UNDERSTANDING GREYWATER REUSE

Wayne Galliher
Water Conservation Project Manager
City of Guelph – Water Services
June 26, 2014

CITY OF Guelph
Making a Difference

CITY OF GUELPH, ONTARIO BACKGROUND

- One of Canada's largest communities reliant solely on groundwater
- 123,000 residents, with additional 55,000 persons by 2031 forecasted through Province of Ontario Places to Grow Plan
- Sustainability a guiding principle for local growth

LOCAL GROWTH MANAGEMENT STRATEGY

Challenges to Facilitating Growth – Water/Wastewater

- New Water Supply Availability
- Watershed Assimilative Capacity for Treated Wastewater
- Affordability of Alternatives
- Environmental Impacts of Alternatives

Opportunities to Facilitating Growth:

- Optimization of current treatment capacity
- Reclamation of Water /Wastewater Capacity

CITY OF Guelph
Making a Difference

WATER SUSTAINABILITY: A GUELPH PRIORITY

Water Supply Master Plan (2006)

Targets:

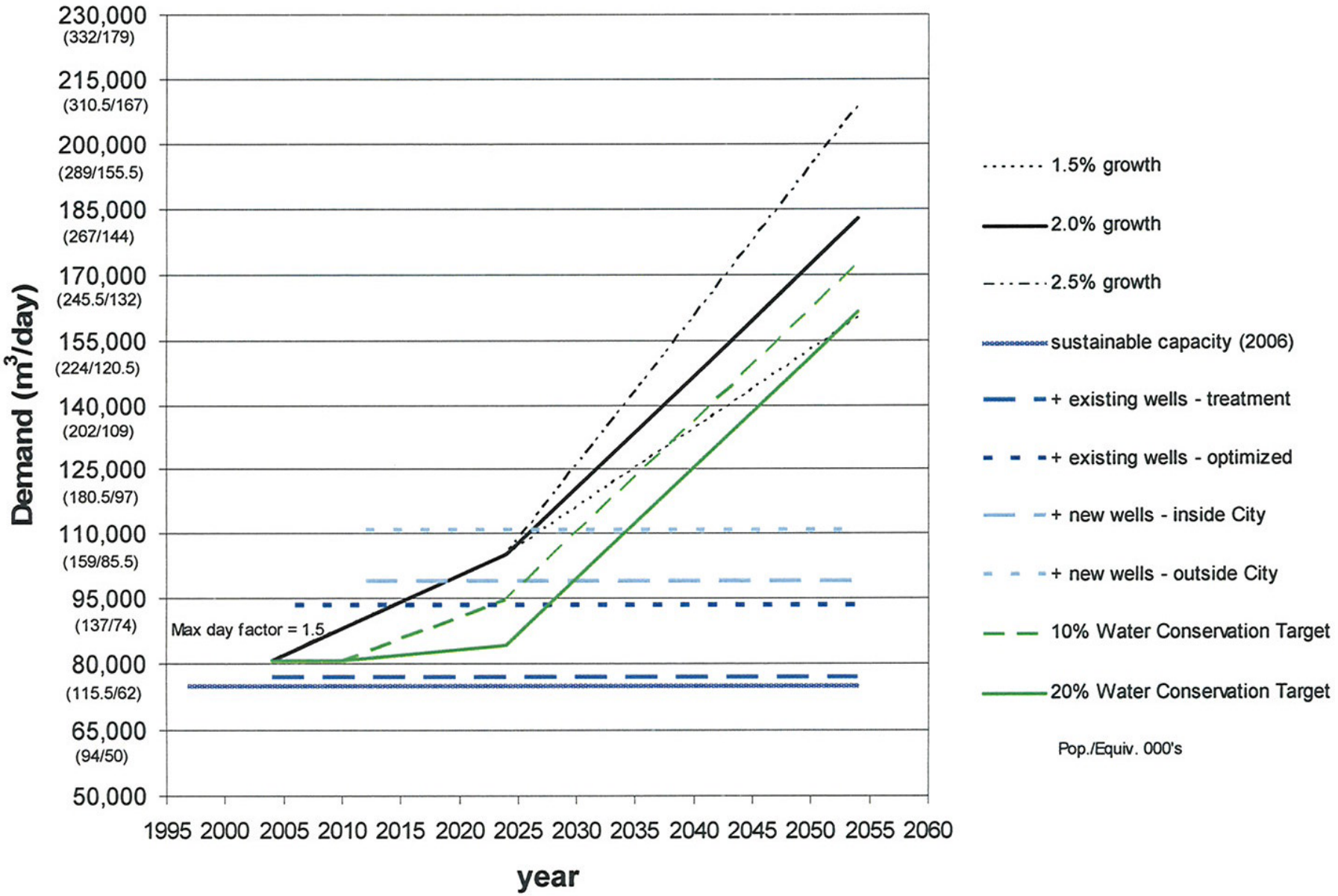
- 10% reduction in daily water use by 2010
- 15% reduction in daily water use by 2017
- 20% reduction in daily water use by 2025

Community Energy Initiative (2007)

GOAL: "To use less water and energy per capita than any comparable Canadian City"

CITY OF Guelph
Making a Difference

Groundwater Supply Potential



Water Efficiency Net Financial Benefit

Plan	Net Present Value (NPV) with Reduced Conservation Programming (2006 dollars)	Net Present Value (NPV) with WSMP 20% Reduction Target (2006 dollars)
Water Supply Master Plan	$92,515,456	$49,847,529
Wastewater Treatment Master Plan	$59,743,881	$16,657,935

Net Benefit in Avoided Infrastructure Costs (NPV 2006 Dollars)

