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Jeff & Trish Pearse

Residential Development

- Engineering Report

St Omer, Kenepuru Sound

09 July 2014

Our ref: 4560

Jeff and Trish Pearse
Site Development
St Omer, Kenepuru Sound

Contents

Issue No.	1	2	3	4	5
Date	09.07.14				
Prepared By	KS				
Approved By	RE				

1 Executive Summary

Smart Alliances Ltd has been engaged by Jeff and Trish Pearse to provide engineering assessment for their proposed site development in Saint Omer, Kenepuru Sound.

Provided the foundations penetrate into the underlying weathered bedrock by 1.0m, the dwelling is unlikely to cause any instability as long as good construction practices are adhered to.

It is proposed to create an earth bench to site the dwelling on, and a timber retaining wall to enable the placement of fill (from the excavation) behind the wall.

It is recommended that tanks giving a total minimum storage capacity for domestic use of 30,000 litres be installed to store roof water collection for any proposed dwelling. Special care is required if the dwelling is to be permanently occupied with 6 people as the supply is expected to run out from time to time.

Stormwater control is a very important part of Marlborough Sounds developments. A great deal of care needs to be taken to collect stormwater in a controlled manner. The overflow from the water storage tanks and any other stormwater from roofed areas should be directed into the foreshore below the property and discharged through a suitable energy dissipation structure to minimise scour.

No reticulated wastewater system is available on or near the property, however domestic wastewater can be collected, treated and disposed on the site. An assessment of the best practical option has determined that secondary treatment and drip irrigation land application is appropriate when the site conditions and constraints, and soil conditions are taken into account

2 Introduction

Jeff and Trish Pearse (the clients) propose to construct a dwelling on their land at Saint Omer in the Kenepuru Sound.

The development will include amongst other things a benched platform to site the dwelling, altered access track and onsite wastewater system.

Smart Alliances Ltd has been engaged by the clients to provide full engineering assessment of the proposed site development.

The purpose of this report is to present the results of site investigations undertaken on 06 June 2014 and engineering assessment in relation to the proposed site development.

3 Site Description

The subject property is Lot 1, D.P.9507, within Saint Omer Bay, Kenepuru Sound.

The property is located within an area of established smaller lot sounds residential properties along the southern side of Saint Omer Bay.

The property is bound by two private properties and the foreshore reserve.

An existing access track is formed between the beach to the west of the property and the south east corner of the property. The property itself is essentially undeveloped, an

area of cleared vegetation has been recently undertaken in and around the proposed building site.

The property comprises of steep (25°-35°) north, northeast and northwest aspect topography leading down to the foreshore. There is a short and narrow ridge running in a north northwest direction in the south eastern corner of the property. The ridge is of gentle to moderate gradient (5°-25°).

There is a uniform square depression located at the northern tip of the ridge approximately 600mm deep.

The site is generally vegetated in moderately dense regenerating bush with areas of large beech trees.

4 Geotechnical Investigations

We have conducted a visual assessment of the property and excavated cut batters. Additionally we have undertaken three scala penetrometer tests to determine the soil bearing capacity and the depth to bedrock and three hand augers to analyse the surface soils for onsite wastewater.

The cut faces and exposures on the access track provide a good representation of the soil in and around the proposed building site location.

The cut faces and augers indicates a pale yellowy brown silty CLAY of varying depths over highly weathered pale grey/brown bedrock.

Appraisals of the slopes affected by the development, including the immediate back slopes have been assessed. No detailed assessments of the stability of the slopes away from the development area have been undertaken.

5 Geotechnical Assessment

The site is not shown to be enclosed by the 'unstable' hazard overlay according to the maps within the Marlborough District Council Sounds Resource Management Plan.

The New Zealand Geological Map (Begg and Johnston 2000) indicates that the subject site is underlain by well bedded grey sandstone-siltstone and strongly foliated Marlborough schist of early Triassic age (Caples Group, textural sub-zone IIB). The results of the subsurface investigation reported herein generally confirms the stratigraphy shown on the geological map.

The St Omer fault runs in a west/east direction approximately 100m north of the property.

Bedrock is relatively shallow and offers good foundation for structures. The soil as outlined in NZS1170.5 is a Class C soil type.

No signs of significant active instability, colluvial debris, or soil creep were identified in the vicinity of the proposed building site. Minor slope failure is located directly below the house (north) between the proposed house site and the foreshore. The area has stability issues and a 5m no build zone is recommended from this area of slope failure.

The scala penetrometer tests indicate that an ultimate bearing pressure of 300kPa exists at approximately 0.3m below ground level. The soil bearing capacity of the soils below this level achieve GOOD GROUND in accordance with New Zealand Standard NZS3604:2011 for Timber Framed Buildings.

Weathered bedrock was generally encountered 0.7m to 1.0m below ground level, it is recommended to improve the stability that the house and retaining wall footing extend a minimum of 1.0m into this bedrock (bedrock expected at or close to excavation level).

On the basis of the foregoing, the proposed benching and dwelling are unlikely to be adversely affected by slope instability, provided that retaining walls are constructed retaining the cut faces.

The conclusions and recommendations reported are based on subsurface tests obtained from hand operated equipment and exposed cut faces. Although the opinions expressed in this report are based on the interpolation and extrapolation between the test locations, no guarantee as to the validity of this inference or the nature and continuity of the subsurface materials can be made, and the possibility that variation from the assumed conditions between the test locations may occur cannot be ruled out. If substantial variation between the assumed conditions expressed in this report is encountered, then it is recommended that Smart Alliances Ltd be consulted in order to establish whether any revisions to the recommendations for building development should be adopted.

Following periods of intense and prolonged rainfall events in the Marlborough Sounds Region, it has been observed that some slips have been initiated by hydraulic failure, caused by elevated perched water tables within the weathered schist bedrock material. It is considered that these perched water tables are formed by the passage of elevated groundwater levels through fractures and weak zones within the schist bedrock material to a point where they break-out of the bedrock and saturate the soil veneer, initiating slope instability. The occurrence of perched water tables is very difficult to detect without large scale site excavations and cannot be identified in the standard site appraisals that are appropriate for these residential development approval purposes. It should therefore be specifically noted that while no evidence for under-runners or associated slope instability was identified at the site at the time of the investigation reported herein, this does not preclude the occurrence of under-runners from being present beneath the site.

The Development Risk with the proposed development is assessed as MEDIUM. An opinion as to land stability in the format required by Council is provided in Appendix C.

6 Wastewater Assessment

An assessment of the best practical option has determined that secondary treatment and drip irrigation land application is appropriate when the site conditions and constraints, and soil conditions are taken into account.

No reticulated wastewater system is available on or near the property, however domestic wastewater can be collected, treated and disposed on the site.

A septic tank and trenched field was considered for this development, however primary treated effluent distributed through trenches is not recommended for wastewater treatment on this property for the following reasons:

- Proximity to the foreshore
- Poor drainage capabilities of the soil at the trench base (category 5).

- Topography.

The proposed land application area is to be split into two. One field to the northwest and the other to the north east (downhill) of the proposed building site on a moderate to steep northerly facing slopes, exposed to both sun and wind. The slopes are covered in dense regenerating native bush and beech trees.

Three hand augered boreholes, were put down within the area of the proposed wastewater field. The test locations are shown on the appended site plan, the test results are shown in Appendix B.

