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Engineering Report

Proposed Extensions to Dwelling

Lot 10 DP 4360
923 Kenepuru Road, Willow Bay
Mahau Sound

For Kevin Morgan

Jan Dimmendaal
Chartered Engineer
ENSURV
3 March 2008

Job No 20071263

Table of Contents

1. Introduction

1.1 Kevin Morgan proposes to carry out extensions to his existing holiday home located at 923 Kenepuru Road, Willow Bay. Proposed minor excavation work relating to the manoeuvring and parking of his trailer boat and an upgrade to the on-site wastewater system servicing the property are covered by U071221 granted in December 2007.

1.2 The legal description of the land covered by this development is Lot 10, DP 4360. The land area is 3,000m². The property is zoned as 'Sounds Residential' and is shown to be encompassed by the 'unstable' hazard overlay according to the Marlborough District Council Sounds Resource Management Plan.

1.3 The purpose of this report is to present the results of site investigations carried out in relation to extensions to the dwelling. The site investigation was carried out on 29 February 2008.

1.4 A Geotechnical assessment of the excavations proposed for the manoeuvring and parking area was carried out by Engineering Geologist, Malcolm Maxwell in combination with engineering investigations carried out for this work. This assessment is considered to be relevant to the proposed dwelling extensions also and a copy of the report is presented in Appendix B.

2. Description

2.1 The subject property is accessed of Kenepuru Road via a shared right of way. The property is bounded on the southern quarter by Kenepuru Road and has an average slope of 10° towards the north.

2.2 The existing dwelling on the property was constructed in the 1970's and provides for a total of three bedrooms. A double garage is positioned immediately to the south of the dwelling.

2.3 The proposed extensions comprise a foundation footprint of 3.78m x 2.34m on the west side of the dwelling and a foundation footprint of 4.38m x 2.0m on the east side of the dwelling.

3. Geotechnical and Foundation Assessment

3.1 Site investigations carried out consist of four scala penetrometer tests carried out at the outside corners of the two extensions. The location of each test site is shown on the site plan with sites being numbered P1 – P4.

3.2 The Geotechnical Report (Appendix B) refers to the site as being located on stable ground. Geotechnical investigation has determined that the foundation rock is stable, and comprises weathered Schist with a high rock mass strength.

3.3 The affected soils report complex and variable subsoil profiles resulting from historic levelling works, together with the periodic deposition of minor alluvial sandy gravel. This assessment is supported by the scala penetrometer test results which indicate subsoils generally having a minimum soil bearing resistance of 100 kPa at depths of 0.6m – 0.8m below the current surface.

3.4 It is considered that the site is suitable for the proposed extensions and for construction using conventional shallow foundations designed and constructed in accordance with NZS 3604:1999 with a minimum founding depth of 0.6m below cleared ground level.

3.5 The proposed dwelling extensions may be completed without immediate or long-term adverse affect on land stability.

4. Recommendations

4.1 It is recommended that the site is suitable for the proposed extensions and for construction using conventional shallow foundations designed and constructed in accordance with NZS 3604:1999 with a minimum founding depth of 0.6m below cleared ground level.

5. Limitations

This report has been prepared for Kevin Morgan and is valid for two years from the date of issue. It covers the assessment of land stability and foundations relating to proposed extensions to the existing dwelling on his property. Any other areas are outside the scope of this report.

The reliance by other parties on the information or opinions in the report shall, without our prior review and agreement in writing, be at such parties' sole risk.

Report prepared by:

Jan Dimmendaal, Chartered Engineer
3 March 2008

Appendix A

Site Plan

north

Lot 11
DP 4360

6.62

Deck

P4

New

P3

House

P1

New

Existing Septic Tank

P2

Shed

Existing Bottom of Bank

4m

Existing Top of Bank

Boat Park
GL 10.16 approx

11.70

AG1

10.00

R11000

9.90

10.06

9.92

10.91

10.97

10.56

11.60

12.38

12.02

Access to potential building site (grade 1 in 6 max)

12.44

12.35

Land Application Area (Drip Irrigation)

Toe of new cut

Geotech X-sect line

12.93

10°

12.89

W2

Stream

Water Tank

14.45

Gentle slopes on residual soils. Stable

Regen. native bush

14.04

W3

W1

11.07

15.25

15°

14.16

10m

Bund

Cut-off Drain

2m

Kenepuru Road

16.28

16.61

Lot 10
DP 4360

Stream

NOTE:
Relative Heights with IS V at 10.00m in Driveway
All heights deduced by trigonometric levelling.

Kenepuru Road

18.78

Road Culvert

LEGEND
Auger test sites (AG1)
Wastewater test sites (W1)
Wastewater land application area (LAA)

2 PROPOSED SITE LAYOUT
Scale 1:250

REVISIONS -1/3/08 Penetrometer test sites bach

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ACENZ

PROPOSED DEVELOPMENT LOT 10 DP 4360, 923 KENEPURU ROAD WILLOW BAY, MAHAU SOUND	SITE PLAN ONSITE WASTEWATER SYSTEM AND EXCAVATION		DRAWING No. .001
PROJECT No. **20071263**	DRAWN JD / CHECKED JD / COMPUTER FILE: COMP_FILE	SCALE (A3) As Shown	DATE OCT 07 REVISION /

Appendix B

Geotechnical Report

Petrographic Services... Est. 1978
Economic Geology & Geotechnical
M.G.Maxwell M.Sc A.U. 1968
21 A Solway Drive Blenheim
Ph: 03-5788809

Ref: K. Morgan 2007-1263
Lot 10 DP 4360
923 Kenepuru Sound
23/10/07

This report is presented in a format required by the Marlborough District Council.

Site Investigation Report - Geo-technical

CONTENTS

A SYNOPSIS

1. Scope of Investigation

1.1. Mr Morgan proposes to upgrade the wastewater treatment system on his property and also proposes to undertake minor excavation work to improve vehicle access. The subject property falls within a Sounds MP Natural Hazard Zone (land instability). Consequently, the purpose of this site investigation is to provide an assessment of the development risk in the context of land stability, supporting a recommendation regarding the suitability of the site for the proposed works, and any remedial action required to insure the immediate and long-term stability of the affected land.

1.2. The site investigated is Lot 10 DP 4360, located on the north side of Kenepuru Road, at Willow Bay. The site assessment was carried out on the 16th Oct. 2007.

1.3. *Plans* and *Sections* presented with this report are for geotechnical purposes only, and are presented solely for the purpose of assessing the potential immediate and long-term development impact on land stability.

2. *Summary and Conclusions*

2.1 The specific areas shown on the attached ***Site Plan*** and ***Section***, labeled "Proposed excavation" and "Proposed LAA for wastewater", are deemed to constitute stable ground that is suitable for the proposed development works.

2.2 The foundation rock is stable, and comprises weathered Schist with a high rock mass strength (see photo ***Plate 1***). The overlying regolith is stable, and comprises residual soils with a thin veneer of recent alluvial sandy gravel (see ***Section – Geotech.***).

2.3 At the culvert location shown on the ***Site Plan,*** (adjacent to Everest's letterbox) there has been periodic blockage, and/or the stream flow has exceeded culvert capacity, on numerous occasions over the past 40 yrs or so. On such occasions, storm-water passes over Kenepuru Road and enters the subject Lot. Consequently, a surface cutoff drain (with a north-side bund) must be installed at the location shown on the ***Site Plan***. to effect re-entry of this episodic surface storm-water into the existing incised stream channel.

2.4 The risk of bedrock displacement during an earthquake is very low. Seismic shaking hazard is moderate.

2.5 A suitable LAA for wastewater soakage has been designated on gentle stable slopes. It is concluded that adequate treatment of wastewater can be achieved by dripper irrigation, without adverse affect on land stability.

2.6 An existing formed driveway and turning area is located on stable ground. The proposed excavation work required to effect the desired increase to the turn/park area will not result in any detrimental impact on land stability. (see ***Section – Geotech.*** and ***Plate 1***).

2.7 Given compliance with the specified ***Control Measures***, the proposed development work may be completed without immediate or long-term adverse affect on land stability, and the Development Risk is therefore assessed as LOW (geotechnical risk matrix).

3. *Recommendations*

In the context of the MDC required format, the only relevant recommendations are those provided under Section 4. **Control Measures.**

B. REPORT

1. *Site Description*

1.1 Geological Setting

Within a regional NE trending zone of the Marlborough Schist Series a[illegible] zone 2 Chlorite Schist.
There are no active faults.

1.2 Landform Elements and Natural Drainage

Throughout the area of the proposed development works, the ground slopes are gentle (not exceeding 15^0). There has been significant historic modification by way of leveling earthworks. Vegetation comprises dense, kanuka and mahoe dominant, regenerating native bush, with sparse groundcover. A small stream reports in a deeply-incised channel that runs along the western side of the subject Lot. At the culvert location shown on the ***Site Plan,*** (adjacent to Everest's letterbox) there has been periodic blockage, and/or the stream flow has exceeded the 600mm culvert capacity, on numerous occasions over the past 40 yrs or so. On such occasions, storm-water passes over Kenepuru Road and enters the subject Lot, causing surface flooding with variable deposition of alluvial sandy gravel. Such episodic flooding would adversely affect the proposed LAA for wastewater soakage. Consequently, a

surface cutoff drain (with a north-side bund) must be installed at the location shown on the ***Site Plan***. to effect re-entry of storm-water to the existing incised stream channel.

1.3 Recent and Historic Instability

There are no recent or historic land instability features that are relevant to the assessed site, other than the minor episodic surface flooding referred to in the foregoing section **1.2.**

2. Geotechnical Investigations

The character of the parent rock and regolith underlying the proposed excavation area was determined by extrapolation from the proximal side cut (see Section) and from the nature of cuttings obtained from auger hole AG1, and from exposures on Kenepuru Road (see Plate 1). The cross section profile (***Section – Geotech.***) was drawn from data obtained by tape-and-compass traverse along the line shown on the ***Site Plan***. Slope angles were measured using a hand-held Sunto clinometer.
There is no record of any previous site-specific geotechnical assessment.

