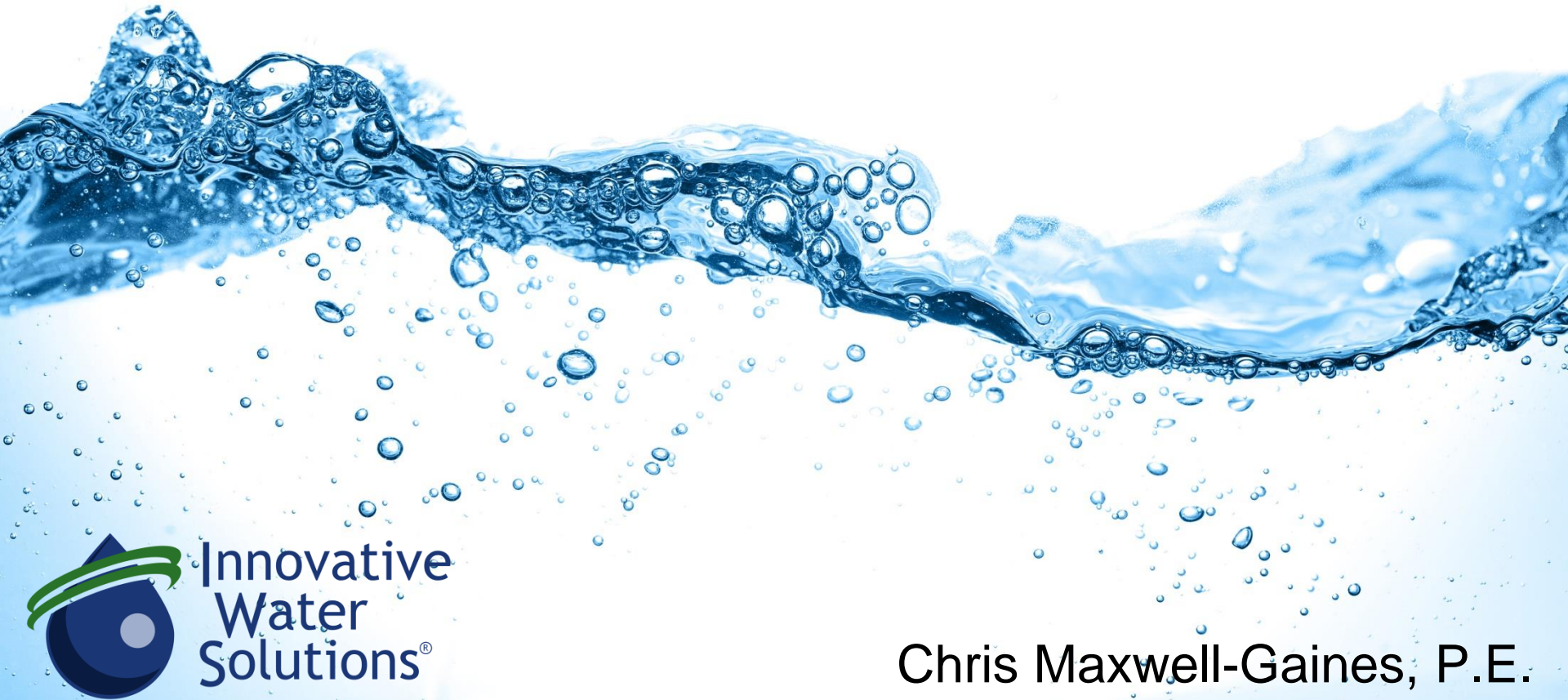


Graywater Reuse Systems

System Design and Best Management Practices



Chris Maxwell-Gaines, P.E.



- Integrated water conservation solutions
- Rainwater, Graywater, Drainage, Irrigation
- Design / Build
- Residential / Commercial



Before we go any further...



Before we go any further...

Is it GRAYWATER

or GREYWATER

or GRAY WATER

or GREY WATER?



Before we go any further...

