WARRNAMBOOL WWTP - IDEA SYSTEM AND FILTER PRESS

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WARRNAMBOOL WASTEWATER TREATMENT PLANT INTERMITTENT DECANTING EXTENDED AERATION SYSTEM AND PILOT OF A FILTER PRESS

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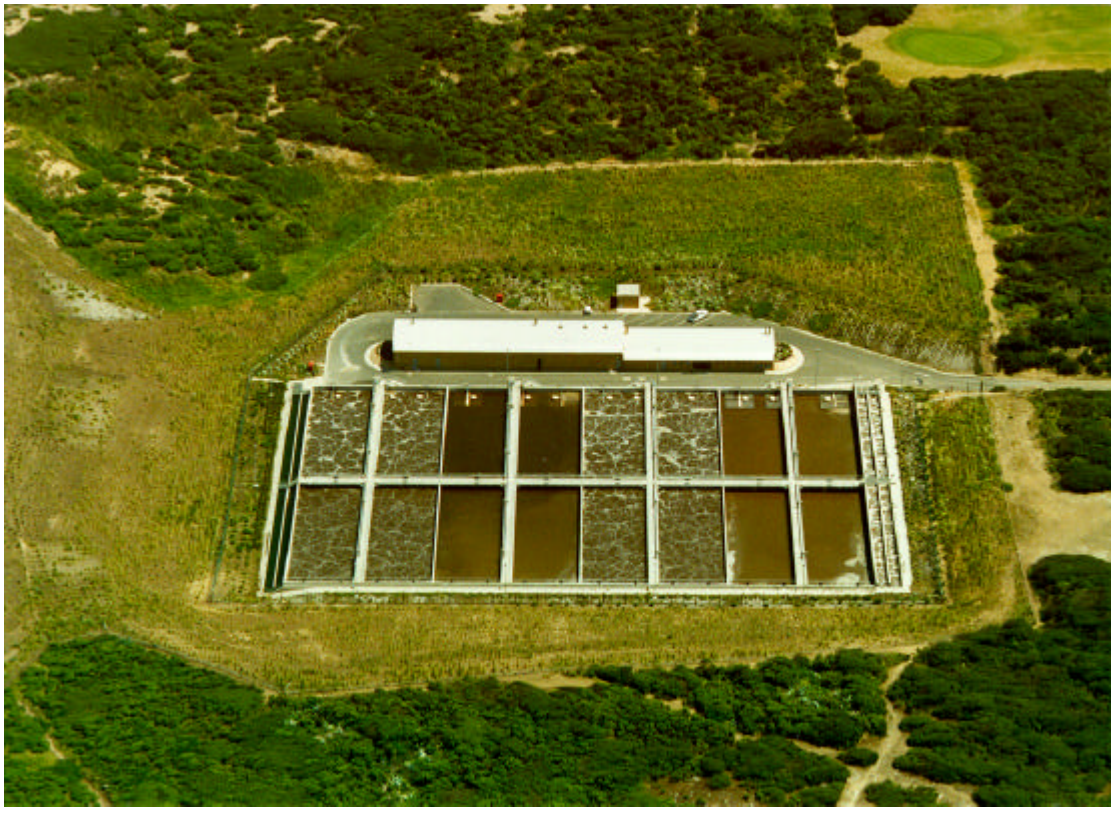
ABSTRACT

The Wastewater plant is an Intermittent Decanting Extended Aeration plant, currently servicing the City of Warrnambool and two small townships, along with several large Trade waste Industries. This paper describes the treatment process; the difficulties with dewatering the by-product of the treatment process - biosolids, and the pilot filter belt process we trailed in an attempt to produce a better biosolids.

1.0 INTRODUCTION.

The City of Warrnambool is situated in Western Victoria on the Southern Ocean and its at the end of that magnificent drive along the Great Ocean Road, with a population of 30,000. The wastewater plant services the City of Warrnambool, Allansford, Koroit and three major trade waste suppliers that being Nestles, Warrnambool Milk Products and Midfield Meats.

Figure 1 : ***Ariel View of Warrnambool WWTP***



The treatment plant is an Intermittent Decanting Extended Aeration plant designed by Connell Wagner in 1994 and commissioned in September 1996. An average of 10 ML per day is discharged to the southern ocean under an E.P.A. operating license of 20mg/L Biochemical Oxygen Demand (B.O.D) and 30mg/l Suspended solids. It along with Black Rock and Moe were the first of this type in Victoria and were all commissioned within weeks of one another.

