

# GRAYWATER REUSE

Sybil Sharvelle

Civil and Environmental Engineering

Colorado State University

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# Presentation Overview



- Benefits of graywater reuse
- Graywater quality
  - Comparison to other nonpotable sources
- Typical Graywater system
- Regulations

# Graywater Defined

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- Excludes

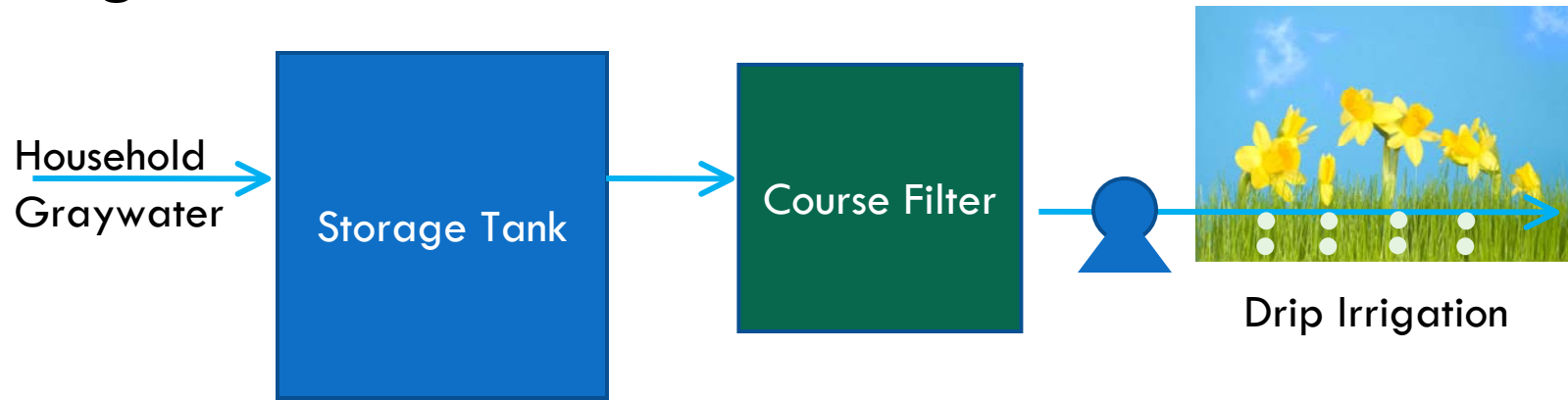
- Toilet water
- Kitchen water
  - High organics
  - Food born pathogens

- Includes

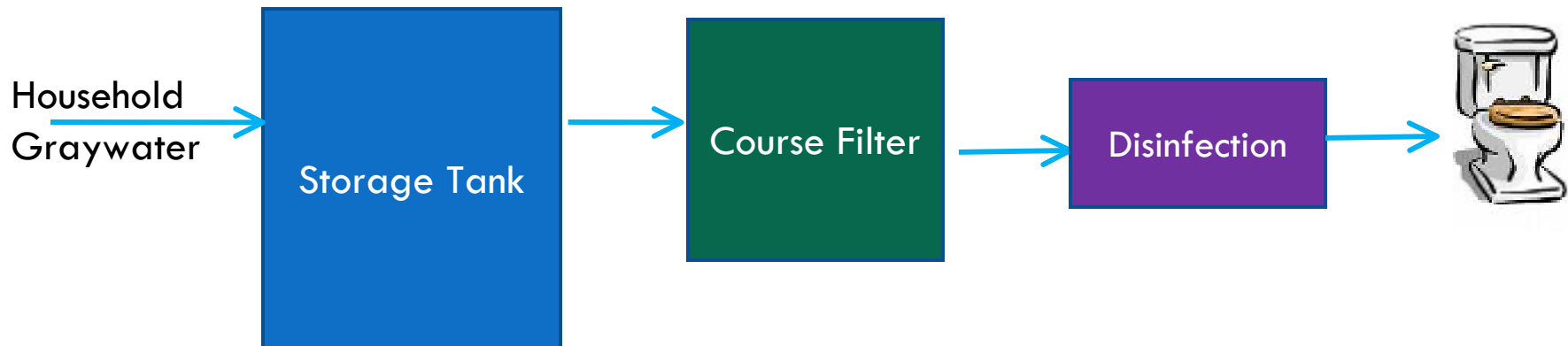
- Shower/bath water
- Laundry water
- Wash basins

