# On-site Effluent Treatment National Testing Programme

## TRIAL X – November 201A to July 201B

# OSET ATP-NB

## TESTING RESULTS REVIEW

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**Date:** 15 January 201C

# Disclaimer

This document reports on the measured ability of a wastewater treatment system to reduce the concentration of a range of wastewater parameters under controlled input conditions. The test results do not necessarily accurately reflect performance under field conditions. No testing was performed on the integrity, capacity or durability of this system.

The findings of this testing and auditing report apply to the specific treatment unit model tested, and remain current for 5 years from the date of this report.

**This report is a SAMPLE ONLY, using fictitious random results and reporting to illustrate the format and content of a typical OSET NTP Testing Results Review.**

**[NOTE: The data sets used to compile the figures are not consistent from figure to figure across all parameters.]**

## Summary

The OSET ATP-NB wastewater treatment system participated in Trial X of the On-site Effluent Treatment National Testing Programme (OSET NTP). This commenced on 2 November 201A and ran over nine months (39 weeks) during which the treated effluent discharge was monitored generally every six days. The test flow rate was 1,000 L/day to represent the daily domestic wastewater flow from a 3-bedroom dwelling with occupancy of 5 to 6 persons.

A two month (8 week) media development and settling in period (with 5 samples over weeks 4 to 8) was followed by the testing programme involving a 3-month 'pre-benchmarking period' (19 samples over weeks 9 to 22), and a 3-month 'benchmarking period' (19 samples over weeks 23 to 35). Within each block of 19 samples three extra samples were taken (weeks 17 and 29) to provide results for two five day consecutive sample periods. A 1-month high load effects period followed in weeks 36 to 39 (3 samples).

Treatment performance is assessed in two ways.

First, the 38 samples taken through the pre-benchmarking and benchmarking periods were used to assess treatment performance against the secondary effluent quality requirements for biochemical oxygen demand ($BOD_5$) and total suspended solids (TSS) defined by AS/NZS 1547:2000 as follows:

*(a) 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$^3$.*
*(b) 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$^3$.*

The OSET ATP-NB had **95% of $BOD_5$** results and **100% of TSS** results within the requirements for (a) and (b) above. No $BOD_5$ samples exceeded the maximum of 30 g/m$^3$. The ATP-NB thus achieved AS/NZS 1547 secondary effluent quality performance requirements.

Second, the 16 (six day interval) benchmarking samples were used for rating the performance of the OSET ATP-NB wastewater treatment system in relation to $BOD_5$, TSS, nitrogen (total nitrogen and ammonia nitrogen), total phosphorus, faecal coliforms and energy consumption indicators. The OSET NTP assessment rates the indicators to a letter-based scale on their median values. The scale rates effluents from a "D" standard, which is considered a minimal level of treatment or quality for a particular indicator, to an "A+" standard, which is an exceptional level of treatment or quality. The standard deviation is also provided.

The OSET ATP-NB system achieved the following effluent quality ratings:

| Indicator Parameters | Median | Std Dev | Rating | Rating System | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | A+ | A | B | C | D |
| $BOD_5$ (g/m$^3$) | 7.2 | 4.7 | A | <5 | <10 | <20 | <30 | ≥30 |
| TSS (g/m$^3$) | 4.5 | 7.2 | A+ | <5 | <10 | <20 | <30 | ≥30 |
| Total nitrogen (g/m$^3$) | 18.4 | 2.5 | B | <5 | <15 | <25 | <30 | ≥30 |
| $NH_4$- Nitrogen (g/m$^3$) | 2.91 | 1.14 | A | <1 | <5 | <10 | <20 | ≥20 |
| Total phosphorus (g/m$^3$) | 4.23 | 0.55 | B | <1 | <2 | <5 | <7 | ≥7 |
| Faecal Coliforms (cfu/100mL) | 75,500 | 29 x 10$^3$ | C | <10 | <200 | <10,000 | <100,000 | ≥100,000 |
| Energy (kWh/d) (mean) | 1.55 | -- | B | 0 | <1 | <2 | <5 | ≥5 |

The standard of treatment required is dependent upon the sensitivity of the receiving environment and the policies put in place by the statutory authority.

# Contents

## Tables



## Figures

# 1 Introduction

This report sets out the results of the benchmark testing of the OSET ATP-NB (On-site Effluent Treatment Aerobic Treatment Plant-No Brand) wastewater treatment system which has undergone performance testing at the OSET NTP facility in Rotorua, New Zealand. The results of this testing have subsequently been audited by the OSET NTP Management and Audit Group.

The purpose of the testing is to

(a) demonstrate conformity with parameters relating to quality of secondary effluent from domestic wastewater treatment systems under standard AS/NZS 1547:2000 for the specific flow of 1,000L/day; and

(b) provide a treated effluent quality performance rating for six indicator parameters together with an assessment of treatment process energy consumption.

The testing was carried out over a 39 week period from November 201A to July 201B as per **Appendix 1**. This included a settling in period (weeks 1 to 8), a pre-benchmarking period (weeks 9 to 22) followed by a benchmarking period (weeks 23 to 35). A high load effects test was carried out during a four week period at the end of the trial (weeks 36 to 39). This involved increasing the test flow to 2,000L/day over 5 days of week 36, then returning to 1,000L/day for a three week recovery period (weeks 37 to 39).

The background to the development of the Rotorua On-site Effluent Treatment Testing Facility and the OSET NTP is described in the document entitled 'On-Site Effluent Treatment National Testing Programme, Strand 1 Benchmarking Procedures, 201A-201B.' This document sets out the procedures for testing and evaluation and provides details of the trial set up and methodology, the pre-trial procedures, as well as the management of the testing and auditing programme.

The operational structure of the OSET NTP and details of key personnel involved in the testing and auditing procedures are set out in **Appendix 2** to this report.

# 2 System Information

**System Name/Model:**
OSET ATP-NB

**Manufacturer:**
OSET Manufacturing
25 Somewhere Avenue, PO Box 1122
URBAN TOWN 2345

Phone: (12) 345 6789
E-mail: info@osetmanufacturing.co.nz
Web-site: www.osetmanufacturing.co.nz

**Supplier:**
OSET Distributors
25 Somewhere Avenue, PO Box 1122
URBAN TOWN 2345

Phone: (12) 345 6789

# 3 System Specification

**Table 1: System Specification Summary**

| Supplier | System Model | Rated Flow (L/day) | Operating Capacity in litres (L) | Treatment Technology |
|---|---|---|---|---|
| OSET Distributors | OSET ATP-NB | 1,800 | Total treatment volume: 7,600 L<br><br>Primary treatment: 3,500 L<br><br>Aeration treatment 1,800 L<br><br>Clarification: 1,700 L<br><br>Pump chamber 600 L<br><br>Emergency storage: 1,800 L | Submerged growth media |

OSET Manufacturing provided a declaration of the specifications for the system submitted for testing. No independent verification of these specifications has been made. The results presented in this report were obtained when dosing at 1,000 litres per day (L/day), approximating the daily volume of domestic wastewater from a 3-bedroom dwelling with occupancy 5 to 6 persons.

# 4 Testing Regime

## 4.1 Background

Untreated wastewater has grit removed and is screened to 3 mm before being pumped into a dedicated header tank for each system under test. From each header tank influent is discharged under gravity to the treatment system twice a day. The loading regime is 1,000 L/day per system. Five hundred litres is delivered in the morning from 6.30am and the other 500 litres delivered from 3.30 pm. It takes 4.5 hours to completely deliver the 500 litres. This regime is designed to approximate typical household usage.

The header tank has an overflow pipe set at the level corresponding to 500 litres. It also has a pressure transducer fitted at its base measuring volume. These are used to verify that the header tank is filling and emptying as expected. The data is collected in the Rotorua District Council (RDC) SCADA system. There are two fill and empty cycles per day.

Samples of influent and treated effluent discharge were taken at (generally) six day intervals. In addition to the regular interval sampling, there were two consecutive five day blocks of samples. These were analysed for the parameters set out in the sampling profiles in Section 4.2 below.

Analysis was performed by the RDC Environmental Laboratory (IANZ accredited) in accordance with “Standard Methods for the Examination of Wastewater”, APHA, AWWA, WPCF.

Effluent from each wastewater treatment system was discharged into a 5 litre container placed within a 200 litre drum, from where it returned to the sewer.

Samples were taken from the 5 litre container to ensure that completely fresh and representative samples are taken every time. Temperature of the effluent was recorded at the time of sampling.

### 4.2 Sampling Profiles

**Appendix 1** depicts the sampling programme. There were two sampling profiles used throughout the trial. They differ only in their incorporation of Faecal Coliform testing. The profiles encompass the key parameters required for the benchmark assessment:

**Profile A** consists of:

- Biochemical oxygen demand ($BOD_5$);
- Total suspended solids (TSS);
- Total nitrogen (TN);
- Ammoniacal nitrogen ($NH_4$-N);
- Total kjeldahl nitrogen (TKN);
- Total oxidised nitrogen (TOXN);
- Nitrate;
- Nitrite;
- Total phosphorus (TP);
- Alkalinity;
- pH; and
- Temperature.

**Profile B** consists of:

- All the parameters of Profile A, plus
- Faecal Coliforms (FC).

# 5 General Issues Encountered During the Trial

Due to a local power failure on 22 March 201A dosing and treatment unit operation was interrupted for 12 hours. Inspection of the test results for the following sample days showed no unusual quality in any parameter. The fail-safe system in place worked as designed and prevented any unscheduled wastewater discharges occurring.

# 6 Test Results

### 6.1 Application of Test Results

Flow to the OSET ATP-NB wastewater treatment system commenced on 2 November 201A (week 1). Sampling was carried out on a flow rate of 1,000 L/day from 24 November 201A (week 4) through to 4 July 201B (week 35), and from 12 July to 28 July 201B (weeks 37 to 39) following a peak flow event at 2,000 L/day over 5 days 7 to 11 July (week 36).

