Source Separation and Reuse

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A. R. Rubin

Professor Emeritus, NCSU-BAE

Direct or Indirect Re-Use?

It’s All Water

Potable Water

Reuse Water

Wastewater

Groundwater

Stormwater

Non-potable Water

Roof Water

Gray Water

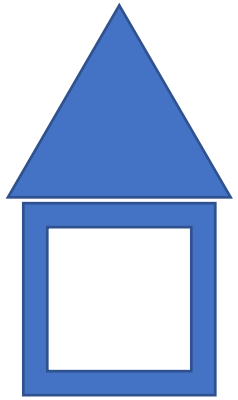
Reclaimed Water

Rainwater

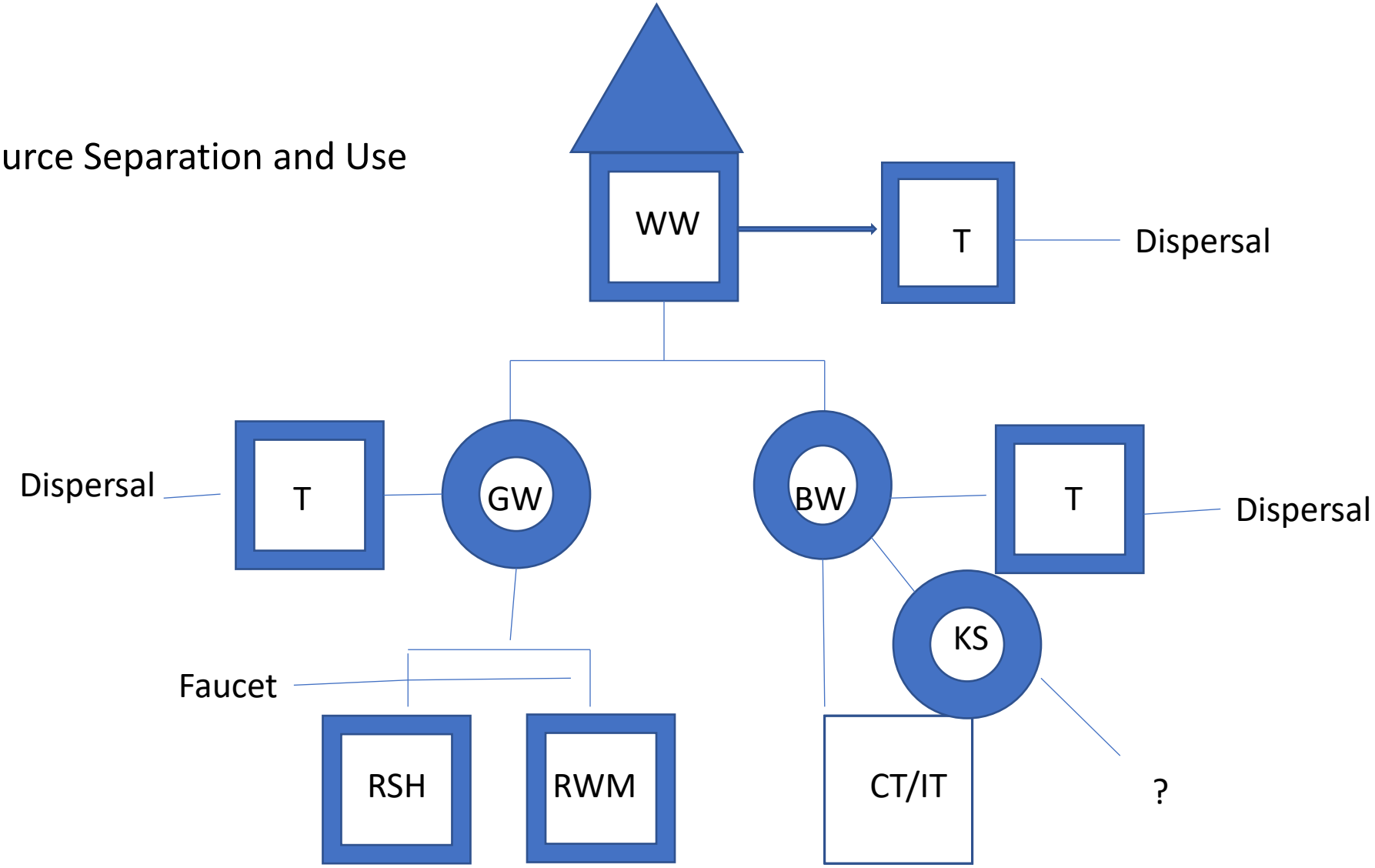
Surface Water

What is Source Separation?

- Where do we start?
  - What constitutes the modern wastewater stream
  - What opportunities exist to modify the wastestream with separation
  - What are implications for potential reuse



Source Separation and Use