Google: GREYWATER

2012 UPC Chapter 16: GRAY WATER

Texas Admin Code: GRAYWATER



Graywater Reuse

Graywater:

Bathroom sink

Shower/Bath tub

Clothes washer

Blackwater:

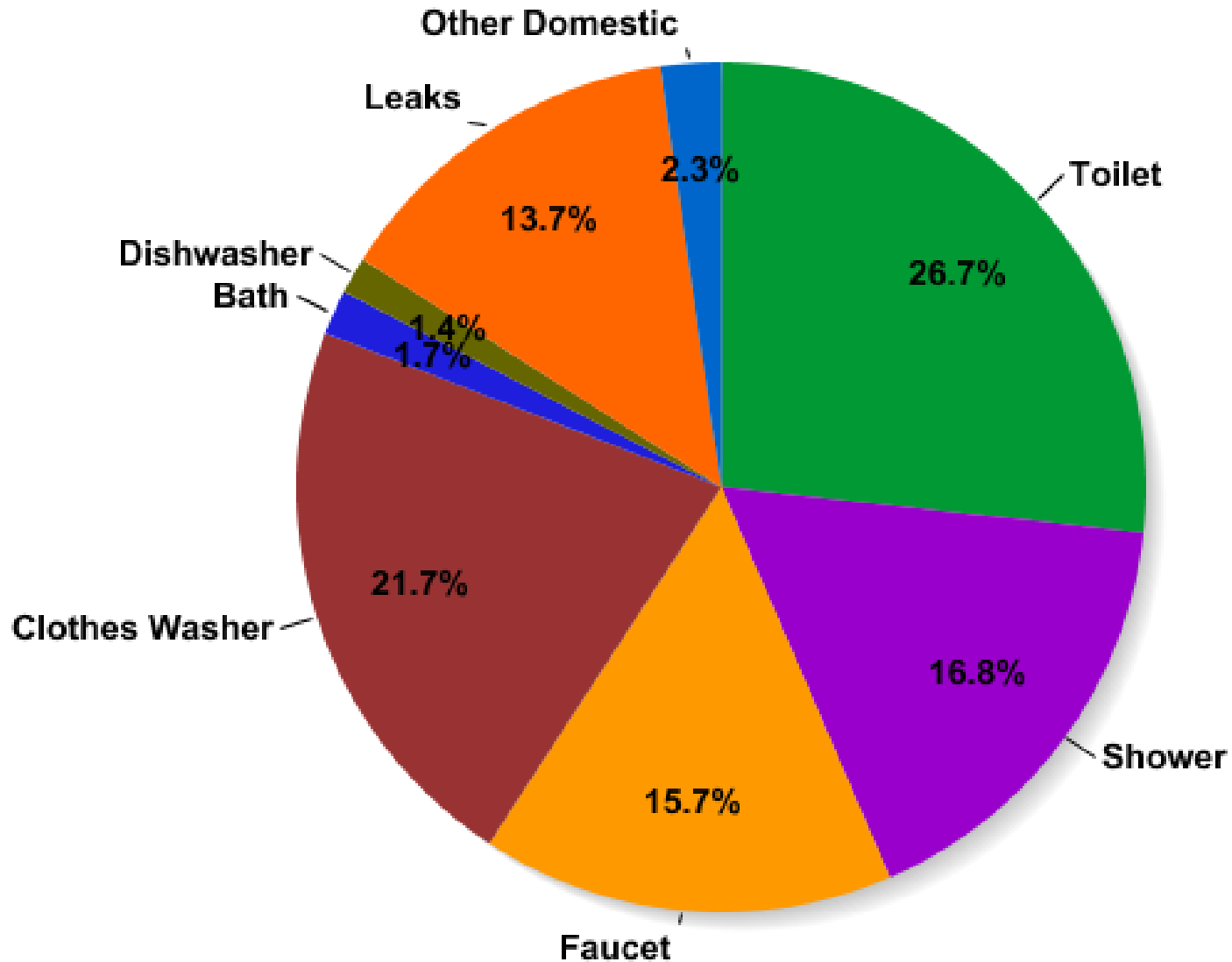
Toilet

Kitchen sink

Dishwasher



Typical Indoor Water Use



American Water Works Association, 1999

Graywater Reuse Benefits

- Cascading water usage – water already paid for
- Minimal treatment required
- Accounts for about 40-50% of indoor water use
- No need to store graywater – constant production
- Simple to Complex systems



Graywater Laws in Texas

- HB 2661 (2003)
 - Made GW legal in Texas
 - Texas Administrative Code
- HB 1902 (2015)
 - Use GW for toilet/urinal flushing
 - Allow adjustment in size of required on-site sewage disposal system if used with GW system



