PERFORMANCE TESTING OF ON-SITE DOMESTIC WASTEWATER TREATMENT UNITS – THE ON-SITE EFFLUENT TREATMENT NATIONAL TESTING PROGRAMME

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ABSTRACT

The OSET NTP (On-site Effluent Treatment National Testing Programme) is a SWANS-SIG initiative which has evaluated the performance of 21 treatment units in Trials 3 to 8 (2007 to 2013) via a nine month testing programme in each trial. Of the 17 systems currently available commercially, all systems met the 90% performance requirements of AS/NZS 1547:2012 for biochemical oxygen demand (BOD_5) and total suspended solids (TSS), but only 47% achieved 100% for both parameters. Benchmarking of 16 test results from Weeks 23 to 35 of the test programme for five chemical parameters, faecal coliforms and average daily energy use shows the relative performance for all treatment systems. These results enable a comparison of overall performance rating, treatment process stability, aeration effectiveness, nitrogen reduction and energy consumption. The ongoing success of the OSET NTP will depend on more council Funding Partners joining up to contribute grants towards management and auditing costs.

KEYWORDS

On-site wastewater, treatment performance, effluent quality testing, benchmarking

1 INTRODUCTION

The On-Site Effluent Treatment National Testing Programme (OSET NTP) was set up during 2008 based on the OSET Testing Facility (TestFac) at the Rotorua City wastewater treatment plant (WTP). Its genesis was the nitrogen reduction testing programme established in 2005 by Bay of Plenty Regional Council (BOPRC) in association with Waikato Regional Council (WRC) and Rotorua District Council (RDC) to performance test household domestic wastewater treatment plants (OSET units) for installation in the Rotorua Lakes and Lake Taupo catchments. BOPRC had set a requirement for total nitrogen (TN) discharges from on-site wastewater systems serving development around the Rotorua Lakes at $15g/m^3$ TN and WRC had a similar requirement for lakeside development around Lake Taupo, but at the limit of $25g/m^3$ TN.

The objective of the BOPRC/WRC/RDC testing programme was to verify claims from manufacturers/suppliers re the nitrogen reduction capability of their OSET units. With over 35 companies marketing such units throughout NZ and with many of these claiming to meet or better the nitrogen reduction targets of BOPRC and WRC, both regional councils were concerned that approved systems should verify their performance via a 9 month testing trial at the TestFac set up for this purpose at the RDC WTP.

SWANS-SIG (the Small Wastewater and Natural Systems Special Interest Group of Water NZ) had meanwhile been looking at nationwide performance of OSET systems and noted concerns expressed by several regional councils regarding the treatment performance levels and hardware integrity of OSET systems. As a first step toward improving these matters SWANS-SIG approached BOPRC and RDC with a proposal to adapt and utilise the Rotorua TestFac for a national testing programme. This recognised that secondary treatment systems and dripline land application was being widely adopted nationwide to replace septic tank and soakage trench systems for rural residential subdivisions, and that the performance capability of treatment systems was based only on manufacturers claims.

Rather than concentrate testing on just the nitrogen reduction capability of OSET units the OSET NTP was set up to assess treatment performance against the secondary treatment requirements of AS/NZS 1547:2012 *On-site*

domestic wastewater management and to benchmark treatment capability for five chemical and one bacteriological parameter plus energy use. The intention is to provide a performance rating for OSET units that can assist councils and consumers to better understand the treatment capabilities of systems currently on the market.

2 ORGANISATION AND FUNDING

2.1 ESTABLISHMENT

SWANS-SIG has a membership involving engineers, scientists, planners, lawyers, manufacturers, researchers and regulators specialising in wastewater management, and as a professional association interest group has no source of funds. To set up a grass roots testing programme required negotiations with the Ministry for the Environment, the Water Managers Group of Water NZ (representing local authorities), BOPRC and RDC. Establishment funding grants were obtained from the first three agencies, with RDC, based on experience with the initial nitrogen testing platforms for Trials 1 and 2 in 2005 through to 2007, investing a substantial sum in upgrading the OSET TestFac to improve the operational and testing systems. The 2007/2008 nitrogen reduction Trial 3 was undertaken at the upgraded facility and provided far greater consistency and reliability in the testing outcomes than Trials 1 and 2.

OSET NTP establishment funding in 2008 was used to produce (via consultants) a set of testing procedures for approval by SWANS-SIG, with the first trial under OSET NTP operations in 2008/2009 being Trial 4. SWANS-SIG also used 2008 to establish a Memorandum of Understanding (MoU) between Water NZ, BOPRC, RDC and SWANS-SIG. Each MoU partner provides a representative on the Partners Advisory Group (MoU-PAG) which meets annually to review OSET NTP activities and approve budgets. Operational oversight is provided by SWANS-MAG, the management and audit group set up by SWANS-SIG to oversee the work of the team responsible for day to day operations and to undertake auditing and reporting of testing results. Figure 1 sets out the organisational structure of the OSET NTP

2.2 FUNDING

Income to operate the OSET NTP comes from testing fees from Trial participating companies plus grants from council Funding Partners.

The testing fee for manufacturers/suppliers submitting their ex-factory OSET units for benchmarking at the Rotorua TestFac covers site rental and power costs plus laboratory testing with a small portion contributing to management and auditing costs. The bulk of management and auditing is covered by council Funding Partner grants. BOPRC and RDC have been the key Funding Partners since inception with cash and/or support in kind via staff time allocations. Grant payments at $5,000 (regional council), $3,000 (unitary council) and $1,500 (district council) have provided the funds to cover management and auditing costs. During 2009 to 2013 some eleven to thirteen councils have joined BOPRC and RDC in annual support. However, the funding grant base is fragile. The current level of grants support nominal payments for technical management and honoraria to the independent members of SWANS-MAG.

The ongoing success of the OSET NTP is very much dependant on the voluntary component of the contribution of the team involved in management and audit, and additional council Funding Partner support is urgently needed to maintain current operational activity and ongoing development of the testing programme. In return for their support Funding Partners receive copies of all testing reports along with a comparative results review for each Trial. This comparative results review is restricted to council Funding Partners only, and aggregates the results of the test reports on each individual OSET unit in a Trial into a single report.