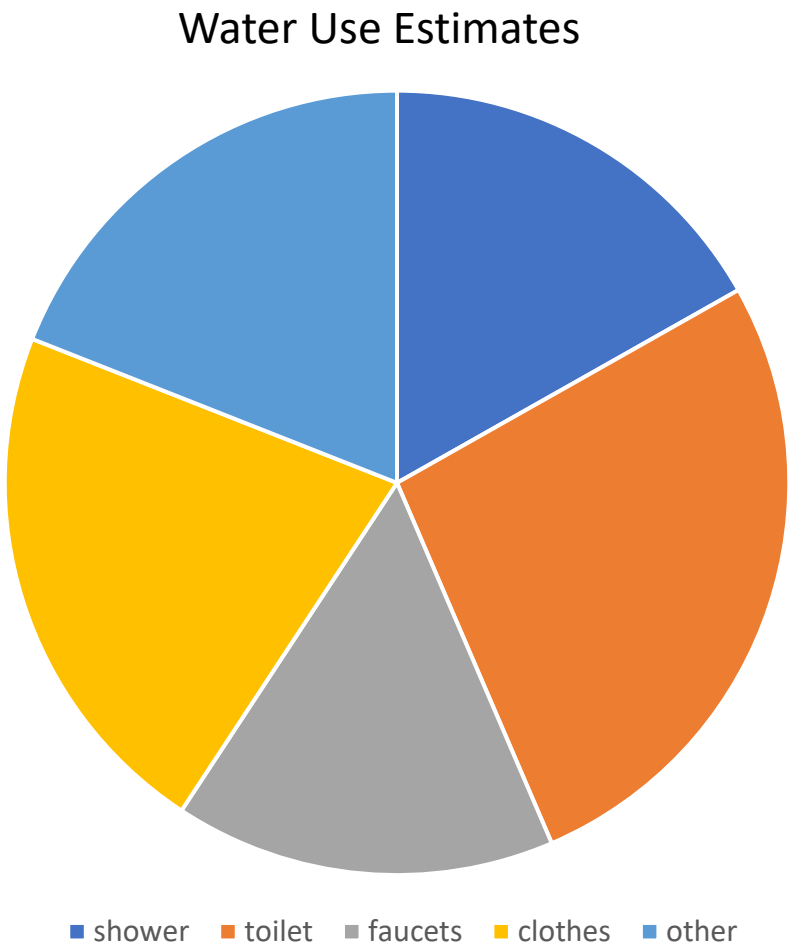


Modern Wastestream

- Water with a little bit of added flavor
- The modern wastestream is over 99.5% water
  - Please remember, 1% is 10,000 PPM or mg/l
- Total Solids level typically 1000 to 1500 mg/l
- Organic solids around 500 mg/l
  - Fecal material
  - Food waste
  - Some textile waste and paper waste

Wastewater composition

- Relative percentages of water using activities
- Percentages have changed as plumbing has gotten more efficient, but pounds of pollutant have remained about the same
- Consequence – higher strength wastewater



What are some of the available options to provide opportunities for source separation?