Water: $42,667,927
Wastewater: $43,085,946

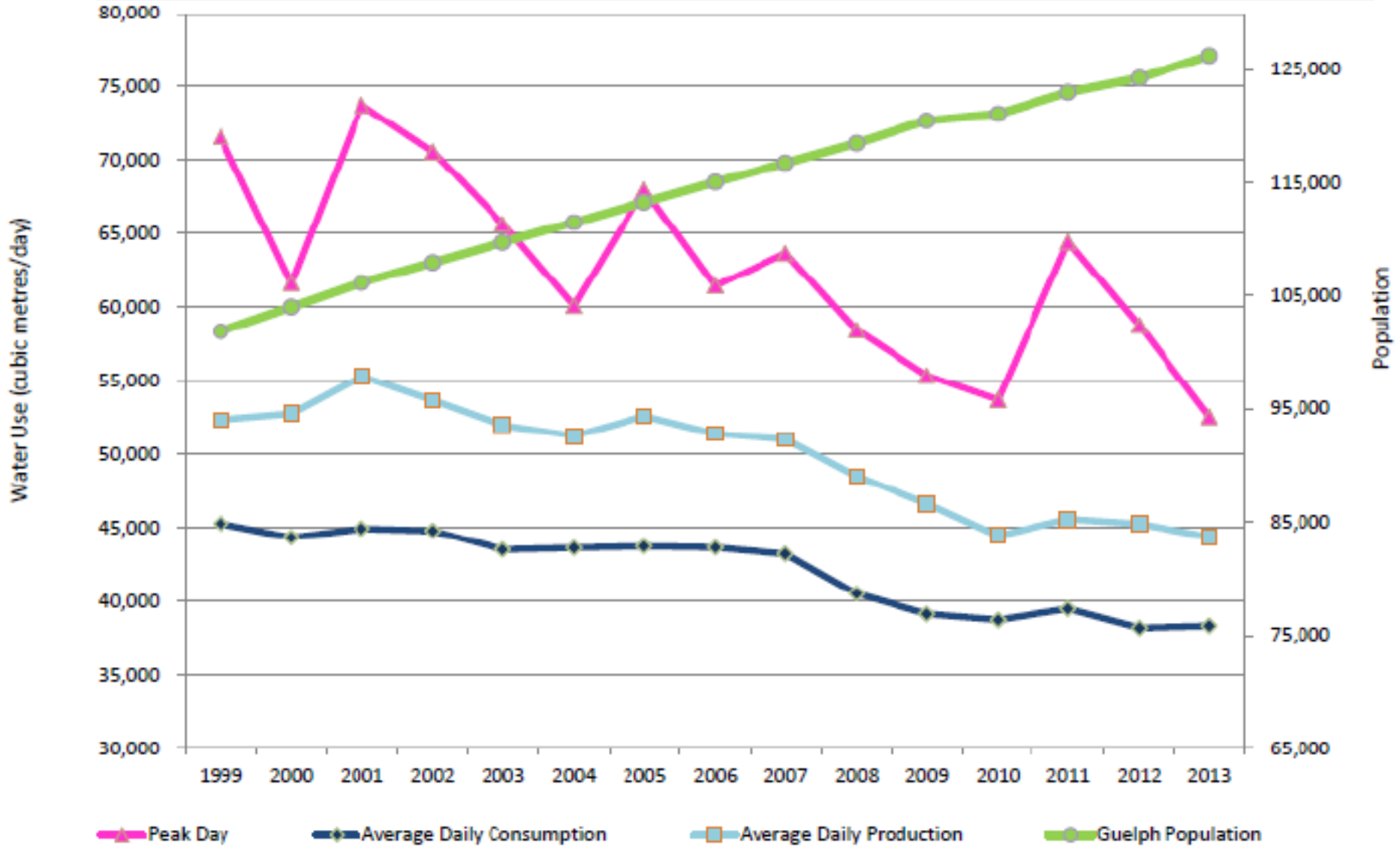
CITY OF Guelph
Making a Difference

2009 WATER CONSERVATION & EFFICIENCY STRATEGY

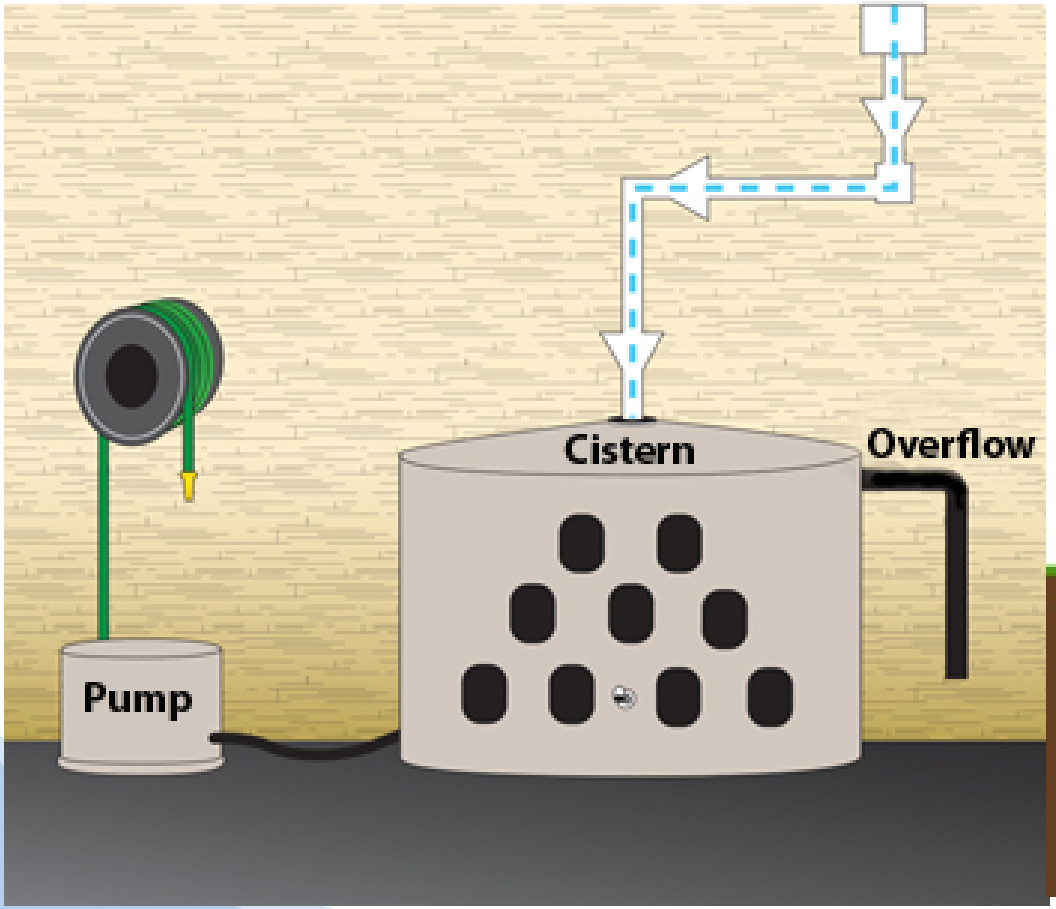
- 10 year, $20 million Water Sustainability Strategy
- Goal: Reduce water use by **8.7 MLD by 2019**
- **Co-benefits:**
  - **GHG Reductions: 2,412 tonnes/yr CO_2E**
  - **Operational Savings: $141,000/yr**
- Multi-sector approach (res, multi-res, ICI, new dev, municipal)
- Emphasis on public and youth education
- Water loss mitigation strategy
- Support for innovation and capacity building

