Wastewater Treatment Upgrade at Cargill Wagga Meat Processing Plant

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Executive Summary

This document describes the upgrade for the CBA Wagga Wagga beef processing facility for a 2,000 head/day throughput operating up to 6 days/week basis.

The primary changes include:

- Installation of a new enclosed screw press and red DAF to improve TSS and oil & grease removal;
- Improved stream segregation in the primary system to optimize performance;
- A new covered anaerobic system to ensure the capacity to treat the organic load from the upgraded processing plant and to capture and significantly reduce odour.
- Decommissioning of anaerobic ponds 1 & 2, eliminating these ponds as potential odour sources;
- Decommissioning of anaerobic pond 3 and potential recommissioning as a part of the proposed BNR plant;
- Construction of a new BNR plant capable of achieving treatment of effluent to comply with sewer discharge limits and to appropriately manage waste sludge volumes.
- Provision of equalization volume, preferably using the existing Pond 4, to allow uniform, continuous discharge of the treated effluent to sewer.

The result will be to provide an upgraded treatment system for the CBA Wagga facility that is state-of-the-art and capable of treating the effluent to a high standard within trade waste limits for sewer discharge and reuse on site.

The odour footprint will be markedly reduced through the decommissioning of old anaerobic ponds and their replacement with a covered anaerobic system with biogas flaring. This will also reduce Scope 1 wastewater CO_2-e emissions.

The construction of the BNR Plant will allow Pond 4 to be used as an equalization storage pond, rather than as its current role of attempting to treat anaerobic-treated effluent.

The upgraded treatment system will provide CBA Wagga with a sustainable, robust and cost effective treatment system.

Table of Contents

Executive Summary **2**

Table of Contents **3**

1 Introduction **5**

2 Objectives of the Upgrade **5**

3 Description of CBA Wagga Operations **6**

3.1 Facility Operations 6

3.2 Existing Wastewater Treatment Facility 6

4 Design Wastewater Flows **8**

4.1 Overall Water Balance & Definitions 8

4.2 Current Flows as at early 2009 9

4.3 Design Flows for 2,000 head/day 9

4.4 Basis for Design Flows 9

5 Design Wastewater Composition **10**

6 Final Effluent Specifications **11**

7 Overview of the Proposed Wastewater Treatment Plant **13**

7.1 Primary Treatment System 13

7.2 Covered Anaerobic System (CAL) 13

7.3 Biological Nutrient Removal System 14

8 Upgrading the Primary Treatment System **15**

8.1 Reason for the Upgrade 15

8.2 Primary Treatment Upgrade Recommendations 15

8.3 Implications for Specific Streams 16

9 Covered Anaerobic System **17**

9.1 Reason for the Upgrade & Technology Selection 17

9.2 Process Description 18

9.3 Mode of Action 18

9.4 Assessment of Benefits 18

10 Biological Nutrient Reduction (BNR) Plant 19

10.1 Reason for the Upgrade 19

10.2 Process Description 19

10.3 Mode of Action 20

10.4 Assessment of Benefits 20

11 Conclusion 21

Abbreviations 22

Appendix 24

1 Introduction

The management of Cargill Beef Australia (CBA) desires to upgrade the wastewater treatment system at its Wagga Wagga meat processing plant to permit its operation at 2-shift, 2,000 head/day for 6 days/week.

After discussions with CBA personnel and the Cargill Project Management Team and assessment of current wastewater system performance, attention was targeted on three aspects:

- Improved primary treatment.
- Replacement of existing anaerobic ponds with a new covered anaerobic system;
- Biological nutrient removal plant with ancillary dosing for phosphorus removal.

This report lays out two preliminary concept design options for consideration by the Cargill team.

2 Objectives of the Upgrade

The primary objectives of the upgrade are:

- Odour elimination from the current anaerobic system
- Ensure Cargill Australia Limited meets the trade waste requirements set out in the WWCC Liquid Trade Waste Policy (LTWP) at a production rate of 2000 head/day.
- Provide a significant reduction in carbon emissions from the anaerobic ponds thus reducing the liability of the facility for any carbon emissions under the Carbon Pollution Reduction Scheme

3 Description of CBA Wagga Operations

3.1 Facility Operations

As of January 2009, the Cargill Beef Australia (CBA) meat processing plant is a fully integrated food manufacturing facility processing approximately 1,600 head of beef cattle in a 16 hour, 2-shift basis working day. The facility works 5 days/week. The kill runs from approximately 6 am until 11 pm. Plant cleaning occurs from approx. 11:30 pm until 5am.

Ancillary facilities include:

- Hide processing which runs for approx. 14 hrs/day and washes the hides before shipping them chilled in ice.
- Rendering facilities which processes in-house raw material using a continuous high temperature rendering cooker. Blood is processed in-house. Rendering operates 22 hours.
- Full range of offal processing.
- Cattle holding yards equipped with cattle washing using recycled treated effluent from Pond 4.

For the upgrade, CBA have advised that the upgraded wastewater treatment facility should be capable of treating effluent generated from 2,000 head/day processed over a 16 hour, 2-shift working day.

3.2 Existing Wastewater Treatment Facility

The current wastewater treatment process is depicted in Figure 1. The key elements to this process are:

- The red stream enters an in-ground pump pit and is sent to a Contrashear rotary wedgewire screen to remove gross solids, before levels of oil, grease and suspended solids are further reduced in the Red Dissolved Air Flotation (DAF) plant.

- The offal / cattleyard stream passes through an in-ground screw press to remove gross solids before passing through a series of pits and a shaker screen.