2.0 WASTEWATER CHARACTERISTICS

The wastewater plant currently receives an average flow of 10.3 Ml/d and was designed for 12.8Ml/d (ADWF). A summary of the total loading on the plant is provided in the table below.

Table 1 : ***Plant Loading Details***

Parameter	Average	90th Percentile
Daily Flow (ML/d)	10.3	12.1
Fortnightly Flow (ML/d)	10.3	11.5
Annual Flow (ML/y)	3700	-
Fortnightly BOD (kg/d)	3940	5180
Fortnightly S.S (kg/d)	8470	12100
Fortnightly TKN (kg/d)	950	1120
Fortnightly COD (kg/d)	13100	17200
TP (kg/d)	350	450
Elec. Cond. (uS/cm)	1600	1800
Na (mg/L)	230	270

The final effluent averages 11 B.O.D and 18 mg/l Suspended Solids.

3.0 THE WASTEWATER PROCESS.

The wastewater passes through a screen and grit chamber some 800 metres upstream of the wastewater plant and is then collected in the inlet pump station and is pumped into two aerated selection tanks. Each tank is 66 metres long by 2 metres wide and 2.9 metres deep and has banks of fine bubble diffuses fixed to the floor. The raw influent at the entrance to the selection channel is seriously lacking oxygen. Return activated sludge is returned to the start of the selection tank as this helps to reduce Filamentous Bacteria, and gives the micro-organisms first use of the new food.

After the fluid passes through the selection tanks it runs into a distribution channel which has course bubble diffuses. This allows the even distribution into each of the four activated sludge tanks. Each tank is 68 metres in length and 27 metres wide by 4.6 metres in depth and has 4200 fine bubble Sanitaire diffusers fixed to the floor. The normal operating depth is between 3.1 and 3.8 meters.

The four hour cycle process is 2 hours aeration, one hour settling and one hour decanting and then back through the same process. This is one advantage when you have four tanks each day the cycle time is the same.

The decanting mechanism is a series of pipes like arms, that span across the outlet end of the tanks, and the Gas Lock siphon system has solenoid control to allow the water to displace the air when told to open from the P.L.C. This allows the treated wastewater to flow from the tanks to the Outfall sewer. When it reaches a level of 3.2 metres the solenoid valve opens again to allow the air to break the siphon and stop the flow of effluent. This is a very simple system.

The solids handling is carried out by extracting the mixed liquor from the tank that is in the second hour of aeration. This gives us the maximum mixing of the liquors. The mixed liquor concentration is usually around 6,000 to7,000mg/l.

The fluid then is drawn from the bottom of the tank about halfway along by two submersible pumps and is transferred to a gravity drainage deck (G.D.D). By adding a liquid cationic polymer it chemically charges the solids to allow separation of the effluent and sludge, the sludge then rolls off the G.D.D with a total solids retention (T.S.R) of 3.5 to 4 % onto the filter belt press which then reduces the water content to between 10% to 13% solids depending on the time of the year. About 10% is achieved from September to December. The biosolids is then removed by a conveyor belt to a 13 metre bin and then transported to a licensed biosolids storage site.

A schematic of the wastewater treatment process is provided in figure 3.

4.0 PROBLEMS ASSOCIATED WITH THE PLANT

The loading received from trade waste customers at times severely overload the plant. It was designed to cater for around 5 tonne of BOD_5 per day. On an average, up to 13 tonne of COD per day and on some days up to 20 tonne of C.O.D per day is received. This creates a large loading on the plant and puts excessive pressure on the 4 blowers to maintain DO at a suitable level to keep the micro-organisms happy.

Also with the large amounts of suspended solids (on an average of 8.5 tonne per day with some peaks up to 15 tonne per day) this also keeps pressure on the solids handling. It was originally designed to generate around 132 tonnes of wet sludge per week and we currently are averaging around 300 tonnes of wet sludge per week with several peak weeks of being around 400 tonnes per week.

The other major problem is that when we receive the spring loadings from the major trade waste customers which are large milk factories we seem to develop a very fatty product which does not dewater properly and hence produce a very wet biosolid. As we pay by the cubic metre for cartage its important to have the driest solids as we can.