The value for Funding Partner councils from the set of test reports and the comparative results overview is that judgments can be made on treatment process stability to set alongside the benchmark performance ratings for individual units. The OSET NTP testing covers 9 months late spring through summer, autumn and into mid-winter, and offers a unique view of seasonal performance under warm and cold conditions. For a council consenting officer, the treatment unit stability as shown by seasonal performance variations can provide guidance on the extent of maintenance inspections and effluent quality checks which may need to be set under consent conditions for discharges from a specific treatment unit.

3 TESTING PROGRAMME

3.1 PERFORMANCE AND INTEGRITY TESTING

Three strands of testing are undertaken by the OSET NTP. Figure 2 summarises the overall OSET NTP testing and auditing process.

Strand 1 ex-factory unit trials are undertaken at the Rotorua TestFac. The occupied test platforms pictured in Figure 3 show uninsulated units. Units are now fully insulated to represent installation in the ground. Trials 4 (2008/2009) to 8 (2012/2013) under OSET NTP management and audit have had 17 units tested.

A Strand 2 field testing pilot study is underway during 2014 in Canterbury to evaluate testing protocols and establish the required number of test results needed for field test performance verification for a specific treatment unit which already holds benchmark certification and rating. Field performance testing of ten Oasis Clearwater OSET systems certified under Trial 3 (2007/2008) involves sampling and testing each system on four occasions at three month intervals.

Strand 3 product integrity testing requires an Australian certification authority visit and assessment, and to date no NZ company has sought such certification. However, some systems marketed in NZ from Australian suppliers already have Australian certification as has one NZ company marketing in Australia.

3.2 TESTING PROCEDURE

The Strand 1 AS/NZS 1547 and benchmark testing programme runs for 9 months from October in year 1 to July in year 2. Each OSET unit receives 1,000L/day of screened raw domestic wastewater in two doses of 500L spread over 4 hours, with varying incremental amounts to mimic household daily wastewater outputs.

The testing timeline for Trial 8 (2012/2013) is set out in Figure 4. Following the settling in period Weeks 1 to 8, test sampling commences Week 9 with samples at six day intervals for Weeks 9 to 35. From Week 36 a high load trial comprising 5 days at 2,000L/day returning to 1,000L/day in Week 37 is used to evaluation high load effects on the treatment system for the final 3 weeks. The timeline shows the 12 physical and chemical characteristics along with bacteriological quality (faecal coliforms – FC) being tested. Energy use in operating aeration devices and a final effluent pump (to replicate the dosing of a drip irrigation line) is recorded.

4 TESTING OBJECTIVES

4.1 AS/NZS 1547:2012 EFFLUENT QUALITY PERFORMANCE REQUIREMENTS

The test results for Weeks 9 to 35 are used to evaluate the biochemical oxygen demand (BOD_5) and total suspended solids (TSS) effluent quality in achieving the secondary treatment performance requirements of AS/NZS 1547:2012. These requirements are that:

- *When sampled and tested for biochemical oxygen demand (BOD_5) 90% of samples shall have a BOD_5 of less than or equal to 20 g/m^3 with no sample greater than 30 g/m^3.*
- *When sampled and tested for total suspended solids (TSS) 90% of samples shall have a TSS of less than or equal to 30 g/m^3 with no sample greater than 45 g/m^3.*

A total of 37 samples are generally available for assessment during each trial, the six day samples being supplemented by 6 additional samples from a consecutive five day sampling sequence in each of Weeks 17 and 29 (Figure 4).

4.2 BENCHMARKING

Sixteen test results for Weeks 23 to 35 are used to develop a benchmark rating for 5 chemical parameters, being BOD_5, TSS, total nitrogen (TN), ammonia nitrogen (NH_4-N), and total phosphorus. Ten faecal coliform (FC) samples are also rated, along with average daily power consumption for the 13 week benchmarking period.

Ratings are based on the median of test results and assigned a letter grade according to parameter ranges. An example set of rating results is shown in Table 1 below.

Table 1: Example Performance Rating

Indicator Parameters	Median	Std Dev	Rating	Rating System				
				A+	A	B	C	D
BOD_5 (g/m^3)	2	0.69	A+	<5	<10	<20	<30	≥30
TSS (g/m^3)	7	2.16	A	<5	<10	<20	<30	≥30
TN (g/m^3)	37	5.16	D	<5	<15	<25	<30	≥30
NH_4-N (g/m^3)	0.4	0.043	A+	<1	<5	<10	<20	≥20
TP (g/m^3)	3.6	0.28	B	<1	<2	<5	<7	≥7
FC(cfu/100mL)	9,400	15,300	B	<10	<200	<10,000	<100,000	≥100,000
Energy (kWh/d) (mean)	0.98		A	0	<1	<2	<5	≥5

Of significance is the standard deviation for the test results for each parameter, as this provides an indication of the stability of the treatment process. However, a full understanding of treatment performance variation from week to week throughout the testing programme is only available from examining the test reports. These reports are issued separately to each company involved in testing, and collectively to each Funding Partner. The public has access to a one page performance certificate for each treatment unit tested via the OSET NTP web pages on the Water NZ web site; to see a full report on any system they will need to contact the manufacturer/supplier directly.

Most treatment plants do not provide for disinfection of treated effluent to reduce faecal coliforms to a very low level consistent with the bacteriological standard in AS/NZS 1547:2012. This standard is for effluents used in spray irrigation, and requires that the average E.coli count should be $\underline{<}$ 10cfu/100ml with no more than 20% of samples exceeding 20cfu/100ml. Given that spray irrigation is not utilised in NZ in on-site wastewater management (drip irrigation being standard practice) disinfection systems are not used except in special cases where risk reduction measures are required for difficult site locations. However, FC performance rating is of interest to regional councils in comparing risk reduction potential of individual treatment units in maintaining a low FC discharge quality.

5 TESTING RESULTS – TRIALS 3 TO 8

5.1 SYSTEMS TESTED

Table 2 sets out the OSET units tested 2007 to 2013. The test results for Trial 3 (2007/2008) were audited under OSET NTP procedures as a precursor to full OSET NTP management from 2008. Of the twenty one systems tested over six trials three are not available commercially and one system has been superseded by a new unit. The performance certificates for all 21 units are downloadable from the OSET NTP pages on the Water NZ web site. For a copy of the full testing report on an individual system, the company cited on the certificate will need to be contacted.

The testing results analyses set out in 5.2 to 5.6 below are based on the publically available information in the performance certificates posted on the OSET NTP pages of the Water NZ web site. The fact that only 20 units are cited in the results presented in 5.2 to 5.6 relates to the fact that the test results for one unit (AdvanTex) come from two separate trials with Trial 5 results for BOD_5, TSS, TN, NH_4-N and energy use superseding those of Trial 3.

