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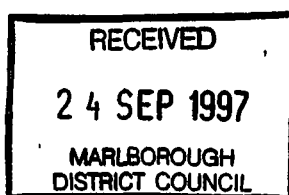
**WORSELDINE & WELLS (1994) LTD**

23 September 1997

Marlborough District Council  
P O Box 443  
**BLLENHEIM**

**FAXED**

**Attention: Mr Gavin Cooper**



Dear Sir,

**RE: Bulwer Lodge, Effluent Field**

The design of the field has been carried out by an engineer, Mr D Kirk, (B.E. Natural Resources) under the supervision of Mr R Gibson (B.E. Registered Engineer). Site observation has been carried out by Mr R Gibson.

We have inspected the effluent field area beneath the pine trees and scrub to the south east of the lodge. The area consists of a broad spur and bluff set back from the coast which appears stable. There was no noticeable ground movement, cracks or distortion of tree growth. Effluent loadings are based on 10 mm per day which should be able to be transpired and evaporated without adverse effect to land stability. We consider the effluent field area a more stable area and that the application of effluent will not lead to any instability.

Yours faithfully

R Gibson

**Worseldine & Wells (1994) Ltd**

DIRECTORS: R.W.L. WELLS BE MIPENZ REGISTERED ENGINEER • B.D. SHAW NZCE REA ASSOC IPENZ MIHT  
CONSULTANT: M.J.B. WORSELDINE BE FIPENZ MIHT REGISTERED ENGINEER

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APPROX EDGE OF GULLY.

EXISTING UNIT TO BE REMOVED.

PROPOSED UNIT.

NEW SEWER LINE TO CONNECT INTO EXISTING

10,000

SMALL CREEK.

EXISTING HOUSE.

Blackwater.  
Grey.

Existing 3000l Specific.

Rising Sewer to Effluent Field on Bluffs.

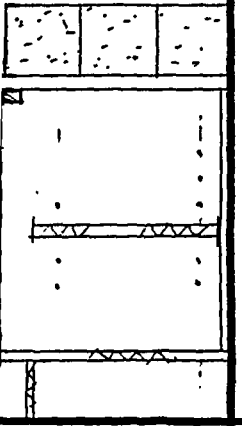
New Homes (2) 5000l.

STORMWATER.

SEWER

EXISTING BOAT SHED

640 BENCH TOP.



80 540

DRY

Worseldine & Wells (1994) Ltd.  
28 Nile Street  
Nelson  
Ph. 03 548-8259

LAYOUT PLAN. AMENDED BY WORSELDINE & WELLS 400.  
29/9/97. RBG.

SCALE: 1:50

UGH SOUNDS



**WORSELDINE & WELLS (1994) LTD**

Ref. 6917-1

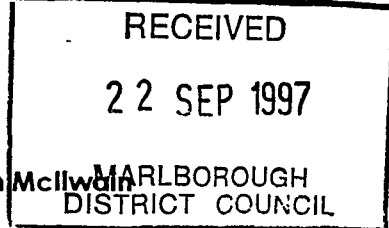
16 September 1997

Marlborough District Council

PO Box 443

**BLenheim**

**ATTENTION: Mr John McIlwain**



Dear Sir,

**RE: Bulwer Lodge Wastewater System Upgrade - Design Report**

Please find enclosed a report outlining the proposed system upgrade for wastewater treatment at Bulwer Lodge.

A description of the treatment and disposal circuit is supplied, along with the design basis of the system.

I trust the necessary information is at hand to enable an assessment to be made of the proposal, relevant to the approval sought for development to proceed by our client, proprietor Bill Ford.

Should you require further details, please do not hesitate to contact me.

Yours faithfully

D Kirk

**WORSELDINE & WELLS (1994) LTD**



**WORSELDINE & WELLS LTD**  
CONSULTING CIVIL & STRUCTURAL ENGINEERS

**Bulwer Lodge  
Wastewater  
System Upgrade**

**Design Report**

**Job No. 6917  
September 1997**

**Prepared by: Worseldine & Wells (1994) Ltd  
26 Nile Street, Nelson  
Phone (03) 548 8259**

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## **Bulwer Lodge Wastewater System Upgrade**

### **Design Report**

#### **Executive Summary**

Upon request, a wastewater treatment and disposal system has been designed for Bulwer Lodge. The system services a maximum population of 25 persons, with a design flow of 4,500 ℓ/day.