Another major problem is trying to keep the mixed liquors concentration equal in each of the tanks, sometimes you can have 9,000 to 10,000 mg/l M.L.S.S. in one tank and 7,000 mg/l in another, this needs constant monitoring.

Which bought about me trialing some different polymers of a higher charge and to a pilot trial of a filter press to see if we can produce a drier cake.

5.0 TRIAL OF FILTER PRESS.

We started the trial in September 99 when we received the filter press from Netzsch of Germany and in conjunction with Filter-Tex Media of Melbourne. We started by taking a pipeline from the pipe coming from the activated sludge tank. After being injected with liquid polymer prior to dispersion onto the gravity drainage belt it was around 0.6% solids, and as we pumped it into the press with a small variable speed pressure pump we found the liquor to be to fluidised and kept filtering through the cloth filter, you could tell by the colour of the fluid discharging from the drainage hose and discharging through the cloth filter.

The second trial commenced by taking a line from the pipe transporting the mixed liquors to the G.D.D, prior to any polymer being injected, this was piped into a 200 litre barrel and allowed to settle for 1 hour then the top level of water was decanted from the barrel then refilled again with more mixed liquors and then decanted again until we had a concentration of around 1.2% solids.

This was then pumped into the filter press and injected with a mixed up batch of powder polymer at 1% which appeared to give a better dewatered sludge, (see table 2 for results) final result was a 15% solid cake.

The third trial started on the next day by carrying out the same process as the previous day but this time reducing the pump speed which took less time to fill and produce a slightly better cake of 16.3% (see table 3 for results).

Figure 2 : ***Pilot Filter Press***

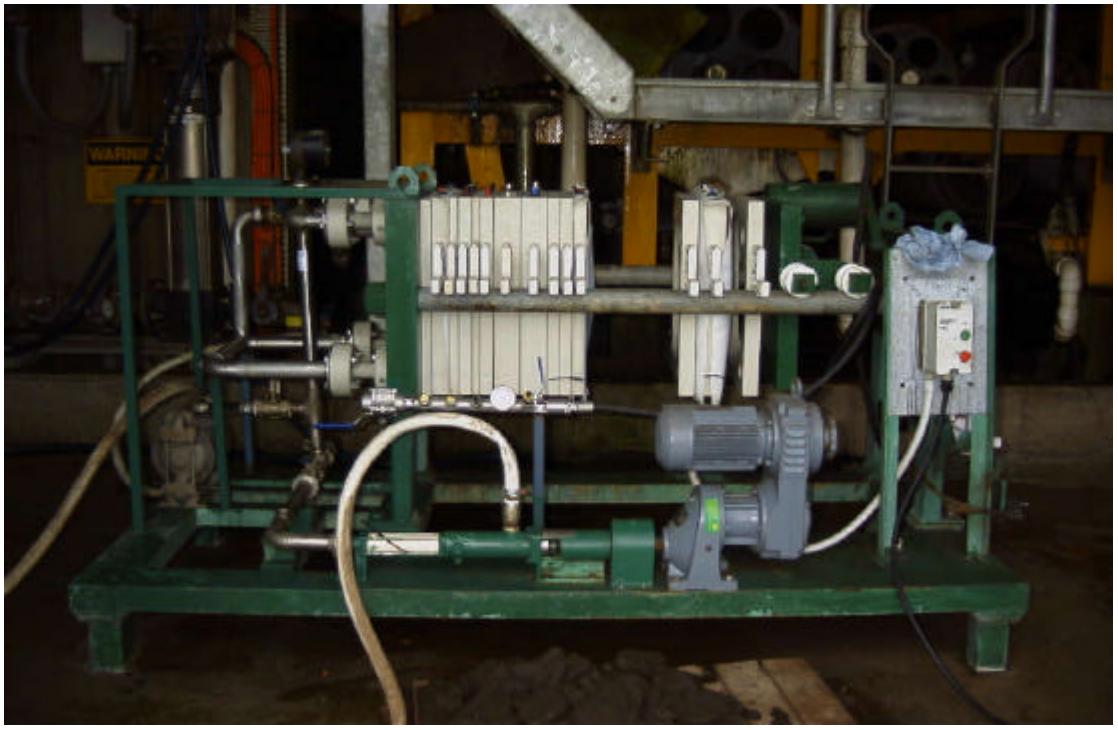


Figure 3 : ***Dried Cake following trials***

6.0 CONCLUSION

This trial proved successful and a costing was carried out at the end of the trial and it now remains an option for future development of the solids processing upgrade.

