FERRIC CHLORIDE TRIAL AT EILDON WASTE WATER FACILITY

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ABSTRACT

Preliminary investigations into the upgrade of the Eildon Wastewater Management Facility have resulted in Goulburn Valley Water undertaking a ferric chloride trial on its trickling filter system. The trial aimed to determine the suitability of dosing ferric chloride, with the intention of reducing phosphorus levels to acceptable environmental limits for future discharge to waterways (ultimately the Goulburn River). The trial was conducted between December 2000 and April 2001. This paper aims to present the results of this trial.

KEY WORDS

Ferric Chloride ($FeCL_3$), Phosphorus

1.0 INTRODUCTION

The Eildon Waste Water Treatment plant is a conventional Trickling filter system that irrigates during the summer months, and discharges to the Goulburn River at all other times. While providing an acceptable level of treatment for solids removal and BOD reduction, allowable discharge levels of phosphorus set by the EPA remained difficult to meet.

The lack of available land suitable for irrigation lead Goulburn Valley Water to seek an alterative method for the reduction of phosphorous levels within the discharge water in order to continue discharge to the Goulburn River

A ferric chloride trial was decided upon as the best option for it's low capital cost, ease of set-up, and low operator attendance. The aim was to reduce total phosphorus levels from 10.0mg/l to 0.5mg/l in the final effluent

2.0 DISCUSSION

2.1 Waste Water Treatment Plant

The Eildon wastewater treatment system is a conventional trickling filter unit comprising of:

- Inlet
- Primary sedimentary Tank
- Trickling Filter
- Humus Tank
- Digester
- 6 Drying Beds
- Chlorine dosing

The average daily dry weather flow is 0.5ML, which is predominately domestic waste. The treatment process utilises sedimentation, aided by aerobic action, for solids removal, and anaerobic action to stabilise sludge for drying and disposal.
Pre-dose treated loadings were as follows:

BOD	16mg/l
TP	10mg/l
SS	39mg/l
pH	7.3

New equipment required for the trial consisted of

- Flow paced dose pump
- Electronic flow meter
- Chemical storage
- Chemical (Ferric Chloride, 15% Ferric)
- 5m pipeline between Filter & Humus tank
- Flash mixer

A chemical dose point just prior to the humus tank was established to minimise any acidic affect the ferric chloride may have on the trickling filter and digester (refer figure 1). The dose pump was controlled by an electronic mag flow meter installed at the trickling filter outlet. A flash mixer was installed to mix the water for optimum chemical dispersion.

2.2 Dosing & Monitoring

Initial Monitoring points were set to fully analyse the effect ferric chloride had on the treatment process and the final effluent. The monitoring stations and their specific tests were:

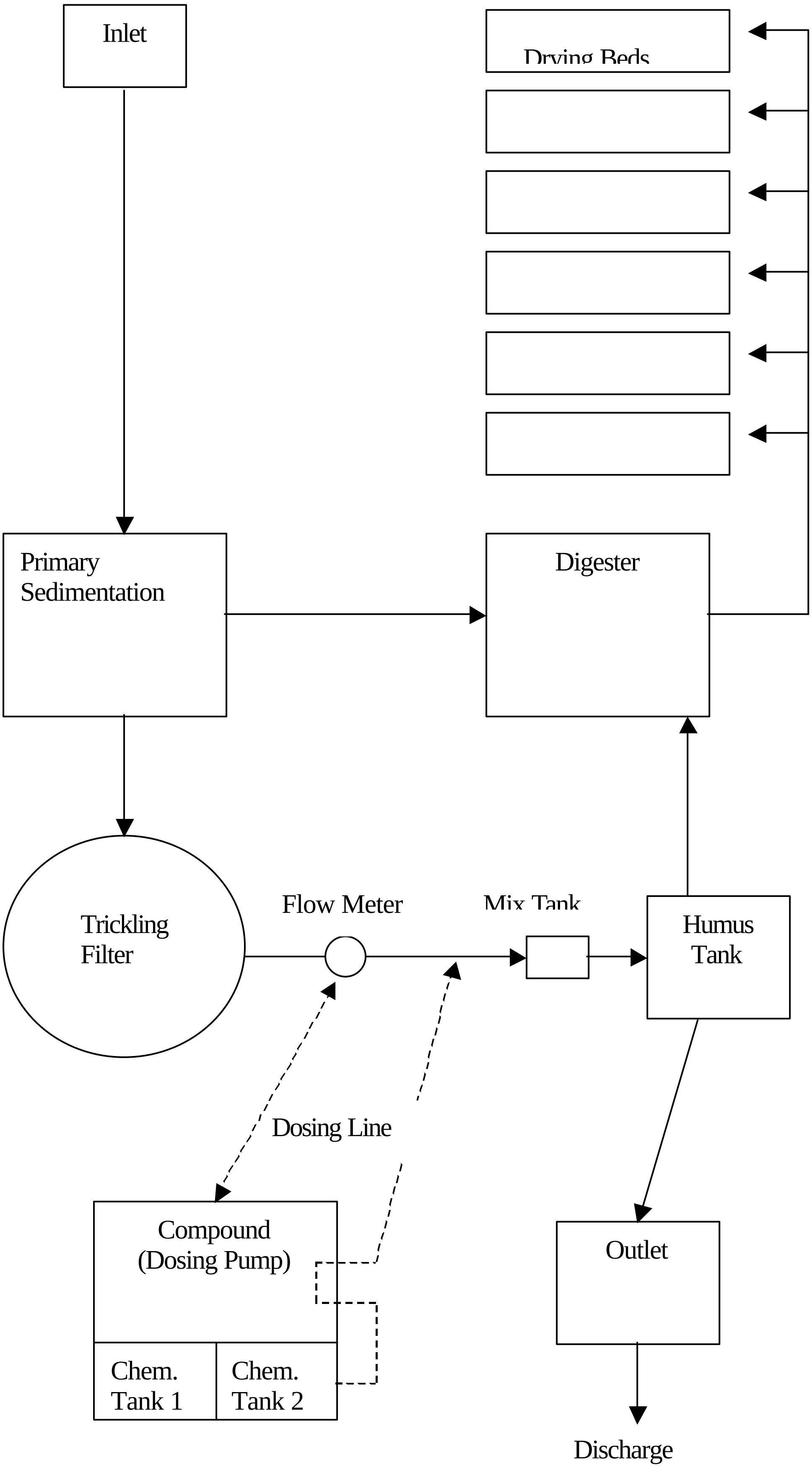
Table 1: ***Monitoring Parameters***

Site	pH	Temp	VFA	Alk	EC	Ortho P	Total P (Filtered)	TKN	NH#	BOD	SS
Trickling filter outlet	√	√				√		√	√	√	√
Humus Tank Outlet	√	√				√		√	√	√	√
Digester	√	√	√	√							
Irrigation Pond	√	√				√		√	√	√	√

A Later sample point was located in the discharge channel at the exit point of the farm.

Tests were carried out at least 3 days after each change in dose rate to allow the system to fully adjust. The dosing rate was initially 20mg/l and progressively increased by 20mg/l to a maximum of 80mg/. Dose rates stated are for Fe only

Figure 1: ***Site Layout***



3.0 RESULTS

Prior to the trial, phosphorous reduction in the humus tank was minimal with an average of 10% removal, from around 11mg/l to 10mg/l. The target was less than 0.5mg/l.

Initial removal of phosphorous was promising, with a 50% reduction. This was backed up with another set of samples indicating a 43% decrease.

Table 2: ***Total Phosphorous Levels – 20 mg/L Dose Rate***

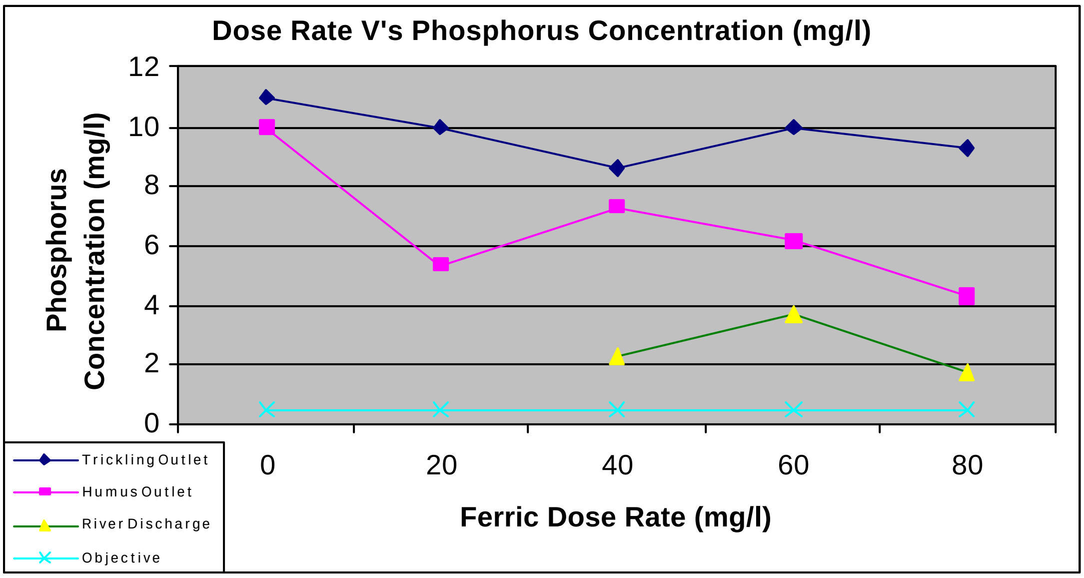
Dose Rate (mg/L)	Site	TP (mg/L)
20	Trickling Outlet	12
	Humus Outlet	6
20	Trickling Outlet	10
	Humus Outlet	5.3