The pre-determined benchmarking period is a three month period (from 5 April 201B to 4 July 201B, weeks 23 to 35 inclusive) during which 16 samples are taken at six day intervals, with the first sample on day two and the last sample on day 91. This follows a 'settling-in' period of around two months (weeks 1 to 8) and a pre-benchmarking period of around three months (weeks 9 to 22). At completion of the benchmarking period a one month high load effects period occurs where 2,000 L/day is loaded over five days in the first week, with a return to 1,000 L/day for the following 3 weeks.

The test results for all parameters for the two month settling in period are available to the system supplier to enable minor adjustment to operational procedures prior to 'hands-off' operation through the subsequent 7-month testing programme.

The 38 test results for $BOD_5$ and TSS from the 6-months pre-benchmarking and benchmarking period (weeks 9 to 35) are used to assess performance in accordance with the secondary treatment requirements of AS/NZS 1547:2000.

The 16 test results for $BOD_5$, TSS, total nitrogen, ammonia nitrogen, total phosphorus and faecal coliforms from the benchmarking period (weeks 23 to 35) are used to undertake a performance rating assessment for the treatment unit. Power consumption is also recorded during this period.

The three test results for all parameters during the one month high load effects period (weeks 36 to 39) are used to assess the response of the treatment unit to a 5-day peak load event in week 36.

### 6.2 Presentation and Discussion of Test Results

The test results are presented and discussed in eight sections as follows:

**6.3** sets out the raw influent quality for 41 test results for $BOD_5$, TSS, TN and NH4 for weeks 9 to 39 (Figure 1). The temperature variation between raw influent and treated effluent is presented in Figure 2.

**6.4** sets out the raw influent and treated effluent quality for 41 test results for $BOD_5$, TSS, TN and $NH_4$-N for weeks 9 to 39 (Figures 3 to 6).

**6.5** examines the relationships between TN, $NH_4$-N, temperature and alkalinity relative to nitrification/de-nitrification processes for weeks 9 to 39 (Figures 7 and 8).

**6.6** sets out the raw influent and treated effluent quality for 41 test results for TP and 19 test results for FC for weeks 9 to 39 (Figures 9 and 10).

**6.7** sets out the daily energy use for weeks 9 to 39 (Figure 11).

**6.8** sets out the treated effluent quality for 38 test results in assessing BOD and TSS in meeting AS/NZS 1547:2000 secondary effluent requirements for weeks 9 to 35 (Figure 12).

**6.9** sets out the treated effluent quality for 16 test results for benchmarking $BOD_5$, TSS, TN, NH4-N, TP, FC and daily energy use for weeks 23 to 35 (Figure 13).

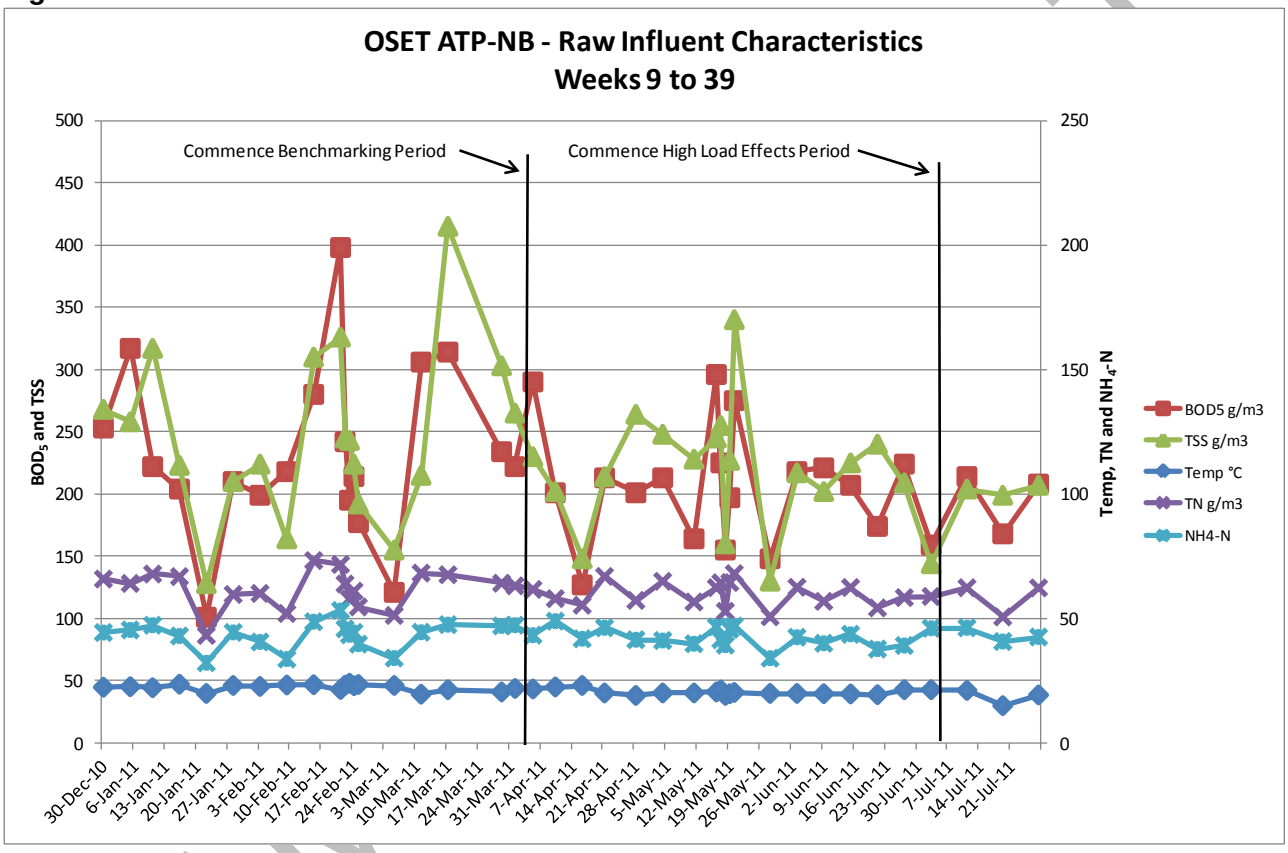
**6.10** sets out the treated effluent quality for 3 test results for $BOD_5$, TSS and TN for the high load effects period in weeks 36 to 39 (Table 2).

### 6.3 Raw Influent Quality ($BOD_5$, TSS, TN, NH4-N) Weeks 9 to 39

**Figure 1** illustrates the variation in raw influent quality throughout the trial. All four main parameters fluctuate quite significantly from time to time, which provides opportunity to examine the resulting effects on treatment process stability. There are spikes in BOD and TSS at various times. Total nitrogen and ammonia hold to a limited range of results. Influent quality and the type of variations experienced remain substantially consistent from year to year.

During the two five day consecutive results (week 17, 22/26 February and week 29, 17/21 May) both BOD and TSS varied significantly from day to day.

**Figure 1:**




It is noted that the testing protocols under AS/NZS 1546.3:2008 recommend the following range of raw influent quality:

- BOD 150 to 300g/$m^3$
- TSS 150 to 300g/$m^3$
- Tot-N 20 to 100g/$m^3$

In this instance the Trial X ranges were generally:

- BOD 100 to 350g/$m^3$ (with one spike of around 400g/$m^3$)
- TSS 130 to 350g/$m^3$ (with one spike above 400g/m3)
- Tot-N 50 to 75g/$m^3$

Overall raw effluent quality was:

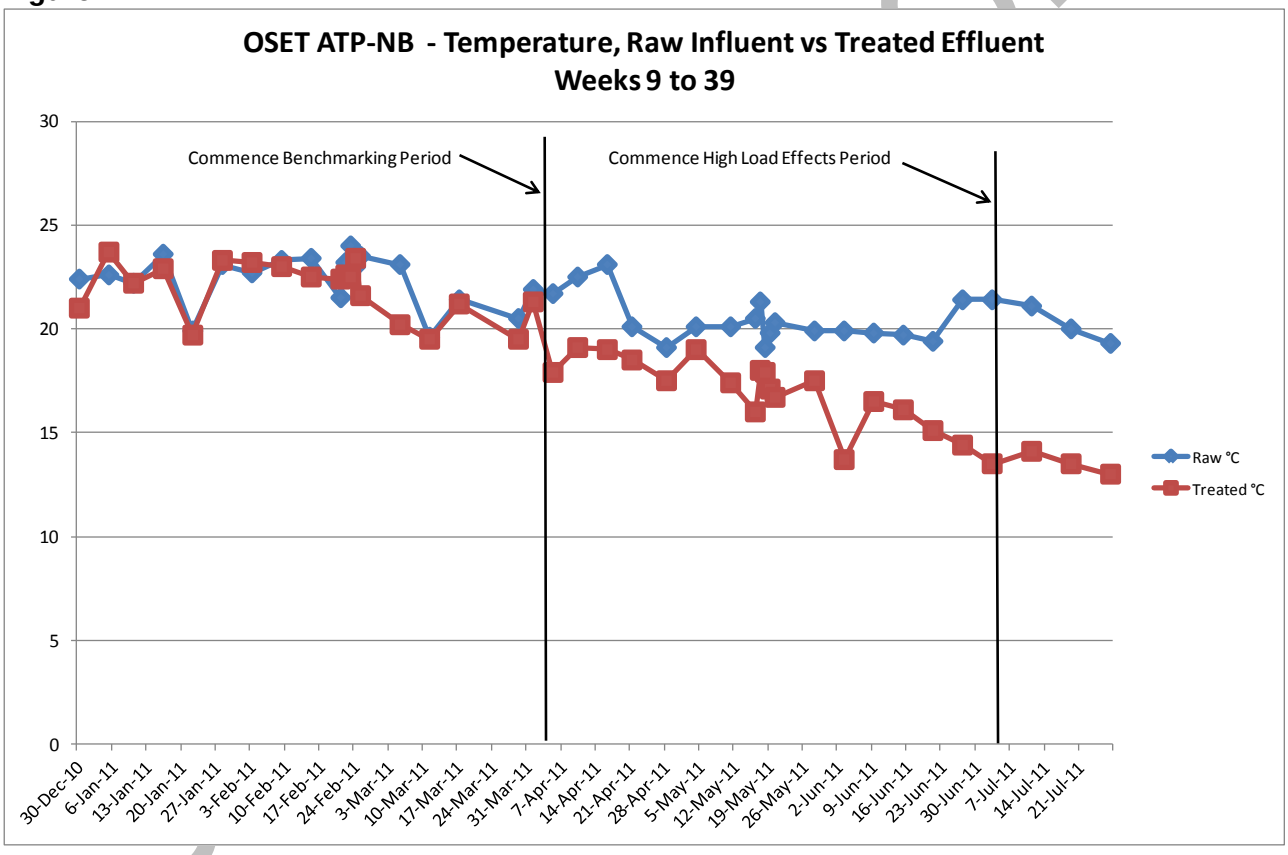
| Parameter | Median | Std Dev | Mean |
|---|---|---|---|
| cBOD | 192g/m$^3$ | 7.1 | 192g/m$^3$ |
| TSS | 208g/m$^3$ | 7.7 | 203g/m$^3$ |
| Tot-N | 59.8g/m$^3$ | 9.0 | 59.5g/m$^3$ |

**Figure 2** shows the relationship between raw effluent temperature and the temperature of the liquid within the treatment unit and final effluent. Temperature is measured by probe in the treated effluent chamber.

