	2.0
GRAVEL	Fine	2.0	–	6.0
	Med	6.0	–	20.0
	Course	20.0	–	60.0
VERY COURSE GRAVEL		60.0	–	200.0
BOULDERS			>	200.0

GRAPHIC SYMBOLS: clay, silt, sand, gravel, boulders

STRENGTH

CLAYS and SILTS

TERM	DIAGNOSTIC FEATURES	"N–VALUE"	UNDRAINED COMPRESSIVE STRENGTH (kPa)
Very soft	Exudes between fingers when squeezed	0–2	<25
Soft	Easily indented by fingers	2–4	25 – 50
Firm	Indented only by strong finger pressure	4–8	50 – 100
Stiff	Indented by thumb pressure	8–15	100 –200
Very stiff	Indented by thumb–nail	15–30	200 –400
Hard	Difficult to indent by thumb–nail	over 30	400–1000

SANDS and GRAVELS

TERM	"N–VALUE"	SCALA PENETROMETER (No. Blows per 100mm)
Very loose	0–4	0–2
Loose	4–10	1–3
Medium dense	10–30	3–7
Dense	30–50	7–17
Very dense	over 50	> 17

NB: Although given in the same table no correlation is implied between the SPT and the Scala Penetrometer values.

The "N– value" represents the penetration resistance (PR) recorded during SPT Testing. It is the sum of the number of blows recorded between 150mm and 450mm recorded for a 450mm driving distance using a 50mm O.D split spoon sampler driven by a 63.5 kg hammer falling freely for 760mm.

Sources:

USBR 1974: Earth Manual, 2nd edition. U.S. Department of the interior, Bureau of Reclamation

New Zealand Geomechanics Society 1988: Guidelines for Field Description of Soils and Rocks in Engineering Use.

MWH

SOIL EXPLORATION LOG TERMINOLOGY