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Wastewater Treatment Performance Reivew

Prepared for

AFFCO New Zealand Ltd, Manawatu Plant

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Contents

1 Introduction

1.1 Background

AFFCO New Zealand Limited (AFFCO) owns and operates the AFFCO Manawatu beef processing plant at 7 Campbell Road, Feilding.

The plant processes up to 700 cattle per day on two shifts, and up to 130,000 per year. Apart from a maintenance shutdown of 1-6 weeks in late winter or spring, the plant operates year-round with peak production from December to April.

A range of chilled and frozen beef cuts/edible offal is produced for markets throughout the world. Blood, renderable material and hides are sent offsite daily for further processing at other AFFCO plants.

On average, approximately 2.5 m^3 of wastewater is produced per animal processed. The wastewater is treated onsite in effluent ponds and irrigated onto a neighbouring farm or discharged to the Oroua River. The wastewater is irrigated during summer (December to March inclusive) and when the river flow is below permitted limits for discharge. When conditions are not suitable for discharge to land or the river, wastewater accumulates within the storage capacity of the treatment ponds.

Amenities wastewater from the plant kitchens and toilets is treated in a separate on-site package plant and discharged into land via a soakage field.

Resource consents for discharging the processing effluent discharges to land and water expired in May 2011, but remain operative while an application for replacement consents is being assessed.

1.2 Purpose and Scope of Report

This report provides information on the design, management and performance of the AFFCO Manawatu wastewater treatment process to supplement that provided in the Assessment of Environmental Effects lodged with the consents application.

Monitoring data for the last six years are provided and assessed in relation to production at the site and improvements made to the treatment process.

2 Description of Wastewater Treatment System

2.1 Wastewater Sources and Primary Treatment

A process flow diagram of the wastewater treatment system is shown in Figure 1 and a layout of the treatment facilities is shown in Figure 2.

The process wastewater derives from a range of sources including the stockyards, truck wash, slaughtering, boning, processing of edible offal and gut washing. Stormwater catchment areas that have potential to become contaminated also drain to the effluent system.

The untreated wastewater from the plant contains small quantities of blood, fat, meat scraps and biodegradable detergents from the processing areas, and animal faeces and urine from the stockyards, truck wash and gut washing operations.

The wastewater is separated at source into two main streams:

- “Green” streams containing paunch contents (semi digested grass) from paunch washing, and faeces and urine from the stockyards and truck wash.
- “Red” streams containing predominantly animal tissues (blood, fat and meat scrap) from the slaughterfloor, boning room, soft-offal washing and chillers. This stream also includes some gut contents from the cutting and washing of gut material.

The green streams, containing a high loading of suspended solids, are pumped to the solids pond where most of the solids separate from the wastewater.

Most of the red wastewater streams are used to wash macerated gut material (soft offal) in a large Contra-Shear milliscreen with 1 mm aperture. In this process, solids larger than about 1 mm, consisting mainly of animal tissues, are recovered from the gut material and wastewater streams and sent off-site to rendering.

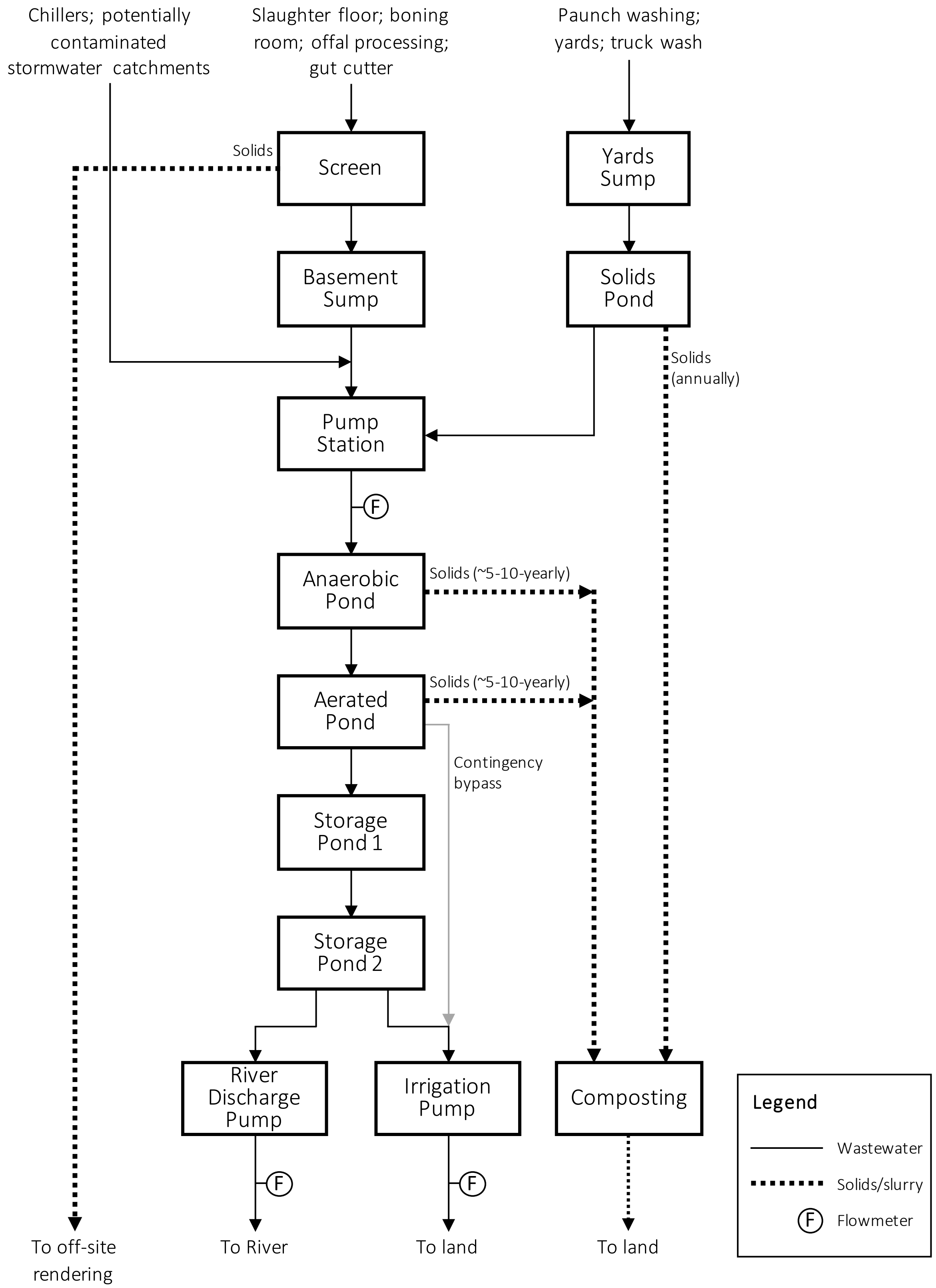

Figure 1
Wastewater treatment process flow diagram.