5.2 AS/NZS 1547 ASSESSMENT

Table 3 sets out details of the BOD_5 and TSS treatment performance of all OSET units in achieving the AS/NZS 1547 requirements based on the proportion of test results better than the 90% limits detailed in 4.1 above. Two units did not achieve the BOD_5/TSS requirements, one a development model (Biocycle) and one a non-commercial model (Devan). One unit (Hynds) did not submit for AS/NZS 1547 assessment. The remaining seventeen units all achieved AS/NZS 1547 requirements, although 9 of these (53%) had one or more parameters

less than a 100% performance level but greater than the 90% limit with 8 (47%) reaching a 100% performance level for both parameters.

Table 2: OSET Units Tested Trials 3 to 8 (2007 to 2013)

Company	OSET Unit	Treatment Process	Abbreviation
Trial 3 (2007/2008)			
Biocycle Holdings, Napier	Biocycle 6300 [development model not available commercially]	SAF	**Biocycle**
Innoflow Technologies Ltd, Auckland	AdvanTex AX-20 Mode 3	rPBR-T	**AdvanTex**
Oasis Clearwater Systems, Christchurch	Oasis Clearwater S 2000	SAF	**Oasis**
Waipapa Tanks, Kerikeri	Waipapa Tanks Maxi-Treat MV-C 3000 (superseded by Econo-Treat)	SAF	**Maxi-Treat**
Trial 4 (2008/2009)			
Humes Pipeline Systems, Auckland	Humes FR1 [model not currently available commercially]	SAF	**Humes**
Hynds Environmental, Auckland	Hynds Advanced Lifestyle	SAF	**Hynds**
WaterGurus (NZ) Ltd, Christchurch	WaterGurus NovaClear	MBR	**NovaClear**
Waipapa Tanks, Kerikeri	Waipapa Tanks Econo-Treat VBB C-2200 2	SAF	**Econo-Treat**
Trial 5 (2009/2010)			
Devan Group, Tauranga	Devan Green [model not available commercially]	SAF	**Devan**
RX Plastics Ltd, Ashburton	Airtech 7000	SAF	**Airtech**
Innoflow Technologies Ltd, Auckland	AdvanTex AX-20 Mode 3	rPBR-T	**AdvanTex**
Trial 6 (2010/2011)			
Bay of Plenty Regional Council, Whakatane	BOPRC AWTS NI [Council evaluation of bark-bed denitrification system]	AWTS-NI	**AWTS-NI**
Quantum Waste Water Systems, Levin	Quantum Eco System	SAF	**Quantum**
Trial 7 (2011/2012)			
Allflow Equipment Ltd, Nelson	Allflow Klaro 9000 10PE	SBR	**Klaro**
Trial 8 (2012/2013)			
Aqua Nova NZ Ltd Auckland	Aqua-nova	SAF	**Aqua-nova**
Aqua Nova NZ Ltd Auckland	Aqua-nova NR	SAF-NR	**Aqua-nova NR**
TechTreat Ltd Kerikert	TechTreat SS10	SAF	**TechTreat**
Ecological Technologies Auckland	BIOROCK-S	Passive Media	**BIOROCK**
Findlater Construction Ltd nelson	Findlater PA 5x5	SAF	**Findlater**
Super-Treat Systems NZ Ltd, Kerikeri	Super-Treat NZ12	SAF	**Super-Treat**
EcoSewerage, Coromandel	Eco Sewerage	Worm-Wetland	**EcoSewerage**

Treatment Process Key:

SAF	Submerged aerated filter		
SAF-NR	Submerged aerated filter & nitrogen reduction	AWTS-NI	Submerged aerated filter & bark bed denitrification
MBR	Membrane aerated bioreactor	Passive media	Gravity dosed patented media layers
SBR	Sequencing batch reactor		
rPBR-T	Textile recirculating packed bed reactor	Worm-Wetland	Worm based primary treatment & wetland cells secondary treatment

Table 3: Achieving AS/NZS 1547 Requirements

OSET Unit	BOD_5	TSS	Achieved Standard
Biocycle	86%	55%	NO
Oasis	100%	100%	YES
Maxi-Treat	100%	95%	YES
Humes	100%	97%	YES
Hynds	---	---	---
NovaClear	100%	100%	YES
Econo-Treat	100%	94%	YES
Devan	100%	76%	NO
Airtech	97%	94%	YES
AdvanTex	100%	100%	YES

OSET Unit	BOD_5	TSS	Achieved Standard
AWTS-NI	100%	100%	YES
Quantum	95%	100%	YES
Klaro	100%	97%	YES
Aqua-nova	100%	100%	YES
Aqua-nova NR	97%	100%	YES
TechTreat	100%	91%	YES
BIOROCK	100%	100%	YES
Findlater	100%	100%	YES
Super-Treat	100%	97%	YES
EcoSewerage	100%	100%	YES