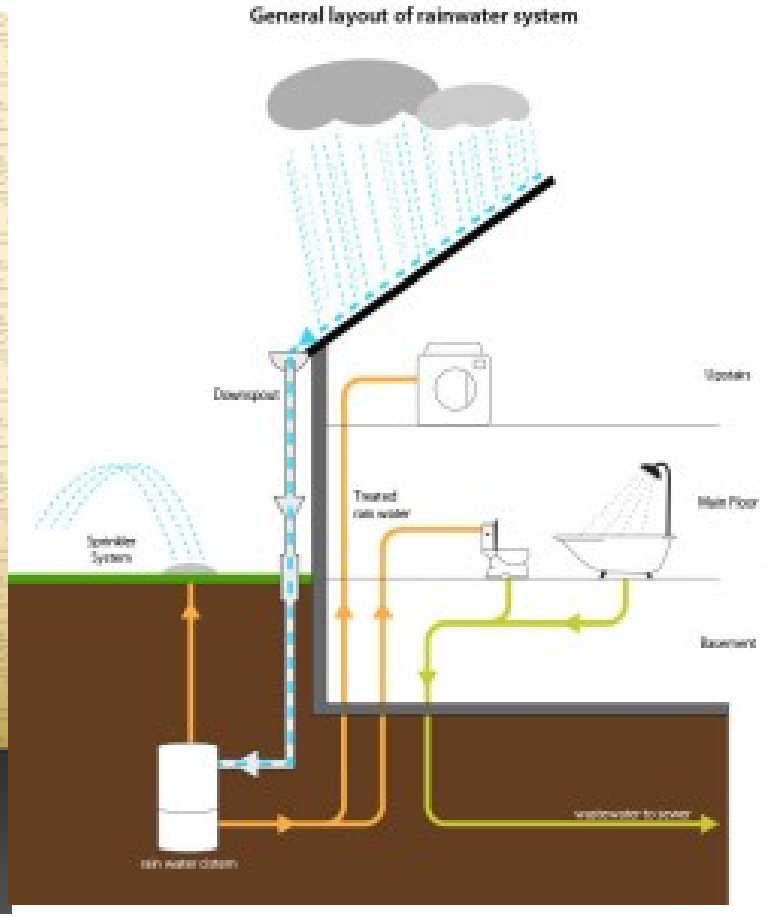
CITY OF Guelph
Making a Difference

Water Use and Community Growth



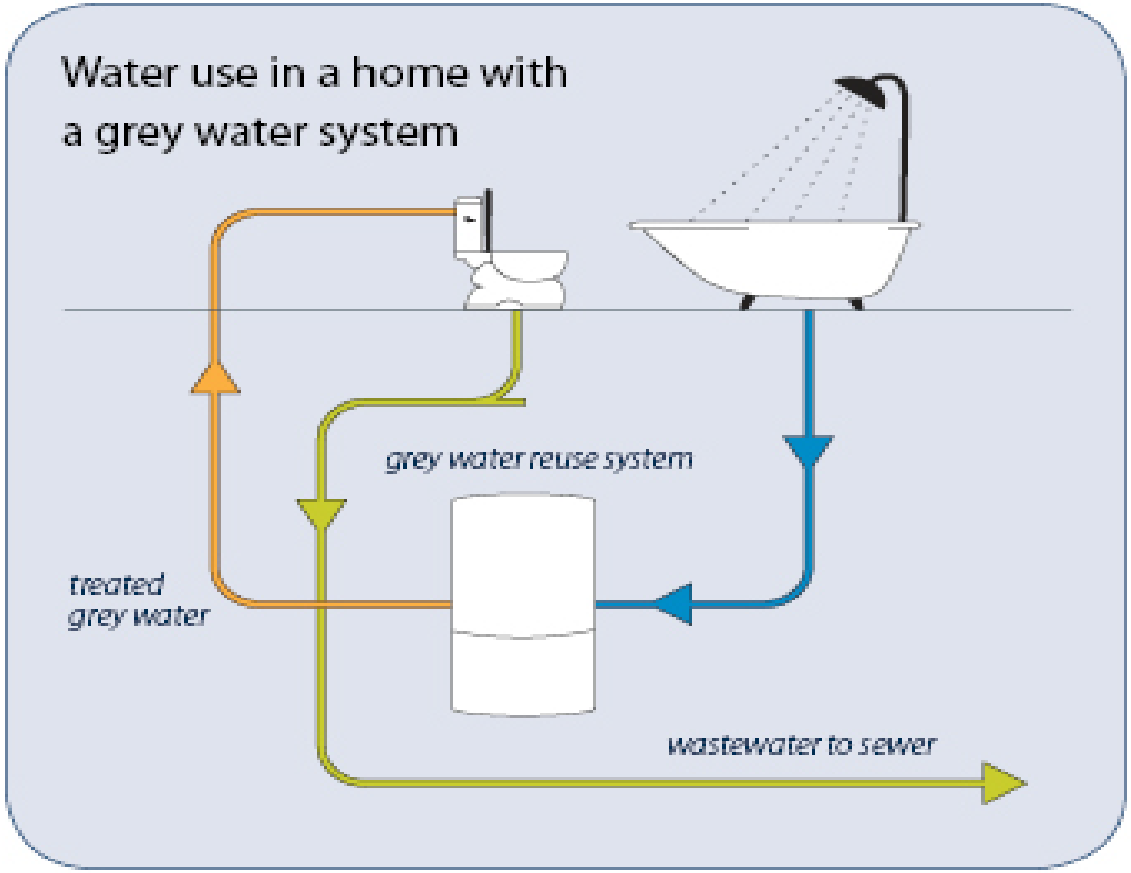
HOME RAINWATER HARVESTING





CITY OF Guelph
Making a Difference

HOME GREYWATER REUSE



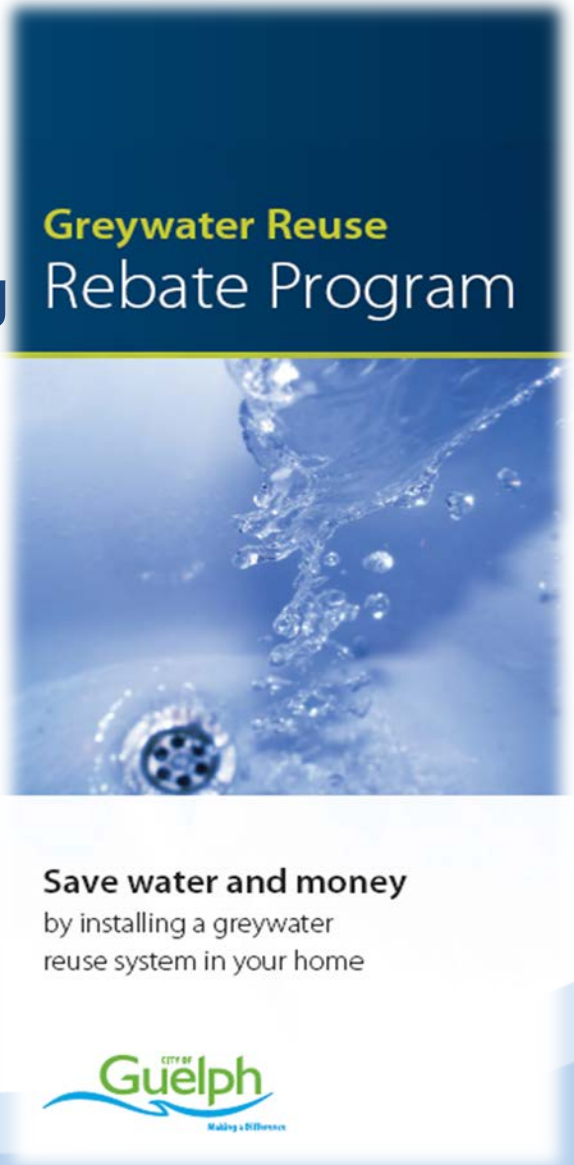
CHALLENGES TO GREYWATER

- Health and Human Contact
- Technology Affordability & ROI
- Technology Certification & Performance
- Public Awareness and Market Availability