3. Geotechnical Assessment

3.1 Foundation rock strength and stability.

Bedrock is defined as Schist: subzone 2: The attitude of the foliation planes is 180^0-240^0 / 20^0 – 45^0 . Low frequency of sub-vertical fractures. (see Plate 1). Highly weathered: High rock mass strength (Hoek GSI 70). The foundation rock is stable.
Given the proposed excavation profile shown on the attached section, there are no rock mass defects that could result in potential planar failure geometry.

3.2 Regolith Slope Stability

The affected soils report complex and variable subsoil profiles resulting from historic leveling works, together with the periodic deposition of minor alluvial sandy gravel, as described in section **B1.2.** The orientation of rock mass defects and primary fabric (foliation) gives rise to a highly variable depth of mature residual soil (1-2m), as shown on the attached ***Section.***, and a sharp contact with the underlying weathered Schist bedrock.
Ground slopes across the proposed excavation area and relevant marginal areas do not exceed about 15^0 and they exhibit historic stability.
In the context of the proposed development works, I conclude that there is an adequate safety factor associated will all aspects of land stability. As indicated by way of the " Proposed Excavation Profile " shown on the attached ***Section***, adequate stability will be achieved by retaining the lower 1m of the excavation batter, and reducing the upper batter slope to an angle not exceeding 25^0. The upper batter slope should be re-grassed as soon as practicable.

3.3 Land Application Area (Wastewater)

The assessed LAA (suitable for dripper irrigation) reports on a slightly waning planar landform with slopes not exceeding 5^0, with a good cover of regenerating native bush. Soils are dominantly sandy gravelly Loam (recent alluvium) and patchy redistributed side castings associated with Kenepuru Road, and historic leveling works.
Given implementation of the drainage Control Measure (cut-off drainage), it is concluded that wastewater can be adequately treated on-site, and that the application of the required drip irrigation loading will not adversely affect slope stability.

3.4 Development Impact

Given compliance with the following control measures, the proposed development works will have no immediate or long term detrimental impact on land or foundation stability, and there will be no adverse impact on neighbouring properties.

The development risk is assessed as LOW (geotechnical risk matrix).

4. Control Measures

4.1. A surface cutoff drain (with a north-side bund) must be installed at the location shown on the ***Site Plan***. to effect re-entry of any episodic surface storm-water into the existing incised stream channel.

4.2. All spoil produced by excavation work is to be removed from the Lot.

4.3. The lower 1m of the excavation batter is to be retained, and the upper batter slope should be reduced to an angle not exceeding 25^0. The upper batter slope should be re-grassed as soon as practicable.

5. Management Plans

There are no geotechnical issues associated with the proposed development that require the implementation of any MDC management plan additional to those already in force.

6. References

- Beck, A C 1964: Sheet 14 Marlborough Sounds, Geological Map of NZ, 1:250,000 NZDSIR
- Marlborough District Natural Hazard & Risk Study. SES Vic. Uni. 1999
- Identification of active fault traces in the Marlborough District. Geotech Consulting Ltd. May 2003
- Guidelines for the Classification and Field Description of Soils and Rocks for Engineering Purposes NZ Geotechnical Society Inc Jan. 2006

C. MAPS AND PLANS

Photo Plates	1
Location Plan	1
Sections	1
Site Plan	1

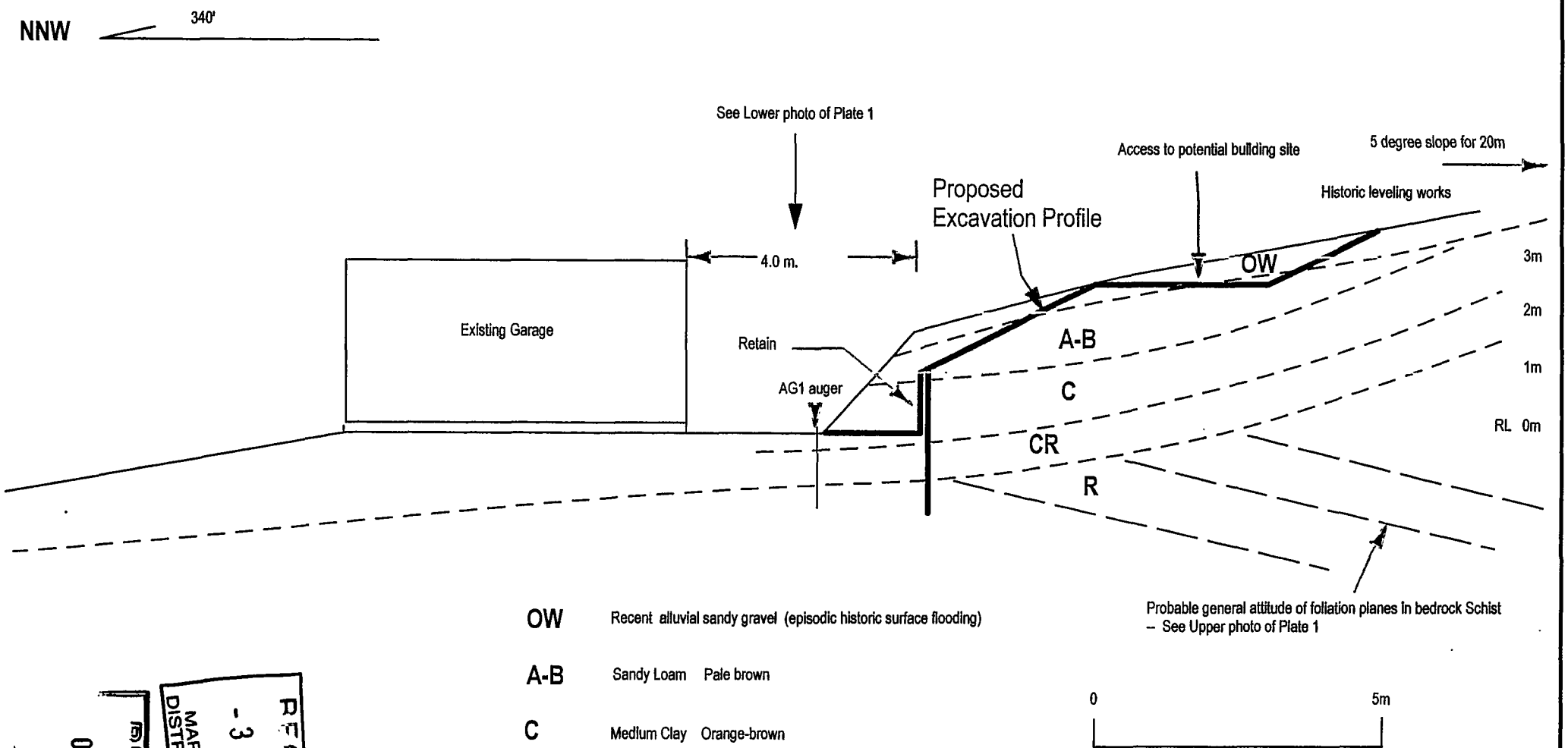
M. G. Maxwell 23/10/07

Plate 1 K. Morgan Lot 10 923 Kenepuru Road

Above: Schist bedrock exposed on Kenepuru Road. Proximal southern boundary of subject Lot. Foliation at 180^0-240^0 / 20^0-45^0. Low frequency of sub-vertical fractures. High rock mass strength. Sharp contact with residual sandy clay loam. Soil depth in the range 1-2m.

Below: Location of proposed excavation, in stable residual soil.

Compiled by: M.G.Maxwell 16/10/07



OW	Recent alluvial sandy gravel (episodic historic surface flooding)	
A-B	Sandy Loam	Pale brown
C	Medium Clay	Orange-brown
CR	Sandy clay	Orange / mottled grey
R	Highly weathered Schist	Grey-brown

Relative locations have been established by tape, compass, and GPS instrumentation, and are approximate. Any accurate distances required must be established by a registered surveyor

Lot 10 DP4360
923 Kenepuru Road

Petrographic Services
Blenheim Ph: 5788809

Property / Project:	Drawing Ref:	Scale:	Drawn by:	Date:
K.Morgan / 2007-1263	Section - Geotech.	1:100	M.G.Maxwell	19/10/07

Opinion as to Land Stability.

With Reference to: **Property:** Lot 10. DP 4360 Proposed Excavation and new Wastewater LAA
Location: Willow Bay 923 Kenepuru Sound
Client: K. Morgan **Project:** 2007-1263

The following Opinion is presented in the format required by the Marlborough District Council.

I, Malcolm George Maxwell

Hereby confirm that:

I am experienced in the field of **soils engineering** and more particularly **land and foundation stability** and am formally recognised by the Marlborough District Council. I am familiar with and understand the purpose of the Marlborough District Council's geo-technical reporting standards.
This professional opinion is furnished to the Marlborough District Council.
The purpose of the investigation is to provide a geotechnical risk assessment of the proposed excavation earthworks for improved vehicle access, and a new land application area for treated wastewater, on the subject Lot 10 DP4360 located at Willow Bay, Kenepuru Sound, in the context of land stability, and a consequential recommendation regarding the suitability of the sites for the specified development work, and any remedial work required.

A Site Investigation Report, formatted as required, is attached.

In my professional opinion, and having regard to the specifics of the land area that I have investigated to the extent that acceptable engineering practices require giving due regard to acceptable engineering principles and practices for land slope and foundation stability, then with regard to the specified proposed development work, and providing that the recommendations in my accompanying report " **Site Investigation Report – Geotechnical 2007-1263"** dated **23/10/07** are complied with, namely that:

4.1. A surface cutoff drain (with a north-side bund) must be installed at the location shown on the ***Site Plan***. to effect re-entry of any episodic surface storm-water into the existing incised stream channel.
4.2. All spoil produced by excavation work is to be removed from the Lot.
4.3. The lower 1m of the excavation batter is to be retained, and the upper batter slope should be reduced to an angle not exceeding 25^0. The upper batter slope should be re-grassed as soon as practicable.

.....then Council and client may be confident that any variation in the predicted subsoil conditions that may be exposed during site development works, within the dimensional constraints specified, will not be of such nature as to invalidate the assessment presented in the above specified report, AND the assessed locations constitute suitable sites for the above-specified proposed works, AND the development risk is LOW (geotechnical risk matrix), in the context of intra-development, medium, and long-term land stability.

