



WASTEWATER INVESTIGATION REPORT

BLACKWOOD BAY LTD
BLACKWOOD BAY

Our Ref: 25403
Date: December 2015

Our Ref: 25403

21 December 2015

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BLACKWOOD BAY LTD BLACKWOOD BAY

Contents

| | | |
|-----------|--|-----------|
| 1. | Introduction | 3 |
| 2. | Site Description | 3 |
| 3. | Investigation | 4 |
| | 3.1 Existing System (Sea Discharge) | 4 |
| | 3.2 Proposed System (Land Based) | 5 |
| 4. | Risk Assessment | 8 |
| 5. | Conclusions | 9 |
| 6. | References | 10 |
| | Appendix | 11 |

1. **INTRODUCTION**

Blackwood Bay Ltd is a holding company for seven holiday houses located in Blackwood Bay.

The wastewater from all seven houses is presently collected and treated through a primary treatment process before being discharged by gravity to the sea via an 80 m long outfall pipe to about 6 m water depth.

The current Resource Consent, U980815, is for a sea discharge of up to 7.6 m³ per day and expired on 28 February 2014. The Company has permission to continue using the sea outfall pending a proposal to explore a land based discharge.

The purpose of this report is to investigate and propose recommendations for a land based application.

Our on-site investigation included;

- a general visual inspection and a site meeting with the applicants and a contractor,
- excavation of test pits to evaluate the soil properties,
- an inspection of the existing primary treatment facilities and wastewater fixtures and flows, and
- an assessment of the potential environmental effects.

We have also inspected the original design drawings for the current system.

2. **SITE DESCRIPTION**

The property (Pt Lot 2 DP 1045) is located on the western side of Blackwood Bay and consists of south facing, moderate to steep slopes which are well vegetated with regenerating natives.

A water course bisects the property and is piped through the low lying, flat area where most of the dwellings are located, before discharging at the beach.



View from the South

3. INVESTIGATION

3.1 Existing System (Sea Discharge)

There are presently seven shareholders and a total of ten buildings or units, one of which is a boatshed.

The total number of bedrooms is 19 (equivalent to 38 persons) and all dwellings are connected to an all year round creek water supply, although careful use is required during peak occupancies in the summer.

The units have only single flush toilet cisterns and no washing machines.

Flows from showers and taps were measured in units able to be accessed and generally varied from 6.4 litres/min to 8.1 litres/min from taps, and 4.6 litres/min for the one shower tested. These are considered to be low pressure flows, corresponding to the flows from showers and basins in 'households with low water reduction fixtures' attached (Flow Allowances).

The outside tap on one unit had a flow of 11.3 litres/min, considered to be a medium pressure flow (equivalent to standard water reduction fixtures), but had flow restrictors inside.

All the waste is reticulated to a primary treatment (solids settling) system consisting of three 3,300 litres round fibreglass septic tanks (9,900 litres in total), connected in series, with a Biofilter at the outlet, flowing to a deep chamber from where it discharges by gravity to the sea through a long 111 mm diameter HDPE outfall about 80 m long to 6 m water depth.

3.2 Proposed System (Land Based)

3.2.1 Site Investigation

An investigation was carried out in accordance with AS/NZS 1547:2012 'On-Site Domestic Wastewater Management' and the Marlborough District Council 'Guidelines for New On-Site Wastewater Management Systems'. Refer to the site notes in the Appendix.

The property is large, about 5.6 Ha, but much of it is very steep and incised with watercourses and gullies, some of which have had significant land slips in the recent past. The low lying land is occupied by buildings and grassed recreational areas.

Our inspections concentrated on the side face and ridge crest areas, both east and west of the built up area in the middle of the site.

The land in the south western area of the property (areas 1 and 2 on the attached site plan) consists of a broad stable ridge which slopes generally less than 20° but steepens to 35° for a short distance in the upper slope. The vegetation consists of regenerating natives and the exposure to the sun and wind is good to moderate. A land application area (LAA) of up to 40 m wide and at least 2,000 m² is available.

In areas 3 and 4, TP3 confirmed 300 mm topsoil over a light brown, moist, firm, sandy CLAY which ribboned 60 - 70 mm (Category 5). The slope was 25 - 30° and has poor exposure to the sun and moderate exposure to the wind. The side slopes were 35 - 40° and showed signs of movement.

