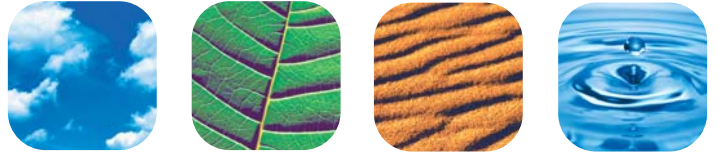


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AN APPLICATION OF VIROSEWAGE™ TECHNOLOGY

CASE STUDY: EVANS HEAD SEWAGE TREATMENT PLANT

“The Case Study demonstrates that a simple, low-cost methodology exists for treating sewage to EPA licence limits, improving treated effluent quality, removing nutrients, eliminating odour and handling increased hydraulic capacity of the treatment plant...”



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BACKGROUND

The Evans Head Sewage Treatment Plant (EHSTP) located in the Richmond Valley Council area, northern NSW, treats sewage generated from the towns of Evans Head and Woodburn. The equivalent population for the EHSTP is 3,700 but during the summer months and vacation periods (coinciding with school holidays) it is not unusual for the population to increase to 10,000. The EHSTP has been operating at its peak design capacity for some time with treated effluent quality consistently approaching and occasionally exceeding the discharge licence limits.



Fig 1. The Southern trickling filter at Evans Head sewage treatment plant.

PROBLEM

As part of Richmond Valley Council's on-going efforts to encourage development and simultaneously improve and provide sustainable environmental outcomes for the community, especially in the Salty Lagoon area, Council set out to improve the performance of the EHSTP in the interim while plans to invest in a new activated sludge plant were being formulated. These plans are now in place and detailed designs for a new EHSTP are being prepared.

In order to ensure that the EHSTP consistently meets EPA discharge licence conditions for Biochemical Oxygen Demand (BOD) and Suspended Solids (SS), Council looked at several treatment technologies, including one offered by Mess Industries (which was still on the drawing board) and another promoted by BioRemedy. This second technology was trialed for six months but achieved little success in meeting the targets. Council then decided to trial ViroSewage™ Technology offered by Virotec Global Solutions, an Australian based company.

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The EHSTP is a trickling filter (bio-filter) plant that treats sewage to secondary effluent quality. The process layout is depicted in Figure 1 and includes an inlet works consisting of a flow balancing chamber, bar screens and flow metering.

The flows from Woodburn and Evans Head are pumped into the inlet works chamber and flow attenuation methods were adopted by Council on Virotec's recommendations to reduce fluctuation between peak and low flow conditions. Average dry weather flow (ADWF) varies between 1.3 to 1.5 MLD. The original design flow for winter (ADWF) was 567,500 LPD and for summer was 1.6MLD. Current winter ADWF is two to three times the original design flow. Daily peak flows commence around 8 a.m. to 8.30 a.m. and start to decrease around 10.30 a.m. to 11 a.m., and the evening peak lasts from around 5 p.m. until about 9 p.m. Although most small STPs have little or no flow between midnight and 5 a.m., this plant still handles flows averaging about 30,000L/hr. These flows have been attributed to infiltration in the sewerage network.