Based on the onsite soil assessment an average drainage category of 5 has been adopted.

Groundwater was not encountered within the subsurface investigation reported herein, and is expected to be generally located at a depth greater than two metres beneath the existing ground surface.

A secondary treatment system involves aerobic biological processing and settling or filtering of effluent received from a primary unit which is required to equal or better the following standards:

BOD after 5 days (average) < 20 g/m^3
Suspended solids (average) < 30 g/m^3

Any system that has been tested and meets the above standard is satisfactory, such systems include (but are not limited to) Biolytix, Oasis Clearwater Series 2000, Watergurus Novaclear, Hynds Advanced Lifestyle, Findlater 5x5 PA, Airtech 9000. These systems have been tested by the On-Site Effluent Treatment National Testing Programme (OSET NTP) and have proven their compliance with the above standard.

Grid power supply will be created to the property, which will provide power to any blower / pump associated with the treatment unit.

A wastewater design sheet is provided in Appendix B with the design calculation based on the following criteria for the proposed development:

- 3 bedrooms with permanent occupation by 6 people.
- Roof water supply.
- Total design flow of 990 litres/day (6 persons and 165 l/p/day).
- Soil category 5 and a design loading rate of 2.4mm day (16.8mm / week).
- Included in the loading rate a reduction of 20% according to slope
- Standard water reduction fixtures

Standard water reduction fixtures are to be installed in accordance with Appendix note 2, in Table H3 of AS/NZS1547:2012 to assist in minimising water usage, such fixtures include:

Dual flush 11/5.5 litre water closets, shower-flow restrictors, aerator faucets (taps) and water conserving automatic washing machines.

Based on the above assumptions, the length of drip line required is $413m^2$.

The irrigation system design requires 1.6 litre/hour emitters spaced at 0.4m centres (or similar approved). The dripper lines are to be laid at minimum 1.0m spacing and laid as close to horizontal as possible, and running parallel with the contours. The dripper lines are to be pinned to the ground and covered with leaf matter where available.

The installation of the irrigation system is to be in accordance with the product installer guide supplied by the manufacturer. Prior to the proposed system becoming operational the system installer must certify that the system has been constructed according to the design. This certification must then be forwarded to Council.

As the design satisfies G13/VM4 of the NZ Building Code, a PS1 and monitoring schedule for the wastewater installation at the site is not required. No road access is available, the system will need to be service by barge from the sea.

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 are required to 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.

7 Environmental Assessment of Wastewater Discharge

An onsite wastewater system is required on this property as there is no reticulation in the area.

Because of the following reasons we do not envisage the wastewater becoming an environmental risk:

- Reduced water usage
- More than 600mm to ground water
- Secondary treatment wastewater
- Restrictive soil qualities
- The environmental buffering capacity of land
- Low application rate
- Even distribution of wastewater

Field percolation rates vary according to the soil type. We have classified the soil as a category 5 type soil which has limitations for on-site disposal due to a low percolation rate.

The soil is prone to biological slime clogging of the clay pores, in dry weather shrinkage channels form in the upper layers of clay and effluent passes through the cracks without effective treatment. In order to overcome this issue adequate disposal area is required to provide long term disposal capacity.

The risk from the wastewater system contaminating drinking water is negligible. There are no streams in close proximity to the proposed field location.

Public health risks from an underperforming on-site wastewater system in this location would come from unlikely contamination of sea water.

Due to the distance between the field and the sea, the higher treatment of the wastewater and the environmental buffering capacity of land is sufficient to treat the wastewater to a suitable standard and avoid risk to public health.

The wastewater will have a positive effect on the environment by providing additional water and nurturance for existing native vegetation.

Coliform numbers, the indicators used to measure the various pathogens present in sewage effluent are not considered to be a concern as bacterial, (and viral etc), numbers are reduced exponentially with passage of effluent, whether primary-treated through mid-range textured soils. The distributed system will assist the effectiveness of this by reducing the quantity of effluent required to be treated by the soil in a single location. This will also provide a greater safety margin for accommodation of any fluctuations in discharge that may not be able to be accommodated or adequately treated by the soil within the existing field.

It is generally accepted 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. The upper layers of soil on the property fall into this mid-range soil category. It is therefore our opinion that no significant adverse effect on the environment will result from reduced proximity to the sea.

The proposed wastewater system generally complies with the Marlborough Sounds Resource Management Plan, Marlborough District Councils Guidelines and New Zealand Standard AS/NZS1547:2012.

Provided the proposed system is installed, operated and maintained any effects on the environment will be in accordance with the environmental outcome provided for by the Council guidelines.

8 Stormwater

Stormwater control is a very important part of Marlborough Sounds developments. A great deal of care needs to be taken to collect stormwater in a controlled manner for disposal away from the proposed building site and any steep slopes.

The overflow from the water storage tanks and any other stormwater from roofed areas should be directed into the foreshore below the property in a controlled manner.

A suitable energy dissipation structure such as rocks embedded in mass concrete should be placed at the outfall, to minimise potential adverse effects of erosion and scour and ensure compliance with the Resource Management Plan. Refer to the stormwater drawing in Appendix A for a typical energy dissipation structure.

9 Earthworks

A moderate amount of earthworks is required to enable the construction of the house and track.

It is proposed to excavate a benched area to site the dwelling, batter the cut face and spread excavated material onto benched slopes to the immediate north of the proposed dwelling.

We estimate an excavated house platform and track volume of 160m^3 and fill volume of 60m^3, the residual amount will be placed on site as removal would be uneconomical.

It is recommended to undertake the excavations during the months of October to May, a time of settled dry weather. Soils should be relatively dry and stable allowing for quick construction time.

The earthworks will be short term and sediment control is not critical, although stormwater control should be managed appropriately directing water away from exposed soil. Sediment control is not critical as the surface area is small, and the resultant sediment run off will be similar to most other exposed soil surfaces in the Sounds (such as natural features such as slips, vegetated slopes, cut faces and the like) during the rainfall event.

We recommend the cut face is retained or battered as soon as practically possible to ensure the integrity of the slope.

10 Access Track

An existing access track is formed between the beach to the west of the property and the south east corner of the property.

The track crosses the neighbouring privately owned property and requires realigning, primarily within the foreshore reserve, to remove the parts of the track on the neighbouring property.

We consider the track to be a walking track, user group 3 (day visitor) as defined by tables 1 and 2 of the New Zealand Handbook, Tracks and Outdoor Visitor Structures. The maximum gradient specified in section 2.5.1.2 is 1 in 2.7 over 100m.

To create a safe, all weather walkway for pedestrians we have designed the realigned section of tack at a gradient of 1 in 3. The length of the new gradient is approximately 38m.

The track is to be 1.5m wide and cross fall 5% to the inside of the track (cut batter side) to a stormwater dish channel.

To create the track, it is anticipated the outside of the track will be formed by 300mm wide side cast material from the excavation of the formed track. The side cast material is not to be placed on any felled vegetation.

It is expected a maximum 2m cut face will be created on the hill side of the track. The cut slope is to be battered at 2(vert) : 1(horiz), and may require retaining in places if unfavourable soils are encountered.

We estimate the excavation volume in the order of 50m^3.

The proposal is shown in Appendix A.