- Both red and green streams combine in Pit 6 and are treated in common from this point onwards;

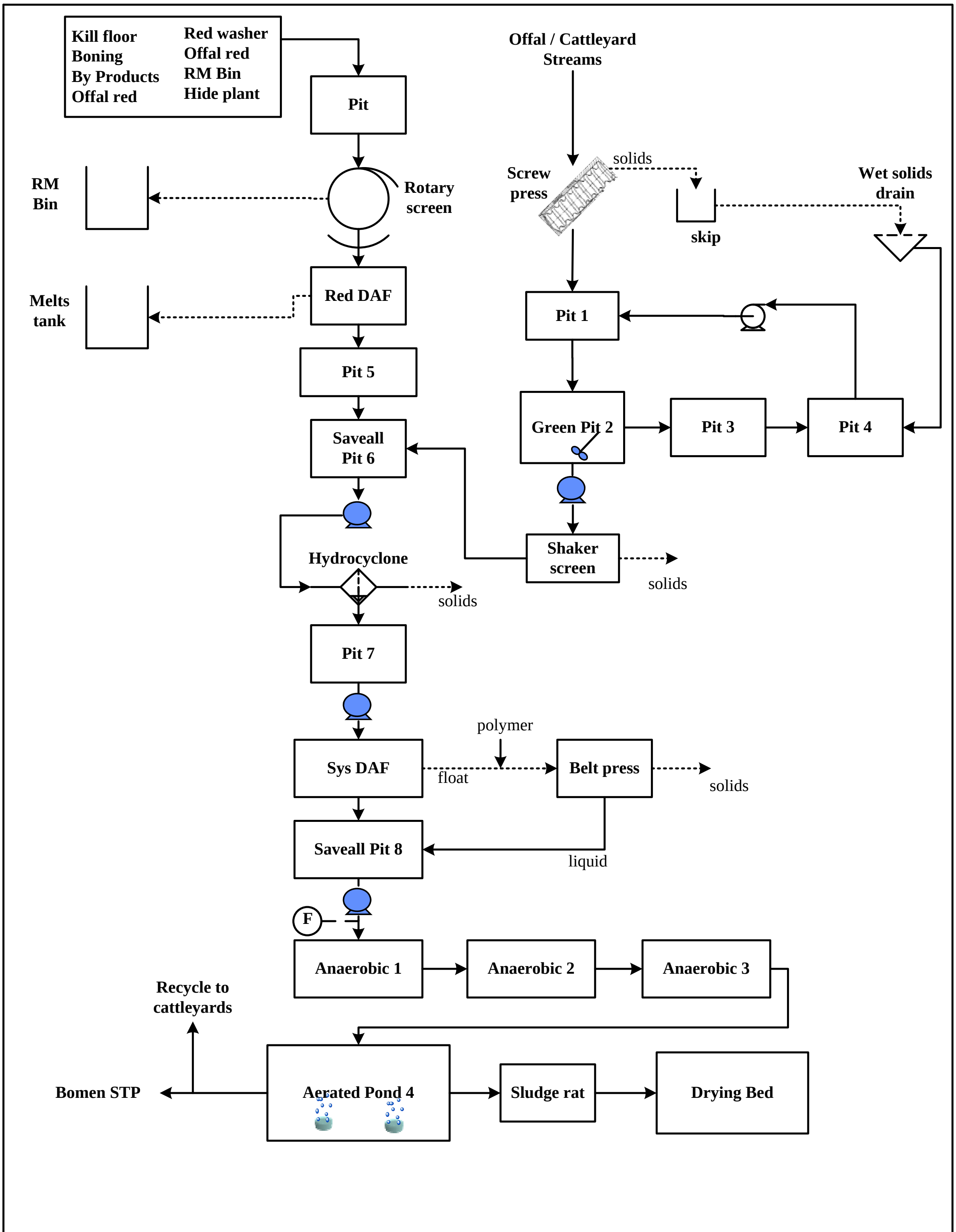
- The combined wastewater effluent passes through a hydrocyclone and Sys-DAF to further reduce grit, TSS and oil and grease. All primary solids are allowed to drain in a wet solids drying area. The dewatered solids are then transported for composting off-site.

- The effluent is then pumped through a new pipeline into a series of three anaerobic ponds (Ponds 1 -3) before entering the final aerated pond (Pond 4).

- Sludge from Pond 4 is removed and dried in drying beds as required;

- The treated effluent is split into two streams – a portion is returned as recycled water for use in the cattleyards, the remainder is sent to the Bomen Industrial Sewage Treatment Facility (BISTF).

Figure 1. Process Flow Diagram of Current WWTP



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4 Design Wastewater Flows

A concise summary of the design flows and compositions used to evaluate upgrade options are provided below. The key sources of information were:

- "Effluent System Upgrade Project – Basic system description" Cargill Australia Ltd. July 2009 [CBA description]
- Liquid Trade waste Policy" March 2009. City of Wagga Wagga. [LTWP]
- Wastewater quality data supplied for 2009 in excel format as BOD_COD removal.xls.
- Wastewater flows supplied for the period August 2008 to early August 2009 in excel format.
- Discussions with Cargill personnel.

4.1 Overall Water Balance & Definitions

The following flows are important for the design:

1. **Town Supply.** This is potable water supplied to the facility through the incoming town supply and used throughout the facility. It is the sole source of incoming process water. This flow is relatively consistent day to day during the 5-day working week. It falls to lower weekend values.

2. **Recycled Water**. This is an internal water loop at the facility. Treated water from Pond 4 is recycled back to a concrete tank for cattle washing in the cattleyards. It is not used for processing. It is the main water source for the cattleyards area.

3. **Red Stream.** This is a sub-set of raw wastewater from the facility. It refers to wastewater streams originating from the rendering and blood processing operations and slaughtering and boning operations (not associated with paunch, green offal or intestines processing).

4. **Green Stream.** This is a sub-set of raw wastewater from the facility and refers to wastewater produced through the emptying of cattle stomachs (paunches) and associated processing of intestinal offals. In this report, the Green Stream does not include the Cattleyards waste streams, although traditionally, they are both referred to as green streams.

5. **Cattleyards Wastewater.** Comprises effluent from the cattleyards area to the south of the facility. This wastewater is a combination of urine and manure from cattle and the cattle wash water (predominantly originating from the Recycle Water).

6. **Primary-treated Wastewater**. The combined wastewater resulting from primary treatment. This is sent for biological treatment.