Subsequent increases in dosing resulted in indifferent results. An additional sample was taken at the discharge channel at the farm boundary

Table 3: ***Total Phosphorous Levels – 40 – 80 mg/L Dose Rate***

Dose Rate (mg/L)	Site	TP (mg/L)
40	Trickling Outlet	8.6
	Humus Outlet	7.3
	River Discharge	2.3
60	Trickling Outlet	10
	Humus Outlet	6.2
	River Discharge	3.7
80	Trickling Outlet	9.3
	Humus Outlet	4.3
	River Discharge	1.8

Figure 2: ***Dose Rates V's Phosphorus Concentration (mg/L)***



The results showed a significant reduction of phosphorous at the humus tank and an even greater reduction at the discharge point, indicating floc carry over and further settlement in the open discharge channel.

The plant is manually operated and visited once per day for 1 hour by an operator. The increased sludge generated in the humus tank had a tendency to float after 12 hours, and run over the baffle boards. Installing an automatic valve that operated every 4 Hours may have better controlled the sludge removal.

Overall the reduction in phosphorous levels fell well short of our target and the trial was halted.

3.1 Process Effects of Ferric Chloride

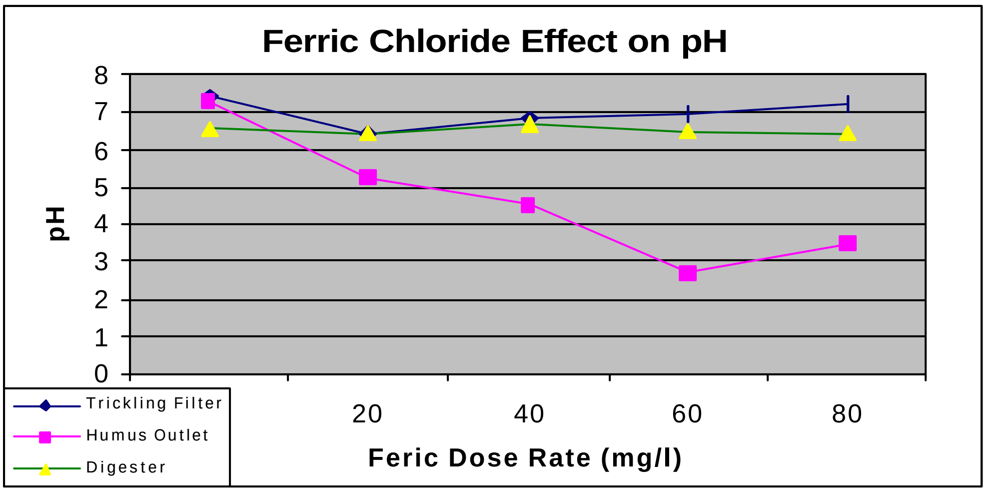
Floating sludge appeared in the humus tank within days of trial dosing, which indicated an increase in draw off frequency was required.

Ferric chloride significantly effected the pH of the Humus tank and consequently the final effluent. Adoption of ferric chloride would require pH correction.

Table 4: ***Ferric Chloride effect on pH***

Dose Rate (mg/L)	Site	pH
0	Trickling Filter	7.42
	Humus Outlet	7.31
	Digester	6.53
20	Trickling Filter	6.45
	Humus Outlet	5.25
	Digester	6.41
40	Trickling Filter	6.81
	Humus Outlet	4.53
	Digester	6.66
60	Trickling Filter	6.93
	Humus Outlet	2.69
	Digester	6.49
80	Trickling Filter	7.23
	Humus Outlet	3.49
	Digester	6.44

Figure 3: ***Ferric Chloride Effect on pH***



4.0 CONCLUSION

Ferric chloride dosing proved to be a significant aid in the removal of total phosphorous at the Eildon waste water facility, but failed to meet our objective of 0.5mg/l. At best, it provided just under a 60% reduction in total phosphorus levels to a concentration of 3.04 mg/l.

Phosphorus levels sampled in the discharge channel indicated that further testing of a more effective sludge removal system may provide better results. The acidic nature of ferric chloride significantly lowered pH levels in the humus tank to the extent that further trials would require pH correction.

Overall, the trial, although unsuccessful, provided our technical and operational staff a greater insight into the chemical processes of a trickling filter system and the effect ferric chloride dosing has for phosphorus removal.