Meeting *challenges* and taking *initiatives* to be one step ahead

By Stella Chiu, P.Eng. and Rob Isaac, Eng.L., City of Abbotsford

Located south of Fraser River, within the City of Abbotsford boundary, the JAMES (Joint Abbotsford Mission Environmental System) Wastewater Treatment Plant serves its contributory area including Abbotsford, Mission, Sumas and part of Langley (Aldergrove and Gloucester), with an equivalent population of approximately 210,000.

Co-owned by the City of Abbotsford and the District of Mission, the governance of the JAMES plant is provided through the Abbotsford/Mission Water and Sewer Commission (AMWSC), which is comprised of elected representatives of the City of Abbotsford and the District of Mission. The City of Abbotsford is the operator of the JAMES plant.

Since its original construction in 1981, the plant has undergone several major expansions to service growth. The liquid treatment processes of the JAMES plant now include influent pumping, screening, aerated grit removal, primary sedimentation, trickling filter/solids contact (TF/SC) process, secondary clarification, and chlorination/dechlorination as disinfection. The treated effluent is discharged into the high current area of Fraser River through a 1.2 km long outfall. The plant's solids handling processes include thickening of secondary sludge, pre-pasteurization, stabilization (dual digestion) and solids dewatering. 'Class A' biosolids are produced as a result of the pasteurization and digestion process. The biosolids are either transported to an interior mine site for site reclamation, or used on-site to produce a growing medium (topsoil) sold under the Val-E-Gro™ name. A soil biofilter system is used for odour control and treatment.

CHALLENGES

Like many other wastewater treatment plants across the country and province, the JAMES plant faces a number of challenges from engineering planning to operations:

For example, the plant has seen high effluent ammonia concentration in winter time, combined with high effluent pH, which presents risk of failing the 96-hour LC50 fish toxicity bioassay. Ongoing dissolved oxygen (DO) monitoring in the solids contact tanks indicated that DO, which assists with further ammonia oxidation in these tanks, was absent. Further investigation was undertaken and the AMWSC decided to proceed with an aeration improvement that would maximize nitrification and, in turn, reduce ammonia concentration and decrease pH. In 2008, the aeration systems in both solids contact tanks were upgraded from a coarse-bubble system to a fine-bubble system to improve the oxygen transfer. An increase in DO to 4 mg/L was seen immediately after the upgrade. This upgrade increased overall plant nitrification and effluent ammonia concentrations decreased significantly, with a decrease in pH at the same time (See Graphs 1 & 2).

Another challenge the plant sees is the seasonal variability of the quantity and strength of the industry discharges. Approximately 35% of the Biological Oxygen Demand (BOD) load in the influent is contributed by monitored industries on an average annual basis. Some of these

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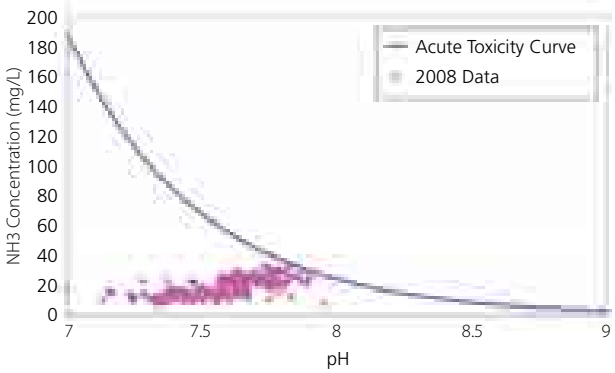
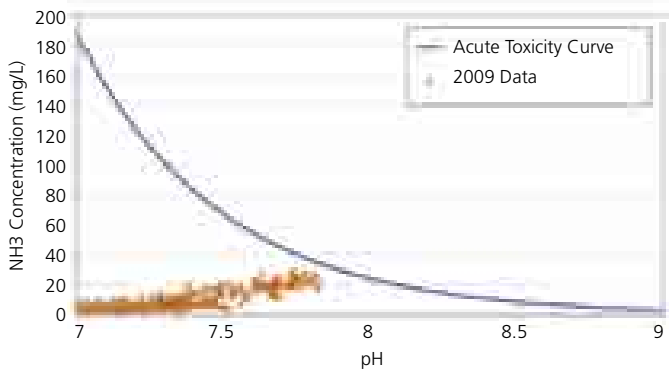
GRAPH 1 - 2008 Data



GRAPH 2 - 2009 Data



monitored industries are food processing plants, which operate only in a certain season of the year. From a planning perspective, the AMWSC has to make sure there is adequate capacity at the plant during the peak discharge season of these industries and that the effluent meets discharge permit.

Metals toxicity is another challenge. There was a spike of chromium in 2000 and the source was unknown. Also in 2006, biosolids sampling and analysis revealed that the metal contents fluctuated. Biosolids recycling efforts and the Val-E-Gro™ process were jeopardized for a period of time due to the incidence.