5.3 BENCHMARKING

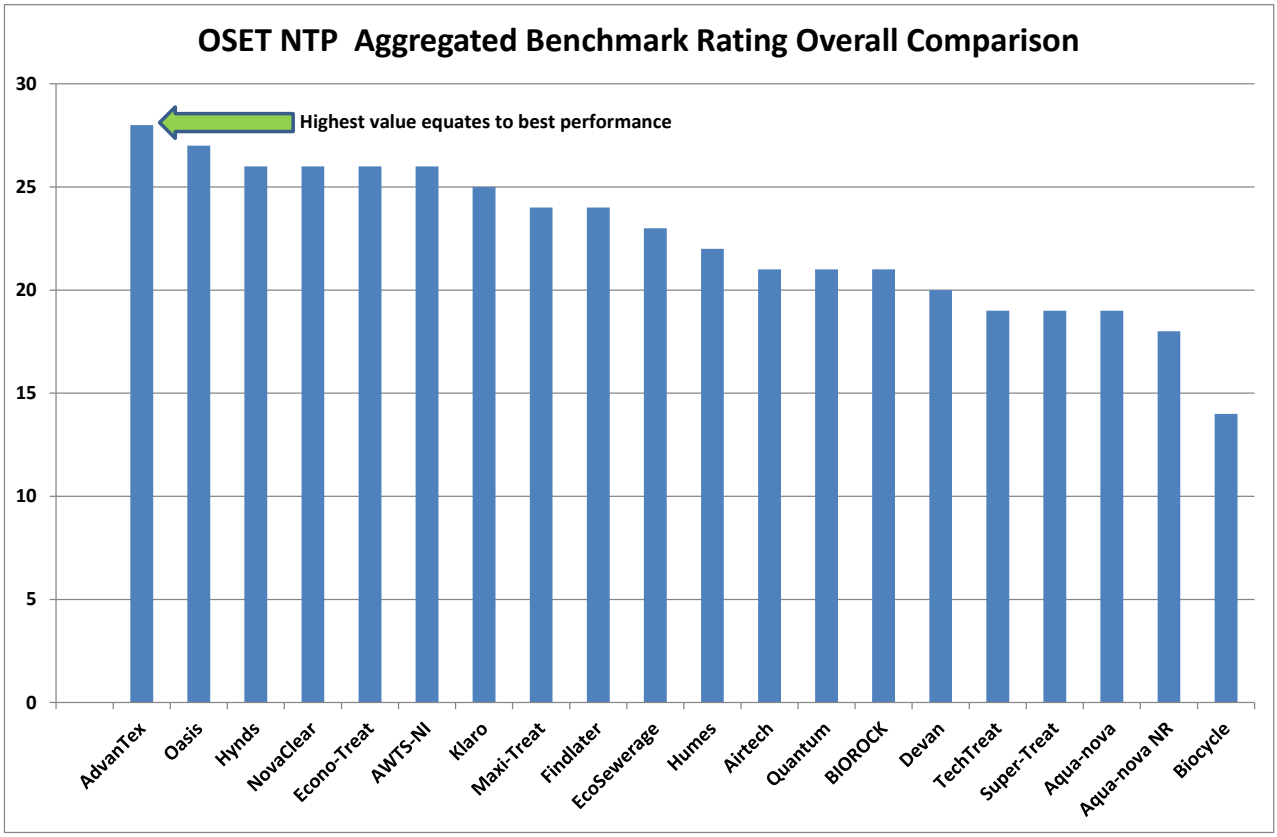
Benchmark testing is based on 16 test results over three months from Weeks 23 to 35 (Figure 4) which follow five months of treatment operation. At this point it is anticipated that all treatment processes will have reached optimum performance, particularly nitrification and denitrification leading to nitrogen reduction. Hence, the benchmarking ratings represent optimum performance of a unit under controlled test conditions. The benchmark ratings do not in any way indicate actual field performance, but provide a base against which field performance (assessed under Strand 2 testing) can be compared. Table 4 sets out the benchmark ratings for all systems tested.

Table 4: Benchmark Ratings

Unit	BOD_5	TSS	TN	NH_4-N	TP	FC	Energy
Biocycle	B	C	C	C	C	D	C
Oasis	A+	A+	A	A+	B	C	B
Maxi-Treat	A+	A	A	A+	B	C	D
Humes	A+	A	A	A	B	D	D
Hynds	A+	A	A	A+	B	C	B
NovaClear	A+	A+	C	A	B	A+	C
Econo-Treat	A+	A+	A	A	B	C	B
Devan	A	B	D	A	B	C	B
Airtech	A	B	B	A	B	C	C
AdvanTex	A+	A+	A	A+	B	C	A
AWTS-NI	A+	A+	A	A+	B	C	C
Quantum	A	A+	C	C	B	C	B
Klaro	A+	A	D	A+	B	B	A
Aqua-nova	A+	B	D	A	B	D	C
Aqua-nova NR	A	B	D	B	B	C	C
TechTreat	A	B	B	C	B	C	C
BIOROCK	A+	A	D	C	B	C	A
Findlater	A+	A+	D	A+	B	B	C
Super-Treat	A+	C	B	B	B	C	D
EcoSewerage	A	A+	B	C	B	C	A

Chart 1 takes the above rating indicators from the seven test parameters and assigns a score of 5 for A+, 4 for A, 3 for B, 2 for C and 1 for D. It then places the twenty systems by aggregated scoring value in order from highest (overall best performance) to lowest scoring value.

Chart 1:



5.4 TREATMENT PERFORMANCE STABILITY

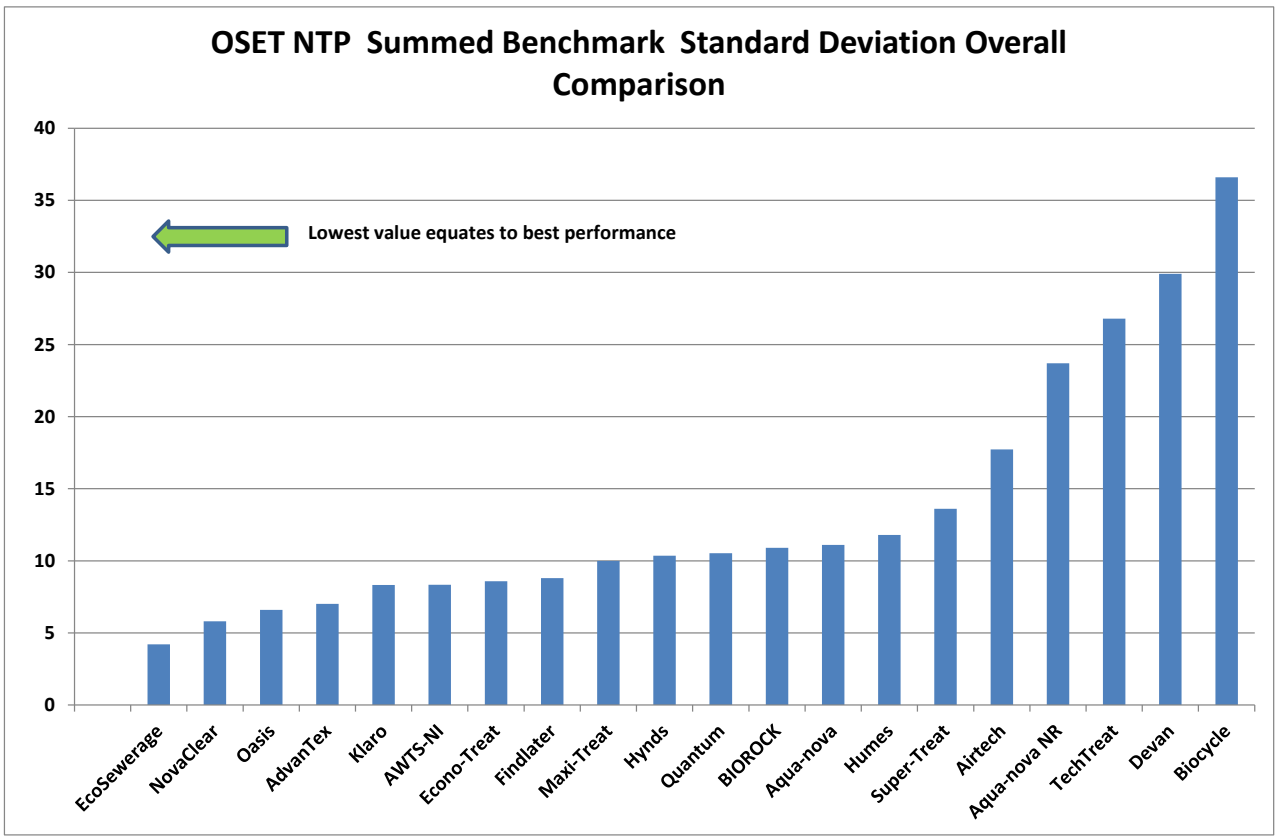
The median of the sixteen benchmarking results is used for assigning the rating values A+ to D. However it is the standard deviation which indicates the variability of results. Table 5 shows the variation in standard deviations for each of the five chemical parameters (excluding FC and energy).