TAC Specifics: Graywater

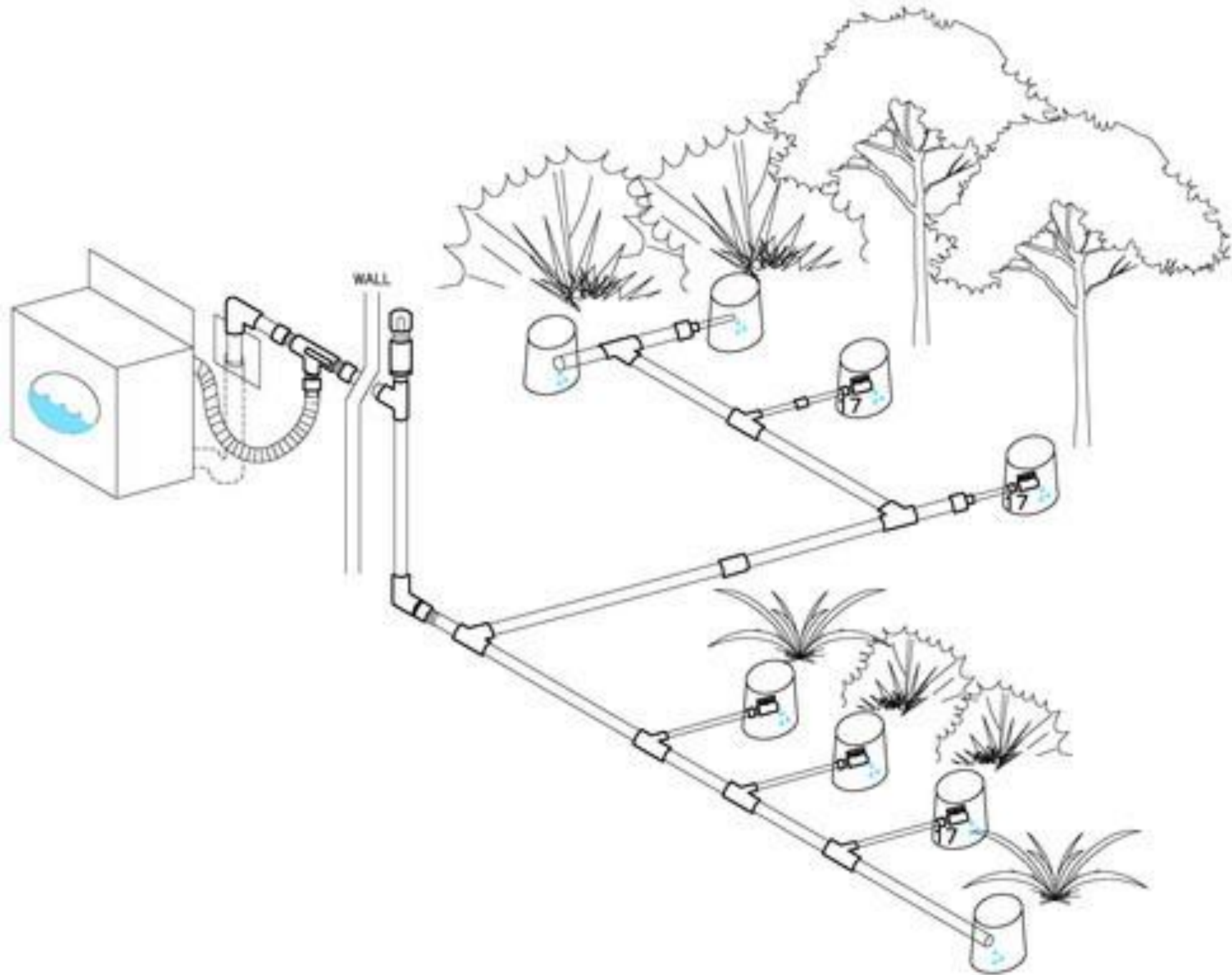
- No permit for domestic use of less than 400 gallons per day
- Can't hold on to it
- 100% diversion capability
- No spray irrigation
- No indoor use (HB 1902 changes this)
- System clearly labeled



Types of Graywater Systems

- Gravity Systems
 - Laundry to Landscape
 - Branched drain system
- Pressurized Systems