The treatment circuit utilises an existing 3,000 ℓ tank with two additional Humes Ecotanks to follow in series. Wastewater streams are separated at source, such that the greywater is diverted directly to the second tank of the circuit. This creates a digestive series of tanks with enhanced levels of treatment.

The effluent is then pumped to a disposal field amid forestry and dense undergrowth at an elevated site, 200 m from the tanks. The distribution of effluent is by way of a shallow-buried LPED network to enable even loading on the soil at a design LTAR of 10 mm/day.

Provision has been made for the event of pump failure, by way of an overflow capacity of 1,800 ℓ incorporated into the last tank.

#### **1.0 Introduction**

Worseldine & Wells (1994) Ltd have been requested to develop a system design for the on-site treatment and disposal of wastewater for Bulwer Lodge.

This task coincides with the construction of a new accommodation unit. The upgraded system is designed to handle the wastewater generated by all of the accommodation present on-site.

The following report outlines the current situation of wastewater management, a description of the proposed system upgrade and the design basis for this new system.

## **2.0 Site Description**

Bulwer Lodge is situated near Port Ligar on the mainland of the north-west reaches of the Marlborough Sounds. The geology is predominantly composed of greywacke/ argillite, with soils of moderate drainage.

Site population extends from 2 persons (proprietors) during much of the year up to an expected maximum of 25 persons during peak periods.

### **2.1 Existing Waste Water System**

At present all greywater has been directed to discharge into an adjacent creek.

The blackwater passes through a septic tank of capacity 3,000 ℓ, with the effluent then drained for disposal at the beach front.

Both waste streams are presently receiving inadequate levels of contaminant removal prior to re-entering the water cycle. A need therefore exists to install a system that provides both sufficient treatment and a method of disposal appropriate to ensuring that there is no adverse effect on receiving waters.

### **3.0 Proposed System Upgrade**

A preference of the system upgrade is to incorporate the existing tank into the treatment circuit. This is so as to comply with the further demand that the designed system remain as cost-effective as is possible, without compromise of treatment standard.

The designed system will cater for the expected maximum population, with inclusion of the new units, of 25 persons.

This will require additional tank volume to enable adequate retention time of the wastewater to allow for enhanced settling and reduction of the organic load.

A digestive system involving a series of tanks in which greywater bypasses the first existing tank is deemed suitable for this situation.

The effluent shall then be transported by pump to an elevated site for disposal. An area to the east of the tank, covered in pine trees with areas of dense undergrowth, has been identified as ideal for this purpose.

The flow shall be released by way of intermittent dose through a shallow-buried Low Pressure Effluent Distribution (LPED) system.

#### 4.0 Design Of Upgraded System

##### 4.1 Loadings

Number of persons serviced,	$N_p = 25$
Per capita design flow,	$Q = 180 \text{ } \ell/\text{cap}/\text{day}$ (Gunn, 1994)
Design flow,	$Q \text{ design} = 4,500 \text{ } \ell/\text{day}$

##### 4.2 Size Of Tanks

Existing tank	$V_1 = 3,000 \text{ } \ell$
---------------	-----------------------------

Most appropriate system to fit with constraint of utilising existing tank component is a digestive series of tanks.

For 25 persons,	$Q \text{ design} = 4,500 \text{ } \ell/\text{day}$
-----------------	---

The following tank volumes are recommended to achieve effluent of a high standard - arrived at by interpolation of given volumes in TP 58 (Gunn, 1994). Values are:

Tank 1 (blackwater)	$V_1 = 2,700 \text{ } \ell$
Tank 2 (greywater)	$V_2 = 4,500 \text{ } \ell$
Tank 3 (laundry)	$V_3 = 1,800 \text{ } \ell$

#### 4.2.1 Separation Of Waste Streams

Diversion of the greywater flow directly to the second tank prevents mixing waste flows that vary significantly in quality.

In particular, it prevents the disturbance of treatment processes taking place within the low flow/high waste content blackwater, such as breakdown of volatile solids by anaerobic organisms.