7. **Final Treated Effluent**. The total treated effluent after biological treatment. This flow is either recycled back to the facility (Recycled Water), or discharged to the Bomen Industrial Sewage Treatment facility (BISTF) via the WWCC sewer.

4.2 Current Flows as at early 2009

Current flows measured by CBA Wagga during the period Jan 16th until late July were analysed to assist in determining appropriate design flows for budget costing. Appendix 1 contains plots of water flows for the last 12 months.

4.3 Design Flows for 2,000 head/day

Table 1 identifies the design flows used in this report. These were determined to provide costing on an order-of-magnitude basis and must not be used for detailed design or construction purposes. The basis for the selection of these values is covered below. The ex-primary flows were used to assess the Covered Anaerobic System and BNR Plant options.

The analysis of flows suggests that even at the high winter flows, it is unlikely that CBA Wagga will exceed the 3,700 kL/d sewer discharge limit.

Table 1. Design Flows in ML/process day

	Town Supply	Recycle	Ex Primary	To Sewer
Median				
Summer	3.6	1.4	4.5	3.1
Winter	3.7	2.4	5.5	3.1
Maximum				
Summer	4.2	2.2	5.4	3.25
Winter	4.2	3.0	6.2	3.2

4.4 Basis for Design Flows

A number of critical issues were considered in the selection of the flows in Table 1.

1. Operation at 2,000 head/day.

Town Supply:
To upgrade town supply flow from 1,600 to 2,000 head/day, the additional consumption was considered to occur at a marginal rate of 50% that of water consumption at 1,600 head/day. This reflects the fact that the additional throughput is achieved by increasing chain speed. A large proportion of water consumption is on a time-basis rather than a per body basis. Further, the cleaning shift usage is largely unaffected.

Consequentially there is an improvement in water efficiency from 2 kL/head to 1.8 kL/head.

Recycle water:
Analysis of plant recycle flow data suggests that 2-shift consumption is 90% more than for 1-shift in the cattleyards. A factor of 100% on 1-shift operation was used to determine median flows for 2,000 head/day summer operation. Maximum summer flow was estimated by analysis of 2009 data (Jan – May) where the maximum usage was approx. 2 ML/d for 1,600 head/day.

2. Seasonal Variation

Perusal of 1 year's flow data for the plant shows that there is little variation in town supply consumption due to season. However, there is a very significant increase in recycled water consumption during winter (4 months between mid June – mid October).

Consequently, rather than use the 1.5 ML/d value given in the CBA description document, a full year of daily flows was analysed. Unfortunately, there is only limited data for 2-shift winter recycled water consumption (2.55 ML/d max in July 2009). Further, recycled water use for the single shift operation in August 2008 recorded some very high values (2.2 ML use on some days). A value of 3 ML/d was selected.

The increased winter water consumption in the cattleyards is almost solely responsible for the high flows ex saveall in winter.

5 Design Wastewater Composition

CBA Wagga conducts comprehensive sampling and analysis of their wastewater post-primary and pond treatment. The main points of interest from these data are:

- Very high TSS and oil & grease levels indicating poor current primary treatment.
- Very high organic loads (COD, BOD_5) even post-upgrade. These levels are higher than comparable modern integrated facilities in Australia.
- High nitrogen and phosphorus levels, particularly nitrogen.

It has been estimated that TSS and O&G concentrations will be significantly reduced by the improved primary treatment with reasonable reduction in associated organic load.

6 Final Effluent Specifications

The design final effluent quality is presented in Table 2. The specification is derived from CBA description document and is taken from the Liquid Trade Waste Policy limits [LTWP] issued by WWCC. The limits represent maximum values above which non- compliance excess mass charges are incurred.

Table 2. Treated effluent specification (composition)

Parameter	Units	Trade Waste Limits	Quality to Sewer
TCOD	mg/l		150
BOD_5	mg/l	300	<20
Total Suspended Solids	mg/l	300	<100
Oil & Grease	mg/l	50	<10
TDS	mg/l	1,000	< 1,500
Total Nitrogen	mg/l		
TKN	mg/l	50	<40
NH_3-N	mg/l	35	<10
Total Phosphorus	mg/l	10	<10
Sulfite	mg/l		
Sulphate	mg/l	50	< 50
pH	-	7.0 – 9.0	7.0 – 9.0
Colour	-	None visible	ND

Note: Limits can be negotiated above this limit (LTWP)