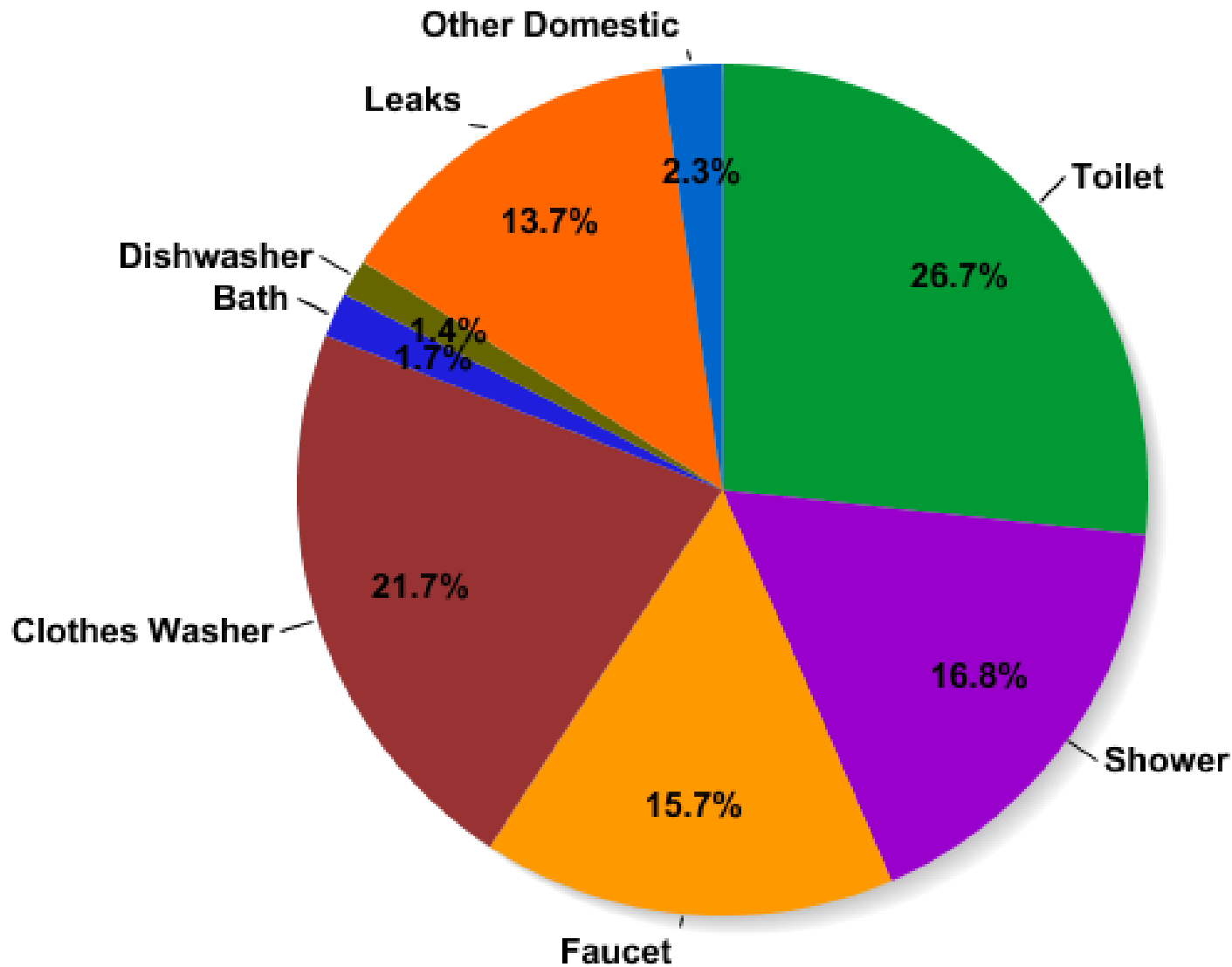
Types of Graywater Systems







Typical Indoor Water Use



American Water Works Association, 1999

Let's Crunch Some Numbers!

*Family of 4 X 50 gal/day/capita X
50% graywater rate =*



Let's Crunch Some Numbers!

*Family of 4 X 50 gal/day/capita X
50% graywater rate =*

100 gallons / day



Let's Crunch Some Numbers!