11 Water Supply

In this part of the Marlborough the average rainfall is approximately 1800mm/year, which is generally to provide for the water supply requirements of a permanently occupied 3 bedroom dwelling. Due to the proposed roof area of only 100m^2, we consider the supply marginal.

It is recommended that tank/s giving a total minimum storage capacity for domestic use of 30,000 litres be installed for any proposed dwelling of this size (around 120m^2).

We have based the water storage calculations on the following criteria at attach the calculation sheet in Appendix G:

- Storage capacity 30,000 litres.
- Permanent occupation by 6 people.
- Consumption of 990 litres/day (6 persons and 165 litres/head/day).
- Roof area of 100m^2.
- Consumption reduced to 495 litres/day (half) when the volume of water in storage drops down to 15m^3 (tank half full).
- Standard water reduction fixtures installed.

The calculation shows that there would theoretically be 70 days per year where the water storage tanks would be empty. The shortage is not considered significant given the proposed intermittent occupation and unlikely full occupancy of the proposed dwelling.

Human management and consumption should reduce the number of shortage days as well as the number of days when operating under short water use conditions.

The property is not accessible by road for the supply of bulk water delivery should the water supply run out. The tank would have to theoretically be filled twice a year by other means based on full occupancy with 6 people.

Standard water reduction fixtures are to be installed see section 6 for details.

We recommend a 30,000L storage tank positioned The property does not allow for head for mains pressure via gravity, the system will be boosted by a water pump. This should be determined by the plumber at the time of installation. The position of the tank should be such that it is not directly behind the house.

Overflow from any tank/s should be controlled and discharged into the stormwater system (see section 7).

The water supply is susceptible to contamination and should be filtered and disinfected / sterilised to ensure compliance with the Drinking Water Standard for New Zealand 2005 (revised 2008). A suggested basic filtration / disinfection package is shown in Appendix G.

12 Development Impact

The retaining wall and foundation footings will penetrate the clay loam / bedrock seam and increase the friction at the seam assisting in slope stability.

There will be moderate earthworks associated with the development, the exposed cut faces are to be suitably battered therefore this will cause minimal impact.

Stormwater will be controlled by flexible pipe fixed to the ground and discharged to the road drain through an outlet structure, minimising scour.

13 Control or Implementation Measures

The retaining wall and house foundations wall should be constructed by a suitably qualified contractor with experience in Marlborough Sounds construction.

Suitable sediment control should be installed to mitigate the effects of sediment entering the foreshore.

14 Management Plans

An inspection by an Engineer should be carried out following excavation of the post holes prior to concrete backfill, to ensure adequate embedment into stable sub-strata is achieved and confirm soil conditions.

The monitoring inspections will be enforced by way of a building consent.

15 Conclusion

We can confirm the property is suitable for residential development.

The building site is stable provided the cut faces are retained and footings for the retaining walls and house piles are embedded at least 1.0m into the underlying bedrock.

It is confirmed that there is sufficient area available for the adequate treatment and application of effluent for the accommodation on site provided the conditions and recommendations specified in this report are implemented.

The existing access can be easily modified to provide all weather access by pedestrians to the property.

Water supply is marginal but achievable by roof water collection and storage tank provided there is management of consumption.

16 References

Marlborough District Council, Marlborough Sounds Resource Management Plan.

Begg, J.G. and Johnston, M.R. (compilers) 2000. Geology of the Wellington Region, Institute of Geological and Nuclear Sciences 1:250,000 Geological Map 10. Lower Hutt New Zealand.

Guideline for the Field Classification and Description of Soils and Rock for Engineering Purposes NZ Geotechnical Society Inc December. 2005.

Marlborough District Council DEKHO (GIS mapping).

NZS 1547:2012 New Zealand Standard, On-site Domestic Wastewater Management.

Marlborough District Council Guidelines for New On-site Wastewater Management Systems, July 2005.

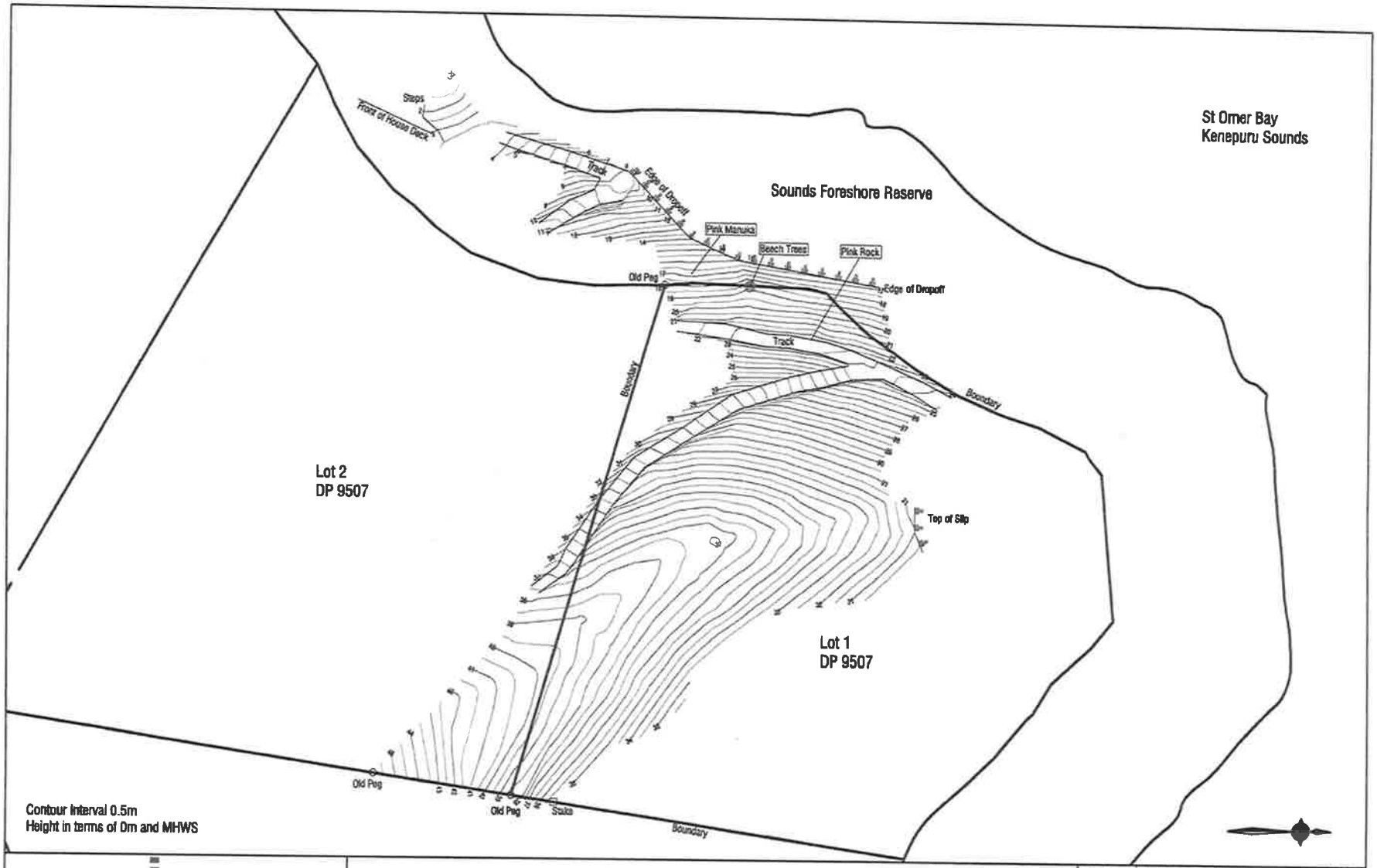
SNZ HB 8630:2004 New Zealand Handbook, Tracks and Outdoor Visitor Structures.