INITIATIVES

The AMWSC has been proactive in looking into ways to tackle the challenges. The implementation of the Source Control Program in 2008 spearheaded by the Source Control Section was one of the major initiatives supported by the AMWSC to handle the challenges of variability of industrial discharges and influent toxicity.

Source control is a pollution prevention strategy aimed at reducing the amounts of chemical contaminants that industries, commercial businesses, institutions and households discharge to sewers. This is often done through a combination of regulation, education and promotion of pollution prevention measures.

The Source Control Section researched the prohibited and restricted wastes listed in the sewer bylaw for each municipality and completed a risk assessment. The metal finishing businesses, food services, dental, automotive repair and photo imaging businesses were identified as potential dischargers of specific contaminants of most concern in the assessment. Monitoring programs were initiated for the metal finishing, dental and photo imaging businesses operating within the City of Abbotsford and the District of Mission.

Based on the risk assessment and sampling analysis, the Source Control Section outlined a 10-Year Source Control Program Plan. The schedule is based on contaminants with the highest risk to the JAMES plant. Codes of Practice for dental operations and photo imaging operations were subsequently developed and adopted by the AMWSC. These Codes of Practice set out minimum waste treatment, equipment maintenance and record keeping requirements for various operations, and ensure the risk of contaminants in non-domestic waste discharges is kept to a minimum to protect the Val-E-Gro™ operation.

Apart from the Source Control Program Plan, a new rate structure to recover the operational cost of treating organic waste contributed by the extra strength industries was proposed. A consultation meeting was held with industry stakeholders prior to the implementation of the new rate structure to make sure all were on board. The new rate structure based on Full Mass Loading was effective as of January 2009. It eliminates the threshold limit of 0 to 300 mg/L before the extra strength rates are applied. The rate for each kg of BOD/TSS is now the same regardless of its concentration.

Other than the above, the JAMES plant is taking a number of ongoing initiatives in an effort to reduce plant flows, improve plant energy efficiency and reduce its carbon footprint:

VAL-E-GRO™

Val-E-Gro™ is a growing medium developed and trademarked by the AMWSC. It is manufactured by mixing 'Class A' biosolids with washed sand and composted bark at about 1:1:1 ratio. The mixture is combined in a rough mix using a loader and processed through a soil shredder to completely mix the materials into the product. The use of biosolids to produce Val-E-Gro™ reduces trucking to the interior mine site, which saves costs and reduces the greenhouse gases produced via trucking significantly. Currently, 5% of the biosolids are being used to produce Val-E-Gro™. The AMWSC has recently signed an agreement with a private company to market and distribute Val-E-Gro™ with the goals to expand this program and explore options to use Val-E-Gro™ locally. (For more information, please visit *www.val-e-gro.com*.)

USE OF RECLAIMED WATER

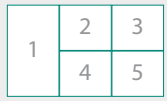
The JAMES plant currently uses reclaimed water for many areas within the plant. These areas include process water for chlorination/dechlorination, cooling water, hose stations, sprays for equipment cleaning and landscape irrigation.

USE OF EXCESS BIOGAS

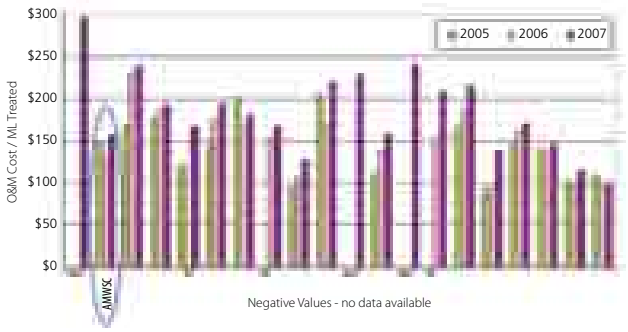
Digester gas is created from the three anaerobic digesters at the JAMES plant. The gas is currently converted to electricity and heat for the plant's use via the plant's co-gen and boiler systems. Surplus gas is compressed and stored in a high pressure gas storage tank on-site.

