Greywater, Green Landscape

Presentation by Laura Allen

Part 1: GW 101

Part 2: Design your own laundry-to-landscape system
HOW MUCH WATER DO YOU USE EACH DAY?
THE GLOBAL WATER GAP

Mozambique: 1 gal/person
UK: 40 gal/person
France: 76 gal/person
US: 150 gal/person

Source: UNDP Human Dev. Report 2006
Figure 3-3. Average Monthly Temperature, Rainfall, and ETo

<table>
<thead>
<tr>
<th>Month</th>
<th>Temperature</th>
<th>Rainfall</th>
<th>ETo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>49</td>
<td>4.2</td>
<td>1.9</td>
</tr>
<tr>
<td>Feb</td>
<td>51</td>
<td>3.6</td>
<td>2.2</td>
</tr>
<tr>
<td>Mar</td>
<td>55</td>
<td>2.8</td>
<td>3.7</td>
</tr>
<tr>
<td>Apr</td>
<td>58</td>
<td>1.5</td>
<td>4.8</td>
</tr>
<tr>
<td>May</td>
<td>60</td>
<td>0.5</td>
<td>5.3</td>
</tr>
<tr>
<td>Jun</td>
<td>64</td>
<td>0.1</td>
<td>5.7</td>
</tr>
<tr>
<td>Jul</td>
<td>65</td>
<td>0.0</td>
<td>5.6</td>
</tr>
<tr>
<td>Aug</td>
<td>65</td>
<td>0.0</td>
<td>5.3</td>
</tr>
<tr>
<td>Sep</td>
<td>67</td>
<td>0.2</td>
<td>4.2</td>
</tr>
<tr>
<td>Oct</td>
<td>60</td>
<td>1.0</td>
<td>3.4</td>
</tr>
<tr>
<td>Nov</td>
<td>55</td>
<td>2.1</td>
<td>2.4</td>
</tr>
<tr>
<td>Dec</td>
<td>50</td>
<td>3.6</td>
<td>1.9</td>
</tr>
</tbody>
</table>
Where does the water go after the drain?
The WWTP serves 143,000 people from many different communities in San Mateo County.
About 50% of residential water is used for irrigation. I don't need clean drinking water!
Greywater Reuse
16-40% reduction in water use

House using greywater for irrigation with simple laundry-to-landscape and gravity-fed systems

© Steve Sanford from The Water-Wise Home
Avg. household savings of 15,000/year (GWA Study)
Greywater is water from:

#1 Washing machines

- Top loading machine: 30-50 gallons/load
- Front loading machine: 12-25 gallons/load
- Top efficient: 15-25 gallons/load
Greywater is water from:

#2 Showers and baths
Greywater is water from:

#3 Sinks
Greywater is never from toilets!
A brief history of the legality of greywater:

Before 2009:

- It was not possible to install a legal system, there were 1.6 million illegal systems in California.

After 2009:

- It is possible to install several types of systems legally, some don't require a permit.
Is greywater legal? Yes!

Greywater is regulated by Chapter 15 of the California Plumbing Code.
How can you use greywater?

#1 For outdoor irrigation

#2 To flush toilets

These systems require filtration, disinfection, and frequent maintenance. They are difficult to obtain permits for.
Another Option

Sink Positive- Retrofit

Caroma’s integrated sink lid
Use Plant Friendly Products

These products don't contain BORON, CHLORINE, or high levels of SALT.

For example: ECOS, Biopac, Trader Joes, Oasis, Vaska, Aubrey Organics, FIT organic, hydrogen peroxide bleach.

Don't use sodium based water softened water.
Greywater is NOT Potable
Wood chips filter and absorb greywater before it soaks into the soil.
“Mulch Basin”

A shallow basin filled with mulch (wood chips).

The basin spreads greywater out, provides surge capacity, and prevents pooling or runoff.

This man is filling the basin with wood chips.
“Diverter Valve”

The valves allow us to control the flow of greywater (either to the landscape, or to the sewer/septic)
A Bucket

- Collect cold water as shower heats up
- Dishpan in sink to collect wash water
- Use for irrigation
- Use to “bucket” flush toilet (pour into toilet bowl)

www.greywateraction.org
Greywater Systems can be Simple or High-Tech
Simple Systems Irrigate Larger Plants

- Trees
- Bushes
- Vines
- Larger annuals and perennials
...but not lawns or small plants

Irrigating these types of plants requires a more complex type of system.
Simple System:
Laundry-to-Landscape (L2L)

Costs: $150-$250 parts, $700-$2,500 professional installation
Laundry-to-Landscape System

Sewer connection

Greywater goes to landscape

Diverter valve
Branched Drain: A Gravity System

Costs: $250-$500 parts, $800-$4,000 professional installation (permit fees cost more)
A Diverter Valve Controls GW Flow