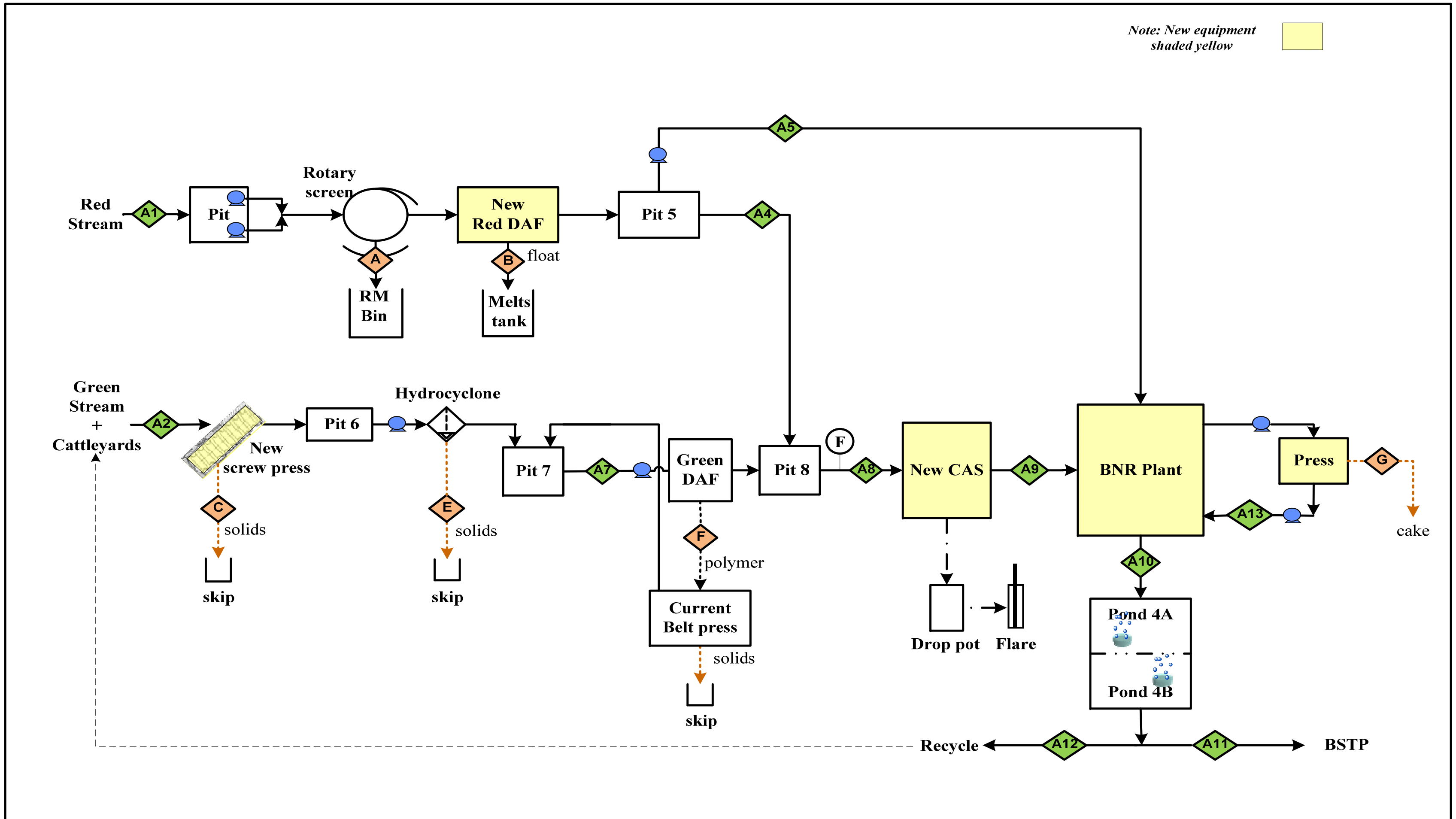
The “Quality to Sewer” column in Table 2 identifies the expected final treated effluent quality from the upgraded wastewater treatment plant handling the wastewater from the CBA facility at 2,000 head/day, 6 days/week. The concept design is readily capable of meeting the trade waste limits stated in Table 2.

The only parameter where this is not the case is TDS. There is some doubt whether the final treated effluent quality TDS will consistently meet the TDS limit of 1,000 mg/l. It is noted that CBA monitoring data for the Pond 4 discharge during 2009 year-to-date delivers a mean TDS result of 943 mg/l and a 95 percentile value of 1,100 mg/l. Consequently – since the technologies used in the upgrade are capable of much superior treatment than the current system – the TDS may consistently meet the 1,000 mg/l limit. However, the need for chemical dosing to achieve the tight TP limit may increase TDS by 10 – 20%.

The main option for reducing TDS further is membrane treatment. This would be prohibitively expensive for the flows experienced at CBA Wagga ($10 – 20 million order of magnitude CAPEX on top of the investment required for the upgrade).

The final effluent will have no offensive odour and be suitable for sewer discharge, reuse for non-potable purposes and for irrigation (and associated storage) if desired.

Figure 2. Proposed Wastewater Treatment Plant Process Flow Diagram



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7 Overview of the Proposed Wastewater Treatment Plant

A process flow diagram outlining the proposed wastewater treatment system is provided in Figure 2. Codes in brackets below denote particular streams that can be found in this Figure. Key features of the proposed system upgrade include:

7.1 Primary Treatment System

- The primary treatment system is extensively reconfigured to achieve superior removals of oils & greases and total suspended solids prior to the biological system.

- Currently human amenities wastes are segregated from all process effluent and sent to Council sewer. There is no change to this approach. No human wastes will enter the upgraded wastewater treatment plant.

- For the red stream (A1), important upgrade features include:
    - Retention of existing Contrashear rotary screen which is capable of good performance.
    - Replacement of the aged existing red DAF with a new DAF using pressurisation of the clarified effluent to better cope with hot temperatures and high solids loads and achieve better float recovery.
    - DAF-treated red stream (A4) then bypasses both the hydrocyclone and the Sys (green) DAF. There is provision for a DAF-treated ("raw bypass") bypass (A5) to the activated sludge units for carbon supply for denitrification if required.
    - Exclusion of the red stream from the sysDAF.

- For the green and cattleyards streams (A2) crucial changes include:
    - Replacement of the existing in-ground bar-caged screw screen with improved fully contained screw press units to remove and dewater the very high TSS loads that currently overwhelm the SysDAF. A short HRT device precedes the new press units to protect them from stones, and other heavy objects that might damage the press.
    - The existing shaker screen is decommissioned.
    - Continuation of the treatment of the green and cattleyards streams through the sysDAF without the added red stream.

Both the red and green (including cattleyards) streams are combined (A8) after their respective treatments into Pit 8 for pumping to biological treatment.

7.2 Covered Anaerobic System (CAL)

Anaerobic treatment is retained as a first stage in biological treatment of wastewater. The key change will be the use of an anaerobic pond system covered with a synthetic HDPE cover with gas flaring to ensure capture and destruction of odour and reduction in carbon-rich methane off-gas emissions. Critical aspects include:

- The combined abattoir wastewater streams (A8) are pumped in an existing pipeline to a new covered anaerobic system (CAS). The purpose of this treatment is to reduce organic pollutant concentrations to levels suitable for subsequent treatment in the activated sludge system.

- The two existing anaerobic ponds (Ponds 1 & 2), both of which are naturally crusted, will be decommissioned. This will eliminate the potential for odour generation from these ponds.

