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*rr (1984)* states, "...the anks became forgotten" because of construction nort, stagoW(b:**buyer**) of w**W/f**cd**#66**5b**%** t**287**5h**%**Ca **JbN/BBW**(**j)b**(**j)b**(**j**(**j)b**(**j)b**(**j)**(**j**(**j)b**(**j)b**(**j)**(**j**(**j)b**(**j)**(**j**(**j)**(**j)**(**j**(**j)**(**j)**(**j**(**j)**(**j**)(**j**(**j)**(**j**(**j)**(**j**)(**j**(**j)**(**j**(**j)**(**j**(**j)**(**j**(**j)**(**j**(**j)**(**j**(**j)**(**j**(**j)**(**j**(**j)**(**j**(**j**(**j)**(**j**(**j**(**j**)(**j**(**j**(**j**)(**j**(**j**(**j**(**j**(**j**)(

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## From prescription to functionality, if not performance

#### Industry standards

Septic tank standards that apply across Canada (*CMHC*, 1984; *CSA*, 2005) are primarily prescriptive construction manuals for building competent tanks out of various materials. Prescriptions are based on the established methods of the time of writing, and, once they are published and adopted by manufacturers and regulators, with time they develop a respectable and authoritative aspect. One is naturally more hesitant to change the familiar written word, which favours the *status quo* for incumbent technology and may obstruct the new.

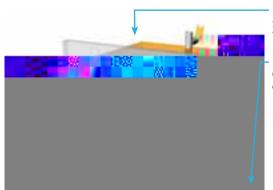
Prescriptions set out designs that do impact sewage treatment, such as

### **Enermodal Engineering**

Enermodal Engineering is Canada's largest consulting firm exclusively dedicated to *LEED* buildings and communities, being responsible for 40% of certified buildings in Canada. Originating in Ontario, Enermodal has now expanded to four locations and over 100 employees in North America. Enermodal delivered the *LEED* 2009 Rating System and serve as *LEED* faculty members, with President Stephen Carpenter appointed Chair of the Technical Advisory Committee. This firsthand knowledge of *LEED* is an important contributor to Enermodal's recordbreaking 200 *LEED* projects across North America. Projects include the first Platinum certification in Ontario at Toronto Region Conservation Authority, first Platinum industrial certification at Fifth Town Cheese, first Canadian Stage 2 *LEED*-ND certification at Currie Barracks, and the largest *LEED* project in Canada at RBC Centre.

For over 25 years, Enermodal has pioneered the use of some of the most innovative and practical

technologies for use in green infrastructure, even in remote Arctic areas. These include rainwater cisterns and re-use, onsite wastewater biofiltration, radiant cooling, renewable energy, and variable flow refrigerant systems. Enermodal's success is rooted in a hands-on approach and technical understanding of building systems and energy use, and a need to promote innovative technologies based on performance and testing for their projects.



#### FIGURE 1

Standard Ontario 'box-type' 4500 L septic tank with 150 mm partition orifices close to the outlet. Turbulent plumes (in orange) short-circuit untreated sewage to outlet pipe (Lay et al., 2005).

#### FIGURE 2

Closed-conduit tank limits turbulence (in orange) to the inlet area, and only 'old,' treated sewage exits the tank, depicted as laminar-flow parabolic discs A to B (Lay et al., 2005).

#### FIGURE 3

'Flooded' or closed-conduit flow tank of 5700 L capacity tested side-by-side with conventional single- and double-compartment tank at Buzzards Bay test facility.



## Waterloo Biofilter

For his Doctorate degree at University of Toronto and as a NATO Science Fellow at Michigan and Cornell, Craig Jowett specialized in physical properties of rocks and fluid flow within sedimentary basins, to determine timing of flow and met at an awards dinner (she was the award winner), and together they developed a simple, free-draining trickle filter suitable for peoples' back yards – for treatment before disposal. Beneficial microbes set up housekeeping on solid surfaces to treat sewage, but this researchers and manufacturers from around the world to Ontario to develop a new industry of on-site treatment before disposal. Waterloo Biofilter Systems was incorporated in 1995 to manufacture and market the patncos incorporated in plier of high-quality corrugated steel products, corrugated HDPE pipe, and, now, concrete structures for infrastructure markets. Rockwood-based A is a pioneering innovator

in decentralized sewage treatment, nutrient removal, disposal, and re-use. Kitchener-based

is a major player in designing buildings, which often incorporate sustainable 'green' infrastructure.

The first tank was 4500 L capacity for the tracing studies of *Lay et al. (2005)* (Figure 2), and second was 5700 L fabricated in two lengths (Figure 3) to fit within the test site at the Massachusetts Alternative Septic System Test Center (*www.buzzardsbay.org/etimain.htm*), where the biochemical testing is carried out. The 5700 tank segments were connected with two 200-mm pipes to allow sludge and scum to migrate between tanks and not to act as a partition.

## Long-term sewage test results

Since April 2005 a *A* tank has been in operation in side-by-side testing with a single-compartment 'Massachusetts' tank (Studies 1 and 2), fully presented in *Jowett (2007, 2009)* and summarized here. Study 3 is ongoing with an 'Ontario' tank + effluent screen.

## Study 1: **B66** test protocol residential-type testing

Study 1 was carried out for 15 months and conform hir CODENCE OF CONFERENCE OF CODENCE O do alkalinity and solubilization parameters. The performance parameters of cBOD, TSS, COD generally decrease as expected between inlet and outlet as the sewage is being treated.

# Study 2: lower hydraulic loading rate

Study 2 was carried out for 12 months, with flows of 2500 L/d, increasing to 2850 L/d for the last two months. Tank A3 removed 35% cBOD and 81% TSS, and the F3 single compartment tank

removed 13% cBOD and 76% TSS (Table 3).

The F3 anomaly in cBOD values for days 170–230 (Figure 4) is not explained by sewage values, and does not appear in COD or TSS values.

## Conclusions

Removing the airspace to induce closedconduit flow in a long, narrow, shallow septic tank results in substantially less scum and sludge formation and higher quality effluent compared to a conventional box-like tank with airspace. Introducing new technology into the environmental arena should be encouraged, to reduce pollution and improve health and safety. Standards organizations and regulators need to review existing prescribed designs, which may limit the treatment capabilities of the important septic tank, and to introduce performance standards and benchmarks suitable for Ontario's climate.

### References

Bailey, W.A., Junnila, W.A., Aho, W.A. and Wheeler, W.C., 1957. A Heated Septic Tank for Disposal of Dead Poultry. Storrs Agricultural Experi-