Overall raw influent temperature variation was modest, increasing slowly November through to March before declining to a low point in July.

Treated effluent temperature declined steadily through the benchmarking period to drop below 15$^O$C in June before tailing off to between 14 to 13 $^O$C into the high load period.

**Figure 2:**



### 6.4 Raw Influent and Treated Effluent Quality ($BOD_5$, TSS, TN and $NH_4$-N) Weeks 9 to 39

**Figure 3** shows the BOD relationship. Treated effluent results fluctuate throughout the test period with a range from 20g/$m^3$ to below 5g/$m^3$.

**Figure 4** shows the TSS relationship. The pattern of results is far more stable than that for $BOD_5$. A 'spike' in TSS follows the high load in week 36 but with quick recovery.

Both $BOD_5$ and TSS effluent quality is overall satisfactory.

**Figure 3:**

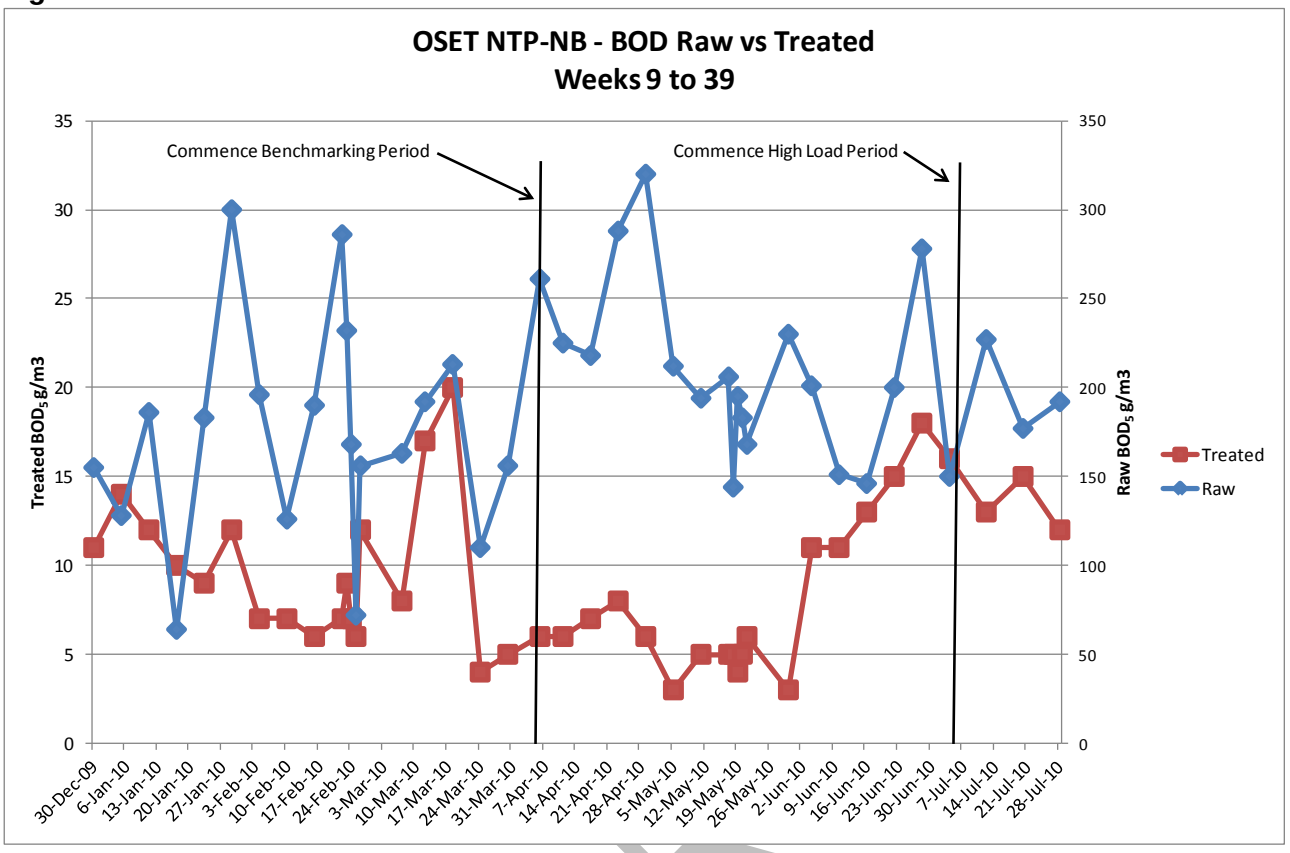



**Figure 4:**

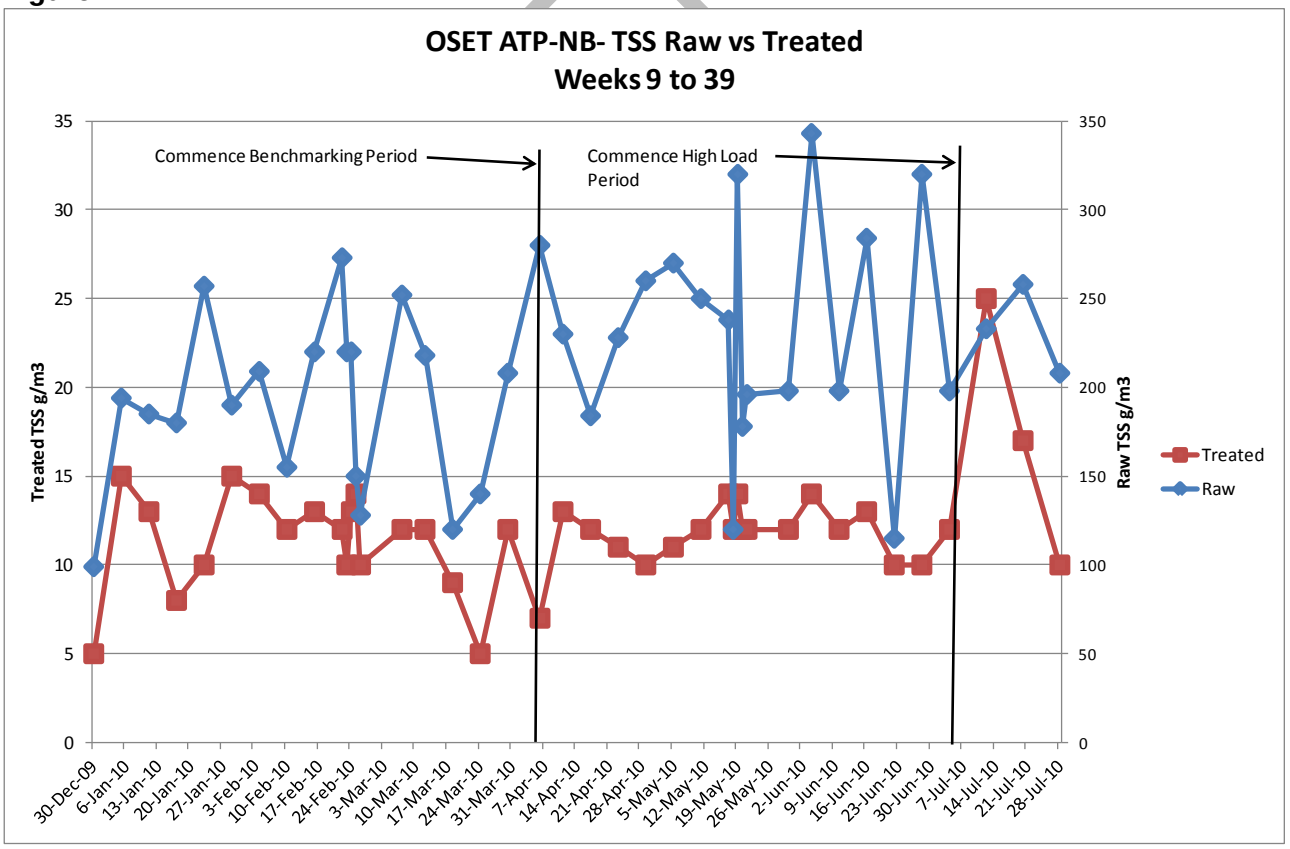


**Figure 5** shows the TN relationship. The OSET ATP-NB is not configured for nitrogen reduction, and maintains a relatively consistent effluent quality of between 30 and 40g/$m^3$.

**Figure 6** shows the NH4-N relationship. Nitrification effectiveness does not fully settle down until the commencement of the benchmarking period following which a high level of ammonia reduction is maintained through to the high load effects period. The unit recovers quickly from the “spike” in $NH_4$-N following the high load event.