- Existing anaerobic Pond 3 will also be decommissioned once the new CAS is commissioned successfully and be reconfigured (see Section 7.3);

- Biogas generated by the covered anaerobic system will be collected, the excess moisture and hydrogen sulfide removed by a drop pot and the treated gas flared, with provision for subsequent use for energy production in the future. This capture, treatment and flaring of the biogas will reduce the odour footprint of the anaerobic treatment system.

- The anaerobically treated abattoir wastewater (A9) will discharge into activated sludge plant capable of biological nitrogen removal (BNR Plant).

7.3 Biological Nutrient Removal System

The upgrade will reconfigure the aerobic part of the existing wastewater treatment system to form a Biological Nutrient Removal (BNR) Plant consisting of an activated sludge system capable of nutrient, particularly nitrogen, reduction. In brief:

- Pond 3 will be incorporated into the BNR plant if suitable.

- The BNR Plant will operate via aerobic and anoxic periods or zones to reduce nitrogen and phosphorus levels to those compliant with trade waste limits. Mixed Liquor Suspended Solids (MLSS) will be settled to allow discharge of treated effluent.

- There will be low potential for offensive odours during this treatment due to the intense aeration capacity installed and the low organic concentrations in the basins.

- Chemical dosing will be provided to ensure that phosphorus levels attain the 10 mg/l discharge criterion and to allow contingency dosing to counter pH values that do not meet trade waste criteria. Dosing will be minimised to avoid undue TDS increase.

- Significant quantities of waste biological solids are generated by the BNR Plant due to excess bacterial growth. A portion of BNR Plant mixed liquor suspended solids (MLSS) will be removed (or "wasted") as required and the excess biological solids dewatered after polymer dosing using a press equipped with a gravity deck to permit dewatering of the solids to a level of dryness suitable for transport of the dewatered solids to a suitable solids processing facility. This equipment will be new.

  The filtrate from this operation will be returned to the BNR Plant for treatment.

- The BNR Plant may discharge treated effluent into the existing Pond 4A if hydraulic and siting outcomes are favorable. The water then overflows to existing Pond 4B for storage for recycling back to the facility or irrigation, if required.

- Equalisation of flows from the BNR plant can occur in Pond 4, subject to matters above, permitting a uniform and continuous flow to the BISTF.

8 Upgrading the Primary Treatment System

The existing primary treatment system at CBA Wagga suffers from numerous problems. Its role is to prepare the wastewater for effective treatment by biological processes – namely anaerobic and aerobic processes. The current system fails to do this well and results in operational challenges with the existing pond system.

8.1 Reason for the Upgrade

Concentrations of contaminants, especially oil & grease and TSS discharged from the existing primary treatment system are very high. This in turn imposes high organic and solids loads on downstream biological ponds, which leads to high levels of sludge formation, thick crusts and over time deterioration in performance.

Some of the equipment installed is capable of good performance, while other equipment is under-sized for the processing of 2,000 head/day.

The upgrade seeks to:
- Maximise benefits from stream segregation to reduce loads on specific equipment and obtain improved outcomes;
- Replace obsolete or aged equipment;
- Minimise the primary system footprint to reduce odour emissions;
- Reduce oil & grease and TSS concentrations sent to the biological system.

This is important as the facility installs more intensive biological systems which are both more vulnerable to oil and grease or solids accumulation than the older ponds they replace and more expensive to construct and operate – these costs principally relate to the contaminant load received from the primary system. Consequently a well designed and operated primary system can save significant capital and operating costs downstream.

8.2 Primary Treatment Upgrade Recommendations

The tests for new equipment and for retaining existing primary treatment equipment includes:
- It must operate efficiently for 2,000 head/day flow and loads;
- It must treat waste streams for which it is appropriately designed;
- It should not be obsolete or so old as to lack efficiency
- It must not contribute significantly to odour emissions and should reduce them.

Irrespective of these recommendations, there will be need in the more detailed design phase of the Upgrade Project to ensure that a risk assessment is performed to identify where problems with equipment can lead to untreated wastewater bypassing treatment and proceeding to downstream biological units, where it can seriously affect performance. Appropriate safety measures can then be instituted.

8.3 Implications for Specific Streams

8.3.1 Red Streams

The waste streams from the facility that combine to form the “Red Stream” can be characterised as:

- High in oil & grease and COD, especially streams from the rendering plant;
- Often high temperature (>40^{o}C), especially render streams and those from areas where large volumes of hot water are used for hygiene purposes.
- Moderate nutrient and TSS levels.
- Extremely variable in contaminant content, especially those from render.

The intent of the upgrade is to keep red streams separate until combined with green streams immediately prior to discharge to the CALs. The main rationale is to reduce the hydraulic load on the hydrocyclone and SysDAF, which can now be dedicated to green streams.

The critical improvements that are needed for the red stream are:

1. Minimise bypassing of screen & DAF treatment when pumps get blocked, etc. Bypassing risks putting high shock loads of O&G and TSS into the CALs, where they may lead to cover failure.

2. Improve O&G and TSS recoveries.
   The upgrade looks to manage this by replacing the existing aged DAF with a superior new unit appropriately sized, especially in respect of high O&G and TSS loads and temperatures.

There is no real benefit seen in hydrocyclone treatment of the red stream, nor by further DAF treatment.

8.3.2 Green & Cattleyards Streams

These streams typically generate:

- very high levels of TSS, especially stomach contents, and O&G. There is a significant risk of inanimate objects such as bolusses, stones and other foreign material entering the stream. This can damage screw presses.

- very high grit and sand levels, which can sediment in pits and equipment and is difficult to remove.

- very high flows, especially in winter. These originate primarily from the cattleyards.

The upgrade strategy for the green streams is to keep them separate initially from the red stream to allow targeted TSS reduction through a new enclosed screw press (which achieves high solids capture and a well dewatered material for disposal) and an existing degritting hydrocyclone for grit removal. Subsequently, the green stream is polished through the SysDAF to achieve further reductions in fine TSS and O&G levels.

9 Covered Anaerobic System

CBA Wagga currently operates three anaerobic dams in a series configuration (Figure 1). These ponds have nominal capacities of:

- Pond 1: 7.8 ML
- Pond 2: 17.5 ML
- Pond 3: 24.9 ML

for a total anaerobic capacity of 50 ML according to the CBA Description document.

