

On-site Wastewater Treatment System Environment Discharge Performance Appraisal

For the Biolytix BF6 2500 PAT



Prepared by:

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Disclaimer

Testing reported in this document is in relation to the concentration of environmental parameters in the on-site wastewater treatment systems discharge.

No testing was performed on the integrity, capacity or durability of this system. For such information refer to AS/NZS 1546.1:1998 or AS/NZS 1546.3:2001 for aerated wastewater treatment plants as a product standard for conventional septic tanks constructed in either pre-cast concrete, cast in-situ concrete, reinforced cement mortar, glass fibre reinforced plastic and polyolefin plastic. The general requirements deal with capacities, durability of materials, design, fittings, marking and installation.

For further information refer to:

- AS/NZS 1546.1:1998 – On-site domestic wastewater treatment units Part 1: Septic tanks.
- AS/NZS 1547:2000 – On-site domestic wastewater management.
- AS/NZS 1546.3:2001 – On-site domestic wastewater treatment units Part 3: Aerated wastewater treatment systems.

Summary

After a short stabilisation period, the Biolytix wastewater treatment system model BF6 2500 PAT influent and effluent was monitored over a 96 day test period to ascertain the parameters total nitrogen, biochemical oxygen demand, and total suspended solids.

Effluent discharged from the system over a 96 day testing period was found to comply with Environment Bay of Plenty's five day biochemical oxygen demand and total suspended solid discharge standards as a permitted activity, as specified in rules 11 and 12 of the On-site Effluent Treatment Regional Plan 2006.

It can therefore be installed in the Bay of Plenty in all regions except the Rotorua Lakes' catchments. The system did not meet total nitrogen minimum standard for the Rotorua Lakes' catchments and Environment Waikato's total nitrogen minimum standard for the Taupo catchment.

One outstanding aspect of this system was its low electricity usage. It used as little as 5% or less of the electricity of some other systems measured.

Contents

Disclaimer	i
Summary	iii
1 System information	1
2 System specifications.....	1
3 Testing regime	1
4 Test Results	2
4.1 Nitrogen Test Results.....	2
4.2 BOD ₅ , Faecal Coliform and TSS Test Results	3
4.3 Other results	4
5 Compliance Statement.....	5
6 Compliance Standard.....	5
Appendices	7
Appendix I – Electricity Consumption	9

1 System information

System Name/Model: Biolytix BF6 2500 PAT

Manufacturer: Biolytix Technologies Pty Ltd Australia
PO Box 591, Maleny, QLD 4552, Australia

Supplier: Biolytix Technologies Pty Ltd New Zealand
(contact Antony Willemse)

Address: 16 Rochester Crescent, Rolleston 7614
Phone: (03) 3473450 or 0800 700818
Fax: (03) 3473451
E-mail: willemse@paradise.co.nz or Antonyw@biolytix.com

2 System specifications (according to manufacturer)

Supplier	System	Treatment		Technology	Effluent Quality		
		Flow ¹ (l/day)	Tanks Operating Capacity(l)		BOD (g/m ³)	SS (g/m ³)	TN (g/m ³)
Biolytix Technologies	BF6 2500 PAT	1600	2500	Passive, Macro/Micro Organism, Aerated	<14	<14	28 typical

Notes:

- 1 Long Term Acceptance Rate (LTAR) 1600 l/day
- 2 4 day peak capacity = 2150 litres

3 Testing regime

Untreated wastewater from Rotorua City's Eastside sewer is screened, before passing into a header tank from which influent is delivered to systems in equal quantities. Influent is pumped to the system twice daily by a positive displacement pump operating from a single variable drive. Loading regime is approximately 1.0 m³/day/system with two thirds of the load delivered between 6.00 am and 11.00 am every morning and the balance between 6.00 pm and 9.00 pm at night. This pumping regime is designed to simulate average household usage.

Effluent from each system was collected in a 20 litre container from which grab samples were taken between 7.00 am and 11.00 am. Sampling occurred every six days, ensuring sampling occurred on a different day of the week.

Samples were analysed for pH, alkalinity, total nitrogen (TN), ammonium-nitrogen (NH₄-N), nitrate-nitrogen (NO₃-N), nitrite-nitrogen (NO₂-N), total phosphorus (TP), dissolved reactive phosphorus (DRP). Additional analyses of carbonaceous oxygen demand (CBOD₅), total suspended solids (TSS) and faecal coliforms (FC) were done on the consecutive daily sampling events. Analysis was performed by the Rotorua District Council Environmental Laboratory (IANZ accredited) in accordance with "Standard Methods for the Examination of Waste Water", APHA, AWWA, WPCF.