*Family of 4 X 50 gal/day/capita X
50% graywater rate =*

100 gallons / day

*How much landscaping can be
watered with that?*



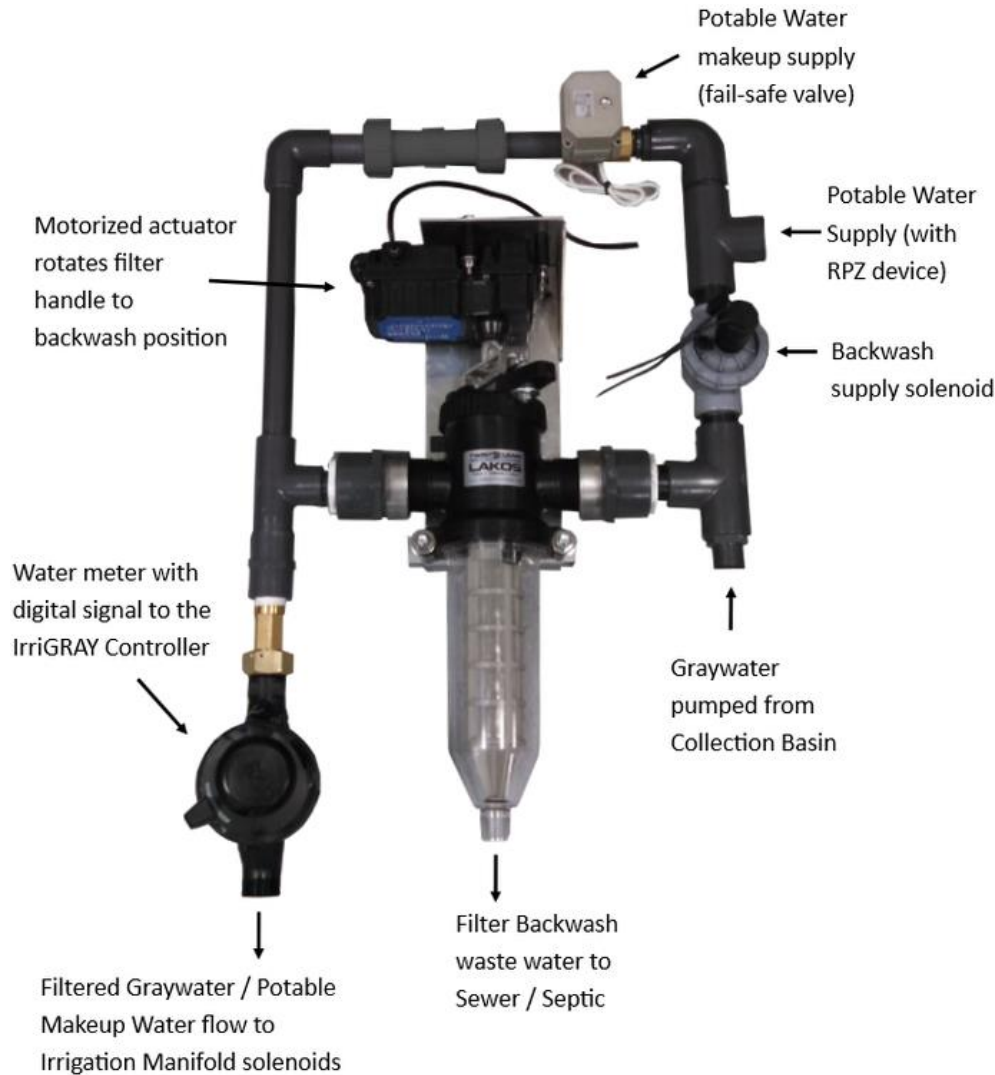
Distribution & Efficiency



Current Graywater Technology