The designed system does not propose to separate the laundry flows from the greywater component. Extra tank compartments and enhanced aerobic treatment surfaces shall be utilised to achieve effluent of a comparable standard to those in which the laundry load enters at a later stage.

#### 4.2.2 Extra Provisions In Tank Volumes

The effluent is to be lifted by pump to the disposal site. Some provision may therefore be incorporated into the tank system for the following:

- pump chamber
- overflow storage capacity in the event of pump failure or power cut.

#### 4.2.3 Recommended Tank System

The following set-up is suggested (refer fig, Appendix 1)

Tank 1 (receives blackwater)	Existing tank	$V = 3,000 \ell$
Tank 2 (receives greywater plus Tank 1 overflow)	Humes RD5000 (standard)	$V_{2A} = 2,700 \ell$ $V_{2B} = 1,800 \ell$
Tank 3	Humes RD5000 (modified)	$V_{3A} = 1,800 \ell$ $V_{3B} = 600 \ell$ pump chamber



Selection of a Norlings BP3 centrifugal pump unit gives design parameters of:

$$H_{\text{design}} = 17.5$$

$$Q_{\text{design}} = 175 \text{ l/min}$$

System can support  $175/1.45 = 120$  squirt holes. Choose 90 holes for design.

#### 4.3.2 Disposal Field Design

Soil type = Category 4, moderate drainage

$$\text{Design LTAR areal loading} = 10 \text{ mm/day (Gunn, 1994)}$$

$$\text{Required area of disposal field} = \frac{4,500 \text{ l/day}}{10 \text{ l/m}^2/\text{day}}$$

$$= 450 \text{ m}^2$$

$$\text{Spacing between disposal laterals} = 2.0 \text{ m}$$

$$\text{Length of disposal field} = \frac{450}{2}$$

$$= 225 \text{ m}$$

$$\text{Spacing of holes} = 225/90$$

$$= 2.5 \text{ m}$$

Maximum length of a 40 mm diameter lateral is 86 m (Innoflow).

Choose 3 laterals at 75 m each, to follow the contour of the land.

$$\text{No. of holes per lateral} = 75/2.5 - 1$$

$$= 29$$

$$\text{Diameter of squirt holes} = 3 \text{ mm}$$

PVC pressure pipe laterals  $\varnothing$  40 mm Class B to lay inside  $\varnothing$ 110 mm Nova Flow.

Refer to figures 3 and 4 of Appendix One.

## 5.0 Effects On The Environment

The proposed system has been designed to achieve a high standard of wastewater treatment, able to provide effluent of a quality that can be safely released to the environment without significant adverse effect on receiving waters.

The recommendations of TP58 have been adhered to, so as to provide adequate retention time of waste flows to obtain acceptable reduction efficiencies of the major contaminant concentrations present in the flow.

There is considerable fluctuation of the population contributing to the system over the year, however a system designed to service an expected maximum of 25 persons sets the constraint of sizing. This is to ensure that effluent quality is at no time compromised, due to an overloaded system (Gunn, 1994).

### 5.1 Treatment Quality

As described in section 3.0, the system proposes to separate waste flows of varying quality, such that a digestive series of tanks is utilised.

Sufficient tank volume is given with a blackwater to greywater ratio of 3,000 ℓ : 6,300 ℓ. This is comparable to values recommended by Gunn, although this design combines laundry flow to enter at the second stage. This practice presents no foreseeable impact on treatment processes, as adequate provision has been made to compensate, by way of compartmentation and increased bacterial treatment surfaces.

The greywater passes through three compartments in the circuit with capacities 2,700 ℓ : 1,800 ℓ : 1,800 ℓ. The use of compartments will enhance the settling of solids, with the first used to take the incoming flow surge and the latter two providing calm conditions for optimum settling.

Further provision to obtaining high quality treatment is given by the use of plastic mesh in the last two compartments. This provides a greater surface area for bacteria to undertake their function in reducing the organic loading of the system.

Rock filters positioned in Tank 2 and Tank 3 provide a means to remove gross solids that have been carried over and to trap oil and grease.

The overall treatment efficiency of this system is expected to be in line with that of a digestive tank under average operation.