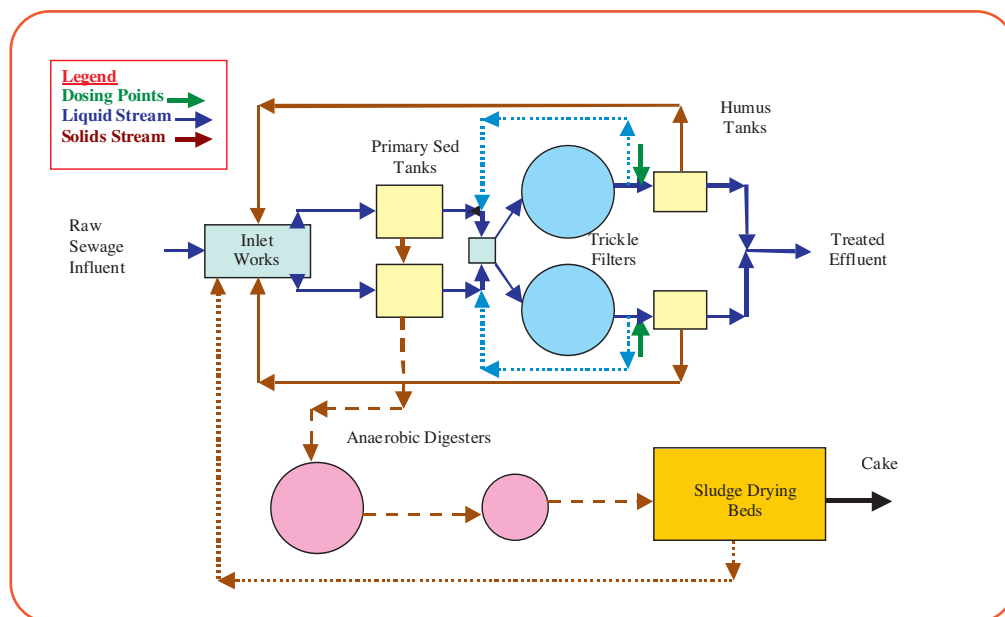


Table 1: Layout of the EHSTP

The flow from the balance chamber is split (unequally) and sent to a primary sedimentation tank (Imhoff Tank) and a sedimentation tank with a hopper bottom. The performance of these primary facilities is inadequate given the increased flows. The split streams re-combine at a syphon chamber before being divided to feed two 22 m diameter trickling filters. The increased organic matter and hydraulic loading has stretched the trickling filter performance and caused the high BOD₅ readings in the treated effluent. Two humus tanks with hopper bottom design settle solids, but these tanks are grossly (50 percent) undersized for current loadings. Roughly 50 percent of the treated flow is

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re-circulated to the syphon chamber (located between the primary sedimentation tanks and trickle filters) for additional treatment.

The treated effluent is discharged to nearby wetlands without any further treatment. Council intends to install equipment to disinfect the effluent prior to discharge to the wetlands by February, 2005.

Analyses taken of the treated effluent between March, 2003 and January, 2004 are tabulated below to characterize the EHSTP's plant performance before the application of ViroSewage™ Technology.

*Table 2: EHSTP Treated Effluent Results
Without ViroSewage™ Technology Treatment*

(All parameters expressed in mg/L except for pH and coliform count in cfus/100mL; Licence conditions are BOD₅ = 40 mg/L and SS = 40 mg/L)

Sample Date	BOD ₅	SS	Faecal Coliform
20/3/03	26	15	110,000
3/04/03	21	27	1,800,000
16/04/03	23	22	310,000
30/04/03	24	33	630,000
13/05/03*	25	57	990,000
28/5/03*	25	23	340,000
17/06/03*	33	16	475,000
24/06/03	27	43	380,000
8/07/03*	23	34	180,000
23/07/03	46	43	1,250,000
19/08/03	42	33	1,800
2/09/03	28	30	3,800
18/09/03	37	26	660,000
7/10/03	30	33	640,000
28/10/03	40	36	1,800,000
12/11/03	49	31	1,760,000
25/11/03	15	25	1,380,000
9/12/03	19	16	1,260,000
6/01/04	29	25	1,760,000
14/01/04	36	29	1,950,000
27/01/04	16	21	650,000
11/02/04	20	20	900,000

FOOTNOTE: * Dates when BioRemedy technology was applied.

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Fig 2. The ViroSewage™ Technology dosing plant being installed at Evans Head.

VIROTEC TOTAL SOLUTION

The Virotec Total Solution included design, engineering, installation, commissioning, monitoring, evaluation of the treatment system and liaison with Council officers. Under normal circumstances, Virotec would also liaise with the regulatory authorities on behalf of its client, but on this occasion Council deemed that it was not necessary.

TREATMENT METHODS AND RESULTS

ViroSewage™ Technology is a chemical treatment system which works in conjunction with, but does not displace, biological treatment of sewage. The addition of ViroSewage™ Technology reagents at specific locations and in precise dosages are an integral part of the technology.

The actual chemical reactions taking place will not be described here, but the ViroSewage™ Technology reagents consist of a cocktail of very fine grained minerals which can have a positive or negative surface charge depending on the pH conditions they are exposed to. The very fine size of the mineral particles gives them a high surface area to volume ratio and a high surface charge to mass ratio. These properties make the reagents extremely surface active, giving them the ability to attract and hold charged particles or polar molecules. The reagents enhance precipitation, co-precipitation, and coagulation and improve flocculation, resulting in denser agglomerates which settle rapidly. Both suspended solids and organic matter are removed from the liquid stream.

At the EHSTP ViroSewage™ Technology was applied after the trickling filter but before the humus tanks (see Fig. 1). After careful assessment of the hydraulic loading and daily flow patterns, a series of full-scale field trials were conducted on one half of the plant. Following the initial trials and minor adjustments, the ViroSewage™ Technology application successfully treated the sewage to comply with the EPA licence conditions. The performance of the humus tanks was improved dramatically as a consequence of the enhanced settling brought about by the ViroSewage™

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Technology reagents. Treated effluent properties improved significantly in colour, clarity, turbidity and phosphorus content after application of ViroSewage™ Technology. The table below provides details of the treatment results.