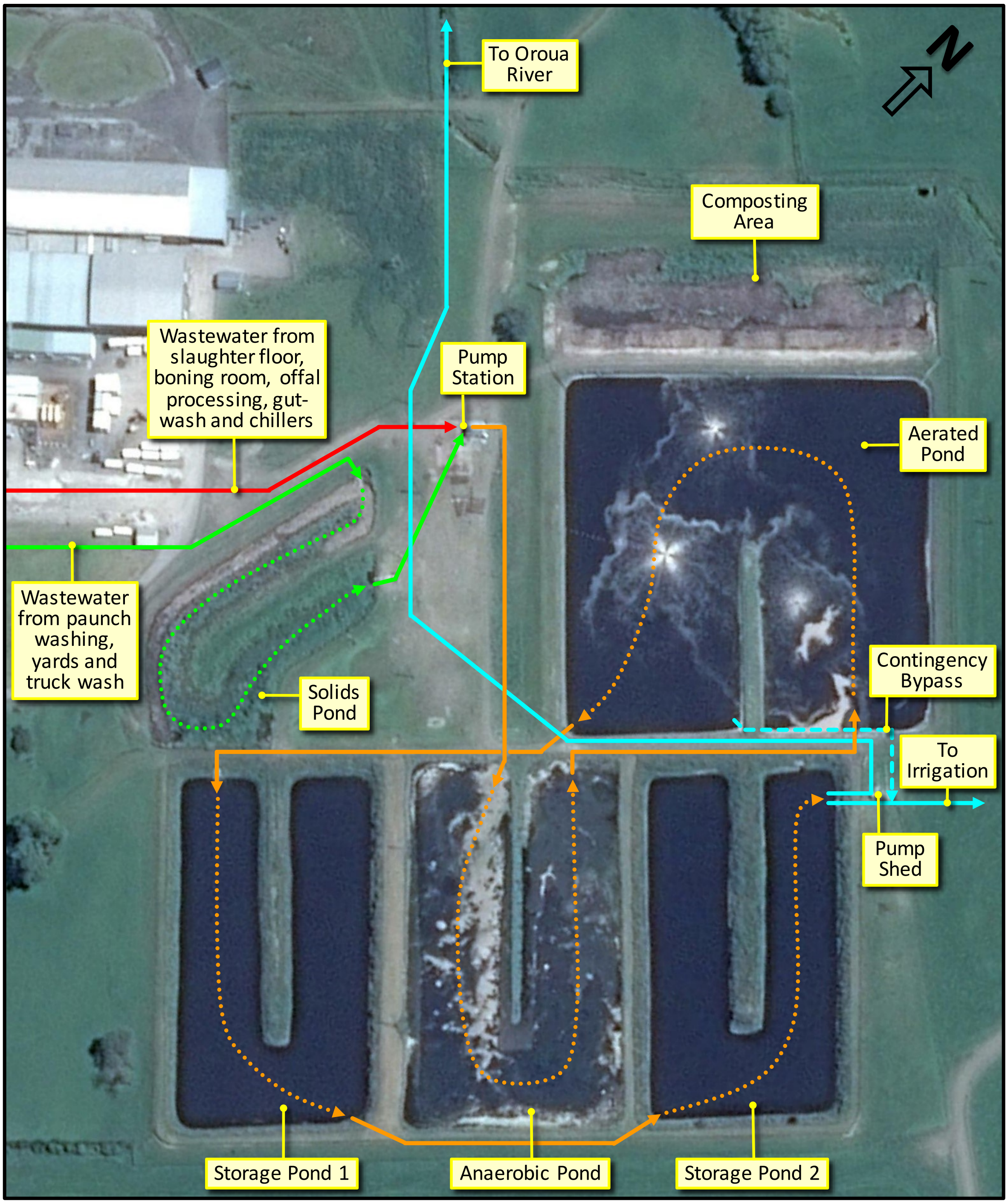

Figure 2

Wastewater treatment system layout showing wastewater flow paths.

2.2 Solids Pond

The solids pond has an area of 4150 m^2, an operating depth of 3.6 m and an operating volume of approximately 10,000 m^3.

The high-solids wastewater streams from the truck wash, stockyards and paunch emptying, estimated to be around a third of the total plant wastewater volume, are pumped to the solids pond. The solids separate from the liquid forming a thick floating crust and some sediment. Some of the organic matter in the pond decomposes to biogas (methane and carbon dioxide) in the pond by anaerobic digestion processes. Most of the biogas discharges to atmosphere. Some biogas becomes entrapped in the crust, which helps keep the crust afloat.

The physical and biological treatment processes in the pond remove approximately 70% of the dissolved and particulate organic matter in the wastewater.

The effluent from the pond discharges by gravity to the main pump station where it combines with the screened "red" wastewater from the plant. The solids pond is operated with a constant level determined by the outlet structure.

Excess solids are removed from the solids pond once or twice a year by a contractor using an excavator. The solids are deposited in the nearby composting area. Normally, only the thickest surface solids are removed to minimise the volume and water content of the removed solids. This also ensures that sufficient anaerobic sludge remains to rapidly reform a crust and sustain anaerobic digestion activity.

2.3 Anaerobic Pond

The anaerobic pond has an area of 10,000 m^2 and a normal operating volume of approximately 30,000 m^3. The average hydraulic retention time in this pond is around 36 days for an annual effluent volume of 300,000 m^3.

This pond receives screened effluent from the plant together with the discharge from the solids pond. The combined wastewater streams are pumped into the north-east end of the anaerobic pond (Figure 2).

Microorganisms in the lagoon pond digest the wastewater organic matter, converting most of it to biogas. The wastewater is typically warm (25-30°C), which promotes anaerobic digestion. The warm wastewater combined with a relatively long hydraulic residence time in the pond results in approximately 90% removal of wastewater BOD and COD.

The U-shaped anaerobic pond has a high length-to-width ratio of 7:1, which promotes plug-flow conditions and enhances treatment performance.

Some of the organic matter is converted to bacterial biomass which slowly accumulates as sludge sediment in the base of the pond. Approximately 5-10% of the organic matter removed from the wastewater in the anaerobic lagoon accumulates as sediment.

Faecal bacteria removal in the pond has not been measured, but can be expected to be 90-99%, based on the performance of similar ponds in the meat industry.

Proteins and other forms of organic nitrogen are converted to ammonia. Sulphur-containing compounds are reduced to sulphides.

No nitrogen or phosphorus is removed in the anaerobic pond other than that which accumulates in the sediment and is ultimately removed when the pond is de-sludged. Approximately 5-10% of the influent nitrogen and phosphorus is removed in this way.

Sludge accumulation is particularly slow because of the large pond volume, which allows the sludge to digest for many years before the residue accumulates to a level where it needs to be removed. Our experience with anaerobic ponds in the meat industry is that they perform best with large volumes of sludge (50% of the pond volume or more), but the sludge should be prevented from reaching a level where it begins to carry over into the discharge.

Recently the AFFCO Manawatu anaerobic pond became full of sludge after at least 20 years without any sludge removal. Treatment performance suddenly deteriorated, but the extra load was easily handled by downstream treatment ponds with no adverse effects on final effluent quality. The situation was rectified by desludging. Removal of excess sludge every 5-10 years to maintain an average sludge volume of around 50% is recommended. A benefit of maintaining a high sludge age in the pond is that it minimises the quantity of sludge to be removed.

2.4 Aerated Pond

The effluent from the anaerobic pond flows by gravity to the aerated pond.

The aerated pond has an area of 17,000 m^2 and a normal operating volume of approximately 34,000 m^3. The average hydraulic retention time in this pond is around 41 days for an annual effluent volume of 300,000 m^3.

The main functions of the aerated pond are:

- Aerobic removal of residual carbonaceous biochemical oxygen demand ($CBOD_5$).
- The oxidation of sulphides to sulphate.
- The oxidation of ammonia to nitrate (nitrification).
- Removal of nitrogen by reduction of nitrate to nitrogen gas (denitrification) in the anoxic pond sediments and lower water column.
- Reduction of faecal bacteria.
- Storage of wastewater as required.

The aerated pond contains three floating 18.5 kW high speed vertical shaft mechanical aerators: two Ashbrook units and one Aquasystems Aqua Turbo AER-AS unit. The aerators can be seen in Figure 2. They provide the oxygen necessary for oxidising residual organic matter, sulphides and ammonia in the wastewater. The dissolved oxygen and nitrates produced by the aeration, combined with low residual $CBOD_5$ levels, ensure that the bulk of the pond volume is maintained in an aerobic state.

