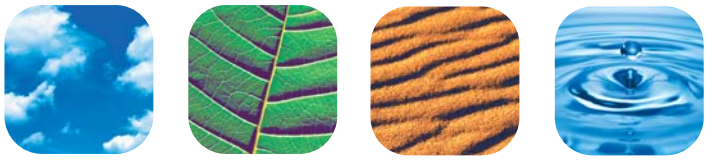

A COMMERCIAL APPLICATION OF VIROSEWAGE™ TECHNOLOGY

CASE STUDY: ROYAL AUSTRALIAN AIR FORCE BASE, AMBERLEY SEWAGE TREATMENT PLANT

"The ViroSewage™ Technology treatment applied at the RAAF Amberly base demonstrated that there is now a simple, low-cost methodology for treating wastewater to EPA's discharge licence limits, improving treated effluent quality, removing nutrients, eliminating odour and handling increased hydraulic throughput at the treatment plant."

Trickling Filter (left)
Overview of the Sewage Treatment Plant (above)

VIROTEC

>>> CASE STUDY: AMBERLEY SEWAGE TREATMENT PLANT

BACKGROUND

The Royal Australian Air Force (RAAF) Base at Amberley is on the Western fringe of the town of Ipswich, about 40 km west of Brisbane in South East Queensland. The sewage treatment plant treats wastewater generated from the RAAF base population. In 2006, the Department of Defence announced a major redevelopment of the base that would result in an increase in personnel on the base from 2,500 to 3,280 by the end of 2007, when the redevelopment was completed.

The wastewater requiring treatment comes from the personnel quarters, administration buildings, a school and on-site maintenance workshop and other related facilities. Therefore, it is a mixed residential and industrial discharge. No records of wastewater flows have been maintained in the last five years, but the consultant for the project, GHD, provided design parameters listed in Table 1.

PROBLEM

The redevelopment involves major works essential to the Air Force base's upgrade and includes upgrades to the communications, electrical, water supply, sewerage, storm water and road systems. The sewage treatment plant is operated and managed by private contractors employed by the RAAF.

As the population on the base increased, the existing sewage treatment plant (STP) reached its design limits and there was an increasing risk that it would not be able to produce treated effluent that complied with the EPA's discharge license conditions. The STP is an old trickling filter plant, and with the future growth in population predicted for Amberley and its surrounds, it was likely that Ipswich City Council would eventually provide new sewage treatment facilities nearby and would allow the RAAF base to be connected to it. As a result of this plan, an interim solution was required to enable the STP to handle the increased plant flows and loadings, and to improve plant performance. After carefully assessing available methodologies, Virotec's ViroSewage™ Technology was selected as the prefered technology to be adopted, with minimal changes to the existing infrastructure.

RAAF BASE AMBERLEY SEWAGE TREATMENT PLANT

The Amberley STP uses a trickling filter (bio-filter) system that treats effluent to secondary effluent quality. The process layout is depicted in Figure 3 and includes an inlet works (Figure 1) consisting of a Spirac screening and grit removal system, a bypass channel and ultrasonic level control system that regulates the operation of the screening system.

The inlet works discharges into a flow-splitting channel that divides the incoming wastewater flows into three streams, each leading to an Imhoff tank (the primary sedimentation facility - Figure 2). Most of the solids entering the plant (as well as debris that has escaped the screen) are collected in this primary sedimentation stage. The flow-splitting channel is not designed to be precise.

VIROTEC

>>> CASE STUDY: AMBERLEY SEWAGE TREATMENT PLANT

TABLE 1: DESIGN PARAMETERS FOR AMBERLEY STP

Parameter	Units	Value (Maximum)
Average Dry Weather Flow (ADWF)	*ML/d*	*1.1*
Design Peak Flow (DPF in dry weather)	*ML/d*	*2.3*
Total Phosphorous (TP)	*mg/L*	*<2*
Biological Oxygen Demand (BOD)	*mg/L*	*<20*
Total Suspended Solids (TSS)	*mg/L*	*<30*

Each of the three primary settling tanks feeds its wastewater to its own trickling filter bio-reactor (Figure 3). The discharges from the bio-reactors are collected in secondary settling tanks that are designed as a hopper bottom, square at the top, tanks to maximize solids separation from flowing water. The supernatant liquor from each of these secondary sedimentation tanks is recombined in a chlorine contact dosing system and then released through a final discharge channel. The humus sludge collected in the three secondary settling tanks is pumped back to the inlet works so that it can be collected and discharged from the primary settling tank underflow to sludge drying beds.