*Table 3: EHSTP Treated Effluent Results
After ViroSewage™ Technology Treatment*

(All parameters expressed in mg/L except for pH and coliform count in cfus/100ml; Licence conditions are BOD5 = 40 mg/L and SS = 40 mg/L)

Sample Date	BOD ₅	SS	Faecal Coliform
12/05/04	5	36	380
14/05/04	6	36	93,000
17/05/04	9	23	27,000
19/05/04	5	48	<1
21/05/04	3	33	1,100
24/05/04	6	51	180
26/05/04*	9	26	700
28/05/04*	15	35	24,000
31/05/04*	13	58	528,000
2/06/04	8	23	37,500
4/06/04	8	18	340,000
7/06/04#	5	24	56,000
9/06/04	8	32	180,000
11/06/04*	12	107	1,600
9/07/04	<2	13	1,570
13/07/04	5	8	2,200
16/07/04	7	8	7,500
20/07/04	4	17	9,500
23/07/04	4	14	2,300
27/07/04	4	9	13,700
10/08/04	4	15	19,000
13/08/04	9	19	13,000
17/08/04	5	11	3,800
20/08/04	4	15	4,000
24/08/04	4	15	3,700

FOOTNOTES: * Dosage low. # Rainfall.

The treatment was carried out in three phases. The first phase was a field trial carried out on the southern half of the plant from 12/05/04 to 31/05/04. Some flow attenuation steps were recommended to Council which were implemented, yielding some improvement in the treatment.

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The second phase was to switch the treatment over to the northern half of the plant. Changes to the dosing rates were carried out with results reflecting the impact of the change. This was carried out in July, 2004.

The third phase involved a further recommendation to control pumped inflows to the STP so that a more even flow was achieved instead of the regular surges which upset the sedimentation tanks' settling performance. A flow bypass system was also introduced by Virotec to enable the humus tanks to perform efficiently. The net impact of these changes resulted in greatly enhanced coagulation and flocculation processes taking place and rapid solids settling, leading to improved BOD₅ and SS readings as demonstrated by the 13th July results and onwards. The average BOD₅ after full treatment had been implemented was 5.0 mg/L and SS was 13.1 mg/L.

A consequence of the treatment is the production of additional volumes of humus sludge which may affect existing sludge handling facilities, including the holding capacity in digesters and the availability of sand drying beds. The current 20 to 30 days anaerobic digestion times may be reduced but this is at least partly compensated for by the stabilized nature of the sludge. It follows that decomposition and consequently generation of noxious odours may be eliminated. This is one of the characteristics of the sludge that is formed as a result of ViroSewage™ Technology. The sludge wasting cycle may be shortened but drying cycles will be longer because the sludge will be thicker, requiring more time to dry out.

SUMMARY OF BENEFITS

The EHSTP is now operating well within its EPA licence limits. With BOD₅ and SS readings averaging 5.0 and 13.0 mg/L respectively based on the most recent results, ViroSewage™ Technology provides a credible approach for producing consistent results.

The technology's ability to handle excessive hydraulic and organic matter loadings is well demonstrated and it is clear that the Technology is able to handle two to three times the original design flows.

Richmond Valley Council have been able to progress their plans to build additional facilities for current and future increased loadings without having to expend excessive capital to address the current problems at the EHSTP.

An additional benefit at the EHSTP is the absence of obnoxious odours. The treated humus returned from the humus tanks mixes with fresh raw sewage and arrests the formation of odour forming compounds. (Please refer to Virotec's Technical Data Sheet on the unique odour reducing properties of ViroSewage™ Technology reagents.)

The addition of ViroSewage™ Technology reagents improves settling allowing for secondary settling tanks to be designed and constructed more economically.

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Fig 3. ViroSewage™ Technology containerised mixing and dosing plant alongside trickling filter.

The ViroSewage™ Technology treatment method is a simple add-on to the existing treatment plant and does not require any major capital intensive structural or civil works to accommodate the technology.

Although not an issue for Council, the type of sludge produced (a mix of primary sludge, humus and ViroSewage™ reagents) has excellent properties for use with composting. Richmond Valley Council may wish to investigate the re-use potential of this valuable bi-product. (Please refer to Virotec's Technical Data Sheet on Bio-solids Treatment and Composting.)

CONCLUSION

This case study demonstrates that a simple, low-cost methodology exists for treating sewage to EPA licence limits, improving treated effluent quality, removing nutrients, eliminating odour and handling an increased hydraulic loading of the treatment plant. ViroSewage™ Technology is proving to be a viable answer to manage these issues.