- Waterless systems
  - Composting toilets – fecal matter and urine
  - Composting food waste – Lower organic input from sink
  - Incinerating toilets – fecal matter and urine
- Graywater separation – shower and bath water – generally not the kitchen sink

Removal rates

- Composting toilet or incinerating toilet will remove about 25% of the wastewater volume generated per day
- The level of organic removal is significant
- Total amount of OM/day/person is about 0.35 to 0.4 lb (food waste, lint, feces, etc.)
- Composting and incinerating toilets will remove between 0.2 and 0.25 lb OM/day

- Assume NO removal of food waste and NO garbage grinder use

Removal of urine and feces yields graywater

- Graywater is still considered a waste in many jurisdictions
- There is NO uniformity regarding classification of graywater
- Permits may be required in some jurisdictions
- Graywater reuse may be allowed in many areas as irrigation water

GW Sources

Table 4.1. State Analysis of Graywater/Wastewater Regulations

States without Formal Graywater Regulations			States Allowing Graywater Reuse		
States allowing wastewater reclamation that define graywater as wastewater (4.1.1)	**States not defining graywater (4.1.2.1)**	**States treating graywater as septic (4.1.2.2)**	**States permitting graywater using a tiered approach (4.2.1)**	**States regulating graywater reuse without a tiered approach (4.2.2)**	**States allowing residential irrigation only (4.2.3)**
Alabama	Illinois	Connecticut	Arizona	Florida	Hawaii
Alaska	Kansas	Kentucky	California	Georgia	Idaho
Arkansas	North Dakota	Maryland	New Mexico	Montana	Maine
Colorado	Ohio	Michigan	Oregon	Massachusetts	Nevada
Delaware	South Carolina	Minnesota	Washington	North Carolina	
Indiana	Tennessee	Nebraska		South Dakota	
Iowa		New Hampshire		Texas	
Louisiana		New Jersey		Utah	
Mississippi		New York		Virginia	
Missouri		West Virginia		Wisconsin	
Oklahoma				Wyoming	
Pennsylvania					
Rhode Island					
Vermont					

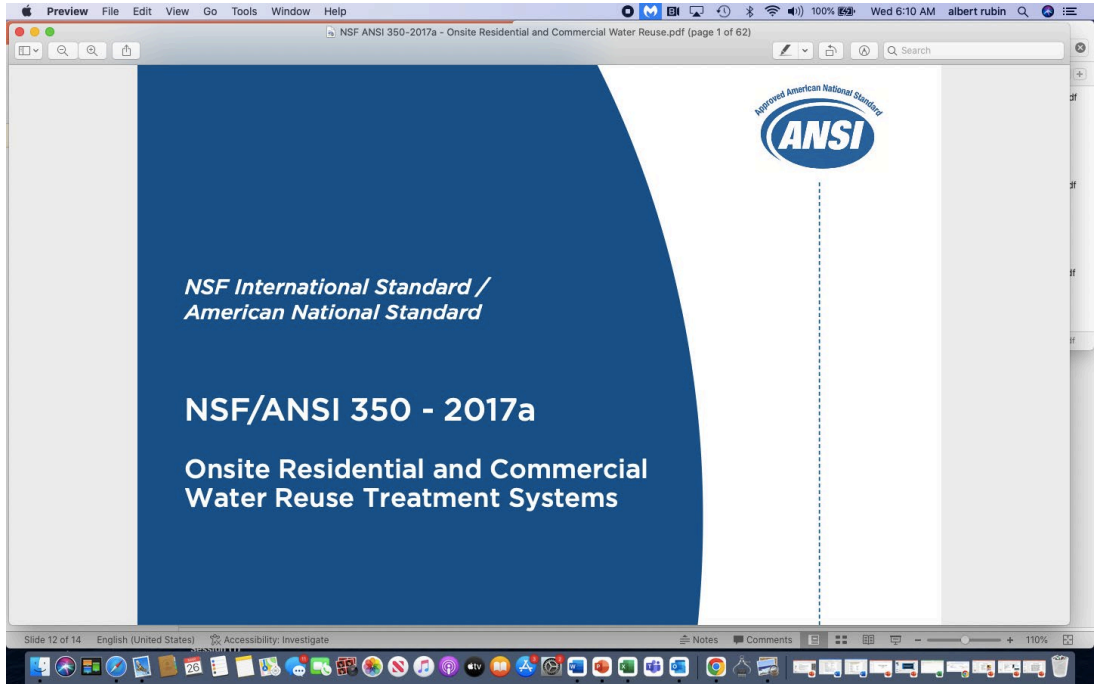
Table from "Treatment, Public Health, and Regulatory Issues Associated with Greywater Reuse. *Guidance Document*. By Sybil Sharvelle et. al. for WERF