M. G. Maxwell M.Sc. Engineering Geologist 23/10/07

Appendix C

Penetrometer Sheets

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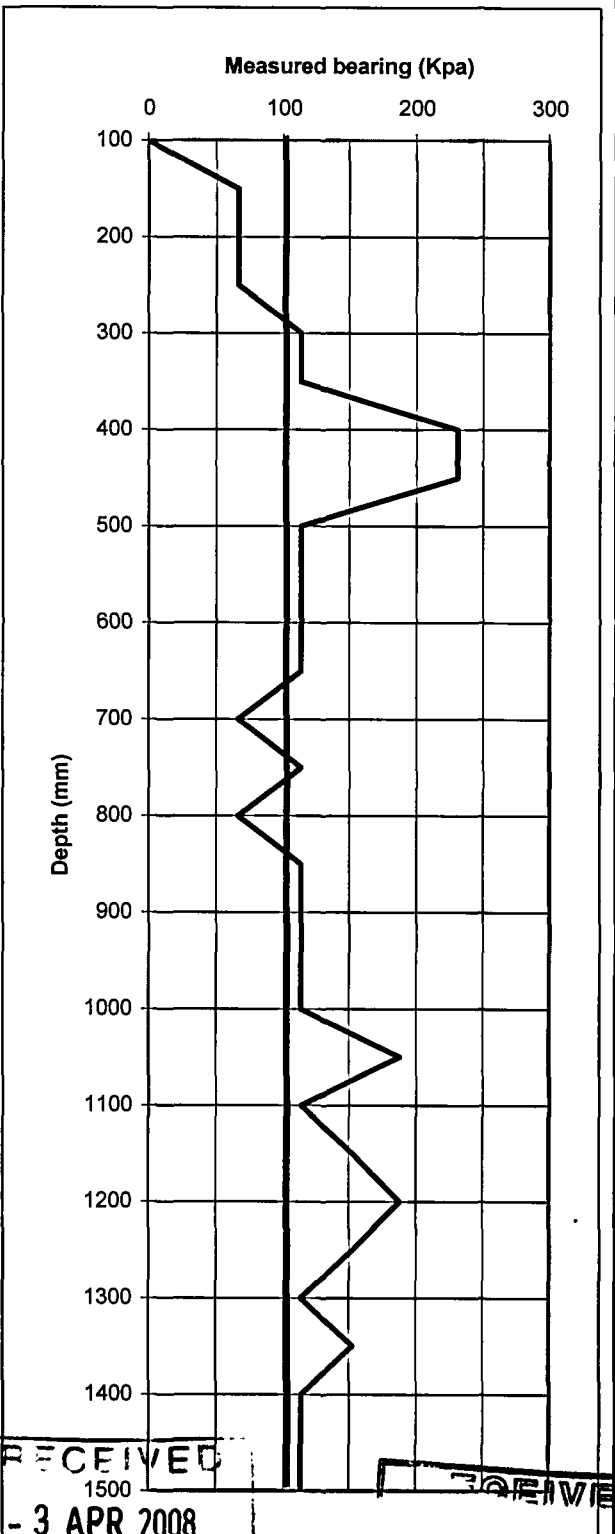
PENETROMETER TEST RESULTS

Client:	Kevin Morgan	**Date:**	29-Feb-08
Project:	Lot 10 DP 4360	**Investigator:**	J.Dimmendaal
Site:	923 Kenepuru Road Mahau Sound	**Project No:**	20071263
		Site No:	P1

Notes: Test Locations Refer to drawing

P1

No. of Blows	e (mm/blow)	Soil bearing resistance (Kpa)	Depth (mm)
0	0	0	100
1	50	66	150
1	50	66	200
1	50	66	250
2	25	113	300
2	25	113	350
5	10	231	400
5	10	231	450
2	25	113	500
2	25	113	550
2	25	113	600
2	25	113	650
1	50	66	700
2	25	113	750
1	50	66	800
2	25	113	850
2	25	113	900
2	25	113	950
2	25	113	1000
4	13	188	1050
2	25	113	1100
3	17	153	1150
4	13	188	1200
3	17	153	1250
2	25	113	1300
3	17	153	1350
2	25	113	1400
2	25	113	1450
2	25	113	1500



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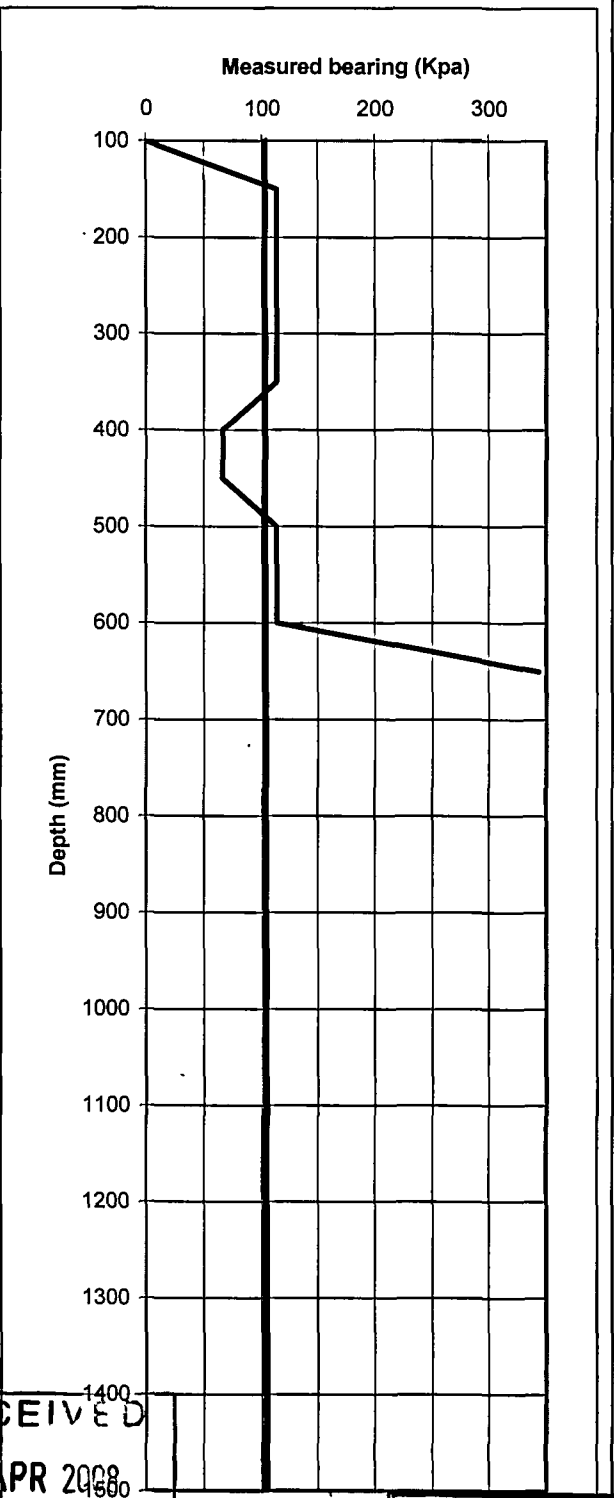
PENETROMETER TEST RESULTS

Client:	Kevin Morgan	**Date:**	29-Feb-08
Project:	Lot 10 DP 4360	**Investigator:**	J.Dimmendaal
Site:	923 Kenepuru Road Mahau Sound	**Project No:**	20071263
		Site No:	P2

Notes: Test Locations Refer to drawing

P2

No. of Blows	e (mm/blow)	Soil bearing resistance (Kpa)	Depth (mm)
0	0	0	100
2	25	113	150
2	25	113	200
2	25	113	250
2	25	113	300
2	25	113	350
1	50	66	400
1	50	66	450
2	25	113	500
2	25	113	550
2	25	113	600
8	6	344	650
			Refusal on rock



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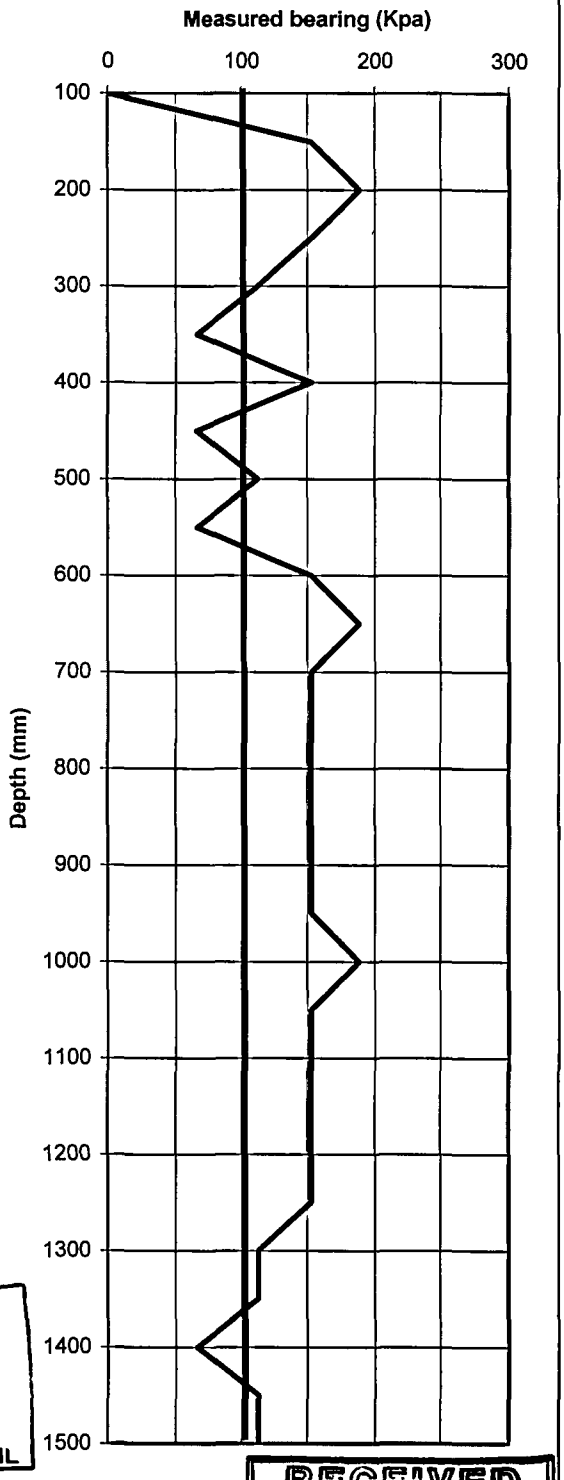
PENETROMETER TEST RESULTS