PHOTO CAPTIONS:

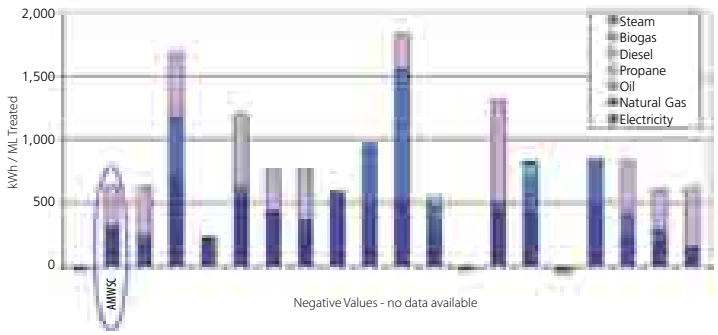
1 - Secondary clarifier with trickling filter in the background
2 - Trickling filter
3 - Trickling filter and solids contact tanks
4 - Primary sedimentation tanks
5 - Centrifuges



GRAPH 3 - O&M Cost / ML Treated
Secondary & *BNR WWTPs AAF Above 50 ML/day



GRAPH 4 - Breakdown of Energy Consumed kWh/ML Treated 2007
Secondary & *BNR WWTPs AAF Above 50 ML/day



In 2008, approximately 950,000 m^3 of digester gas was flared because the gas produced has exceeded the capacity of the co-gen system. The AMWSC is currently exploring options to utilize the excess digester gas and harness the energy content. These options include upgrading the co-gen system, cleaning and selling the gas to a local gas supplier, or for use in fueling of the city's vehicles.

END USE ASSESSMENTS

The JAMES plant received funding from BC Hydro in 2009 to assess both its pump systems and its blowers under the BC Hydro Power Smart Partners – Industrial Program. The goal of the program is to identify opportunities to increase energy efficiency at the facility. Opportunities to improve efficiency in both the pump and blower systems were identified in the assessments, such as adjusting the control logic of the primary effluent pump system. An energy efficiency feasibility study was recommended to develop business cases for capital improvements.

AGGRESSIVE INFLOW & INFILTRATION (I&I) MONITORING PROGRAM

Over the years, the City of Abbotsford expanded and improved its I&I monitoring program by installing permanent flow monitoring sites at strategic locations, refining its catchment areas, monitoring the real-time flow data via its SCADA system, and analyzing it using a web-based tool designed locally.

As a result of the expanded program, flows due to I&I to the JAMES plant have been reduced. In turn, this has reduced energy usage at the JAMES plant, and allowed for better forecasting of the plant's upgrade needs. Also, accurate I&I rates were determined for use in the city's sewer model, which helps to accurately determine the timing of capital upgrades to the collection system. The tie-in of the city's closed-circuit television (CCTV) program with the improved I&I monitoring program allows problematic areas to be assessed and pinpointed in a timely fashion. In addition to the CCTV camera, the city now also uses the side-scan sonar technology to evaluate major structural and operational condition of the sewer below water level. The problematic areas are then included in the city's rehabilitation program.

2007 BENCHMARKING STUDY

JAMES plant is an ongoing participant of the National Benchmarking Initiative (NBI) for the water and wastewater industry that was started in 1997. The NBI compares performance measures from different utilities across the country, including 28 waste water utilities, 28 water utilities, and 12 storm water management programs.

The benchmarking results show that both the AMWSC compares very well with those in the survey group, and have a well maintained sewage treatment system with a low operating cost and low energy consumption (see graphs 3 & 4).

MOVING FORWARD

With continued growth, the JAMES plant flows have now reached an average day design flow of 61 ML/d, and increased treatment capacity is required. The design of the Stage VII expansion is underway, which includes a new primary effluent pump station, trickling filter, solids contact tank, secondary clarifier, and return biological sludge pump station. This expansion will increase the plant's average day design flow capacity from 61 ML/d to 100 ML/d, at the current treatment level requirements. Construction is anticipated to start in 2010. The expansion will provide room for residential growth within the JAMES contributory area, as well as growth for businesses and industries that would like to invest in the area.

Centrifuges are currently being installed to replace the aged belt filter presses in the solids dewatering process. It is anticipated that the centrifuges will produce biosolids with 25% solids content, which is 30% drier than before. Trucking requirements to the interior mine site will be reduced, which also reduces the greenhouse gases produced from transportation.

A new master plan is currently underway to identify the future expansion requirement of the JAMES plant to meet the discharge standard. Sustainable design will be considered in the evaluation and recommendation of plant's capacity expansion options.

In an effort to conserve water, the City of Abbotsford is upgrading the current universal water metering program to a radio-read meter system in 2010. It is anticipated this measure will encourage efficient use of water, identify leakage and high water consumers within the system, and reduce flows discharging to the JAMES plant.

The AMWSC will continue to be proactive and look for ways to improve the JAMES plant from an energy efficiency and sustainable perspective, to provide excellent service to its contributory areas, and to be a good environmental steward. With the continued coordination between the engineering and operations department and support from the AMWSC, it is anticipated that JAMES plant will continue to meet any challenges that come its way.

**Aldergrove and Gloucester have elected to divert their sewage flows to another treatment system in 2010.*

***Stella Chiu** is the Wastewater Planning/Process Engineer with the City of Abbotsford.*

***Rob Isaac** is the Wastewater and Asset Engineering Manager with the City of Abbotsford.*

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