**Figure 5:**

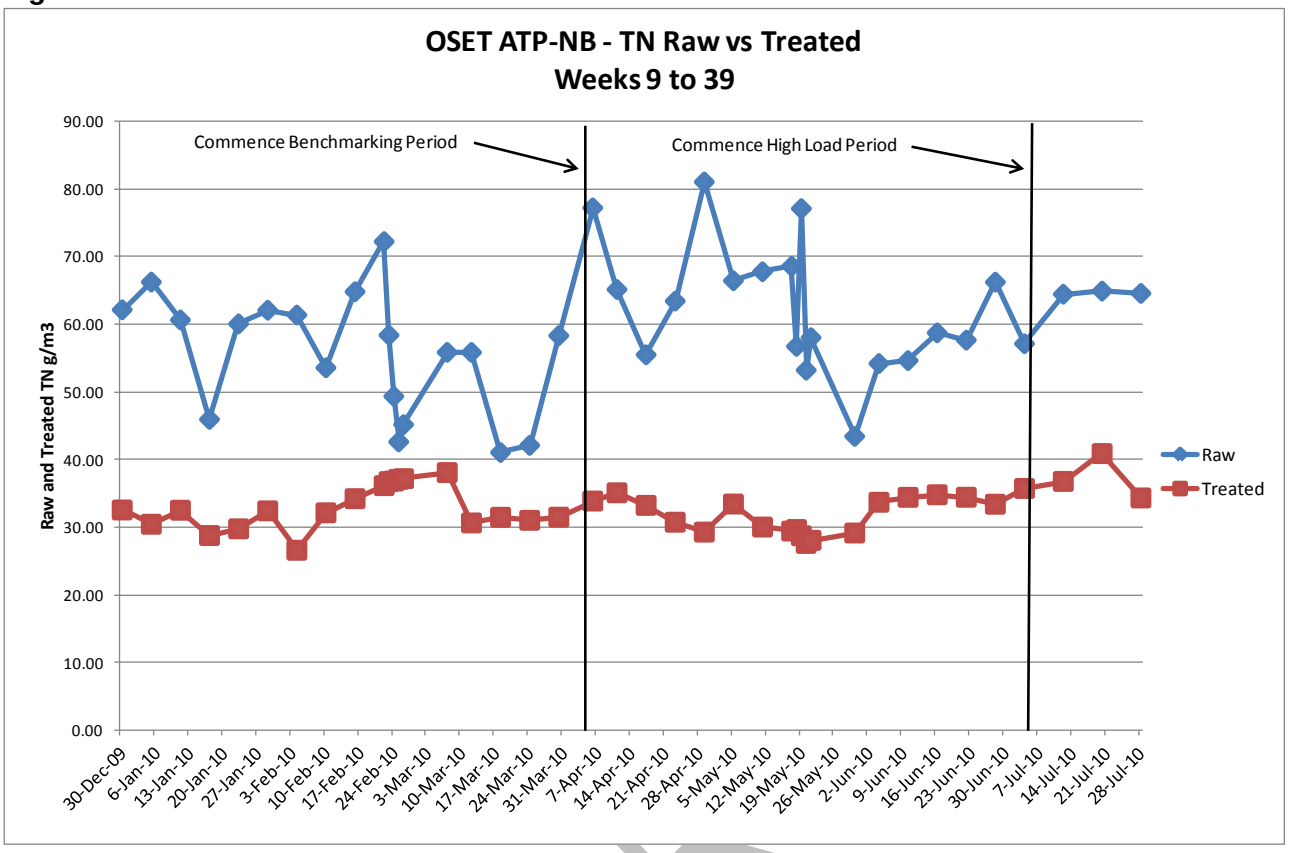
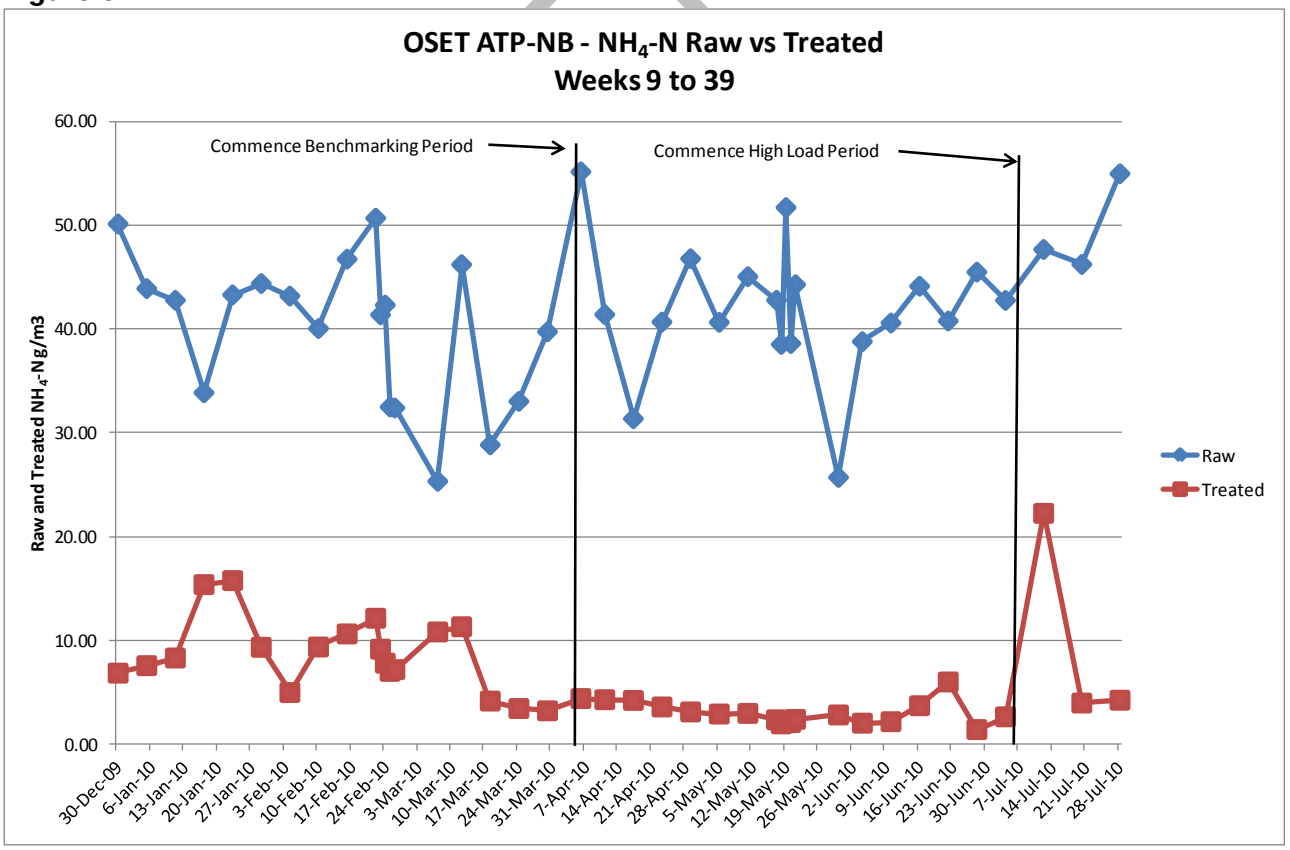



**Figure 6:**



### 6.5 Treated Effluent Alkalinity, TN, $NH_4$-N and Temperature, Weeks 9 to 39

Consideration of the various forms of nitrogen during aerobic biological treatment provides an important indicator of how well a system is operating and how much the system is sensitive to variations in temperature, pH, loading variations and start-up operations. Good conversion of ammonia to nitrate (nitrification) indicates effective aeration and maintenance of high levels of aerobic activity. Reduced total nitrogen levels indicates effective de-nitrification during which nitrate is converted under anoxic conditions to nitrogen gas as denitrifying microorganisms strip oxygen from the nitrate.

Alkalinity is required as a buffer to deal with the acid generated by nitrification. During de-nitrification alkalinity is produced.

**Figure 7** shows the relationship between raw influent and treated effluent alkalinity. Clearly raw influent alkalinity is not limiting in supporting the nitrification process. However, ammonia oxidation (nitrification) is variable, fluctuating in cyclic fashion, with alkalinity similarly fluctuating but not necessarily in step with nitrification.

**Figure 8** shows the relationship between TN, $NH_4$-N and temperature. Temperature has a significant influence on the ability of an advanced treatment system to reduce nitrogen levels. Cooler temperatures impact on the effectiveness of nitrification/de-nitrification processes. Winter temperatures in Rotorua are quite low, and in large measure reflect cold weather winter conditions throughout southern regions of the country.

Where systems are buried in the ground, as is typical, the impact of seasonal temperature fluctuations are far less than where the treatment systems are positioned above ground, such as was the case for this trial. To simulate in-ground conditions all treatment units are required to be insulated for the benchmarking period.

Clearly the nitrification/denitrification processes in the OSET ATP-NB follow each other consistently in cycles of up and down. Of particular note is that once temperature drops to 15°C then both nitrification and denitrification effectiveness drops off. The high load period causes a ‘spike’ in both $NH_4$-N and TN before a recovery in $NH_4$-N begins.