# Domestic Graywater Reuse

## Irrigation



## Toilet Flushing

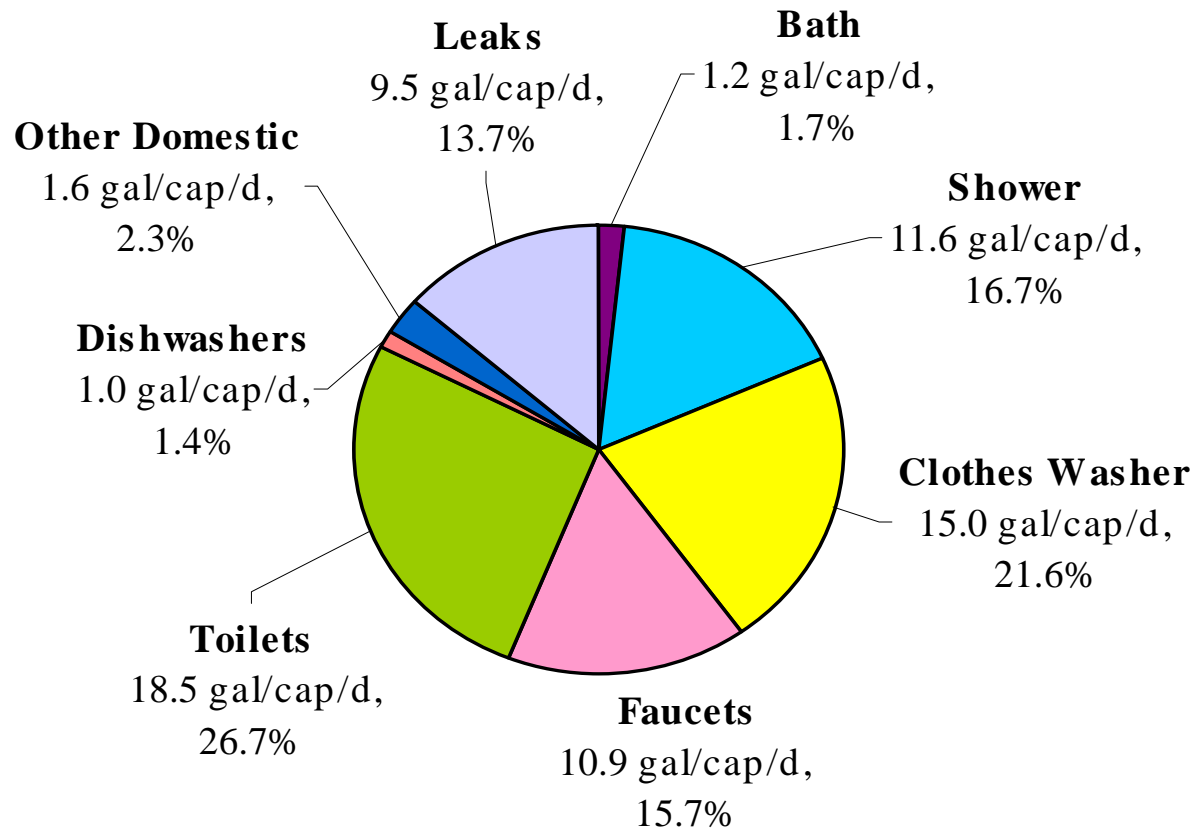


# Why Reuse Graywater?

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- Reduced load to wastewater treatment plant
  - ▣ Reduced capital costs
  - ▣ Reduced energy requirements
- Water conservation – Reduced demand for potable water
- Preservation of source waters

# Graywater Production



## Household Graywater Production (family of four, gpd)

- Bath	4.8
- Shower	46.4
- Washer	60.0
- Faucets	43.6
- <u>Other</u>	<u>6.4</u>

**TOTAL 161 gpd**  
**1128 g/wk**

- Toilets	74 gpd
	<u>518 g/wk</u>
- Irrigation	610 g/wk

(waters 300 plants or  
1000 ft<sup>2</sup> of grass)

Source: AWWARF

# Graywater Quality

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- Graywater contains soap products and anything washed from body or clothes
  - Organics
  - Bacteria
    - Minimal compared to blackwater
- Considerations for reuse
  - Nutrients
  - Salts
  - Pathogens

# Graywater Quality

- How does graywater compare to reclaimed wastewater?