SMART ALLIANCES LTD

Richard Evans
Chartered Professional Engineer
09 July 2014

Appendix A - Drawings

- **Topographical Survey**
- **Site Plan Drawing**
- **Typical Field Area Details**
- **Stormwater Details**



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Lot 1 DP 9507
Topographical Survey
St Omer Bay

Scale:	1:400	A3
Drawn by:	BW	
Job Ref:	20142000	
Date:	Fri Jun 06 10:31:04 2014	
Drawing:	1	Rev.

J:\Job Folders\20142000 - Smarts - St Omer\12D\St Omer Topographical Survey\St Omer Topographical Survey

NOTES

Key:

- PT2 — Penetrometer test location
- AUG3 — Auger location
- Contours

St Omer Bay
Kenepuru Sounds

Sounds Foreshore Reserve

Boundary

Slip
(1.0m vertical displacement)

Lot 1
DP 9507

Unstable slopes

Edge of Dropoff

Pink Rock

Wastewater field 2
(163m²)

AUG1

AUG2

Wastewater field 1
(250m²)

Proposed batter slope

AUG3

Beech Trees

Proposed track

Pink Manuka

Existing track to be made redundant

Existing track

Proposed
Dwelling

PT3

PT2

Proposed excavated
bench (RL 36.5m)

Old Peg

Boundary

Existing track to be abandoned

Existing Track

Edge of Dropoff

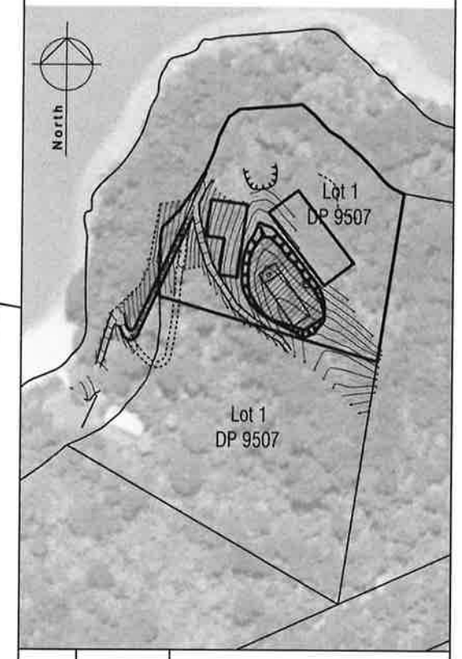
PT1

Stake

Lot 2
DP 9507

0 5 10

Do not scale from this drawing



REV	DATE	DETAILS

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CLIENT
PEARSE

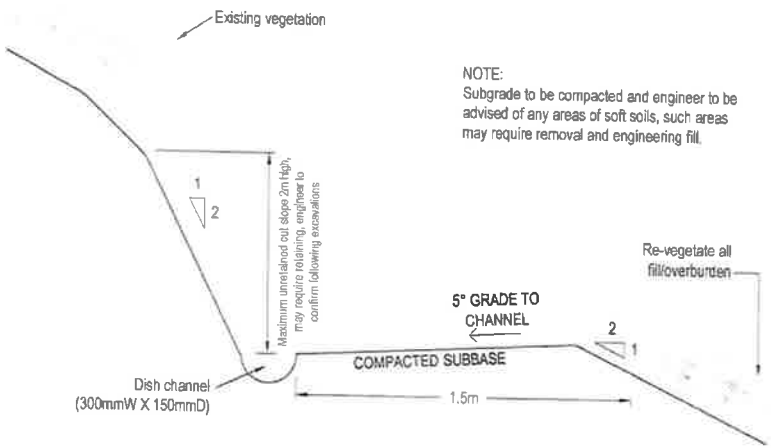
PROJECT
PEARSE BATCH
ST OMER BAY

DRAWING
SITE PLAN

ISSUE
REPORT

DATE	SCALE (A3)
10/06/14	1:250
DRAWN	REVISION
KL	**0**
APPROVED	DWG NO.
KS	**4560-C01**

CAD FILE REF: P:/ 4560-C01 Site Layout



2 - TYPICAL SECTION
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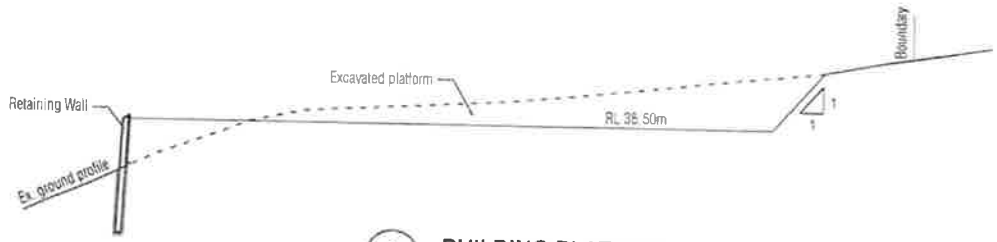

3 - BUILDING PLATFORM SECTION
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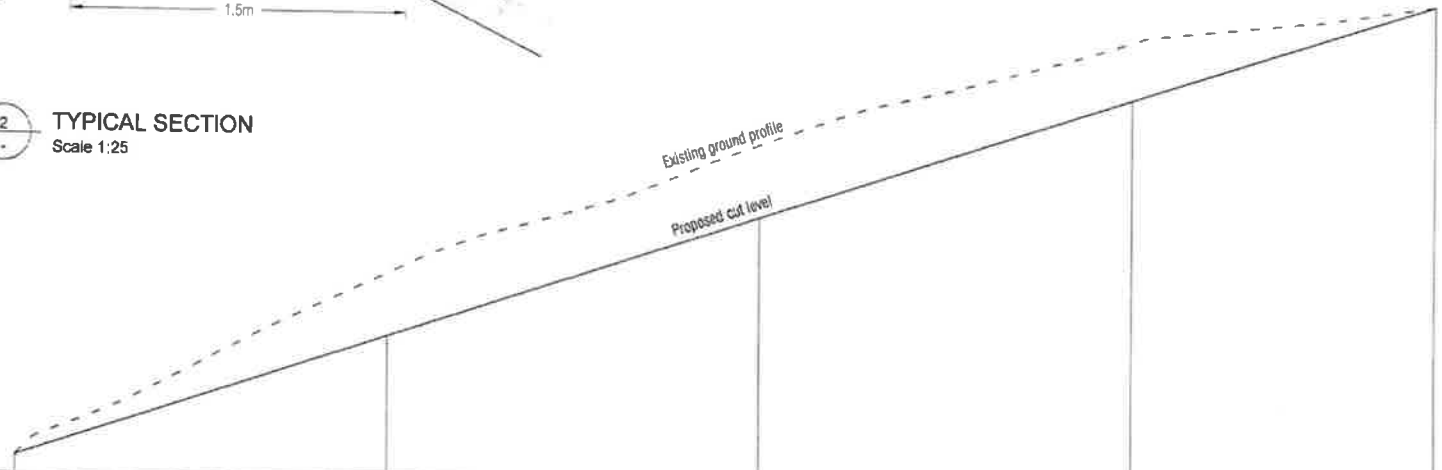