Temperature of effluent was measured in the outflow collection drums. The drums are filled intermittently depending upon the individual system characteristics. As 1000 litres of influent is introduced to each system over the course of a day, the 20 litre containers are periodically flushed as treated effluent is discharged.

4 Test Results

Testing of the Biolytix Wastewater Treatment System BF6 2500 PAT occurred from 23 January 2006 to 2 September 2006 at Rotorua City's Eastside sewage plant. The weeks below refer to the number of weeks from when the effluent feed to the plant began on 23 January 2006.

4.1 Nitrogen Test Results

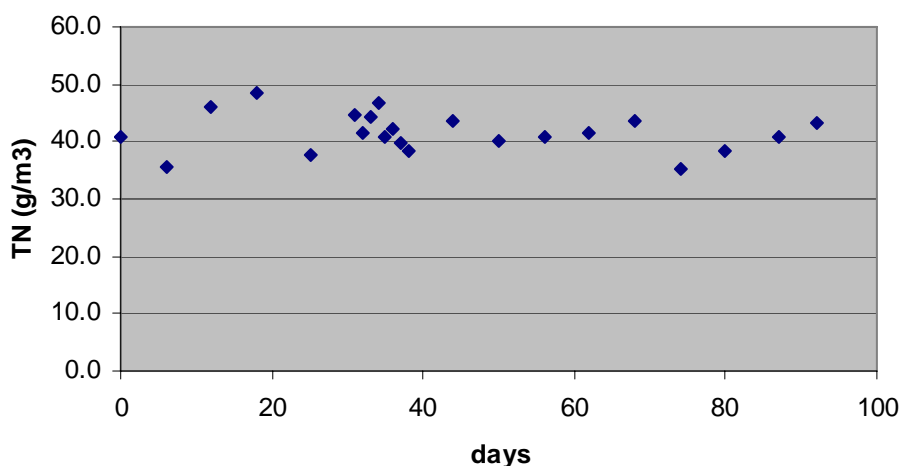
Nitrogen test results are based on data from sampling every six days over a 96 day period. The 96 day period generally starts after the system has settled in (after a maximum period of six months). However in this case the 96 day period began after 4 months.

Table 1 displays total nitrogen influent and effluent results for the 96 day test period. Based on the average of the 96 day test period results, the system reduced nitrogen by 45%.

Table 1 Summary of Total Nitrogen results over 96 day test period.

Date	Influent (gm ⁻³)	Effluent (gm ⁻³)	Parameter	Influent (gm ⁻³)	Effluent (gm ⁻³)
27-May-06	56.7	40.8	n	23	23
2-Jun-06	59.5	35.5	mean	75.2	41.5
8-Jun-06	83.4	45.9	median	78.0	41.1
14-Jun-06	91.8	48.6	SD	16.3	3.3
21-Jun-06	68.7	37.5	Max	98.3	48.6
27-Jun-06	76.9	44.7	Min	34.6	35.2
28-Jun-06	89.4	41.4	lower quartile	60.9	39.9
29-Jun-06	93.9	44.4	upper quartile	89.2	43.6
30-Jun-06	86.1	46.7			
1-Jul-06	98.3	40.7			
2-Jul-06	54.9	42.3			
3-Jul-06	78.0	39.7			
4-Jul-06	74.6	38.5			
10-Jul-06	92.2	43.7			
16-Jul-06	34.6	40.1			
22-Jul-06	62.4	40.7			
28-Jul-06	56.9	41.5			
3-Aug-06	65.2	43.6			
9-Aug-06	95.4	35.2			
15-Aug-06	58.6	38.5			
22-Aug-06	79.5	41.0			
27-Aug-06	89.1	43.1			
2-Sep-06	82.9	41.1			
Average	75.2	41.5			
Reduction	45%				

Figure 1 Total nitrogen results over 96 day test period - Biolytix



4.2 BOD₅, Faecal Coliform and TSS Test Results

Three one week (7 day) duration tests periods at week 5, 13 and 22 were delineated for testing five day biochemical oxygen demand ((c)BOD₅), total suspended solids (TSS), faecal coliforms (FC) and TN.

Table 2 Average Influent and Effluent results over seven days for weeks 5, 13 and 22.