Constituent	Graywater Range (mg/ L)	Reclaimed Wastewater Range (mg/L)
COD	140 - 700	20 - 100
Total Nitrogen	1 - 20	2 - 100
TDS	300 - 700	360 - 2800
EC ( $\mu\text{S}/\text{cm}$ )	800 - 2000	1300 - 4100
SAR	3 - 6	3 - 11
Total Coliforms (#/100mL)	10 - $10^7$	0 - 10

SAR = Ratio of  $\text{Na}^+$  to  $\text{Ca}^{2+} + \text{Mg}^{2+}$   
Higher than 15 problematic  
Effects noticed when SAR > 5

- Graywater has more organics, less nitrogen, lower salts, more indicator organisms



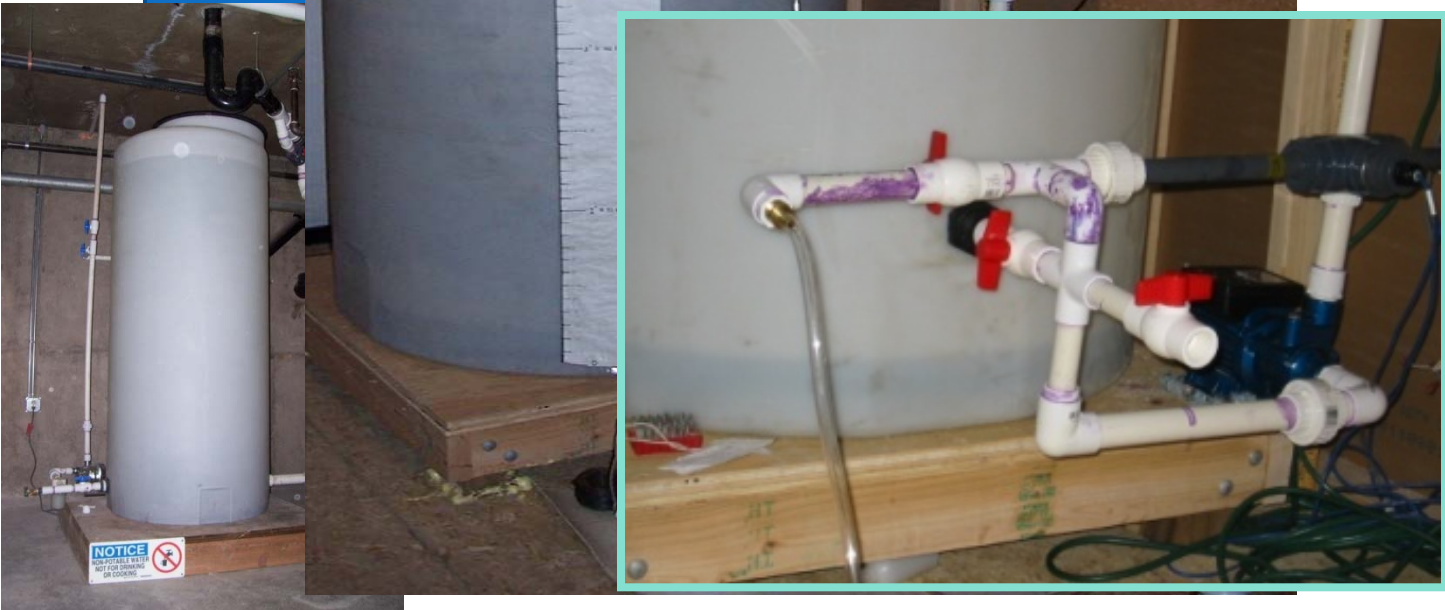
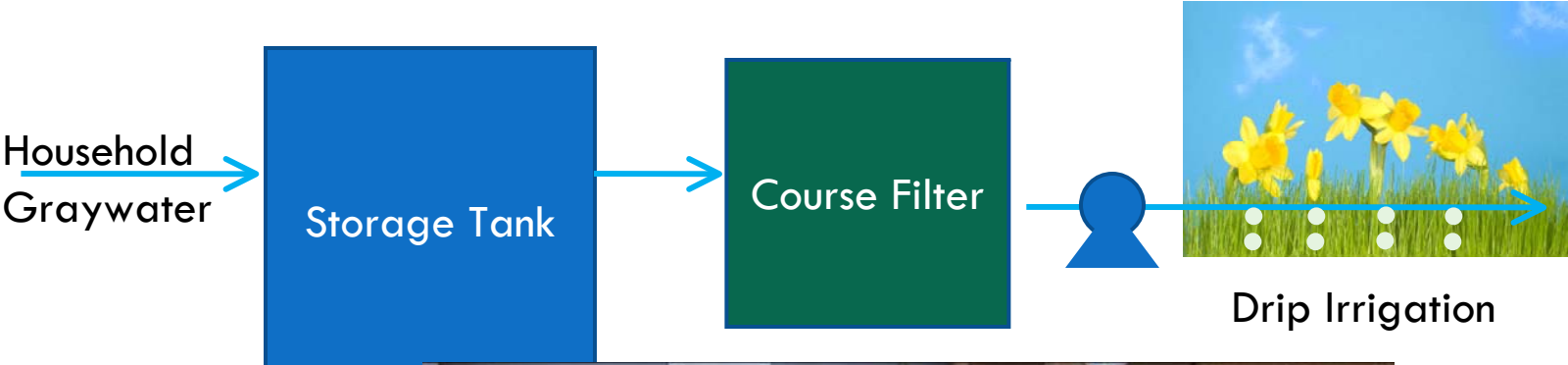
# Graywater Quality