Existing Height	10.50	15.45	18.99	21.88	23.00
Proposed Height	10.50	13.78	17.06	20.34	23.00
Gradient	1:3				
Distance	0.00	10.30	20.00	30.00	38.11

1 - LONGSECTION
Scale 1:125

Do not scale from this drawing

REV	DATE	DETAILS	REV	DATE	DETAILS

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CLIENT: PEARSE

ISSUE: REPORT

PROJECT: PEARSE BATCH ST OMER BAY

DRAWING: LONG SECTION & TYPICAL CROSS SECTION

DATE: 10/06/14

SCALE (A3): AS SHOWN

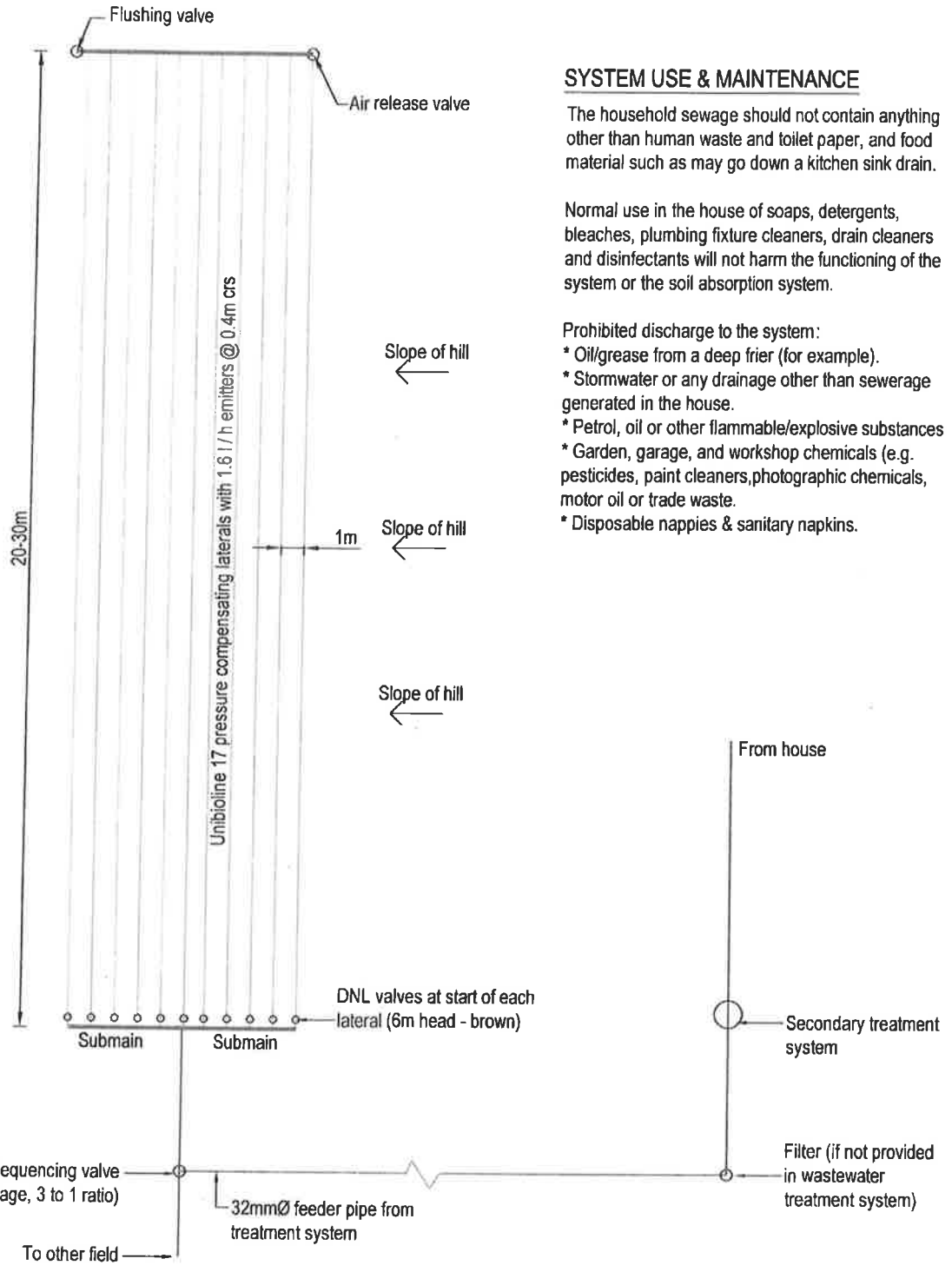
DRAWN: KL

REVISION: 0

APPROVED: KS

DWG NO: 4560-C02

CAD FILE REF: P:/ 4560-C01 Site Layout



SYSTEM USE & MAINTENANCE

The household sewage should not contain anything other than human waste and toilet paper, and food material such as may go down a kitchen sink drain.

Normal use in the house of soaps, detergents, bleaches, plumbing fixture cleaners, drain cleaners and disinfectants will not harm the functioning of the system or the soil absorption system.

Prohibited discharge to the system:
* Oil/grease from a deep frier (for example).
* Stormwater or any drainage other than sewerage generated in the house.
* Petrol, oil or other flammable/explosive substances
* Garden, garage, and workshop chemicals (e.g. pesticides, paint cleaners,photographic chemicals, motor oil or trade waste.
* Disposable nappies & sanitary napkins.