Client:	Kevin Morgan	**Date:**	29-Feb-08
Project:	Lot 10 DP 4360	**Investigator:**	J.Dimmendaal
Site:	923 Kenepuru Road Mahau Sound	**Project No:**	20071263
		Site No:	P3

Notes: Test Locations Refer to drawing

P3

No. of Blows	e (mm/blow)	Soil bearing resistance (Kpa)	Depth (mm)
0	0	0	100
3	17	153	150
4	13	188	200
3	17	153	250
2	25	113	300
1	50	66	350
3	17	153	400
1	50	66	450
2	25	113	500
1	50	66	550
3	17	153	600
4	13	188	650
3	17	153	700
3	17	153	750
3	17	153	800
3	17	153	850
3	17	153	900
3	17	153	950
4	13	188	1000
3	17	153	1050
3	17	153	1100
3	17	153	1150
3	17	153	1200
3	17	153	1250
2	25	113	1300
2	25	113	1350
1	50	66	1400
2	25	113	1450
2	25	113	1500



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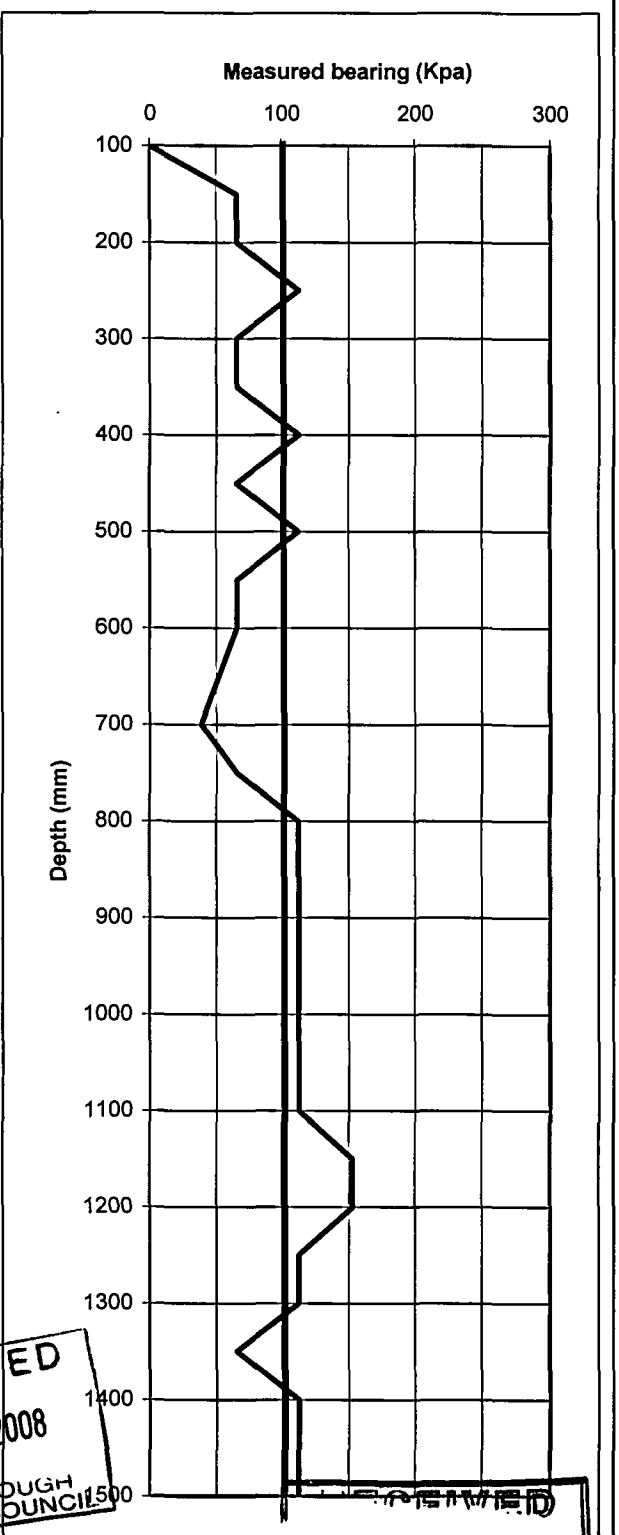
PENETROMETER TEST RESULTS

Client:	Kevin Morgan	**Date:**	29-Feb-08
Project:	Lot 10 DP 4360	**Investigator:**	J.Dimmendaal
Site:	923 Kenepuru Road	**Project No:**	20071263
	Mahau Sound	**Site No:**	P4

Notes: Test Locations Refer to drawing

P4

No. of Blows	e (mm/blow)	Soil bearing resistance (Kpa)	Depth (mm)
0	0	0	100
1	50	66	150
1	50	66	200
2	25	113	250
1	50	66	300
1	50	66	350
2	25	113	400
1	50	66	450
2	25	113	500
1	50	66	550
1	50	66	600
1	100	38	700
1	50	66	750
2	25	113	800
2	25	113	850
2	25	113	900
2	25	113	950
2	25	113	1000
2	25	113	1050
2	25	113	1100
3	17	153	1150
3	17	153	1200
2	25	113	1250
2	25	113	1300
1	50	66	1350
2	25	113	1400
2	25	113	1450
2	25	113	1500



Appendix D

Professional Opinion as to Land Stability

Date 3 March 2008

Opinion As To Land Stability

Description: Lot 10 DP 4360, BC 080205, PIM 080160

For: K & L Morgan Partnership

I, Jan Dimmendaal of ENSURV, PO Box 189, Blenheim,

hereby confirm that:

1. I am experienced in the field of soils engineering and more particularly land and foundation stability and am formally recognised by the Marlborough District Council. I am familiar with and understand the purpose of the Marlborough District Council's geotechnical reporting standards. This professional opinion is furnished to the Marlborough District Council alone, on the express condition that it will not be communicated to or be relied upon by any other person. It is based on conditions presently found on site and is consistent with standards currently being applied.

2. Site investigations have been carried out by Geologist Malcolm Maxwell and myself and are described in the site investigation report dated 3 March 2008, attached. The following professional opinion is based on the assumption that the data obtained from the investigations is representative of the whole area under consideration. In my professional opinion it is reasonable for Council to assume that the data referred to above is representative of the whole area under consideration.

3. A site plan been prepared and the report describes the soil conditions at the building site.

4. In my professional opinion, not to be construed as a guarantee, and having regard to the specifics of the site which has been investigated to the extent that acceptable engineering practices require, giving due regard to acceptable engineering principles and practices for land and foundation stability, then the building site shown on the site plan is suitable for building construction, providing that the following recommendation described in my accompanying report (Engineering Report – Proposed Extensions to Dwelling) is adhered to:

    1. It is recommended that the site is suitable for the proposed extensions and for construction using conventional shallow foundations designed and constructed in accordance with NZS 3604:1999 with a minimum founding depth of 0.6m below cleared ground level.

5. This professional opinion shall remain current for a maximum of two years.

Jan Dimmendaal, ENSURV
BE(Hons), CP Eng, MIPENZ

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3 March 2008

Ron Wass
Corporate Information Officer
Marlborough District Council
PO Box 443
BLENHEIM

ALLOCATED TO
GPA
PEER REVIEW

Dear Ron

Proposed On-site Wastewater System – K & L Morgan Partnership, 923 Kenepuru Road, Willow Bay, Mahau Sound –BC080205, PIM 080160

The design of the proposed on-site wastewater system included with my report dated 30 October 2007 was based on a three bedroom dwelling.

I understand that as part of the building consent application assessment it has been determined that the proposed system must be designed on the basis of the dwelling providing for four bedrooms.

I have reviewed my design accordingly and confirm that there is sufficient suitable land application area available to allow for the installation of the required additional drip irrigation line.

To allow for a four bedroom dwelling with a potential permanent occupation of eight people the total length of drip irrigation line required is 379m. The design flow is 1,440l/day and is calculated using a wastewater flow design allowance of 180 litres/person/day. A copy of the design sheets is attached.

Please contact the writer should you require any further information.

Regards

Jan Dimmendaal
Chartered Engineer

RECEIVED
- 3 APR 2008
MARLBOROUGH DISTRICT COUNCIL

RECEIVED
10 APR 2008
MARLBOROUGH DISTRICT COUNCIL

RECEIVED
10 APR 2008

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WASTEWATER SYSTEM DESIGN SHEET

To AS/NZS 1547:2000

Morgan: Willow Bay **File No: 20071263**

Intended water Supply:

~~*Public Supply*~~ ~~*Rain water (roof collection)*~~ *Bore/Stream/Dam*

Local experience with existing on-site systems:

Septic Tank or similar (Primary treatment):

Secondary treatment:

Produce high quality effluent suitable for irrigation. Increased loading rate can be used if trench disposal is used - less disposal area required

Recommendation for this site: *Biolytix Secondary Treatment and drip irrigation land application*

DRAINAGE CONTROLS:

Need for surface water collector / cut-off drains?

AVAILABILITY OR RESERVE / SETBACK AREAS

Reserve area available for extensions, % of design area:

Setback distance? (between development and disposal system): *Min. as required by Resource Management Act*

Ksat, (m/day): ESTIMATED SOIL CATEGORY: *Category 3 - Moderately drained loam*

Design

RECOMMENDED D.I.R. *4* mm/day

(NOTE: Where DIR is 10mm/week or less, ETA/ETS trenches to Fig 4.5A7 NZS1547:2000 should be specified to enable the utilisation of such soils)

8 Permanent People At 180L/person/day: *1440* L/day from Appendix 4.2D AS/NZS 1547:2000

DESIGN FLOW: *1440* L/day

Storage size (min): *4000* (Table 4.3A1)

AREA REQUIRED: *360.0* m²

IRRIGATION LENGTH : *379.0* m .

RECOMMENDATION :

Biolytix Secondary treatment with dripper line irrigation. Irrigation lines to be a minimum total length of 379m using 1.6 l/hr emitters Lines to be laid at 1.0m spacing at 150mm below ground level or stappled to the surface and covered with 150mm of inert material (bark or leaf mulch). Installation of the irrigation system to be in accordance with the product Installer Guide. Detailed design of the irrigation system is to be responsibility of the installer.