Trials were carried out in Germany on a wastewater plant with a Thermophilic Aerobic Digester. Sludge from the Digester was able to produce a sludge cake of the best around 40% dry solids with the worst being 25% and an average of 30 to 35%.

It was felt in Warrnambool that with the fatty substance in the effluent it may have produced a better sludge cake after it had been through either ATAD or TAD Aerated Digester.

7.0 ACKNOWLEDGMENTS

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Netzsch
Filter-Tex Media
Mr Bernd Friedrich
Mr Stephen Vass
Mr David Drabble

Table 2 : ***Filter Press Trial 1***

Date 13 September 1999
Slurry Activated Sludge from Sewage Treatment Plant
Customer South West Water, Warrnambool, Australia

Slurry Data

Density 1.0 kg/l
SG 1.2 % after settling in a 2001 barrel from 0.6 %

Additives

Polymer Cationic, Powderform

Slurry Volume 115 L **Pump Speed Setting** 309 l/sqm h
Temp. 20°C **Operator** John Harris

Time [min]	Volume [l]	Pressure [bar]	Filtration Performance [l/sqmh]	Filtrate	Remarks
0	0	0	0	Clear	
9	20	0	275	Clear	
19	55	0	433	Clear	
23	65	3	309	Clear	
31	80	7	232	Cloudy	
54	87	5	38	Clear	Man.red. to 4-6 bar
59	89	5	50	Clear	Man to 4-6 bar
86	99	6	46	Clear	Man to 5-7 bar
118	107	6	31	Little Cloudy	Man to 5-7
126	112	7.5	77	Little Cloudy	Man to 6-9
146	114	8	12	Little Cloudy	Man to 6-9
151	114.5	9	12	Little Cloudy	Air-Squeezing

Press Data

Plate Type: 500 Membrane + Frame

Cake TS 15 %
SG 1

Remarks

Cake is soft in the middle, elastic character, wet looking but dry surface. High content of fat in slurry. No water release if squeezed by hand. Sticking strongly to the filter cloth. Test done with other Cloth, the same sticking and cloudy filtrate resulted.
Existing Belt Press gets 10 % TS only. Clogging of the belts by fat reported.

Table 3 : ***Filter Press Trial 2***

Date 14 September 1999
Slurry Activated Sludge from Sewage Treatment Plant
Customer South West Water, Warrnambool, Australia

Slurry Data

Density 1.0 kg/l
SG 1.2 % after settling in a 2001 barrel from 0.6 %

Additives

Polymer Cationic, Powderform

Slurry Volume 53 L **Pump Speed Setting** 197 l/sqm h
Temp. 20°C **Operator** John Harris

Time [min]	Volume [l]	Pressure [bar]	Filtration Performance [l/sqmh]	Filtrate	Remarks
0	0	0	0	Clear	
5	2	0	50	Clear	
9	7	0.5	155	Clear	
15	15	1.5	165	Clear	
17	18	2.8	186	Cloudy	
25	22	1.5	62	Clear	Man.red. to 1-2 bar
38	26	2.5	38	Clear	Man to 2-3 bar
45	29	3.5	53	Little Cloudy	Man to 3-4 bar
70	36	6	35	Little Cloudy	Man to 5-7 bar
92	43	7.5	39	Little Cloudy	Man to 6-9 bar
106	50	8	62	Cloudy	Man to 6-9 bar
121	53	8	25	Cloudy	Man to 6-9 bar

Press Data

Plate Type: 500 Membrane + Frame

Cake SC 16.3 %
SG 1

Remarks

Cake is soft in the middle, elastic character, wet looking but dry surface. High content of oil and fat in the slurry. No water release if squeezed by hand. Sticking strongly to the filter cloth. Test done with other Cloth, the same sticking and cloudy filtrate resulted.
Existing Belt Press gets 10 % TS only. Clogging of the belts by fat and oil reported.

Figure 3 : ***Schematic of Warrnambool WWTP Layout***