**Figure 7:**

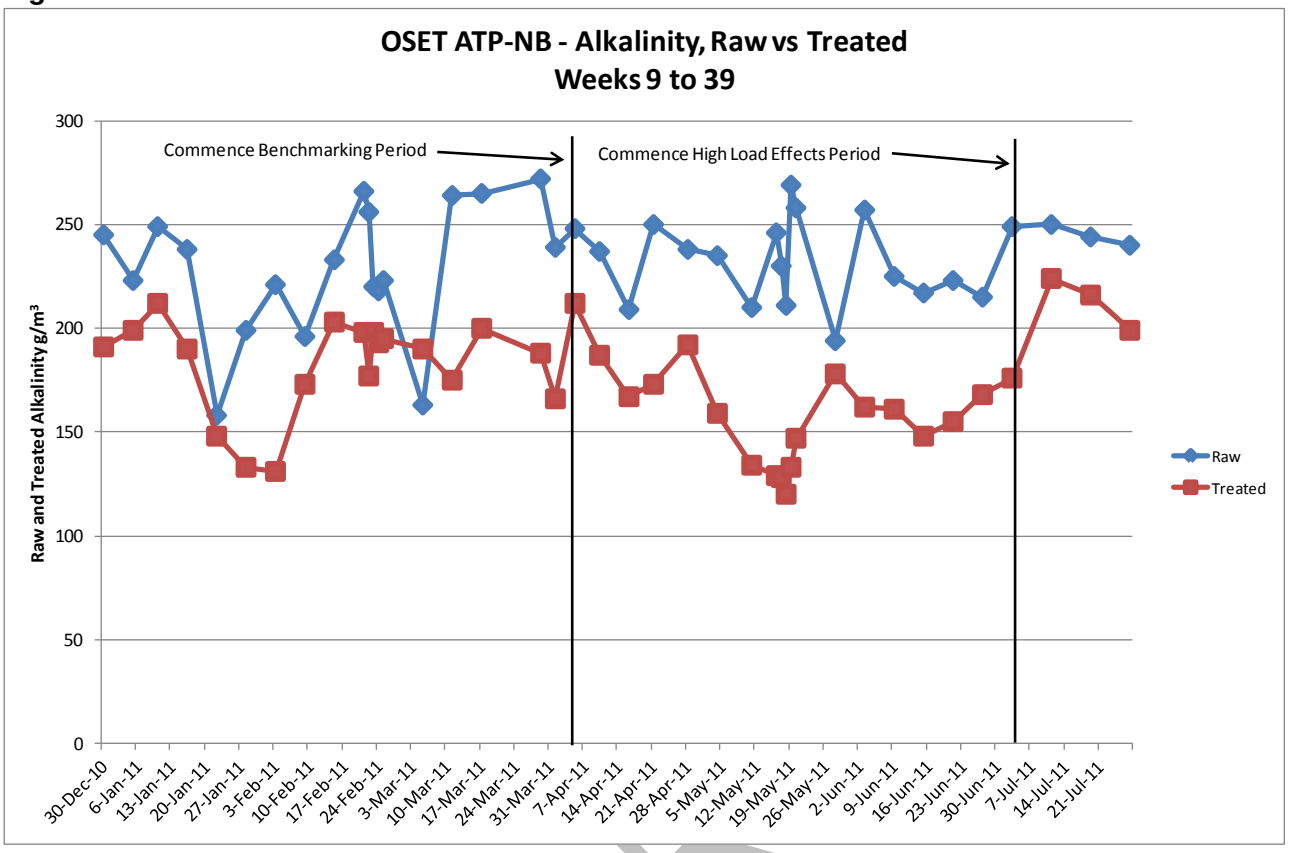
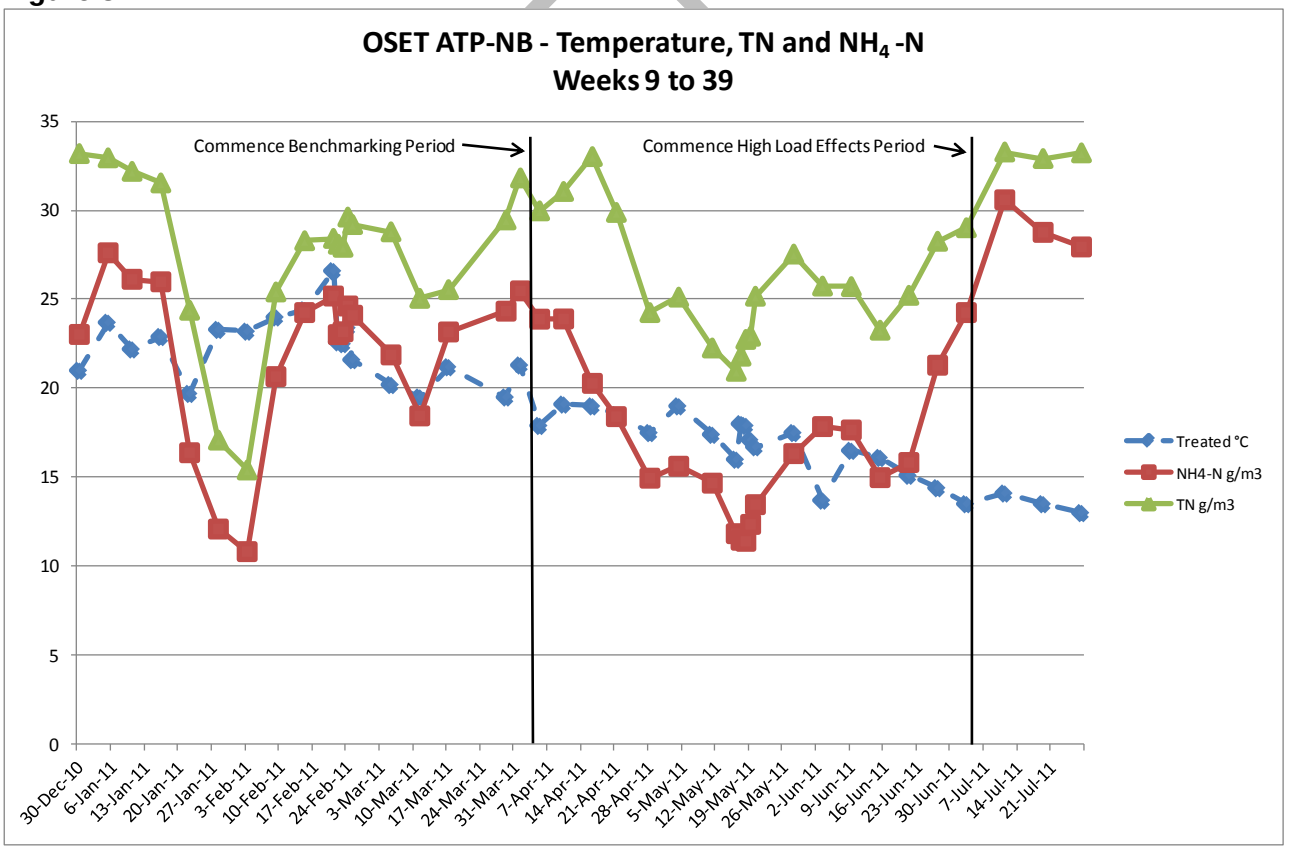



**Figure 8:**



### 6.6 Raw Influent and Treated Effluent Quality for Total Phosphorus (TP) and Faecal Coliform (FC), Weeks 9 to 39

Total phosphorus reduction (**Figure 9**) improves slowly until the cooler temperature conditions from early June. High load conditions affect TP reduction temporarily.

Faecal coliform reduction declines slowly over the period (**Figure 10**). The OSET ATP-NB is not specifically configured for disinfection so the FC reduction is controlled by natural biological treatment conditions in the unit. Because the faecal coliform vertical scale in Figure 10 is logarithmic, the individual data points are not joined by lines as for other data.