The ponds are naturally crusted and have been in place for a number of years and have struggled to cope with current organic loads.

The upgrade will:

- Lead to construction of a new covered anaerobic system (CAS);
- Decommission anaerobic ponds 1 and 2 after successful commissioning of the Covered Anaerobic System.
- Recommissioning of Pond 3 as part of the BNR Plant subject to suitability. Otherwise it will be decommissioned.

9.1 Reason for the Upgrade & Technology Selection

There are clear benefits in moving to new anaerobic ponds equipped with synthetic covers and gas extraction and flaring. These include:

1. The existing anaerobic pond capacity is inadequate to manage the load expected from 2,000 head/day;
2. Anaerobic pond technology represents the most cost-effective reduction of organic load of any technology.
3. Greater capture of odorous emissions compared to uncovered ponds.
4. High rate anaerobic technologies, such as UASB and Anaerobic Filters, have proven unsuitable for meat processing effluents due to their high oil & grease and TSS levels, which disrupt granulation (for UASB) and block filter-based technologies.
5. A synthetic floating cover captures the odorous and methane-rich biogas which can then be flared, or at a later date used for energy recovery. This reduces the permit-liable wastewater CO_2-e emissions.

9.2 Process Description

The Covered Anaerobic System would have the following features:

- The system will treat the influent at 2000 head / day, up to 6 days/week;
- HDPE lining of walls and floor to protect groundwater resources;
- HDPE floating cover with provision for stormwater removal;
- Sludge removal in-place.
- Gas collection, extraction and processing system. This will incorporate appropriate measures to ensure destruction reduced sulphur contaminants.

9.3 Mode of Action

In the anaerobic pond, anaerobic bacteria break down the complex compounds in the wastewater in the absence of oxygen to release carbon dioxide and methane as the main products of decomposition in addition to a small increase in bacterial numbers. These products are gaseous and are released to atmosphere. Sludge production is 10 – 20% that of equivalent aerobic treatment and tends to escape as elevated suspended solids in the dam discharge. For this reason sludge wasting from the Covered Anaerobic System will be on an intermittent basis, perhaps each 1-2 years.

9.4 Assessment of Benefits

- Outstandingly cost effective technology for organic load reduction;
- Anaerobic ponds are proven technology for meat processing;
- Operate at optimal temperatures year round due to the warmth of the effluent;
- Require little manual oversight or operational labour;
- Synthetic cover captures and allows destruction of odour by flaring;
- Synthetic cover allows eventual use of energy-rich biogas for electrical and/or thermal uses potentially bringing further financial return on the initial investment.

These benefits speak for themselves.

10 Biological Nutrient Reduction (BNR) Plant

An activated sludge BNR plant will be constructed to reduce organic and nutrient concentrations to levels compliant with LTWP limits for sewer discharge.

10.1 Reason for the Upgrade

Currently, Pond 4 is the sole asset polishing the anaerobic-treated wastewater prior to sewer discharge. The pond has a number of short-comings including:

- No capacity to reduce nutrient concentrations significantly to achieve compliance with sewer limits;
- Inadequate capacity to handle the organic load remaining after anaerobic treatment at 2-shift operation. The BOD_5 in the Pond 4 discharge during the first 3 months of 2009 has been in the range 10 – 200 mg/l. More recently, it has increased significantly as winter flows increased.
- The use of extensive aerated ponds suffers from high quantities of bacterial sludge production, the management of which is time-consuming and onerous.

Pond 4 has done a magnificent job, but further capacity is now required for a 2-shift, 2,000 head/day operation.

10.2 Process Description

The BNR Plant will have the following features:

- Sufficient volume to achieve organic and nitrogen concentrations to levels compliant with trade waste limits year round.
- Both aerobic and anoxic zones suitable for biological nitrogen removal;
- Capability to separate the MLSS from the treated effluent and return the separated MLSS to the plant as required to achieve the required sludge age.
- Waste activated sludge (WAS) withdrawn for dewatering. Dewatering by gravity deck equipped press to produce a dewatered cake suitable for composting.
- Chemical dosing with alum and alkalinity source to precipitate phosphorus where concentrations exceed the trade waste limit and to ensure pH is maintained in the range required for discharge.
- Provision for primary-treated red stream bypass to fuel microbial denitrification, if required. The high organic loads in CBA Wagga wastewater suggest this may not be needed.
- Discharge of treated effluent into Pond 4A (if suitable siting possible) where flows will be equalized to permit a continuous, steady sewer discharge.
- Excess treated water overflows to Pond 4B for recycling (depending on siting & hydraulic issues).

10.3 Mode of Action

Very high concentrations of bacterial flocs are grown and maintained in the BNR Plant basin. The process passes the effluent through anoxic and aerobic environments, which permits reactions to occur which eliminate BOD and nitrogen from the water to the design levels. Once the process is complete, the bacterial floc settles out of the water, a portion of which (the waste activated sludge or WAS) is discharged to the sludge management system. The treated clarified effluent is discharged to the equalization pond.

Although biological phosphorus removal is now common with low strength wastewaters (e.g. domestic sewage), those containing high concentrations of nitrogen have proven more difficult to operate to achieve significant removals of organic, nitrogen and phosphorus. It is probable that chemical dosing will be required to achieve compliance.

10.4 Assessment of Benefits

- Excellent history of success in the Australian meat processing industry with at least six BNR plants installed, some operating more than 10 years to stringent discharge standards.
- Rapid response to effluent changes possible.
- Highly flexible and robust technology – can be easily adapted for production changes, flow changes & different effluent TN levels.
- Excellent turndown performance during shutdowns, or weekends.
- Low odour potential due to efficient aeration and high level of sludge management.
- Produces high quality effluent compliant with the required WWCC sewer limits.
- The treated effluent is suitable for non-potable reuse (e.g. truckwash, cattle wash) or irrigation.