Test pit TP4 confirmed 200 mm topsoil over similar sandy CLAY which ribboned to the same lengths (Category 5). Some rock fragments were present and there were some large rock fragments lying on the surface. Some degraded scarps were also evident. However, the area is on a ridge feature and use of slopes less than 30° for the LAA, with reduced loading rates, is considered acceptable.

The total area available at locations 3 and 4 is estimated to be at least 1,700 m².

The land in the eastern sector (areas 5 and 6) consists of 20/25° south facing slopes which showed some signs of small degraded scarps which were less prevalent as the slope eased higher up. The vegetation was regenerating natives. The topsoil depth was 300 - 400 mm lying over a light brown, wet, soft sandy CLAY loam which ribboned 40 - 50 mm and was gritty when saturated, indicating a Category 4 soil (Test Pit 1). The available area here for a LAA was not exactly determined, but is about 30 m wide and followed the face up to about the 80 m contour level and is estimated to be at least 3,000 m².

The ridge crest just below the power pole, also in the eastern sector, was on a 10 - 15° slope lying above much steeper (unsuitable), 40 - 45° side slopes. For the record, the vegetation was similar to areas 5 and 6 and the test pit (TP2) confirmed 300 mm of topsoil over a dark brown, wet, soft gritty sandy CLAY loam which ribboned 45 - 50 mm (also a Category 4 soil).

For design purposes, we consider that a Category 5 soil is appropriate (conservative).

3.2.2 Design Flows

The water supply is from a creek and the recorded flows are less than 9 litres/min, which, at least for the showers and taps, makes the usage equivalent to 'Households with Full Water Reduction Facilities' (see attached).

If there was a requirement for front loading or low water use washing machines and 6/3 dual flush toilet cisterns in all units, the per capita flow would be 145 litres/person/day.

Given that not all water outlets were tested, we consider that, for design purposes, a flow allowance of 150 litres/person/day is reasonable, especially given that the creek runs low in the summer (when occupancies are peaking) and the water is used carefully.

We have been advised that the maximum number of residents at any one time has been recorded as 24, not 38, and that the occupancy is very intermittent, with maximum loading over the Xmas and Easter holiday periods.

We therefore consider it reasonable that the design flow be 24 people x 150 litres/person/day or 3,600 litres/day.

We recommend that a water meter be installed on the outlet to the pump to continuously record the flows and monitor water use. Additional measures, such as water restrictors, may be required if flows exceed 3,600 litres/day.

3.2.3 Land Application System

3.2.3.1 Assessment of Land Application Options

The following options were reviewed:

a) Primary Treatment to Trenches

This is the most basic system and uses the pipe work and aggregate in the trench to evenly distribute effluent onto the surface of the underlying soil which then provides further treatment before being completely assimilated.

However, the length of trenches required will be excessive/not fit within the area available and construction on the steep slopes available will be inappropriate.

b) Primary or Secondary Treatment to Bed

This system has the advantage of reducing the area requirements. However, a bed requires flat land and at least 300 m² area will be required for secondary treated effluent and there is unlikely to be that area available and also, primary treatment is preferred over secondary treatment for maintenance reasons where there is multiple ownership (primary treated effluent will require an area of 450 m²).

c) Primary Treatment to Low Pressure Effluent Distribution (LPED)

The principle of the LPED is to discharge primary effluent through a small diameter pipe nestled within a larger pipe to evenly distribute into the topsoil for evapotranspiration uptake by the vegetation covering the area.

This option is appealing given that the treatment requirements are much less onerous than a secondary treatment process and there will be sufficient land available.

f) Secondary Treatment to Drip Irrigation

The principle of the drip irrigation system is irrigation into the topsoil at a low application rate for evapotranspiration uptake by the dense bush covering the area. Use of drip irrigation will require secondary treatment.

This is an option but is not the most economical one.

The best practical option is considered to be primary treatment to LPED.

3.2.3.2 Detailed Design of Land Application System

For Category 5 soil the Design Irrigation Rate (DIR) is 2.5 mm per day. Allowing for a 20% reduction due to the slope, the DIR for design should be 2.0 mm/day.

The required irrigation field area is therefore approximately $3,600/2 = 1,800 \text{ m}^2$.

The Marlborough District Council guidelines for on-site wastewater systems (11 July 2005) recommend that on slopes greater than 15° , the line spacing should be increased to allow for potential seepage downslope.

If a line spacing of 1.5 m is allowed, a total LPED line length of $1,800/1.5 = 1,200 \text{ m}$ is required.