Figure 1: Inlet Works

Figure 2: Primary Sedimentation Facility

VIROTEC

>>> CASE STUDY: AMBERLEY SEWAGE TREATMENT PLANT

Humus sludge is returned from the secondary settling clarifiers once per day and the combined humus and primary sludge is sent to the drying beds at least once per week.

The sludge drying beds are two rectangular collection troughs that contain aggregate and sand to act as a filter and to increase air circulation and moisture removal during drying. The dried sludge is removed from the beds at least once per month and dispatched to the local Council's landfill.

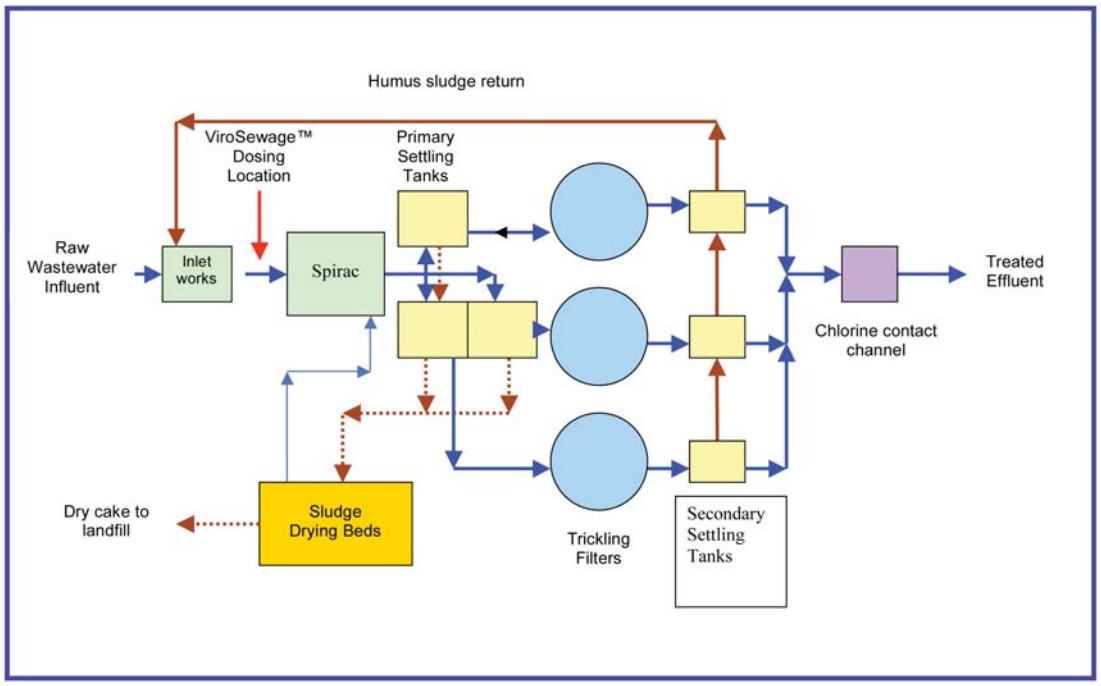

Figure 3: Layout of Sewage Treatment Plant (STP) at RAAF Base Amberley

VIROTEC TOTAL SOLUTION

The Virotec total solution for the RAAF Sewage Treatment Plant at Amberly included plant design, engineering, installation, commissioning, monitoring, evaluation and liaison with relevant parties. ViroSewage™ Technology uses patented reagents in a two-stage process to remove phosphate, reduce Total Suspended Solids (TSS) and Biochemical Oxygen Demand (BOD), and a wide range of trace elements. ViroSewage™ reagent A reacts with phosphate to form low solubility minerals while ViroSewage™ reagent B provides crystal growth templates to enhance the removal of the mineralised phosphate. ViroSewage™ reagent B also removes a wide range of potentially environmentally hazardous trace elements (including: As, Cd, Cu, Cr, Hg, Ni, Pb) from the liquid phase. The precipitated solids are then separated from the liquid phase as part of the normal operations of the STP.

>>> CASE STUDY: AMBERLEY SEWAGE TREATMENT PLANT

TREATMENT METHODS AND RESULTS

ViroSewage™ Technology is a chemical treatment system that works in conjunction with, but does not displace, the biological treatment of wastewater. An important part of the Technology involves controlled addition of the required amounts of ViroSewage™ reagents at appropriate points in the treatment plant.

Figure 4: The ViroSewage™ Technology dosing plant at Amberley Sewage Treatment Plant (STP).

The ViroSewage™ reagents consist of a cocktail of very fine grained minerals that each have a positive or negative surface charge depending on the pH conditions they are exposed to. The very fine grain 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, acting together with other chemical compounds, enhance precipitation, co-precipitation and coagulation, thereby, improving flocculation and producing denser flocs that settle more rapidly. Both suspended solids and organic matter are settled and removed in the liquid stream.