A concrete wave band around the pond prevents the turbulence caused by the aerators from eroding the embankments.

The normal operating depth of the aerated pond is 2.4 m. When effluent must be stored in the ponds, the aerated pond level can be increased by 700 mm, which increases the wastewater volume in the pond by 11,000 m^3.

The aerated pond effluent discharges by gravity via an outlet weir to Storage Pond 1. The depth in the aerated pond can be controlled between 2.4 and 3.0 m via the outlet weir, or the depth may naturally increase as the downstream storage ponds become full.

Aerated pond effluent can be irrigated to land directly via a separate bypass pipe as shown in Figure 1 and Figure 2. This bypass is for contingency purposes and only for discharge to land. Under normal circumstances, and for discharge to the river, the wastewater flows through all available ponds for maximum treatment.

2.5 Storage Ponds

Until late 2001, the storage ponds as shown Figure 2 were operated as anaerobic ponds in parallel with the current anaerobic pond. After the meat plant was rebuilt in 1992, the existing anaerobic treatment capacity was more than required so the two outer anaerobic ponds were eventually put to better use for storage of aerobically treated effluent prior to discharge. Reducing the number of anaerobic ponds also greatly reduced odour emissions from the treatment process.

Each storage pond has the same dimensions and capacity as the anaerobic pond. When not used for storage, the ponds are not completely emptied but operated at a depth of approximately 1.4 m, including up to 0.8 m depth of accumulated organic sediment. Maintaining a continual but shallow flow of wastewater through the storage ponds provides for additional treatment – particularly the reduction of nitrates in the anoxic sediments, and the reduction of faecal bacteria through natural sunlight disinfection.

The two ponds can store 52,000 m^3 of wastewater by increasing their operating depth by 3.1 m as required.

The wastewater flows by gravity from Storage Pond 1 to Storage Pond 2 and is pumped from Storage Pond 2 to land or the Oroua River.

2.6 Total Storage Capacity

When the effluent ponds (excluding the solids pond) are full of wastewater, they operate at a common level water level (Figure 3). Contingency storage capacity is maximised by maintaining the normal operating level of each pond as much as practicable. When conditions are not suitable for discharge to land or water, wastewater first accumulates in the storage ponds. As the storage ponds approach their maximum operating level, wastewater begins to accumulate in the aerated pond and then the anaerobic pond. The total safe storage capacity with a minimum pond freeboard of 300 mm, is approximately 66,000 m³. The total volume between normal operating levels and embankment overflow is approximately 80,000 m³ (Table 1).

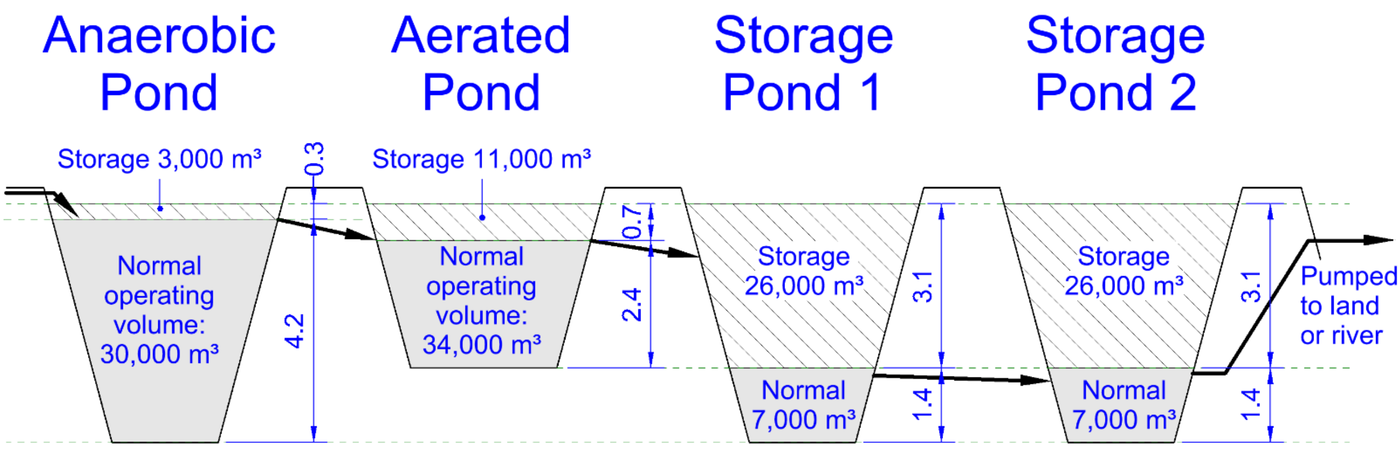

Figure 3
Hydraulic profile.

Table 1.
Pond dimensions and volumes.

	Units	Solids pond	Anaerobic pond	Aerated pond	Storage pond 1	Storage pond 2	Total
Normal operating volume	m³	10,000	30,000	34,000	7,000	7,000	88,000
Normal operating depth	m	3.6	4.2	2.4	1.4*	1.4*	
Maximum safe operating depth	m	3.6	4.5	3.1	4.5	4.5	
Maximum safe storage volume**	m³	n/a	3,000	11,000	26,000	26,000	66,000
Maximum storage volume***	m³	n/a	6,000	16,000	29,000	29,000	80,000
Maximum safe operating volume**	m³	10,000	33,000	45,000	33,000	33,000	154,000
Area at maximum water level	m²	4,150	10,000	17,000	10,000	10,000	51,150

* Includes approximately 0.8 m depth of accumulated organic sediment.

** With at least 300 mm freeboard remaining in ponds.

*** No freeboard remaining.

2.7 Treatment Process Improvements

Until mid-2014, the storage ponds were not a continuous part of the treatment process. They were fed intermittently as required and were emptied into the aerated pond using a portable pump. The management of storage was a manual process. The storage ponds were often idle and contributed little to wastewater treatment. Most of the time the combined wastewater from the solids pond and plant was treated in only the anaerobic and aerated ponds. All discharges to land and river were from the aerated pond.

In 2014, new gravity pipe connections were installed between the aerated pond and Storage Pond 1, and between the two storage ponds. The gravity discharge to river on the aerated pond was demolished and new pumped outlets to land and river were installed in Storage Pond 2 – to create the current flow paths shown in Figure 1 and Figure 2.

The upgrade work undertaken in 2014 also included the following:

- Installation of a new pipeline from the pump station to the anaerobic pond to bypass an old concrete save-all (primary sedimentation tank) that was being used only as a conduit for the wastewater. The save-all tank was then demolished.
- Installation of electromagnetic flowmeters in the pipelines discharging to land and river, to enable accurate monitoring of discharge volumes. The accuracy of the discharge flowmeters has been independently verified.
- Installation of continuous hydrostatic level monitoring in Storage Pond 2.
- Installation of an additional 18.5 kW aerator in the aerated pond.
- Installation of an electronic system that precisely controls the pumped discharge to river at a set rate.
- Connection of the river discharge flowmeter to the Horizons Regional Council telemetry system for real-time monitoring of discharge volumes.

Most of the above upgrades became operational in May 2014. The flow and level monitoring upgrades were completed in August 2014.

Benefits of the upgrades include:

- Simplified management of wastewater storage.
- A greatly reduced risk of pond overflow and spillages.
- Improved treatment performance due to a longer treatment flow path through four ponds instead of two.
- Improved process monitoring and control.
- More precise control over the discharge rate to the Oroua River.