The effluent quality parameters of the proposed design are therefore expected to be within the following range: (Gunn, 1994)

BOD <sub>5</sub>	Biological Oxygen Demands	=	60 - 100 mg/L
SS	Suspended Solids	=	40 - 50 mg/L

## 5.2 Disposal

The effluent is to be pumped to an elevated site, 150 - 200 m distance from the tanks. The site is vegetated in self-sown pine forest with areas of dense undergrowth, and the soil is expected to display moderate drainage characteristics. This area is considered well suited for the use of LPED technology as an appropriate means of disposal.

LPED technology with dosed loading ensures an even distribution of effluent over the treatment area. This avoids the problem of 'creeping' failure experienced by a trickle-fed network.

A soil loading rate of 15 mm/day is used as a conservative value for a moderately draining, category 4 soil (Gunn, 1994). For design purposes, a 10 mm/day loading rate shall be used, to allow for application close to the surface on sloping land.

The LPED disposal field will consist of three discharge laterals, each of length 75 m, following the contour of the land (refer fig 3 and fig 4, Appendix One) spacing between laterals is 2 m.

The number of laterals in use at any one time is able to vary, enabling a degree of flexibility to rest the various treatment areas. This is a sustainability measure that will extend the life of the disposal field considerably.

At design levels of operation all three laterals are in use. Table 5.2 gives variations in loading rate with respect to contributing population and number of laterals in use.

**Table 5.2**

No. of laterals in use	LTAR (mm/day)	No. of persons
1	3.2	2
	10	6
2	5.6	7
	10	12
	(15)	(25)
3	5.2	13
	10	25

The release of effluent to the designated area will allow further treatment of contaminants through treatment processes in the soil and nutrient uptake by surrounding vegetation.

### 5.3 Mitigation Measures

#### 5.3.1 Pump Failure

The use of a pump to despatch effluent to a suitable disposal site requires some provision to be made should the pump fail.

This requires additional overflow capacity to be included in the tank circuit.

Tank 3 of the designed circuit has an overflow weir from the pumping chamber to divert flow to a storage volume, with capacity 1,800 ℓ. This would allow around 5 hours to remedy the problem during flows of the peak period.

## 6.0 Conclusion

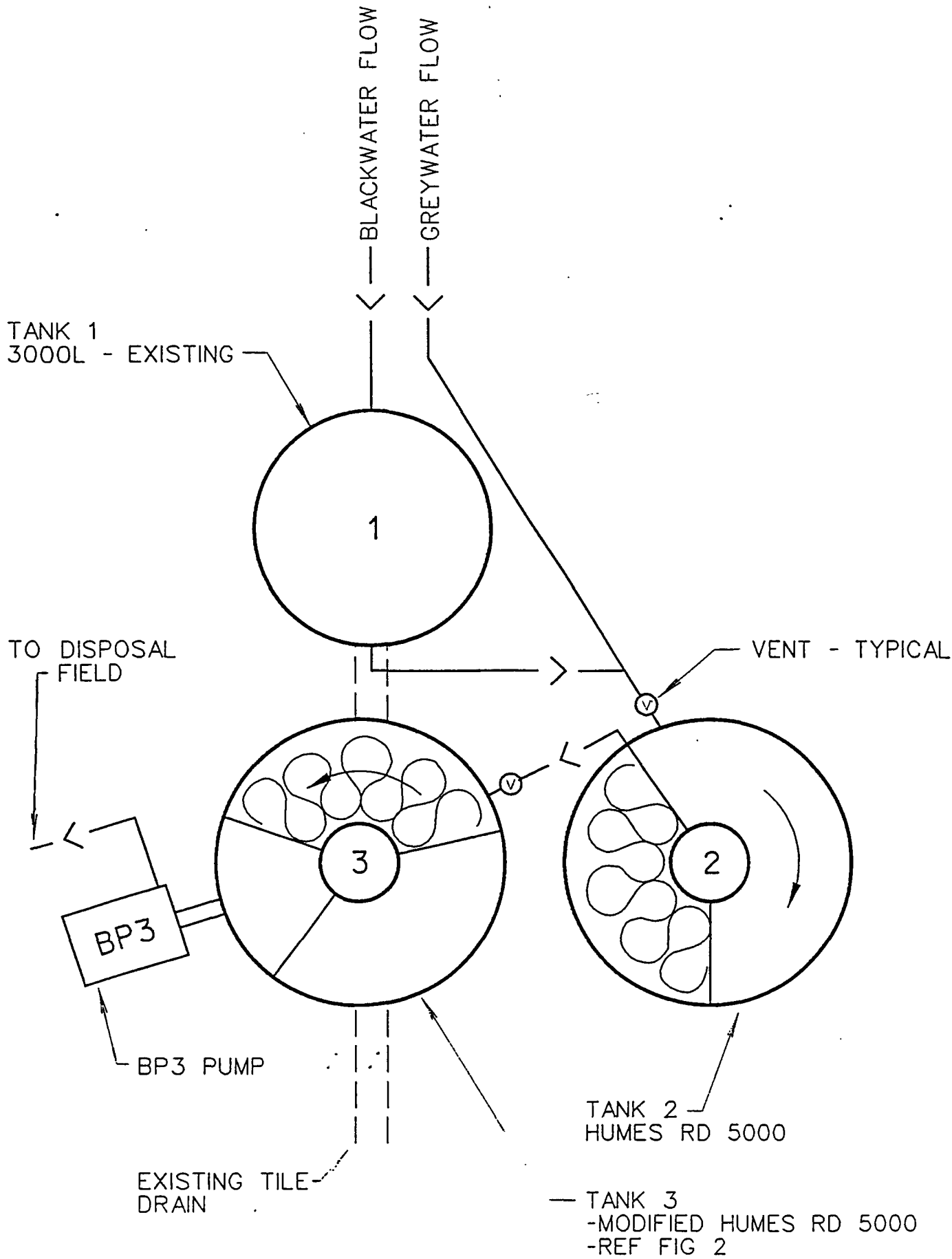
A system suitable to adequately treat wastewater flows from dwellings present at Bulwer Lodge, has been outlined in the preceding report.