Influent	CBOD ₅ (gm ⁻³)	FC cfu/100mls	TSS (gm ⁻³)	TN (gm ⁻³)
Wk 5	326	16983333	409	94
Wk 13	236	8248333	269	76
Wk 22	241	6830000	371	82
Effluent				
Wk 5	4.4	532857	4.3	41
Wk 13	5.8	75500	4.0	37
Wk 22	6.3	463333	4.8	42

Effluent	CBOD ₅ (gm ⁻³)	FC cfu/100mls	TSS (gm ⁻³)
Mean	5.5	366474	4.4
Median	4.5	360000	4.0
SD	3.2	287378	1.8
n	20.0	19	20
Maximum	14.0	1000000	7.7
Minimum	2.0	7000	1.6
Upper Quartile	8.0	495000	5.5
Lower Quartile	3.0	140000	2.8

4.3 Other results

Table 3 Statistics for nutrient data over the 96 day test period.

Effluent	DRP (gm^{-3})	TP (gm^{-3})	NO ₃ -N (gm^{-3})	NO ₂ -N (gm^{-3})	NH ₄ -N (gm^{-3})
Mean	7.3	8.1	27.9	0.11	11.8
Median	7.4	7.9	27.8	0.10	12.5
SD	0.8	0.8	3.7	0.04	2.7
n	23	23	23	23	23
Maximum	8.7	9.6	35.6	0.19	16.4
Minimum	5.0	6.5	20.6	0.03	6.4
Upper Quartile	7.7	8.6	30.2	0.13	13.7
Lower Quartile	6.8	7.7	24.6	0.09	9.7

5 Compliance Statement

The Biolytix wastewater treatment system model BF6 2500 PAT met the performance requirements for effluent discharge quality as a permitted activity within Bay of Plenty Region, not including the Rotorua Lakes' catchments. It did not meet the nitrogen limit set by Environment Waikato for the Taupo catchment, but may be installed elsewhere in the Waikato.

Over a 96 day test period total nitrogen was reduced on average by 45 percent to an average of 41.5g/m³. This is well above the permitted maximum for nitrogen of 15g/m³ for within the Rotorua Lakes' catchments, and 25g/m³ for the Taupo catchment.

CBOD₅ and TSS maximum results were both well below Environment Bay of Plenty permitted maximums of 30 gm⁻³ and 45 gm⁻³ respectively.

The compliance statement relates only to the particular model described above, and on the basis that the key specifications are the same as those in the model tested.

6 Compliance Standard

The performance standard for on-site wastewater treatment systems are based on the rules stated in Environment Bay of Plenty's Operative On-site Effluent Treatment Regional Plan 2006. Relevant rules for new advanced systems in the Bay of Plenty are numbered 12 and 13.

For discharges from on-site effluent treatment systems located within the Rotorua Lakes Catchments to be a permitted activity the effluent quality, after a maximum settling in period of six months, must not exceed:

- a total nitrogen (TN) level of 15 grams per cubic metre as nitrogen;
- 30 grams per cubic metre of BOD₅;
- 45 grams per cubic metre of suspended solids; and
- prior to discharge to the dispersal system.

For installations outside the Rotorua Lakes' catchments the nitrogen limit does not apply.

For queries about this report please contact:

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Appendices

Appendix 1Electricity Consumption

Appendix I – Electricity Consumption

Electricity consumption by the Biolytix wastewater treatment system model BF6-2500-PAT averaged 0.2 kWh per day over the trial period. This is significantly less than any other system trialled and represents substantial savings in operating costs over the life of the system.

When comparing electricity use in the table below note that only some systems included irrigation pumps. Typically electricity use for irrigation pumps in 'real life' situations is around 0.5 to 1.0 kWh per 1000 litres. This will vary depending on pump efficiency, difference in elevation, distance to irrigation, pipe size etc. During the trial the irrigation pumps used less power than typical because of the low head requirement.

Electricity usage by the irrigation pumps in the systems trialled varied from about 100W up to about 600W per day.

The following chart lists the power consumption of the systems which have completed testing at the Rotorua trial facility so far.

Average Electricity Consumption (kWh per day) based on approximately 1000 litres* wastewater per day

	Irrigation pump included in test?	Power use (measured kWh)
Biolytix BF6 2500-PAT	Yes	0.2
Devan Blue 9000	Yes	6.3
Hynds Lifestyle	Yes	1.7
Oasis 2000	Yes	7.3
Orenco (AdvanTex) AX20	No	0.6
Smith and Loveless (FAST)	No	7.2
Supertreat SB440 (N12)	Yes	10.8

* Note: 1000 litres is approximately what is generated by a typical five person family. This includes waste from showers, washing machines, sinks, dishwashers and toilets.