The preferred zone for this LPED option is in areas 1 and 2 where at least $1,800 \text{ m}^2$ is available, the slopes are less steep, the access to the field for maintenance is relatively easy and the exposure to the sun and wind is maximised.

The LPED lines will be laid over the surface around level contours and will be covered eventually with leaf litter and undergrowth.

The final location and layout of the effluent field must be confirmed by the Designer at the time of installation to ensure the best possible siting of the field.

3.2.4 Distribution

It is proposed to distribute the treated effluent to the land application field by pump dose to ensure even loading throughout the whole field.

The reserve storage capacity in the pump chamber should allow for a 36 hour power outage plus a dose load. This amounts to $1.5 \times 3,600 \text{ plus } 500 = \underline{5,900 \text{ litres total}}$.

The pump will have to allow for a 60 m static lift plus the line losses, equivalent to a duty of about 75 m at 105 litres/min.

This may require a 3 phase pump. A 3 phase pump has significantly less power demand on start-up and when running compared to a single phase pump.

3 phase power is available at the property and a soft start motor will be required to minimise the drop in voltage.

3.2.5 Treatment

The proposed LPED land application system requires only primary treatment.

The current 3 x 3,300 litre primary settling (septic) tanks have about 50% of the load entering the first tank and 50% to the third. This system will have sufficient capacity if it is configured slightly differently whereby the discharge from the second tank by passes the third so that the second and third tanks both discharge directly to the (new) 5,900 litre pump chamber.

This is based on a 13 year maximum period before removal of the scum and sludge is required, for the design flows adopted.

An effluent filter should also be placed at the outlet from the second tank.

4. RISK ASSESSMENT

The following risk assessment for the proposed land application areas follows the guidelines and recommendations in AS/NZS 1547:2012.

- Risk Reduction Measures (Table A1)

Hydraulic Failure

The risk of hydraulic failure will be reduced by good hydraulic design, the use of water conservation fixtures, and the use of pressure dosing within the LPED field to create an even distribution.

Power Failure

The proposed system will have a 36 hour reserve storage capacity at full design flow.

Bacteria Washout

The risk of bacteria washout will be mitigated by the low application rate and pressurised (even) distribution.

Dispersive Soils

The soils are not dispersive.

Marginal Soil Conditions

The soils are clays but their low drainage properties are compensated by the good topsoil depth over, good exposure to the sun and wind, good vegetation cover, little stormwater runoff to the LAA and the irrigation type system proposed.

Site Constraints

Site constraints are few but include the moderate to steep slopes. These constraints have been mitigated by using water saving fixtures and a water meter to monitor flows to the LAA.

Rainfall

The annual rainfall is greater than 1400 mm and there are high rainfall events on occasion. However, the catchment above is insignificant and runoff will be directed to the south west, not north to the LAA. Also, there is a good topsoil depth to assimilate stormwater.

Salinization

The drip irrigation areas are bush clad and not pasture and therefore salinity will not be an issue. Also, there is no groundwater table at the LAA's.

Highly permeable Soils

The soils are not free draining and there is no permanent water table.

No specific measures are therefore required to reduce the risk of water table contamination.

- Slope (Table M2)

The slopes at the LAA's are up to 30°.

We recommend a slope reduction of 20% for these slopes.

- Setback Distances (Table R2)

The setback distances have been assessed by way of a weighting analysis (see Appendix) and can be summarised as follows;

| Feature | Setback | | Comment |
|-------------------------------------|----------|--------------------------------|----------|
| | Assessed | Proposed | |
| Property Boundary | 26 m | 5.0 m to across slope boundary | No risk |
| Building/House | 4 m | 25 m | No risk |
| Surface Water | 65 m | 40 m | Low risk |
| Bore/Well | 24 m | No well | No risk |
| Recreational Areas | 9.0 m | >10 m | No risk |
| In-ground water tank | 9.5 m | No in ground tanks | No risk |
| Retaining wall cut within 3m or 45° | - | None within 3 m or 45° | No risk |
| Ground Water | 800 mm | No permanent ground water | No risk |
| Hardpan/Bedrock | 800 mm | >1.2 m | No risk |

5. CONCLUSIONS

- a) It is accepted that the present sea discharge will not be acceptable to Council and also other interested parties and that a land based on-site wastewater system is required.

