This presentation premiered at WaterSmart Innovations

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Residential Graywater Systems (warts and all)

WATER SMART INNOVATIONS CONFERENCE
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Potable vs. Non-potable

- If you are connected to a municipal water system, all of the water supplied to your home is potable water (i.e., water that is fit to drink)
- It costs a lot of money to turn raw water into potable water and to keep it potable as it makes its tenuous journey through the distribution network until it reaches your home.

End of Journey

- Once this wonderful, pristine water reaches your home –
- You drink some of it (water, coffee, juice, etc.)
- You cook with some of it
- You wash dishes with some of it
- You bathe with some of it
- You wash clothes with some of it
- And…

Too Fit for Purpose

- You flush your toilet with some of it, and
- You irrigate your landscape with some of it.

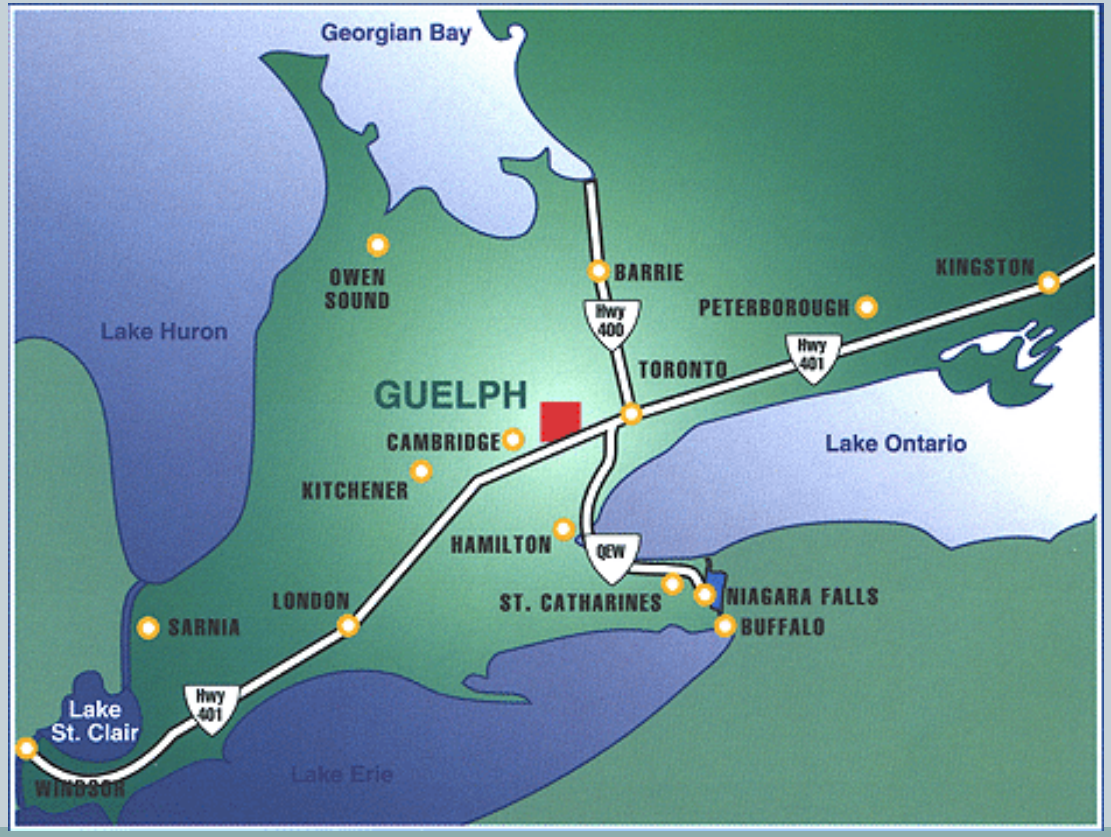
- Can anybody argue that we SHOULD be flushing our toilets and watering our lawns with potable water?

- No! It makes no sense.

- Or does it?

Guelph Greywater Reuse Pilot Project

- The City of Guelph, located about an hour west of Toronto, is a land-locked city.



Con't

- Surrounded by the Great Lakes
- But not connected to any of them
- One of the largest municipalities in Canada (just over 100,000 population) reliant solely on groundwater.
- Community goal – to be a leader in water conservation and efficiency
- Not afraid to be first.

Pilot Project

- Target – include 30 new and existing homes in a residential graywater reuse pilot project
- Graywater used to flush toilets (no irrigation)
- Assess:
  - System operation and performance
  - Homeowner satisfaction
  - Household water savings
  - Municipal management frameworks
  - Backflow prevention devices

Requirements for Program Success

- What is required for a voluntary water efficiency program to be successful?

