

My Experiences with Water Reuse

Rappahannock-Rapidan Regional Commission Living Lands Workshop: Water Planning

Presented by:

Michael S. Rolband, P.E., P.W.S., P.W.D., LEED®AP

mrolband@wetlandstudies.com

Wetland Studies and Solutions, Inc.

5300 Wellington Branch Drive · Suite 100
Gainesville, Virginia 20155
www.wetlandstudies.com



November 18, 2014

Wetland Studies and Solutions, Inc.

a DAVEY company

Natural & Cultural Resources Consulting Firm:

- Founded in 1991
- 85 Staff

Expertise:

- Civil and Biological Engineering
- Environmental Science
- Landscape Architecture
- Regulatory
- Archeology
- Ecosystem Restoration
- Surveying
- Compliance
- Geographic Information Systems



Acquisition by The Davey Tree Expert Company (4/1/2014)

- Expertise in tree protection, assessment, and analysis
- Largest employee-owned service company in U.S.
- Founded in 1880
- 7,300 employees, 47 States and 5 Provinces

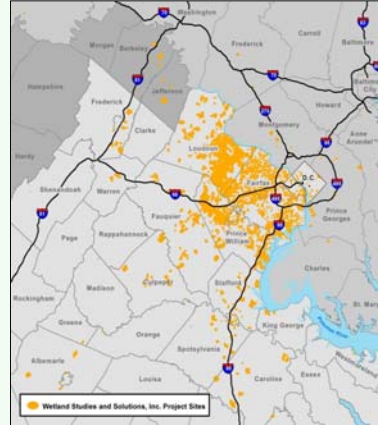


Wetland Studies and Solutions, Inc.

a DAVEY company

Our Coverage

- Consulted on over 5,000 project sites
- Covered 200,000+ acres
- Created, restored, or designed
 - 1,300+ acres of wetlands
 - 156,000+ linear feet of streams.
- Wetland Research Initiative (WRI):
<http://www.wetlandstudies.com/resources-regulations/additional-resources/wriresources.html>
- First Wetlands and Stream Banks in Virginia
(1991) (2002)



3

Wetland Studies and Solutions, Inc.

a DAVEY company

Example Projects



4

Wetland Studies and Solutions, Inc.

a DAVEY company



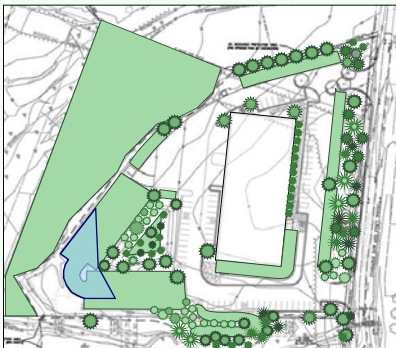
LEED and LID

- Virginia's first building certified Gold under the Leadership in Energy and Environmental Design (LEED) rating system.
- Low Impact Development (LID) design throughout the WSSI office property to reduce storm water volumes and peak flow rates through detention, retention, and evapotranspiration



5

Water Treatment and Conservation at WSSI



6

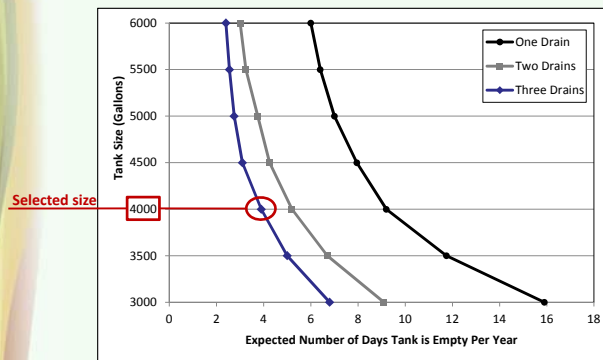
4,000 Gallon Toilet Cistern

- Design assumptions (Using historic rainfall data from 1964-2006):

75 F.T.O. | $\frac{2 \text{ flushes}}{\text{person}} / \text{day}$ | $\frac{1.1 \text{ gallons}}{\text{flush}}$

*F.T.O. stands for full-time occupants

- Calculated results:** Cistern will be empty \pm 4 days per year
- Actual results:** Cistern has not gone dry, even in 2009 drought



On the Farm: 3,400 Gallon Irrigation Cistern Under Construction (Effective size = 2,980 gallons)



Cistern manufacturer: www.rainharvest.com

A good opportunity for reuse:

- Large supply
 - 1,200 ft² barn roof footprint
 - \pm 40 in/yr local average rainfall
 - Expected annual water supply: \pm 30,000 gallons
 - Effective tank size large enough to contain a 4" rain event (overkill! – but based on cost)
- Low, occasional demand for water
 - Equipment cleaning
- Sold as a package (\$8,795)
 - Includes pump, valves, seals



Obstacles to On-Site Reuse: 2009 Virginia Building Code Amendments

**SECTION AO102
SYSTEMS FOR FLUSHING WATER
CLOSETS AND URINALS**

AO102.1 Collection reservoir. The holding capacity of the reservoir shall be a minimum of twice the volume of water required to meet the daily flushing requirements of the fixtures supplied with gray water, but not less than 50 gallons (189 L). The reservoir shall be sized to limit the retention time of gray water to a maximum of 72 hours.

AO102.6 Identification. Distribution piping and reservoirs shall be identified as containing nonpotable water. Piping identification shall be in accordance with Section 608.8 of the International Plumbing Code®.