- b) An investigation has confirmed that a land based system is feasible and that there will be minimal adverse effects on the environment.
- c) The system will require;
- replacing all the existing toilet cisterns with dual 6/3 litre flush units,
 - ensuring that only low water use washing machines are used (less than 90 litres/load),
 - ensuring that flows from all water outlets are less than 9 litres/min (as per current flows),
 - modifying the existing primary treatment tanks,
 - placing a new 5,900 litre minimum pump chamber with pump,
 - placing a water meter on the outlet to the pump and
 - constructing a 1,800 m² drip irrigation field on the slopes on the western side of the property.

6. **REFERENCES**

Crites, R and Tchobanoglous, A (1998). 'Small and Decentralized Wastewater Management Systems'.

ARC Environment, Technical Paper No. 58, Third Edition 'On-Site Wastewater Disposal from Households and Institutions'.

AS/NZS 1546.1:2008 'On-Site Domestic Wastewater Treatment Units, Part 1: Septic Tanks.

AS/NZS 1547:2012 'On-Site Domestic Wastewater Management'.

Marlborough District Council (11 July 2005) 'Guidelines for New On-Site Wastewater Management Systems'.

Marlborough Sounds Resource Management Plan.

Centre for Environment Training 'On-Site Wastewater Management Training Course', Christchurch 2001.

Resource Consent Approval U980815.

Application to Revalidate U980815 (U130434).

Davidson Group Ltd, October 2013, 'Wastewater Investigation Report' (preliminary).

DAVIDSON GROUP LTD



W L McGlynn

WLM:LW

APPENDIX

- A1.** Site Investigation
 - Field Assessment Report
 - Test Pit Logs
- A2.** Land Application System Design
- A3.** Set back Risk Assessment Analysis
- A4.** Drawing Numbers 25403 sheets;
 - R1 Location and Site Plans
 - R2 Details



FIELD ASSESSMENT REPORT

**Blackwood Bay Ltd
Blackwood Bay**

**Job No
Name
Date**

25403
WLM
1.10.13

REFS : 1 MDC, 11.07.05 "Guidelines for new on-site wastewater management systems"
2 AS/NZS 1547:2012 "On Site Domestic Wastewater Management"



1 Soil log (depth from surface in mm)

2 Coarse Fragments (size / abundance)

3 Ribbon Length (mm)

4 Soil Structure (Pedal Content)

5 Soil Category (1 - 6)

6 Site Exposure to - sun
- wind

7 Nearby Water Bodies ?
- Separation Distance ?

8 Nearby Wells ?
- Separation Distance ?

9 Runoff To Be Controlled ?

10 Ground Water To Be Controlled ?

11 Any Stability Considerations ?

12 Depth to Water Table

13 Vegetation Cover Existing ?
- Proposed ?

14 Gravity Head to Proposed Disposal Field

15 Existing Systems Nearby - type
- proximity
- perform'ce

16 Reserve Area Available ?

17 Intended Water Supply

18 Power Available?

19 Other Comments ?

| Test Pit No. | | | | | |
|--|---|-----------|--|------------|---|
| 1 | | 2 | | 3 & 4 | |
| 300 | Topsoil | 300 | Topsoil | 200 300 | Topsoil TP4 TP3 |
| 400 | Light brown, wet, soft, sandy CLAY loam | 400 | Dark brown, wet, soft, gritty, sandy CLAY loam | 500 | Light brown, moist, firm, sandy CLAY (some rock fragments present in TP4) |
| none | | some grit | | occasional | |
| 40-50 | | 45-50 | | 60-70 | |
| high | | high | | high | |
| 4 | | 4 | | 5/5 | |
| poor | | | | | |
| moderate | | | | | |
| sea/watercourses | | | | | |
| 30 | | | | | |
| no | | | | | |
| no, if LAA located on crests as proposed. | | | | | |
| no | | | | | |
| not if slopes less than 30° | | | | | |
| na | | | | | |
| young regenerating natives | | | | | |
| young regenerating natives | | | | | |
| no | | | | | |
| septic/sea (will be discontinued if land based proceeds) | | | | | |
| minimal | | | | | |
| creek | | | | | |
| yes | | | | | |
| will suit irrigation LAA and with limited reserve area, secondary treatment. | | | | | |