Variety of delegations based on state rule, Sharvelle, 2018

GW Treatment

- Challenge to treat with traditional options
- C:N ratios inadequate to “feed the bugs”
- Several special GW treatment systems available typically physical treatment
- Some treat to NSF 350 Reuse standard
  - Grayter
  - Hydraloop

NSF 350 GW reuse standard Same as WW



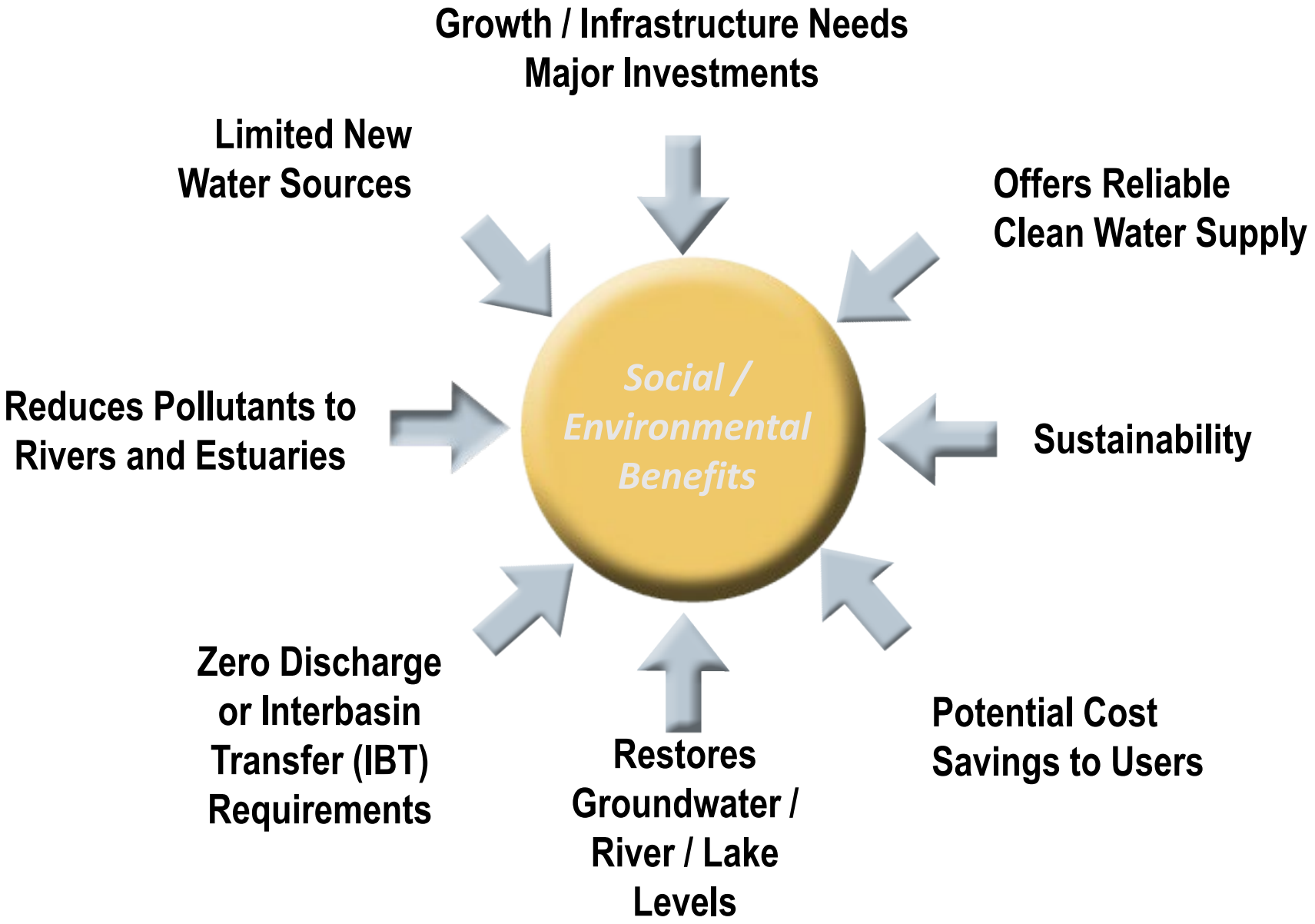
- BOD – 10 mg/l
- TSS – 10 mg/l
- Turbidity - 5
- Coliform Residential - 14 mpn
- Coliform Commercial – 2.2 mpn