Current Graywater Technology



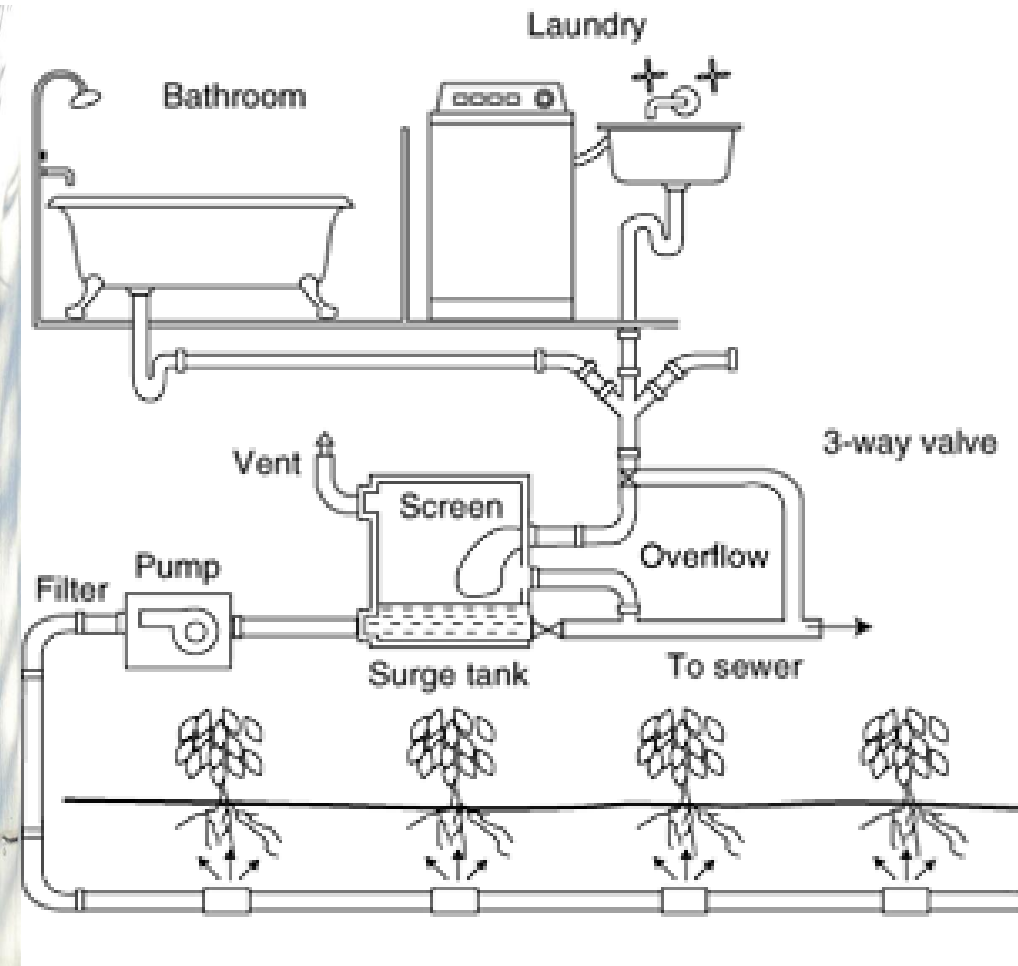
Current Graywater Technology



Current Graywater Technology



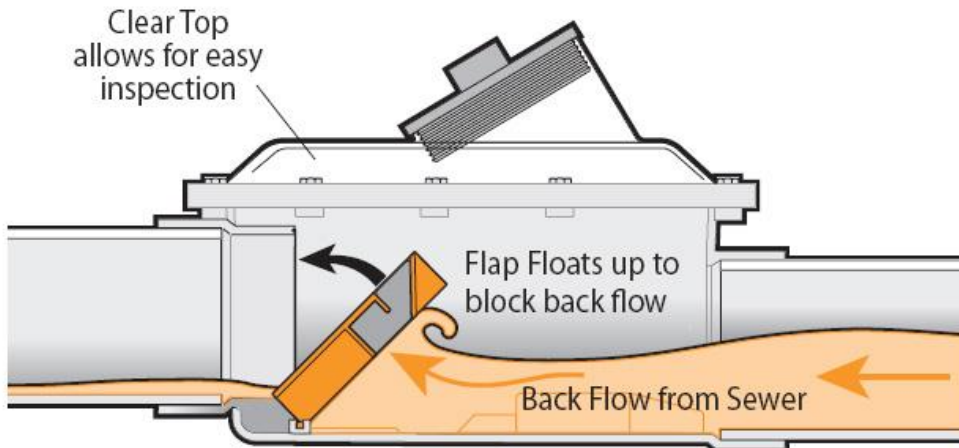
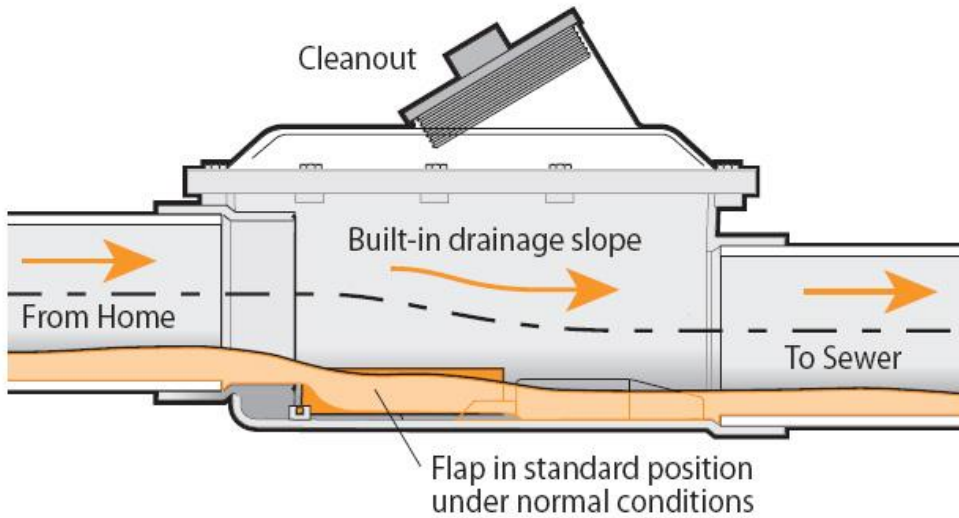
Current Graywater Technology