FLOW ALLOWANCES
REFERENCES : ARC IP # 58 Third Edition

- 2 AS/NZS 1547:2012 "On Site Domestic Wastewater Management"
- 3 ON-SITE NewZ Special Report - 97/1
- 4 MDC, 11 July 2005, "Guidelines for New On -Site Wastewater Systems"

| | Appliance / Fixture per Capita Daily Flow Allowance | | | | Total per Capita Flow (l/p/d) |
|--|--|------------------|--|------------------------------------|-------------------------------|
| | Toilet | Washing Machine | Shower | Basin (kitchen, bathroom, laundry) | |
| 1 Households with standard fixtures | 11 litre cistern | >120 litres/load | <i>flows > 14 litres/min</i> | | 200 <i>180</i> |
| | 60 <i>60</i> | 25 <i>25</i> | 85 <i>70</i> | 30 <i>25</i> | |
| 2 Households with standard water reduction fixtures | 11/5.5 dual flush | <120 litres/load | <i>flows < 14 litres/min (may need shower flow restrictors or aerator taps)</i> | | 165 <i>145</i> |
| | 40 <i>40</i> | 20 <i>20</i> | 80 <i>65</i> | 25 <i>20</i> | |
| 3 Households with full water reduction facilities | 6/3 dual flush | <90 l/load | <i>flows < 9 litres/min (may need aerator taps and flow/pressure control valves on all outlets)</i> | | 145 <i>120</i> |
| | 35 <i>35</i> | 15 <i>15</i> | 75 <i>55</i> | 20 <i>15</i> | |
| for design, assume (see report) | 35 | 15 | 80 | 20 | 150 |
| Design wastewater flow per person per day | | | | | 150 |
| Number of Bedrooms | | | | | |
| Equivalent Occupancy (see report) | | | | | 24 |
| Design Daily Wastewater Allowance | | | | | 3600 |
| NOTES 1 Add 5 l/p/d for a bath | | | | | |
| 2 Figures in <i>italics</i> are for roof water supply. Other values are for creek, community and/or bore water supply (see also Note 6, Table H3, 1547). | | | | | |



On Site Wastewater Design
Client Blackwood Bay Ltd
Location Blackwood Bay

Job No 25403
Sheet No 3
Name WLM
Date 16.12.15

LPED DESIGN

| | | | | | | |
|---------------------|----------------------------|--|----------------------------------|-----------------|----------------------------------|---------|
| 1 | Design Basis | Soil Category | 5 | | | |
| | | DIR | 2.5 | 20% % reduction | 2.00 mm/day | |
| | | Minimum land application area (A)= Q/DIR | | | 1800.0 m ² | |
| | | Let wetted width (WW) = | | | 1.5 m | |
| | | Total length of LPED required (L) = A/WW | | | 1200.0 m | |
| | | No. of subfields | | | 12 | |
| | | Lateral | NB | Greenline MDPE | 32.0 | |
| | | | | | ID | 26.9 mm |
| | | | | | max length | 17.5 m |
| | | | | | hole dia | 3.5 mm |
| | | | | | hole centres | 2.0 m |
| | | | | | head req'd at end | 2.0 m |
| | | Submain | NB | | 32.0 | LDPE |
| | | | | | ID | 31.0 mm |
| | | | | | max length | 30 m |
| | | | | | elevation head (-ve if downhill) | 13.0 m |
| | | Rising Main | NB | Greenline MDPE | 50.0 | |
| | | | | | ID | 43.8 mm |
| max length | 90 m | | | | | |
| | | | elevation head | 47 m | | |
| | Sequencing Valve | | | | | |
| | Type | | 6600.0 | | | |
| | Min. Flow rate to activate | | 38 | litres/min. | | |
| 2 | Design Subfield | Flow variation | 2.7% | OK, <5% | | |
| | | Head variation | 6% | OK, <10% | | |
| | | Ideal dose vol | 568.3 | litres | | |
| | | Let dose vol be | 500.0 | litres | | |
| | | No. of doses / day at full daily flow | 7.2 | | | |
| | | System head losses | Head at end of lateral | | 2.0 | m |
| | | | Line losses in lateral | | 0.6 | m |
| | | | Line loss in submain | | 5.6 | m |
| | | | Elevation head along submain | | 13.0 | m |
| | | | Sequencing Valve | 6600x2 | 4.0 | m |
| | | | Line loss along rising main | | 3.2 | m |
| | | | Elevation head along rising main | | 47.0 | m |
| Loss thru bends etc | | 1.0 | m | | | |
| Total Head Losses | | 76.4 | m | | | |
| 3 | Pump Details | Total Head, includes cham depth of | 2 | | | |
| | | at Max Flow | 79 | m | | |
| | | | 105 | litres/min. | | |
| 4 | Check Sequencing Valve | Min flow | 38 | litres/min. | | |
| | | Flow | 105 | litres/min. | | |
| | | | OK, >min flow | | | |