This entails a digestive series of tanks with sufficient retention of flows to lower levels of contaminant content, such that the effluent is suitable for discharge to the environment.

## Reference

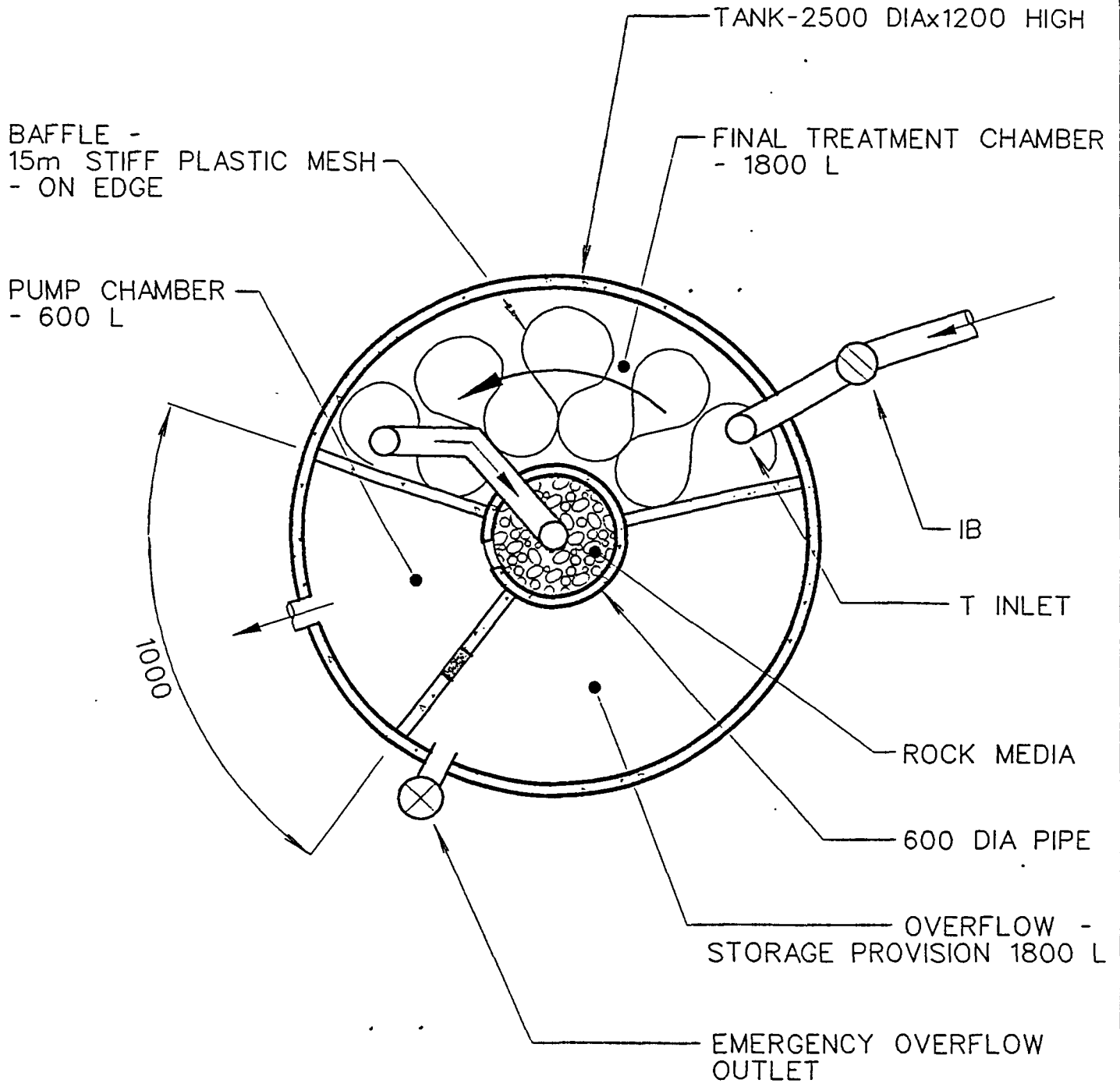
- Gunn, I (1994)      On-site wastewater disposal from households and institutions,  
TP58, ARC
- Innoflow, (1997),      LPED design, Innoflow Technologies Ltd