**Figure 9:**

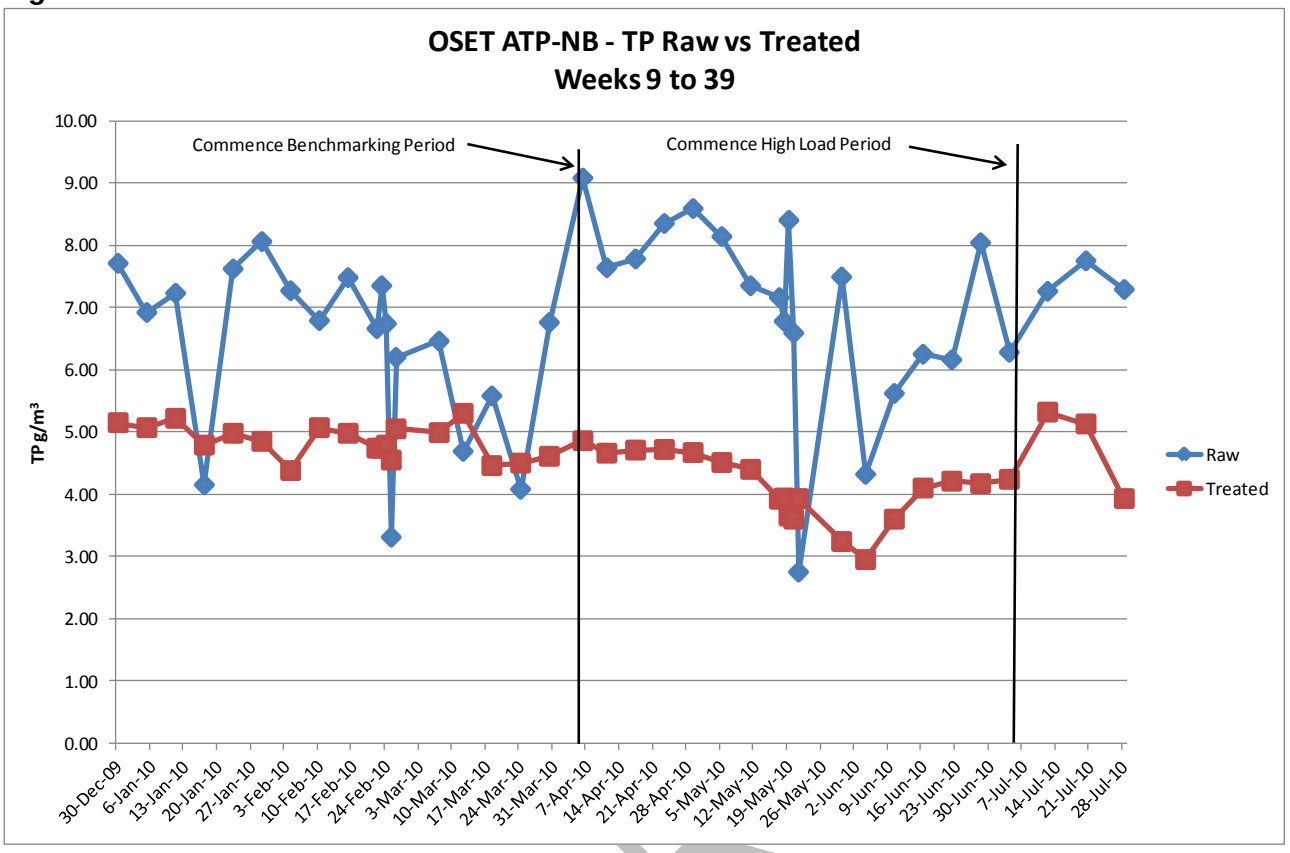
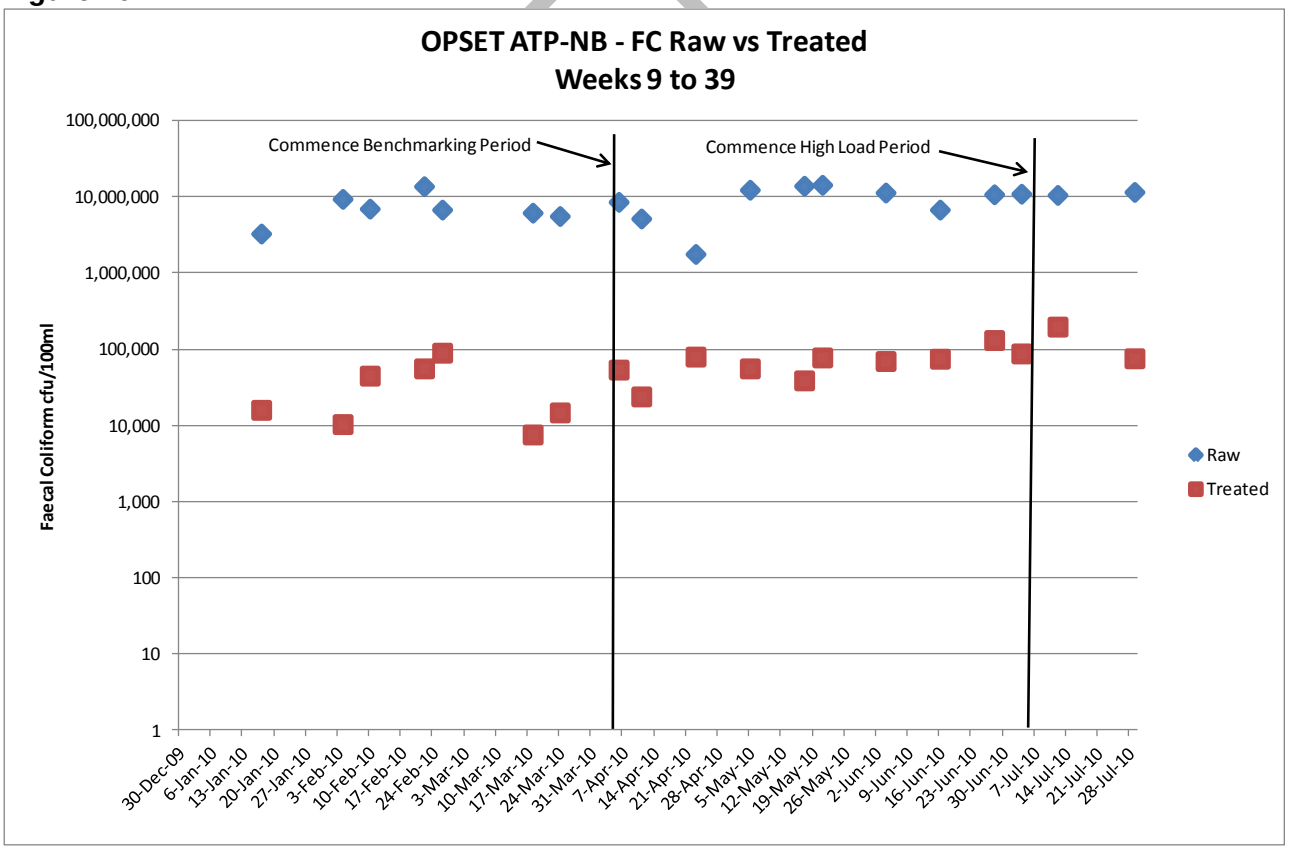


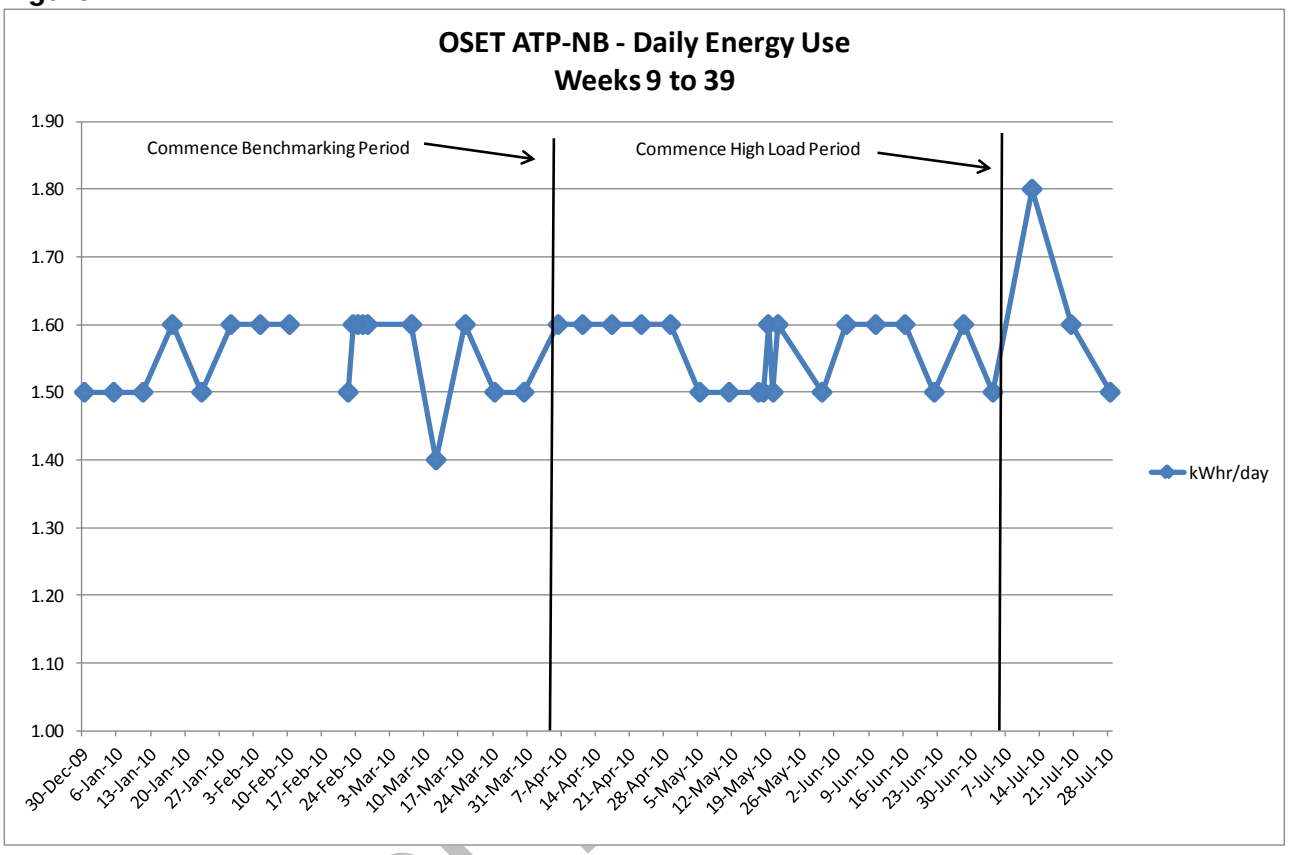

**Figure 10:**



### 6.7 Daily Energy Use, Weeks 9 to 39

**Figure 11** provides a record of the daily energy use. Power consumption is recorded for aerators and/or internal recycle pumping together with that for the effluent discharge pump. The treated effluent pump has to deliver against a 3.5m (5lb) static head. The OSET ATP-NB has a flexible air diffuser with a 60 L/min air blower and a high head (35m) effluent pump.

**Figure 11:**




### 6.8 Treated Effluent BOD and TSS Results, Assessment to AS/NZS 1547:2000, Weeks 9 to 35

**Figure 12** shows that $BOD_5$ reduction performance takes another 4 weeks over and above the 8 week media development period to fully settle down to a produce consistent high quality performance of between 5 and 10g/m$^3$ treated effluent. TSS reduction behaves similarly, and from week 13 (28 January) produces an exceptional quality TSS effluent.

### 6.9 Treated Effluent Benchmarking for all Parameters, Weeks 23 to 35

**Figure 13** sets out the treated effluent quality for 16 test results for benchmarking $BOD_5$, TSS, TN, $NH_4$-N, and TP, as well as daily energy use for weeks 23 to 35.