Table 5:

Unit	Benchmark Standard Deviation by Parameter				
	BOD_5	TSS	TN	NH_4-N	TP
Biocycle	4.1	22.0	2.5	7.2	0.8
Oasis	0.9	2.0	2.9	0.1	0.7
Maxi-Treat	1.6	6.0	1.0	0.8	0.6
Humes	1.9	7.3	1.3	0.9	0.4
Hynds	2.3	3.76	2.6	1.4	0.3
NovaClear	0.0	0.9	3.6	1.0	0.3
Econo-Treat	1.5	3.49	1.3	1.8	0.5
Devan	4.7	21.0	2.5	1.14	0.55
Airtech	3.3	5.7	2.7	5.3	0.73
AdvanTex	0.7	4.1	1.3	0.21	0.7
AWTS-NI	1.71	1.71	2.81	1.87	0.24
Quantum	1.44	1.55	3.34	3.88	0.32
Klaro	0.69	2.16	5.16	0.04	0.28
Aqua-nova	1.9	4.8	3.3	0.7	0.4
Aqua-nova NR	4.6	8.3	8.5	1.9	0.4
TechTreat	3.5	11.0	5.8	5.9	0.6
BIOROCK	2.3	1.5	2.7	3.8	0.6
Findlater	1.8	1.0	4.6	1.0	0.4
Super-Treat	1.7	4.6	2.5	4.5	0.3
EcoSewerage	1.1	1.0	0.7	1.1	0.3

The higher the standard deviation the less stable the treatment performance related to an individual parameter. If the standard deviation values in Table 5 above are summed for each of the parameters shown, then a comparison between the summed values can be made. This comparison is set out in Chart 2.

Chart 2:



However, the overall treatment stability as assessed by variability of test results over time is best appreciated by examination of the individual OSET testing results review reports.

5.5 AERATION PERFORMANCE

The effectiveness of aerobic treatment (as supported by the aeration system) is best assessed via the ammonia oxidation (nitrification) performance of a treatment unit. This is indicated by the treated effluent ammonia concentration, with low NH_4-N values indicating high aeration performance. Chart 3 compares the benchmark effluent NH_4-N values for each treatment unit.

The six best aeration performance systems in terms of ammonia reduction involve four submerged aeration filter units (Oasis; Hynds; Maxi-Treat; Findlater), a sequencing batch reactor (Klaro) and a textile recirculating packed bed reactor (AdvanTex).

5.6 NITROGEN REDUCTION PERFORMANCE

The nitrogen reduction performance is important for some councils in implementing nutrient management practices for rural residential development. For example only those treatment units with a total nitrogen rating of A or A+ meet the BOPRC 15g/m^3 TN limit for installation of OSET units in the Rotorua Lakes areas.

Currently only four commercially available systems achieve this treatment level (as shown in Chart 4 for Advantex, Oasis, Econo-Treat and Hynds).