**Appendix 1**



TANK LAYOUT  
SCHEMATIC

FIG 1  
NOT TO SCALE



- \* OUTLET TO PUMP 50 DIA CENTRED AT HEIGHT 150 FROM BOTTOM OF TANK
- \* PUMP DOSE VOLUME SET TO 350 L BY FLOAT SWITCH CONTROL.
- \* INVERT OF OVERFLOW WEIRS AND EMERGENCY OUTLET SET AT HEIGHT 900mm

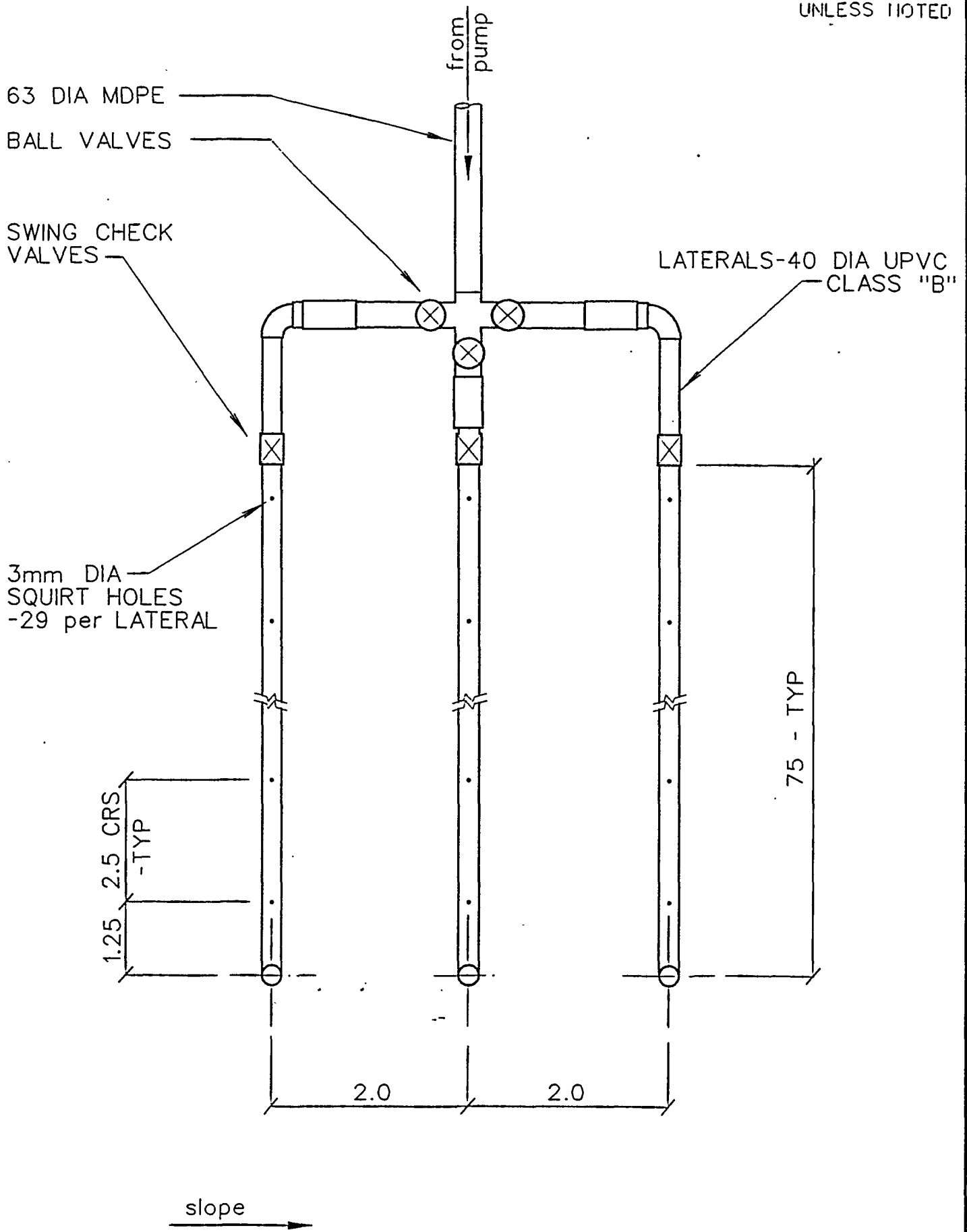
TANK 3 - DETAIL

SCHEMATIC

FIG 2

NOT TO SCALE

NOTE:- DIMENSIONS ARE IN METRES UNLESS NOTED

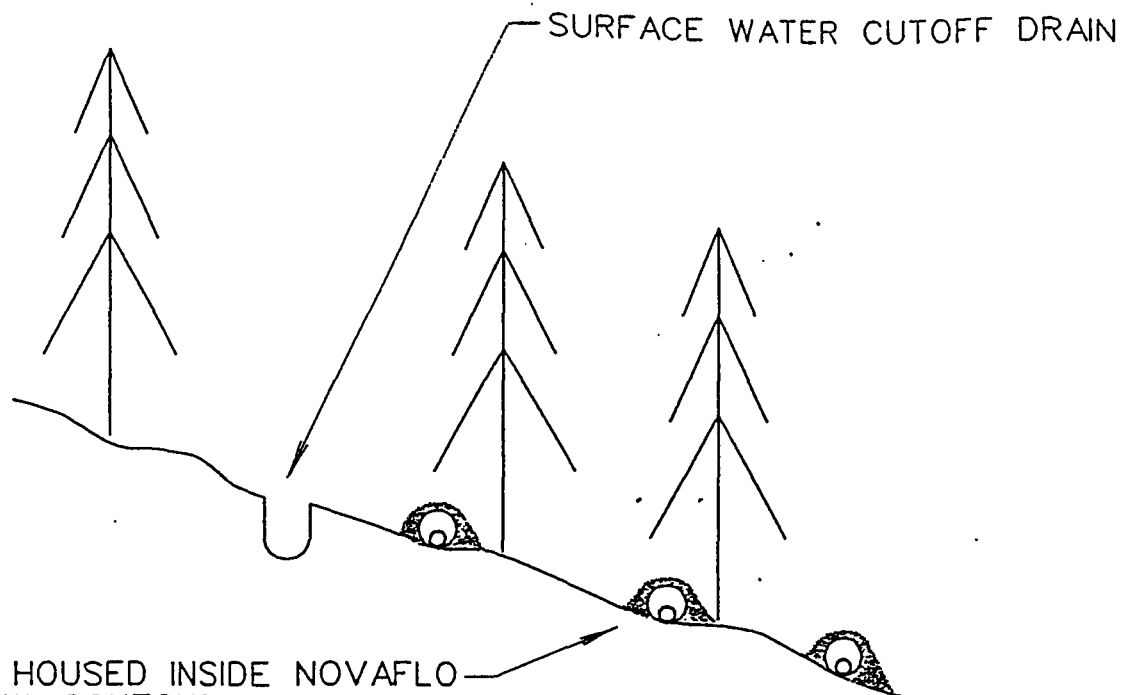


LPED DISPOSAL FIELD

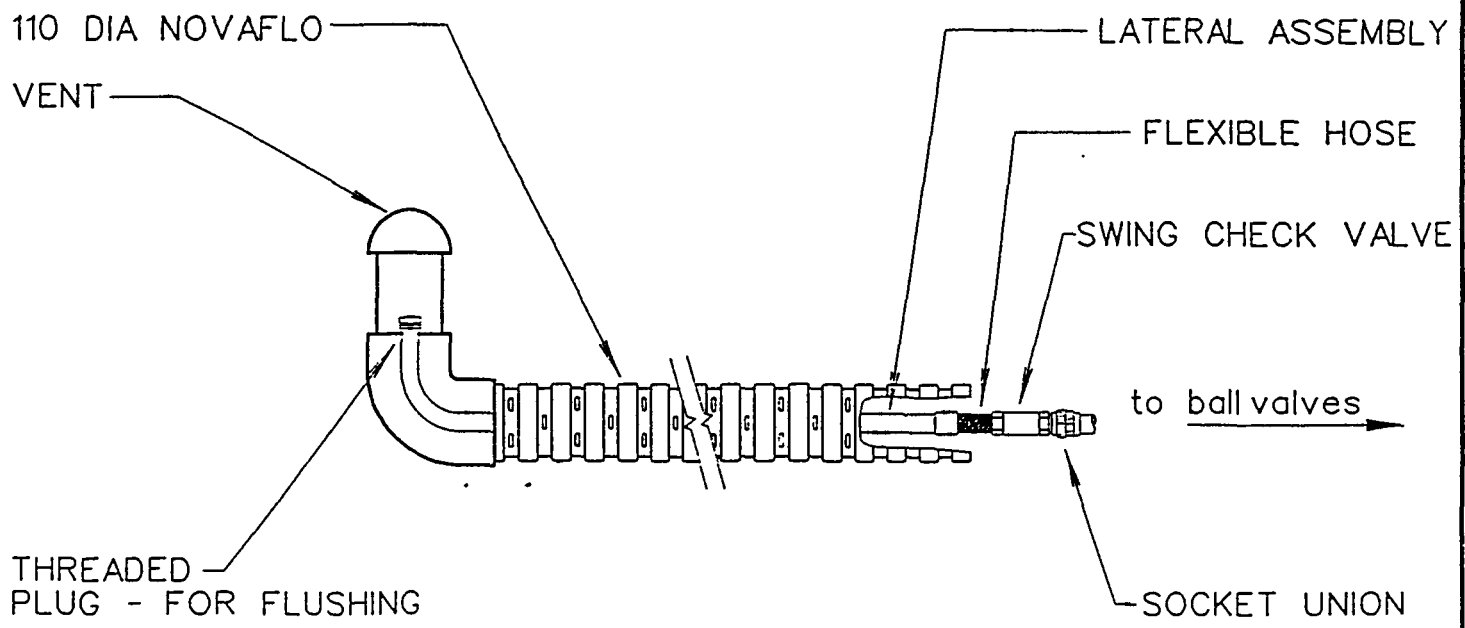
SCHEMATIC

FIG 3

NOT TO SCALE



UPVC PIPE HOUSED INSIDE NOVAFLO  
 -TO FOLLOW CONTOUR  
 NOVAFLO PINNED TO GROUND  
 AND SHALLOW BURIED WITH BARK



NOTE:- FLOW CONTROL ORIFICE PLATES TO BE HOUSED IN SIDE SOCKET UNION ONCE IN POSITION

LPED DETAIL & SECTION  
 SCHEMATIC

FIG 4  
 NOT TO SCALE