NOTE: INDICATIVE LAYOUT - PLUMBER / DRAINLAYER TO CONFIRM

Do not scale from this drawing

REV	DATE	DETAILS

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CLIENT
J & T PEARSE

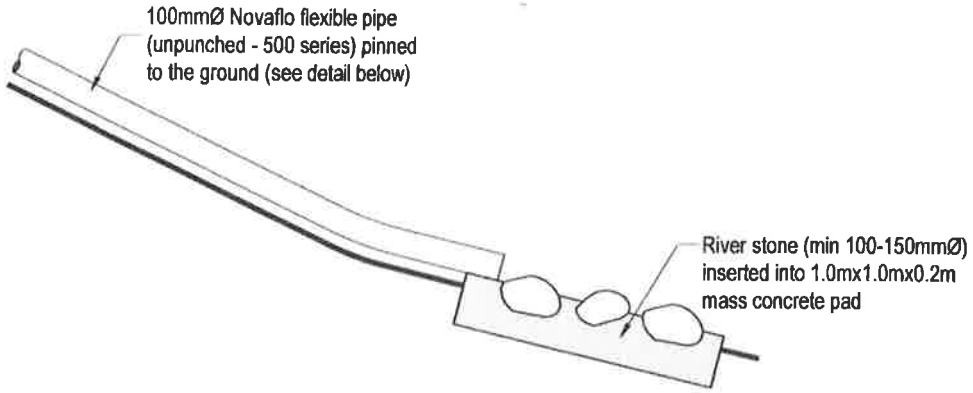
PROJECT
SITE DEVELOPMENT
SAINT OMER BAY

DRAWING
TYPICAL WASTEWATER FIELD LAYOUT

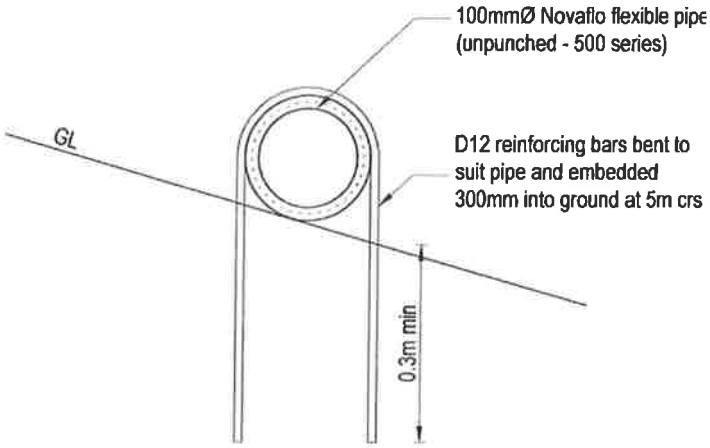
ISSUE
REPORT

DATE	SCALE (A4)
09 JUL 14	N.T.S
DRAWN	REVISION
KL	**0**
APPROVED	DWG NO.
KS	**4560-C10**

CAD FILE REF: p:/4560



1 STORMWATER OUTFALL
SCALE 1:25



2 HOLD DOWN DETAIL
SCALE 1:10

Do not scale from this drawing

REV	DATE	DETAILS

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CLIENT
J & T PEARSE

PROJECT
SITE DEVELOPMENT
SAINT OMER BAY

DRAWING
TYPICAL STORMWATER DETAILS

ISSUE
REPORT

DATE	SCALE (A4)
09 JUL 14	N.T.S
DRAWN	REVISION
KL	**0**
APPROVED	DWG NO.
KS	**4560-C20**

CAD FILE REF: n:/4560

Appendix B – Wastewater Details, Calculations and Logs

smartalliances
ENGINEERING / RESOURCE MANAGEMENT / ARCHITECTS LTD
TEL 03 579 6211 FAX 03 579 6233
P.O. BOX 546 BLENHEIM NEW ZEALAND

Project:	New Dwelling		
Client:	J & T Pearse		
Ref:	4560	Eng:	KS
Date:	9/07/2014	Sheet:	1 of 1

WASTEWATER SYSTEM DESIGN SHEET

To AS/NZS 1547:2012 & MDC Guidelines for New Onsite Wastewater Management Systems

Number of Proposed Bedrooms: 3

Intended water Suppl Roof Water Collection

Soil Category Determined on Site Category 5

DRAINAGE CONTROLS:
Need for surface water collector / cut-off drains? *No*

AVAILABILITY OR RESERVE / SETBACK AREAS
Reserve area available for extensions, % of design area: *100%*
Setback distance? (between development and disposal system):

DESIGN
Daily Loading Rate: ***3.0*** mm/day
2.4 mm/day with 20% reduction

Occupancy: **6** *Persons*

L/person/day: ***165*** L/p/d **990** L/day from Table M1 in AS/NZS1547:2012

DESIGN DAILY FLOW: **990** L/day

AREA REQUIRED: **413** m²

LENGTH REQUIRED: **348** m

RESERVE AREA REQUIRED: *100%* of specified

Irrigation Design

Acceptable daily loading rate (mm/day)	3.0
Daily influent (l/day)	990
Emitter type	Raam 17
Emitter flow rate (l/h)	1.6
Emitter Spacing (m)	0.4
Dripline Spacing (m)	1
Distance from Treatment system to Irrigation Field (m)	5
Field Size (m^2)	330
Field length assuming square area	18
Number of lines	19
Total Dripline Length (m)	348

PROJECT:	**Residential Development**		
CLIENT :	**Jeff & Trish Pearse**		
REF:	**4560**	**Eng:**	**KS**
DATE:	**09 July 14**	**Page:**	**1 of 1**

Soil Evaluation

St Omer
Kenepuru

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Aug 1

Horizon	Lower depth (mm)	Moisture content	Colour	Classification	Course fragments % volume	Structure	Strength	Stickiness	Soil Category
A	50	Dry	Light brown	Silty loam	<5%	Single grain	Very weak	Slightly	2
B	900	Dry	Light yellowy brown	Clayey LOAM	<10%	Single grain	Weak	Slightly	4

Aug 2

Horizon	Lower depth (mm)	Moisture content	Colour	Classification	Course fragments % volume	Structure	Strength	Stickiness	Soil Category
A	100	Dry	Light brown	Silty loam	<5%	Single grain	Very weak	Slightly	2
B	900	Moist	Light yellowy brown	Silty CLAY	<5%	Single grain	Firm	Moderately	5

Aug 3

Horizon	Lower depth (mm)	Moisture content	Colour	Classification	Course fragments % volume	Structure	Strength	Stickiness	Soil Category
A	150	Dry	Light brown	Silty loam	<5%	Single grain	Very weak	Slightly	2
B	700	Dry	Yellowy brown	Silty CLAY	<5%	Single grain	Firm	Moderately	5

Moisture content: Dry, moist, very moist, saturated,
Structure: Single grain (non coherent) or massive (coherent),
Strength: Loose, very weak, weak, firm, very firm, strong, very strong, rigid,
Stickiness: Non, slightly, moderately, very

Appendix C – Photographs

Aerial view of the property and surrounding area

Building site looking north

Building site looking south

Main wastewater field location

Appendix D – Geotechnical Risk Assessment

PROJECT:	**Residential Development**		
CLIENT :	**J & T Pearse**		
REF:	**4560**	**Eng:**	**KS**
DATE:	**09 Jul 14**	**Page:**	**1 of 1**

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Geo-technical Risk Matrix

St Omer – Kenepuru Sound

Gentle Slopes 0 - 10°
Moderate Slopes 10 - 25°
Steep Slopes 25 - 35°
Very Steep Slopes > 35°

Consequence / Likelihood		No risk to life, minor financial loss (<$5k). Potential for small scale instability only	No risk to life, minor financial loss (<$50k). Potential for small scale instability only	Very low risk to life, moderate damage and financial loss (<$150k). Potential for moderate scale instability	Low risk to life, significant damage and financial loss (<$500k). Potential for large scale instability	High risk to life, extensive and significant damage and financial loss (>$500k). Potential for large scale instability
Almost Certain	Extensive evidence of active creep and active instability Steep slope	**M**	**H**	**H**	**E**	**E**
Likely	Evidence of active creep and/or historic instability Steep to Moderate slopes	**M**	**M**	**H**	**E**	**E**
Moderate	Evidence of historic soil creep and/or historic instability Steep to Moderate slopes	**L**	**M**	**M**	**H**	**H**
Unlikely	No evidence of historic soil creep and/or historic instability Steep to Moderate slopes	**L**	**L**	**L**	**M**	**H**

Appendix E – Opinion as to Land Stability

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09.07.2014

Opinion As To Land Stability

Description: Site Development

For: Jeff & Trish Pearse

I, Richard Evans, hereby confirm that:

1. I am experienced in the field of soils engineering and more particularly land and foundation stability and we are formally recognised by the Marlborough District Council. We are 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 and are described in the Engineering Report dated 09 July 2014. The following professional opinion is based on the assumption that the data obtained from these 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. Site plans and details have been prepared and the report describes the soil conditions relating to the proposed building development.