3 Wastewater Treatment Monitoring and Management

3.1 Operational Monitoring and Contingencies

The main operational requirements for the treatment process are to ensure that the pumps and aerators are working correctly and that discharge volumes and rates comply with consent conditions.

Pumps are regularly inspected and maintained. The pump station feeding the anaerobic pond is most critical. This facility consists of duty and standby pumps to ensure that the wastewater continues to be pumped to the treatment system if one of the pumps fail.

The discharge pumps are less critical as the storage capacity in the pond system allows for these pumps to be repaired or replaced without the need for backup units on site.

Normally two aerators are sufficient to oxidise most of the ammonia in the wastewater to nitrate. The complete oxidisation of ammonia to nitrate is usually limited by wastewater alkalinity rather than aeration capacity. Aerators are turned on and off manually as required, depending on aerated pond nitrate nitrogen levels and pH. The aim is to provide sufficient aeration to maintain the concentration of total oxidised nitrogen (nitrate nitrogen plus nitrite nitrogen) in the aerated pond effluent above 20 g/m^3. The generation of nitrate and nitrite nitrogen in the aerated pond is a requirement for subsequent removal of nitrogen by conversion to nitrogen gases in the anoxic sediments of the aerated and storage ponds.

3.2 Discharge Flow Monitoring and Control

The discharge to the Oroua River is monitored continuously via AFFCO's SCADA system and Horizon's telemetry system.

When discharging to river, river flows and the discharge rate are monitored at least once a day and recorded on a log sheet to ensure that discharge volumes and rates comply with consent requirements.

When discharging to land, volumes of wastewater applied to each irrigation block are recorded and nitrogen loading rates are calculated to monitor compliance with consent requirements.

3.3 Wastewater Characteristics

The performance of the wastewater treatment system is monitored by regular sampling and testing of the wastewater as summarised in Table 2. Samples are sent to an accredited laboratory for analysis.

Table 2 Wastewater sampling locations, sampling frequency and parameters tested.			
Parameter	Final effluent (ex. Storage Pond 2)	Aerated Pond effluent	Anaerobic Pond effluent
Total suspended solids	Fortnightly		Fortnightly
Carbonaceous BOD_5	Fortnightly		Fortnightly
Total nitrogen	Fortnightly	Fortnightly	Fortnightly
Ammoniacal nitrogen	Fortnightly		
Nitrate-nitrite nitrogen	Fortnightly	Fortnightly	
Nitrite nitrogen	Fortnightly		
Total phosphorus	Fortnightly		
Dissolved reactive phosphorus	Fortnightly		
Enterococci	Fortnightly		
E. coli	Fortnightly		
pH	Fortnightly	Fortnightly	Fortnightly
Temperature	Weekly	Weekly	Weekly
Total calcium	Monthly*		
Total magnesium	Monthly*		
Total potassium	Monthly*		
Total sodium	Monthly*		

* When irrigating wastewater onto land

3.4 Data Management and Reporting

Wastewater flow data and analysis results are collated together with plant production data to assess trends in treatment performance and compliance with discharge consent conditions.

Collation and analysis of the data is managed by Albert van Oostrom & Associates. Discharge consent compliance reports are provided to AFFCO Manawatu management monthly and the Regional Council annually.

4 Treated Wastewater Characteristics

4.1 Flow Volumes

Wastewater discharge volumes can vary substantially from day to day, depending on whether river or soil conditions are suitable for discharge, and on the volume of wastewater in the ponds (Figure 4).

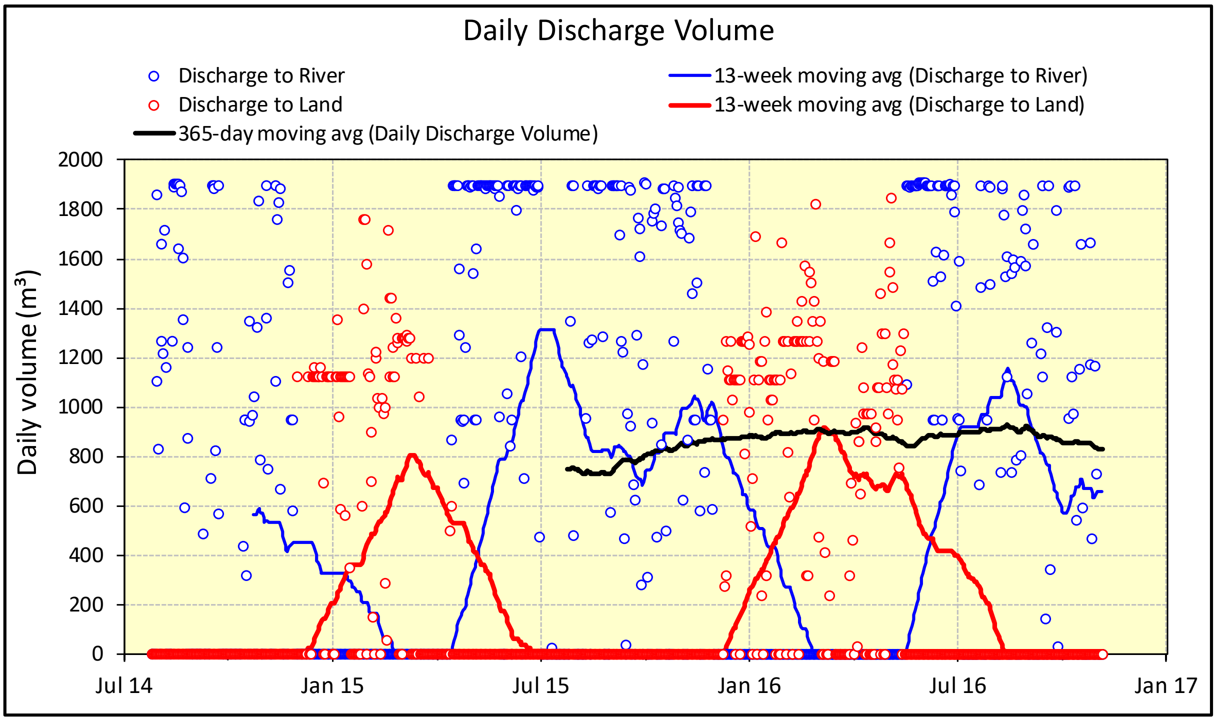

Figure 4

Daily discharge volumes for treated wastewater.

On an annual basis, the volume of wastewater discharged at recent production levels is around 300,000 m³ or 2.30 -2.66 m³ per animal processed (Table 3).

Table 3

Volumes of treated wastewater discharged.

	To Land	To River	Total
Total volume (m³)			
Year ending 30 Sep. 2015	80,488	209,162	289,650
Year ending 30 Sep. 2016	125,075	192,473	317,548
Specific volume (m³/head)			
Year ending 30 Sep. 2015	-	-	2.30
Year ending 30 Sep. 2016	-	-	2.66

Note: Variations in the total volume discharged between years could be partly due to differences in pond storage volumes used at the beginning and end of each year.

These wastewater volumes are similar to plant water consumption, which averages around 2.5 m³ per head. Potable water use per head is as low as 1.5 m³ on high production days, but increases during periods of lower production due to necessary "background" water usage that does not change with production.

Water usage and effluent production at AFFCO Manawatu is lower than at many beef processing plants, as a significant proportion of wastewater is recycled for use in gut washing and flushing paunch contents.

4.2 Suspended Solids

The concentration of total suspended solids (TSS) in the final effluent has generally improved from an annual median concentration of around 100 g/m³ 5-6 years ago to 43 g/m³ for the past 12 months – despite a significant increase in meat plant production over this period (Figure 5).

Raw settled or screened beef processing wastewater typically contains around 2000 g/m³ of TSS. The treatment system therefore reduces the wastewater TSS load by around 97% on average.