At Amberley, the ViroSewage™ reagents were applied after the inlet works but before the primary settling tanks (see Fig. 3). The ViroSewage™ Technology application successfully treated the sewage to comply with the Queensland Environmental Protection Agency's (EPA) discharge license limits. Furthermore, the physical performance of the secondary settling tanks improved dramatically as a consequence of the enhanced settling brought about by the ViroSewage™ reagents and hence, the colour, clarity, turbidity and total phosphorus content improved significantly after application of ViroSewage™ Technology. Table 2 provides details of the treatment results.

>>> CASE STUDY: AMBERLEY SEWAGE TREATMENT PLANT

TABLE 2: EFFECT OF TREATING AMBERLEY WASTEWATER USING VIROSEWAGE™ TECHNOLOGY

Analyte	Raw Influent (mg/L)	Treated Effluent (mg/L)	Treated Target Limit (mg/L)
13/08/07			
BOD_5	430	5.4	<20
TSS	925	30	<30
Total Phosphorus	15.6	1.29	<2.0
14/08/07			
BOD_5	230	5.7	<20
TSS	234	14	<30
Total Phosphorus	8.13	0.81	<2.0
15/08/07			
BOD_5	310	1.2	<20
TSS	130	9.0	<30
Total Phosphorus	7.03	0.73	<2.0
16/08/07			
BOD_5	210	11	<20
TSS	835	24	<30
Total Phosphorus	17.6	1.17	<2.0
17/08/07			
BOD_5	210	8.4	<20
TSS	150	20	<30
Total Phosphorus	9.36	0.79	<2.0

TSS is Total Suspended Solids and represents all solid particles suspended in the liquid that are coarser than 0.45 µm. BOD_5 represents the biochemical oxygen demand of the effluent as recorded during a five-day test.

As a consequence of the treatment, there was an increase in the volumes of humus sludge produced as a result of the improved solids settling properties of the Sewage Treatment Plant (STP); this could mean that sludge may need to be removed a little more frequently to avoid exceeding the holding capacity in digesters and sand drying beds.

VIROTEC

>>> CASE STUDY: AMBERLEY SEWAGE TREATMENT PLANT

However, the improved separation of solid and liquid phases also means that anaerobic digestion times can be reduced and the sludge that is produced is more stable. Furthermore, because the reagents used in ViroSewage™ Technology have an outstanding ability to bind odour producing molecules (particularly, foul smelling sulphides and mercaptans), generation of the obnoxious odours normally associated with drying sewage sludge was greatly reduced or eliminated; this is one of the additional benefits of applying ViroSewage™ Technology. The sludge wasting cycle was shorter after the application of ViroSewage™ Technology, but drying cycles were somewhat longer because the thicker sludge took longer to dry.

SUMMARY OF BENEFITS

The Amberley Sewage Treatment Plant (STP) is now operating extremely well and discharges remain within the EPA's discharge license limits. With the total phosphorus under 1.0 mg/L, and BOD_5 and TSS readings averaging 6.0 and 20 mg/L respectively, ViroSewage™ Technology is a credible approach for producing consistently high quality effluent.

The Technology's ability to handle excessive hydraulic and organic loadings was also well demonstrated.

An additional benefit at the Amberley STP is the almost complete elimination of obnoxious odours. The humus returned from the secondary settling tanks, after the addition of the ViroSewage™ reagents, mixes with raw influent and arrests the generation of odour forming compounds. (Please refer to Virotec's Technical Data Sheet on the unique odour reducing properties of ViroSewage™ reagents.)

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

The ViroSewage™ Technology method was a simple add-on to the existing treatment plant at Amberly, and no significant, capital intensive, structural or civil works were required to accommodate the Technology.

The type of sludge produced (a mix of primary sludge, humus and ViroSewage™ reagents) has excellent drying and micronutrient properties, making it ideal for use in composting; the elimination of obnoxious odours also makes this proposition more appealing. The Sewage Treatment Plant (STP) at Amberley and local Council will investigate the re-use potential of this potentially valuable by-product.

CONCLUSION

This case study on the application of ViroSewage™ Technology at the RAAF base at Amberly has demonstrated that there is now a simple, low-cost methodology for treating wastewater to EPA's discharge licence limits, improving treated effluent quality, removing nutrients, eliminating odour and handling increased hydraulic throughput at the treatment plant. ViroSewage™ Technology proved to be a viable answer to manage these issues.

0523/MKJ/08
25/01/08

VIROTEC