- How does graywater compare to rainwater harvest (roof runoff)?

Constituent	Graywater Range (mg/ L)	Harvested Rainwater Range (mg/L)
COD	140 - 700	5 - 150
Total Nitrogen	1 - 20	0 - 10
TDS	300 - 700	9 - 50
EC ( $\mu\text{S}/\text{cm}$ )	800 - 2000	56 - 220
SAR	3 - 6	N/A
Total Coliforms (#/100mL)	10 - $10^7$	0 - 570

- Graywater has more nutrients, more salts, and more indicator organisms

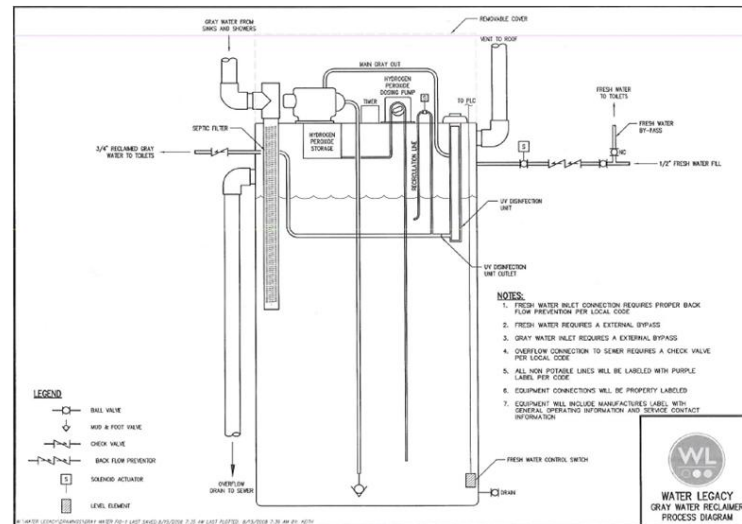
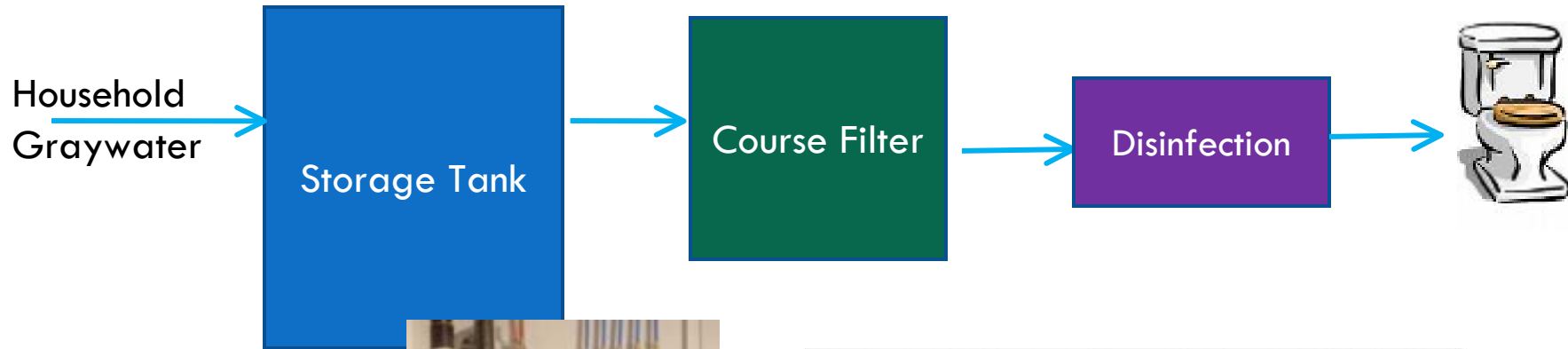
# Graywater Irrigation System