SETBACK RISK ASSESSMENT

re : AS/NZS 1547:2012, TABLE R1 (Weighted Assessment)

Blackwood Bay Ltd

Blackwood Bay

Job No

25403

Name

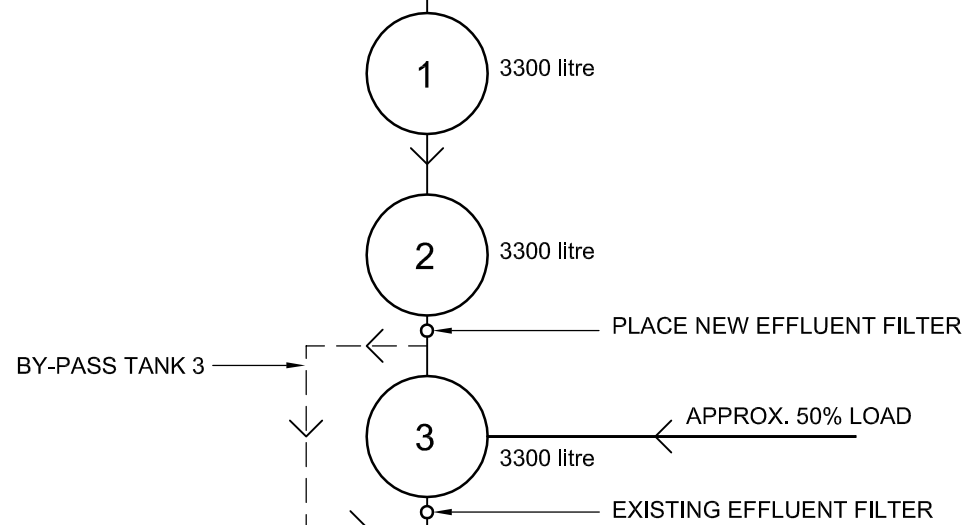
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Date