Chart 3

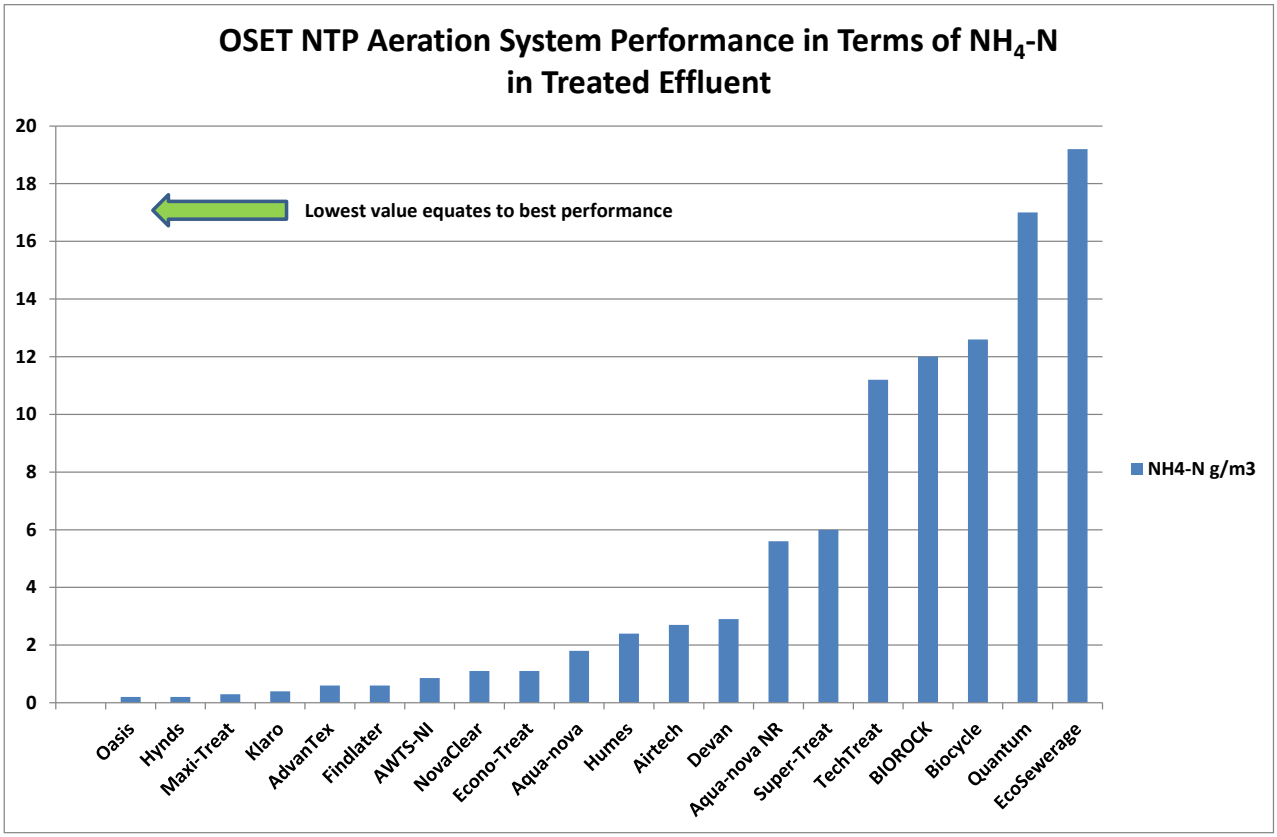
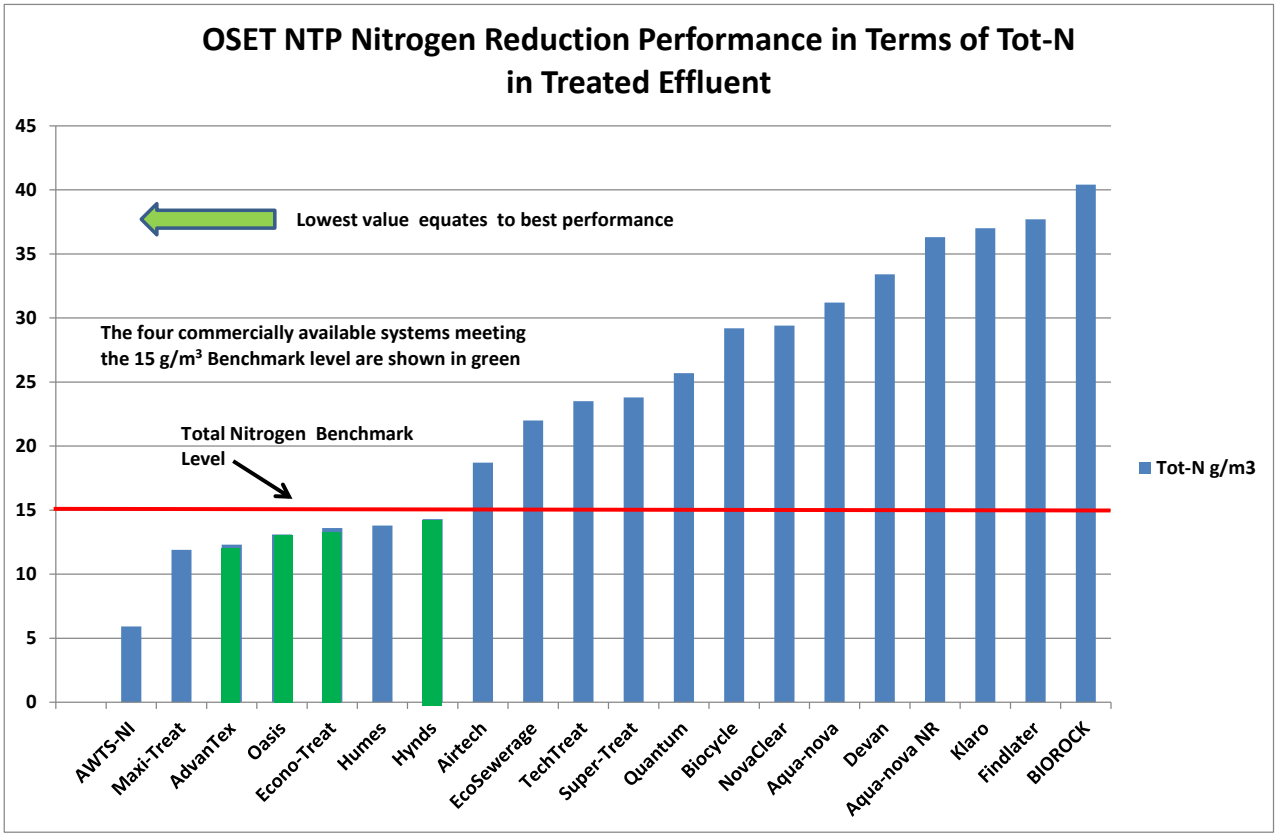