- End User O&M Dependence
- Future Reliability of Servicing Capacity
- Availability of Support Networks

CITY OF Guelph
Making a Difference

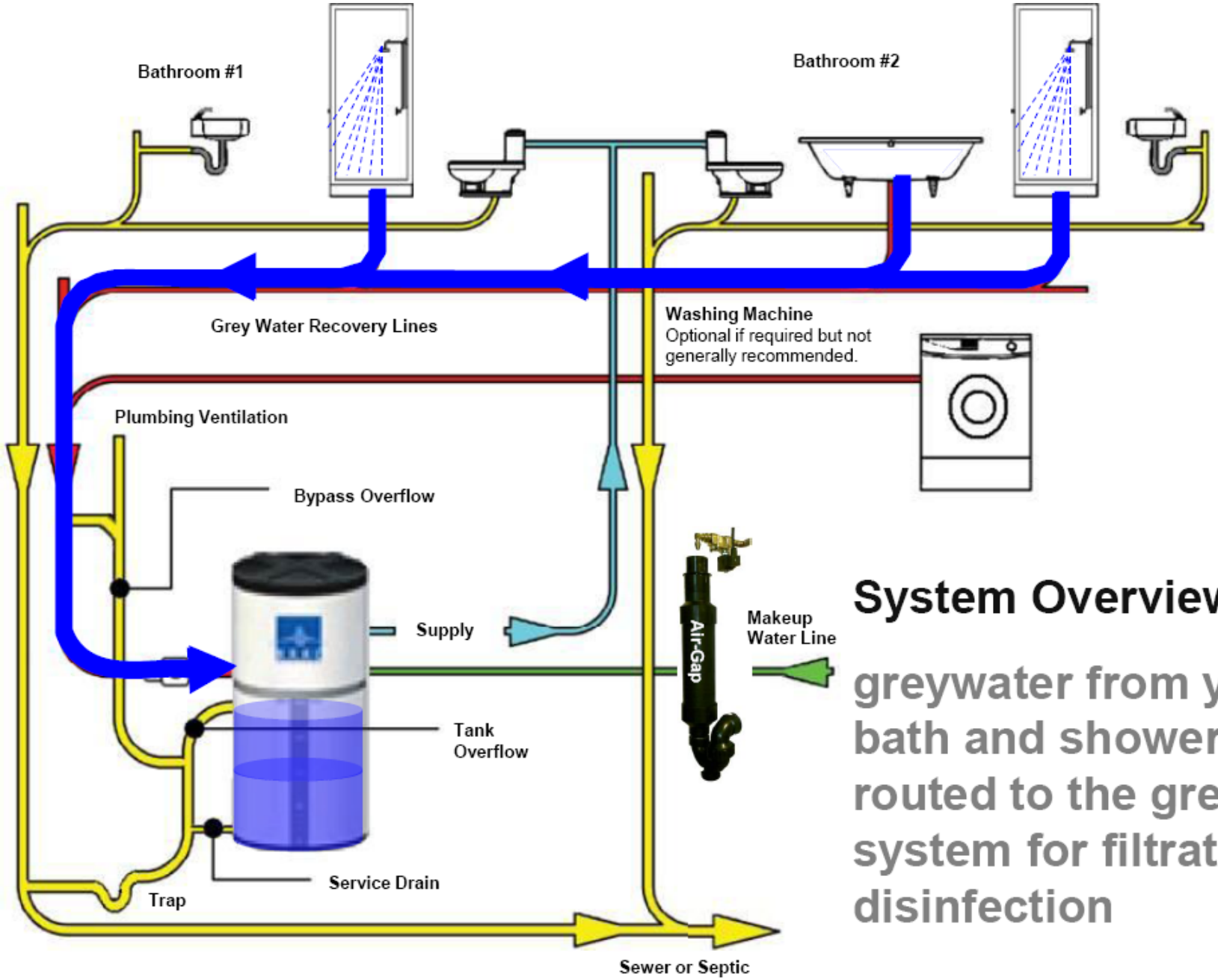
FIELD TEST PROGRAM BACKGROUND

- Project Duration: May 2009 – Sept 2011
- Install of 26 GWR Systems in New/Existing Homes
- Mandate: Assess Technology Performance and Acceptance, Municipal Role & Responsibility.
- FCM Green Municipal Fund: $72,524