The general improvement in effluent quality with respect to suspended solids can be attributed to the pond system upgrade in 2014. Notwithstanding the general improvement, a few samples of the wastewater continue to contain unexpectedly high concentrations of TSS (>300 g/m³). We recommend that AFFCO undertakes a review of sampling procedures and the storage pond outlet design in case the occasional high TSS results are a sampling artefact or the result of pond sediment being drawn into the discharge pump.

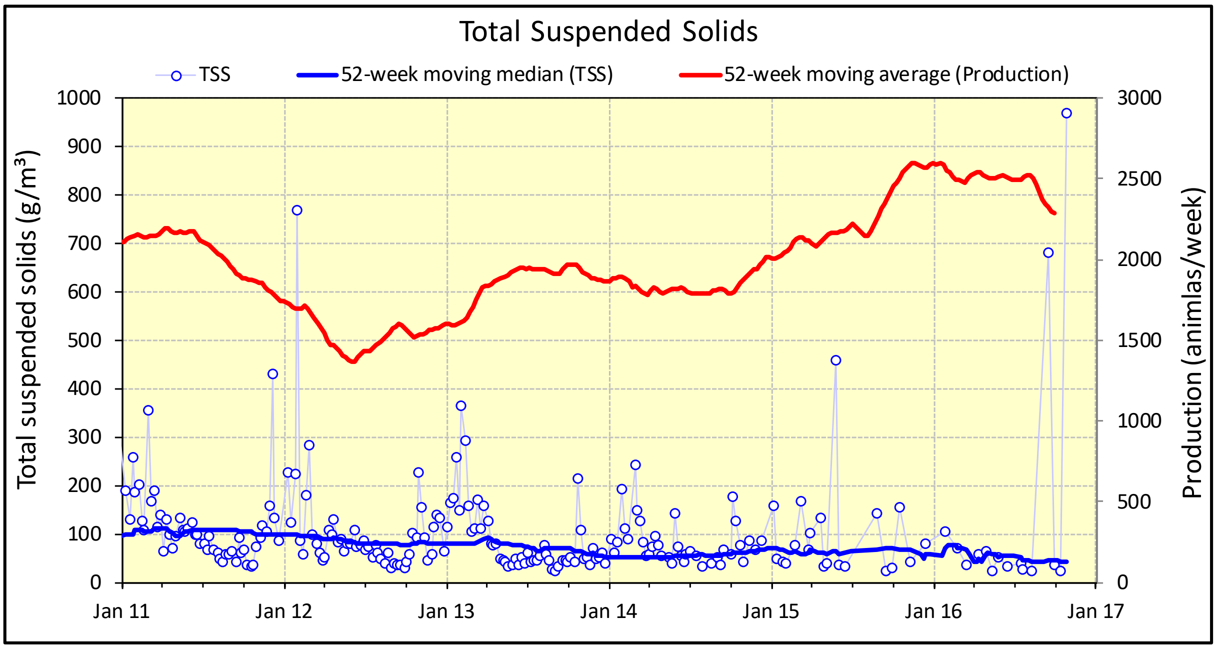

Figure 5

Concentration of total suspended solids in the treated wastewater.

4.3 Biochemical Oxygen Demand

The average concentration of carbonaceous 5-day biochemical oxygen demand ($CBOD_5$) in the final effluent was 31 g/m³ for the past 12 months. $CBOD_5$ concentrations have generally improved and become less variable over the last 6 years despite the increase in meat plant production (Figure 6).

Primary treated (settled or screened) beef processing wastewater typically contains around 2000 g/m³ of $CBOD_5$. The treatment system therefore typically reduces the wastewater $CBOD_5$ load by around 98%.

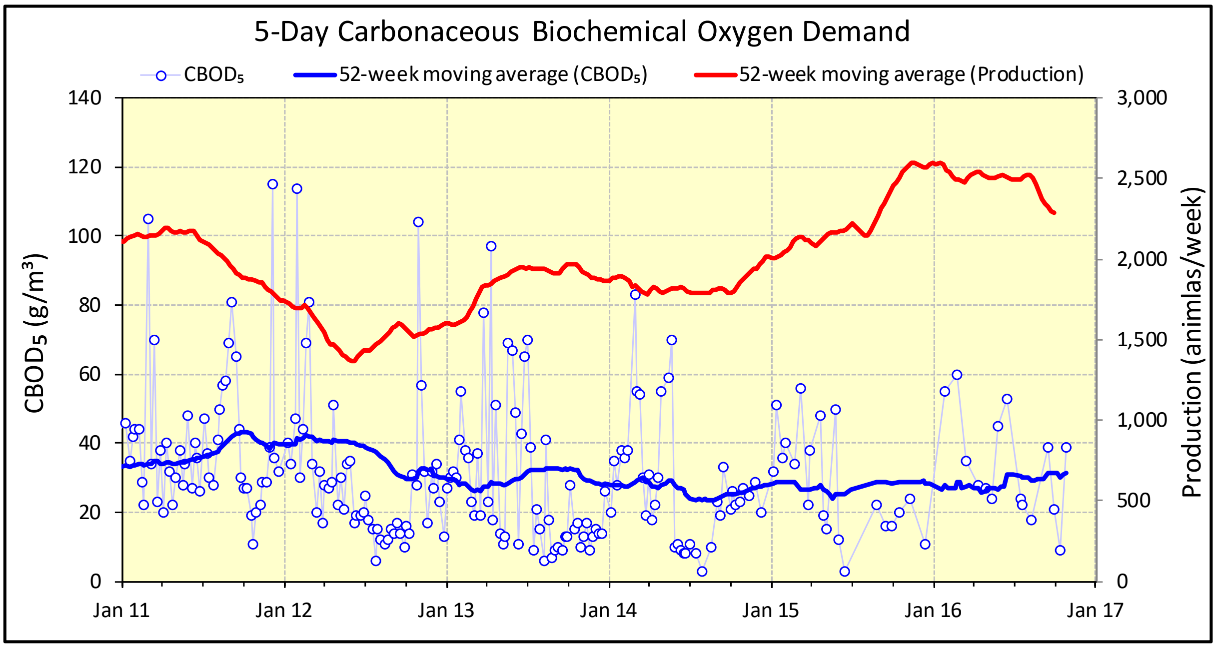

Figure 6

Concentration of carbonaceous biological oxygen demand in the treated wastewater.

4.4 Total Nitrogen

Despite the recent spike in animals processed at the AFFCO Manawatu, the annual average nitrogen concentration in the treated wastewater has decreased by over 35% in recent years. The average nitrogen concentration over the last 12 months was 78 g/m³, compared to typical annual average concentrations of 120-140 g/m³ prior to the pond upgrade in 2014 (Figure 7).

The concentration of total nitrogen in untreated beef processing effluent is typically around 200 g/m³.

Nitrogen loading data (Table 4) confirm an improvement in nitrogen removal performance. In the year ending 30 September 2016, the average load of nitrogen discharged was 0.22 kg per animal processed. Primary-treated effluent from processing beef animals typically contains around 0.5 kg of nitrogen per head; therefore, the treatment system is currently removing approximately 56% of the influent nitrogen on average.

The improvement in nitrogen removal can largely be attributed to the increased aeration capacity in the aerated pond as well as continuous operation of the storage ponds as part of the treatment process.

To achieve further improvements in nitrogen removal performance, a dedicated biological nitrogen removal system would be required. This would involve substantial capital and operating costs, and increased operational complexity.