Chart 4



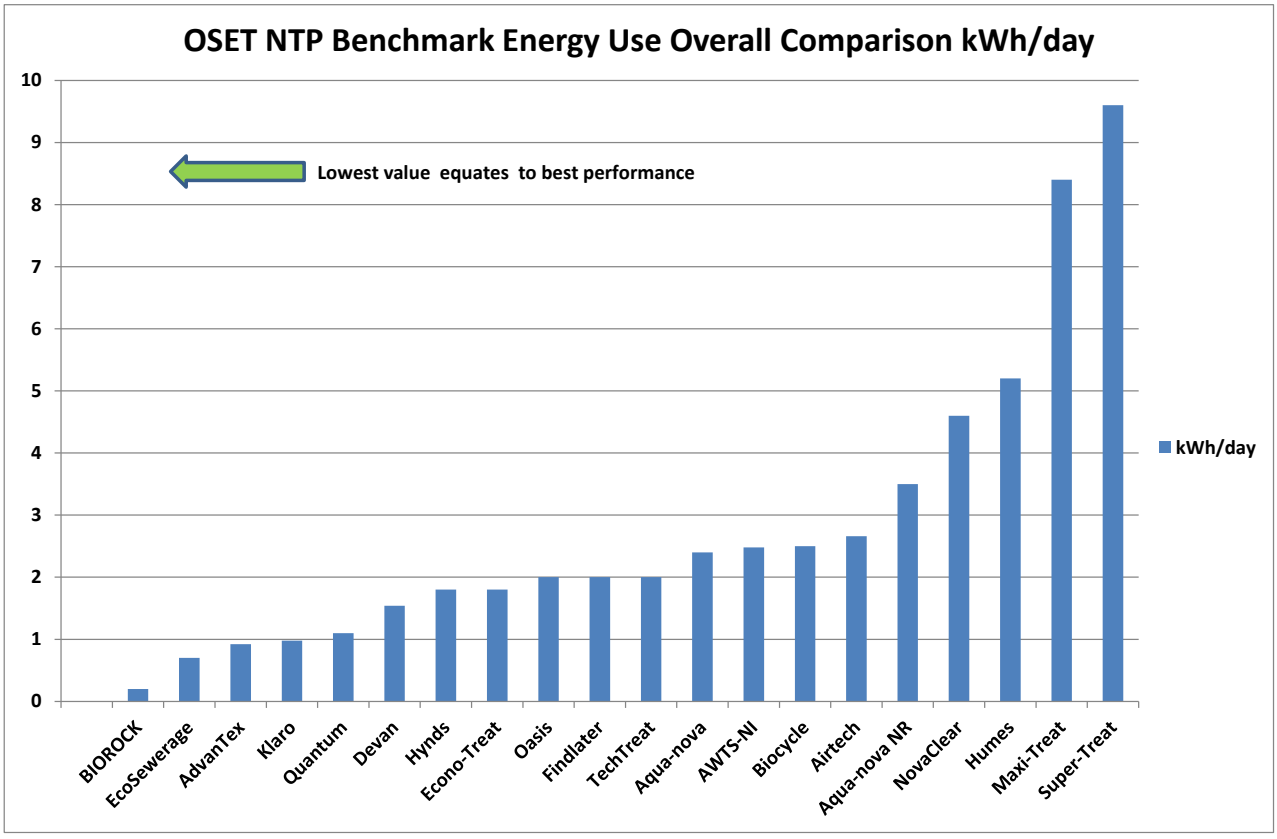
5.7 ENERGY USE

In selecting an OSET system for their property a key element in homeowner evaluation of alternative treatment systems will be capital cost, along with running cost. The OSET NTP testing results assist in evaluating running costs via the average daily energy benchmark value. It is important to recognise that the kWh/day benchmark values do not indicate likely field performance. The overall energy rating of a treatment unit reflects conditions at the test facility – power consumption for effluent pumping under field conditions will be specific to the irrigation distribution system as installed.

Chart 5 compares the benchmark kWh/day average daily energy use for each system. The five lowest energy use units include two with passive ventilation systems (BIOROCK and EcoSewerage) a textile recirculating packed bed reactor (AdvanTex), a sequencing batch reactor (Klaro) and a submerged aerated filter (Quantum).

Overall energy consumption needs to be compared to aeration performance since over-aeration will result in high consumption without necessarily achieving best available effluent quality.

Chart 5:



6 SUMMARY AND CONCLUSION

The OSET NTP has evaluated twenty one treatment units over seven years. Four of the tested systems are not available commercially due in part to testing results that indicate the units would benefit from technical improvements.

Of seventeen units which achieved AS/NZS 1547 performance levels for BOD_5 and TSS, eight (47%) achieved 100% for both parameters with nine (53%) between 90% and 100% for one or more of the two parameters.

The benchmark performance ratings show that of the commercially available units six achieve four or more A+ and A parameter performance ratings (Advantex; Oasis; Hynds; NovaClear; Econo-Treat; Klaro).

Five of the above six treatment units indicate high treatment unit process stability as assessed by the sum of standard deviation values for the five chemical parameters (Advantex; Oasis; NovaClear; Econo-Treat; Klaro)

with the two natural process units (bark filter AWTS-NI; worm-wetland EcoSewerage) proving highly stable as well.

The five commercially available systems showing high aeration performance as assessed by ammonia reduction levels are Oasis, Hynds and Findlater (SAF units), Klaro (SBR) and AdvanTex (rPBR-T). Four commercially available systems are within a benchmark level of 15 g/m^3 total nitrogen, these being AdvanTex (rPBR-T), Oasis, Econo-Treat and Hynds (SAF units).

Selecting an OSET unit for a particular application will depend on many factors of which some will include the performance ratings from OSET NTP testing. It has become clear that the testing and auditing process has proved invaluable to manufacturers in indicating robustness of system performance as well as indicating when technical improvements may be beneficial. Several companies have subsequently submitted modified treatment units for retesting.

The key constraint to improving and developing the operation and outreach of the OSET NTP is the low number of Funding Partners contributing annual grants. The current Funding Partners group comprise five Regional Councils, two Unitary Councils and seven District Councils. This is in spite of detailed representations to all Councils on three occasions in recent years seeking support funding. OSET NTP believes that widespread council support is essential to maintain the already high standards of OSET NTP operations, and thereby contribute to significant environmental and public health benefits from well-functioning and performing on-site domestic wastewater treatment units throughout all areas of New Zealand