FCM | Green Municipal Fund / Fonds municipal vert

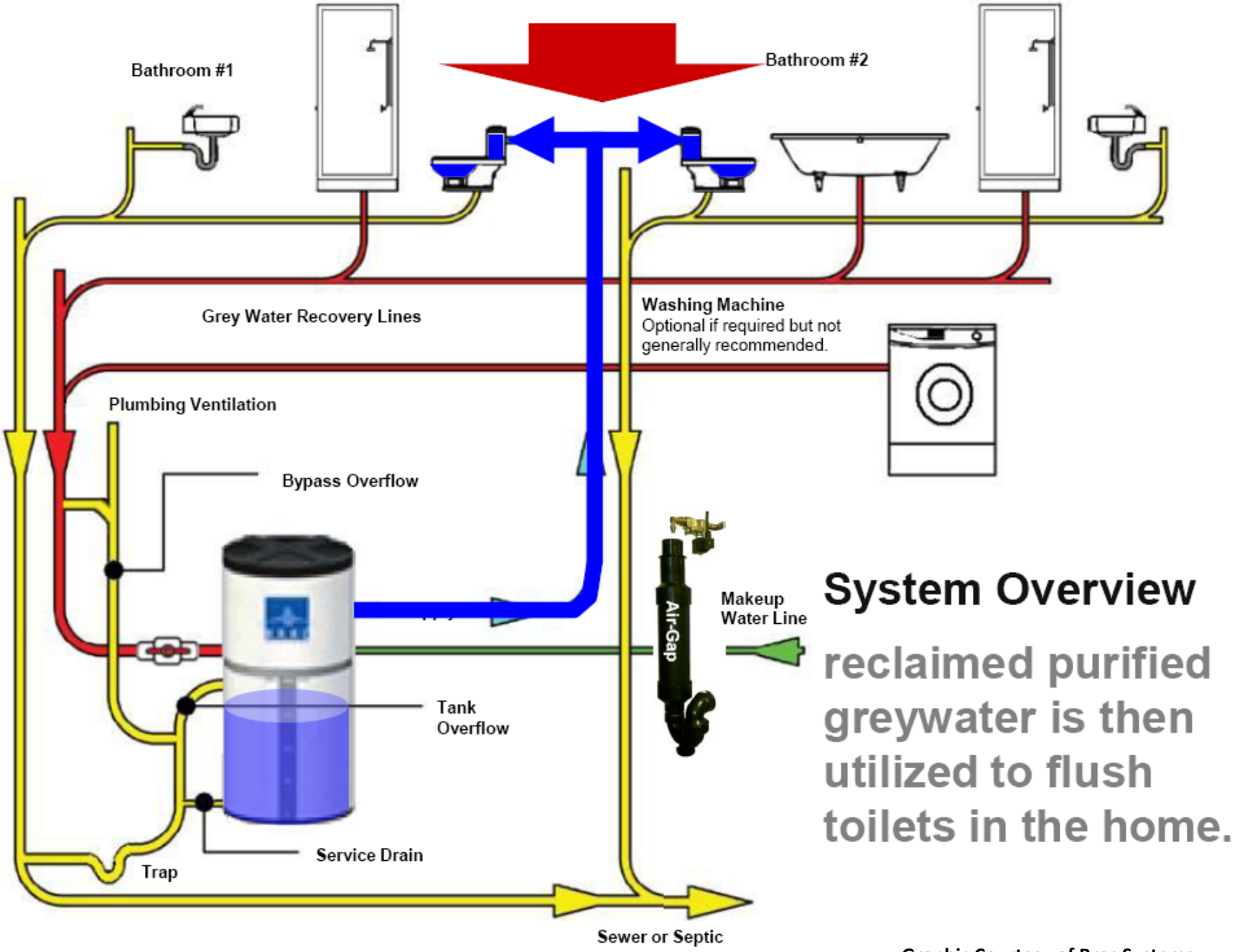
Guelph
Making a Difference



System Overview

greywater from your bath and shower is routed to the greywater system for filtration and disinfection

Graphic Courtesy of Brac Systems



System Overview

reclaimed purified greywater is then utilized to flush toilets in the home.

Graphic Courtesy of Brac Systems

FIELD TEST: CORE STUDY AREAS

- Ability to achieve water quality standards
- System operation and performance
- Social acceptance of technology
- Water use reductions
- Reducing environment footprint
- Required support networks
- Municipal management responsibility
- Premise isolation device requirements

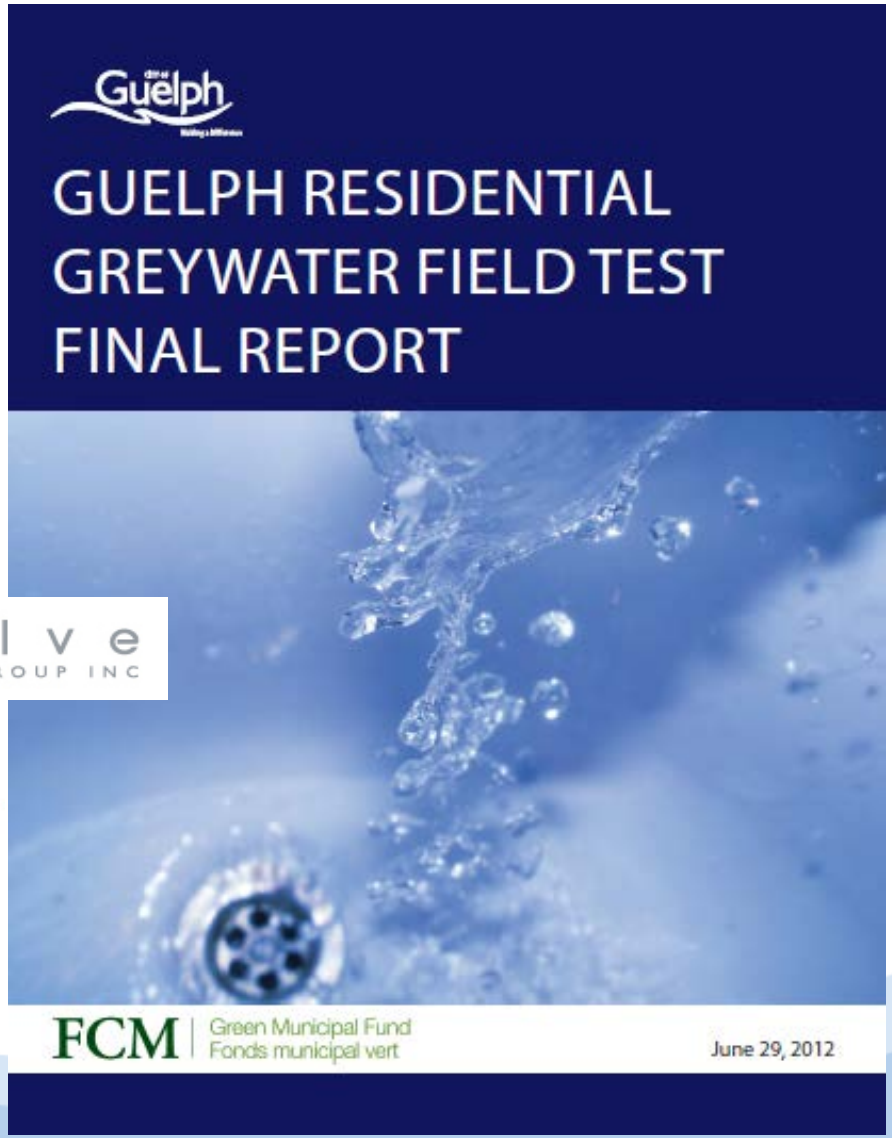
CITY OF Guelph
Making a Difference

RESIDENTIAL GREYWATER FIELD TEST

Final report submitted to FCM in June 2012.