Graywater System Components



Graywater System Components



Graywater System Components



Graywater System Components



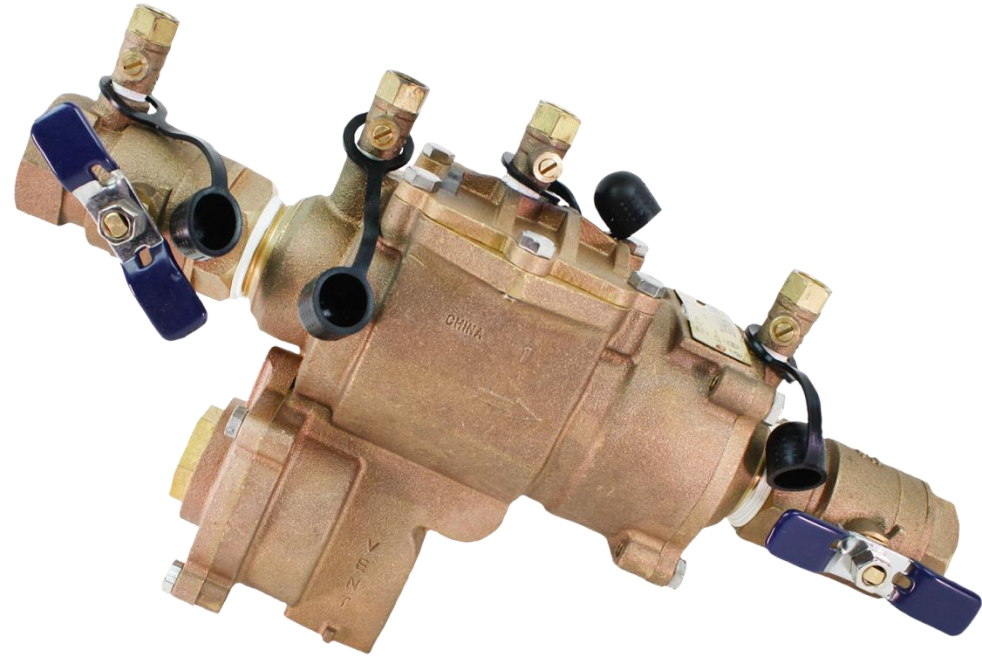
Graywater System Components



Graywater System Components



Graywater System Components



Graywater System Components



Graywater Effects on Plant Life

Long-term Study on Landscape Irrigation Using Household Graywater | WERF 2012

- Began in May 2008
- Most landscape plants are healthy under long-term graywater irrigation compared to freshwater irrigation
- GW irrigation accumulated surfactants, antimicrobials, & sodium in soil but sodium increase after 5 years was not high enough to raise concern about soil quality or plant health



Graywater Effects on Plant Life

Water Conservation through Reuse of Graywater | Texas A&M AgriLife Research Center at El Paso 2008

- Rogelio Sanchez Texas State Prison, El Paso, TX
- 3 year experiment demonstrated that GW use with tomato, chili & bell pepper is feasible and even outperformed over brackish groundwater. No significant impacts of salinity were observed for GW irrigation.



Dual Plumb to Advance GW



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