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Engineering Report

Proposed On-site Wastewater Management System Upgrade and Site Excavations

Lot 10 DP 4360
923 Kenepuru Road, Willow Bay
Mahau Sound

For Kevin Morgan

Jan Dimmendaal
Chartered Engineer
ENSURV
30 October 2007

Job No 20071263

Table of Contents

1. Introduction

1.1 Kevin Morgan proposes to upgrade the existing wastewater management system at his holiday home located at 923 Kenepuru Road, Willow Bay so that it meets current Marlborough District Council standards. Minor excavation work to facilitate the manoeuvring and parking of his trailer boat is also proposed.

1.2 The legal description of the land covered by this development is Lot 10, DP 4360. The land area is 3,000m². The property is zoned as 'Sounds Residential' and is shown to be encompassed by the 'unstable' hazard overlay according to the Marlborough District Council Sounds Resource Management Plan.

1.3 The purpose of this report is to present the results of site investigations carried out in relation to onsite wastewater treatment and effluent land application and proposed excavation on the property. The site investigation was carried out on 16 October 2007.

1.4 A Geotechnical assessment of the proposed excavation was carried out by Engineering Geologist, Malcolm Maxwell in combination with engineering investigations. His report is presented in Appendix B and is referred to in the relevant sections of this report.

1.5 The site investigation was carried out on 16 October 2007.

2. Description

2.1 The subject property is accessed of Kenepuru Road via a shared right of way. The property is bounded on the southern quarter by Kenepuru Road and has an average slope of 10° towards the north.

2.2 The existing dwelling on the property was constructed in the 1970's and provides for a total of three bedrooms. A double garage is positioned immediately to the south of the dwelling. The driveway turning circle leading up to the garage and the available land area adjacent to the garage is such that it is difficult to manoeuvre and park a trailer boat.

2.3 That part of the property to the south of the dwelling and garage is vegetated in regenerating native bush with sparse undergrowth. An incised stream flows proximal to the western boundary of the property.

2.4 The dwelling is currently serviced by a septic tank and drainage field located to the south of the dwelling.

2.5 Water supply for the property is from a stream source.

3. Site Evaluation – On-site Wastewater

3.1 In accordance with Plan Change 7 Rule 27.2.4.5.5 an assessment of the best practical option has determined that utilising the existing septic tank (primary treatment) and constructing a dose pumped trench land application system is not suitable for the property as there is insufficient suitable level area available with a minimum offset of 30m from the stream running through the property. It is considered that the most suitable alternative for this property is to use Secondary treatment and drip irrigation land application.

3.2 The proposed land application area is located on the slopes to the south of the dwelling. The land application area has a north aspect and has filtered exposure to sunlight and wind. At the closest point the land application area separation from the stream is 10m (refer Site Plan Appendix A). The landform element is linear planar

3.3 Three test pits were dug at the site in the proposed effluent land application area and their locations are shown on the site plan (Appendix A). Soils consist of sandy loam of colluvial (and road side castings) origin. Based on the soil assessment carried out, an average drainage category of 3 has been adopted. The representative soil properties are:

W 1

(m)	Horizon or Layer and boundary	Genesis	Description							Drainage Category
			Colour	Field Texture	% + 2mm Fragments	Compactness	Consistency	Structure	Moisture condition	
0.05	1	Topsoil	Dark Brown	Humus	None	V.Loose	V.Soft	V. Strong	Moist	2
0.45	2	Colluvial	Pale Brown	Sandy loam	5%	Loose	Soft	Strong	Moist	3
0.60	3	Colluvial	Pale yellow brown	Sandy loam	10%	Firm	Stiff	Strong	Moist	3

W 2

(m)	Horizon or Layer and boundary	Genesis	Description							Drainage Category
			Colour	Field Texture	% + 2mm Fragments	Compactness	Consistency	Structure	Moisture condition	
0.05	1	Topsoil	Dark Brown	Humus	None	V.Loose	V.Soft	V. Strong	Moist	2
0.80	2	Colluvial	Pale yellow brown	Sandy loam	15%	Firm	Stiff	Strong	Moist	3

W 3

(m)	Horizon or Layer and boundary	Genesis	Description							Drainage Category
			Colour	Field Texture	% + 2mm Fragments	Compactness	Consistency	Structure	Moisture condition	
0.05	1	Topsoil	Dark Brown	Humus	None	V.Loose	V.Soft	V. Strong	Moist	2
0.80	2	Colluvial	Pale yellow brown	Sandy loam	20%	Firm	Stiff	Strong	Moist	3

3.4 A secondary treatment system involves aerobic biological processing and settling or filtering of effluent received from a primary unit. The following system is considered suitable:

Biolytix BF6 3000 PAT treatment system coupled with a drip irrigation system. System performance details are:

BOD after 5 days (average) $< 8.8\ g/m^3$
Suspended solids (average) $< 5.4\ g/m^3$

A Biolytix system specification is attached (Appendix D).

Based on information provided by the system supplier the Biolytix system is very suitable for a holiday home situation where the house is unoccupied for extended periods and as a consequence there is no flow of effluent going into the system.

The design irrigation rate for Category 3 soil is 28mm/week (i.e. 4 mm/day).

3.5 The system design has been based on a 3 bedroom dwelling with a permanent occupancy of 6 people (as per MDC Guidelines for new on-site wastewater management systems and Plan Change 7 Rule 28.1.21) to calculate a design flow of 1,080 litres/day. The wastewater flow design allowance of 180 litres/person/day has been used in the

design of the system. This allowance is in accordance with Appendix 4.2D of AS/NZS 1547:2000 and is based on a stream water source supply for the dwelling.

3.6 The length of drip line required for the dwelling is 286m (refer wastewater design sheets Appendix C). The irrigation system design requires 1.6 litre/hr emitters with lines laid at 1.0m spacing and at 150mm below ground level or on the ground surface secured by stainless steel staples and covered with 150mm of inert material such as leaf mulch. As per Council guidelines, irrigation lines should be set back a minimum distance of 2m from the property boundaries. The installation of the irrigation system is to be in accordance with the product installer guide supplied by the manufacturer.

3.7 The construction of a cut-off drain with a north-side bund along the southern boundary of the lot is recommended. This cut–off will serve to intercept stormwater run-off from Kenepuru Road and direct water into the existing incised stream channel. The proposed location of the drain is shown on the site plan included in Appendix A.

3.8 Prior to the proposed system becoming operational the system designer must inspect and certify that the system has been installed according to the design. This certification must then be forwarded to Council.

3.9 The Marlborough District Council requires that the owner of any advanced wastewater treatment system enters into and retains a maintenance contract with the supplier of the system, or with a recognised maintenance contractor, for maintenance to be carried out at yearly intervals. Records of the maintenance should be forwarded to the Council as soon as practicable following the completion of the inspection or, in the case of remedial works being required, on completion of those remedial works.

3.10 Access to the system for maintenance will be available via the house access.

4. Assessment of Effects on the Environment – On-site Wastewater

Activity - Install Effluent Land Application Field within 30 metres of a Watercourse and within the Hazard Overlay of the MSRMP

4.1 Effects

It is proposed to install a Biolytix secondary treatment system and drip irrigation effluent land application system at the site, with part of the effluent field being located within 30m of an existing watercourse and the whole property being with the Hazard Overlay of the Marlborough Sounds Resource Management Plan.

A possible environmental effect resulting from the proposed activities is a decrease in the stability of the land and contamination of the existing watercourse through the vertical movement of secondary-treated effluent that is not treated or consumed in the soil.

4.2 Mitigation Measures

Treatment

The treatment system proposed is a Biolytix secondary treatment system, which produces high quality effluent (refer 3.4 above), and therefore has a minimum impact on the environment.

Coliform numbers, the indicators used to measure the various pathogens present in sewage effluent, are initially very low in the secondary-treated effluent. These will not be a concern for it is well established that bacterial, (and viral etc), numbers are reduced exponentially with passage of effluent, whether primary-treated or secondary-treated, through mid-range textured soils.

This is evidenced by Note 1 in Table 4.2B1 of NZS 1547:2000 where it is noted that a "path length of 0.3 – 0.4 metres would be sufficient to reduce (bacterial) numbers to insignificant levels in normal soils i.e. soils that are of a mid-range texture, not too sandy or too clayey, and not saturated all the time".

We are of the opinion that the soils on the property (refer 3.3 above) fall into this mid-range soil category.

Land Stability

The low rate of effluent application (4mm/day) spread over a large area (270m²) is unlikely to have a detrimental effect on the stability of the property, particularly as the proposed works include the construction of a surface water cut-off drain up-slope of the land application. Refer also to the Geotechnical Report in Appendix B.

5. *Proposed Excavation – driveway and boat parking*

5.1 To facilitate the manoeuvring and parking of a trailer boat it is proposed to remove approximately 60m^3 of material to widen out the driveway turning circle on the approach to the garage and to increase the width of the parking area on the south side of the garage by approximately 2m.

5.2 The Geotechnical Report (Appendix B) refers to the site as being located on stable ground. The proposed excavation work required to effect the desired increase to the turn/park area will not result in any detrimental impact on land stability. Geotechnical investigation has determined that the foundation rock is stable, and comprises weathered Schist with a high rock mass strength. The overlying regolith is stable, and comprises residual soils with a thin veneer of recent alluvial sandy gravel.

6. *Assessment of Effects on the Environment*

Activity – Excavate in Excess of 20m^3 within the Marlborough Sounds Resource Management Plan Sounds Residential Zone and Hazard Overlay

6.1 Effects

It is proposed to excavate approximately 60m^3 of material to provide for manoeuvring and parking of a trailer boat. The property is within the Marlborough Sounds Resource Management Plan Sounds Residential Zone and Hazard Overlay.

A possible environmental effect resulting from the proposed activities is de-stabilising of the slope to the south of the dwelling and contamination of the stream running through the property with material eroding from cut-faces.

6.2 Mitigation Measures

It is proposed that all excavated material is removed form the site and that the lower 1m of the excavation is retained with the upper batter slope reduced to an angle not exceeding 25°. The upper batter slope is to be regrassed as soon as practicable after excavation.