11 Conclusion

This document describes the upgrade for the CBA Wagga Wagga beef processing facility for a 2,000 head/day throughput on an up to 6 days/week basis. The primary changes include:

- Installation of a new enclosed screw press and red DAF to improve TSS and oil & grease removal;
- Improved stream segregation in the primary system to optimize performance;
- A new covered anaerobic system to ensure the capacity to treat the organic load from the upgraded processing plant and to capture and reduce odour.
- Decommissioning of anaerobic ponds 1 & 2, eliminating these ponds as potential odour sources;
- Decommissioning of anaerobic pond 3 and potential recommissioning as a part of the proposed BNR plant;
- Construction of a new BNR plant capable of achieving treatment of effluent to comply with sewer discharge limits and to appropriately manage waste sludge volumes.
- Provision of equalization volume, preferably using the existing Pond 4, to allow steady, continuous discharge of the treated effluent to sewer.

The result will be to provide an upgraded treatment facility for the CBA Wagga facility that is state-of-the-art and capable of treating the effluent to a high standard for sewer discharge and reuse on site.

The odour footprint will be markedly reduced through the decommissioning of old anaerobic ponds and their replacement with a covered anaerobic system with biogas flaring. This will also reduce Scope 1 wastewater CO_2-e emissions.

The construction of the BNR Plant will allow Pond 4 to be used as an equalization storage pond, rather than as its current role of attempting to treat anaerobic-treated effluent.

The upgraded treatment system will provide CBA Wagga with a sustainable, robust and cost effective treatment system.

Abbreviations

ADWF	=	average dry weather flow
AOTR	=	actual oxygen transfer rate.
BFP	=	belt filter press
Bio-P	=	Biological Phosphorus removal
BNR	=	Biological Nutrient Removal
BOD_5	=	Biochemical Oxygen Demand (measured in 5 days at 20°C) (mg/ℓ).
CAS	=	Covered Anaerobic System
CAPEX	=	Capital Cost
COD	=	Chemical Oxygen Demand (mg/ℓ)
CPRS	=	Carbon Pollution Reduction Scheme
DAF	=	Dissolved Air Flotation
DO	=	dissolved oxygen concentration (mg/ℓ)
EP	=	Equivalent Person (used as basis for sizing sewage plants)
E.coli	=	Escherichia coli (cfu/100ml)
F/M	=	Food/Micro ratio – a measure of organic loading to activated sludge plants
HDPE	=	high density polyethylene
HRT	=	hydraulic retention time (days)
LTWL	=	Liquid Trade Waste License
LTWP	=	Liquid Trade Waste Policy
NGERS	=	National Greenhouse and Energy Reporting System
MLSS	=	Mixed Liquor Suspended Solids (mg/ℓ)
ND	=	Not Determined
NH_3-N	=	ammonia-nitrogen concentration (mg/ℓ)
NO_2-N	=	nitrite-nitrogen concentration (mg/ℓ)
NO_3-N	=	nitrate-nitrogen concentration (mg/ℓ)
O&G	=	Oil and Grease
SRT	=	solids retention time (sludge age) (days)
SS	=	suspended solids concentration (mg/ℓ)
STP	=	Standard Temperature and Pressure
SVI	=	Sludge Volume Index (ml/g)
TCOD	=	Total Chemical Oxygen Demand (mg/ℓ)
TDS	=	Total Dissolved Solids (mg/ℓ)
TKN	=	Total Kjeldahl nitrogen (mg/ℓ)

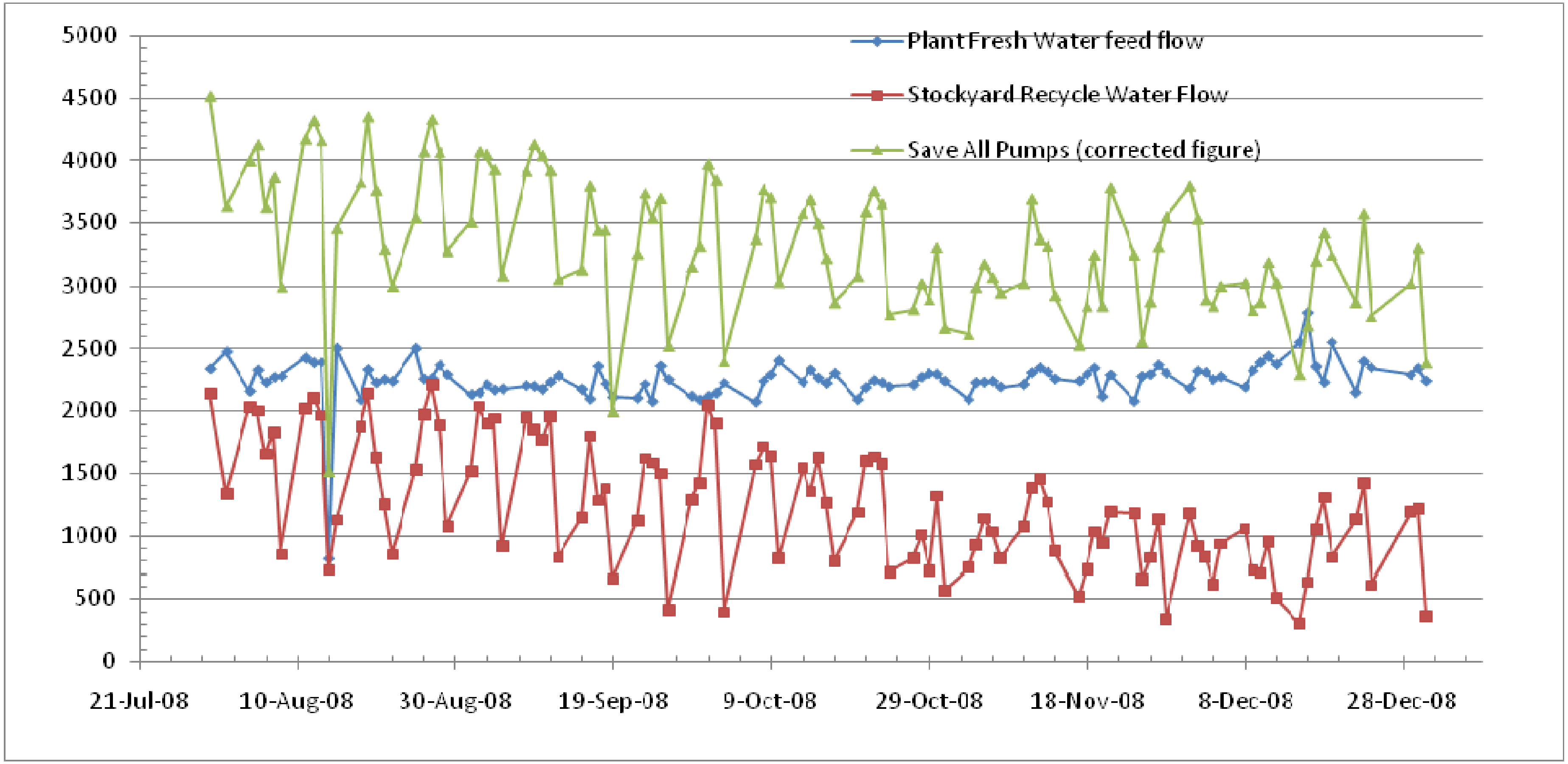
TN	=	Total Nitrogen concentration (mg/ℓ)
TP	=	Total Phosphorus concentration (mg/ℓ)
TSS	=	Total Suspended Solids (mg/ℓ)
TWL	=	top water level
UASB	=	Upflow Anaerobic Sludge Blanket
UV	=	UltraViolet
VFA	=	Volatile Fatty Acids
VOC	=	Volatile Organic Compound
VS	=	Volatile Solids
VSS	=	Volatile Suspended Solids
WAS	=	Waste Activated Sludge