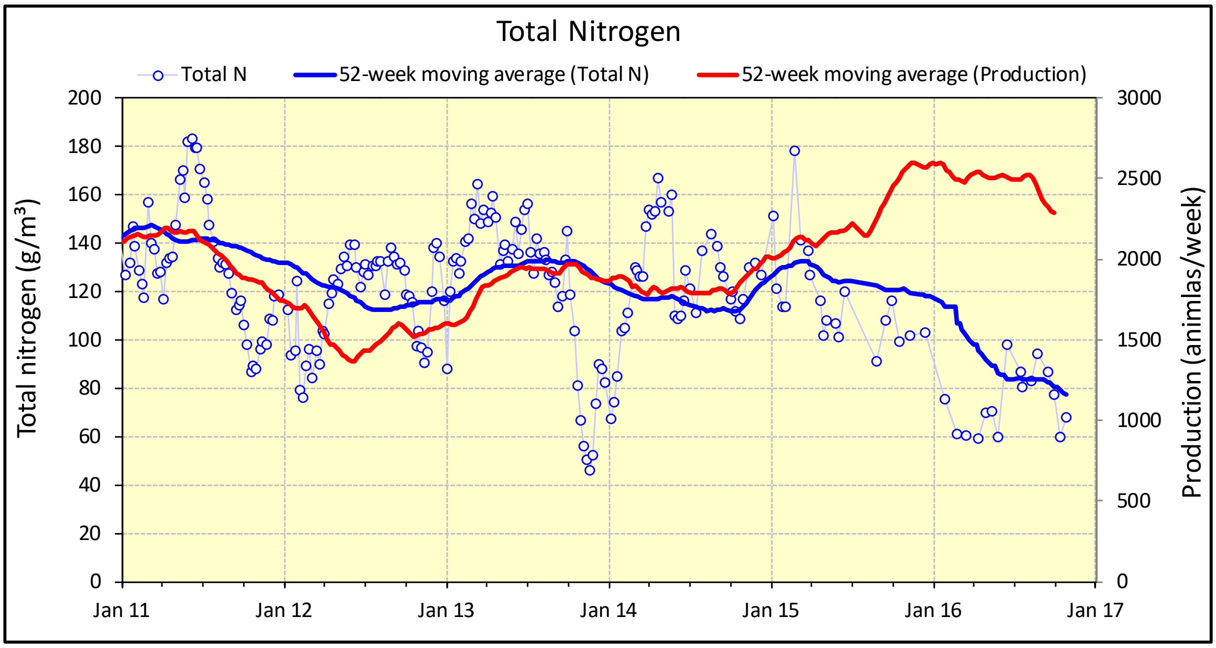

Figure 7

Concentration of total nitrogen in the treated wastewater.

Table 4 Total nitrogen loads and concentrations discharged.			
	To Land	To River	Total
Total nitrogen load (kg)			
Year ending 30 Sep. 2015	11,154	23,035	34,189
Year ending 30 Sep. 2016	10,330	15,934	26,264
Average nitrogen concentration (g/m³)			
Year ending 30 Sep. 2015	139	110	118
Year ending 30 Sep. 2016	83	83	83
Specific nitrogen load (kg/head)			
Year ending 30 Sep. 2015	-	-	0.27
Year ending 30 Sep. 2016	-	-	0.22

4.5 Ammoniacal Nitrogen

Most of the organic nitrogen (protein and urea) in the untreated wastewater is converted to ammonia in the anaerobic pond and then oxidised to nitrite and nitrate in the aerated pond. With increased aeration capacity and improvements in managing the aerators, ammonia levels in the treated effluent have substantially decreased in recent years – despite the increase in plant production (Figure 8).

The average concentration of ammoniacal nitrogen in the final effluent over the last 12 months was 10 g/m³.

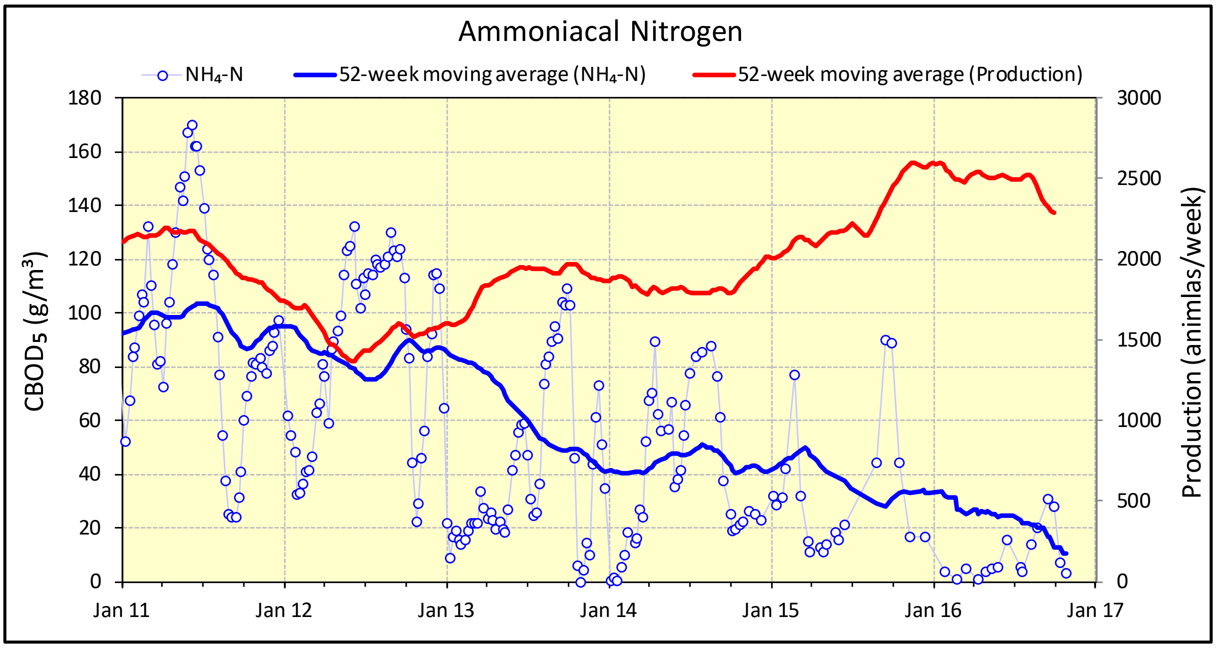

Figure 8

Concentration of total ammoniacal nitrogen in the treated wastewater.

4.6 Total Oxidised Nitrogen

The concentration of total oxidised nitrogen in the final effluent has generally increased in recent years (Figure 9). This trend is a result of increased conversion of ammonia to nitrate as discussed above. As ammonia is potentially toxic to fish and other aquatic organisms, the potential effects of discharging non-toxic nitrate are less than for discharging ammonia to the Oroua River.

An advantage of nitrate in the irrigated wastewater is that it maintains the wastewater in an “aerobic” and odourless state. Many bacteria can respire using nitrate if no oxygen is available. About 1 g N/m³ of nitrate has the same effect as 4.5 g/m³ of dissolved oxygen in preventing the development of anaerobic conditions in the wastewater. Nitrate-rich wastewater with a low BOD concentration can be left standing for weeks in irrigation lines without becoming odorous, avoiding the need to flush the lines with fresh water in odour-sensitive environments.