Figure 1: OSET NTP Organisational Structure

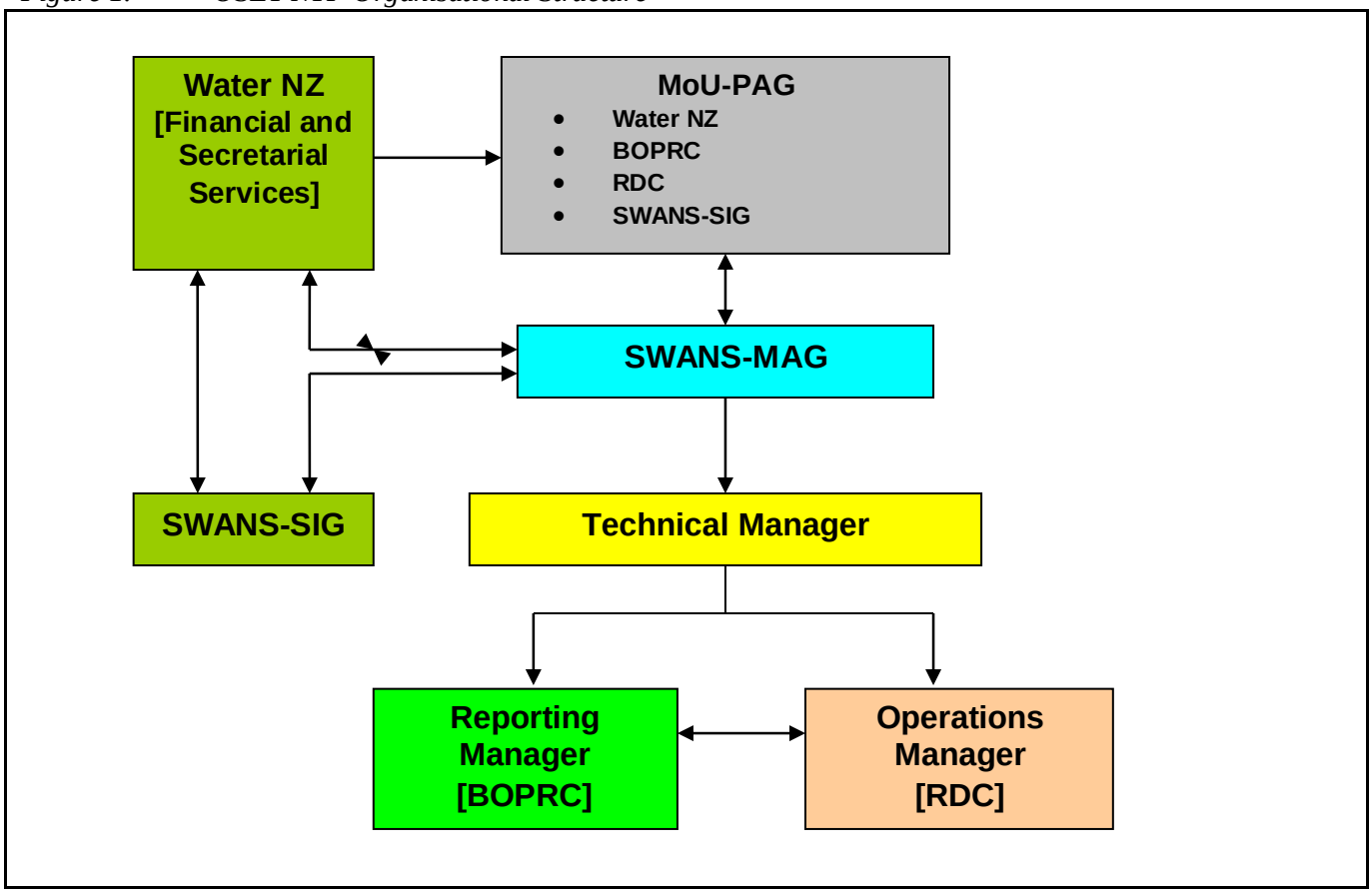


Figure 2: OSET NTP Testing and Auditing Process

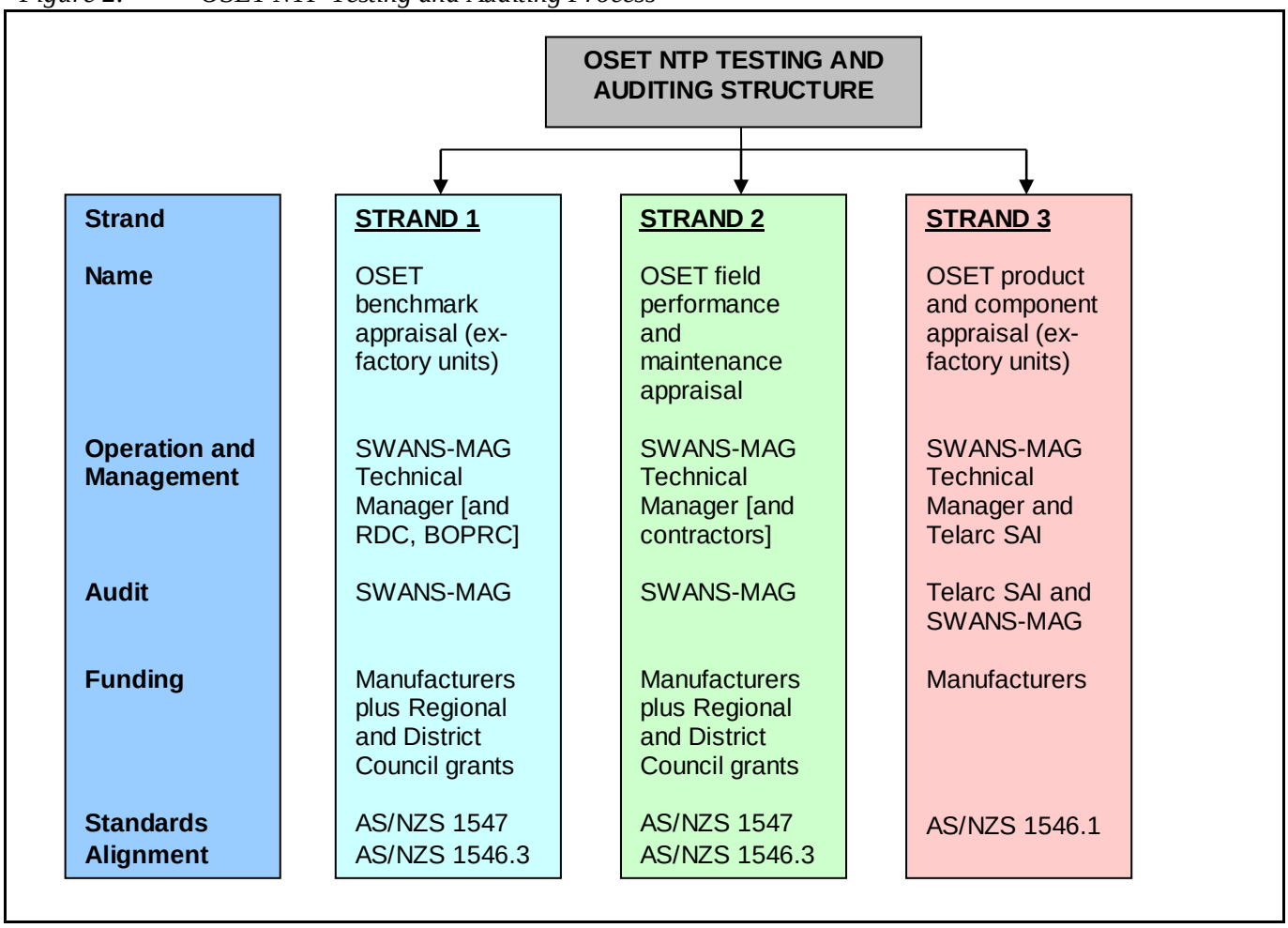


Figure 3: The OSET Testing Facility

Figure 4: Testing Timeline Trial 8 – 2012/2013