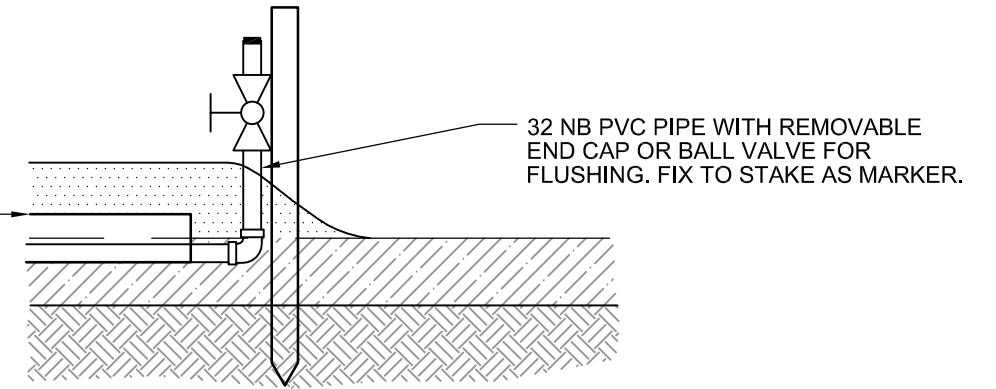
Dec 15

| SITE FEATURE | SETBACK(m) | | SITE CONSTR ITEM | SCORE (0,1 or 2) low-best high-worst | WEIGHTED SETBACK (m) | COMMENTS |
|---|------------|-------|------------------|--|----------------------|--|
| | min | max | | | | |
| Property | 1.5 | 50.0 | A | 2 | | The effluent is primary treated |
| Boundary | | | D | 1 | | > 30% , some risk of off site export but no erosion risk |
| | | | J | 0 | | drip type irrigation method |
| | | | TOTAL | 3 | 25.8 | |
| Building/ houses | 2.0 | 6.0 | A | 2 | | The effluent is primary treated |
| | | | D | 1 | | > 30% , some risk of off site export but no erosion risk |
| | | | J | 0 | | drip type irrigation method |
| | | | TOTAL | 3 | 4.0 | |
| Surface water | 15.0 | 100.0 | A | 2 | | The effluent is primary treated |
| | | | B | 2 | | Cat 5 soil. The sea is about 40 m away, downgradient |
| | | | D | 1 | | > 30% , some risk of off site export but no erosion risk |
| | | | E | 1 | | No private property bdy downhill but the sea is downgradient |
| | | | F | 1 | | Cat 5 soil but no seepage or groundwater, low pollution haz |
| | | | G | 0 | | No flooding risk |
| | | | J | 0 | | drip type irrigation method |
| | | | TOTAL | 7 | 65.0 | |
| Bore, well | 15.0 | 50.0 | A | 2 | | The effluent is primary treated |
| | | | C | 0 | | Cat 5 soil and no groundwater |
| | | | H | 0 | | Cat 5 soil, low porosity soils, no groundwater, v low groundwater pollution risk |
| | | | J | 0 | | drip type irrigation method |
| | | | TOTAL | 2 | 23.8 | |
| Recreatnl areas | 3 | 15 | A | 2 | | The effluent is primary treated |
| | | | E | 1 | | No private property bdy downhill but the sea is downgradient |
| | | | J | 0 | | drip type irrigation method |
| | | | TOTAL | 3 | 9.0 | |
| In-ground water tank | 4 | 15 | A | 2 | | The effluent is primary treated |
| | | | E | 1 | | No private property bdy downhill but the sea is downgradient |
| | | | J | 0 | | drip type irrigation method |
| | | | TOTAL | 3 | 9.5 | |
| Ret. wall, embankm, escarpmt, cuttings | 3 or > 45° | | D | | | > 30% , some risk of off site export but no erosion risk |
| | | | G | | | No flooding risk |
| | | | H | | | Cat 5 soil, low porosity soils, no groundwater, v low groundwater pollution risk |
| | | | | | | nothing within 3 m |
| Ground water | 0.6 | 1.5 | A | 2 | | The effluent is primary treated |
| | | | C | 0 | | Cat 5 soil and no groundwater |
| | | | F | 1 | | Cat 5 soil but no seepage or groundwater, low pollution haz |
| | | | H | 0 | | Cat 5 soil, low porosity soils, no groundwater, v low groundwater pollution risk |
| | | | I | 0 | | Side slope, no concentration of surface waters, small catchment above |
| | | | J | 0 | | drip type irrigation method |
| | | | TOTAL | 3 | 0.8 | |
| Hardpan, bedrock | 0.5 | 1.5 | A | 2 | | The effluent is primary treated |
| | | | C | 0 | | Cat 5 soil and no groundwater |
| | | | J | 0 | | drip type irrigation method |
| | | | TOTAL | 2 | 0.8 | |