Report available for download by interested parties at:

www.guelph.ca/greywater



fusion HOMES

REID'S HERITAGE HOMES LTD.

evolve BUILDERS GROUP INC

UNIVERSITY of GUELPH
CHANGING LIVES IMPROVING LIFE
SCHOOL OF ENGINEERING
WWW.GUELPHENGINEERING.COM

VERITEC

FCM | Green Municipal Fund Fonds municipal vert

CITY OF Guelph
Making a Difference

UNDERSTANDING GREYWATER REUSE

- Legislation, Standards and Certification
- Public Health
- Policy Drivers and Economics
- Public Awareness and Acceptance
- Management Frameworks

CITY OF Guelph
Making a Difference

LEGISLATION: PLUMBING CODES

Province	Alberta	British Columbia	Ontario
Summary of Requirements	-Individuals must obtain a variance under the Safety Codes Act and a variance by the technical administrator of the equipment used for the application. It also indicates that individuals must obtain approvals to use certain natural source water through the authority having jurisdiction or ESRD, as well as a number of other detailed information requirements.	-non-potable systems must be designed, fabricated and installed in accordance with good engineering practice, such as ASHRAE Handbook -requirements for reclaimed wastewater reuse in new construction where centralized system available at property line.	-particulate removal from greywater source -dedicated piping clearly marked as “non-potable” in french and english -premise isolation device -no direct connection potable & non potable systems
Permitted End Uses	-Outdoor Irrigation Only -Does not allow for closed loop greywater use applications within buildings.	-Use of non-potable water for flush toilets, urinals and subsurface irrigation systems. -Does not allow for closed loop greywater use applications within buildings.	-Use of non-potable water for flush toilets, urinals and subsurface irrigation systems.

LEGISLATION: EFFLUENT CATEGORIZATION

CITY OF Guelph
Making a Difference

LEGISLATION: EFFLUENT CATEGORIZATION

- **Unrestricted Urban Reuse & Recreational Use** - Unrestricted refers to the contact the general public will have with water treated to this quality. This category would include the irrigation of parks and sports fields, fire protection, decorative fountains, and urban uses such as toilet flushing.

- **Restricted Urban Reuse** - This category restricts use of reclaimed water to activities that result in no contact with the general public or where the areas affected are restricted from the general public. This level of water quality could be used for private landscape irrigation, municipal works uses, such as street cleaning and sewer flushing, and for construction purposes, such as site dust control and concrete making.

- **Industrial Reuse** - Industrial uses of reclaimed water varies based on the requirements of the industry, this could include the use of reclaimed water for equipment washing, cooling towers, stack scrubbing, boiler feed, and process water.

- **Groundwater Recharge** - Groundwater recharge is used to ensure a stable, high quality ground water supply. This process requires reclaimed water of a high quality to be pumped into a holding area, where it is allowed to infiltrate into the water table below, replenishing the ground water supply.

Source: US EPA

STANDARDS

- **CSA B64.10**, Selection and installation of backflow preventers/ Maintenance and field testing of backflow preventers, is the standard used to test for compliant backflow devices.
- **CSA B128.1/ B128.2,** best practices in the design and installation of non-potable water systems/ Maintenance and field testing of non-potable water systems.
- **Health Canada Guidelines for Domestic Reuse (2010)**

CITY OF Guelph
Making a Difference

HEALTH CANADA DOMESTIC REUSE GUIDELINES

Parameter	Units	Water quality parameters	
		Median	Maximum
BOD_5	mg/L	≤10	≤20
TSS[b]	mg/L	≤10	≤20
Turbidity[b]	NTU	≤2 **(alternative to TSS)**	≤5 **(alternative to TSS)**
Escherichia coli[c]	CFU/100 mL	Not detected	≤200
Thermotolerant coliforms[c]	CFU/100 mL	Not detected	≤200
Total Chlorine residual[d]	mg/L	≥0.5	

[a] Unless otherwise noted, recommended quality limits apply to the reclaimed water at the point of discharge from the treatment facility or treatment unit. BOD_5 = five-day biochemical oxygen demand; TSS = total suspended solids; NTU = nephelometric turbidity unit; CFU = colony-forming unit.

[b] Measured prior to disinfection point.

[c] Only one of either *Escherichia coli* or thermotolerant coliforms needs to be monitored in a given system. Further information is provided in Box 1.

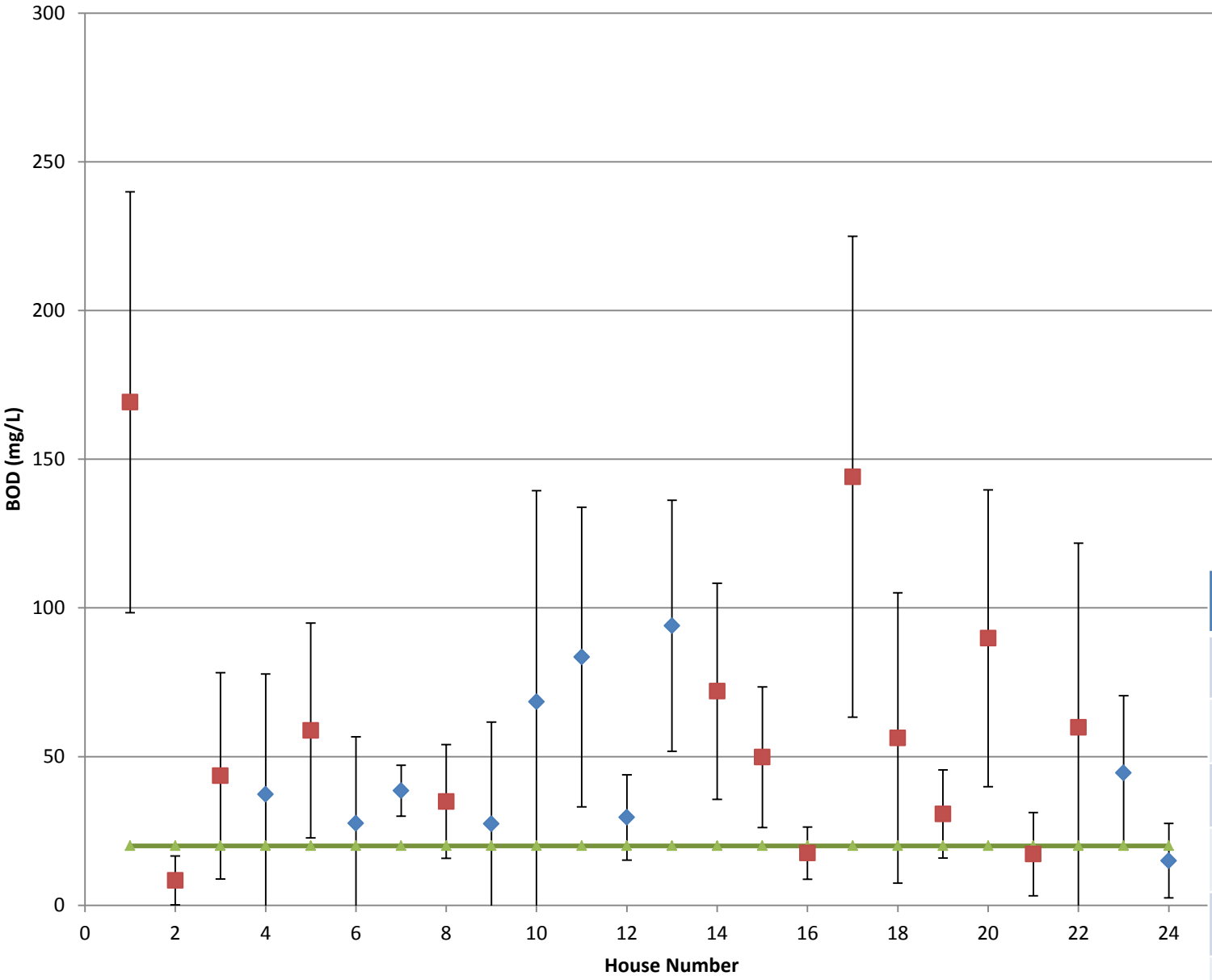
[d] Measured at the point where the treated effluent enters the distribution/plumbing system.