**Figure 12:**

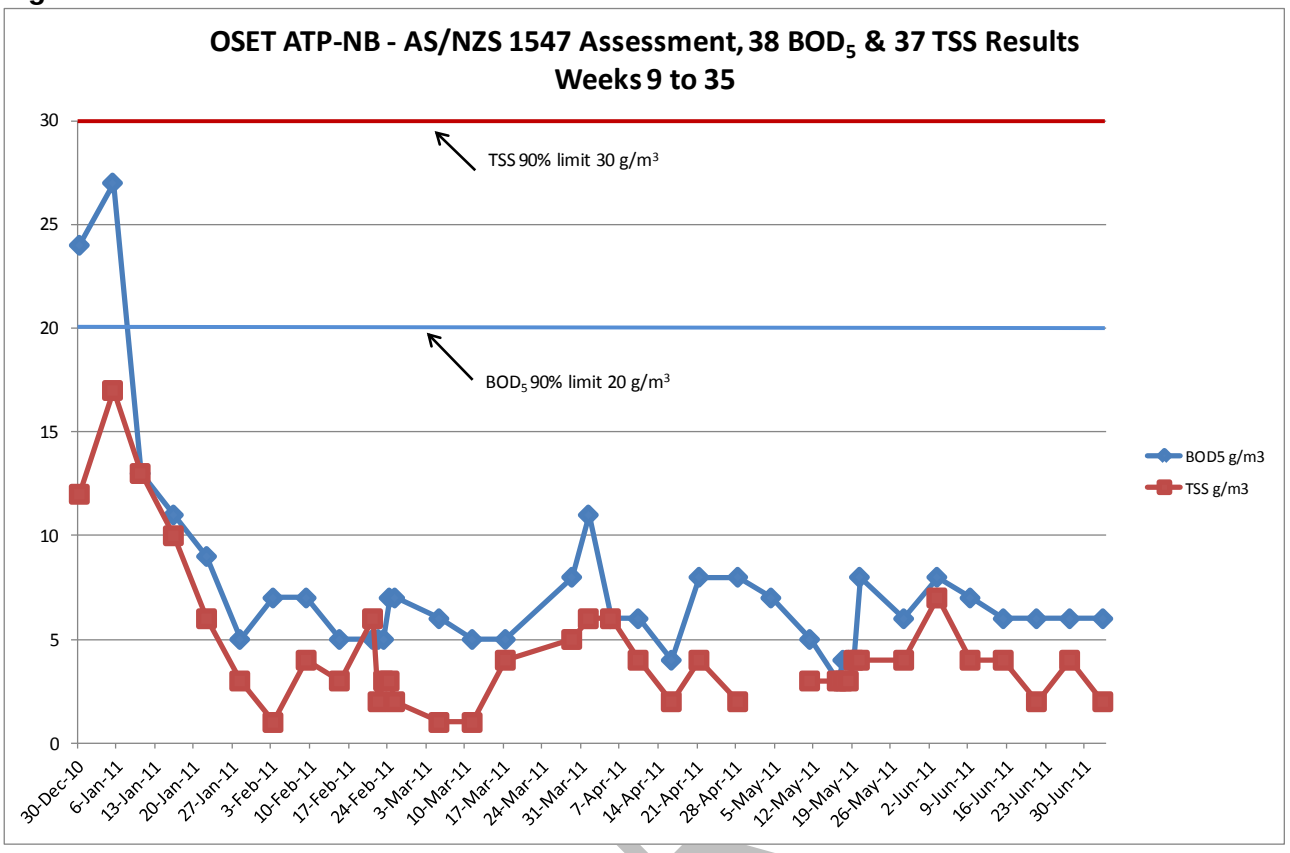
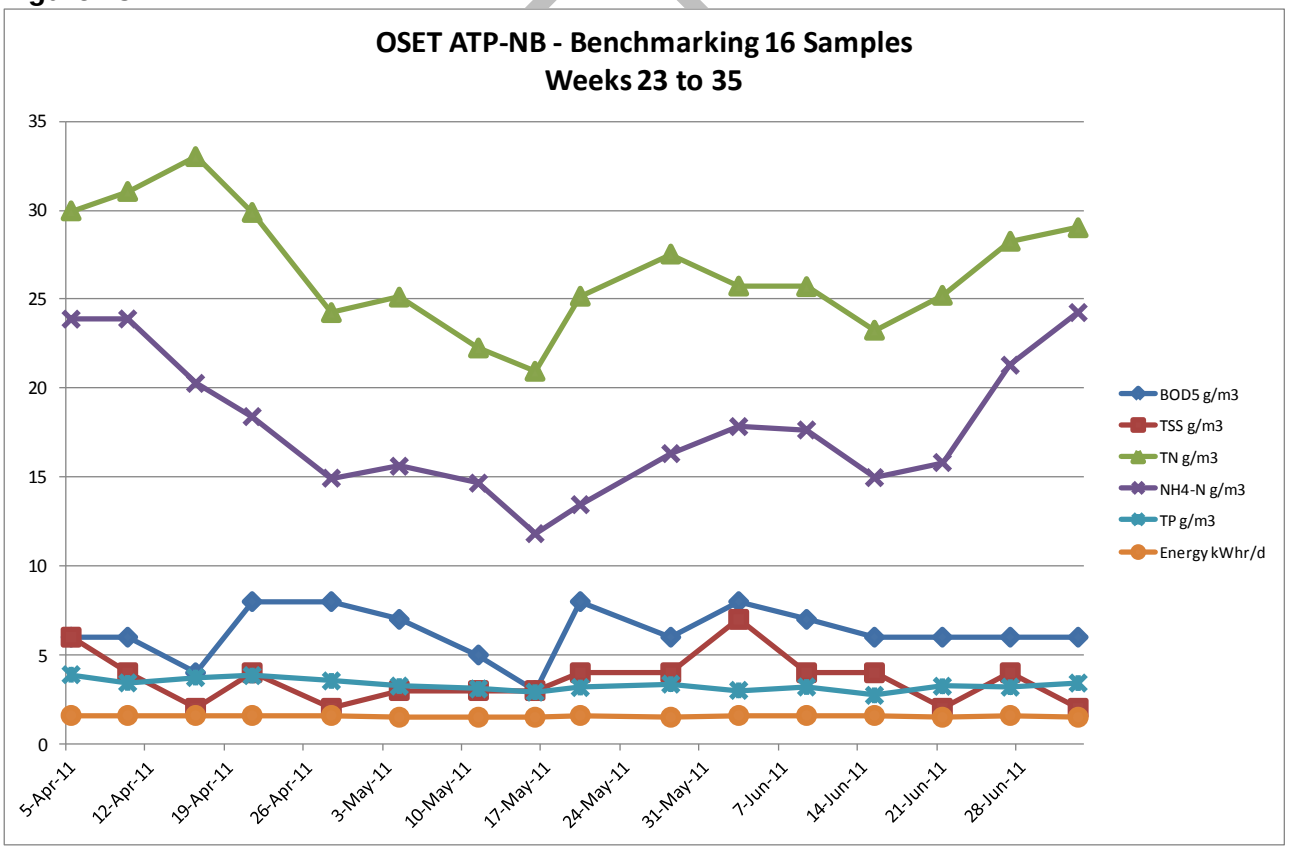



**Figure 13:**



### 6.10 High Load Assessment BOD, TSS and TN, Weeks 36 to 39

The high load effects period comprised 5 days peak load at 2,000 L/day in week 36 (6-10 July) followed by a 3 week recovery period [weeks 37 to 39 (11 July to 27 July)] involving three sampling events. The variation in test results for all parameters under the high load event and the subsequent recovery period are shown in **Figures 2** to **10**.

A comparison of the high load effects results for $BOD_5$, TSS and TN with mean values over the benchmarking period is shown in Table 2 as follows:

**Table 2: High Load Performance**

| Parameter | 1000 L/day [Mean of 16 results weeks 23 to 35] | 1000 L/day [Recovery – week 37] | 1000 L/day [Recovery – week 38] | 1000 L/day [Recovery – week 39] |
|---|---|---|---|---|
| $BOD_5$ | 6.25 g/m$^3$ | 14 g/m$^3$ | 3 g/m$^3$ | 8 g/m$^3$ |
| TSS | 3.7 g/m$^3$ | 12 g/m$^3$ | 8 g/m$^3$ | 5 g/m$^3$ |
| TN | 26.6 g/m$^3$ | 33.3 g/m$^3$ | 32.9 g/m$^3$ | 33.2 g/m$^3$ |

The high load event resulted in the following effects:

- $BOD_5$ level increased moderately over the first sample following return to 1,000 L/day, then recovered quickly (Figure 3).
- TSS level also increased moderately, then recovered to pre-high load levels within the 3 week recovery period (Figure 4).
- TN reduction performance was only very slightly affected by the high load event (Figure 5).

# 7 Performance evaluation

## 7.1 Meeting AS/NZS 1547:2000 secondary effluent quality requirements

The secondary effluent quality requirements for biochemical oxygen demand ($BOD_5$) and total suspended solids (TSS) defined by AS/NZS 1547:2000 is as follows:

*(a) 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$^3$.*
*(b) 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$^3$.*

Tables 3 and 4 below indicate the OSET ATP-NB treatment performance against these requirements.

**Table 3: $BOD_5$ Performance**

| BOD Item | OSET ATP-NB |
|---|---|
| No. of Test Results | 38 |
| No. of results = or < 20g/m$^3$ | 36 |
| % Achieving Performance Level | 95% |
| Maximum to be Within | 30g/m$^3$ |
| No. of Results >30 g/m3 | 0 |
| Meets AS/NZS 1547 requirements? | **YES** |

**Table 4: TSS Performance**

| Item | OSET ATP-NB |
|---|---|
| No. of Test Results | 38 |
| No. of results = or < 30g/m$^3$ | 38 |
| % Achieving Performance Level | 100% |
| Maximum to be Within | 45g/m$^3$ |
| No. of Results > 45 g/m3 | 0 |
| Meets AS/NZS 1547 requirements? | **YES** |

The OSET ATP-NB wastewater treatment system has achieved the AS/NZS 1547:2000 secondary effluent quality performance levels for $BOD_5$ and TSS.

## 7.2 Benchmark rating

To provide a simple, quantitative benchmark rating that is transferable across all possible effluent qualities, a system has been developed that rates the measured constituents, or ranked indicators, on a letter-grade based on the quality of effluent produced (or the quality of that particular indicator within the effluent produced). Table 5 below sets out the basis of this rating system.

**Table 5: Benchmark Rating Indicators**

| Rated Indicators for Median Value | Rating Letters and Corresponding Levels | | | | |
|---|---|---|---|---|---|
| | **A+** | **A** | **B** | **C** | **D** |
| BOD ($g/m^3$) | <5 | <10 | <20 | <30 | ≥30 |
| TSS ($g/m^3$) | <5 | <10 | <20 | <30 | ≥30 |
| Total nitrogen ($g/m^3$) | <5 | <15 | <25 | <30 | ≥30 |
| Ammoniacal nitrogen ($g/m^3$) | <1 | <5 | <10 | <20 | ≥20 |
| Total phosphorus ($g/m^3$) | <1 | <2 | <5 | <7 | ≥7 |
| Faecal coliforms (cfu/100ml) | <10 | <200 | <10,000 | <100,000 | ≥100,000 |
| Energy (kWh/d) (mean) | 0 | <1 | <2 | <5 | ≥5 |

The benchmarking evaluation for the OSET ATP-NB was carried out on 16 samples for six parameters plus energy use throughout the 91 day benchmarking test period. The results are rated as per Table 6 below.