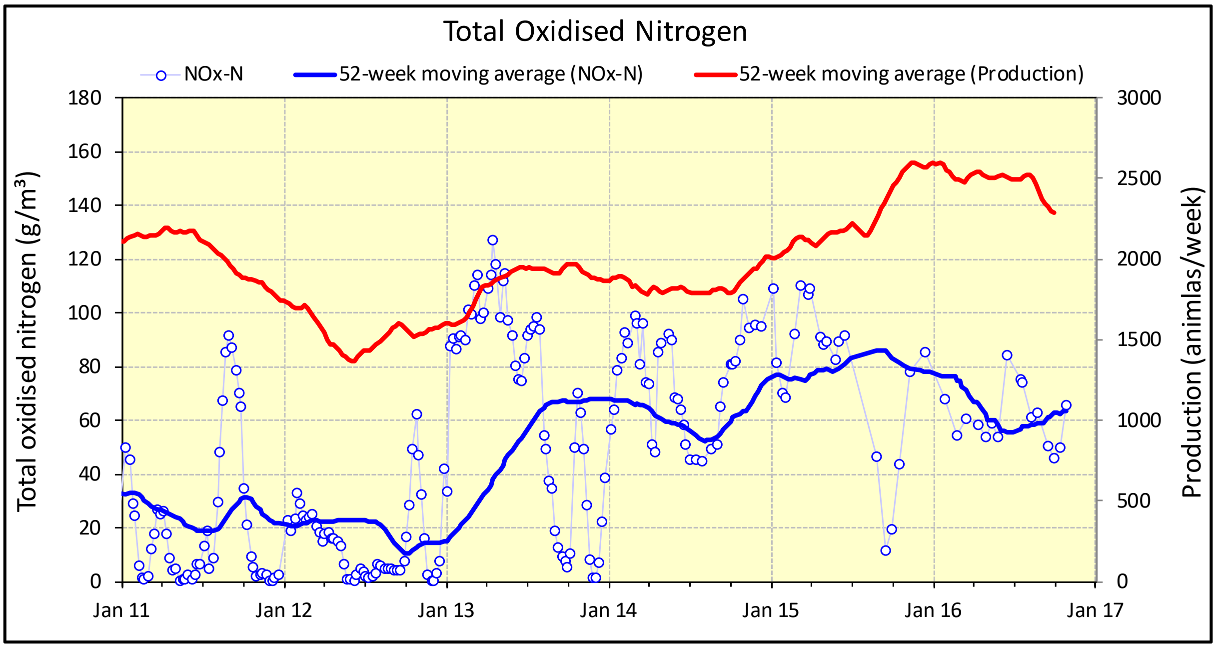

Figure 9

Concentration of total oxidised nitrogen in the treated wastewater.

4.7 Phosphorus

The treatment process removes around 5-10% of the phosphorus from the wastewater by accumulation in the pond sediments and in the floating crust of the solids pond. This phosphorus is removed from the system when the ponds are desludged.

Over the last 6 years, concentrations of total phosphorus and dissolved reactive phosphorus in the treated wastewater have generally increased by around 50% (Figure 10). This increase is attributed to a combination of reduced water use in the plant (which increases the concentration of all contaminants in the raw wastewater) and an increase in the proportion of cows processed. Cows have large paunches with a high phosphorus content.

Approximately 94% of the phosphorus is dissolved reactive phosphorus.

Phosphorus loading data in the discharged wastewater for the last two years are summarised in Table 5. The treated wastewater contains approximately 70-78 g of phosphorus per animal processed.

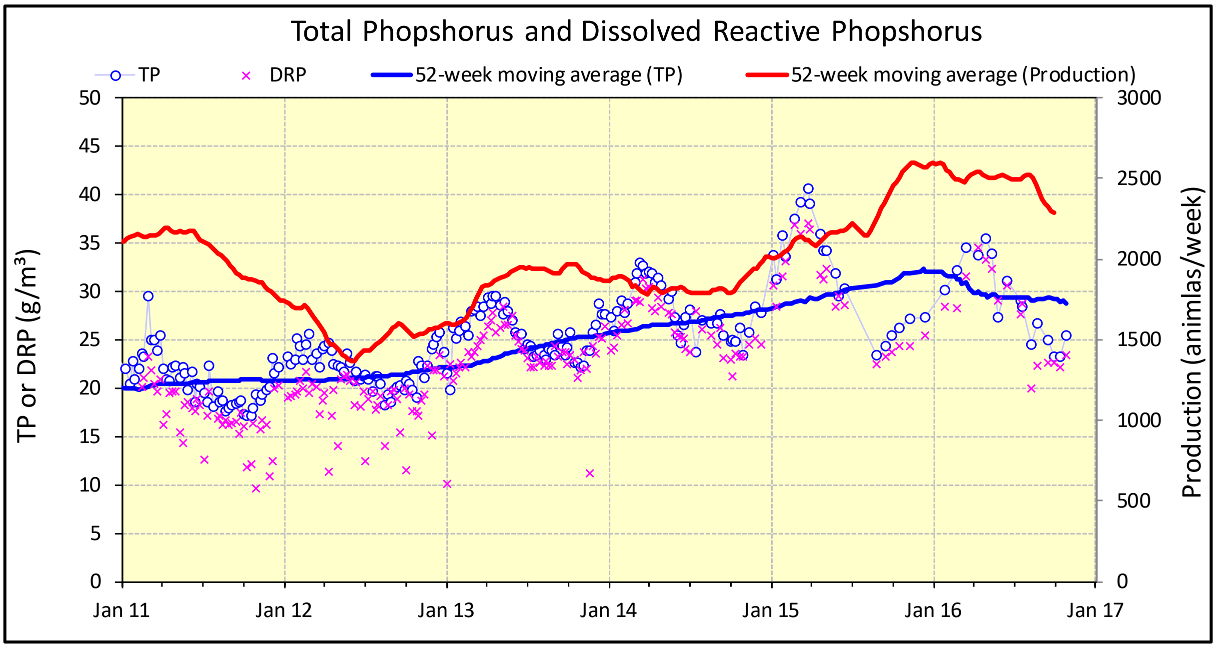

Figure 10

Concentrations of total phosphorus and dissolved reactive phosphorus in the treated wastewater.

Table 5

Total phosphorus loads and concentrations discharged.

	To Land	To River	Total
Total phosphorus load (kg)			
Year ending 30 Sep. 2015	2,755	6,094	8,850
Year ending 30 Sep. 2016	4,384	4,952	9,336
Average total phosphorus concentration (g/m³)			
Year ending 30 Sep. 2015	34	29	31
Year ending 30 Sep. 2016	35	26	29
Specific phosphorus load (kg/head)			
Year ending 30 Sep. 2015	-	-	0.070
Year ending 30 Sep. 2016	-	-	0.078

4.8 Faecal Indicator Bacteria

Concentrations of the faecal indicator bacteria in the final effluent, Enterococci and *E. coli*, are shown in Figure 11 and Figure 12, respectively.

Concentrations of both bacteria have generally decreased slightly over the past six years despite an increase in production at the site.

Over the last year, median concentrations of Enterococci and *E. coli* were 445 and 1150 per 100 mL, respectively. These results represent removal rates in the treatment process of around 99.9% to 99.99%.