LIST of UNITS

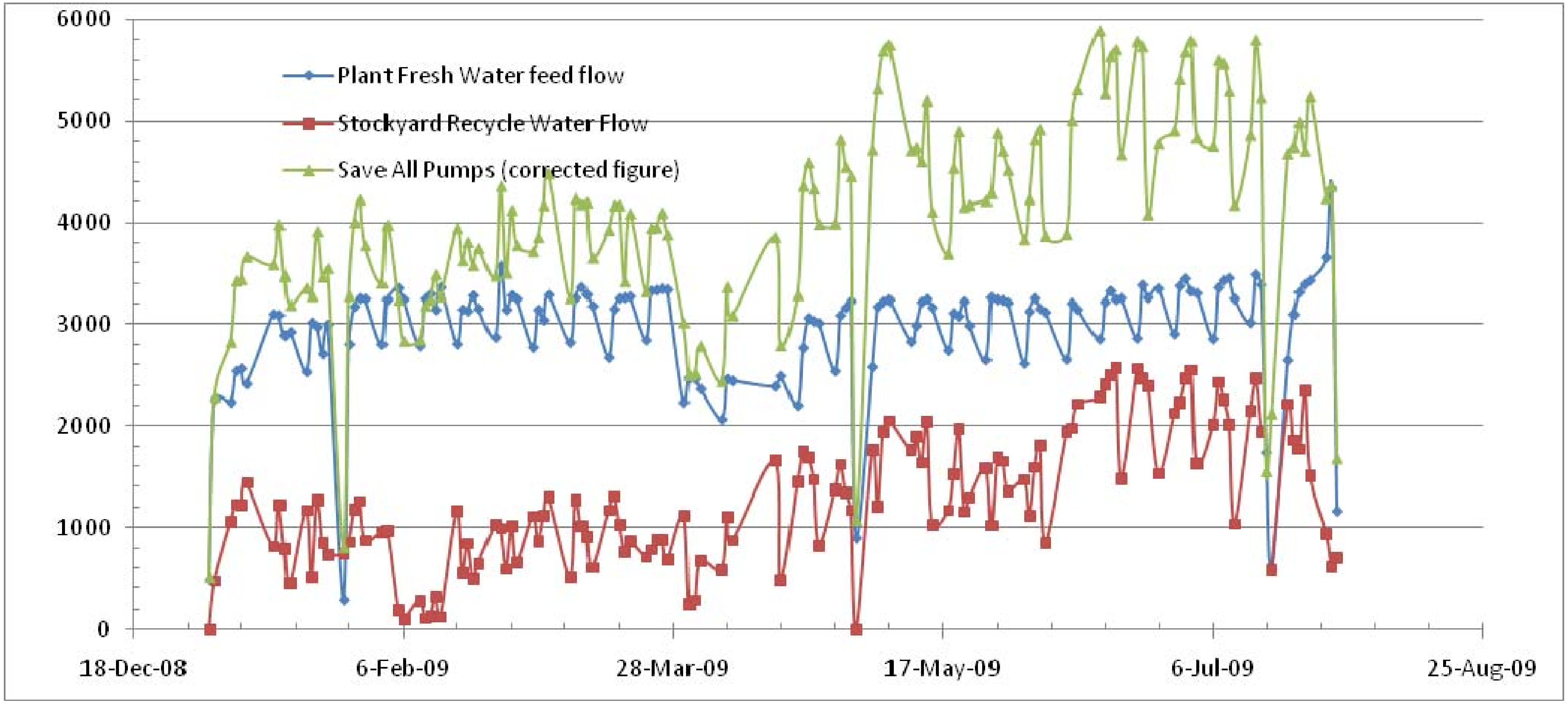
kg/ha.d	=	loading rate in kilograms per hectare per day
$kg/m^2.d$	=	loading rate in kilograms per square metre per day
kL/d	=	kilolitres (cubic metres) per day
mg/L	=	milligrams per litre = ppm.
m/h	=	metres per hour
$m^3/m^2.d$	=	surface loading rate in cubic metres per square metre per day
ML	=	Megalitres (1,000 kL)

Appendix Flows

Graph A1.1 Water Flows 2008



Graph A1.2 Water Flows 2009 YTD



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