# Graywater Irrigation

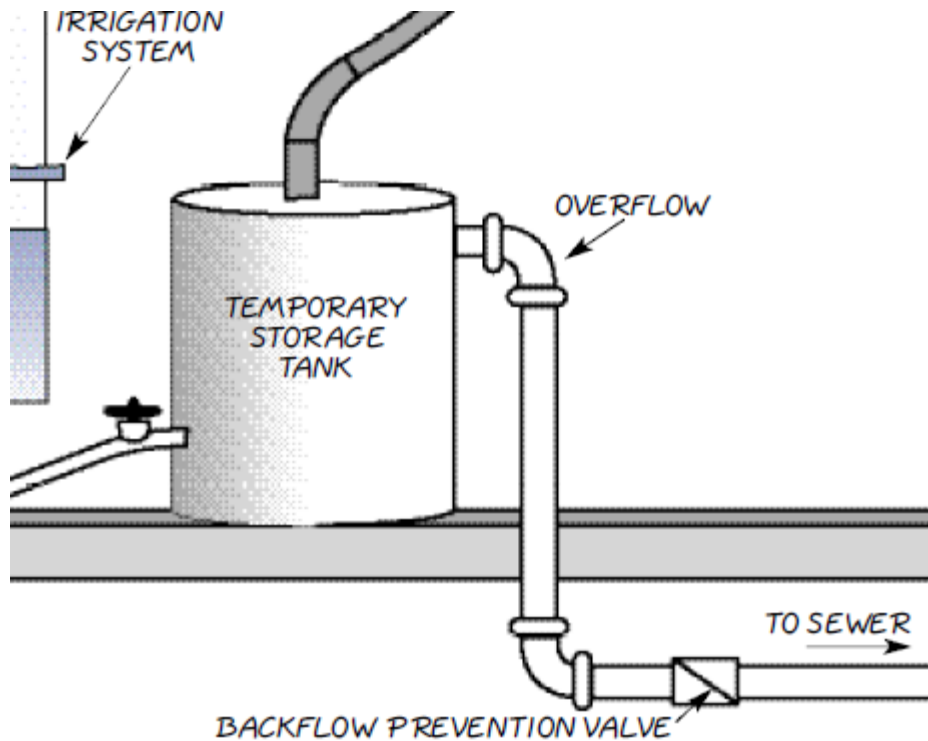


# Graywater Toilet Flush System



Source: Water Legacy

# Design Considerations



Odors may be problematic  
If storage is too long at  
High temperature

# Graywater Regulations

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- There is currently no regulation in CO for graywater
- Graywater is treated under septic tank requirements
  - ▣ Don't make sense for irrigation

# Graywater Regulations

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- Two issues
  - ▣ Environment and Health
  - ▣ Water Rights
    - Actually zero sum, i.e. source water is preserved
- Permit – County Health and Environment Department (< 3000 gpd)
  - ▣ More acceptance for toilet flushing
  - ▣ Subjective
- Working group has been formed to develop state regulation

# Graywater Irrigation Regulations

State	Permit Required	Submerged Irrigation	Treated as Septic
AZ	No (<400 gpd)	No	No
NM	No (<250 gpd)	No	No
TX	No (<400 gpd)	No	No
UT	Yes	No	No
CA	Yes	Yes	No
NV	Yes	Yes	No
OK	Yes	Yes	Yes
CO	Yes	Yes	Yes



# Recommended Best Management Practices

- Drip irrigation only
  - No spray
- Should not be used for foot crops except fruit trees
- Tank should be covered
- Graywater system should not be in area prone to flooding
- Graywater should not run off site
- No ponding of graywaer
- Application under mulch bed is ideal

# Questions