4. In my professional opinion, not to be construed as a guarantee, and having regard to the specifics of the site which have 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 assessed building area is suitable for the residential development, providing that the following recommendations described in our accompanying Engineering Report are adhered to:

   (a) Foundations for any building on the property are to be embedded a minimum of 1.0m into bedrock.

   (b) Following completion of the construction of the access track an inspection and certification by a chartered professional engineer to confirm the track has been constructed to a suitable engineering standard.

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

Richard Evans, Smart Alliances
Chartered Professional Engineer
BSc Eng Civ, CPEng, MIPENZ

Appendix F – Scala Penetrometer Test Results

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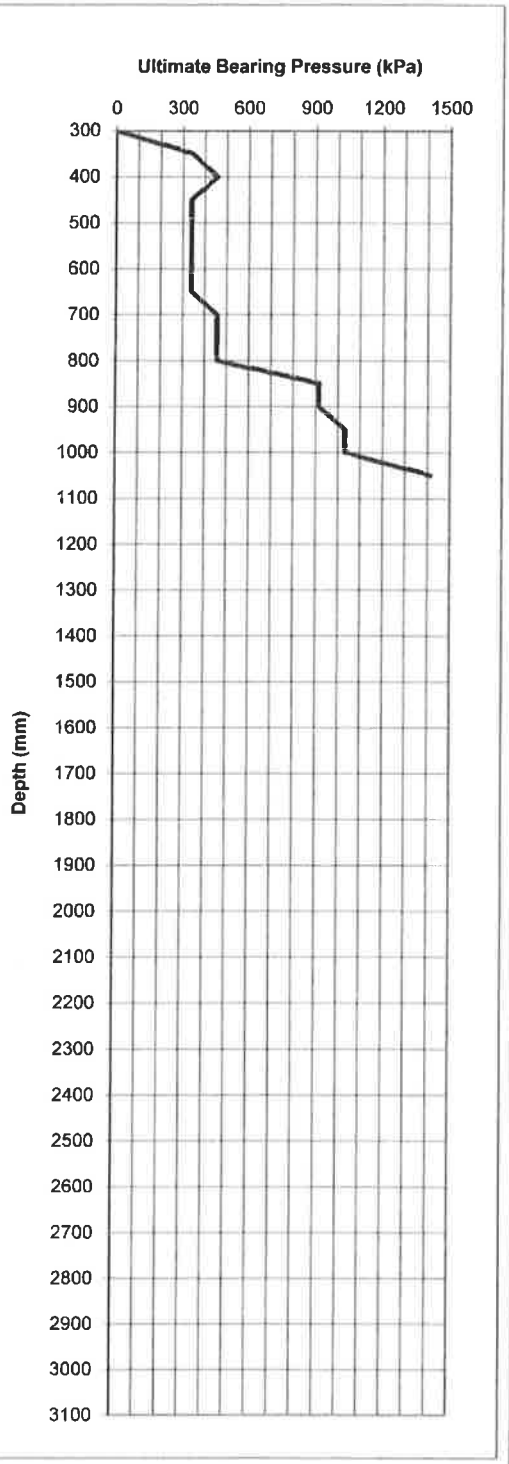
Project:	Site Development		
Client:	J & T Pearse		
Ref:	4560	Eng:	KS
Date:	9/07/2014	Sheet:	1 of 3

PENETROMETER TEST RESULTS

Notes:

No. of Blows	e (mm/blow)	Soil bearing resistance (kPa)	Depth (mm)
0	0	0	300
2	25	339	350
3	17	458	400
2	25	339	450
2	25	339	500
2	25	339	550
2	25	339	600
2	25	339	650
3	17	458	700
3	17	458	750
3	17	458	800
7	7	915	850
7	7	915	900
8	6	1031	950
8	6	1031	1000
13	4	1414	1050



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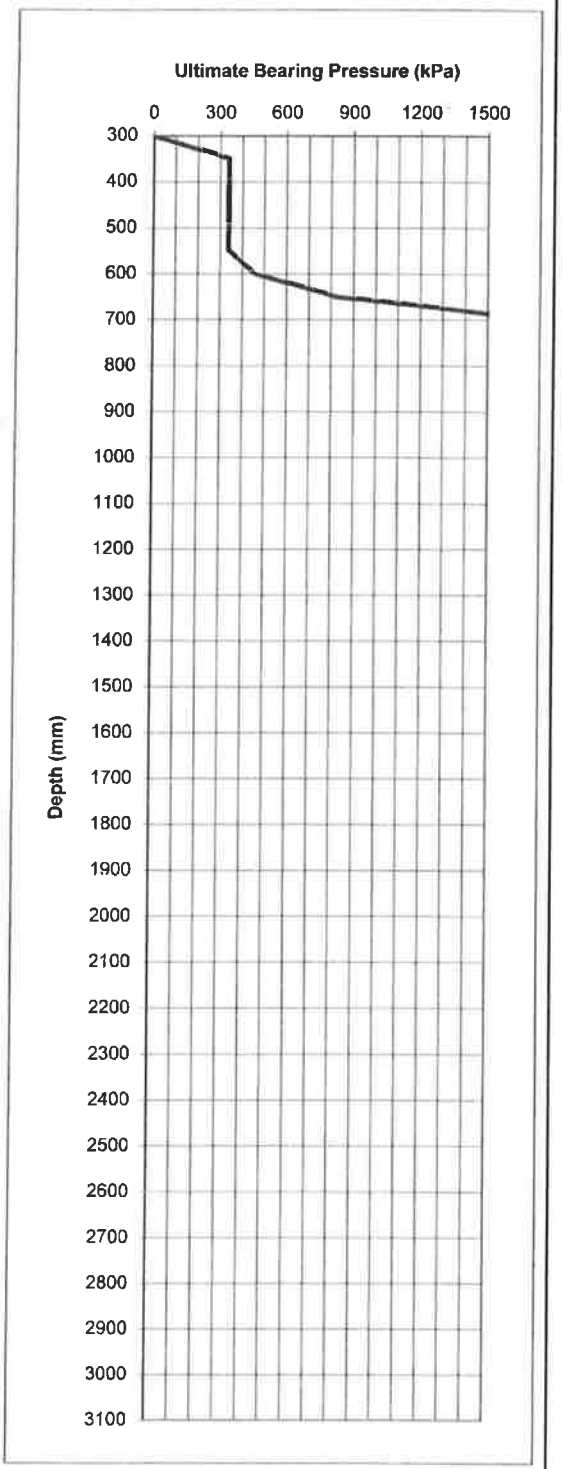
Project:	Site Development		
Client:	J & T Pearse		
Ref:	4560	Eng:	KS
Date:	9/07/2014	Sheet:	2 of 3

PENETROMETER TEST RESULTS

Notes:

No. of Blows	e (mm/blow)	Soil bearing resistance (kPa)	Depth (mm)
0	0	0	300
2	25	339	350
2	25	339	400
2	25	339	450
2	25	339	500
2	25	339	550
3	17	458	600
6	8	824	650
15	3	1769	700



Appendix G – Water Supply

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Domestic Water Supply Calculations

Client:	**J & T Pearse**	**Date:**	**09.07.14**
Project:	**Site Development**	**Engineer:**	**K.Suleiman**
Site:	**Saint Omer Bay**	**Project No:**	**4560**