Source: Health Canada, 2010, Canadian Guidelines for Domestic Reclaimed Water for Use in Toilet and Urinal Flushing

TECHNOLOGY CERTIFICATION

- **B128.3-12 - Performance of non-potable water reuse systems** "this dual-standard is an installation guide specifying the design, installation, maintenance and field testing of non-potable water systems. Both standards target manufacturers and other users of non-potable water reuse products and can be used for conformity assessment of products."
- **NSF/ANSI Standard 350 and 350-1** establishes "material, design, construction and performance requirements for onsite residential and commercial water reuse treatment systems. They also set water quality requirements for the reduction of chemical and microbiological contaminants for non-potable water use. Treated wastewater (i.e. treated effluent) can be used for restricted indoor water use, such as toilet and urinal flushing, and outdoor unrestricted water use, such as lawn irrigation."
- **IAPMO IGC 207 – 2009a:** standard used to confirm that the systems meet the minimum requirements for protection of public health and safety associated with reclaimed water conservation at the toilet level, the materials in the construction of a reclaimed water conservation system for toilet flushing and to prescribe the minimum testing requirements for the performance of the reclaimed water conservation system for flushing

BOD Averages vs. Guidelines



Population Statistics	
Total	227
Cells >20	160
Cells ≤20	67
% within	29.5%
Standard Deviation	57.41
Average	59
Target	20

MUNICIPAL POLICY DRIVERS

- Demand Management
- Scarcity and Risk to Existing Supply
- Infrastructure Costs and Limitations
- Regulatory Drivers
- Community Ecological Needs and Sensitivities

GREYWATER REUSE ECONOMICS

NEW SUPPLY

Construction cost of 1L of new water supply and wastewater treatment capacity

$3 - $8 per litre capacity per day

VS

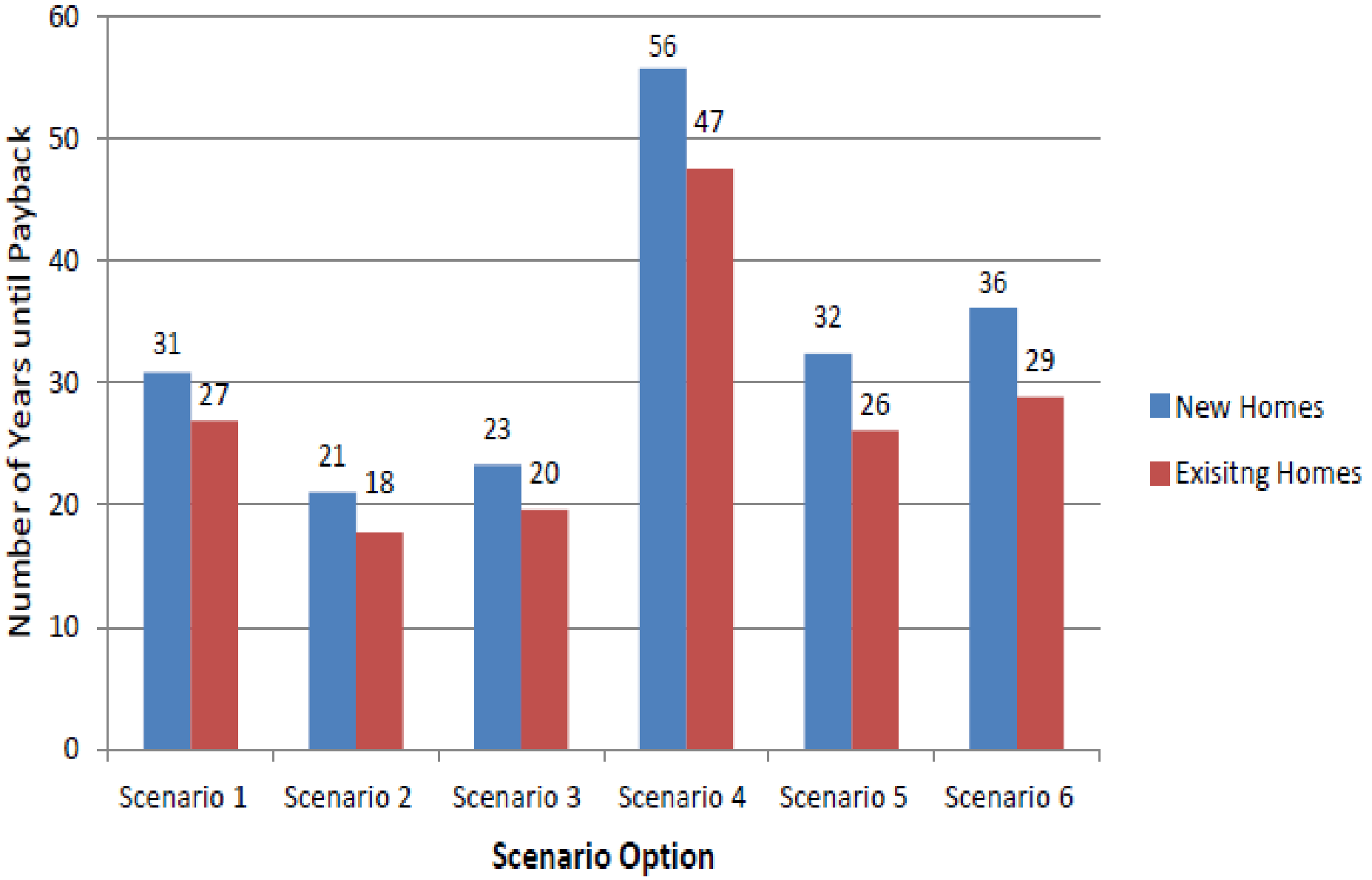
DECENTRALIZED REUSE

Cost of Incentives for Homes Installing GWR System

$22 to 30 per litre capacity per day (based on $1500 incentive/home)