Providing the proposed mitigation measures are implemented, the development works will have no immediate or long term detrimental impact on land or foundation stability, and there will be no adverse impact on neighbouring properties.

7. Recommendations

7.1 It is recommended that a Biolytix BF6 3000 PAT treatment system treatment system coupled with drip irrigation land application be installed to service the dwelling on lot 10 DP 4360. Installation is to be in accordance with requirements and recommendations of NZS1547:2000.

7.2 It is recommended that a surface water cut-off drain be installed along the southern boundary of the lot at the location shown on the site plan.

7.3 It is recommended that all excavated material is removed form the site and that the lower 1m of the excavation is retained with the upper batter slope reduced to an angle not exceeding 25°. It is recommended that the upper batter slope is regrassed as soon as practicable after excavation.

8. Limitations

This report has been prepared for Kevin Morgan and is valid for two years from the date of issue. It covers the design of a wastewater treatment and land application system for Lot 10 DP 4360 and also earthworks associated with the boat parking area and driveway widening. Any other areas are outside the scope of this report.

The reliance by other parties on the information or opinions in the report shall, without our prior review and agreement in writing, be at such parties' sole risk.

9. References

1. NZS 1547:2000 On-site Domestic Wastewater Management
2. Marlborough District Council Guidelines for new on-site wastewater management systems.

Report prepared by:

Jan Dimmendaal, Chartered Engineer
30 October 2007

Appendix A

Site Plan

north

Lot 11
DP 4360

6.62

Deck

P4

New

P3

House

P1

New

P2

Existing Septic Tank

10.00

Shed

R11000

Existing Bottom of Bank

4m

Existing Top of Bank

Boat Park
GL 10.16 approx

9.90

10.06

AG1

11.70

9.92

10.91

10.97

12.38

10.56

11.60

12.02

Access to potential building site (grade 1 in 6 max)

12.44

12.35

Land Application Area (Drip Irrigation)

Toe of new cut

Geotech X-sect line

12.93

Stream

10°

12.89

W2

Water Tank

14.45

Gentle slopes on residual soils. Stable

Regen. native bush

14.04

W3

W1

11.07

15.25

15°

14.16

10m

Bund

Cut-off Drain

2m

Kenepuru Road

16.28

Lot 10
DP 4360

16.61

NOTE:
Relative Heights with IS V at 10.00m in Driveway
All heights deduced by trigonometric levelling.

Stream

LEGEND

- Auger test sites (AG1)
- Wastewater test sites (W1)
- Wastewater land application area (LAA)

Kenepuru Road

18.78

Road Culvert

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2 PROPOSED SITE LAYOUT
Scale 1:250

REVISIONS -1/3/08 Penetrometer test sites bach

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ACENZ

PROPOSED DEVELOPMENT
LOT 10 DP 4360, 923 KENEPURU ROAD
WILLOW BAY, MAHAU SOUND

PROJECT No. **20071263**

SITE PLAN
ONSITE WASTEWATER SYSTEM
AND EXCAVATION

DRAWING No. **.001**

DRAWN JD | CHECKED JD | SCALE (A3) As Shown | DATE OCT 07

COMPUTER FILE: COMP_FILE | REVISION /

Appendix B

Geotechnical Report

Petrographic Services... Est. 1978
Economic Geology & Geotechnical
M.G.Maxwell M.Sc A.U. 1968
21 A Solway Drive Blenheim
Ph: 03-5788809

Ref: K. Morgan **2007-1263**
Lot 10 DP 4360
923 Kenepuru Sound
23/10/07

This report is presented in a format required by the Marlborough District Council.

Site Investigation Report - Geo-technical

CONTENTS

A SYNOPSIS

1. Scope of Investigation

1.1. Mr Morgan proposes to upgrade the wastewater treatment system on his property and also proposes to undertake minor excavation work to improve vehicle access. The subject property falls within a Sounds MP Natural Hazard Zone (land instability). Consequently, the purpose of this site investigation is to provide an assessment of the development risk in the context of land stability, supporting a recommendation regarding the suitability of the site for the proposed works, and any remedial action required to insure the immediate and long-term stability of the affected land.

1.2. The site investigated is Lot 10 DP 4360, located on the north side of Kenepuru Road, at Willow Bay. The site assessment was carried out on the 16th Oct. 2007.

1.3. *Plans* and *Sections* presented with this report are for geotechnical purposes only, and are presented solely for the purpose of assessing the potential immediate and long-term development impact on land stability.

2. *Summary and Conclusions*

2.1 The specific areas shown on the attached ***Site Plan*** and ***Section***, labeled "Proposed excavation" and "Proposed LAA for wastewater", are deemed to constitute stable ground that is suitable for the proposed development works.

2.2 The foundation rock is stable, and comprises weathered Schist with a high rock mass strength (see photo ***Plate 1***). The overlying regolith is stable, and comprises residual soils with a thin veneer of recent alluvial sandy gravel (see ***Section – Geotech.***).

2.3 At the culvert location shown on the ***Site Plan,*** (adjacent to Everest's letterbox) there has been periodic blockage, and/or the stream flow has exceeded culvert capacity, on numerous occasions over the past 40 yrs or so. On such occasions, storm-water passes over Kenepuru Road and enters the subject Lot. Consequently, a surface cutoff drain (with a north-side bund) must be installed at the location shown on the ***Site Plan.*** to effect re-entry of this episodic surface storm-water into the existing incised stream channel.

2.4 The risk of bedrock displacement during an earthquake is very low. Seismic shaking hazard is moderate.

2.5 A suitable LAA for wastewater soakage has been designated on gentle stable slopes. It is concluded that adequate treatment of wastewater can be achieved by dripper irrigation, without adverse affect on land stability.

2.6 An existing formed driveway and turning area is located on stable ground. The proposed excavation work required to effect the desired increase to the turn/park area will not result in any detrimental impact on land stability. (see ***Section – Geotech.*** and ***Plate 1***).

2.7 Given compliance with the specified ***Control Measures***, the proposed development work may be completed without immediate or long-term adverse affect on land stability, and the Development Risk is therefore assessed as LOW (geotechnical risk matrix).

3. *Recommendations*

In the context of the MDC required format, the only relevant recommendations are those provided under Section 4. **Control Measures.**

B. REPORT

1. *Site Description*

1.1 Geological Setting

Within a regional NE trending zone of the Marlborough Schist Series and comprising sub-zone 2 Chlorite Schist.
There are no active faults.

1.2 Landform Elements and Natural Drainage

Throughout the area of the proposed development works, the ground slopes are gentle (not exceeding 15^0). There has been significant historic modification by way of leveling earthworks. Vegetation comprises dense, kanuka and mahoe dominant, regenerating native bush, with sparse groundcover. A small stream reports in a deeply-incised channel that runs along the western side of the subject Lot. At the culvert location shown on the ***Site Plan,*** (adjacent to Everest's letterbox) there has been periodic blockage, and/or the stream flow has exceeded the 600mm culvert capacity, on numerous occasions over the past 40 yrs or so. On such occasions, storm-water passes over Kenepuru Road and enters the subject Lot, causing surface flooding with variable deposition of alluvial sandy gravel. Such episodic flooding would adversely affect the proposed LAA for wastewater soakage. Consequently, a

surface cutoff drain (with a north-side bund) must be installed at the location shown on the ***Site Plan***. to effect re-entry of storm-water to the existing incised stream channel.

1.3 Recent and Historic Instability

There are no recent or historic land instability features that are relevant to the assessed site, other than the minor episodic surface flooding referred to in the foregoing section **1.2.**

2. Geotechnical Investigations

The character of the parent rock and regolith underlying the proposed excavation area was determined by extrapolation from the proximal side cut (see Section) and from the nature of cuttings obtained from auger hole AG1, and from exposures on Kenepuru Road (see Plate 1). The cross section profile (***Section – Geotech.***) was drawn from data obtained by tape-and-compass traverse along the line shown on the ***Site Plan***. Slope angles were measured using a hand-held Sunto clinometer.
There is no record of any previous site-specific geotechnical assessment.

3. Geotechnical Assessment

3.1 Foundation rock strength and stability.

Bedrock is defined as Schist: subzone 2: The attitude of the foliation planes is 180^0-240^0 / 20^0 – 45^0. Low frequency of sub-vertical fractures. (see Plate 1). Highly weathered: High rock mass strength (Hoek GSI 70). The foundation rock is stable.
Given the proposed excavation profile shown on the attached section, there are no rock mass defects that could result in potential planar failure geometry.

3.2 Regolith Slope Stability

The affected soils report complex and variable subsoil profiles resulting from historic leveling works, together with the periodic deposition of minor alluvial sandy gravel, as described in section **B1.2.** The orientation of rock mass defects and primary fabric (foliation) gives rise to a highly variable depth of mature residual soil (1-2m), as shown on the attached ***Section.***, and a sharp contact with the underlying weathered Schist bedrock.
Ground slopes across the proposed excavation area and relevant marginal areas do not exceed about 15^0 and they exhibit historic stability.
In the context of the proposed development works, I conclude that there is an adequate safety factor associated will all aspects of land stability. As indicated by way of the " Proposed Excavation Profile " shown on the attached ***Section***, adequate stability will be achieved by retaining the lower 1m of the excavation batter, and reducing the upper batter slope to an angle not exceeding 25^0. The upper batter slope should be re-grassed as soon as practicable.

3.3 Land Application Area (Wastewater)

The assessed LAA (suitable for dripper irrigation) reports on a slightly waning planar landform with slopes not exceeding 5^0, with a good cover of regenerating native bush. Soils are dominantly sandy gravelly Loam (recent alluvium) and patchy redistributed side castings associated with Kenepuru Road, and historic leveling works.
Given implementation of the drainage Control Measure (cut-off drainage), it is concluded that wastewater can be adequately treated on-site, and that the application of the required drip irrigation loading will not adversely affect slope stability.

3.4 Development Impact

Given compliance with the following control measures, the proposed development works will have no immediate or long term detrimental impact on land or foundation stability, and there will be no adverse impact on neighbouring properties.

The development risk is assessed as LOW (geotechnical risk matrix).

4. Control Measures

4.1. A surface cutoff drain (with a north-side bund) must be installed at the location shown on the ***Site Plan***. to effect re-entry of any episodic surface storm-water into the existing incised stream channel.

