This presentation premiered at WaterSmart Innovations

watersmartinnovations.com
Developing a Field Testing Standard for Performance of Residential Greywater Reuse Systems:

Case Study of Canplas’ Recover Greywater Reuse System in Homes in Southern Ontario.

Carl Robb
Canplas Industries Ltd.

Madeleine Craig
Ryerson University
INTRODUCTION

- Carl Robb
  - Canplas Industries Ltd.

- Madeleine Craig
  - M.A.Sc. Building Science, Ryerson University
Presentation Overview

- Introduction
- Greywater Reuse System Field Performance Testing
  - Greywater Reuse
  - Previous Work
  - Research Objectives
- Canplas’ Recover System Pilot Study
  - Methodology
  - Preliminary Results
- Next Steps
By 2025, 45% of the world could be living under water stressed conditions (Daigger, 2009)

Canadian centralized water treatment and conveyance systems (Brandes et. al, 2010)
- require $31 billion to repair
- $57 billion to expand
- energy intensive
DOMESTIC WATER USE

Adapted from Environment Canada (2013)

Average Daily Domestic Water Use

<table>
<thead>
<tr>
<th>Country</th>
<th>Litres per capita per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>450</td>
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<tr>
<td>Canada</td>
<td>400</td>
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<tr>
<td>Italy</td>
<td>300</td>
</tr>
<tr>
<td>Sweden</td>
<td>250</td>
</tr>
<tr>
<td>France</td>
<td>150</td>
</tr>
<tr>
<td>Israel</td>
<td>100</td>
</tr>
</tbody>
</table>

Adapted from Environment Canada (2013)

M.Craig, WSI 2014
343Lcd of fresh water daily through domestic use

(Statistics Canada, 2011)

Domestic Water Consumption

End Use

- Showers and baths
- Toilet Flushing
- Laundry
- Kitchen and drinking
- Cleaning

Adapted from Environment Canada (2013)
GREYWATER REUSE PROCESS

INTRO.
G.W.
PREV.
OBJ.
METH.
PILOT
NEXT

M. Craig, WSI 2014
PREVIOUS WORK: PERFORMANCE

- **NSF / ANSI 350.1 & 40 Standards**
  - Water Quality, maintenance, reliability

- **De Luca & City of Guelph, 2012**
  - Performance of 2 Greywater Recycling Systems

- **Sharvelle et al., 2014**
  - Performance in residence at Colorado State University
RESEARCH OBJECTIVES

- Metrics that quantify field performance of GWRS
- Performance of Canplas Recover system
- Trends in performance data?
  - factors that affect performance (i.e. number of users)?
Performance Testing Metrics

1. Water Quality
2. Water Balance
3. Energy Use
4. Durability & Maintenance
5. Installation
6. User Satisfaction

M.Craig, WSI 2014
Pilot Study

Guelph (13 homes)

Barrie (9 homes)

Toronto (1 home)

M. Craig, WSI 2014
WATER QUALITY PARAMETERS

- Turbidity
- Hardness
- Odour
- Colour
- Total & Free Chlorine
- Temperature
- pH
- BOD$_5$
- COD
- Fecal Coliforms
- Total Coliforms

Craig (2014)

maxxam.ca (2014)
WATER BALANCE

Greywater IN

Municipal Water IN

Monitoring Program

Treated greywater OUT

Purged/ Overflow OUT

Pressure Transducer

Canplas (2014)
<table>
<thead>
<tr>
<th>Day</th>
<th>Real Date</th>
<th>Event</th>
<th>Hour</th>
<th>Minute</th>
<th>am/pm</th>
<th>Quantity (L)</th>
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<tbody>
<tr>
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<td>Full Purge</td>
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<td>10</td>
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<td>11</td>
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<td>11</td>
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<td>23</td>
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<td>20</td>
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<tr>
<td></td>
<td></td>
<td>Flush</td>
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<td>Fresh Added</td>
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<td>50</td>
<td>pm</td>
<td>4.750</td>
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</table>
WATER BALANCE RESULTS*

*PRELIMINARY, AVERAGE RESULTS FROM ONE HOUSE

INTRO.
G.W.
PREV.
OBJ.
METH.
PILOT
NEXT

M.Craig, WSI 2014
2 WATER BALANCE VALIDATION

INTRO.
G.W.
PREV.
OBJ.
METH.
PILOT
NEXT

- Flow Meters
- Usage Log

Craig (2014)
3 Energy Use

Belkin WeMo Insight Switch  P3 Kill A Watt EZ Electricity Monitor

### Energy Use

<table>
<thead>
<tr>
<th>Date</th>
<th>Time ON</th>
<th>Power Consumption ON</th>
<th>Time STANDBY</th>
<th>Power Consumption STANDBY</th>
<th>Cost in Canada</th>
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<td>0.04057</td>
<td>23:22</td>
<td>0.05362</td>
<td>$0.009</td>
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</tbody>
</table>

M.Craig, WSI 2014
Uses on average $\rightarrow$ 2.64 Watts

Average energy use per day $\rightarrow$ 0.051kWh

Equates to 18.9kWh per year $\rightarrow$ $2.55$
When & how could a system fail?

- Filter issues?
- Mechanical issues?
- Flooding?
- Pressure?

What maintenance is expected by users?

- Maintenance Log
Installation

- Cost
- Interview plumbers
- ‘Ease of Installation’
- Roughed-in vs. retrofit

Craig (2014)
M.Craig, WSI 2014
User Satisfaction Survey

- System operations
- System aesthetics
- Maintenance
- Water Aesthetics
- Noise
- Payback period

Craig (2014)
Data Analysis

Part 1: User Survey

Canplas Greywater Recover System User Survey #1

User Information
Please fill out the following information for each resident. The order of completion for each user is not important.

Resident #1
Data collection of Resident 1's use of the recover system.

Please indicate the age of Resident 1.

How much time does Resident 1 typically spend at home during the day?
- At home all day
- Away 8+ hours - work/school Full time
- Away 4+ hours - work/school Part time

How does Resident 1 typically bathe?
- shower
- bath
Part 2

- Correlating user profiles to collected data:
  - # of users vs. water savings?
  - Age of users vs. water quality?
  - Effect of high-efficiency fixtures
Method for field testing performance of residential single family greywater reuse systems

Currently collecting pilot study field data

Stay tuned for results...

- Standard testing methodology for field performance of GWRS
- Performance data of Canplas’ Recover System
Thanks!
Questions & Comments?
**De Luca & City of Guelph, 2012**

- Performance of 2 Greywater Recycling Systems
- Appropriate technology
  - Reliability, soundness, flexibility
  - Affordability
  - Sustainability
- Specific to systems tested

M.Craig, WSI 2014