Remote monitoring for wastewater sites

Optimize and understand your treatment process

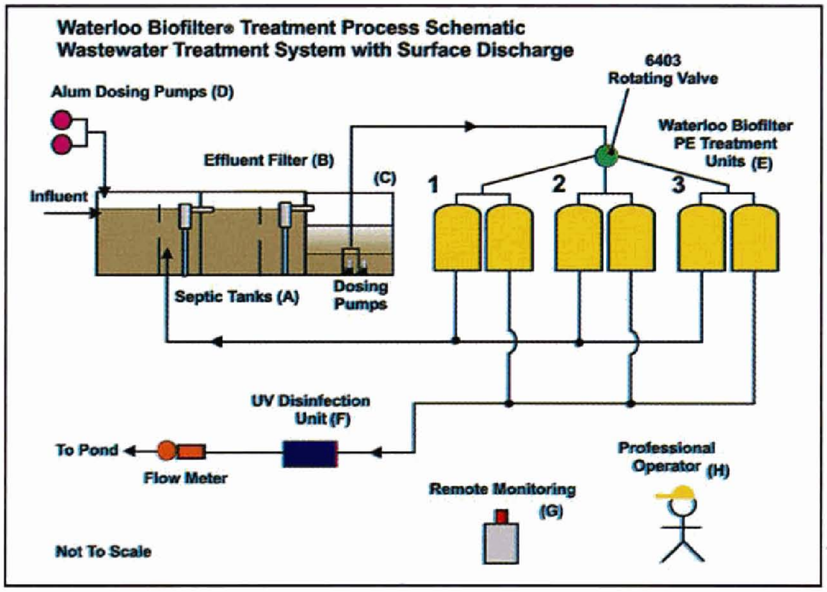

Figure 1. *Process schematic of a 30m³/day Waterloo Biofilter® wastewater treatment system with surface discharge to irrigation ponds.*

A remote monitoring system (RMS) for a number of wastewater treatment sites could be an invaluable tool in optimizing the treatment process and in complying with Ministry of Environment surface water discharge criteria for organics, solids, ammonium, phosphorus, and pathogens. It was developed for Waterloo Biofilter Systems.

The ClubLink golf courses of Blue Springs, Rattlesnake Point, King's Riding and Rocky Crest use the Waterloo Biofilter septic tank and absorbent trickle filter system to treat highly variable flows of high-strength wastewater from the clubhouses and resort buildings for reuse in irrigation. **Figure 1** is a schematic diagram of a 30 m^3/day peak system and includes: (a) two-day capacity septic tanks, (b) effluent filters, (c) a surge pump tank, (d) aluminum sulfate addition, (e) six Waterloo Biofilter PE tanks, (f) Trojan 3000 UV disinfection, (g) SiteWatch RMS, and (h) operations staff.

Treatment and compliance may be compromised if one of these components does not function properly, and so it is important to pre-empt problems.

By Ignatius Ip[1], E. Craig Jowett[1] and Scott Kirby[2]

Remote monitoring allows for immediate detection of problems off-site and is easier and faster than on-site troubleshooting.

The RMS consists of SiteWatch-designed software and hardware connected to mechanical equipment, to record pump-on times and cycles for all pumps, rotating valve cycles, flow meters, temperatures, UV light intensity, and individual alarms. Certain alarms are automatically paged to the operator with the site location, who can investigate remotely by computer before visiting the site, saving much time. Remote monitoring also provides off-site preventive maintenance. By downloading and viewing daily summaries, problems such as stuck rotating valves or inefficient pump cycles can be isolated and fixed, generally before they become a problem.

Optimizing treatment

1. *Pump Frequency Too High* – In May 2001, one system had frequent low-level alarms in the pump chamber, and event listings of the pump on-times were investigated to determine activity throughout the day. **Figure 2** shows the pumps were active only 50% of the time (green is on, white is off) because the timer had been set for short cycles at too high of a frequency. The water level in the surge pump chamber remained low because the pumps would discharge the effluent as soon as it came in, almost on a demand basis, and the surge capacity was not utilized. If this situation were to continue, ammonium levels in the effluent would rise.

The timer cycles were changed to spread the dosing evenly throughout the day, allowing more effective use of the surge chamber.

2. *Rotating Valve Stuck* – Three sets of Biofilters at Rattlesnake Point Golf Course are dosed using a mechanical

Table 1. Daily pressure switch dosing cycles through rotating valve.