4.2. All spoil produced by excavation work is to be removed from the Lot.

4.3. The lower 1m of the excavation batter is to be retained, and the upper batter slope should be reduced to an angle not exceeding 25^0. The upper batter slope should be re-grassed as soon as practicable.

5. Management Plans

There are no geotechnical issues associated with the proposed development that require the implementation of any MDC management plan additional to those already in force.

6. References

- Beck, A C 1964: Sheet 14 Marlborough Sounds, Geological Map of NZ, 1:250,000 NZDSIR
- Marlborough District Natural Hazard & Risk Study. SES Vic. Uni. 1999
- Identification of active fault traces in the Marlborough District. Geotech Consulting Ltd. May 2003
- Guidelines for the Classification and Field Description of Soils and Rocks for Engineering Purposes NZ Geotechnical Society Inc Jan. 2006

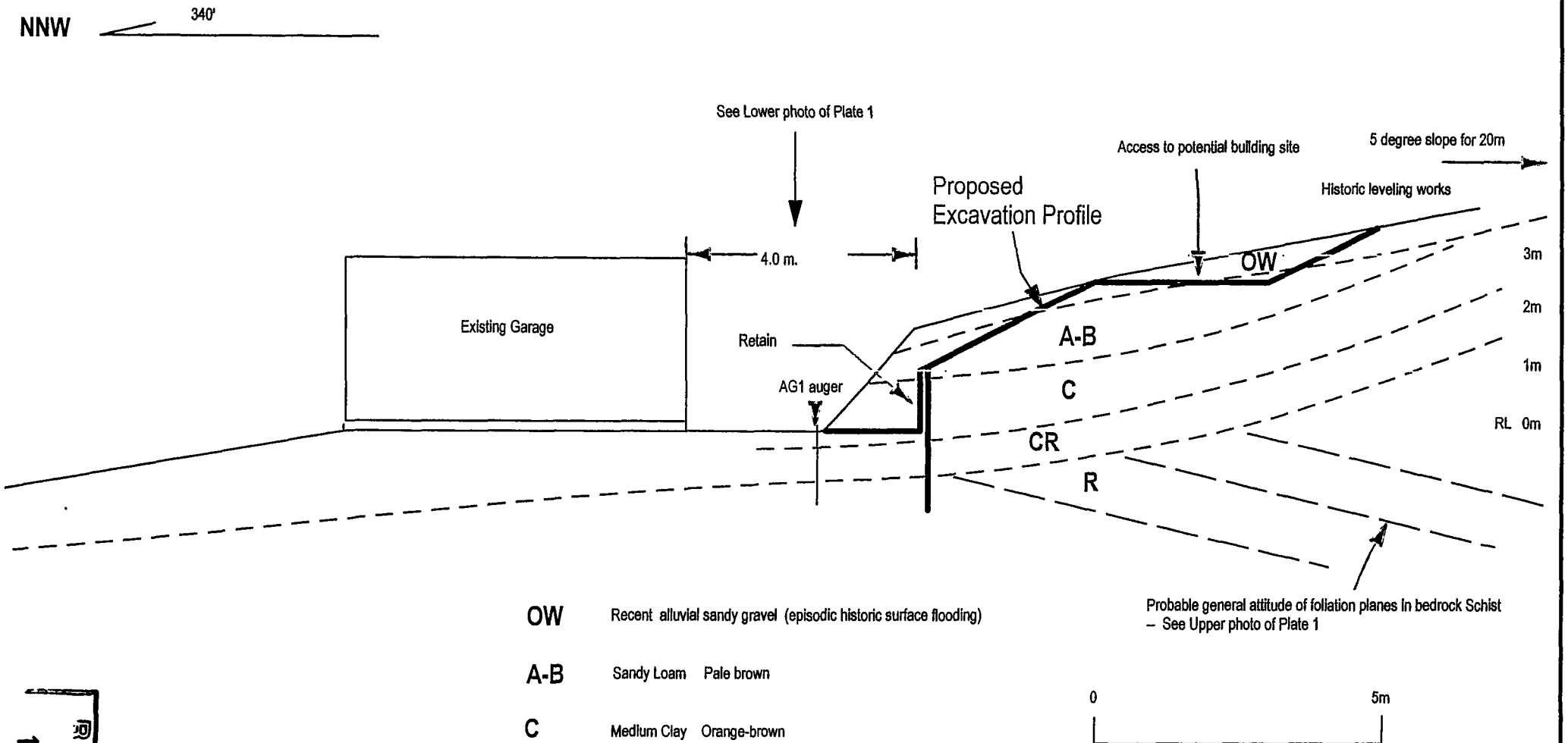
C. MAPS AND PLANS

Photo Plates	1
Location Plan	1
Sections	1
Site Plan	1

M. G. Maxwell 23/10/07

Plate 1 K. Morgan Lot 10 923 Kenepuru Road
Above: Schist bedrock exposed on Kenepuru Road. Proximal southern boundary of subject Lot. Foliation at 180^0-240^0 / 20^0-45^0. Low frequency of sub-vertical fractures. High rock mass strength. Sharp contact with residual sandy clay loam. Soil depth in the range 1-2m.
Below: Location of proposed excavation, in stable residual soil.

Compiled by: M.G.Maxwell 16/10/07



OW	Recent alluvial sandy gravel (episodic historic surface flooding)
A-B	Sandy Loam Pale brown
C	Medium Clay Orange-brown
CR	Sandy clay Orange / mottled grey
R	Highly weathered Schist Grey-brown

Relative locations have been established by tape, compass, and GPS instrumentation, and are approximate. Any accurate distances required must be established by a registered surveyor

Lot 10 DP4360
923 Kenepuru Road

Petrographic Services
Blenheim Ph: 5788809

Property / Project:	Drawing Ref:	Scale:	Drawn by:	Date:
K.Morgan / 2007-1263	Section - Geotech.	1:100	M.G.Maxwell	19/10/07

Opinion as to Land Stability.

With Reference to: **Property:** Lot 10. DP 4360 Proposed Excavation and new Wastewater LAA
Location: Willow Bay 923 Kenepuru Sound
Client: K. Morgan **Project:** 2007-1263

The following Opinion is presented in the format required by the Marlborough District Council.

I, Malcolm George Maxwell

Hereby confirm that:

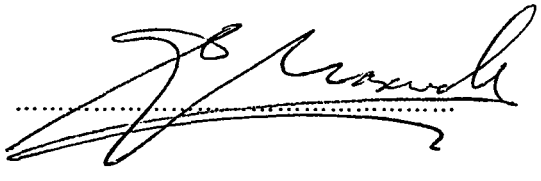
I am experienced in the field of **soils engineering** and more particularly **land and foundation stability** and am formally recognised by the Marlborough District Council. I am familiar with and understand the purpose of the Marlborough District Council's geo-technical reporting standards.
This professional opinion is furnished to the Marlborough District Council.
The purpose of the investigation is to provide a geotechnical risk assessment of the proposed excavation earthworks for improved vehicle access, and a new land application area for treated wastewater, on the subject Lot 10 DP4360 located at Willow Bay, Kenepuru Sound, in the context of land stability, and a consequential recommendation regarding the suitability of the sites for the specified development work, and any remedial work required.

A Site Investigation Report, formatted as required, is attached.

In my professional opinion, and having regard to the specifics of the land area that I have investigated to the extent that acceptable engineering practices require giving due regard to acceptable engineering principles and practices for land slope and foundation stability, then with regard to the specified proposed development work, and providing that the recommendations in my accompanying report " **Site Investigation Report – Geotechnical 2007-1263"** dated **23/10/07** are complied with, namely that:

4.1. A surface cutoff drain (with a north-side bund) must be installed at the location shown on the ***Site Plan.*** to effect re-entry of any episodic surface storm-water into the existing incised stream channel.
4.2. All spoil produced by excavation work is to be removed from the Lot.
4.3. The lower 1m of the excavation batter is to be retained, and the upper batter slope should be reduced to an angle not exceeding 25^0. The upper batter slope should be re-grassed as soon as practicable.

.....then Council and client may be confident that any variation in the predicted subsoil conditions that may be exposed during site development works, within the dimensional constraints specified, will not be of such nature as to invalidate the assessment presented in the above specified report, AND the assessed locations constitute suitable sites for the above-specified proposed works, AND the development risk is LOW (geotechnical risk matrix), in the context of intra-development, medium, and long-term land stability.

M. G. Maxwell M.Sc. Engineering Geologist .....  23/10/07

Appendix C

Wastewater Design Sheets

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WASTEWATER SYSTEM DESIGN SHEET

To AS/NZS 1547:2000

Morgan: Willow Bay **File No: 20071263**

Intended water Supply:

~~*Public Supply*~~ ~~*Rain water (roof collection)*~~ *Bore/Stream/Dam*

Local experience with existing on-site systems:

Septic Tank or similar (Primary treatment):

Secondary treatment:

Produce high quality effluent suitable for irrigation. Increased loading rate can be used if trench disposal is used - less disposal area required

Recommendation for this site: *Biolytix Secondary Treatment and drip irrigation land application*

DRAINAGE CONTROLS:

Need for surface water collector / cut-off drains?

AVAILABILITY OR RESERVE / SETBACK AREAS

Reserve area available for extensions, % of design area:

Setback distance? (between development and disposal system): *Min. as required by Resource Management Act*

Ksat, (m/day): ESTIMATED SOIL CATEGORY: *Category 3 - Moderately drained loam*

Design

RECOMMENDED D.I.R. *4* mm/day

(NOTE: Where DIR is 10mm/week or less, ETA/ETS trenches to Fig 4.5A7 NZS1547:2000 should be specified to enable the utilisation of such soils)

6 Permanent People At 180L/person/day: *1080* L/day from Appendix 4.2D AS/NZS 1547:2000

DESIGN FLOW: *1080* L/day

Storage size (min): *4000* (Table 4.3A1)

AREA REQUIRED: *270.0* m²

IRRIGATION LENGTH : *286.4* m .