APPROX. 50% LOAD

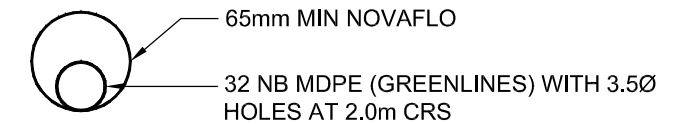


65mmØ NOVAFLO LAID FLAT



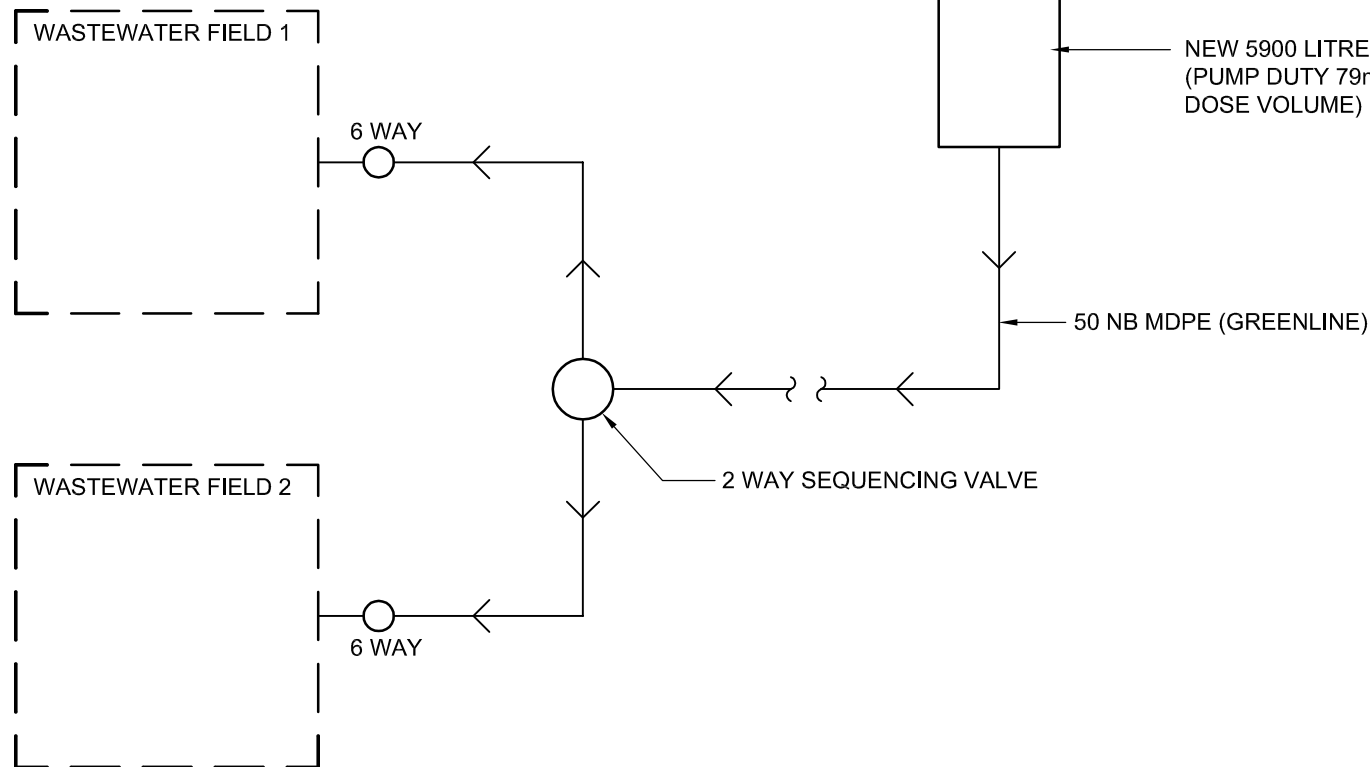
LPED END DETAIL

1:10



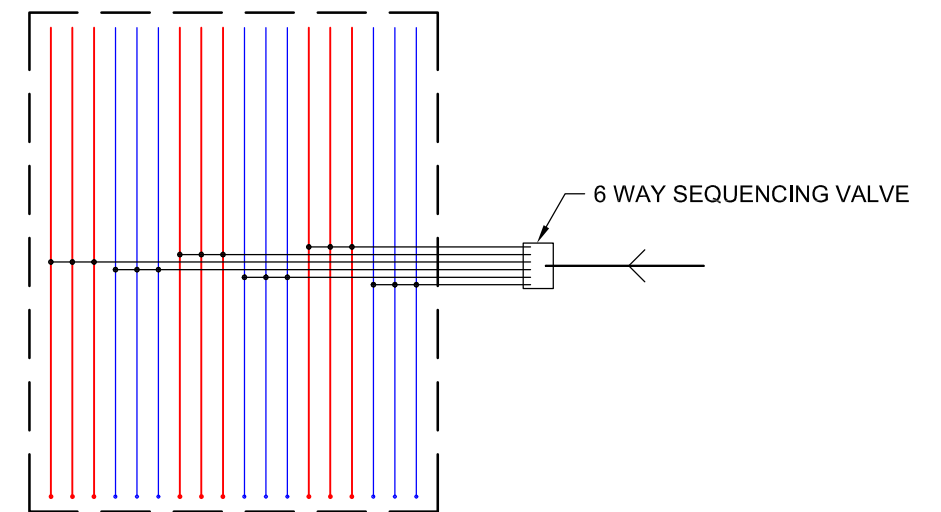
DISTRIBUTION DRAIN

1:5



DIAGRAMATIC LAYOUT

NTS



TYPICAL WASTE WATER FIELD LAYOUT

1:5



PROJECT PLANNERS
RESOURCE MANAGERS
CIVIL & STRUCTURAL ENGINEERS
BUILDING DESIGNERS
ENVIRONMENTAL ENGINEERS

Davidson Ayson House, 4 Nelson St
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E: service@DavidsonGroup.co.nz
W: DavidsonGroup.co.nz



BLACKWOOD BAY LTD
BLACKWOOD BAY, QCS.
WASTEWATER INVESTIGATION

waste water field layout and details

| | | | | |
|----------|---------------|-------------|-------|-------|
| DATE | ORIGINAL SIZE | DRAWING No. | SHEET | ISSUE |
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| DES L.M. | DRN M.S. | CK | REF | |

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