A motor (called an actuator) can be added, enabling the valve to be controlled by a switch inside the house.

www.greywateraction.org
Branched Drain System

Setbacks from buildings and property lines

Greywater outlet is under a solid shield and flows into a mulch basin. Size of basin depends on soil type and amount of water.

www.greywateraction.org
Completed System and 1 Year Later

Images: Josh Lowe

www.greywateraction.org
Simple Pumped System (no filters)
Pump and Manually Cleaned Filter System for **Drip Irrigation**

*(Filters must be cleaned manually and require *frequent* maintenance)*

Image: Leigh Jerrard

**Note:** Filtered GW requires special drip tubing and is not compatible with most standard drip systems.
Whole House Systems (auto-cleaned filters)

Grey Flow Plug-n-Play
- Filter cleaned automatically with compressed air and greywater (no make-up water)
- Roto valve offers 6 zones
- Gw compatible drip irrigation

IrriGRAY from WaterRenu
- Filter cleaned automatically with potable water
- Controller operates irrigation system
- Able to monitor system on-line
New Construction and High-End Residential
Common Errors

“I'm going to pump my greywater to the top of my property and store it in a large tank, then gravity flow it down the hill to irrigate through drip irrigation system”.

#1 Storage tank

#2 Overuse of pumps

#3 Misuse of filters

www.greywateraction.org
Design Considerations

• **WHAT** sources of greywater can you access?

• **HOW** much greywater does your home produce?

• **WHAT** plants will you irrigate?
  • Match the amount of GW with their weekly irrigation needs. Remember to “hydro-zone”! (Keep plants with similar water needs together.)

• **CHOOSE** a system to meet your needs.
How-To Books

The Water-Wise Home
How to Conserve, Capture, and Reuse Water in Your Home and Landscape

Greywater Green Landscape
How to Install Simple Water-Saving Irrigation Systems in Your Yard

Laura Allen
Cofounder, Greywater Action
and author of The Water-Wise Home
For more information visit: greywateraction.org
Part 2: Design Your Own Laundry-to-Landscape System

Laundry machine

Diverter valve

To sewer

Washing machine

1" irrigation tube

½" outlets

Mulch basin

Image © Steve Sanford, from Greywater: Green Landscape by Laura Allen, © 2017 Storey Publishing
Connections Inside the House

- Loose fitting connection to the sewer/septic
- Diverter valve
- Washer drain hose
- Anti-siphon vent installed on the landscape side of the valve
- Greywater goes to landscape

www.greywateraction.org
Before You Start- Clean the Pump Filter

Pump filter
3-way Valve Configurations

1. Valve must be above “flood rim” of machine.

2. Washer hose must connect to middle port
3-way Valve Configurations

Washer hose connected to middle port
3-way Valve Configurations

Second washer hose used for sewer connection
PVC-Free Version : BluLock

Image credit Leonard Edmonson
Drill Hole for Pipe
(through the wall/floor)

- Look for potential issues (electrical lines, gas pipes, etc.)
- Drill a 1/4” pilot hole
- If no obstructions, drill hole for 1” PVC with 1½” holesaw (Drill from outside in, and inside out for a clean looking hole)
- Use proper bit for your wall/floor (wood bit, stucco bit, etc.)
Anti-siphon Component

This piece is called an Auto-Vent, inline vent or AAV).

It's function is to prevent a siphon from forming and sucking water out of the machine when it tries to refill.
Placement of Anti-siphon

- Can be inside or outside (may need freeze protection)
- Must be at the high point of the system
- Must be accessible/visible in case of future leaks (e.g. not behind a wall)
Strap Valve and/or Pipe

✓ Use 2-hole straps or plumbers tape
✓ Add wood blocking as necessary
✓ Strap so valve is secure
Label Pipe and 3-way Valve

Label above ground pipe: “CAUTION: Non-potable graywater, do not drink”

Label valve: show direction of greywater

Handle to side = Greywater to garden

www.greywateraction.org
Stacked Washer
New Construction
Estimate Greywater Production

1. Number of loads of laundry done each week?

2. Number of gallons per load?
   - Top loading machine uses \(\approx 40\) gallons/load
   - Front loading machine uses \(\approx 15\) gallons/load
   - Top efficient machines uses \(\approx 25\) gallons/load

3. Future changes?
   - New machine? Change in usage?
Estimate Greywater Production

**Formula:**

\[ \text{# of loads per week} \times \text{gallons per load} = \text{gallons/week of greywater} \]

**Example:**

4 loads/week \( \times \) 25 gallons/load = 100 gallons/week of greywater
Choosing Plants for L2L Greywater Irrigation

Good options:

1. 1st Trees (fruit trees are nice!)
2. 2nd Shrubs/bushes
3. 3rd Perennials and large annuals
4. Food crops are fine as long as greywater doesn't touch the edible portion

Plants with larger root zones thrive with laundry watering patterns.
Choosing Plants for L2L Greywater Irrigation

Not as good options:
1. Lawns
2. Drought established (eg. never irrigated)
3. Small plants or in pots
4. Sensitive plants
5. Root crops (not allowed by code)
6. Raised beds- depending on the situation
What would you water here?
Rank that Plant

Good choice for a L2L system

Might be okay

Bad idea
Potted Plants
Raised Beds

Salad greens?
Raised Beds

Squash?
Another Option

Photos by: City of Santa Rosa
Fruit Trees?
Edible in the Ground?