**SECTION AO103
SUBSURFACE LANDSCAPE
IRRIGATION SYSTEMS**

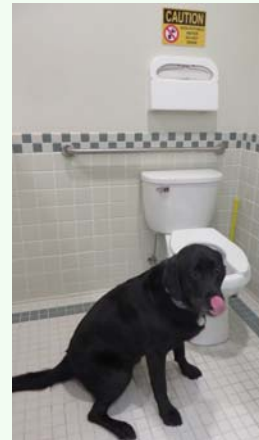
AO103.1 Collection reservoir. Reservoirs shall be sized to limit the retention time of gray water to a maximum of 24 hours.

AO103.1.1 Identification. The reservoir shall be identified as containing nonpotable water.

For urinal reservoirs:
“The reservoir shall be sized to limit the retention time of gray water to a maximum of 72 hours.”

For underground irrigation:
“Reservoirs shall be sized to limit the retention time of gray water to a maximum of 24 hours.”

- Retention time requirement limits utility of water reuse as a stormwater solution
- In direct conflict with Virginia’s Watershed Implementation Plan goals
- Waivers available



11

Stormwater Management and Water Conservation

- Too much of a good thing:
 - Thanks to effective water-saving measures, cisterns at WSSI often full
 - Without available storage, stormwater benefits are lost
- Possible solution: **Detention cisterns**

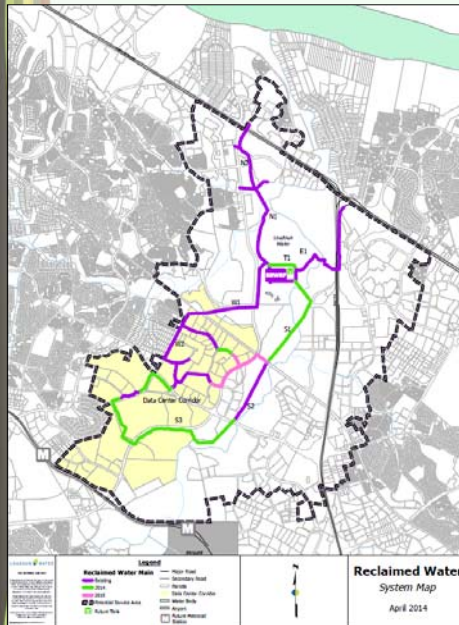


Image reprinted with permission of Dr. Kathy Gee (Longwood University)



12

Loudon Water: Large-Scale Reuse



- Broad Run Water Reclamation Facility (BRWRF)
 - Built in 2008 with a \$20 million dollar DEQ grant
- “Purple Pipe” system transports reclaimed water from BRWRF to private clients for:
 - Irrigation
 - Toilet flushing
 - HVAC cooling
 - Chilling for data centers



13

What About Just Using Less Water?

At the Wetland Studies office:

Inside:

- Low-flow sinks, toilets, and showers
- Motion-based faucet controls
- Waterless urinals
- **72% reduction in potable water use**

Outside:

- Naturalistic landscaping
- Drip irrigation



14

What About Utility Savings?

Utility Type	Annual Use	2014 Rate / Total Cost	Savings
Irrigation water		\$3.70 / 1,000 gal ¹	
Estimated typical use	2,600,000 gal	\$9,620	\$9,620 / year
Estimated WSSI use	200,000 gal	\$0	
Total premium for cistern, drip irrigation, and native landscape ²			\$56,871
Capitalized value of savings (at 6%)			\$160,333
Payback			5.9 years
Potable water (with toilet cistern)		\$10.85 / 1,000 gal ¹	
Estimated typical use	245,214 gal	\$2,661	\$1,922 / year
Estimated WSSI use	68,084 gal	\$739	
Total premium for low-flow/waterless fixtures, cistern, and pump equipment (excl. installation) ²			\$69,382
Capitalized value of savings (at 6%)			\$32,031
Payback (with toilet cistern)			36 years
Potable water (without toilet cistern)		\$10.85 / 1,000 gal ¹	
Estimated typical use	245,214 gal	\$2,661	\$1,346 / year
Estimated WSSI use (before cistern)	121,095 gal	\$1,314	
Total premium for low-flow and waterless fixtures (excl. installation) ²			\$7,564
Capitalized value of savings (at 6%)			\$22,443
Payback (without toilet cistern)			5.6 years

1. Water costs per PWC Service Authority, 1/1/14-1/1/15

2. Cost adjusted for inflation. Construction costs have inflated by 24% since 2006, according to the Engineering-News Record 1913 Price Index History (http://enr.construction.com/economics/quarterly_cost_reports/)

15

Prioritizing Water Goals

THE WALL STREET JOURNAL.

Dry Humor: Too Much Water Doesn't Damp Germans' Thrifty Habits

Nation's Love of Conservation Criticized By Some as Overkill

By ANTON TROIANOVSKI

September 28, 2014

- Germans have been so effective in reducing water consumption that their existing sanitary sewers are too large to move the lower flow rates.
 - "Utilities in Germany are forced to pump hundreds of thousands of liters of fresh water through the system to keep it operable"

-Der Spiegel 3/17/2011

- How much water should we use?
- Local conditions must dictate priorities



A deodorant pad is used to reduce the stench in the Berlin water system. Anton Troianovski/The Wall Street Journal



16

Questions?



17

Thank you!



18