RECOMMENDATION :

Biolytix Secondary treatment with dripper line irrigation. Irrigation lines to be a minimum total length of 286m using 1.6 l/hr emitters Lines to be laid at 1.0m spacing at 150mm below ground level or stappled to the surface and covered with 150mm of inert material (bark or leaf mulch). Installation of the irrigation system to be in accordance with the product Installer Guide. Detailed design of the irrigation system is to be responsibility of the installer.

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Irrigation System Calculation

Project Title:Morgan
File Ref: 20071263

Date: Friday, 19 October 2007
Operator:

Acceptable daily loading rate (mm/day)	4
Daily influent (l/day)	1080
Emitter type	Raam 17
Emitter flow rate (l/h)	1.6
Emitter Spacing (m)	0.6
Dripline Spacing (m)	1
Distance from Treatment system to Irrigation Field (m)	15
Field Size (m^2)	270
Field length assuming square area	16
Number of lines	17
Total Dripline Length (m)	286
Total flow Rate Required (l/h)	764

Pump Duty

Flow (l/h)	764
Head (m)	29

Head-Loss Table		
Item	**Head loss (m)**	**Comments**
Emitter	5	Minimum pressure required
Lateral	0	Head loss insignificant
Submain	1	Using Netafim Raam 17 as a submain
Main	0.06	Using 25mm LDPE x main length
Water meter	0	For a 15mm Multijet Turbine Water Meter
Filter	3	For a Semi blocked filter
Tank Depth	2	
Elevation	15	
Sub Total	26.06	
Total	29	including 10%

NOTE:
This design is indicative only and detailed design is the responsibility of the installer.

Appendix D

Biolytix BF6 3000 PAT System
Specification

A Strong Track Record

Biolytix has spent more than $3 million to refine its patented treatment process. Many discerning clients in Australia, New Zealand, and South Africa already enjoy its benefits for households and on a larger scale for Golf Course Estates, Eco-lodges, National Parks, Five Star Hotels and housing developments.

The Biolytix filter is the smallest system, making it easier to transport, install and hide in your garden.

20-Year Performance Guarantee

Receive A Free Report

Visit www.biolytix.com for "The 17 Vital Points You Need To Know Before Investing In A Waste Treatment System".

A "New Inventors" Winner

Winner (The Judge's Award) Winner (The People's Choice)

Why Ian Kiernan ("Clean Up Australia") Chose Biolytix

"In 2001, when the task of selecting the sewage treatment plant for the new Lord Howe Island Museum fell to me, I looked at many options.

I chose a Biolytix™ Filter because our museum is a long way from spare parts and specialist servicing.

Its simple but smart design and promise of consistent, reliable performance, together with a guarantee of no odour, were very appealing. The system delivered... just as we were promised."

For more information or to get a free quote:

www.biolytix.com

or call our Head Office:

1300 881 472

The International Award-Winning

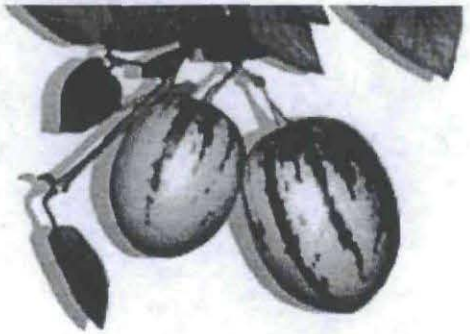
BIOLYTIX

Waste Treatment Systems

Recycle sewage, greywater, sanitary items and food scraps into a lush garden.

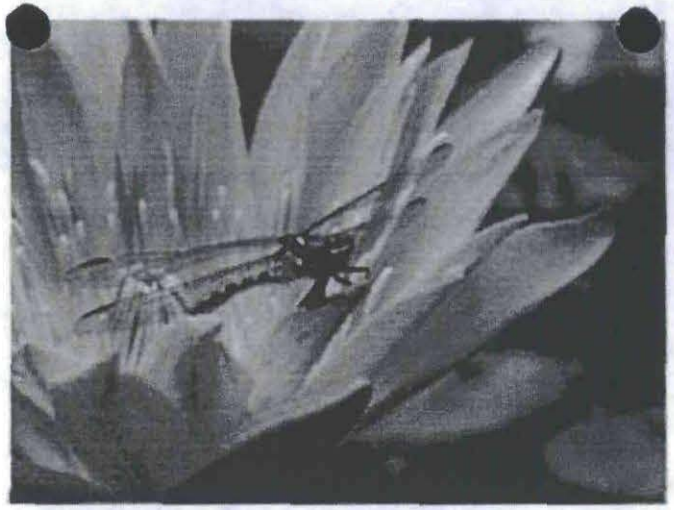
By the time the waste filters through the first layer, it is cleaner than septic output.
By the second layer it is cleaner than an aerated system. By the third layer, it's winning awards ....

Global Winner of an Environmental Technology Award at the World Expo, Japan 2005.



How Biolytix Shines

Most of our competitors make a lot of money from frequent servicing (usually 4 times per year!), and from replacing expensive parts, such as blowers. Below are just some of the many ways Biolytix™ protects your quality of life, and your wallet....



Global Environmental Leaders

Biolytix has the lowest greenhouse gas emissions of any waste treatment system in the world.

COMPETITOR COMPARISON

Biolytix Systems	Most Other Systems
✓Guarantee performance and parts for 20 years	×Guarantee parts only for 2 yrs
✓Only need 1 service per year	×4 services per year essential
✓Power costs less than $12 p/yr	×Power costs are more than $130 p/yr
✓Silent operation	×Noisy and annoying blowers hum 12-20 hrs/day
✓Natural process that needs no chemicals	×Rely on chlorine – so can't remove all pathogens
✓Safe for people, pets and your soil	×Pathogens potentially sprayed around
✓No odour guaranteed!	×Often stink after a high loading
✓Smallest tank on market	×Are large and can disrupt the garden
✓Continue to treat during power failure	×Stop working after power failure
✓Alarm notifies Head Office if problems	×You inform service personnel of problems
✓Handles peaks and troughs in loading	×Can fail after holidays or during a party
✓Loves organic loads, such as milk down sink	×Food down the sink can lead to failure
✓Handles a large range of household cleaners	×Must use a strict list of cleaners
✓You can shower and wash when you want	×Must spread out water usage
✓Recycles kitchen waste through a sink grinder	×Can't handle the extra load of sink grinder

HOW BIOLYTIX™ SOLVED THE WASTE TREATMENT RIDDLE

It was a humble beginning. In 1987 Dean Cameron couldn't find a waste treatment system that didn't have problems. When it comes to managing sewage he thought people shouldn't have to put up with foul smells, breakdowns and having to continually add chemicals. So he set out to invent the world's best system.

Convinced that nature had the answer, he studied such things as the decomposition of forest litter in rivers and on river edges. He discovered that the fastest decomposition was not occurring in the water, but rather on river edges.

"Historically, nearly all treatment systems leave the waste to fester in the water and expensively blow air into it",he said, "yet this is not how nature works". So Dean separated the waste from the water immediately and used selected organisms and smart engineering to convert it into structured humus. Before long he received fantastic results.

Investors, researchers and engineers quickly saw the benefits and created a dynamic team, including groups such as GHD Engineers, A Co-operative Research Centre (CRC), Spier Holdings, Queensland Uni and Murdoch Uni.

Dean's hunch turned out to be right

Our Patent

"To use the waste material and the structured humus it produces as a filter for cleansing wastewater."

This cleverly turns the problem (the waste) into the solution (the humus to filter and clean the wastewater).

BIOLYTIX

Biolytix® New Zealand Extended Performance Warranty & Service Contract

This agreement is between:

Name/s (the owner): _____
Site Address: _____ P/Code _____
Postal Address: _____ P/Code_____
Equipment Phone Line Number: ( ) _____ (see Clause 6)
Contact # ( ) _____ **Facsimile #** ( ) _____ **Mobile #** _____
Email: _____

And: Biolytix® Technologies Pty Ltd ("Biolytix") **ACN 097 798 966** PO Box 591, Maleny QLD 4552

Purpose of the agreement: The professional maintenance and servicing of the Biolytix® Wastewater Treatment Filter.

Product/Filter type: _____ Serial Number: _____("the Equipment") (To be completed by Biolytix®)

Installation Date/Start Date: _____ (To be completed by Biolytix®)

Annual Service Fee: The Extended Performance Warranty is available after the first year, as indicated below for clients who have not held a contract with Biolytix® consecutively from the installation date and wish to start or renew a contract. The contract start date will be determined by Biolytix® and does not include the complimentary free year. A complimentary warranty for the first year is valid from the Installation date for newly purchased equipment only.

Optional Extended Performance Warranty: Please circle one of the following if you would like to extend your warranty after the first complimentary year. If no option is circled, 20 years will be the default.

Terms: ***5 Years 10 Years 20 Years***

Payment options:
For Second and subsequent years choose one payment option only:

- **Payment option (1):** per Annum (ONE PAYMENT ANNUALLY IN ADVANCE)
- **Payment option (2):** per Quarter (4 PAYMENTS QUARTERLY IN ADVANCE)
- **Your preferred payment method: Cash Cheque Direct Debit** (please circle one choice)

Additional travel costs and Travel allowance: See Clause 7 of Terms and Conditions

Terms of Agreement: See Terms and Conditions attached hereto.

BIOLYTIX® RESERVES THE RIGHT TO INCREASE ITS SERVICE FEE IN ACCORDANCE WITH CLAUSE 7 HERETO

WORK TO BE DONE BY BIOLYTIX®:

A. At the end of each 12 month period from the Installation date/start date-carry out a comprehensive service on the Equipment including:

1. Assess effectiveness of treatment;
2. Check dispersal and flush irrigation;
3. Check irrigation filters;
4. Check pumping equipment;
5. Check equipment alarm system;
6. Visually check final effluent quality;
7. Replace all worn parts;
8. Re-inoculate if necessary
9. Advise Owner of care and maintenance of Equipment;
10. Prepare and submit maintenance report to Owner and Local Authority.

B. Carry out any emergency repairs as required due to faulty components/parts.

OBLIGATIONS OF THE OWNER: See Clause 4 of the Terms and Conditions.

Signed by the Owner/s: _____ Date: _____

Signed by Biolytix® CEO as authorised representative: _____ Date: _____

Appendix E

Photos

Proposed Development
923 Kenepuru Road
Mahau Sound
Kevin Morgan
16 October 2007

20071263