1. Should save sufficient volumes of water
2. Should not have unreasonable ROI
3. Should not require an undue level of effort on the part of the participant

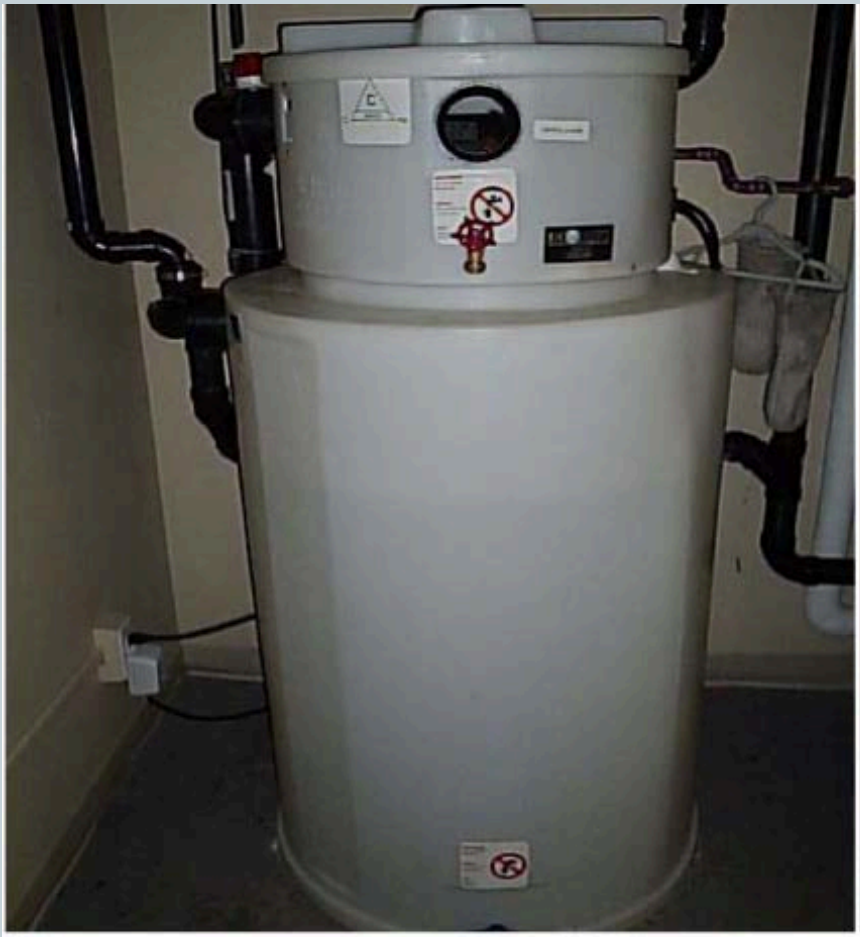
City Offering

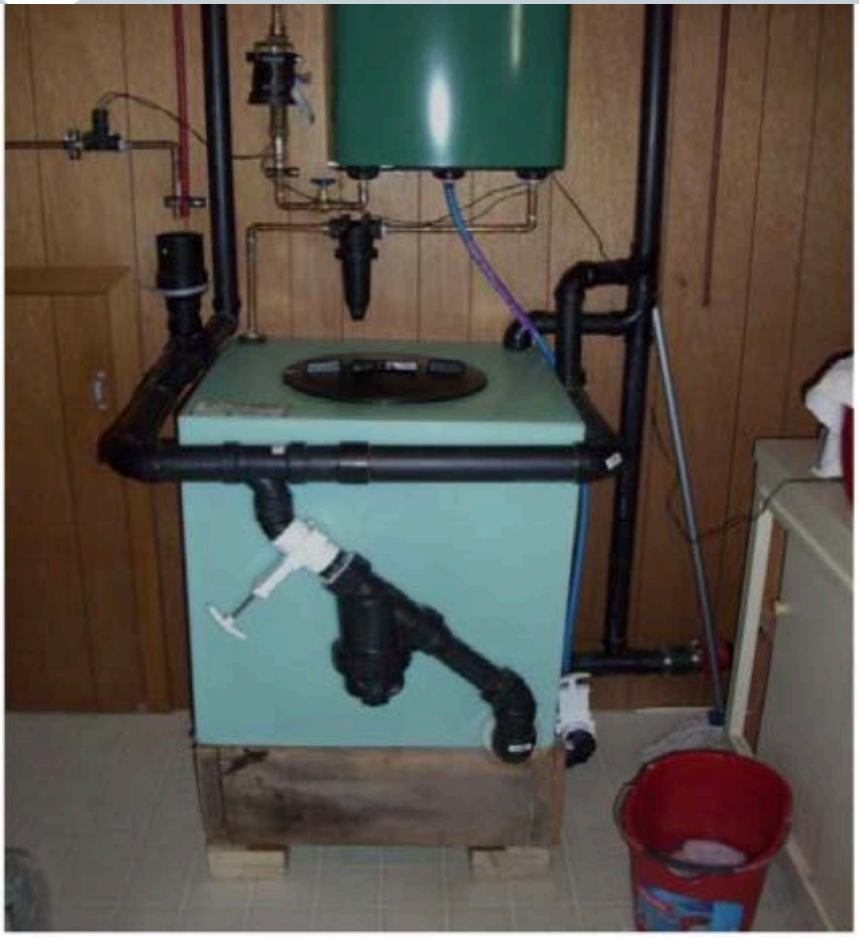
- The City gave builders of new homes $1500 for every graywater system they installed
- The City gave existing homeowners $1500 to install a graywater system
- Each home also received free backflow prevention devices
- Participants had to agree to allow monitoring of their systems

Graywater Systems Used

- Packaged graywater systems were used
- 25 homes actually participated
- All but one system used a Brac system (other used an iDus Controls system)
- Only water from shower / bath was collected
- Sub-meters were installed on freshwater make-up lines and graywater supply lines (to toilets)
- Energy meters were installed on power supply to pumps

Brac (left) and iDus (right)





Water Quality

- Brac system – during prolonged storage graywater is recycled back over chlorine puck and then returned to the storage tank.
- iDus ConservePump system - system purges stored graywater on a 48- or 72-hour basis and adds small volume of freshwater.