What is reuse/Why re-use

- What: Reuse involves a water treatment process that renders a variety of degraded water sources into a water resource that is “fit for purpose”

- Why: Scarcity of water resources is driving the need to examine and implement alternative water supply options

Why Water Reuse?



Some implications

- Treat entire volume of wastewater
  - Entire volume allows wider reuse options
    - Outdoor uses
    - Indoor uses with HQW
    - Local codes may not allow total reuse
    - Wastewater permitting process views this as high risk option
- Treat source separated wastewater
  - Allows limited option for reuse due to lower volume generated
  - Typically recycled for toilet flushing
  - Limited supply for outdoor use
  - Codes typically favorable for graywater
  - Graywater permitting views as lower risk option

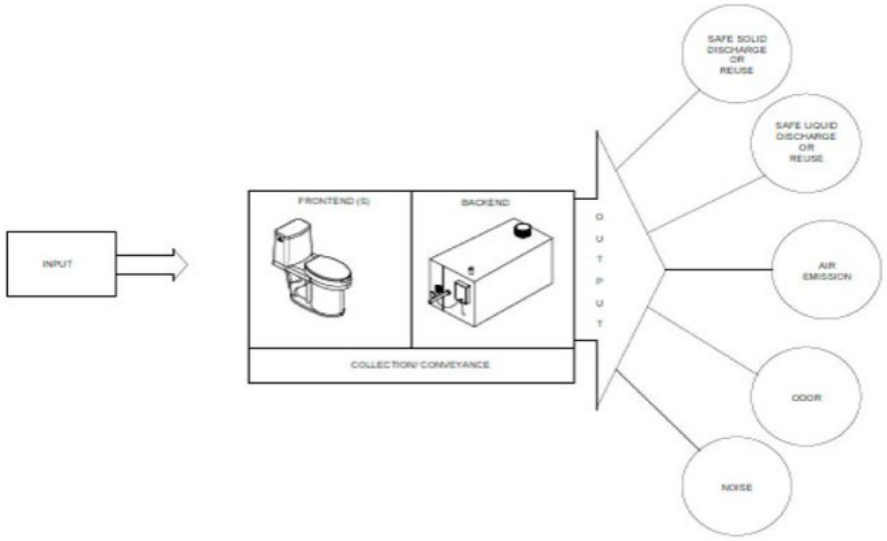
Implications

- Composting Toilets
  - Readily available, proven technology
  - NSF Standard available
  - Require no power source
  - Compost may be used onsite
- Incinerating toilets
  - Readily available, proven technology
  - NSF Standard available
  - Require power
  - Ash may be used onsite

New kid on the block

- ANSI/ISO reinvented toilet
- ANSI/ISO 30500 compliant
- Recently allowed in codes