Guelph
Making a Difference

Payback Duration per Scenario with Incentive



PUBLIC AWARENESS AND ACCEPTANCE

Courtesy of Office of the Governor of the State of California

CITY OF Guelph
Making a Difference

TECHNOLOGY AWARENESS & ACCEPTANCE

General Public Focus Group:

- Awareness minimal
- Terminology may be excluding
- Legitimacy/Self Applicability of Technology
- POI/ROI < 10 yrs
- Education should be based on touch/feel
- Support Practice Ideologically

CITY OF Guelph
Making a Difference

TECHNOLOGY AWARENESS & ACCEPTANCE

Technology Users Focus Group:

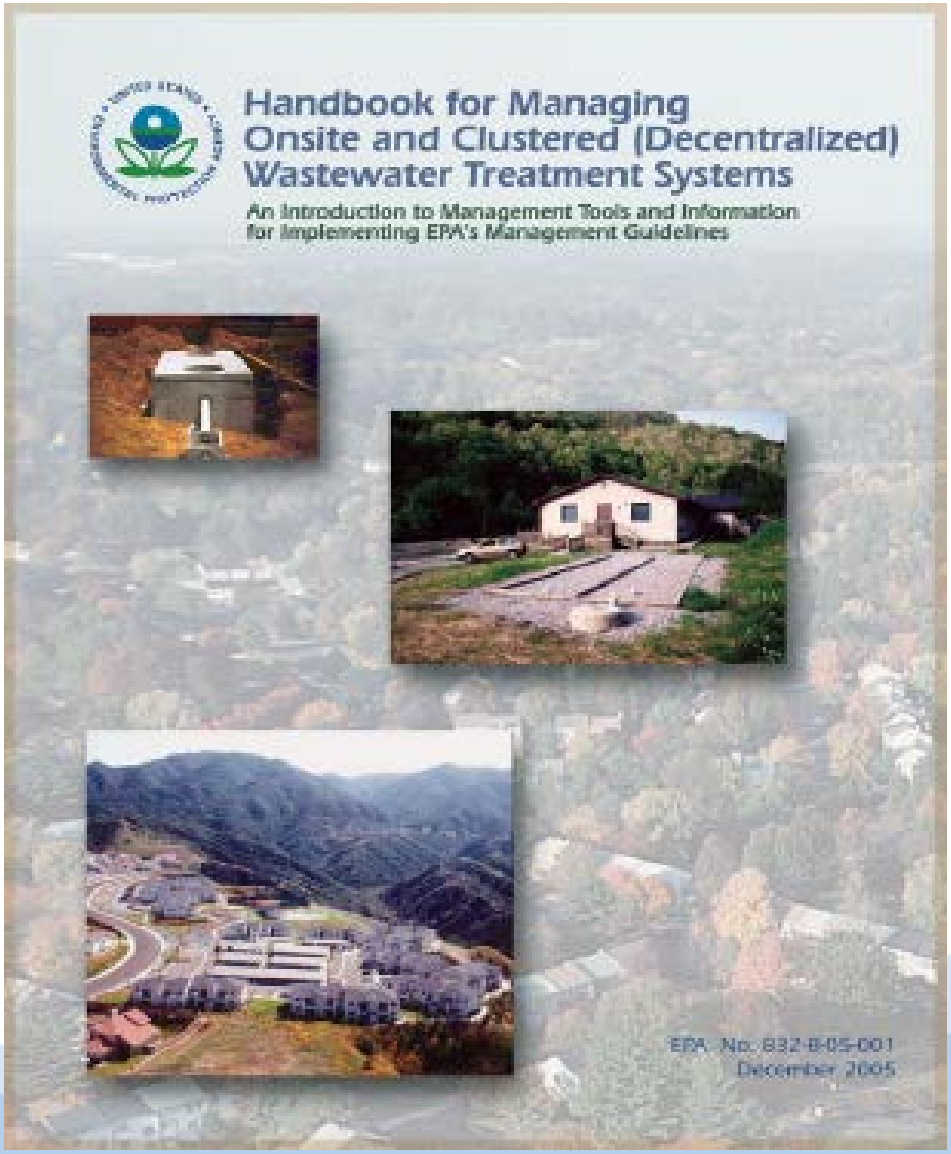
- System Lacking Self Sufficiency
- Initial & Ongoing Engagement Needed
- Concerns of System Support Availability
- Conservation Ideals driving uptake not POI
- Health Concerns generally Non-Issue

CITY OF Guelph
Making a Difference

MANAGEMENT FRAMEWORKS

"each community must carefully evaluate its situation and management needs to develop a program that is supported by residents, protects human health and the environment, and allows the community to grow and prosper in a sustainable fashion consistent with land use plans and needs."

-USEPA Handbook for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems



CITY OF Guelph
Making a Difference

MANAGEMENT FRAMEWORKS

Handbook recommends that each level of government "develop a well thought out strategy that considers a number of factors, including design options, site conditions, operational and maintenance requirements, periodic inspections, monitoring and financial support."

Introduction of necessary legal authority to implement such requirements. Such Legal authority for may include (but are not limited to):

- Issuing System Operating Permits;
- Requiring System Maintenance Contracts;
- Setting System Maintenance, Repair and Replacement and Maintenance Schedules;
- Mandatory System Inspections, and;
- Monetary Fines for Non-Compliance with above.

ASSESSING MUNICIPAL RISK

RISK: Availability of Contractor / Manufacturer to Provide Continuous Support of Greywater Reuse Systems	
Causes: • System repair by homeowner in absence of support • Lack of formal contractor certification program in Canada • Lack of local manufacture representatives to conduct repairs/ education • Warranty Issues	**Impacts to City:** • Impact to City's Reputation • Removal of System
Risk Rating (Pilot): • High Probability of Failure • Low Consequence of Failure	**Risk Rating (Expanded Program):** • High Probability of Failure • High Consequence of Failure
Risk Mitigation: • Lobbying for programs in Canada (Green Plumbers) • Certification for equipment and installation • Require notice if a backflow device is removed • City look to invest /own companies that supply and install products (trend occurring in Europe). Rent systems out to people like a water heater program – establish terms of rental	

CITY OF Guelph
Making a Difference

CLOSING THOUGHTS

- Clear Regulation with Delineation of Source Waters
- Certification and Market Confidence
- Business Case & Appeal by Perspective
- Servicing Approaches and Sustainability
- Management and Broader Engagement

CITY OF Guelph
Making a Difference

THANK YOU!

GUELPH WATER
OURS TO CONSERVE

For more information:
www.guelph.ca/ourstoconserve

Wayne Galliher, A.Sc.T.
Water Conservation Project Manager
City of Guelph Water Services
Wayne.Galliher@guelph.ca
Phone: 519-822-1260 x2106

CITY OF Guelph
Making a Difference