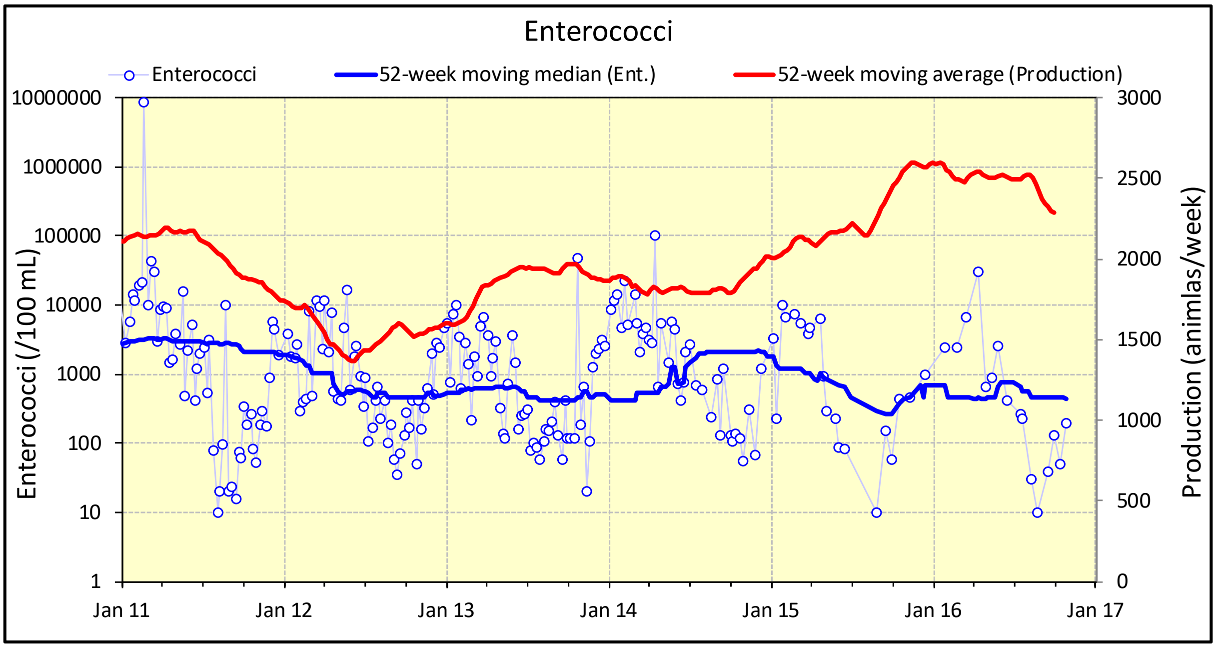

Figure 11
Concentration of enterococci in the treated wastewater.

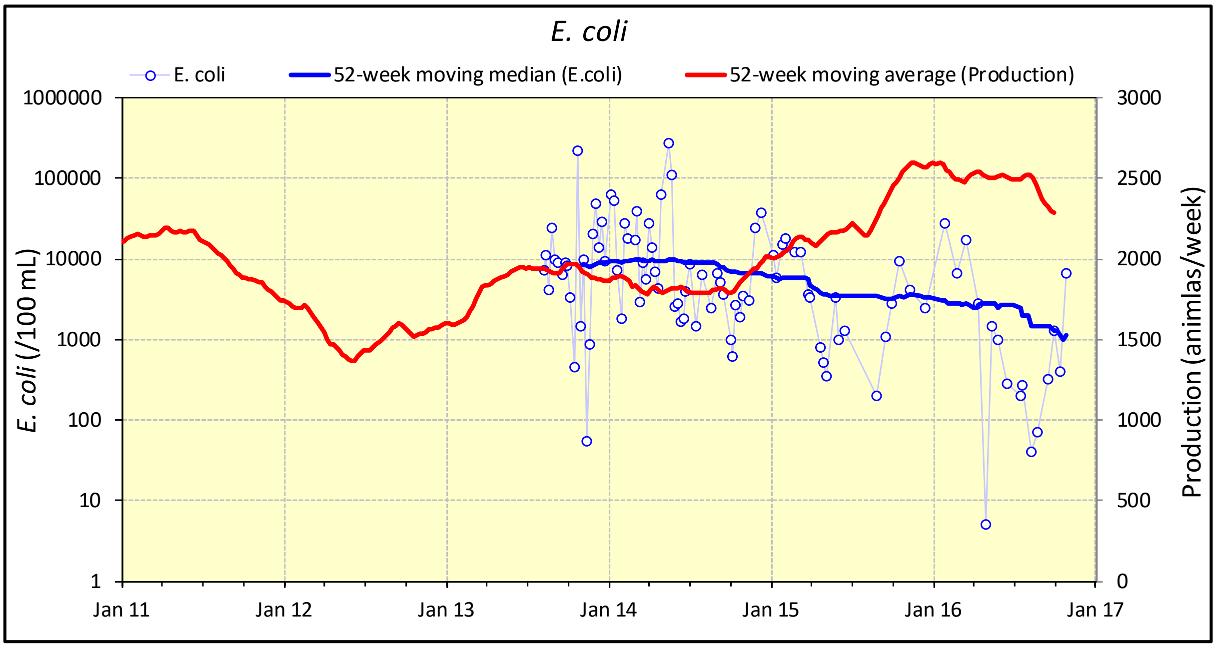

Figure 12
Concentration of *E. coli* in the treated wastewater.

4.9 Temperature

The temperature of the treated wastewater varies seasonally between approximately 5 and 25°C (Figure 13).

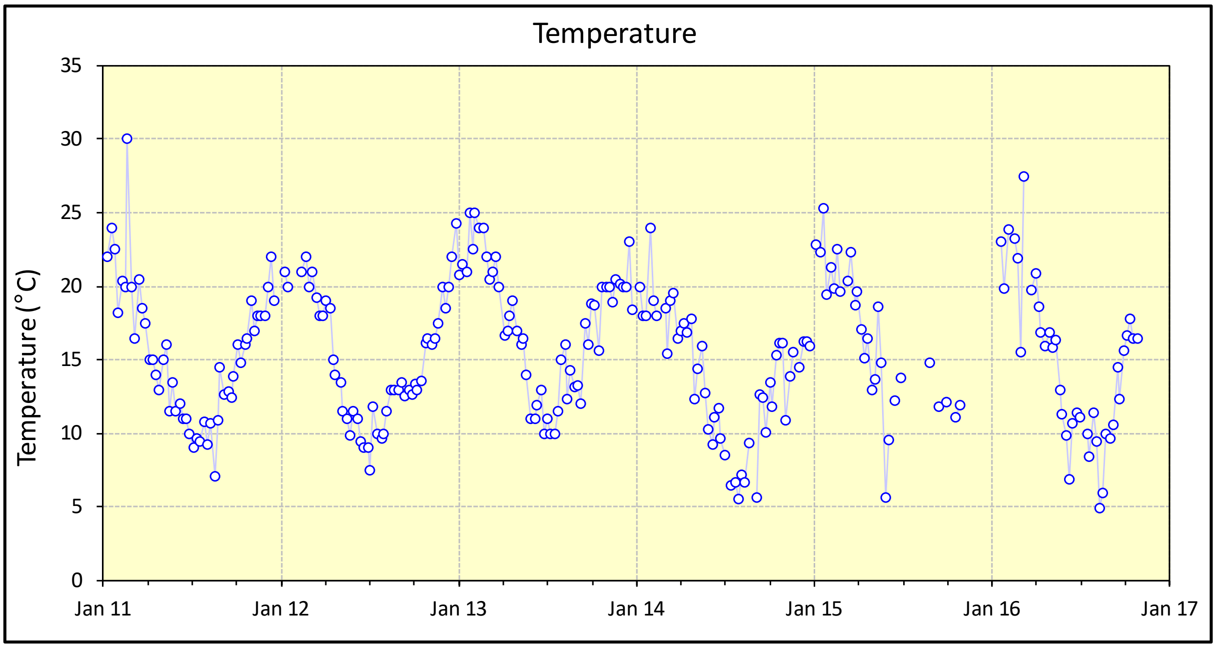

Figure 13
Temperature of the treated wastewater.

5 Concluding Remarks

AFFCO Manawatu's wastewater treatment system uses wastewater treatment pond technologies that are widely used in the New Zealand meat processing industry. Effluent ponds are popular in industry because of their simplicity, reliability and ability to cope with large variations in influent organic loading.

The AFFCO Manawatu effluent ponds reliably remove over 97% of the wastewater BOD and suspended solids, over 50% of the nitrogen, approximately 5-10% of the influent phosphorus and around 99.9% to 99.99% of faecal indicator bacteria.