Cost of Systems

- Both systems cost between $3000 - $4500
- Much easier to install in new homes

Enough Graywater?

- When inefficient toilets and showers are used –
  - About 14 gcd of graywater produced from shower and bath (54 Lcd)
  - About 22 gcd used for toilet flushing (83 Lcd)
  - Not enough graywater available
- When efficient toilets and showers are used –
  - About 12 gcd of graywater produced (47 Lcd)
  - About 8 gcd or less used for toilet flushing (30 Lcd)
  - Enough graywater produced

Potential Water Savings

- So – the potential for water savings (related to toilet flushing) increases as the efficiency of the fixtures decreases
  - Inefficient – produce and use a lot of graywater
  - Efficient – produce and use a little graywater
- Should we be promoting an uptake of inefficient fixtures??
- When the most efficient toilets are used (0.8 gal/flush), the savings is only 4 gcd!!

Expected vs. Actual Savings

- New homes were fitted with HETs (1.28 gal/flush)
- Typical person flushes toilet 5 times/day at home
- Expected (i.e., maximum) savings –
  - 5 flushes/capita/day x 1.28 gal/flush = 6.4 gcd (24 Lcd)
- Actual savings –
  - 4.4 gcd (16.6 Lcd)
- Why? Because in every single system at least some potable water was added as make-up during monitoring period (parties, fewer showers, etc).

Energy Use

- An energy meter was installed on the power supply to the pumps that moved graywater from the tank in the basement to the toilets within the home
- Average energy demand (based on limited data) was 1.58 kWh/m3 or 0.60 kWh per hundred gallons
- Is this a lot of energy?
- No – would equate to about $3.00 - $4.00 per year per household (based on $0.08 per kWh)
- BUT -

Energy Demands vs. Municipal System

- Energy used by graywater systems is not excessive
  - But – it is relatively more expensive on a unit basis than municipally-supplied water, likely due to economies of scale
- Energy use by municipal system to treat and deliver water to customer varies from system to system, but most systems (at least in Canada) use about half the energy required by the graywater systems in this pilot project
- Widespread use of residential graywater systems might increase total energy demands and GHG emissions!

Water Quality

- Quality of graywater varies from home to home
  - Personal hygiene, types of soaps and shampoos, etc.
- Huge variation in graywater quality in participating homes.
- Some systems had relatively “clean” graywater (sometimes because a lot of potable water was added as make-up water)
- Some systems had relatively “dirty” graywater
- Hey – it’s graywater. You’re not supposed to drink it.

Customer Feedback

- Issues included:
  - difficulties with motor controls, system operating too often and/or too noisily, overflow and flooding issues, and difficulty with access to the tank and/or filter.
- Frequency of filter cleaning was problem for some, while not for others.
  - Most noted system requires a lot of diligence in cleaning.
  - Of ten responses to question, five said they cleaned their filters weekly, and 5 cleaned their filters monthly
- Overall satisfaction = “Good”

Graywater and the 3 Elements of Success

1. Should save sufficient volumes of water
   - Expect to save between 4 gcd (with most efficient toilet) and 12 gcd (total graywater production from shower / bath)
2. Should not have unreasonable ROI
   - Best case ROI is 18 years (about the expected life of the system), worst case ROI is 56 years
   - May add to TOTAL energy demands
3. Should not require an undue level of effort on the part of the participant
   - Requires cleaning every one to four weeks (cleaning requires water)

Conclusions

- Using graywater to flush toilets makes sense!!
- Why are these systems not more common?

- Unless water is **very** scarce, residential graywater systems won't become commonplace unless…
  - Price of systems come down significantly
  - Maintenance requirements are significantly reduced or virtually eliminated
  - Cost of water increases significantly

Finally…

- Indoor residential water demands are declining by approximately 1 gcd per year
  - More efficient toilets and clothes washers
- Outdoor irrigation demands not declining in same way
- Use of graywater to offset irrigation demands may be questionable (is taking a shower a good reason to irrigate your lawn?)
- Are there better opportunities out there?

Thanks to…

- Wayne Galliher, City of Guelph

- Full Guelph report can be found at:
- http://guelph.ca/uploads/Water%20Conservation/GuelphResidentialGreywaterFieldTestFinalReportJune2912.pdf
- Or see -

www.guelph.ca/greywater

Thank You

- Questions

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