Date 2001	Dose Cycles Unit 1	Dose Cycles Unit 2	Dose Cycles Unit 3	Status
Oct. 20	183	183	183	Normal
Oct. 21	183	183	183	
Oct. 22	NA	NA	NA	Valve stuck
Oct. 23	76	53	53	
Oct. 24	36	183	183	
Oct. 25	23	183	183	
Oct. 26	29	157	157	
Oct. 27	62	183	183	
Oct. 28	40	183	183	
Oct. 29	184	190	203	Valve Recovery after Cleaning
Oct. 30	172	173	186	
Oct. 31	157	157	165	
Nov. 01	171	171	196	
Nov. 02	163	168	182	
Nov. 03	163	172	190	
Nov. 04	182	183	183	Normal
Nov. 05	143	143	144	

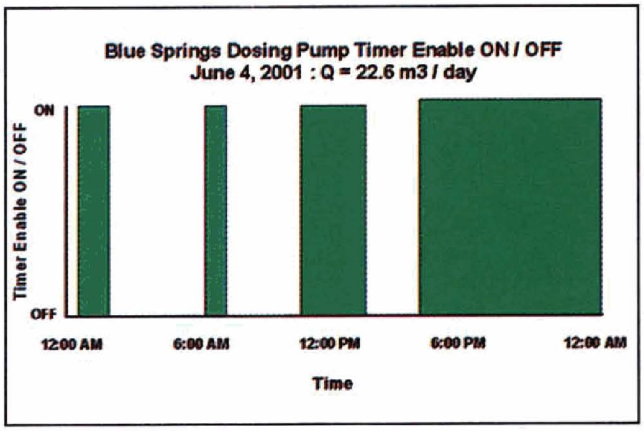

Figure 2. *Dosing pump activity on June 4, 2001.*

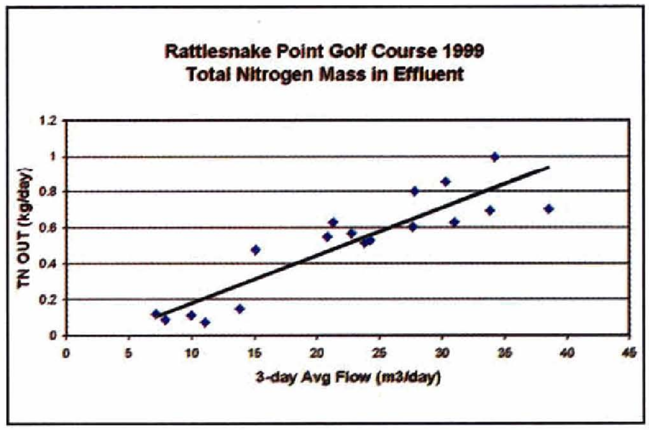

Figure 3. *Predicting Total Nitrogen (TN) mass in effluent.*

rotating valve, and the rotations are recorded using pressure switches on the force mains. **Table 1** shows the cycling of the valve being normal for October 20-21 with all cycles equal, but abnormal for October 23-28, with unequal cycles. After the valve was cleaned, the valve regained normal cycling. If the valve had remained stuck, ammonium levels would have eventually exceeded compliance.

Understanding the treatment

1. *Peaking Factors Too Low* – In June 2001, the ammonia at Rattlesnake began to rise and threaten to fall out of compliance (above 2.0 mg/L). The records of the daily summaries were investigated to determine what might be the cause. The median flows in the peak season May to September were 31 m^3/d in 1999 and 33 m^3/d in 2000 (a peaking factor of ~1.9), but jumped substantially to 44 m^3/d in 2001 (a peaking factor of only 1.4), due to the commercial success of the golf course. The hydraulic and mass loading were much greater than the design loads and caused the ammonia levels to rise.

With the mass loadings to justify the system upgrade, more filter medium was added, and effluent ammonia fell to <0.5 mg/L, well within compliance.

2. *Calculating Nitrogen Loading Rates for Reasonable Use Policy* – A number of effluent samples from Rattlesnake were analyzed for total nitrogen (TN = TKN + NO_2-N + NO_3-N), and the mass of TN (kg/day) calculated using a three-day average flow due to re-circulation and extensive mixing in the plant. **Figure 3** shows a very good correlation between TN mass loading and average flow, indicating simply that the effluent quality is consistent. Using recorded data, the peaking factors were determined for a three-year period, and this data used to predict the nitrogen loading at the new facility.

The two highest consecutive days of flow at Rattlesnake were averaged to determine the peak flow, and annual peaking factors calculated (**Table 2**). The average annual flow of the new facility was back-calculated using this peaking factor, and predicts an average annual flow of 20,400 L/day. This represents 0.48 kg/day of TN released into the environment, or 175.7 kg per year. These figures can subsequently form a basis for hydrogeologic calculations in applications for approval.

Table 2. Determining peaking factors.

	Flow (m^3/day)		
Year	Average	2-day average peak	Peaking Factor
1999	24.0	62.0	2.6
2000	20.1	68.0	3.4
2001	30.5	65.0	2.1
		Average:	2.7

[1]*Waterloo Biofilter Systems Inc.*
[2]*ClubLink Corporation*