Tomatoes?
Edible in the Ground?

Onions?
Edible in the Ground?

Onions?
Very General Plant Water Requirements

In San Mateo

1. A small-medium sized tree needs about 20-40 gallons per week

2. A small-medium sized shrub needs about 10-20 gallons per week

3. A drought tolerant shrub needs about 2-6 gallons per week

Note:
These are very rough estimates!

Plant water requirements are affected by microclimate, sun and wind exposure, size and type of plant, ground water depth, etc.
Plant Water Requirements

Peak irrigation

1. Water $\frac{1}{2}$ a gallon per week, per square foot of planted area

Example:
How much should you water a hedge each week that is 20 square feet in area?

$\frac{1}{2}$ gallon x 20 square feet = 10 gallons/week

Note: For low-water use plants cut this estimate in half.
Area of Planted Area

Rectangle or Square

Area = length x width

Circle

Area = \pi \times r^2
= 3 \times \text{radius} \times \text{radius}
Practice:
Finding Plant Water Requirements

How many gallons a week would this raspberry bush require during the peak irrigation season?
Improper Designs Won't Save Water

GW outlets planted in the middle of turf grass

Image credit City of Long Beach office of Sustainability
Number of Outlets

Top loading machine
No more than 20 distribution points (Reduce to 10 for top-efficient machine)

Front loading machine
No more than 8 distribution points (reduce to 4 for ultra-efficient machines)

www.greywateraction.org
Two Zoned System

To landscape

Greywater from washer

Zone 1

Zone 2

To sewer

Photo: Sergio Scabuzzo
Piping to Landscape

- Pipe around obstacles
- Try to maintain a downwards slope whenever possible
Hardscape

- Go under it
- Go around it
- Remove it
- Cut a strip of it
Crossing Steps

Hug steps to prevent tripping hazard
Trench and Install Tubing to Basins

Keep tubing out of the way, and out of sunlight. Stake down as needed.

Note: If there are any elevation changes between basins, run the tubing to the highest point and then come down.
Flat yard ~ 50 ft

Downslope: Serpentine to slow water

Distributing water to different sloped landscape with an L2L system

Upward slope: Don't irrigate uphill from the washing machine.

Irrigate on upper side of plant. Build a berm to create a flat mulch basin.
Trench and Install Tubing to Basins
Cut in 1x ½” tees, Add ½” tubing as needed

Tips for working with tubing:

• No kinks (cut them out)
• Dip end of tube in hot water to soften plastic
• Minimize 1/2” tubing
Locate Basins in “Drip Line” of Plants
How to Size a Mulch Basin

Make each basin large enough to soak up greywater without ponding or runoff.

Clay soils need larger basins.

Image credit: Ty Teissere
Mulch Shield - prevents roots from clogging outlet

Image from SFPUC manual on greywater
Mulch Shield Options

1. Strongest, most $: Use small irrigation valve box

2. Low cost, sturdy: sections of 4” drain pipe (triple wall HDPE) with lid or cover

3. Repurposed flower pots don't last. 3-5 gallons buckets are fine to use.

These don't hold up over time
Balance Flows

1st- Adjust angle of tees

2nd- Add one or two ball valves to restrict flow from outlets with too much flow
Follow Up

✓ Bury tubing
✓ Check for leaks inside
✓ Paint exposed PVC pipe
✓ Caulk holes
✓ Post signs
✓ Post maintenance manual
✓ Get greywater friendly soap
✓ Do laundry.. and water plants
Paint plastic pipe
to protect from UV Seal hole with Sikaflex
Open End or Fail-Safe Overflow

ONE OPTION FOR END OF MAIN LINE
Open 1" line in a mulch shield.

SECOND OPTION FOR OPEN END OF 1" LINE
Fail-safe overflow. Extend a 1" line off a 1" barbed tee in a discreet location (looking like a snorkel) to provide a fail-safe exit for the water in case the outlets clog over time. Add a 1" barbed 90° elbow on the top to prevent debris from falling into the line.
L2L Mock-Up Activity

✓ What is the part called?
✓ How is it used in an L2L system?
✓ As a group, put a system together
Greywater Parts Primer

Size, material, how they connect together

1” PVC female adapter (FPT x S)

1” PVC male adapter x barbed

1” PVC male adapter (MPT x S)

©CC-BY-NC