ISO 30500



- **Quantitative Performance Standards for All Emissions**
- **Allowable Microbial Concentrations in Solids and Liquids**
- **Required Microbial Reductions in Log10 Units (Very High)**
- **Performance Validation in Lab and Field Studies**
- **Specified Microbes for Testing:**
- ***E. coli, Clostridium perfringens* spores, MS2 coliphage**
- **(fecal indicator virus), Ascaris ova, *Cryptosporidium parvum***

Parameter (Pathogen Class)	Human Enteric Bacterial Pathogens	Human Enteric Viruses	Human Enteric Helminths	Human Enteric Protozoa
Surrogate	(using *E. coli* as surrogate, measured in Colony-Forming Units (CFU))	(using MS2 Coliphage as surrogate, measured in Plaque-Forming Units (PFU))	(using *Ascaris suum* viable ova as surrogate)	(using viable *Clostridium perfringens spores* as surrogate measured in Colony-Forming Units (CFU))
Max concentration in liquids (#/L)	100	10	< 1	< 1
Overall LRV for liquid	≥ 6	≥ 7	≥ 4	≥ 6

LEED Certification

Leadership in Energy and Environmental Design

LEED for New Construction and Major Renovation 2009
Project Scorecard

Yes	?	No			
			Water Efficiency		**10 Points**
			Prereq 1	**Water Use Reduction**, 20% Reduction	Required
			Credit 1.1	**Water Efficient Landscaping,** Reduce by 50%	2
			Credit 1.2	**Water Efficient Landscaping,** No Potable Use or No Irrigation	2
			Credit 2	**Innovative Wastewater Technologies**	2
			Credit 3.1	**Water Use Reduction,** 30% Reduction	2
			Credit 3.2	**Water Use Reduction**, 40% Reduction	2
			Project Totals (Certification Estimates)		**110 Points**

Not Certified

Certified: 40-49 points **Silver:** 50-59 points **Gold:** 60-79 points **Platinum:** 80+ points

Section 704: Treatment Devices

- 704.3: Onsite reclaimed water system applicable to graywater and wastewater
- Water use in toilet and urinals or irrigation AND SIMILAR APPLICATIONS
- NSF 350

Ch 7, section 706: Non-Potable Water Requirements

- 706.1: Scope – Use and application comply w/local laws, rules and ordinances
- 706.2: Signage – “Non-Potable water is used for… DO NOT DRINK”
- 706.3: Quality – Rules and regs in local jurisdiction or NSF 350

Section 707 – Rainwater Collection and Distribution

- 707.11.5: Filtration – intended use
- 707.11.6: Disinfection – intended use
- 707.11.7.2: Materials NSF 61 if potable use

Section 708 – Gray Water Systems

- 708.2: Permits – Local jurisdiction
- 708.3: Potable connection - backflow protection
- 708.5.1 – Gray water irrigation –
  - Surface and subsurface irrigation
  - 24 Hr retention time

Section 709: Reclaimed Water Systems

- 709.2: Permits – Required!!!
- 709.3: Potable Connections – Protected
- 709.5: Applications – used IAW section 706 and local codes
- 709.1: Tests and Inspections
  - 709.10.1: testing make up piping and reclaimed system
  - 709.10.2: inspection and testing of backflow prevention assemblies IAW 312.10 IPC

Section 710: Alternative Onsite Nonpotable Water Sources

- 710.1: including but not limited to stormwater, RO reject water, foundation drain water, pool backwash shall be permitted if properly treated for intended use and IAW local jurisdiction requirements

Ch 9: Commissioning, O and M

- 901.1: Scope - Pre and Post occupancy issues
- 903.1: Commissioning –
  - Registered design professional requirements
  - Commissioning plan
  - 904.3: Building O and M
    - Record documents
    - O and M manual shall be provided to owner

This is the MOST critical component of this standard, The responsibility for performance a
directed to the system designer

Some concluding comments

Do options exist for source separation and are they effective– yes

Can source separation be included in current designs – yes

Does source separation impact the volume of water to be recycled – yes

Does source separation eliminate the need for permits – no

Does source separation eliminate the need for maintenance, operation and management – no