Based on rainfall record at Linkwater-average rainfall **1489 mm**

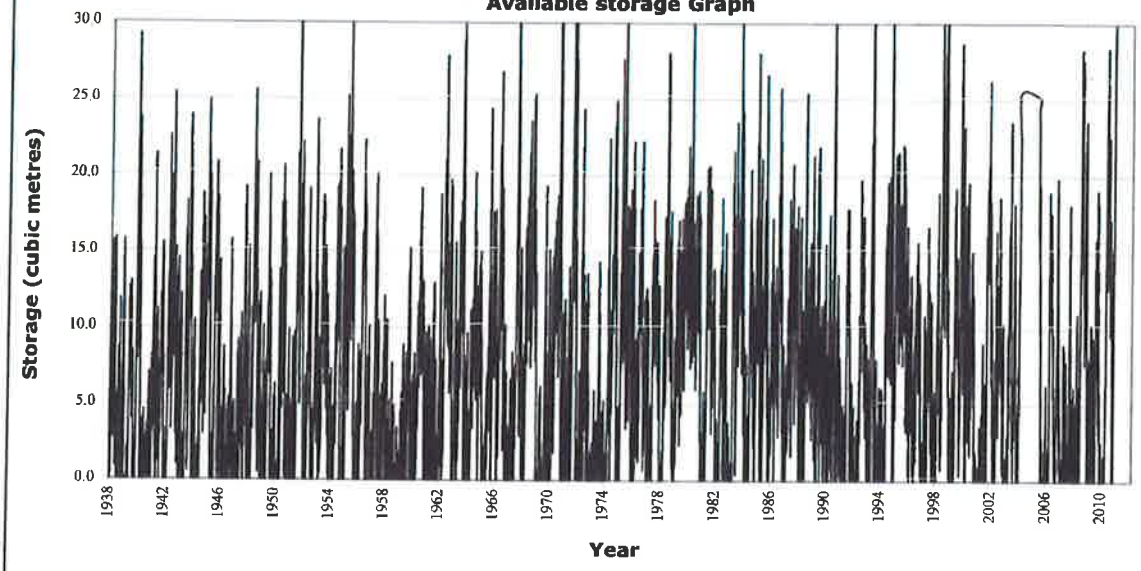
Design Variables

Actual rainfall	**1800**	mm/year
Roof area	**100**	m^2
Stream Supply	**0**	m^3/day
Assessed daily use	**990**	litres
Water short use	**495**	litres
Catch efficiency	**0.95**	
Storage volume	**30**	m^3
Water short trigger	**15**	m^3

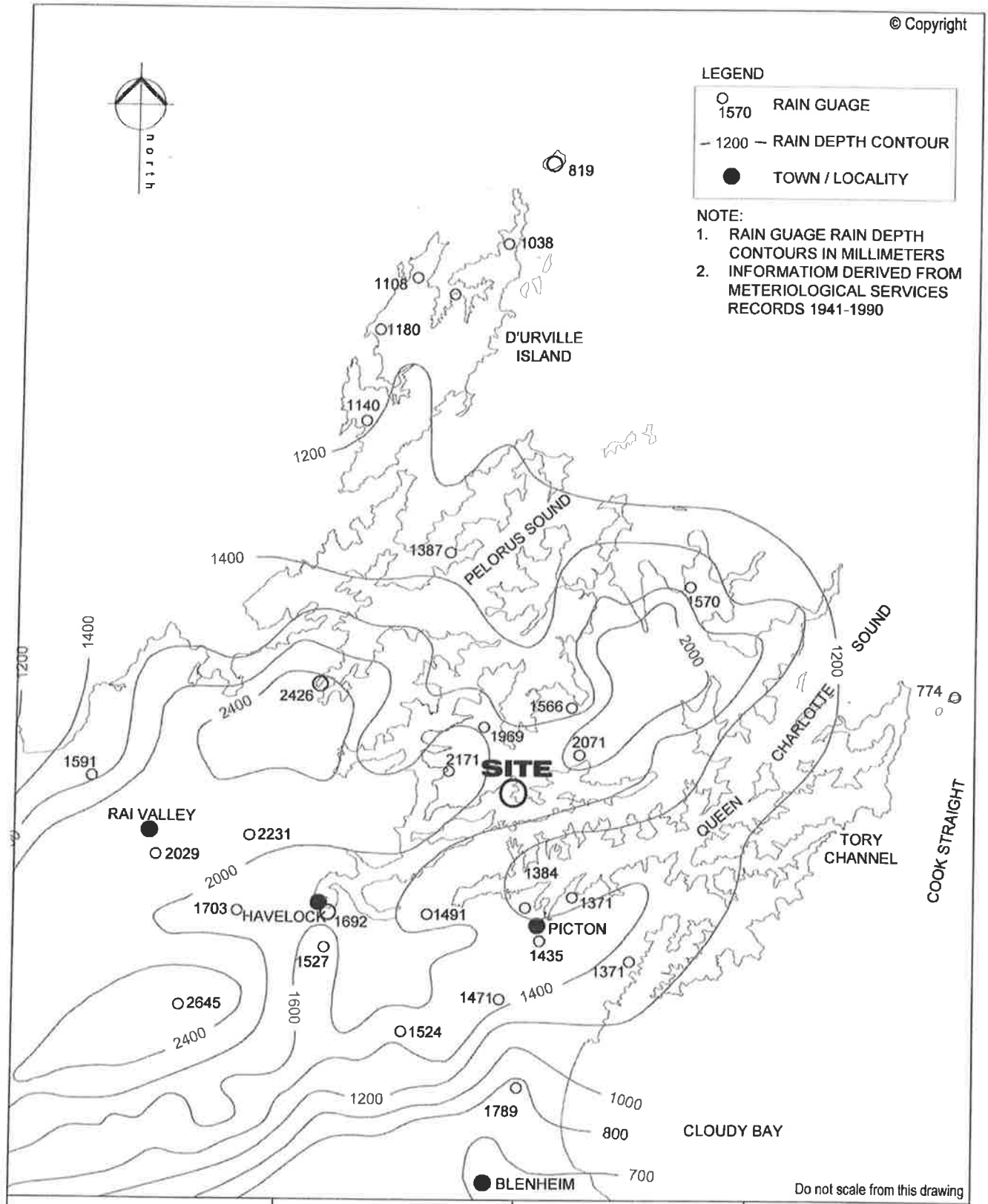
Average empty days per year	**70**
Average days per year tanks full	**1**
Average days per year water short useage	**326**
Maximum days usage without recharge	**45**

Note: Deisgn based on water shortage use at water shortage trigger volume

Available storage Graph



Notes:
This spredsheet is based on the water supply spreadsheet supplied by the Marlborough District Council. Rainfall figures have been supplied by the Marlborough District Council from 1938-2010.



REV	DATE	DETAILS

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CLIENT
J & T PEARSE

PROJECT
SITE DEVELOPMENT
SAINT OMER BAY

DRAWING
RAINFALL CONTOURS

ISSUE
REPORT

DATE	SCALE (A4)
09 JUL 14	N.T.S
DRAWN	REVISION
KL	**0**
APPROVED	DWG NO.
KS	**4560-C40**

CAD FILE REF: n:/4560