**Table 6: OSET ATP-NB Effluent Quality Performance Ratings:**

| Indicator Parameters | Median | Std Dev | Rating | Rating System | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | ***A+*** | ***A*** | ***B*** | ***C*** | ***D*** |
| ***BOD ($g/m^3$)*** | ***7.2*** | ***4.7*** | **A** | ***<5*** | ***<10*** | ***<20*** | ***<30*** | ***≥30*** |
| ***TSS ($g/m^3$)*** | ***4.5*** | ***7.2*** | **A+** | ***<5*** | ***<10*** | ***<20*** | ***<30*** | ***≥30*** |
| ***Total nitrogen ($g/m^3$)*** | ***18.4*** | ***2.5*** | **B** | ***<5*** | ***<15*** | ***<25*** | ***<30*** | ***≥30*** |
| ***$NH_4$- Nitrogen ($g/m^3$)*** | ***2.91*** | ***1.14*** | **A** | ***<1*** | ***<5*** | ***<10*** | ***<20*** | ***≥20*** |
| ***Total phosphorus ($g/m^3$)*** | ***4.23*** | ***0.55*** | **B** | ***<1*** | ***<2*** | ***<5*** | ***<7*** | ***≥7*** |
| ***Faecal Coliforms (cfu/100mL)*** | ***75,500*** | ***29 x $10^3$*** | **C** | ***<10*** | ***<200*** | ***<10,000*** | ***<100,000*** | ***≥100,000*** |
| **Energy (kWh/d) (mean)** | ***1.55*** | ***--*** | **B** | ***0*** | ***<1*** | ***<2*** | ***<5*** | ***≥5*** |

# 8 Audit Group Comments

The OSET ATP-NB has shown a high level of performance in reducing BOD and excellent performance for TSS. Nitrogen reduction is only moderate and may have potential for improvement by adjusting the operational settings for the treatment system. Energy consumption is reasonably economical.

Ian Gunn
Technical Manager, OSET NTP

Ray Hedgland
Chairman, Audit Group, OSET NTP

# Appendices

**Appendix 1:** Trial X – OSET ATP-NB Testing Timeline
**Appendix 2:** OSET NTP Organisational Structure

## Appendix 1: TRIAL X – OSET ATP-NB Testing Timeline

| 201A-201B | | Day of week | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Start Date | WEEK | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday | | |
| 02-Nov-1A | 1 | | | | | | | | Media Development and Pre-Benchmarking Phase | |
| 09-Nov-1A | 2 | | | | | | | | | |
| 16-Nov-1A | 3 | | | | | | | | | |
| 23-Nov-1A | 4 | | | | | | | | | |
| 30-Nov-1A | 5 | | | | | | | | | |
| 07-Dec-1A | 6 | | | | | | | | | |
| 14-Dec-1A | 7 | | | | | | | | | |
| 21-Dec-1A | 8 | | | | | | | | | |
| 28-Dec-1A | 9 | | | | | | | | | |
| 04-Jan-1B | 10 | | | | | | | | | |
| 11-Jan-1B | 11 | | | | | | | | | |
| 18-Jan-1B | 12 | | | | | | | | | |
| 25-Jan-1B | 13 | | | | | | | | | |
| 01-Feb-1B | 14 | | | | | | | | | |
| 08-Feb-1B | 15 | | | | | | | | | |
| 15-Feb-1B | 16 | | | | | | | | | |
| 22-Feb-1B | 17 | | | | | | | | | |
| 01-Mar-1B | 18 | | | | | | | | | |
| 08-Mar-1B | 19 | | | | | | | | | |
| 15-Mar-1B | 20 | | | | | | | | | |
| 22-Mar-1B | 21 | | | | | | | | | |
| 29-Mar-1B | 22 | | | | | | | | | |
| 05-Apr-1B | 23 | | **1** | | | | | **2** | Benchmarking and High Flow Phase | |
| 12-Apr-1B | 24 | | | | | | **3** | | | |
| 19-Apr-1B | 25 | | | | | **4** | | | | |
| 26-Apr-1B | 26 | | | | **5** | | | | | |
| 03-May-1B | 27 | | | **6** | | | | | | |
| 10-May-1B | 28 | | **7** | | | | | | | |
| 17-May-1B | 29 | **8** | | | | **9** | | | | |
| 24-May-1B | 30 | | | | | | **10** | | | |
| 31-May-1B | 31 | | | | | **11** | | | | |
| 07-Jun-1B | 32 | | | | **12** | | | | | |
| 14-Jun-1B | 33 | | | **13** | | | | | | |
| 21-Jun-1B | 34 | | **14** | | | | | | | |
| 28-Jun-1B | 35 | **15** | | | | | | **16** | | |
| 05-Jul-1B | 36 | | | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | | |
| 12-Jul-1B | 37 | | | | | | | | | |
| 19-Jul-1B | 38 | | | | | | | | | |
| 26-Jul-1B | 39 | | | | | | | | | |

| Sampling Profile A | |
|---|---|
| $cBOD_5$ | |
| TSS | |
| TN | |
| $NH_4$-N | |
| TKN | |
| TOXN | |
| $NO_3$-N | |
| $NO_2$-N | |
| TP | |
| Alk | |
| pH | |
| Temp | |

| Sampling Profile B | |
|---|---|
| $cBOD_5$ | |
| TSS | |
| TN | |
| $NH_4$-N | |
| TKN | |
| TOXN | |
| $NO_3$-N | |
| $NO_2$-N | |
| TP | |
| Alk | |
| pH | |
| Temp | |
| FC | |

Legend

Profile A

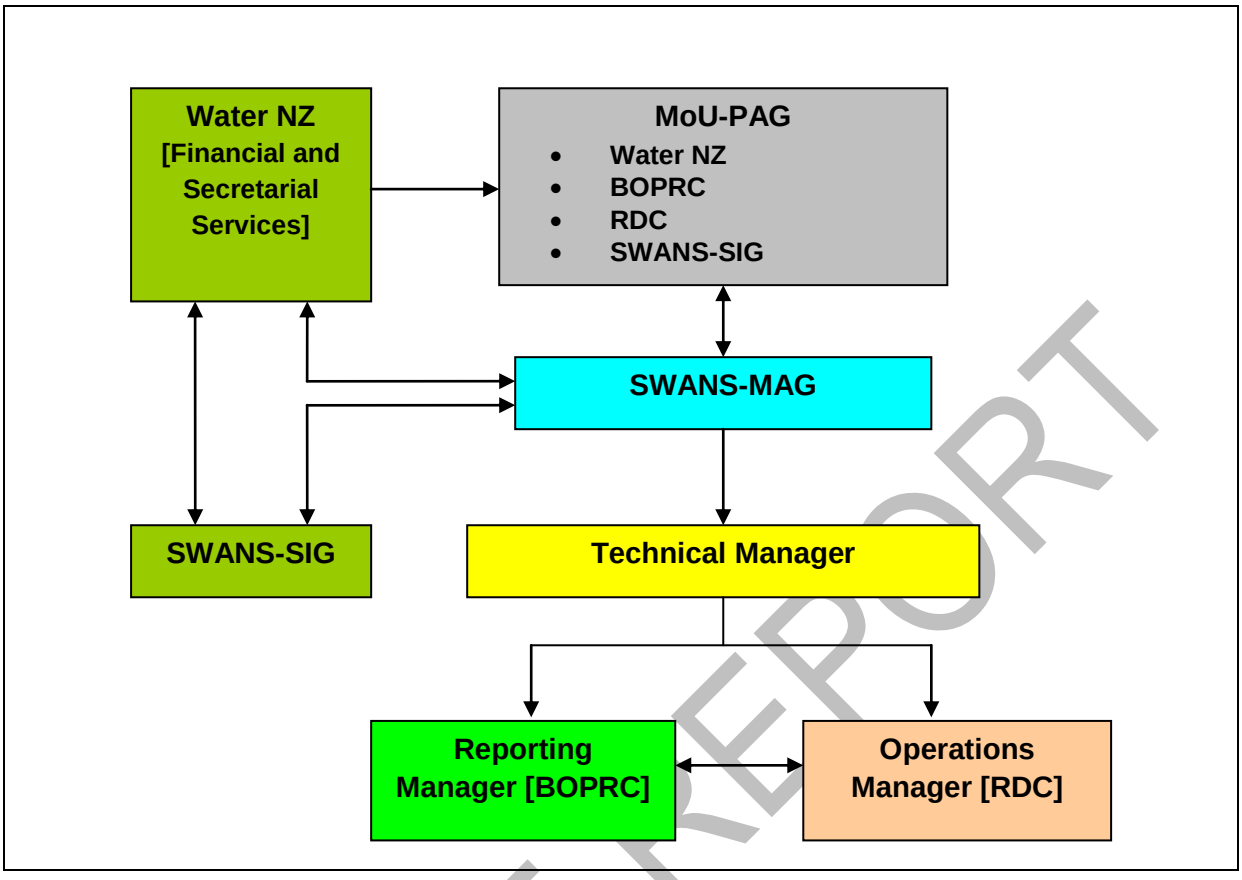
Profile B

**1 -16** indicates Benchmarking samples

Media Development
Pre-Benchmarking

Benchmarking
High Load Effects Period

## Appendix 2: OSET NTP Operational Structure






### Acronyms

| | |
|---|---|
| MoU | Memorandum of Understanding |
| MoU PAG | Partners Advisory Group |
| EBOP | Environment Bay of Plenty |
| RDC | Rotorua District Council |
| OSET | On-Site Effluent Treatment |
| OSET NTP | OSET National Testing Programme |
| SWANS | Small Wastewater and Natural Systems |
| SWANS MAG | SWANS Management and Auditing Group |
| SWANS SIG | SWANS Special Interest Group |
| WATER NZ | Water New Zealand |

### SWANS-MAG Membership

| | |
|---|---|
| Technical Manager | Ian Gunn (SWANS-SIG) |
| Chairman | Ray Hedgland (Fraser Thomas Ltd) |
| Operations & Laboratory Manager | Dave Anderson (Rotorua District Council) |
| Reporting Manager | Sam Weiss (Bay of Plenty Regional Council) |
| Appointed Member | Andrew Dakers (EcoEng Pacific Ltd) |
| Appointed Member | Gilles Altner (Global Environmental Engineering Ltd) |